

ภาคผนวก ง

เอกสารการสอบเทียบเครื่องมือตรวจวิเคราะห์



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รายการเครื่องมือที่ใช้ในการวิเคราะห์ / ทดสอบ

Sample Name	Parameter	Equipment Name	ID No.	Calibrated Date	Next Cal	Freq. Calibrate (Months)
Ambient	Particulate Matter (PM-10)	High Volume	BKK_FS1062	-	-	On site Calibration
Ambient	Particulate Matter (PM-10)	High Volume	BKK_FS1060	-	-	On site Calibration
Ambient	Particulate Matter (PM-10)	High Volume	BKK_FS0374	-	-	On site Calibration
Ambient	Particulate Matter (PM-10)	High Volume	BKK_FS0379	-	-	On site Calibration
Ambient	Particulate Matter (PM-10)	Digital Balance	BKK_EN0004	25-Feb-22	25-Feb-23	12
Ambient	Total Suspended Particulate	High Volume	BKK_FS0363	-	-	On site Calibration
Ambient	Total Suspended Particulate	High Volume	BKK_FS0373	-	-	On site Calibration
Ambient	Total Suspended Particulate	High Volume	BKK_FS0359	-	-	On site Calibration
Ambient	Total Suspended Particulate	High Volume	BKK_FS0372	-	-	On site Calibration
Ambient	Total Suspended Particulate	Digital Balance	BKK_EN0004	25-Feb-22	25-Feb-23	12
Ambient	Nitrogen Dioxide	NO ₂ Analyzer	BKK_FS1070	1-Jul-22	1-Jan-23	6
Ambient	Nitrogen Dioxide	NO ₂ Analyzer	BKK_FS1088	1-Jul-22	1-Jan-23	6
Ambient	Nitrogen Dioxide	NO ₂ Analyzer	BKK_FS1086	1-Jul-22	1-Jan-23	6
Ambient	Nitrogen Dioxide	NO ₂ Analyzer	BKK_FS1072	1-Jul-22	1-Jan-23	6
Ambient	Sulfur Dioxide	SO ₂ Analyzer	BKK_FS1069	1-Jul-22	1-Jan-23	6
Ambient	Sulfur Dioxide	SO ₂ Analyzer	BKK_FS1087	1-Jul-22	1-Jan-23	6
Ambient	Sulfur Dioxide	SO ₂ Analyzer	BKK_FS1085	1-Jul-22	1-Jan-23	6
Ambient	Sulfur Dioxide	SO ₂ Analyzer	BKK_FS1071	1-Jul-22	1-Jan-23	6
Ambient	Wind Speed / Wind Direction	Wind Speed / Wind Direction	BKK_FS0975	26-Jan-22	27-Jul-23	18
Stack (CEMs)	Oxides of Nitrogen	Analyzer , System calibration, Sta	-	-	-	-
Stack (CEMs)	Sulfur Dioxide	Analyzer , System calibration, Sta	-	-	-	-
Stack	Total Suspended Particulate	Console Control Unit	BKK_FS0507	3-Jul-22	3-Jan-23	6
Stack	Total Suspended Particulate	Digital Balance	BKK_EN0309	16-Dec-21	16-Dec-22	12
Noise	Leq 24 hrs	Sound Calibrator	BKK_FS0632	14-Jan-22	14-Jan-23	12
Noise	Leq 24 hrs	Sound Level Meter	BKK_FS0099	11-Jul-22	11-Jan-23	12
Noise	Leq 24 hrs	Sound Level Meter	BKK_FS0110	14-Dec-21	14-Dec-22	12
Noise	Leq 24 hrs	Sound Level Meter	BKK_FS0107	15-Oct-21	15-Oct-22	12
Noise	Leq 24 hrs	Sound Level Meter	BKK_FS0111	14-Dec-21	14-Dec-22	12
Noise	Leq 24 hrs	Sound Level Meter	BKK_FS0109	14-Dec-21	14-Dec-22	12
Noise	Leq 8 hrs	Sound Calibrator	BKK_FS0633	14-Jan-22	14-Jan-23	12
Noise	Leq 8 hrs	Sound Level Meter	BKK_FS0874	28-Oct-21	28-Oct-22	12
Noise	Leq 8 hrs	Sound Level Meter	BKK_FS0878	2-Nov-21	2-Nov-22	12
Noise	Leq 8 hrs	Sound Level Meter	BKK_FS0117	14-Dec-21	14-Dec-22	12
Noise	Leq 8 hrs	Sound Level Meter	BKK_FS0880	25-Oct-21	25-Oct-22	12
Noise	Leq 8 hrs	Sound Level Meter	BKK_FS0922	12-Jan-22	12-Jan-23	12
Noise	Leq 8 hrs	Sound Level Meter	BKK_FS0875	2-Nov-21	2-Nov-22	12
Noise	Leq 8 hrs	Sound Calibrator	BKK_FS0633	14-Jan-22	14-Jan-23	12
Noise	Leq 8 hrs	Sound Level Meter	BKK_FS0924	25-Oct-22	25-Oct-23	12
Noise	Leq 8 hrs	Sound Level Meter	BKK_FS0927	18-Oct-22	18-Oct-23	12
Noise	Leq 8 hrs	Sound Level Meter	BKK_FS0999	19-Sep-22	19-Sep-23	12
Noise	Leq 8 hrs	Sound Level Meter	BKK_FS0923	25-Oct-22	25-Oct-23	12
Noise	Leq 8 hrs	Sound Level Meter	BKK_FS0926	7-Sep-22	7-Sep-23	12
Noise	Leq 8 hrs	Sound Level Meter	BKK_FS0925	18-Oct-22	18-Oct-23	12
Heat	Heat Stress	Heat Stress Monitor	BKK_FS0682	1-Oct-21	1-Oct-22	12
Heat	Heat Stress	Heat Stress Monitor	BKK_FS0672	17-Mar-22	17-Mar-23	12
Heat	Heat Stress	Heat Stress Monitor	BKK_FS0673	1-Oct-21	1-Oct-22	12
Heat	Heat Stress	Heat Stress Monitor	BKK_FS0676	2-Nov-21	2-Nov-22	12
Heat	Heat Stress	Heat Stress Monitor	BKK_FS0671	30-Sep-21	30-Sep-22	12
Heat	Heat Stress	Heat Stress Monitor	BKK_FS0681	1-Oct-21	1-Oct-22	12
Heat	Heat Stress	Heat Stress Monitor	BKK_FS0680	15-Feb-22	15-Feb-23	12
Heat	Heat Stress	Heat Stress Monitor	BKK_FS0678	15-Feb-22	15-Feb-23	12
Heat	Heat Stress	Heat Stress Monitor	BKK_FS0682	21-Nov-22	21-Nov-23	12
Heat	Heat Stress	Heat Stress Monitor	BKK_FS0677	3-May-22	3-May-23	12
Heat	Heat Stress	Heat Stress Monitor	BKK_FS0675	28-Sep-22	28-Sep-23	12
Heat	Heat Stress	Heat Stress Monitor	BKK_FS0679	28-Sep-22	28-Sep-23	12
Heat	Heat Stress	Heat Stress Monitor	BKK_FS0672	17-Mar-22	17-Mar-23	12



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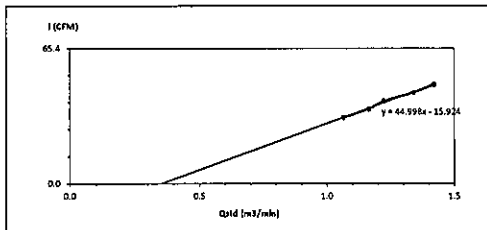
Sample Name	Parameter	Equipment Name	ID No.	Calibrated Date	Next Cal	Freq. Calibrate (Months)
Heat	Heat Stress	Heat Stress Monitor	BKK_FS0681	21-Nov-22	21-Nov-23	12
Illuminance	Illuminance	Lux Meter	BKK_FS0606	15-Feb-22	15-Feb-23	12
Illuminance	Illuminance	Lux Meter	BKK_FS1146	13-Sep-22	13-Sep-23	12
Water Lab	pH at 25 °C	pH meter	BKK_EN0072	12-Sep-22	12-Mar-24	18
Water Lab	Dissolved Oxygen	Burette	BKK_EN0171	30-Aug-22	1-Mar-24	18
Water Lab	Dissolved Oxygen	Chamber (Cold Room)	BKK_EN0167	30-Jun-22	30-Dec-23	18
Water Lab	Oil & Grease	Electronic Top-Loading Balance	BKK_EN0002	25-Feb-22	25-Feb-23	12
Water Lab	Oil & Grease	Water Bath	BKK_EN0148	31-Jan-22	1-Aug-23	18
Water Lab	Total Suspended Solids	Electronic Top-Loading Balance	BKK_EN0002	25-Feb-22	25-Feb-23	12
Water Lab	Total Suspended Solids	Oven	BKK_EN0007	1-Dec-21	1-Jun-23	18
Water Lab	Total Dissolved Solids 180°C	Electronic Top-Loading Balance	BKK_EN0002	25-Feb-22	25-Feb-23	12
Water Lab	Total Dissolved Solids 180°C	Oven	BKK_EN0007	1-Dec-21	1-Jun-23	18
Water Lab	BOD	DO Meter	BKK_EN0017	24-May-22	24-Nov-23	18
Water Lab	BOD	Incubator	BKK_EN0005	4-Oct-21	4-Apr-23	18
Water Lab	Temperature	pH meter	BKK_LG0023	18-Jul-22	18-Jul-23	12
Water Lab	Residual Free Chlorine	Chlorine Meter	BKK_LG0042	28-Jan-22	28-Jan-23	12
Water Lab	Conductivity	Conductivity meter	BKK_EN0065	19-Nov-21	20-May-23	18
Water Lab	Calcium	ICP-OES	BKK_EL0037	13-Sep-21	12-Mar-23	18
Water Lab	Calcium	Hot Block	BKK_EL0054	7-Apr-22	7-Oct-23	18
Water Lab	Calcium	Chamber (Cold Room)	BKK_EN0167	30-Jun-22	30-Dec-23	18
Water Lab	Magnesium	ICP-OES	BKK_EL0037	13-Sep-21	12-Mar-23	18
Water Lab	Magnesium	Hot Block	BKK_EL0054	7-Apr-22	7-Oct-23	18
Water Lab	Magnesium	Chamber (Cold Room)	BKK_EN0167	30-Jun-22	30-Dec-23	18
Water Lab	Sodium	ICP-OES	BKK_EL0037	13-Sep-21	12-Mar-23	18
Water Lab	Sodium	Hot Block	BKK_EL0054	7-Apr-22	7-Oct-23	18
Water Lab	Sodium	Chamber (Cold Room)	BKK_EN0167	30-Jun-22	30-Dec-23	18
Water Lab	SAR	ICP-MS	BKK_EL0043	30-Sep-21	29-Mar-23	18
Water Lab	SAR	Hot Block	BKK_EL0054	7-Apr-22	7-Oct-23	18
Water Lab	SAR	Chamber (Cold Room)	BKK_EN0167	30-Jun-22	30-Dec-23	18



High Volume Air Sampler Calibration Worksheet

Project Site : Gulf IP NKK Co., Ltd. Barometric Pressure (mm Hg) : 755
 Calibrate Location : ชุมชนบ้านนาโพธิ์ Temperature (°C) : 31
 Calibrate Date : 22-Sep-22 High Volume ID : BKK FS1062
 Calibration Sheet No. : C-220922-BKK FS1062 High Volume Model : TE-5009X
 Calibrator ID : BKK FS0624 High Volume S/N : 5686
 Calibrator Model : TE-502RA Calibrator Slope : 1.64942
 Calibrator S/N : 2584 Calibrator Intercept : -0.02902

Test No.	Delta H ₂ O (inch)	Q _{sw} (m ³ /min)	I Chart (CFM)	Linear Regression
1	3.0	1.0653	32	Slope : 44.9975 Intercept : -15.9238 Correlation Coefficient : 0.9970
2	3.6	1.1642	36	
3	4.0	1.2356	40	
4	4.8	1.3398	44	
5	5.4	1.4193	48	



Calibrated by :
 (Mr. Teeravut Sukdee)
 Field Scientist (1)

Approved by :
 (Mr. Noppong Juntarupan)
 Enviro Field Coordinator Scientist (2)

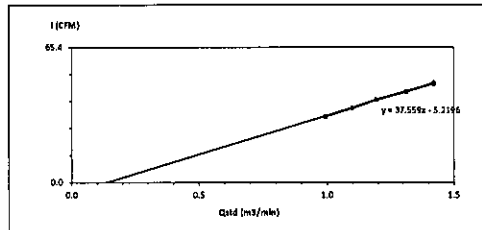
FORM NO: F 06-074 REVISION NO.: ISSUE DATE: 14/03/16



High Volume Air Sampler Calibration Worksheet

Project Site : Gulf IP NKK Co., Ltd. Barometric Pressure (mm Hg) : 755
 Calibrate Location : ชุมชนบ้านนาโพธิ์ Temperature (°C) : 31
 Calibrate Date : 22-Sep-22 High Volume ID : BKK FS1060
 Calibration Sheet No. : C-220922-BKK FS1060 High Volume Model : TE-5009X
 Calibrator ID : BKK FS0624 High Volume S/N : 5503
 Calibrator Model : TE-502RA Calibrator Slope : 1.64942
 Calibrator S/N : 2584 Calibrator Intercept : -0.02902

Test No.	Delta H ₂ O (inch)	Q _{sw} (m ³ /min)	I Chart (CFM)	Linear Regression
1	2.6	0.9937	32	Slope : 37.5595 Intercept : -5.2196 Correlation Coefficient : 0.9996
2	3.2	1.0993	36	
3	3.8	1.1953	40	
4	4.6	1.3122	44	
5	5.4	1.4193	48	



Calibrated by :
 (Mr. Teeravut Sukdee)
 Field Scientist (1)

Approved by :
 (Mr. Noppong Juntarupan)
 Enviro Field Coordinator Scientist (2)

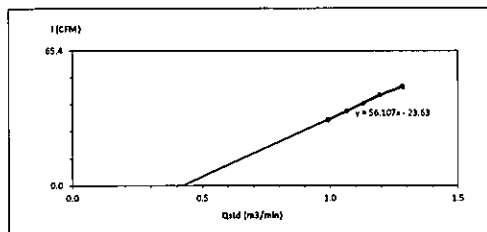
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High Volume Air Sampler Calibration Worksheet

Project Site : Gulf IP NKK Co., Ltd. Barometric Pressure (mm Hg) : 755
 Calibrate Location : ชุมชนบ้านนาโพธิ์ Temperature (°C) : 31
 Calibrate Date : 22-Sep-22 High Volume ID : BKK FS0374
 Calibration Sheet No. : C-220922-BKK FS0374 High Volume Model : TE-5009X
 Calibrator ID : BKK FS0624 High Volume S/N : 5195
 Calibrator Model : TE-502RA Calibrator Slope : 1.64942
 Calibrator S/N : 2584 Calibrator Intercept : -0.02902

Test No.	Delta H ₂ O (inch)	Q _{sw} (m ³ /min)	I Chart (CFM)	Linear Regression
1	2.6	0.9937	32	Slope : 56.1074 Intercept : -23.6301 Correlation Coefficient : 0.9983
2	3.0	1.0653	36	
3	3.4	1.1322	40	
4	3.8	1.1953	44	
5	4.4	1.2840	48	



Calibrated by :
 (Mr. Teeravut Sukdee)
 Field Scientist (1)

Approved by :
 (Mr. Noppong Juntarupan)
 Enviro Field Coordinator Scientist (2)

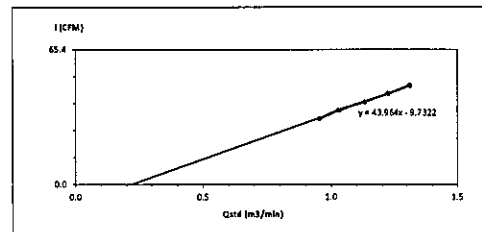
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High Volume Air Sampler Calibration Worksheet

Project Site : Gulf IP NKK Co., Ltd. Barometric Pressure (mm Hg) : 755
 Calibrate Location : ชุมชนบ้านนาโพธิ์ Temperature (°C) : 31
 Calibrate Date : 22-Sep-22 High Volume ID : BKK FS0379
 Calibration Sheet No. : C-220922-BKK FS0379 High Volume Model : TE-5009X
 Calibrator ID : BKK FS0624 High Volume S/N : 4158
 Calibrator Model : TE-502RA Calibrator Slope : 1.64942
 Calibrator S/N : 2584 Calibrator Intercept : -0.02902

Test No.	Delta H ₂ O (inch)	Q _{sw} (m ³ /min)	I Chart (CFM)	Linear Regression
1	2.4	0.9559	32	Slope : 43.9644 Intercept : -9.7322 Correlation Coefficient : 0.9990
2	2.8	1.0201	36	
3	3.4	1.1322	40	
4	4.0	1.2256	44	
5	4.6	1.3122	48	



Calibrated by :
 (Mr. Teeravut Sukdee)
 Field Scientist (1)

Approved by :
 (Mr. Noppong Juntarupan)
 Enviro Field Coordinator Scientist (2)

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



PENTA CALIBRATION CO., LTD.
66/124 The Connect 33 Village Kanchanaphisek Road
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Tel: +66 (0) 2098-0773
www.pentalcal.com

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: 1123091084
Model: XP105 ID No: BKK_EN0004
Type of Balance: Multi interval



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

The Method used: In house method, PTC-WI-07, base on Euramet cp. 18

Traceability: This certificate is traceable to the SI Units through Thai Calibration Service Co.,Ltd.
MSC-ONSC Accreditation No.: Calibration 0189

Date Received: February 25, 2022

Calibration Date: February 25, 2022

Issued Date: March 01, 2022

Calibration By: Mr. Rungroj Metakul

REVIEW BY: *Savarn N.*
APPROVED BY: *KL AL*
NEXT CAL DATE: 30/02/23



PTC-FAC-01-07 3 Feb 2022

Mr. Rungroj Metakul
(Mr. Rungroj Metakul)
Reviewed by

Mr. Keattisak Kerdin
(Mr. Keattisak Kerdin)
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 this results relate only to the items calibrated.

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PTC-FAC-01-07 3 Feb 2022



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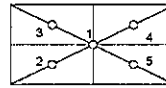
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Measurement Results:

Without Adjustment:

Function Calibration: Non Adjustment

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



Eccentricity test 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., Repeatability 0.0001 (g)

Nominal test value (g)	Standard Deviation
100	0.0005

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-FAC-01-07 3 Feb 2022



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Certificate No.: PTC07/22072

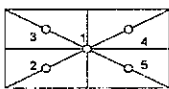
Page: 3 of 3

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	0.000000	0.000000	0.000010	2.52
0.1	0.100000	0.100000	0.000000	0.000019	2.00
0.5	0.499999	0.500000	0.000000	0.000019	2.00
2	2.000010	1.999999	0.000002	0.000024	2.00
5	5.000005	5.000001	0.000000	0.000027	2.00
10	10.000015	10.000000	0.000000	0.000031	2.00
20	20.000019	20.000001	0.000001	0.000042	2.00
30	30.000034	30.000006	-0.000003	0.000069	2.00

Note: Weight of adjust (g)

The End of Certificate

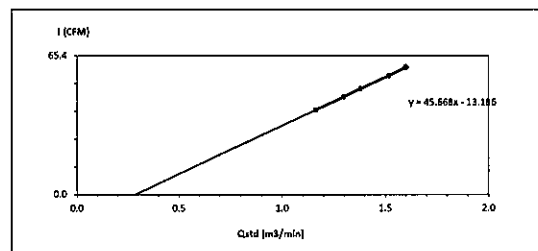
PTC-FAC-01-07 3 Feb 2022



High Volume Air Sampler Calibration Worksheet

Project Site: Gulf PNNK Co.,Ltd. Barometric Pressure (mm Hg): 755
Calibrate Location: Uthairat Road Temperature (°C): 31
Calibrate Date: 22-Sep-22 High Volume ID: BKK_F50263
Calibration Sheet No.: C-220922-BKK_F50263 High Volume Model: TE-5009X
Calibrator ID: BKK_F50624 High Volume S/N: 4160
Calibrator Model: TE-5028A Calibrator Slope: 1.64942
Calibrator S/N: 2584 Calibrator Intercept: -0.02902

Test No.	Delta H ₂ O (inch)	Q _{vol} (m ³ /min)	I: Chart (CFM)	Linear Regression
1	3.6	1.1642	40	Slope: 45.6682
2	4.5	1.2982	46	Intercept: -13.1862
3	5.1	1.3861	50	Correlation Coefficient: 0.9999
4	6.2	1.5187	56	
5	6.9	1.6066	60	



Calibrated by: *Mr. Teeravut Sukdee*
(Mr. Teeravut Sukdee)
Field Scientist (1)

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

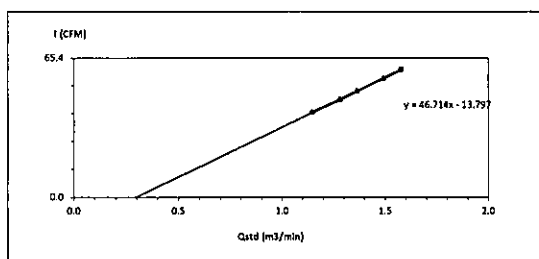
FORM NO: P-06-073 REVISION NO: ISSUE DATE: 14/03/16



High Volume Air Sampler Calibration Worksheet

Project Site: Gulf IP NKK Co., Ltd. Barometric Pressure (mm Hg): 755
 Calibrate Location: กรุงเทพมหานคร Temperature (°C): 31
 Calibrate Date: 22-Sep-22 High Volume ID: BKK_F50373
 Calibration Sheet No.: C-220922-BKK_F50373 High Volume Model: G1051
 Calibrator ID: BKK_F50624 High Volume S/N: 1330
 Calibrator Model: TE-5028A Calibrator Slope: 1.64942
 Calibrator S/N: 2584 Calibrator Intercept: -0.02902

Test No.	Delta H ₂ O (Inch)	Q _{std} (m ³ /min)	I: Chart (CFM)	Linear Regression
1	3.5	1.1483	40	Slope: 46.7142 Intercept: -13.7956 Correlation Coefficient: 0.9999
2	4.4	1.2840	46	
3	5.0	1.3668	50	
4	6.0	1.4945	56	
5	6.7	1.5776	60	



Calibrated by: (Mr. Teeravut Sukdee)
Field Scientist(1)

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

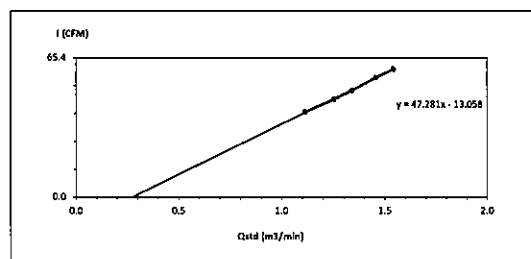
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High Volume Air Sampler Calibration Worksheet

Project Site: Gulf IP NKK Co., Ltd. Barometric Pressure (mm Hg): 755
 Calibrate Location: กรุงเทพมหานคร Temperature (°C): 31
 Calibrate Date: 22-Sep-22 High Volume ID: BKK_F50359
 Calibration Sheet No.: C-220922-BKK_F50359 High Volume Model: TE-5009X
 Calibrator ID: BKK_F50624 High Volume S/N: 5194
 Calibrator Model: TE-5028A Calibrator Slope: 1.64942
 Calibrator S/N: 2584 Calibrator Intercept: -0.02902

Test No.	Delta H ₂ O (Inch)	Q _{std} (m ³ /min)	I: Chart (CFM)	Linear Regression
1	3.3	1.1158	40	Slope: 47.2814 Intercept: -13.0584 Correlation Coefficient: 0.9994
2	4.2	1.2551	46	
3	4.8	1.3398	50	
4	5.7	1.4574	56	
5	6.4	1.5426	60	



Calibrated by: (Mr. Teeravut Sukdee)
Field Scientist(1)

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

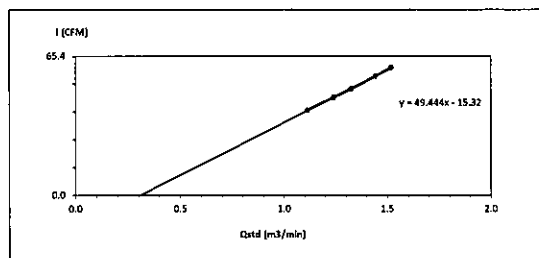
FORM NO.: F 06-073 REVISION NO.: ISSUE DATE: 14/03/16



High Volume Air Sampler Calibration Worksheet

Project Site: Gulf IP NKK Co., Ltd. Barometric Pressure (mm Hg): 755
 Calibrate Location: กรุงเทพมหานคร Temperature (°C): 31
 Calibrate Date: 22-Sep-22 High Volume ID: BKK_F50372
 Calibration Sheet No.: C-220922-BKK_F50372 High Volume Model: TE-5009X
 Calibrator ID: BKK_F50624 High Volume S/N: 5332
 Calibrator Model: TE-5028A Calibrator Slope: 1.64942
 Calibrator S/N: 2584 Calibrator Intercept: -0.02902

Test No.	Delta H ₂ O (Inch)	Q _{std} (m ³ /min)	I: Chart (CFM)	Linear Regression
1	3.3	1.1158	40	Slope: 49.4443 Intercept: -15.3202 Correlation Coefficient: 0.9997
2	4.1	1.2404	46	
3	4.7	1.3261	50	
4	5.6	1.4448	56	
5	6.2	1.5187	60	



Calibrated by: (Mr. Teeravut Sukdee)
Field Scientist(1)

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

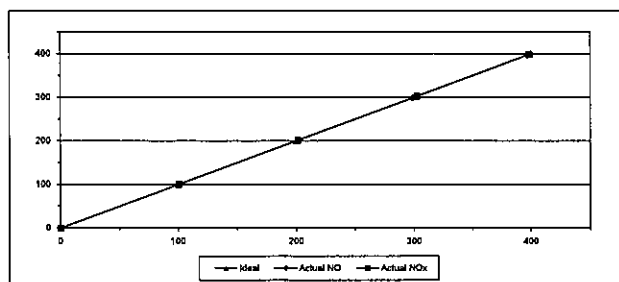
FORM NO.: F 06-073 REVISION NO.: ISSUE DATE: 14/03/16



MULTIPOINT CALIBRATION REPORT

Calibration Date: 1-Jul-22 Equipment Name: NOx Analyzer
 Manufacturer: HORIBA Model: APNA-370
 Serial No.: PPGMHKH Equipment ID: BKK_F81070
 Calibrator Manufacturer: Teledyne API Model: 700
 Serial No.: 847
 Std. Gas Concentration (PPM): 55.88 Cylinder No.: GN0027222
 Cylinder Pressure (psi): 1800 Certified By: Algas Inc.
 Certified Date: 9-Feb-22 Expired Date: 9-Feb-30

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	98.80	-1.20	-1.20	100.80	0.80	0.80
2	200.00	201.30	1.30	0.65	201.50	1.50	0.75
3	300.00	298.30	-1.70	-0.57	302.40	2.40	0.80
4	400.00	396.80	-3.10	-0.78	398.50	-1.50	-0.38
AVERAGE (%)				-0.38			0.41



Calibrated By

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

Approved By

(Mr. Sarayuth Jitbanonit)
Assistant General Manager

ALS Laboratory Group
FORM NO.: F 06-056 REVISION NO.: ISSUE DATE: 02/04/12

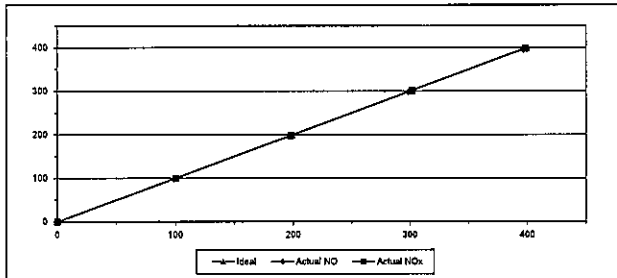


MULTIPOINT CALIBRATION REPORT

Calibration Date: 1-Jul-22
 Manufacturer: HORIBA
 Serial No.: PX13CWA0
 Calibrator Manufacturer: Teledyne API
 Serial No.: 947
 Std. Gas Concentration (PPM): 55.88
 Cylinder Pressure (psi): 1800
 Certified Date: 8-Feb-22

Equipment Name: NOx Analyzer
 Model: APNA-370
 Equipment ID: BKK_F81088
 Model: 700
 Cylinder No.: GN0027222
 Certified By: Aingaa Inc.
 Expired Date: 8-Feb-30

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	100.30	0.30	0.30
2	200.00	198.30	-1.70	-0.85	198.10	-1.90	-0.95
3	300.00	298.40	-1.60	-0.53	301.70	1.70	0.57
4	400.00	398.70	-1.30	-0.33	398.30	-1.70	-0.42
AVERAGE (%)				-0.82			-0.08



Calibrated By

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

Approved By

(Mr. Sarayuth Jitranont)
 Assistant General Manager

ALS Laboratory Group
 FORM NO.: F 06-056 REVISION NO.: - ISSUE DATE: 02/04/12

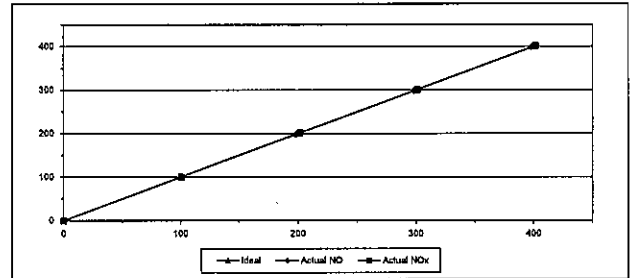


MULTIPOINT CALIBRATION REPORT

Calibration Date: 1-Jul-22
 Manufacturer: HORIBA
 Serial No.: 30K18RHM
 Calibrator Manufacturer: Teledyne API
 Serial No.: 947
 Std. Gas Concentration (PPM): 55.88
 Cylinder Pressure (psi): 1800
 Certified Date: 8-Feb-22

Equipment Name: NOx Analyzer
 Model: APNA-370
 Equipment ID: BKK_F81088
 Model: 700
 Cylinder No.: GN0027222
 Certified By: Aingaa Inc.
 Expired Date: 8-Feb-30

Point	CALIBRATION RESULTS						
	Ideal	Actual NO	Error NO	%Error NO	Actual NOx	Error NOx	%Error NOx
ZERO	0.00	0.05	0.05	0.05	0.10	0.10	0.10
1	100.00	99.50	-0.50	-0.50	100.20	0.20	0.20
2	200.00	198.30	-1.70	-0.85	201.60	1.60	0.80
3	300.00	298.10	-1.90	-0.63	301.10	1.10	0.37
4	400.00	398.20	-1.80	-0.45	401.60	1.60	0.40
AVERAGE (%)				-0.48			0.37



Calibrated By

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

Approved By

(Mr. Sarayuth Jitranont)
 Assistant General Manager

ALS Laboratory Group
 FORM NO.: F 06-056 REVISION NO.: - ISSUE DATE: 02/04/12

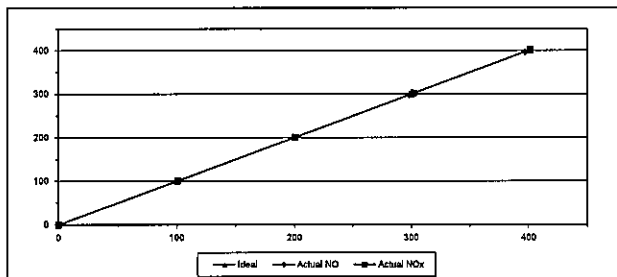


MULTIPOINT CALIBRATION REPORT

Calibration Date: 1-Jul-22
 Manufacturer: HORIBA
 Serial No.: PHD13MC7
 Calibrator Manufacturer: Teledyne API
 Serial No.: 947
 Std. Gas Concentration (PPM): 55.88
 Cylinder Pressure (psi): 1800
 Certified Date: 8-Feb-22

Equipment Name: NOx Analyzer
 Model: APNA-370
 Equipment ID: BKK_F81072
 Model: 700
 Cylinder No.: GN0027222
 Certified By: Aingaa Inc.
 Expired Date: 8-Feb-30

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	98.80	-1.20	-1.20	100.50	0.50	0.50
2	200.00	201.40	1.40	0.70	200.70	0.70	0.35
3	300.00	298.30	-1.70	-0.57	302.10	2.10	0.70
4	400.00	398.90	-1.10	-0.28	401.30	1.30	0.33
AVERAGE (%)				-0.35			0.40



Calibrated By

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

Approved By

(Mr. Sarayuth Jitranont)
 Assistant General Manager

ALS Laboratory Group
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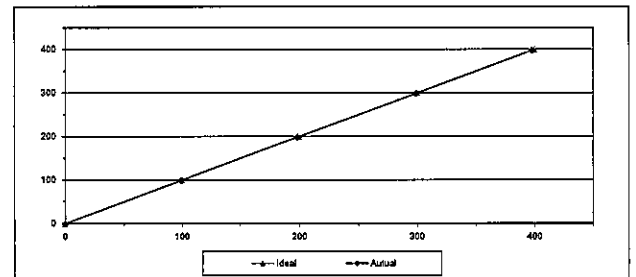


MULTIPOINT CALIBRATION REPORT

Calibration Date: 1-Jul-22
 Manufacturer: HORIBA
 Serial No.: 70Y1R8R0
 Calibrator Manufacturer: Teledyne API
 Serial No.: 947
 Std. Gas Concentration (PPM): 56.3
 Cylinder Pressure (psi): 1800
 Certified Date: 8-Feb-22

Equipment Name: SO2 Analyzer
 Model: APSA-370
 Equipment ID: BKK_F81088
 Model: 700
 Cylinder No.: GN0027222
 Certified By: Aingaa Inc.
 Expired Date: 8-Feb-30

Point	CALIBRATION RESULTS			
	Ideal	Actual	Error	%Error
ZERO	0.00	0.10	0.10	0.10
1	100.00	99.30	-0.70	-0.70
2	200.00	198.20	-1.80	-0.90
3	300.00	298.70	-1.30	-0.43
4	400.00	397.70	-2.30	-0.58
AVERAGE (%)				-0.50



Calibrated By

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

Approved By

(Mr. Sarayuth Jitranont)
 Assistant General Manager

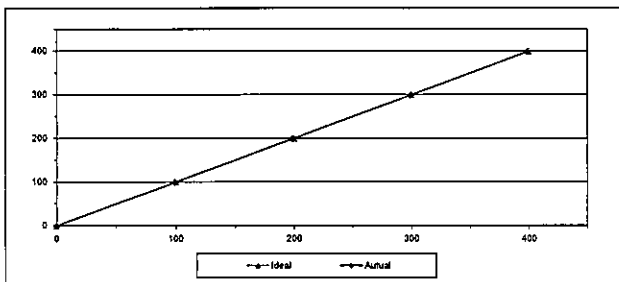
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MULTIPOINT CALIBRATION REPORT

Calibration Date	1-Jul-22	Equipment Name	SO2 Analyzer
Manufacturer	HORIBA	Model	APSA-370
Serial No.	XHV1859F	Equipment ID	BKK_F81087
Calibrator Manufacturer	Teledyne API	Model	700
Serial No.	847		
Std. Gas Concentration (PPM)	56.3	Cylinder No.	GN0027222
Cylinder Pressure (psi)	1800	Certified By	Airgas Inc.
Certified Date	8-Feb-22	Expired Date	9-Feb-30

Point	CALIBRATION RESULTS			
	Ideal	Actual	Error	%Error
ZERO	0.00	0.10	0.10	0.10
1	100.00	99.10	-0.90	-0.90
2	200.00	198.30	-1.70	-0.85
3	300.00	298.70	-1.30	-0.43
4	400.00	398.30	-1.70	-0.42
AVERAGE (%)				-0.50



Calibrated By

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

Approved By

(Mr.Sarayuth Jittrantont)
Assistant General Manager

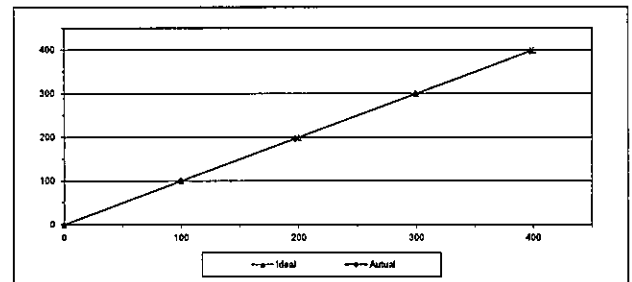
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MULTIPOINT CALIBRATION REPORT

Calibration Date	1-Jul-22	Equipment Name	SO2 Analyzer
Manufacturer	HORIBA	Model	APSA-370
Serial No.	428579RC	Equipment ID	BKK_F81085
Calibrator Manufacturer	Teledyne API	Model	700
Serial No.	847		
Std. Gas Concentration (PPM)	56.3	Cylinder No.	GN0027222
Cylinder Pressure (psi)	1800	Certified By	Airgas Inc.
Certified Date	8-Feb-22	Expired Date	9-Feb-30

Point	CALIBRATION RESULTS			
	Ideal	Actual	Error	%Error
ZERO	0.00	0.10	0.10	0.10
1	100.00	99.50	-0.50	-0.50
2	200.00	197.10	-2.90	-1.45
3	300.00	299.10	-0.90	-0.30
4	400.00	397.50	-2.50	-0.63
AVERAGE (%)				-0.55



Calibrated By

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

Approved By

(Mr.Sarayuth Jittrantont)
Assistant General Manager

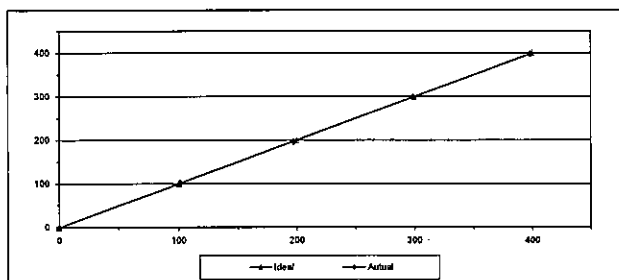
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MULTIPOINT CALIBRATION REPORT

Calibration Date	1-Jul-22	Equipment Name	SO2 Analyzer
Manufacturer	HORIBA	Model	APSA-370
Serial No.	RDH40880	Equipment ID	BKK_F81071
Calibrator Manufacturer	Teledyne API	Model	700
Serial No.	847		
Std. Gas Concentration (PPM)	56.3	Cylinder No.	GN0027222
Cylinder Pressure (psi)	1800	Certified By	Airgas Inc.
Certified Date	8-Feb-22	Expired Date	9-Feb-30

Point	CALIBRATION RESULTS			
	Ideal	Actual	Error	%Error
ZERO	0.00	0.10	0.10	0.10
1	100.00	101.30	1.30	1.30
2	200.00	197.30	-2.70	-1.35
3	300.00	298.50	-1.50	-0.50
4	400.00	398.00	-2.00	-0.50
AVERAGE (%)				-0.18



Calibrated By

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

Approved By

(Mr.Sarayuth Jittrantont)
Assistant General Manager

ALS Laboratory Group
FORM NO.: F 06-056 REVISION NO.: - ISSUE DATE: 02/04/12



63/14-15,67/35-36, Soi Petchkesem 7/71, Petchkesem Rd,
Wathphra, Bangkokyay,Bangkok 10600 Thailand.
Tel: (66) 02-8680812#13 Fax: (66) 02-8680860 www.jirenetec.com

CERTIFICATE OF CALIBRATION

Certificate No. WS 03010022
Page 1 of 2 pages

Measurement Item : Cup anemometer with data logger.

Manufacturer : Data logger: Novolyne
Cup anemometer: Novolyne

Model/Type : Data logger: T10 WS-250L-D
Cup anemometer: WS-02P

Serial Number : Data logger: AS442
Cup anemometer: WS0 002

ID No : Data logger: 989_F80970
Cup anemometer:

Customer : ALS Laboratory Group (Thailand) Co., Ltd.
104 Phrasimachon Rd, Phrasimachon Rd, Khwaeng Suan Luang, Khet Suan Luang, Bangkok 10260 Thailand

Test Conditions : Wind tunnel: cross section 900 cm²
Anemometer: 100 cm²
Diameter of mounting pipe 70 mm
Flowage ratio of test object 0.111 [-]

Test Conditions : Air temperature 24.1 ±0.5 °C
Air pressure 1010.9 ±0.4 hPa
Relative humidity 55.4 ±3.5 %RH

Calibration Procedure : Calibration was carried out based on:
ISO 9150-12:11 4.3.1 2003 Power Performance Measurements of Electricity Producing Wind Turbines
MOA/NET Assessment Calibration Procedure - Version 2, 2009.

Traceability : This calibration documents the traceability to national standard which involve the use of measurements according to the International system of units (SI) through National Institute of Metrology Thailand (NIMT).

Measurement Date : JAN 26, 2022
Issued Date : JAN 31, 2022.

Calibrated By : ☒ Mr. Sorat Thachad
☐ Mrs. Chantana Wacharajaya



Approved Signatory :
Mr. Petchya Boonpradit
Calibration Department Manager

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Continuation of Certificate of Calibration Number

Certificate No: WD-03012022
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.

V _{ref} Reading m/s	V _{act} Reading m/s	Error (m/s)	Uncertainty (%)
2.078	1.0	-0.2	2.8
4.105	4.0	-0.1	1.2
6.00	6.0	0.0	0.65
8.01	8.0	0.0	0.84
10.02	10.1	0.1	0.87
12.02	11.8	-0.2	2.4
13.99	14.1	0.1	0.23
15.99	16.2	0.2	0.42
14.99	15.2	0.2	1.2
12.99	13.0	0.0	0.77
11.01	11.1	0.1	0.48
9.02	9.1	0.1	0.87
6.99	7.0	0.0	1.2
5.145	5.1	0.0	0.96
3.052	3.0	0.0	1.6
1.028	0.8	-0.2	4.8

UUC: U_{ref} 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: Instrumentation

NO	Sensor	Manufacturer	Model/Type	Calibration Date	Certificate Report Number	Range
1	Flat plate	TCSTO INC	06352145	Aug 07, 2021	MW 0014 21	5 - 30 m/s
2	Precision Differential Pressure Meter	Zorgas	DPW2500	Aug 07, 2021	MW 0014 21	5 - 30 m/s
3	Air velocity transducer (flat plate)	TBI INC	8455-12	Aug 08, 2021	MW 0015 21	0 - 5 m/s
4	Temperature	Zorgas	TSV-TM4	March 30, 2021	CL 027-64	-50 - 70 °C
5	Relative humidity	Zorgas	DSH-TM4	March 30, 2021	RH-03032021	0 - 100 %RH
6	Atmospheric pressure	Zorgas	DSH-TM4	March 30, 2021	RH-03032021	960 - 1100 mPa
7	Wind tunnel	CSROW	WTS200	-	-	0 - 50 m/s

End of Certificate of Calibration



CERTIFICATE OF CALIBRATION

Certificate No: WD-03012022
Page 1 of 2 pages

Measurement Item : Wind direction sensor with data logger.

Manufacturer : Data logger: Novatyna.
Wind direction sensor: Novatyna.

Model/Type : Data logger: 110-WS-250L-D
Wind direction sensor: WS-02P

Serial Number : Data logger: A5443
Wind direction sensor: WSD-002

ID No : Data logger: BKH_F50976
Wind direction sensor:

Customer : ALS laboratory group (Thailand) Co., Ltd
104 Phatthanasak 40, Phatthanasak 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 axis 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: Q21086014, Certificate No: RW564/0025.

Measurement Date : JAN 26, 2022.
Issued Date : JAN 31, 2022.

Performed by
☒ Mr. Soravit Thachalad
☐ Ms. Oranai Winitwattaya



Approved Signatory:

Mr. Panyha Boonchorn
Calibration Department Manager

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Continuation of Certificate of Calibration Number

Certificate No: WD-03012022
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 ¹ Reading (°)	Error (°)	Uncertainty (°)
1	Clockwise	0/360	0	0	0	3.0
2		45	45	47	-3	3.0
3		90	90	88	-2	3.0
4		135	135	133	-2	3.0
5		180	180	180	0	3.0
6		225	225	227	2	3.0
7		270	270	272	2	3.0
8		315	315	318	3	3.0
9	Counter Clockwise	0/360	0	0	0	3.0
10		45	45	42	-3	3.0
11		90	90	88	-2	3.0
12		135	135	133	-2	3.0
13		180	180	180	0	3.0
14		225	225	227	2	3.0
15		270	270	272	2	3.0
16		315	315	318	3	3.0

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

End of Certificate of Calibration



CALIBRATION REPORT

Calibration No: RH-03012022
Page 1 of 1 Pages

Measurement Item : Relative humidity with data logger.

Manufacturer : Data logger: Novatyna.
Relative humidity sensor: Novatyna.

Model/Type : Data logger: 110-WS-250L-D
Relative humidity sensor: HWP00

Serial Number : Data logger: A5443
Relative humidity sensor: R1131111

ID No : Data logger: BKH_F50976
Relative humidity sensor:

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

Environmental Condition:
The measurement was carried out in an ambient temperature of (25±3)°C and relative humidity of (50±10)RH.

Measurement Method:
The Relative humidity with data logger (UUC Under Calibration) was calibrated by comparison method with the equilibrium of standard salt solution CH₃COOK, Potassium Acetate, Mg(NO₃)₂ Magnesium Nitrate, KCl, Potassium Chloride to determine the errors.

Measurement Date : JAN 24, 2022
Issued Date : JAN 28, 2022

Measurement Results:
The results of calibration are reported in table below.

Standard salt solution	Standard (RH)	UUC _{Reading}	Error
CH ₃ COOK: Potassium Acetate	22.51	22.1	-0.4
Mg(NO ₃) ₂ Magnesium Nitrate	52.89	52.5	-0.4
KCl: Potassium Chloride	84.34	84.2	-0.1

Performed by
☐ Mr. Soravit Thachalad
☒ Ms. Oranai Winitwattaya



Approved Signatory:

Mr. Panyha Boonchorn
Calibration Department Manager

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CALIBRATION REPORT

Calibration Number: R0-03012022
Page 1 of 2 Pages

Measurement Item : Rain gauge with data logger.
Manufacturer : Data logger Novolyne.
Rain gauge Novolyne.
Model/Type : Data logger 110-W5-200L-D
Rain gauge 110-W5-200R
Serial Number : Data logger A5443
Rain gauge R0-002
ID NO : RKK-P00075
Customer : ALS laboratory group (Thailand) co., Ltd.
104 Phatthanakan 40, Phatthanakan Rd, Khwaeng Suan Luang, Khet Suan Luang,
Bangkok 10250, Thailand.

Environmental Condition:
The measurement was carried out in an ambient temperature of 26.5°C and relative humidity of 60±10%.

Measurement Method:
The Rain gauge, Unit Under Calibration (UUC) was calibrated by Precision reference bottle with flow adjuster at low rate 0.6 mm per minute or 1 tipping every 20 seconds. The tipping number was determined by procedures below.

- Obtain rain gauge inlet area:
Rain gauge precise diameter in cm = Diameter/2 = R (radius)
Rain gauge area = πR^2 (UUC Diameter = 20.3 cm, UUC radius = 10.15 cm)
Rain gauge area = 323.6 cm².
- Obtain theoretical correct rain gauge answer (number of tipping) using 323.6 cm² inlet area and 0.6 L of rain.
a) 10,000 cm³ / 323.6 cm² Inlet area = 30.90 (Rain gauge area = 1/30.90 of square meter)
b) 30.90 * 0.6 L volume = 18.54 mm (mm of rain over 1 m² surface) 320 mm of rain volume on the rain gauge area = 18.54 mm of rain.
c) Number of tipping = 18.54 / 0.25 mm = 62 tipping.

Note: Rain gauge is fully cleaned and leveling prior the calibration performed.

Measurement Date : JAN 28, 2022
Issued Date : JAN 21, 2022

Performed by
☒ Mr. Sorawit Thachalad
☐ Miss Orattai Wivattanasaya



Approved Signatory:
Mr. Parinya Booncharoen
Calibration Department Manager

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Continuation of Calibration of Calibration Number

Calibration Number: R0-03012022
Page 2 of 2 Pages

Result of Calibration: ☒ Without Adjustment ☐ With Adjustment
The results of calibration are reported in table below.

Quantity of H ₂ O (ml)	Determined Tipping	Tipping count	Acceptable Tipping count
500	62	60	60 - 64
500	62	61	60 - 64
500	62	61	60 - 64
500	62	62	60 - 64
500	62	61	60 - 64

Remark: The procedure is made to verify the correct reading of the Unit Under Calibration rain gauge when a precise volume of water falls into its cone. We suggest that the number of tipping should be within ±2% different from the 62 tipping (current range 60-64 tipping). It means that the rain gauge meets the manufacturer acceptable limit.

End of calibration report



J-NAC GROUP

Jirakate Associates Co., Ltd.
63/14-15, 67/35-36
Petchkasem 7/71 Rd,
Walthapa, Bangkok,
Bangkok 10600 Thailand
Tel: +662-8680812
Mobile: +662-8680860
E-mail: jrac-calibration@jirakate.com
Web site: www.jirakate.com

Accredited calibration laboratory
ISO/IEC 17025:2017
Pressure measurement laboratory
NSC-TISI-TIS 17025
CALIBRATION 0367

CERTIFICATE OF CALIBRATION

Certificate No.: CL-004-65 Page 1 of 2 Pages

MEASUREMENT ITEM : Digital barometer
MANUFACTURER : Novolyne
MODEL/TYPE : 110-W5-25BP
SERIAL NUMBER : A5443
ID NUMBER : BKK-F50975
CUSTOMER : ALS laboratory group (Thailand) co., Ltd.
104 Phatthanakan 40, Phatthanakan Rd,
Khwaeng Suan Luang, Khet Suan Luang,
Bangkok 10250 Thailand.
RECEIVED DATE : 12 Jan 2022
MEASUREMENT DATE : 29 Jan 2022
ISSUE DATE : 31 Jan 2022

Calibration procedure:
The pressure calibration was done by in-house calibration method as WI-CL-003 according to comparison method with Digital pressure calibrator based on DKD-R 6-1

Traceability:
The measurement results are traceable to the international system of units (SI) through MENSOR which complies with the requirements of ISO/IEC 17025:2017, ANSI/NCSL Z540-1 via Certificate number: 201479

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

CONDITION OF THIS RESULT OF CALIBRATION:

- Reference Standard Instrument:

Instrument	Model	Serial No.	Certificate No.	Due Date
Absolute Pressure Transducer	CPG2500	410018L1	201479	13 Sep 2022
- The UUC* was installed in vertical orientation above reference standard instrument and center of UUC* was used as the reference level.
- Calibration conditions:
Pressure transmitting medium : Air
p (20°C, 1 bar) : 1.19 kg/m³
Δh : -0.082 m
T_{amb} : (23±2) °C
P_{amb} : 1009.5 mbar
- The certificate is valid only to the item calibrated on date and place of calibration.

Calibrated by:
☒ Mr. Sorawit Thachalad
☐ Miss Orattai Wivattanasaya



Approved signatory:
Mr. Parinya Booncharoen
Calibration Department Manager

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

J-NAC GROUP

Continuation of Certificate of Calibration Number CL-004-65

Page 2 of 2 Pages

MEASUREMENT RESULTS : ☒ Without adjustment ☐ With adjustment

CALIBRATION IN THE RANGE OF : 950 - 1050 mbar

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

STD (mbar)	UUC* (mbar)	Error (mbar)	Uncertainty(k=2) (mbar)
950.17	950.838	0.664	0.88
970.19	970.534	0.385	0.57
990.10	990.493	0.389	0.55
1009.98	1010.064	0.080	0.21
1029.91	1029.743	-0.171	0.28
1049.79	1049.531	-0.263	0.36

Note: UUC* Unit Under Calibration

End of certificate





63/14-16,67/36-36, Soi Pelchhasem 7,7/1, Patchhasem Rd,
Walthapa, Bangkokyal, Bangkok 10600 Thailand.
Tel: (66) 02-8680812#13 Fax: (66) 02-8680860 www.jiranteec.com



CERTIFICATE OF CALIBRATION

Certificate No: CL-003-65
Page 1 of 2

Equipment Name: Data Logger with Temperature
Sensor
Manufacturer: Novalyne
Model: 110-WS-25D-LD
Serial No: A5443
ID No: BKK_FS0975

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: 12 JAN 2022
Calibration date: 24 JAN 2022
Issue date: 25 JAN 2022

Reference Used During Calibration
1. Standard Temperature Probe Model: STS-100 A500,
Serial No: 667592-09, 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-0036-2/L, Certificate number: ER-0032-
21

Calibrated by
Mr. Soravit Thechachol
Miss Orathai Wiwatwittaya



Approved Signatory: *[Signature]*
Mr. Porinya Booncharoen
Calibration Department Manager

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



63/14-16,67/36-36, Soi Pelchhasem 7,7/1, Patchhasem Rd,
Walthapa, Bangkokyal, Bangkok 10600 Thailand.
Tel: (66) 02-8680812#13 Fax: (66) 02-8680860 www.jiranteec.com



Certificate No: CL-003-65
Page 2 of 2

Result of Calibration: ☒ Without Adjustment ☐ With Adjustment
Calibration Range: 20 - 40 °C

Function: This equipment was connected with temperature sensor Model: HMP60 S/N: R1131111
Dimension: Diameter 12mm. Length 80 mm.

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
60	20.053	19.8	-0.3	0.099
60	25.001	24.6	-0.4	0.099
60	29.991	29.7	-0.3	0.099
60	34.980	34.5	-0.5	0.099
60	39.960	39.5	-0.5	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 ★



Lot No. 2284960-1

ANALYZER CALIBRATION DATA

Client: Gulf JP NKK Co., Ltd. Location: 1/101 HRB0 11
Date: 23 Sep 22 Test Operator: Navaphut S.

O₂ ANALYZER
Model: TELEDYNE API 200EH Serial No: 548
Span (%): 25

	Cylinder Value (%)	Initial Analyzers Calibration Response (%)	Final Analyzers Calibration Response (%)	Difference (Percent of Span)
Zero Gas	0.00	0.00	0.10	0.40
Low-Level Gas	8.05	8.00	8.00	0.00
Span Gas	16.05	16.10	16.00	0.40

NO_x ANALYZER
Model: TELEDYNE API 200EH Serial No: 548
Span (ppm): 200

	Cylinder Value (ppm)	Initial Analyzers Calibration Response (ppm)	Final Analyzers Calibration Response (ppm)	Difference (Percent of Span)
Zero Gas	0.00	0.00	0.30	0.15
Low-Level Gas	50.32	50.00	50.00	0.00
Span Gas	150.20	150.00	157.40	0.30

SO₂ ANALYZER
Model: TELEDYNE API 100EH Serial No: 282
Span (ppm): 200

	Cylinder Value (ppm)	Initial Analyzers Calibration Response (ppm)	Final Analyzers Calibration Response (ppm)	Difference (Percent of Span)
Zero Gas	0.00	0.00	0.10	0.05
Low-Level Gas	50.27	50.20	50.00	0.10
Span Gas	151.50	151.60	161.00	0.30

CO ANALYZER
Model: TELEDYNE API 300BH Serial No: 300
Span (ppm): 200

	Cylinder Value (ppm)	Initial Analyzers Calibration Response (ppm)	Final Analyzers Calibration Response (ppm)	Difference (Percent of Span)
Zero Gas	0.00	0.00	0.30	0.10
Low-Level Gas	49.89	50.00	50.00	0.00
Span Gas	157.50	157.50	157.00	0.25

Calibrated by

Navaphut S.

(Mr. Navaphut Sakhya)
Environmental Field Scientist (2)

FORM NO: F-06-002 REVISION NO: 2 ISSUE DATE: 3/06/19
ALS Laboratory Group



Lot No. 2284960-1

SYSTEM CALIBRATION BIAS AND DRIFT DATA

Client: Gulf JP NKK Co., Ltd. Location: 1/101 HRB0 11
Date: 23 Sep 22 Test Operator: Navaphut S.

O₂ ANALYZER
Cylinder Conc. (%): 16.08 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	0.00	0.00	0.00	0.10	0.40	0.40
Upscale Gas	16.10	16.00	0.40	16.00	0.40	0.00

NO_x ANALYZER
Cylinder Conc. (ppm): 154.30 Span (ppm): 200

	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	0.00	0.30	0.15	0.30	0.15	0.00
Upscale Gas	158.00	157.10	0.45	157.40	0.50	0.15

SO₂ ANALYZER
Cylinder Conc. (ppm): 161.60 Span (ppm): 200

	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	0.10	0.05	0.10	0.05	0.00
Upscale Gas	161.60	161.50	0.30	161.00	0.30	0.00

CO ANALYZER
Cylinder Conc. (ppm): 167.80 Span (ppm): 200

	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	0.00	0.40	0.20	0.20	0.10	0.10
Upscale Gas	167.50	167.10	0.20	167.00	0.25	0.05

Calibrated by

Navaphut S.

(Mr. Navaphut Sakhya)

Environmental Field Scientist (2)

FORM NO: F-06-002 REVISION NO: 2 ISSUE DATE: 3/06/19
ALS Laboratory Group



EMISSION TEST RESULT

Client: Gulf JP NKK Co., Ltd.
Date: 28 Sep 22
Start Time: 12:48
Run #: 1
Location: 1565 HRBQ 11
Test Operator: Navaphut S.
Finish Time: 13:08
Serial No.: 262
Model: TELEDYNE API 100EH
Serial No.: 548
Model: TELEDYNE API 200EH
Serial No.: 300
Model: TELEDYNE API 300EH

Time (min)	O ₂ (%)	CO ₂ (%)	NOx (ppm)	SO ₂ (ppm)	CO (ppm)	Remark
12:45	14.29	3.69	21.47	0.01	0.50	
12:46	14.27	3.68	21.44	0.01	0.31	
12:47	14.28	3.69	21.50	0.01	0.41	
12:48	14.28	3.69	21.51	0.04	0.50	
12:49	14.28	3.71	21.48	0.01	0.48	
12:50	14.29	3.71	21.52	0.02	0.31	
12:51	14.30	3.69	21.65	0.05	0.26	
12:52	14.29	3.68	21.64	0.03	0.30	
12:53	14.28	3.75	21.78	0.05	0.34	
12:54	14.27	3.72	21.83	0.03	0.27	
12:55	14.25	3.70	21.85	0.04	0.31	
12:56	14.25	3.77	21.83	0.04	0.39	
12:57	14.25	3.70	21.38	0.04	0.20	
12:58	14.28	3.78	21.32	0.02	0.34	
12:59	14.27	3.73	21.32	0.02	0.31	
13:00	14.28	3.68	21.29	0.05	0.30	
13:01	14.28	3.59	21.27	0.04	0.21	
13:02	14.28	3.70	21.19	0.04	0.32	
13:03	14.29	3.73	21.08	0.05	0.28	
13:04	14.27	3.74	20.96	0.05	0.34	
13:05	14.24	3.76	20.97	0.02	0.32	
Average	14.28	3.71	21.44	0.03	0.38	

Navaphut S.

(Mr. Navaphut S. Nitya)

Environmental Field Scientist (2)

FORM NO. F-04-002 REVISION NO. 2 ISSUE DATE: 2009/18

ALS Laboratory Group



EMISSION TEST RESULT

Client: Gulf JP NKK Co., Ltd.
Date: 28 Sep 22
Start Time: 13:08
Run #: 2
Location: 1565 HRBQ 11
Test Operator: Navaphut S.
Finish Time: 13:28
Serial No.: 262
Model: TELEDYNE API 100EH
Serial No.: 548
Model: TELEDYNE API 200EH
Serial No.: 300
Model: TELEDYNE API 300EH

Time (min)	O ₂ (%)	CO ₂ (%)	NOx (ppm)	SO ₂ (ppm)	CO (ppm)	Remark
13:08	14.28	3.74	21.04	0.04	0.32	
13:07	14.28	3.71	21.21	0.04	0.40	
13:08	14.25	3.70	21.21	0.04	0.28	
13:09	14.25	3.69	21.20	0.02	0.24	
13:10	14.26	3.73	21.20	0.01	0.35	
13:11	14.25	3.72	21.36	0.04	0.32	
13:12	14.28	3.89	21.27	0.05	0.16	
13:13	14.28	3.75	21.18	0.00	0.13	
13:14	14.28	3.89	21.18	0.00	0.12	
13:15	14.28	3.73	21.23	0.04	0.15	
13:16	14.25	3.71	21.26	0.03	0.26	
13:17	14.25	3.74	21.27	0.04	0.26	
13:18	14.26	3.72	21.38	0.04	0.20	
13:19	14.25	3.74	21.36	0.02	0.07	
13:20	14.25	3.80	21.40	0.00	0.00	
13:21	14.23	3.75	21.38	0.00	0.23	
13:22	14.25	3.74	21.40	0.05	0.13	
13:23	14.26	3.73	21.43	0.05	0.20	
13:24	14.24	3.71	21.48	0.03	0.20	
13:25	14.23	3.72	21.53	0.03	0.14	
13:26	14.21	3.78	21.61	0.05	0.25	
Average	14.28	3.73	21.31	0.03	0.22	

Navaphut S.

(Mr. Navaphut S. Nitya)

Environmental Field Scientist (2)

FORM NO. F-04-002 REVISION NO. 2 ISSUE DATE: 2009/18

ALS Laboratory Group



EMISSION TEST RESULT

Client: Gulf JP NKK Co., Ltd.
Date: 23 Sep 22
Start Time: 13:27
Run #: 3
Location: 1565 HRBQ 11
Test Operator: Navaphut S.
Finish Time: 13:47
Serial No.: 262
Model: TELEDYNE API 100EH
Serial No.: 548
Model: TELEDYNE API 200EH
Serial No.: 300
Model: TELEDYNE API 300EH

Time (min)	O ₂ (%)	CO ₂ (%)	NOx (ppm)	SO ₂ (ppm)	CO (ppm)	Remark
13:27	14.23	3.70	21.50	0.02	0.18	
13:28	14.23	3.72	21.27	0.02	0.00	
13:29	14.22	3.73	21.19	0.00	0.28	
13:30	14.21	3.71	21.07	0.04	0.19	
13:31	14.22	3.71	21.05	0.04	0.23	
13:32	14.22	3.74	21.00	0.01	0.33	
13:33	14.21	3.70	20.96	0.05	0.15	
13:34	14.23	3.69	21.05	0.04	0.14	
13:35	14.24	3.68	21.22	0.05	0.21	
13:36	14.23	3.69	21.25	0.05	0.15	
13:37	14.21	3.73	21.24	0.05	0.15	
13:38	14.23	3.74	21.35	0.02	0.16	
13:39	14.24	3.58	21.38	0.02	0.21	
13:40	14.23	3.71	21.30	0.01	0.09	
13:41	14.23	3.75	21.47	0.01	0.20	
13:42	14.22	3.70	21.60	0.00	0.09	
13:43	14.22	3.71	21.64	0.04	0.13	
13:44	14.22	3.67	21.53	0.05	0.18	
13:45	14.23	3.68	21.43	0.03	0.17	
13:46	14.23	3.75	21.42	0.03	0.23	
13:47	14.21	3.72	21.44	0.03	0.19	
Average	14.22	3.71	21.30	0.03	0.17	

Navaphut S.

(Mr. Navaphut S. Nitya)

Environmental Field Scientist (2)

FORM NO. F-04-002 REVISION NO. 2 ISSUE DATE: 2009/18

ALS Laboratory Group



ANALYZER CALIBRATION DATA

Lot No. 2294951-1

Client: Gulf JP NKK Co., Ltd.
Date: 23 Sep 22
Location: 1565 HRBQ 12
Test Operator: Navaphut S.
O₂ ANALYZER Model: TELEDYNE API 100EH
Span (%) : 26
Serial No.: 548

	Cylinder Value (%)	Initial Analyzers Calibration Response (%)	Final Analyzers Calibration Response (%)	Difference (Percent of Span)
Zero Gas	0.00	0.00	0.10	0.40
Low-Level Gas	8.05	8.00	8.00	0.00
Span Gas	18.08	18.10	18.03	0.40

NO₂ ANALYZER Model: TELEDYNE API 200EH
Span (ppm) : 200
Serial No.: 548

	Cylinder Value (ppm)	Initial Analyzers Calibration Response (ppm)	Final Analyzers Calibration Response (ppm)	Difference (Percent of Span)
Zero Gas	0.00	0.00	0.30	0.15
Low-Level Gas	50.32	50.00	50.00	0.00
Span Gas	158.20	158.00	157.40	0.30

SO₂ ANALYZER Model: TELEDYNE API 100EH
Span (ppm) : 200
Serial No.: 262

	Cylinder Value (ppm)	Initial Analyzers Calibration Response (ppm)	Final Analyzers Calibration Response (ppm)	Difference (Percent of Span)
Zero Gas	0.00	0.00	0.10	0.05
Low-Level Gas	50.27	50.20	50.00	0.10
Span Gas	161.60	161.80	161.00	0.30

CO ANALYZER Model: TELEDYNE API 300EH
Span (ppm) : 200
Serial No.: 300

	Cylinder Value (ppm)	Initial Analyzers Calibration Response (ppm)	Final Analyzers Calibration Response (ppm)	Difference (Percent of Span)
Zero Gas	0.00	0.20	0.10	0.10
Low-Level Gas	48.89	50.00	50.00	0.00
Span Gas	157.50	157.50	157.00	0.25

Calibrated by

Navaphut S.

(Mr. Navaphut S. Nitya)

Environmental Field Scientist (2)

FORM NO. F-04-002 REVISION NO. 2 ISSUE DATE: 2009/18

ALS Laboratory Group



Lot No. 2284961-1

SYSTEM CALIBRATION BIAS AND DRIFT DATA

Client : Gulf JP NKK Co., Ltd. Location : Ulae HR88 12
Date : 22 Sep 22 Test Operator : Navaphut S.O₂ ANALYZER
Cylinder Conc. (%) : 18.08 Span (%) : 25

	O ₂ Analyzer Calibration Response	Initial Values		Final Values		Drift (% of Span)
		System Calibration Response	System Cal Bias (% of Span)	System Calibration Response	System Cal Bias (% of Span)	
Zero Gas	0.00	0.00	0.00	0.10	0.40	0.40
Upscale Gas	18.10	18.00	0.40	18.00	0.40	0.00

NO₂ ANALYZER
Cylinder Conc. (ppm) : 168.20 Span (ppm) : 300

	NO ₂ Analyzer Calibration Response	Initial Values		Final Values		Drift (% of Span)
		System Calibration Response	System Cal Bias (% of Span)	System Calibration Response	System Cal Bias (% of Span)	
Zero Gas	0.00	0.30	0.15	0.30	0.15	0.00
Upscale Gas	158.00	157.10	0.45	157.40	0.30	0.15

SO₂ ANALYZER
Cylinder Conc. (ppm) : 161.80 Span (ppm) : 200

	SO ₂ Analyzer Calibration Response	Initial Values		Final Values		Drift (% of Span)
		System Calibration Response	System Cal Bias (% of Span)	System Calibration Response	System Cal Bias (% of Span)	
Zero Gas	0.00	0.10	0.05	0.10	0.05	0.00
Upscale Gas	161.60	161.00	0.30	161.50	0.30	0.00

CO ANALYZER
Cylinder Conc. (ppm) : 167.80 Span (ppm) : 200

	CO Analyzer Calibration Response	Initial Values		Final Values		Drift (% of Span)
		System Calibration Response	System Cal Bias (% of Span)	System Calibration Response	System Cal Bias (% of Span)	
Zero Gas	0.00	0.40	0.20	0.20	0.10	0.10
Upscale Gas	157.50	157.10	0.20	157.50	0.25	0.05

Calibrated by

Navaphut S.

(Mr. Navaphut Srivithya)

Environmental Field Scientist (2)

FORM NO. F-06-002 REVISION NO. 2 ISSUE DATE 3/06/19

ALS Laboratory Group



EMISSION TEST RESULT

Client : Gulf JP NKK Co., Ltd. Run # : 1
Date : 22 Sep 22 Location : Ulae HR88 12
Start Time : 10:46 Test Operator : Navaphut S.
Finish Time : 11:06
SO₂ Analyzer Model : TELEDYNE API 100EH Serial No. : 282
NO_x/O₂ Analyzer Model : TELEDYNE API 300EH Serial No. : 846
CO/CO₂ Analyzer Model : TELEDYNE API 300EH Serial No. : 300

Time (min)	O ₂ (%)	CO ₂ (%)	NO _x (ppm)	SO ₂ (ppm)	CO (ppm)	Remark
10:45	14.15	3.74	16.04	0.04	0.97	
10:46	14.15	3.76	16.04	0.02	0.87	
10:47	14.16	3.74	16.00	0.03	0.79	
10:48	14.17	3.74	16.75	0.02	0.83	
10:49	14.18	3.73	15.59	0.06	0.86	
10:50	14.18	3.74	15.59	0.02	0.92	
10:51	14.18	3.77	15.86	0.02	0.86	
10:52	14.19	3.77	15.68	0.02	0.87	
10:53	14.19	3.70	16.89	0.01	0.83	
10:54	14.21	3.72	15.56	0.04	0.86	
10:55	14.22	3.75	15.77	0.01	0.70	
10:56	14.27	3.71	15.71	0.02	0.74	
10:57	14.26	3.73	15.88	0.01	0.83	
10:58	14.24	3.71	15.55	0.00	0.98	
10:59	14.27	3.73	15.87	0.01	0.81	
11:00	14.28	3.72	15.85	0.01	0.86	
11:01	14.28	3.76	15.75	0.01	0.88	
11:02	14.28	3.75	15.56	0.05	0.54	
11:03	14.30	3.74	15.50	0.00	0.87	
11:04	14.30	3.74	15.70	0.02	0.74	
11:05	14.29	3.75	16.48	0.03	0.84	
Average	14.38	3.74	16.75	0.02	0.86	

Navaphut S.

(Mr. Navaphut Srivithya)

Environmental Field Scientist (2)

FORM NO. F-06-002 REVISION NO. 2 ISSUE DATE 3/06/19

ALS Laboratory Group



EMISSION TEST RESULT

Client : Gulf JP NKK Co., Ltd. Run # : 2
Date : 22 Sep 22 Location : Ulae HR88 12
Start Time : 11:06 Test Operator : Navaphut S.
Finish Time : 11:26
SO₂ Analyzer Model : TELEDYNE API 100EH Serial No. : 282
NO_x/O₂ Analyzer Model : TELEDYNE API 300EH Serial No. : 846
CO/CO₂ Analyzer Model : TELEDYNE API 300EH Serial No. : 300

Time (min)	O ₂ (%)	CO ₂ (%)	NO _x (ppm)	SO ₂ (ppm)	CO (ppm)	Remark
11:06	14.26	3.73	16.42	0.01	0.75	
11:07	14.28	3.76	16.72	0.04	0.72	
11:08	14.25	3.77	16.22	0.00	0.80	
11:09	14.26	3.74	16.02	0.30	0.80	
11:10	14.26	3.74	15.59	0.04	0.82	
11:11	14.26	3.74	15.41	0.03	0.81	
11:12	14.26	3.76	15.58	0.04	0.83	
11:13	14.27	3.82	15.66	0.02	0.78	
11:14	14.29	3.76	15.69	0.03	0.78	
11:15	14.29	3.75	15.72	0.01	0.71	
11:16	14.29	3.77	15.78	0.01	0.63	
11:17	14.26	3.73	15.42	0.05	0.84	
11:18	14.29	3.76	16.48	0.02	0.87	
11:19	14.30	3.71	15.02	0.03	0.67	
11:20	14.28	3.76	15.79	0.02	0.70	
11:21	14.27	3.76	15.68	0.02	0.70	
11:22	14.27	3.73	15.47	0.04	0.68	
11:23	14.27	3.73	15.48	0.04	0.76	
11:24	14.28	3.73	15.43	0.06	0.87	
11:25	14.28	3.70	15.23	0.05	0.66	
11:26	14.27	3.75	15.32	0.03	0.74	
Average	14.38	3.75	16.59	0.08	0.73	

Navaphut S.

(Mr. Navaphut Srivithya)

Environmental Field Scientist (2)

FORM NO. F-06-002 REVISION NO. 2 ISSUE DATE 3/06/19

ALS Laboratory Group



EMISSION TEST RESULT

Client : Gulf JP NKK Co., Ltd. Run # : 3
Date : 23 Sep 22 Location : Ulae HR88 12
Start Time : 11:27 Test Operator : Navaphut S.
Finish Time : 11:47
SO₂ Analyzer Model : TELEDYNE API 100EH Serial No. : 282
NO_x/O₂ Analyzer Model : TELEDYNE API 300EH Serial No. : 846
CO/CO₂ Analyzer Model : TELEDYNE API 300EH Serial No. : 300

Time (min)	O ₂ (%)	CO ₂ (%)	NO _x (ppm)	SO ₂ (ppm)	CO (ppm)	Remark
11:27	14.27	3.74	15.26	0.02	0.73	
11:28	14.26	3.72	15.67	0.01	0.74	
11:29	14.26	3.76	16.04	0.03	0.55	
11:30	14.26	3.74	15.87	0.05	0.54	
11:31	14.26	3.74	15.62	0.05	0.72	
11:32	14.26	3.72	15.50	0.00	0.79	
11:33	14.25	3.75	15.77	0.03	0.53	
11:34	14.26	3.73	15.74	0.02	0.51	
11:35	14.25	3.74	15.77	0.01	0.81	
11:36	14.26	3.75	15.75	0.04	0.48	
11:37	14.26	3.75	15.19	0.04	0.51	
11:38	14.26	3.78	15.74	0.03	0.57	
11:39	14.26	3.75	15.84	0.02	0.59	
11:40	14.27	3.73	15.86	0.00	0.58	
11:41	14.27	3.77	16.37	0.02	0.50	
11:42	14.26	3.74	16.26	0.00	0.55	
11:43	14.26	3.74	16.12	0.00	0.55	
11:44	14.26	3.79	16.06	0.01	0.56	
11:45	14.26	3.77	16.18	0.00	0.57	
11:46	14.27	3.77	16.19	0.03	0.58	
11:47	14.27	3.73	16.06	0.02	0.59	
Average	14.28	3.75	15.98	0.02	0.60	

Navaphut S.

(Mr. Navaphut Srivithya)

Environmental Field Scientist (2)

FORM NO. F-06-002 REVISION NO. 2 ISSUE DATE 3/06/19

ALS Laboratory Group

CERTIFICATE OF ANALYSIS Grade of Product: EPA Protocol

Part Number: E02N184E15A0797 Reference Number: 180-401948145-1
Cylinder Number: CC740033 Cylinder Volume: 145.8 CF
Laboratory: 124 - Plumsteadville - PA Cylinder Pressure: 2015 PSIG
PGVP Number: A12020 Valve Outlet: 580
Gas Code: O2,BALN Certification Date: Nov 11, 2020
Expiration Date: Nov 11, 2028

Certification performed in accordance with EPA Traceability Protocol for Analytical and Calibration Standards (May 2012) document EPA 600/R-10/051, using the same 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 psig, 1 in. O.D. megaphase

ANALYTICAL RESULTS					
Component	Requested Concentration	Actual Concentration	Protocol Method	Total Relative Uncertainty	Assay Dates
OXYGEN	18.00 %	18.08 %	Q1	+/- 0.2% NIST Traceable	11/11/2020
NITROGEN	Balance				
CALIBRATION STANDARDS					
Type	Lot ID	Cylinder No.	Concentration	Uncertainty	Expiration Date
NTRM	16060603	CC109542	93.204 % OXYGEN/NITROGEN	+/- 0.2%	Dec 24, 2021
ANALYTICAL EQUIPMENT					
Instrument/Make/Model			Analytical Principle		
SIEMENS OXYMAT 8 - N1-W5-551 - 02			PARAMAGNETIC		
			Last Multipoint Calibration		
			Oct 25, 2020		

Trid Data Available Upon Request

NOTES:
Gross Weight: 27.8 Kg
Net Weight: 4.7 Kg



Signature

Approved for Release

Page 1 of 180-401948145-1



CONSOLE CONTROL UNIT CALIBRATION TEST REPORT

Calibration Date: 3 Jul 22 Barometric Pressure (mm Hg): 71
Next Calibration Date: 3 Jan 23 Relative Humidity (%): 62
Temperature (°C): 31
Reference Dry Gas Meter Data
Calibration No.: C-030722-BKH_FS0508 Reference Dry Gas Meter ID: 7668004
Dry Gas Meter No.: BKH_FS0508 Serial No.: 1503017
Serial No.: 1503017 Correction Factor (1): 1
Model No.: XC-672-V Next Calibration Date: 7

ΔH		Q		Reference Dry Gas Meter Calibration		Console Control, Oxygen Meter	
(mm Hg)		Modules		m (L/min)		m (L/min)	
				m (L/min)		m (L/min)	
				m (L/min)		m (L/min)	
18	11.12	180.00	5.00	180.00	32.0	71427.0	71427.0
20	9.27	180.00	4.00	180.00	30.0	71427.0	71427.0
30	6.95	180.00	3.00	180.00	24.0	71427.0	71427.0
40	5.16	180.00	2.00	180.00	18.0	71427.0	71427.0
50	4.18	180.00	1.00	180.00	12.0	71427.0	71427.0

1. Rate of change of flow rate is dry gas meter. Reference for individual values ± 0.02 from average.
2. Dry gas pressure (mm Hg) and quality: 40-200 mm Hg at 25 °C and 100 mm Hg at 25 °C. Reference for individual values ± 0.02 mm Hg.
Reference: 65 CFR 83.877 ALUETH, SEC 3.2.1

Calibrated by: *Prasert S.*
(Mr. Prasert Surakhian)
Field Scientist (3)

Approved by: *Signature*
(Mr. Samart Roon-ngan)
Specialist (1)



Stopwatch Calibration Test Report

Calibration Date: 3 Jul 22 Next Cal. Date: 3 Jan 23
Barometric Pressure (mm Hg): 756 Temperature (°C): 31.0
Relative Humidity (%): 62.0

Reference Stopwatch Data Console Control Meter Data
Stopwatch ID No.: E18061 Dry Gas Meter No.: BKH_FS0508
Model: F808 Model: XC-672-V
Serial No.: - Serial No.: 1503017
Calibration Date: 8 Sep 20
Certificate No.: E-2009018

Run No.	Time Actual (m:ss.ms)	Time Reading (m:ss)	Diff. (ms)	Diff. (min)
1	5:00:08	5:00	8	0.00013
2	5:00:11	5:00	11	0.00018
3	5:00:10	5:00	10	0.00017
4	5:00:10	5:00	10	0.00017
5	5:00:10	5:00	10	0.00017
6	5:00:10	5:00	10	0.00017
7	5:00:08	5:00	8	0.00013
8	5:00:09	5:00	9	0.00015
9	5:00:11	5:00	11	0.00018
10	5:00:12	5:00	12	0.00020
Average			0.00017	
SD			0.00002	

Calibrate by:

Mr. Prasert Surakhian

Field Scientist (3)

Approved by:

Mr. Samart Roon-ngan

Specialist (1)



DIGITAL TEMPERATURE CALIBRATION DATA SHEET

Calibration Date: 3 Jul 22 Ambient Temperature (°C): 31
Calibration sheet No.: C-030722-BKH_FS0508 Relative Humidity (%): 62
Digital Temperature ID: BKH_FS0508 Reference Temperature ID: BKH_FS0508
Serial No.: 1503017 Serial No.: 7668004
Model: XC-672-V Model: FLUKE 714
Next Calibrate: 25 Jul 23

Location	Reference Temperature °C	Digital Temperature °C	Error °C	Remark
Stack	0	1	1	
	25	26	1	
	50	51	1	
	100	101	1	
	150	151	1	
	200	201	1	
Probe	250	252	2	
	300	302	2	
	500	503	3	
	1000	1003	3	
	1200	1203	3	
	150	151	1	
Oven	125	126	1	
	150	151	1	
	100	100	0	
Filter	125	125	0	
	150	151	1	
	100	100	0	
Exit	125	125	0	
	150	151	1	
	100	100	0	
Meter	0	1	1	
	10	11	1	
	20	21	1	
ALUX	0	0	0	
	25	25	0	
	50	50	0	

Calibrated by:

(Mr. Prasert Surakhian)

Field Scientist (3)

Approved by:

(Mr. Samart Roon-ngan)

Specialist (1)

FORM NO. 7 (Rev. 02/17) REVISION NO. 1 DATE: 8/15/20



Pitot Tube Calibration Data

Pitot Tube Identification Number: BKK_FS0511 Calibration Date: 3 Jul 22
Lab test duct Number: 258-1-13-01 Standard Pitot ID: BKK_FS0441
Calibration Sheet No.: C-030722-BKK_FS0511 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
\bar{C}_p				0.842	0.842

$$C_p(s) = C_p \cdot \sqrt{\frac{\Delta P(s)}{\Delta P}} \quad (s)$$

$$[\bar{C}_p(A) - \bar{C}_p(B)] \text{ must BE } \leq 0.01$$

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

Calibrated by: Prasert S.
(Mr. Prasert Surakhan)
Field Scientist (3)

Approved by: S.P.
(Mr. Samart Ro-ngan)
Specialist (1)

FORM NO. 7 06-008 REVISION NO. 1 ISSUE DATE: 01/01/02



Pitot Tube Calibration Data

Pitot Tube Identification Number: BKK_FS0512 Calibration Date: 3 Jul 22
Lab test duct Number: 258-1-13-01 Standard Pitot ID: BKK_FS0441
Calibration Sheet No.: C-030722-BKK_FS0512 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
\bar{C}_p				0.842	0.842

$$C_p(s) = C_p \cdot \sqrt{\frac{\Delta P(s)}{\Delta P}} \quad (s)$$

$$[\bar{C}_p(A) - \bar{C}_p(B)] \text{ must BE } \leq 0.01$$

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

Calibrated by: Prasert S.
(Mr. Prasert Surakhan)
Field Scientist (3)

Approved by: S.P.
(Mr. Samart Ro-ngan)
Specialist (1)

FORM NO. 7 06-008 REVISION NO. 1 ISSUE DATE: 01/01/02



PROBE NOZZLE DIAMETER CALIBRATION DATA SHEET

Calibration Date: 3 Jul 22 Nozzle Set ID: BKK_FS0513
Calibration Sheet No.: C-030722-BKK_FS0513 Vernier Caliper ID: BKK_FS0626

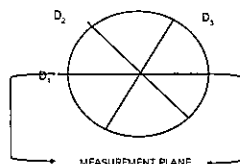
Nozzle ID #	Nozzle Diameter (cm.)			Hi - Lo ΔD	$(D_1 + D_2 + D_3) / 3$ D_{avg}
	D_1	D_2	D_3		
1	0.315	0.315	0.315	0.000	0.315
2	0.475	0.475	0.475	0.000	0.475
3	0.635	0.635	0.635	0.000	0.635
4	0.790	0.790	0.790	0.000	0.790
5	0.950	0.950	0.950	0.000	0.950
6	1.110	1.110	1.110	0.000	1.110
7	1.270	1.270	1.270	0.000	1.270

Where:

D_1, D_2, D_3 = 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} = $(D_1 + D_2 + D_3) / 3$



Calibrated by: Prasert S.
(Mr. Prasert Surakhan)
Field Scientist (3)

Approved by: S.P.
(Mr. Samart Ro-ngan)
Specialist (1)

FORM NO. 7 06-008 REVISION NO. 1 ISSUE DATE: 01/01/02



PENTA
CALIBRATION

PENTA CALIBRATION CO., LTD.
66/124 The Connect 33 Village Kanchanaphisek Road
Dokmai Pratek Bangkok 10250
Tel: +66 (0) 2069-9773
www.pentalab.com

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: 38304165
Model: SECURA224-15 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 \pm 0.4 °C
Humidity 58.1 %RH \pm 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 Tial Calibration Service Co., Ltd.
, NSC-ONS Accreditation No.: Calibration 0189

Date Received: December 16, 2021
Calibration Date: December 16, 2021
Issued Date: December 20, 2021
Calibration By: Mr. Koatsak Kerdto

REVIEW BY: S.P.
APPROVED BY: K.A.
NEXT CAL. DATE: 16/12/22

Mr. Koatsak Kerdto
(Mr. Koatsak Kerdto)
Reviewed by

Approved By: Mr. Koatsak Kerdto
(Mr. Koatsak Kerdto)
Laboratory Manager

This certificate is issued the units of measurement according to the International System of Units (SI). It provides traceability of measurement to international or national standard or other recognized national standard laboratories.
The measurement uncertainty stated is the expanded uncertainty, which is obtained from the standard uncertainty multiplied by the coverage factor (k=2) to provide a level of confidence of approximately 95%. It is determined in accordance with the Guide to Expression of Uncertainty in Measurement (GUM). The effect that the results relate only to the items calibrated.
This calibration certificate shall not be reproduced except in full only, without written approval from Penta Calibration Co., Ltd.

PTC-FAC-01-00-2160-000

Represent to Certificate of Calibration ,PTC/07/21161

Certificate No.: PTC/07/21161

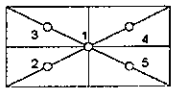
Page: 2 of 2

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 $1/2 \leq L_1 \leq$ 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	2.57
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-FMC-07-07 2146-2020

451-451/1 Sirinithom Rd.,Bangbunmu, Bangplud 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 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 : 05 JANUARY 2022
Calibration Date : 14 JANUARY 2022
Date of Issue : 17 JANUARY 2022

REVIEW BY: *Natthakorn P.*
APPROVED BY: *[Signature]*
NEXT CAL. DATE: 14/1/23

Calibrated by : Natthakorn Pisuipaisan

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.

QI-TS12-04-04-020664

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	33511B	MY52302742	EF-0011-21	10-Feb-22
Digital Multimeter	33461A	MY53220104	EEL-DP. 03-0264	10-Feb-22
Digital Multimeter	33461A	MY53220076	EEL-DP. 03-0264	08-Feb-22
Digital Multimeter	33461A	MY50024273	I-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	V744B6069	EF-0010-21	10-Feb-22

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

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

3.1 National Institute of Metrology (Thailand).

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

Continuation of Calibration Certificate

Cert. No.: ACC22003
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	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

QI-TS12-04-04-020664

QI-TS12-04-04-020664

SITHIPORN ASSOCIATES CO.,LTD. CALIBRATION LABORATORY

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



Cert. No. : ACL22167
Pages : 1 of 8

Calibration Certificate

Equipment : SOUND LEVEL METER
Manufacturer : RION
Model : NL-42/ Microphone UC-52 / Pre-amplifier NH-24
Serial No. : 00658242 / 157782 / 48097
ID No. : BKK_FS0099

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 2022
Calibration Date : 11-18 JULY 2022
Date of Issue : 19 JULY 2022

Calibrated by : Nathakorn Pisutpaisan

Approved by :

T. Petch
(Thanakul Petchurui)

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. : ACL22167
Job No. : VC65AC0069
Pages : 2 of 8

Calibration Procedure : CP-AC-01

Calibration Method :

This equipment was calibrated by based on IEC-61672-3 (2012) 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-0007-22	04-Feb-23
Waveform Generator	33511B	MY52302742	EP-0008-22	04-Feb-23
Digital Multimeter	33461A	MY53220104	EEL-BP_04/0265	09-Feb-23
Digital Multimeter	33461A	MY53220076	EEL-BP_03/0265	09-Feb-23
Digital Multimeter	34461A	MY60024273	EEL-BP_05/0265	09-Feb-23
Programmable Attenuator	MAT-1070	62100114	EP-0009-22	07-Feb-23
Condenser Microphone	4180	29779900	AA-1013-22	24-Feb-23
Measuring Amplifier	NA-42KAI	34560495	AA-3005-22	22-Feb-23

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. Petch

SITHIPORN ASSOCIATES CO.,LTD. CALIBRATION LABORATORY

Continuation of Calibration Certificate

Cert. No. : ACL22167
Job No. : VC65AC0069
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. Petch

SITHIPORN ASSOCIATES CO.,LTD. CALIBRATION LABORATORY

Continuation of Calibration Certificate

Cert. No. : ACL22167
Job No. : VC65AC0069
Pages : 4 of 8

Result of calibration :

1. Absolute sensitivity

Reference Acoustic Signal (dB)	Measured Value (dB)	Deviation (dB)	Acceptance Limit (dB)
93.9 (93.95)	93.9	0.0	±0.3

2. Self-generated noise

2.1 Normal test

Measured Value (dB)
17.7

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

Frequency Weighting	Measured value (dB)
A-weight	16.1
C-weight	21.7
Flat	27.4

3. Acoustical signal tests of frequency weightings

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

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)			
	Flat	C-weight	A-weight	Acceptance Limits
125	0.2	0.2	0.2	±1.5
1000	-0.1	-0.1	-0.1	±1.0
8000	-1.4	-1.3	-1.3	±5.0

QF-TS12-04-04-020664

T. Petch

Continuation of Calibration Certificate

Cert. No. : ACL22167
Job No. : VC65AC0069
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	-0.1	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. Petch

Continuation of Calibration Certificate

Cert. No. : ACL22167
Job No. : VC65AC0069
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	27.9	-0.1	±1.1
27.0	27.1	0.1	±1.1
26.0	26.0	0.0	±1.1
25.0	25.1	0.1	±1.1

QF-TS12-04-04-020664

T. Petch

Continuation of Calibration Certificate

Cert. No. : ACL22167
Job No. : VC65AC0069
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	135.6	-0.8	±3.0

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

QF-TS12-04-04-020664

T. Petch

Continuation of Calibration Certificate

Cert. No. : ACL22167
Job No. : VC65AC0069
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	89.5	-0.2	±1.5

12. High level stability

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

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

End of Calibration Certificate

QF-TS12-04-04-020664

T. Petch

SITHIPORN ASSOCIATES CO.,LTD. CALIBRATION LABORATORY

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



Cert. No. : ACL21169
Pages : 1 of 8

Calibration Certificate

Equipment : SOUND LEVEL METER
Manufacturer : RION
Model : NL-42 / Microphone UC-52 / Pre-amplifier NH-24
Serial No. : 00858520 / 158771 / 58772
ID No. : BKK_JS0110

Condition As Found : GOOD

Customer : ALS LABORATORY GROUP (THAILAND) CO., LTD.
104 PIATTHANAKAN 40, PIATTHANAKAN ROAD,
KHWAENG PIATTHANAKAN, KIET 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 Pisulpaisan

Approved by :

T. Petchum
(Thanakul Petchum)

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. : ACL21169
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_050264	10-Feb-22
Digital Multimeter	33461A	MY53220076	EEL-BP_030264	08-Feb-22
Digital Multimeter	8846A	1997025	EEL-BP_060264	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

SITHIPORN ASSOCIATES CO.,LTD. CALIBRATION LABORATORY

Continuation of Calibration Certificate

Cert. No. : ACL21169
Job No. : VC65AC0033
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

SITHIPORN ASSOCIATES CO.,LTD. CALIBRATION LABORATORY

Continuation of Calibration Certificate

Cert. No. : ACL21169
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)
16.6

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

Frequency Weighting	Measured value (dB)
A-weight	10.8
C-weight	16.9
Flat	22.6

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	0.4	0.4	0.5	±1.5
1000	0.0	0.0	0.0	±1.0
8000	-1.3	-1.2	-1.2	±5.0

QF-TS12-04-04-020664

Continuation of Calibration Certificate

Cert. No. : ACL21169
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	0.0	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	0.1	0.0	±2.0
4000	0.0	0.0	0.0	±3.0
8000	0.0	0.1	0.1	±5.0

5. Frequency and time weightings at 1 kHz

5.1 Frequency weightings at 1 kHz

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

5.2 Time weighting at 1 kHz

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

6. Long-term stability

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

QF-TS12-04-04-020664

T. Rth.

Continuation of Calibration Certificate

Cert. No. : ACL21169
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	33.9	-0.1	±1.1
30.0	29.9	-0.1	±1.1
29.0	29.0	0.0	±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. : ACL21169
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	128.0	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	135.2	-0.2	±2.0
Negative half cycle	135.4	135.2	-0.2	±2.0

QF-TS12-04-04-020664

T. Rth.

Continuation of Calibration Certificate

Cert. No. : ACL21169
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

T. Rth.

SITHIPORN ASSOCIATES CO.,LTD. CALIBRATION LABORATORY

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



Cert. No. : ACL21127
Pages : 1 of 8

Calibration Certificate

Equipment : SOUND LEVEL METER
Manufacturer : RION
Model : NL-42/ Microphone UC-52 / Preamplifier NH-24
Serial No.: 00858517 / 157784 / 48099
ID No.: BKK_FSD107

Condition As Found : GOOD

Customer : ALS LABORATORY GROUP (THAILAND) CO., LTD.
104 PHATTHANAKAN 40, PHATTHANAKAN ROAD,
KHIWAENG 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 OCTOBER 2021
Calibration Date : 15-18 OCTOBER 2021
Date of Issue : 19 OCTOBER 2021

Calibrated by : Nathakorn Pisurpaisan

Approved by :

T. Petchurai
(Thamkul Petchurai)

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QT-TS12-04-04-020664

SITHIPORN ASSOCIATES CO.,LTD. CALIBRATION LABORATORY

Continuation of Calibration Certificate

Cert. No. : ACL21127
Job No. : VC65AC0002
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, 03/0264	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).

QT-TS12-04-04-020664

T. Petchurai

SITHIPORN ASSOCIATES CO.,LTD. CALIBRATION LABORATORY

Continuation of Calibration Certificate

Cert. No. : ACL21127
Job No. : VC65AC0002
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

QT-TS12-04-04-020664

T. Petchurai

SITHIPORN ASSOCIATES CO.,LTD. CALIBRATION LABORATORY

Continuation of Calibration Certificate

Cert. No. : ACL21127
Job No. : VC65AC0002
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

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	18.9
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	0.5	0.5	0.5	±1.5
1000	0.0	0.0	0.0	±1.0
8000	-1.3	-1.3	-1.3	±5.0

QT-TS12-04-04-020664

T. Petchurai

Continuation of Calibration Certificate

Cert. No. : ACL21127
Job No. : VC65AC0002
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	0.0	±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. : ACL21127
Job No. : VC65AC0002
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	79.1	0.1	±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	34.1	0.1	±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	27.2	0.2	±1.1
26.0	26.2	0.2	±1.1
25.0	25.2	0.2	±1.1

QF-TS12-04-04-020664

T. Petch.

Continuation of Calibration Certificate

Cert. No. : ACL21127
Job No. : VC65AC0002
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	135.6	-0.8	±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. : ACL21127
Job No. : VC65AC0002
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

T. Petch.

SITHIPORN ASSOCIATES CO.,LTD. CALIBRATION LABORATORY

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



Cert. No. : ACL21170
Pages : 1 of 8

Calibration Certificate

Equipment : SOUND LEVEL METER
Manufacturer : RION
Model : NL-42/ Microphone UC-52 / Preamplifier NH-24
Serial No. : 00858521 / 158765 / 58767
ID No. : BKK_FS0111

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

REVIEW BY *Nathorn P.*
APPROVED BY *T. Petchur*
NEXT CAL DATE 14/12/22

Calibrated by : Nathorn Pisurpaian

Approved by :

T. Petchur
(Thanakul Petchur)

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. : ACL21170
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 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	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-Q7774E	08-Mar-22
Condenser Microphone	4180	2977900	AA-1008-21	05-Feb-22
Measuring Amplifier	NA-42KAI	34560495	AA-3003-21	16-Feb-22

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

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

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

QF-TS12-04-04-020664

T. Petchur

SITHIPORN ASSOCIATES CO.,LTD. CALIBRATION LABORATORY

Continuation of Calibration Certificate

Cert. No. : ACL21170
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

T. Petchur

SITHIPORN ASSOCIATES CO.,LTD. CALIBRATION LABORATORY

Continuation of Calibration Certificate

Cert. No. : ACL21170
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)
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	10.8
C-weight	17.3
Flat	23.1

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	0.5	0.5	0.5	± 1.5
1000	0.0	0.0	0.0	± 1.0
8000	-2.6	-2.5	-2.5	± 5.0

QF-TS12-04-04-020664

T. Petchur

Continuation of Calibration Certificate

Cert. No. : ACL21170
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	-0.1	±2.0
125	0.0	0.0	0.0	±1.5
250	0.0	0.0	0.0	±1.5
500	0.0	0.0	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

QP-TS12-04-04-020664

T. Bha.

Continuation of Calibration Certificate

Cert. No. : ACL21170
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	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	26.9	-0.1	±1.1
26.0	25.9	-0.1	±1.1
25.0	24.8	-0.2	±1.1

QP-TS12-04-04-020664

T. Bha.

Continuation of Calibration Certificate

Cert. No. : ACL21170
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	127.5	127.6	0.0	±1.0
	200	800	127.5	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	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	135.2	-0.2	±2.0
Negative half cycle	135.4	135.2	-0.2	±2.0

QP-TS12-04-04-020664

T. Bha.

Continuation of Calibration Certificate

Cert. No. : ACL21170
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	89.7	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

QP-TS12-04-04-020664

T. Bha.

SITHIPORN ASSOCIATES CO.,LTD. CALIBRATION LABORATORY

451-451/1 Sithiporn 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. : ACL21168
Pages : 1 of 8

Calibration Certificate

Equipment : SOUND LEVEL METER
Manufacturer : RION
Model : NL-42/ Microphone UC-52 / 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 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 : 09 DECEMBER 2021
Calibration Date : 14-15 DECEMBER 2021
Date of Issue : 16 DECEMBER 2021

REVIEW BY : *Nachakorn P.*
APPROVED BY : *T. Petchur*
NEXT CAL DATE : 14/12/22

Calibrated by : Nachakorn Petchuraisan

Approved by :

T. Petchur
(Thanakul Petchuraisan)

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QF-TS12-04-04-020664

SITHIPORN ASSOCIATES CO.,LTD. CALIBRATION LABORATORY

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 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	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	LS00-Q7774E	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. Petchur

SITHIPORN ASSOCIATES CO.,LTD. CALIBRATION LABORATORY

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

T. Petchur

SITHIPORN ASSOCIATES CO.,LTD. CALIBRATION LABORATORY

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 84 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

T. Petchur

Continuation of Calibration Certificate

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

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Continuation of Calibration Certificate

Cert. No. : ACL21168
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7. Level linearity on the reference level range

Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
137.0	137.0	0.0	±1.1
136.0	136.0	0.0	±1.1
135.0	135.0	0.0	±1.1
134.0	134.0	0.0	±1.1
133.0	133.0	0.0	±1.1
132.0	132.0	0.0	±1.1
131.0	131.0	0.0	±1.1
129.0	129.0	0.0	±1.1
124.0	124.0	0.0	±1.1
119.0	119.0	0.0	±1.1
114.0	114.0	0.0	±1.1
109.0	109.0	0.0	±1.1
104.0	104.0	0.0	±1.1
99.0	99.0	0.0	±1.1
94.0	94.0	0.0	±1.1
89.0	89.0	0.0	±1.1
84.0	84.1	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

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Continuation of Calibration Certificate

Cert. No. : ACL21168
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8. Level linearity including the level range control

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

9. Tone burst response

Time Weighting	Tone burst duration, T _b (ms)	Cycle	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Fast	0.25	1	108.0	107.9	-0.1	1.5; -5.0
	2	8	117.0	117.0	0.0	1.0; -2.5
	200	800	134.0	134.0	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	133.1	0.1	-
Positive half cycle	135.4	135.2	-0.2	±2.0
Negative half cycle	135.4	135.3	-0.1	±2.0

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T. P.T.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

T. P.T.A.

SITHIPORN ASSOCIATES CO.,LTD. CALIBRATION LABORATORY

451-451/1 Srinthorn 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. : 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 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 : 14 JANUARY 2022
Date of Issue : 17 JANUARY 2022

REVIEW BY : *Nathom P.*
APPROVED BY : *Nathom P.*
NEXT CAL. DATE : 14/1/23

Calibrated by : Nathom Pisupaisan

Approved by :

T. Petchurai
(Thanakul Petchurai)

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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	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	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-3350A	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. Petchurai

SITHIPORN ASSOCIATES CO.,LTD. CALIBRATION LABORATORY

Continuation of Calibration Certificate

Cert. No. : ACC22004
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. Petchurai

SITHIPORN ASSOCIATES CO.,LTD. CALIBRATION LABORATORY



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Cert. No. : ACL21137
Pages : 1 of 8

Calibration Certificate

Equipment : SOUND LEVEL METER
Manufacturer : RION
Model : NL-42 / Microphone UC-52 / Preamplifier NH-24
Serial No. : 00572665 / 170402 / 72903
ID No. : BKK_FS0874

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 : *Nathom P.*
APPROVED BY : *Nathom P.*
NEXT CAL. DATE : 05/10/22

Calibrated by : Nathom 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.

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Continuation of Calibration Certificate

Cert. No. : ACL21137
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.	Exp. Date
Waveform Generator	33210A	MY48017076	EF-0012-21	10-Feb-22
Waveform Generator	33511B	MY52302742	EF-0011-21	10-Feb-22
Digital Multimeter	33461A	MY53220104	EEL.BP. 03/0264	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	2977990	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).

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Continuation of Calibration Certificate

Cert. No. : ACL21137
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

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S. Rth...

Continuation of Calibration Certificate

Cert. No. : ACL21137
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)
17.5

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	18.0
Flat	23.6

3. Acoustical signal tests of frequency weightings

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

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)			Acceptance Limits
	Flat	C-weight	A-weight	
125	0.0	0.0	0.0	± 1.5
1000	-0.2	-0.2	-0.2	± 1.0
8000	-0.4	-0.3	-0.3	± 1.0

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Continuation of Calibration Certificate

Cert. No. : ACL21137
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	0.0	-0.1	-0.1	±2.0
125	0.0	0.0	0.0	±1.5
250	0.0	0.0	0.0	±1.5
500	0.0	0.1	0.0	±1.5
1000	0.0	0.0	0.0	±1.0
2000	0.0	0.1	0.0	±2.0
4000	0.0	0.0	0.0	±3.0
8000	0.0	0.1	0.1	±3.0

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

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Cert. No. : ACL21137
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 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

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 Continuation of Calibration Certificate

Cert. No. : ACL21137
 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, T _b (ms)	Cycle	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Fast	0.25	1	108.0	107.9	-0.1	1.5 ; -5.0
	2	8	117.0	117.0	0.0	1.0 ; -2.5
	200	800	134.0	134.1	0.1	±1.0
Slow	2	8	108.0	108.0	0.0	1.5 ; -5.0
	200	800	127.6	127.6	0.0	±1.0
	0.25	1	99.0	98.9	-0.1	1.5 ; -5.0
SEL	2	8	108.0	108.0	0.0	1.0 ; -2.5
	200	800	128.0	128.0	0.0	±1.0

10. Peak C sound level

Number of cycle in test signal	Anticipated Value (dB)	Measured Value, Lepeak (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	135.2	-0.2	±2.0
Negative half cycle	135.4	135.2	-0.2	±2.0

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CALIBRATION LABORATORY
 Continuation of Calibration Certificate

Cert. No. : ACL21137
 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		
89.5	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

T. Petch.

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451-451/1 Sindhorn Rd, Bangbunru, Bangkok Bangkok 10700 THAILAND.
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Cert. No. : ACL21145
 Pages : 1 of 8

Calibration Certificate

Equipment : SOUND LEVEL METER
 Manufacturer : RION
 Model : NL-42/ Microphone UC-52 / Preamplifier NH-24
 Serial No.: 00572562 / 170399 / 72900
 ID No.: BKK_F50878

Condition As Found : GOOD

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

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

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

Calibrated by : Nathakorn Pisutpaisan

Approved by :

T. Petch.
 (Thanakul Petchurai)

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Continuation of Calibration Certificate

Cert. No. : ACL21145
Job No. : VC65AC0011
Page : 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

T. Petch.

Continuation of Calibration Certificate

Cert. No. : ACL21145
Job No. : VC65AC0011
Page : 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. Petch.

Continuation of Calibration Certificate

Cert. No. : ACL21145
Job No. : VC65AC0011
Page : 4 of 8

Result of calibration :

1. Absolute sensitivity

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

2. Self-generated noise

2.1 Normal test

Measured Value (dB)
14.6

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

Frequency Weighting	Measured value (dB)
A-weight	9.9
C-weight	16.5
Flat	22.2

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	0.3	0.3	0.3	±1.5
1000	-0.1	-0.1	-0.1	±1.0
8000	-1.8	-1.8	-1.7	±5.0

QF-TS12-04-04-020664

T. Petch.

Continuation of Calibration Certificate

Cert. No. : ACL21145
Job No. : VC65AC0011
Page : 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	±2.0
125	0.0	0.1	0.1	±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	0.0	±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. Petch.

Continuation of Calibration Certificate

Cert. No. : ACL21145
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	28.0	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. Petchur

Continuation of Calibration Certificate

Cert. No. : ACL21145
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, T _b (ms)	Cycle	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Fast	0.25	1	108.0	108.0	0.0	1.5; -5.0
	2	8	117.0	117.0	0.0	1.0; -2.5
	200	800	134.0	134.1	0.1	±1.0
Slow	2	8	108.0	108.0	0.0	1.5; -5.0
	200	800	127.6	127.6	0.0	±1.0
	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	135.8	-0.6	±3.0

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

QF-TS12-04-04-020664

T. Petchur

Continuation of Calibration Certificate

Cert. No. : ACL21145
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	
89.5	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

T. Petchur

451-451/1 Sithiporn Rd, Bangbunru, Bangkok Bangkok 10700 THAILAND
Tel:0-2435-8800 Fax:0-2431-1679 e-mail:cal-center@sithiporn.com http://www.sithiporn.com



Cert. 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 PIATTHIANAKAN 40, PIATTHIANAKAN ROAD,
KHWAENG PIATTHIANAKAN, 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 : *[Signature]*
EXT CAL DATE : 14 / 12 / 22

Calibrated by : Nathakorn Pisutpaisan

Approved by : *T. Petchur*
(Thanakorn Petchur)

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. : 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.	Exp. Date
Waveform Generator	33210A	MY48017076	EF-0012-21	10-Feb-22
Waveform Generator	33511B	MY52302742	EF-0011-21	10-Feb-22
Digital Multimeter	33461A	MY53220104	EEL.BP. 05/0264	10-Feb-22
Digital Multimeter	33461A	MY53220076	EEL.BP. 03/0264	08-Feb-22
Digital Multimeter	8846A	1997025	EEL.BP. 06/0264	05-Feb-22
Programmable Attenuator	MAT-1070	62100114	1500-07774E	08-Mar-22
Condenser Microphone	4180	2977906	AA-1008-21	05-Feb-22
Measuring Amplifier	NA-42KAI	34560495	AA-3003-21	16-Feb-22

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

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

3.1 National Institute of Metrology (Thailand).

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

QF-TS12-04-04-020664

T. Ratan

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

QF-TS12-04-04-020664

T. Ratan

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 Nonnal 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 64 dB

Frequency (Hz)	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. Ratan

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)	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. Ratan

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. Petchuraj

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	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	124.0	124.1	0.1	±1.0
Slow	2	8	108.0	108.0	0.0	1.5; -5.0
	200	800	127.6	127.6	0.0	±1.0
SEL	0.25	1	99.0	98.9	-0.1	1.5; -5.0
	2	8	108.0	108.0	0.0	1.0; -2.5
	200	800	128.0	128.1	0.1	±1.0

10. Peak C sound level

Number of cycle in test signal	Anticipated Value (dB)	Measured Value, 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	135.2	-0.2	±2.0
Negative half cycle	135.4	135.2	-0.2	±2.0

QF-TS12-04-04-020664

T. Petchuraj

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

T. Petchuraj

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



Cert. No. : ACL21134
Pages : 1 of 8

Calibration Certificate

Equipment : SOUND LEVEL METER
Manufacturer : RION
Model : NL-42/ Microphone UC-52 / Pre-amplifier NH-24
Serial No. : 00572564 / 170401 / 72902
ID No. : BKK_FS0880

Condition As Found : GOOD

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

Location :
Ambient Temperature : (23.0 ± 3) °C
Pressure : (101.3 ± 3) kPa
Relative Humidity : (50.0 ± 20) %
Received Date : 18 OCTOBER 2021
Calibration Date : 25-26 OCTOBER 2021
Date of Issue : 28 OCTOBER 2021

Calibrated by : Natthakorn Pisutpoisan

Approved by :

T. Petchuraj
(Thanakul Petchuraj)

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QF-TS12-04-04-020664

Continuation of Calibration Certificate

Cert. No. : ACL21134
Job No. : VC65AC0005
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	8546A	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.

Continuation of Calibration Certificate

Cert. No. : ACL21134
Job No. : VC65AC0005
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. : ACL21134
Job No. : VC65AC0005
Pages : 4 of 8

Result of calibration :

1. Absolute sensitivity

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

2. Self-generated noise

2.1 Normal test

Measured Value (dB)
14.8

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

Frequency Weighting	Measured value (dB)
A - weight	10.9
C - weight	17.3
Flat	22.9

3. Acoustical signal tests of frequency weightings

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

Frequency (Hz)	Flat	C-weight	A-weight	Acceptance Limits
125	0.2	0.2	0.2	± 1.5
1000	0.0	0.0	0.0	± 1.0
8000	-0.6	-0.5	-0.5	±5.0

QF-TS12-04-04-020664

T. R. R.

Continuation of Calibration Certificate

Cert. No. : ACL21134
Job No. : VC65AC0005
Pages : 5 of 8

4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz

Frequency (Hz)	Flat	C-weight	A-weight	Acceptance Limits
63	0.0	-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	0.1	0.0	±1.5
1000	0.0	0.0	0.0	±1.0
2000	0.0	0.1	0.0	±2.0
4000	0.0	0.1	0.0	±3.0
8000	0.1	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
Lsq	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.

Continuation of Calibration Certificate

Cert. No. : ACL21134
Job No. : VC65AC0005
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	104.1	0.1	±1.1
99.0	99.0	0.0	±1.1
94.0	94.0	0.0	±1.1
89.0	89.0	0.0	±1.1
84.0	84.0	0.0	±1.1
79.0	79.0	0.0	±1.1
74.0	74.0	0.0	±1.1
69.0	69.0	0.0	±1.1
64.0	64.0	0.0	±1.1
59.0	59.0	0.0	±1.1
54.0	54.0	0.0	±1.1
49.0	49.0	0.0	±1.1
44.0	44.0	0.0	±1.1
39.0	39.0	0.0	±1.1
34.0	34.0	0.0	±1.1
30.0	30.0	0.0	±1.1
29.0	29.0	0.0	±1.1
28.0	28.0	0.0	±1.1
27.0	27.0	0.0	±1.1
26.0	26.1	0.1	±1.1
25.0	25.1	0.1	±1.1

QF-TS12-04-04-020664

T. Petcha

Continuation of Calibration Certificate

Cert. No. : ACL21134
Job No. : VC65AC0005
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	127.5	-0.1	±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	136.0	-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. Petcha

Continuation of Calibration Certificate

Cert. No. : ACL21134
Job No. : VC65AC0005
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	89.5	-0.2	±1.5

12. High level stability

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

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

End of Calibration Certificate

QF-TS12-04-04-020664

T. Petcha

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



Cert. No. : ACL22039
Pages : 1 of 8

Calibration Certificate

Equipment : SOUND LEVEL METER
Manufacturer : RION
Model : NL-42/Microphone UC-52 / Preamplifier 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

Calibrated by : Nathakorn Pisutpaisan

Approved by : T. Petcha
(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 Acoustic 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_03/0264	10-Feb-22
Digital Multimeter	33461A	MY53220076	EEL-BP_03/0264	08-Feb-22
Digital Multimeter	34461A	MY60024273	1-15180725251-1	15-Sep-22
Programmable Attenuator	MAT-1070	62100114	1500-07774E	08-Mar-22
Condenser Microphone	4180	2977900	AA-1008-21	05-Feb-22
Measuring Amplifier	NA-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. : 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	0.2
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. : ACL22039
Job No. : VC65AC0041
Pages : 4 of 8

Result of calibration :

1. Absolute sensitivity

Reference Acoustic Signal (dB)	Measured Value (dB)	Deviation (dB)	Acceptance Limit (dB)
93.0 (93.96)	93.9	0.0	±0.3

2. Self-generated noise

2.1 Normal test

Measured Value (dB)
14.6

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

Frequency Weighting	Measured value (dB)
A-weight	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 84 dB

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)			
	Flat	C-weight	A-weight	Acceptance Limits
125	0.2	0.2	0.2	± 1.5
1000	-0.1	-0.1	-0.1	± 1.0
8000	-0.5	-0.5	-0.4	± 5.0

QF-TS12-04-04-020664

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	±2.0
125	0.0	0.0	0.0	±1.5
250	0.0	0.0	-0.1	±1.5
500	0.0	0.0	0.0	±1.5
1000	0.0	0.0	0.0	±1.0
2000	0.0	0.0	0.0	±2.0
4000	0.0	0.0	0.0	±3.0
8000	0.0	0.1	0.1	±5.0

5. Frequency and time weightings at 1 kHz

5.1 Frequency weightings at 1 kHz

Frequency Weighting	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. : 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

QT-TS12-04-04-020664

T. Petchur

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	±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; -3.0
	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	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

QT-TS12-04-04-020664

T. Petchur

Continuation of Calibration Certificate

Cert. No. : ACL22039
Job No. : VC65AC0041
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

QT-TS12-04-04-020664

T. Petchur

451-451/1 Sirinthorn Rd., Bangbunna, Bangkok 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 / Preamplifier NH-24
Serial No. : 00572566 / 170403 / 72904
ID No. : BKK_FSD875

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 Pisulpaian

Approved by : T. Petchur
(Thanakul Petchur)

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QT-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.	Exp. Date
Waveform Generator	33210A	MY48017076	EF-0012-21	10-Feb-22
Waveform Generator	33511B	MY52302742	EF-0011-21	10-Feb-22
Digital Multimeter	33461A	MY53220104	EEL-BP_05/0264	10-Feb-22
Digital Multimeter	33461A	MY53220076	EEL-BP_03/0264	08-Feb-22
Digital Multimeter	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

T. Rth.

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

T. Rth.

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 Limit (dB)
93.9 (93.96)	93.9	0.0	±0.3

2. Self-generated noise

2.1 Normal test

Measured Value (dB)
14.6

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

Frequency Weighting	Measured value (dB)
A-weight	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 94 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. Rth.

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. Rth.

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. Petchur

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. Petchur

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. Petchur

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



Cert. No. : ACL22245
Pages : 1 of 8

Calibration Certificate

Equipment : SOUND LEVEL METER
Manufacturer : RION
Model : NL-42 / Microphone UC-52 / Preamplifier NH-24
Serial No.: 00572609 / 170133 / 72947
ID No.: BKK_FS0924

Condition As Found : GOOD

Customer : ALS LABORATORY GROUP (THAILAND) CO., LTD.
104 PHATTHANAKAN 40, PHATTHANAKAN ROAD,
KJWAENG 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 : 11 OCTOBER 2022
Calibration Date : 25-26 OCTOBER 2022
Date of Issue : 27 OCTOBER 2022

Calibrated by : Natnakorn Pisurpaian

Approved by :

T. Petchur
(Thanakul Petchurai)

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QF-TS12-04-04-020664

Continuation of Calibration Certificate

Cert. No. : ACL22245
Job No. : VC65AC0090
Pages : 2 of 8

Calibration Procedure : CP-AC-01

Calibration Method :

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

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

Condition of this result of calibration :

1. Reference Standard Instruments :

Instrument	Model	Serial No.	Cert. No.	Exp. Date
Waveform Generator	33210A	MY48017076	EP-0007-22	04-Feb-23
Waveform Generator	33511B	MY52302742	EP-0008-22	04-Feb-23
Digital Multimeter	33461A	MY53220104	EEL-BP_04/0265	09-Feb-23
Digital Multimeter	33461A	MY53220076	EEL-BP_03/0265	09-Feb-23
Digital Multimeter	34461A	MY60024273	EEL-BP_05/0265	09-Feb-23
Programmable Attenuator	MAT-1070	62100114	EP-0009-22	07-Feb-23
Condenser Microphone	4180	2977900	AA-1013-22	24-Feb-23
Measuring Amplifier	NA-42KAJ	34560495	AA-3005-22	22-Feb-23

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. Petch.

Continuation of Calibration Certificate

Cert. No. : ACL22245
Job No. : VC65AC0090
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. Petch.

Continuation of Calibration Certificate

Cert. No. : ACL22245
Job No. : VC65AC0090
Pages : 4 of 8

Result of calibration :

1. Absolute sensitivity

Reference Acoustic Signal (dB)	Measured Value (dB)	Deviation (dB)	Acceptance Limit (dB)
93.9 (93.95)	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	11.6
C-weight	17.6
Flat	23.5

3. Acoustical signal tests of frequency weightings

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

Frequency (Hz)	Flat	C-weight	A-weight	Acceptance Limits
125	0.0	0.1	0.1	± 1.5
1000	0.0	0.0	0.0	± 1.0
8000	0.5	0.6	0.6	±5.0

QF-TS12-04-04-020664

T. Petch.

Continuation of Calibration Certificate

Cert. No. : ACL22245
Job No. : VC65AC0090
Pages : 5 of 8

4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

Frequency (Hz)	Flat	C-weight	A-weight	Acceptance Limits
63	0.0	0.0	-0.1	±2.0
125	0.0	0.0	0.0	±1.5
250	0.0	0.0	0.0	±1.5
500	0.0	0.0	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. : ACL22245
Job No. : VC65AC0090
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	34.1	0.1	±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	25.1	0.1	±1.1

QF-TS12-04-04-020664

T. Reth.

Continuation of Calibration Certificate

Cert. No. : ACL22245
Job No. : VC65AC0090
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, 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	133.1	0.1	-
Positive half cycle	135.4	135.3	-0.1	±2.0
Negative half cycle	135.4	135.3	-0.1	±2.0

QF-TS12-04-04-020664

T. Reth.

Continuation of Calibration Certificate

Cert. No. : ACL22245
Job No. : VC65AC0090
Pages : 8 of 8

11. Overload indication

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

12. High level stability

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

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

End of Calibration Certificate

QF-TS12-04-04-020664

T. Reth.

451-451/1 Sitrithom 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. : ACL22233
Pages : 1 of 8

Calibration Certificate

Equipment : SOUND LEVEL METER
Manufacturer : RION
Model : NL-42/ Microphone UC-52 / Preamplifier NH-24
Serial No. : 00672737 / 158772 / 58773
ID No. : BKK_FS0927

Condition As Found : GOOD

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

Location : -
Ambient Temperature : (23.0 ± 3) °C
Pressure : (101.3 ± 3) kPa
Relative Humidity : (50.0 ± 20) %
Received Date : 03 OCTOBER 2022
Calibration Date : 18-19 OCTOBER 2022
Date of Issue : 20 OCTOBER 2022

REVIEW BY	Nathorn P.
APPROVED BY	Nathorn P.
NEXT CAL. DATE	18/10/25

Calibrated by : Nathorn Pisutpaisan

Approved by : T. Reth.
(Thanakul Petchum)

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QF-TS12-04-04-020664

Continuation of Calibration Certificate

Cert. No. : ACL22233
Job No. : VC65AC0088
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-0007-22	04-Feb-23
Waveform Generator	33511B	MY52302742	EF-0008-22	04-Feb-23
Digital Multimeter	33461A	MY53220104	EEL-HP_04/0265	09-Feb-23
Digital Multimeter	33461A	MY53220076	EEL-HP_03/0265	09-Feb-23
Digital Multimeter	34461A	MY60024273	EEL-HP_05/0265	09-Feb-23
Programmable Attenuator	MAT-1070	62100114	EF-0009-22	07-Feb-23
Condenser Microphone	4180	2977900	AA-1013-22	24-Feb-23
Measuring Amplifier	NA-42KAI	34560495	AA-3005-22	22-Feb-23

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. : ACL22233
Job No. : VC65AC0088
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

QP-TS12-04-04-020664

Continuation of Calibration Certificate

Cert. No. : ACL22233
Job No. : VC65AC0088
Pages : 4 of 8

Result of calibration :

1. Absolute sensitivity

Reference Acoustic Signal (dB)	Measured Value (dB)	Deviation (dB)	Acceptance Limit (dB)
93.9 (93.95)	93.9	0.0	±0.3

2. Self-generated noise

2.1 Normal test

Measured Value (dB)
15.5

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

Frequency Weighting	Measured value (dB)
A - weight	10.8
C - weight	17.1
Flat	22.9

3. Acoustical signal tests of frequency weightings

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

Frequency (Hz)	Flat	C-weight	A-weight	Acceptance Limits
125	0.3	0.3	0.3	± 1.5
1000	0.0	0.0	0.0	± 1.0
8000	-0.6	-0.5	-0.6	±5.0

QP-TS12-04-04-020664

Continuation of Calibration Certificate

Cert. No. : ACL22233
Job No. : VC65AC0088
Pages : 5 of 8

4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

Frequency (Hz)	Flat	C-weight	A-weight	Acceptance Limits
63	-0.1	-0.1	-0.1	±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

QP-TS12-04-04-020664

Continuation of Calibration Certificate

Cert. No. : ACL22233
Job No. : VC65AC0088
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. Petch

Continuation of Calibration Certificate

Cert. No. : ACL22233
Job No. : VC65AC0088
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	136.1	-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	135.1	-0.3	±2.0

QF-TS12-04-04-020664

T. Petch

Continuation of Calibration Certificate

Cert. No. : ACL22233
Job No. : VC65AC0088
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11. Overload indication

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

T. Petch

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



Cert. No. : ACL22198
Pages : 1 of 8

Calibration Certificate

Equipment : SOUND LEVEL METER
Manufacturer : RION
Model : NL-42/ Microphone UC-52 / Preamplifier NH-24
Serial No. : 00597164 / 180407 / 88177
ID No. : BKK_FS0999

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 : 15 SEPTEMBER 2022
Calibration Date : 19-21 SEPTEMBER 2022
Date of Issue : 27 SEPTEMBER 2022

REVIEW BY: *Nathakorn P.*
APPROVED BY: *Nathakorn P.*
NEXT CAL DATE: 19/09/23

Calibrated by : Nathakorn Pisutpaisan

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

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QF-TS12-04-04-020664

Continuation of Calibration Certificate

Cert. No. : ACL22198
Job No. : VC65AC0083
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	EP-0007-22	04-Feb-23
Waveform Generator	33511B	MY52302742	EP-0008-22	04-Feb-23
Digital Multimeter	33461A	MY53220104	EEL-BP_04/0265	09-Feb-23
Digital Multimeter	33461A	MY53220076	EEL-BP_03/0265	09-Feb-23
Digital Multimeter	34461A	MY60034273	EEL-BP_05/0265	09-Feb-23
Programmable Attenuator	MAT-1070	62100114	EP-0009-22	07-Feb-23
Condenser Microphone	4180	2977900	AA-1013-22	24-Feb-23
Measuring Amplifier	NA-42KAJ	34560495	AA-3005-22	22-Feb-23

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. : ACL22198
Job No. : VC65AC0083
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. : ACL22198
Job No. : VC65AC0083
Pages : 4 of 8

Result of calibration :

1. Absolute sensitivity

Reference Acoustic Signal (dB)	Measured Value (dB)	Deviation (dB)	Acceptance Limit (dB)
93.9 (93.95)	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	11.6
C - weight	17.6
Flat	23.3

3. Acoustical signal tests of frequency weightings

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

Frequency (Hz)	Flat	C-weight	A-weight	Acceptance Limits
125	0.1	0.1	0.2	± 1.5
1000	0.0	0.0	0.0	± 1.0
8000	0.0	0.1	0.1	± 5.0

QF-TS12-04-04-020664

Continuation of Calibration Certificate

Cert. No. : ACL22198
Job No. : VC65AC0083
Pages : 5 of 8

4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

Frequency (Hz)	Flat	C-weight	A-weight	Acceptance Limits
63	0.0	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

Continuation of Calibration Certificate

Cert. No. : ACL22198
Job No. : VC65AC0083
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	39.0	0.0	±1.1
34.0	34.0	0.0	±1.1
30.0	30.0	0.0	±1.1
29.0	29.0	0.0	±1.1
28.0	28.0	0.0	±1.1
27.0	27.1	0.1	±1.1
26.0	26.0	0.0	±1.1
25.0	25.0	0.0	±1.1

QF-TS12-04-04-020664

T. Petchum

Continuation of Calibration Certificate

Cert. No. : ACL22198
Job No. : VC65AC0083
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	136.3	-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. Petchum

Continuation of Calibration Certificate

Cert. No. : ACL22198
Job No. : VC65AC0083
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

T. Petchum

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



Cert. No. : ACL22243
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 PHATTIANAKAN 40, PHATTIANAKAN ROAD,
KHWAENG PHATTIANAKAN, 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 : 11 OCTOBER 2022
Calibration Date : 25-26 OCTOBER 2022
Date of Issue : 27 OCTOBER 2022

REVIEW BY	<i>Nathakorn P.</i>
APPROVED BY	<i>Nathakorn P.</i>
NEXT CAL DATE	25/10/23

Calibrated by : Nathakorn Pisutpaisan

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

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QF-TS12-04-04-020664

Continuation of Calibration Certificate

Cert. No. : ACL22243
Job No. : VC65AC0090
Pages : 2 of 8

Calibration Procedure : CP-AC-01

Calibration Method :

This equipment was calibrated by based on JEC-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-0007-22	04-Feb-23
Waveform Generator	33511B	MY52302742	EF-0008-22	04-Feb-23
Digital Multimeter	33461A	MY53220104	EEL.BP. 04/0265	09-Feb-23
Digital Multimeter	33461A	MY53220076	EEL.BP. 03/0265	09-Feb-23
Digital Multimeter	34461A	MY60024273	EEL.BP. 05/0265	09-Feb-23
Programmable Attenuator	MAT-1070	62100114	EF-0009-22	07-Feb-23
Condenser Microphone	4180	2977900	AA-1013-22	24-Feb-23
Measuring Amplifier	NA-42KAI	34560495	AA-3005-22	22-Feb-23

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. : ACL22243
Job No. : VC65AC0090
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

QP-TS12-04-04-020664

Continuation of Calibration Certificate

Cert. No. : ACL22243
Job No. : VC65AC0090
Pages : 4 of 8

Result of calibration :

1. Absolute sensitivity

Reference Acoustic Signal (dB)	Measured Value (dB)	Deviation (dB)	Acceptance Limit (dB)
93.9 (93.95)	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	16.9
Flat	22.6

3. Acoustical signal tests of frequency weightings

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

Frequency (Hz)	Flat	C-weight	A-weight	Acceptance Limits
125	0.3	0.4	0.4	± 1.5
1000	0.0	0.0	0.0	± 1.0
8000	-1.4	-1.4	-1.3	±5.0

QP-TS12-04-04-020664

Continuation of Calibration Certificate

Cert. No. : ACL22243
Job No. : VC65AC0090
Pages : 5 of 8

4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

Frequency (Hz)	Flat	C-weight	A-weight	Acceptance Limits
63	0.0	0.0	0.0	±2.0
125	0.1	0.0	0.1	±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	94.1	0.1	±0.3

QP-TS12-04-04-020664

Continuation of Calibration Certificate

Cert. No. : ACL22243
Job No. : VC65AC0090
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	25.1	0.1	±1.1

QF-TS12-04-04-020664

T. Petch.

Continuation of Calibration Certificate

Cert. No. : ACL22243
Job No. : VC65AC0090
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, Lepeak (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	135.1	-0.3	±2.0

QF-TS12-04-04-020664

T. Petch.

Continuation of Calibration Certificate

Cert. No. : ACL22243
Job No. : VC65AC0090
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	S.L.M Display at initial (dB)	S.L.M Display at final (dB)	Deviated Value (dB)	Acceptance Limits (dB)
A-weight	136.9	136.9	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. Petch.

451-451/1 Sirinithom 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. : ACL22190
Pages : 1 of 8

Calibration Certificate

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

Condition As Found : GOOD

Customer : ALS LABORATORY GROUP (THAILAND) CO., LTD.
104 PHATTANAKAN 40, PHATTANAKAN ROAD,
KHWAENG PHATTANAKAN, KHUET 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 SEPTEMBER 2022
Calibration Date : 07-09 SEPTEMBER 2022
Date of Issue : 14 SEPTEMBER 2022

REVIEW BY	<i>Nahakorn P.</i>
APPROVED BY	<i>T. Petch.</i>
NEXT CAL DATE	9/9/23

Calibrated by : Nahakorn Pisutpaisan

Approved by :

T. Petch.
(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. : ACL22190
Job No. : VC65AC0081
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	EP-0007-22	04-Feb-23
Waveform Generator	33511B	MY52302742	EP-0008-22	04-Feb-23
Digital Multimeter	33461A	MY53220104	EEL.BP. 04/0265	09-Feb-23
Digital Multimeter	33461A	MY53220076	EEL.BP. 03/0265	09-Feb-23
Digital Multimeter	34461A	MY60024273	EEL.BP. 05/0265	09-Feb-23
Programmable Attenuator	MAT-1070	62100114	EP-0009-22	07-Feb-23
Condenser Microphone	4180	2977900	AA-J013-22	24-Feb-23
Measuring Amplifier	NA-42KAJ	34560495	AA-3005-22	22-Feb-23

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. : ACL22190
Job No. : VC65AC0081
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

QP-TS12-04-04-020664

Continuation of Calibration Certificate

Cert. No. : ACL22190
Job No. : VC65AC0081
Pages : 4 of 8

Result of calibration :

1. Absolute sensitivity

Reference Acoustic Signal (dB)	Measured Value (dB)	Deviation (dB)	Acceptance Limit (dB)
93.9 (93.95)	93.9	0.0	±0.3

2. Self-generated noise

2.1 Normal test

Measured Value (dB)
14.2

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

Frequency Weighting	Measured value (dB)
A - weight	12.4
C - weight	18.8
Flat	24.2

3. Acoustical signal tests of frequency weightings

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

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)			
	Flat	C-weight	A-weight	Acceptance Limits
125	0.2	0.3	0.3	± 1.5
1000	0.0	0.0	0.0	± 1.0
8000	-0.1	-0.1	-0.1	±5.0

QP-TS12-04-04-020664

Continuation of Calibration Certificate

Cert. No. : ACL22190
Job No. : VC65AC0081
Pages : 5 of 8

4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

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

QP-TS12-04-04-020664

Continuation of Calibration Certificate

Cert. No. : ACL22190
Job No. : VC65AC0081
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. Petch

Continuation of Calibration Certificate

Cert. No. : ACL22190
Job No. : VC65AC0081
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

QF-TS12-04-04-020664

T. Petch

Continuation of Calibration Certificate

Cert. No. : ACL22190
Job No. : VC65AC0081
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	89.5	-0.2	±1.5

12. High level stability

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

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

End of Calibration Certificate

QF-TS12-04-04-020664

T. Petch

451-451/1 Sindhorn Rd, Bangbunru, Bangkok Bangkok 10700 THAILAND.
Tel: 0-2435-6800 Fax: 0-2435-1679 e-mail: cal-center@sithiporn.com http://www.sithiporn.comCert. No. : ACL22232
Pages : 1 of 8

Calibration Certificate

Equipment : SOUND LEVEL METER
Manufacturer : RION
Model : NL-42/ Microphone UC-52 / Preamplifier NII-24
Serial No.: 00584982 / 157781 / 48096
ID No.: BKK_FS0925

Condition As Found : GOOD

Customer : ALS LABORATORY GROUP (THAILAND) CO., LTD.
104 PHATTANAKAN 40, PHATTANAKAN ROAD,
KHUWAENG PHATTANAKAN, KHUAT SUAN LUANG,
BANGKOK, 10250 THAILAND.

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

Received Date : 03 OCTOBER 2022
Calibration Date : 18-19 OCTOBER 2022
Date of Issue : 20 OCTOBER 2022

Calibrated by : Nathakorn Pisutpaisan

Approved by :

T. Petch
(Thanakul Petchursi)

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. : ACL22232
Job No. : VC65AC0088
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-0007-22	04-Feb-23
Waveform Generator	33511B	MY52302742	EF-0008-22	04-Feb-23
Digital Multimeter	33461A	MY53220104	EEL-BP, 04/0265	09-Feb-23
Digital Multimeter	33461A	MY53220076	EEL-BP, 03/0265	09-Feb-23
Digital Multimeter	34461A	MY60024273	EEL-BP, 05/0265	09-Feb-23
Programmable Attenuator	MAT-1070	62100114	EF-0009-22	07-Feb-23
Condenser Microphone	4180	2977900	AA-1013-22	24-Feb-23
Measuring Amplifier	NA-42KAI	34560495	AA-3005-22	22-Feb-23

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. : ACL22232
Job No. : VC65AC0088
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. : ACL22232
Job No. : VC65AC0088
Pages : 4 of 8

Result of calibration :

1. Absolute sensitivity

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

2. Self-generated noise

2.1 Normal test

Measured Value (dB)
17.3

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	19.0
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	0.3	0.3	0.4	±1.5
1000	0.0	0.0	0.0	±1.0
8000	-0.5	-0.4	-0.4	±5.0

QF-TS12-04-04-020664

Continuation of Calibration Certificate

Cert. No. : ACL22232
Job No. : VC65AC0088
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	0.0	±2.0
4000	0.0	0.1	0.0	±3.0
8000	0.0	0.1	0.1	±5.0

5. Frequency and time weightings at 1 kHz

5.1 Frequency weightings at 1 kHz

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

5.2 Time weighting at 1 kHz

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

6. Long-term stability

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

QF-TS12-04-04-020664

Continuation of Calibration Certificate

Cert. No. : ACL22232
Job No. : VC65AC0088
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	119.1	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	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. Petch.

Continuation of Calibration Certificate

Cert. No. : ACL22232
Job No. : VC65AC0088
Pages : 7 of 8

8. Level linearity including the level range control

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

9. Tone burst response

Time Weighting	Tone burst duration, Tb (ms)	Cycle	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Fast	0.25	1	108.0	108.0	0.0	1.5; -5.0
	2	8	117.0	117.0	0.0	1.0; -2.5
	200	800	134.0	134.1	0.1	±1.0
Slow	2	8	108.0	108.0	0.0	1.5; -5.0
	200	800	127.6	127.6	0.0	±1.0
	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	135.4	135.6	-0.8	±3.0

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

QF-TS12-04-04-020664

T. Petch.

Continuation of Calibration Certificate

Cert. No. : ACL22232
Job No. : VC65AC0088
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	SIM Display at initial (dB)	SIM 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. Petch.

63/14-15,67/35-36, Soi Petchkesom 7/1, Petchkesom Rd,
Wattana, Bangkok, Bangkok 10600 Thailand.
Tel: (66) 02-6680812#13 Fax: (66) 02-6680860 www.jranalab.com

CERTIFICATE OF CALIBRATION

Certificate No. : CL-076-64
Page 1 of 2Equipment Name : Heat Stress Monitor with Sensor
Manufacturer : DeltaGEM
Model: HD32.2
Serial No: 16002005
ID No: BHM_FS0682Customer
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 SEP 2021
Calibration date : 1 OCT 2021
Issue date : 4 OCT 2021Reference Used During Calibration
1. Standard Temperature Probe Model: STS 100 A500L
Serial No. 667682 09, Due date: 29 Mar 2022
2. Digital Temperature Indicator Model: DTI 3000 A1KX
II, Serial No: G71407 09591 Due date: 04 June 2022Calibration Condition
Temperature : (23±3) °C
Relative Humidity : (55±15) %Calibration Procedure
The temperature calibration was done by in House
Calibration method as WICL D01 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 0030 21. Certificate number: ER 0037
21REVIEW BY: *T. Petch.*
APPROVED BY: *T. Petch.*
NEXT CAL DATE: 1/10/22Calibrated by
Mr. Somsit Thichulid
Mr. Miss Orathai WatanakulayaApproved Signature: *T. Petch.*
Mr. Parinya Banthachien
Technical Support
and Calibration Manager



63/14-15,67/35-36, Soi Petchkasem 7/71, Petchkasem Rd,
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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: 16009205.
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	24.651	24.8	0.1	0.099
70	29.837	29.7	-0.1	0.099
70	34.775	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: 15008196.
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 65
Page 1 of 2

Equipment Name: Digital thermometer with RTD
Manufacturer: DeltaOHM
Model: HD32.2
Serial No: 16006710
ID No: BKK_F50672

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: 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: *Phanikom P.*
APPROVED BY: *Phanikom P.*
NEXT CAL DATE: 18/3/23

Calibrated by
☒ Mr. Sorawit Thachalad
☒ Miss Oranhai Wiatwittaya



Approved Signatory: *Phanikom P.*
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	40.056	40.0	-0.1	0.099

Table 2: This equipment was connected with temperature probe Model: TP3207.2 S/N: 14035714.
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	25.076	25.0	-0.1	0.099
70	30.068	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-074 64
Page 1 of 2

Equipment Name: Heat Stress Monitor with Sensor
Manufacturer: DeltaOHM
Model: HD32.2
Serial No: 15036012
ID No: BKK_F50673

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: 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: *Phanikom P.*
APPROVED BY: *Phanikom P.*
NEXT CAL DATE: 1/10/22

Calibrated by
☒ Mr. Sorawit Thachalad
☒ Miss Oranhai Wiatwittaya



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

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Certificate No.: CL-074-84
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: 16008211.
Dimension: Diameter 14 mm, Length 170 mm.

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
30	20.050	19.9	-0.2	0.099
30	25.042	24.9	-0.1	0.099
30	30.036	29.8	-0.2	0.099
30	35.029	34.6	-0.2	0.099
30	40.018	39.8	-0.2	0.099

Table 2: This equipment was connected with temperature probe Model: TP3207.2 S/N: 16009354.
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	24.860	24.8	-0.1	0.099
70	29.674	29.6	-0.2	0.099
70	34.760	34.5	-0.3	0.099
70	39.707	39.4	-0.3	0.099

Table 3: This equipment was connected with Globe thermometer probe Model: TP3276.2 S/N: 10008199.
Dimension: Diameter 8 mm, Length 170 mm.

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
110	20.050	20.1	0.0	0.099
110	25.042	25.1	0.1	0.099
110	30.036	30.1	0.1	0.099
110	35.029	35.1	0.1	0.099
110	40.018	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-091-84
Page 1 of 2

Equipment Name: Heat Stress Monitor with Sensor
Manufacturer: DeltaOHM
Model: HD32.2
Serial No: 15036016
ID No: BKA_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	<i>Narong P.</i>
APPROVED BY	<i>Mr. P.</i>
NEXT CAL DATE	2/11/22

Calibrated by
☒ Mr. Sorawit Thachalad
☒ Miss Orathai Wiwatwattaya



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

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Certificate No.: CL 001-64
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: 10009383.
Dimension: Diameter 14 mm, Length 150 mm.

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
70	20.063	20.2	0.1	0.099
70	24.866	24.9	0.0	0.099
70	29.618	29.7	-0.1	0.099
70	34.767	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: 20006276.
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 070-64
Page 1 of 2

Equipment Name: Heat Stress Monitor with Sensor
Manufacturer: DeltaOHM
Model: HD32.2
Serial No: 15006708
ID No: BKA_FS0671

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 SEP 2021
Calibration date: 30 SEP 2021
Issue date: 4 OCT 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	<i>Narong P.</i>
APPROVED BY	<i>Mr. P.</i>
NEXT CAL DATE	30/9/22

Calibrated by
☒ Mr. Sorawit Thachalad
☒ Miss Orathai Wiwatwattaya



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

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Certificate No.: CL-070 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: 15015843.
Dimension: Diameter 14 mm. Length 170 mm.

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
30	20.051	20.1	0.0	0.099
30	25.047	25.1	0.1	0.099
30	30.035	30.1	0.1	0.099
30	35.026	35.1	0.1	0.099
30	40.014	40.1	0.1	0.099

Table 2: This equipment was connected with temperature probe Model: TP3207.2 S/N: 15015489.
Dimension: Diameter 14 mm. Length 150 mm.

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
70	20.045	20.2	0.2	0.099
70	24.874	25.0	0.1	0.099
70	29.821	29.8	0.0	0.099
70	34.779	34.7	0.1	0.099
70	39.735	39.6	0.1	0.099

Table 3: This equipment was connected with Globe thermometer probe Model: TP3276.2 S/N: 15015979.
Dimension: Diameter 8 mm. Length 170 mm.

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
110	20.050	19.9	-0.2	0.099
110	25.047	24.9	-0.1	0.099
110	30.035	29.9	-0.1	0.099
110	35.026	34.9	-0.1	0.099
110	40.014	39.8	-0.2	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 No.: CL-075-64
Page 1 of 2

CERTIFICATE OF CALIBRATION

Equipment Name: Heat Stress Monitor with Sensor
Manufacturer: DeltaOHM
Model: HD32.2
Serial No.: 16002004
ID No: BKK_FS0651

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

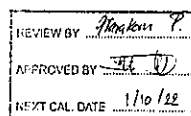
Received date: 6 SEP 2021
Calibration date: 1 OCT 2021
Issue date: 4 OCT 2021

Reference Used During Calibration
1. Standard Temperature Probe Model: STS-100 A500, Serial No.: 607682 08, 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



Calibrated by
☒ Mr. Sorawit Thachalad
☒ Miss Orathini Wiatwattaya

Approved Signatory:
Mr. Panyea 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

Function:

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: 16010550.
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	24.864	24.9	0.0	0.099
70	29.816	29.7	-0.1	0.099
70	34.765	34.6	-0.2	0.099
70	39.749	39.5	-0.2	0.099

Table 3: This equipment was connected with Globe 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 No.: CL-018-65
Page 1 of 2

CERTIFICATE OF CALIBRATION

Equipment Name: Heat Stress Monitor with Sensor
Manufacturer: DeltaOHM
Model: HD32.2
Serial No.: 15036132
ID No: BKK_FS0660

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

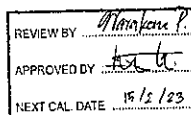
Received date: 10 JAN 2022
Calibration date: 15 FEB 2022
Issue date: 17 FEB 2022

Reference Used During Calibration
1. Standard Temperature Probe Model: STS-100 A500, Serial No.: 607682 08, 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



Calibrated by
☒ Mr. Sorawit Thachalad
☒ Miss Orathini Wiatwattaya

Approved Signatory:
Mr. Panyea Booncharoen
Calibration Department Manager



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Certificate No.: CL-016-65
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: 15015846.
Dimension: Diameter 14 mm. Length 170 mm.

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
30	20.053	20.1	0.0	0.099
30	25.034	25.1	0.1	0.099
30	30.014	30.1	0.1	0.099
30	35.019	35.1	0.1	0.099
30	40.005	40.1	0.1	0.099

Table 2: This equipment was connected with temperature probe Model: TP3207.2 S/N: 14032362.
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	-0.1	0.099
70	34.873	34.7	-0.2	0.099
70	39.864	39.8	0.3	0.099

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

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
110	20.054	20.0	0.1	0.099
110	25.036	25.0	0.0	0.099
110	30.017	30.0	0.0	0.099
110	35.024	35.0	0.0	0.099
110	40.001	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%.



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CERTIFICATE OF CALIBRATION

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

Equipment Name: Heat Stress Monitor with Sensor
Manufacturer: Delta OHM
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: 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-C-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>[Signature]</i>
APPROVED BY	<i>[Signature]</i>
NEXT CAL DATE	19/2/23

Calibrated by
☒ Mr. Soravit Thachalad
☐ Miss Orathai Wiatwattaya



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: 16010556.
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%.



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CERTIFICATE OF CALIBRATION

Certificate No.: CL-165-65
Page 1 of 2

Equipment Name: Heat Stress Monitor
Manufacturer: Delta OHM
Model: HD32.2
Serial No: 16002005
ID No: BKK_F50682

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: 15 Nov 2022
Calibration date: 21 Nov 2022
Issue date: 23 Nov 2022

Reference Used During Calibration
1. Standard Temperature Probe Model: STS 100 A500,
Serial No: 667682-09, Due date: 23 Mar 2022
2. Digital Temperature Indicator Model: DTI-1000 A MK
II, Serial No: 671407-00591 Due date: 22 July 2023

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

Calibration Procedure
The temperature calibration was done by in-house
calibration method as WI-C-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-0034-22, Certificate number: ER-0002-
22

REVIEW BY	<i>[Signature]</i>
APPROVED BY	<i>[Signature]</i>
NEXT CAL DATE	21/11/23

Calibrated by
☒ Mr. Soravit Thachalad
☐ Miss Jiraporn Lertsomplai



Approved Signatory: *[Signature]*
Mr. Parinya Booncharoen
Calibration Department Manager

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Certificate No.: CL-105-65
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	20.065	20.0	-0.1	0.14
30	25.050	24.9	-0.2	0.099
30	30.042	29.9	-0.1	0.099
30	35.040	34.8	-0.1	0.099
30	40.033	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	20.066	20.1	0.0	0.099
70	25.052	24.8	-0.3	0.099
70	30.042	29.7	-0.3	0.099
70	35.038	34.6	-0.4	0.099
70	40.034	39.5	-0.5	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	20.065	20.1	0.0	0.099
110	25.052	25.1	0.0	0.099
110	30.042	30.1	0.1	0.099
110	35.039	35.1	0.1	0.099
110	40.034	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-070-65
Page 1 of 2

Equipment Name: Heat Stress Monitor
Manufacturer: DeltaOHM
Model: H032.2
Serial No: 15038018
ID No: BKK_F50677

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: 05 Apr 2022
Calibration date: 03 May 2022
Issue date: 04 May 2022

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	<i>Phanong P.</i>
APPROVED BY	<i>Mr. P.</i>
NEXT CAL. DATE	3/5/23

Calibrated by
☒ Mr. Sorawit Thachaled
☐ Miss Jitraporn Lertsomphol



Approved Signatory: *Mr. P.*
Mr. Parinya Booncharoen
Calibration Department Manager

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Certificate No.: CL-070-65
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: 16008219.
Dimension: Diameter 14 mm, Length 170 mm.

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
30	20.079	20.1	0.0	0.099
30	25.067	25.1	0.0	0.099
30	30.064	30.1	0.0	0.099
30	35.056	35.0	-0.1	0.099
30	40.056	40.0	-0.1	0.099

Table 2: This equipment was connected with temperature probe Model: TP3207.2 S/N: 15037318.
Dimension: Diameter 14 mm, Length 150 mm.

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
70	20.079	20.1	0.0	0.14
70	25.067	24.9	-0.2	0.14
70	30.064	29.8	-0.3	0.14
70	35.055	34.6	-0.5	0.14
70	40.055	39.5	-0.6	0.14

Table 3: This equipment was connected with Globe thermometer probe Model: TP3276.2 S/N: 16006602.
Dimension: Diameter 8 mm, Length 170 mm.

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
110	20.079	20.1	0.0	0.10
110	25.067	25.1	0.0	0.10
110	30.064	30.0	0.0	0.16
110	35.055	35.0	-0.1	0.10
110	40.055	40.0	-0.1	0.10

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-148-65
Page 1 of 2

Equipment Name: Heat Stress Monitor
Manufacturer: DeltaOHM
Model: H032.2
Serial No: 15038014
ID No: BKK_F50675

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: 12 Sep 2022
Calibration date: 28 Sep 2022
Issue date: 03 Oct 2022

Reference Used During Calibration
1. Standard Temperature Probe Model: STS-100 A500, Serial No.: 667682-09, Due date: 23 Mar 2022
2. Digital Temperature Indicator Model: DTI-1000-A MK II, Serial No.: 671407-00591 Due date: 22 July 2023

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-0034-22, Certificate number: ER-0092-22

REVIEW BY	<i>Phanong P.</i>
APPROVED BY	<i>Mr. P.</i>
NEXT CAL. DATE	28/9/23

Calibrated by
☒ Mr. Sorawit Thachaled
☐ Miss Jitraporn Lertsomphol



Approved Signatory: *Mr. P.*
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	40.056	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	25.076	25.0	-0.1	0.099
70	30.068	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 164 65
Page 1 of 2

Equipment Name: Heat Stress Monitor
Manufacturer: Delta OHM
Model: HD32.2
Serial No: 16002004
ID No: BKK_FSO681

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 Nov 2022
Calibration date: 21 Nov 2022
Issue date: 23 Nov 2022

Reference Used During Calibration
1. Standard Temperature Probe Model: STS-100 A500.
Serial No: 667882-09, Due date: 23 Mar 2023
2. Digital Temperature Indicator Model: DTI-1000-A MK
II, Serial No: 671407-00591 Due date: 22 July 2023

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-0034-22, Certificate number: ER-0092-
22

REVIEW BY	<i>Phonkarn P.</i>
APPROVED BY	<i>[Signature]</i>
NEXT CAL DATE	21/11/23

Calibrated by
☒ Mr. Sorawit Thachalad
☐ Miss Jitraporn Lamsomphol



Approved Signatory: *[Signature]*
Mr. Pongthorn Booncharoen
Calibration Department Manager

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Certificate No.: CL 164-65
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: 16008207.
Dimension: Diameter 14 mm, Length 170 mm.

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
30	20.066	20.0	-0.1	0.099
30	25.049	25.0	0.0	0.099
30	30.042	30.0	0.0	0.099
30	35.037	35.0	0.0	0.099
30	40.030	40.0	0.0	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	20.066	20.1	0.0	0.099
70	25.049	25.0	0.0	0.099
70	30.042	29.9	-0.1	0.099
70	35.034	34.8	-0.2	0.099
70	40.031	39.8	-0.2	0.099

Table 3: This equipment was connected with Globe thermometer probe Model: TP3276.2 S/N: 16006594.
Dimension: Diameter 8 mm, Length 170 mm.

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
110	20.066	20.1	0.0	0.099
110	25.049	25.0	0.0	0.099
110	30.042	30.0	0.0	0.099
110	35.035	35.0	0.0	0.099
110	40.031	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 ★



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
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TEL: 0-2717-3000-24 FAX: 0-2719-9484



Certificate of Calibration

Certificate No.: 22PH75
Page: 1 of 2

Equipment: Lux Meter
Manufacturer: Delta OHM
Model: 2102.2
Serial No: 16002028
ID No: BKK_FSO609

Condition As-Received: Used Item
Received Date: 07 February 2022
Calibration Date: 15 February 2022

Reference: 2202-0252WSG
Ambient Temperature: (23 ± 2) °C
Relative Humidity: (50 ± 15) %

Submitted by: ALS Laboratory Group (Thailand) Co., Ltd.

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104 Phatthanasak 40, Phatthanasak Rd.,
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Bangkok 10250 Thailand

Procedure used: Calibration were conducted using in-house calibration procedure CP-PHD1 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 6.8 m	120RC003	61-140008-1	30 Apr 2022
2) Luminous intensity standard lamp	DL FEL-U	F-1543	TP-1020-21	02 May 2022

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

3. Test Equipment: Programmable Voltage/Current Source (Model: CL83A, S/N: 16221394).

4. Test Equipment: Illuminance Meter (Model: 51002, S/N: 080129).

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

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

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

Calibrated by: Nuntawat Khanchai
Issue Date: 17 February 2022

Approved Signatory: *[Signature]*
[] Phatinee Pradipat
[] Nuntawat Khanchai

B 0281223



Cert. No.: 22PH78
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	0.01	0.01	0.060
15	14.17	-0.83	0.20
100	94.76	-5.24	1.3
500	480.1	-19.9	6.5
1000	976.7	-21.3	13
2000	1985.6	-14.3	26
3000	3006	6	39
4000	4022	22	52
5000	5074	74	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 %

Probe sensor s/n. 15030918
UUC* = Unit Under Calibration.

-000-

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Certificate of Calibration

Certificate No.: 22PH478
Page: 1 of 2

Equipment: Lux Meter
Manufacturer: PEAKMETER
Model: PM6612L
Serial No.: H12A-K20118
ID No.: BKK_FS1146
Condition As-Received: Used Item
Received Date: 12 September 2022
Calibration Date: 13 September 2022

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.

Reference: 2209-0405WSC
Ambient Temperature: (23 ± 2) °C
Relative Humidity: (50 ± 15) %

Submitted by: ALS Laboratory Group (Thailand) Co., Ltd.

104 Phatthananak 40, Phatthananak Rd.,
Khuang Phatthananak, Khet Suan Luang,
Bangkok 10250 Thailand

Procedure used: Calibration were conducted using in-house calibration procedure CP-PH01 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	LM606 9.6 m	120RC003	DL-0064-22	20 Jul 2025
2) High-accuracy Irradiance Standard	OL-FEL-U	F-1471	TP-1037-21	18 Oct 2022

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

3. Test Equipment: Programmable Voltage/Current Source (Model : DL83A, SN : 09220284).

4. Test Equipment: Illuminance Meter (Model : S1002, 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	<i>Warakorn P.</i>
APPROVED BY	<i>TL AL</i>
NEXT CAL. DATE	13/9/23

Calibrated by: Nivul Nites
Issue Date: 14 September 2022

Approved Signatory:

☒ Phatinee Prabpalai
☐ Chatchawan Khunpluek
☒ Nuntawat Khamchai

b 0297390



Cert. No.: 22PH476
Page: 2 of 2

Result of calibration:

(*) Without adjustment () After adjustment
Function: Illuminance Measurement Range: Autorange

Standard Value	Before Adjust	After Adjust	Error	Uncertainty
(lx)	(lx)	(lx)	(lx)	(± lx)
0	0.00	0.00	0.00	0.060
15	-	15.06	0.06	0.22
100	-	100.8	0.8	1.5
500	-	501	1	7.3
1000	956	1001	1	15
2000	-	2020	20	30
3000	-	3010	10	45
4000	-	4020	20	60
5000	4800	5030	30	75

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 %

Before adjustment light source factor setting mode: L0 = 1.000

After adjustment light source factor setting mode: L0 = 1.047

UUC* = Unit Under Calibration.

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TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES
3344 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG BANGKOK 10250
TEL. 0-2717-3000-27 FAX. 0-2719-9484



Certificate of Calibration

Cert.No.: 22CH122
Page: 1 of 2

Equipment: pH Meter
Manufacturer: Mettler Toledo
Model: Seven Compact S220
Serial No.: B520948426
ID No.: BKK_EN0072
Condition As-Received: Used Item
Received Date: 09 September 2022
Calibration Date: 12 September 2022
Reference: 2209-0312DSC-1
Submitted by: ALS Laboratory Group (Thailand) Co., Ltd.

REVIEW BY	<i>Warakorn P.</i>
APPROVED BY	<i>TL AL</i>
NEXT CAL. DATE	12/02/24

104 Phatthananak 40, Phatthananak Rd.,
Khuang Phatthananak, Khet Suan Luang,
Bangkok 10250 Thailand

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

Calibrated by: Warakorn Lemagagrakul

Approved by:

☒ Malee Butkruea
☐ Sallhip Meangmai
☐ Warakorn Lemagagrakul

Issue Date: 15 September 2022

The Uncertainties are for a confidence probability of approximately 95 %

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Cert. No.: 22CH1222
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	54030049	130RC116	22E2769	24 Aug 2023

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	823320	20 June 2024
pH 6.865	CPA chem	794122	14 Feb 2023
pH 10.008	CPA chem	823323	20 June 2023

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

Calibration Results

Function : mV Measurement

Performing standard curve by Fluke at pH (4,7,10)

Unit Under Calibration	Nominal Value		Standard Voltage Input		Actual Reading		Uncertainty of Measurement (±mV)	Coverage factor k
	pH	mV	mV	pH	mV	pH		
pH Meter S/N: B520649426	4.008	177.48	177.4	4.000	0.058	2.00	0.058	2.00
	7.000	0.00	0.0	7.000	0.058	2.00		
	10.000	-177.48	-177.5	10.000	0.058	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: PCE-86-EX1001	4.008	3.999	153.9	0.0055	2.09
	6.865	7.017	-13.7	0.0084	2.00
	10.008	9.996	-176.0	0.0078	2.06

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

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TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
CORPORATE SERVICES & EQUIPMENT CALIBRATION AND TESTING SERVICES
534/4 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG BANGKOK 10250
TEL: 0-2717-3900-27 FAX: 0-2719-9484



Cert. No.: 22CG3154
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, Khet Suan Luang
Bangkok 10250 Thailand

Ambient Temperature : (20 ± 2.5) °C
Relative Humidity : (50 ± 10) %
Barometric Pressure : 759 mmHg
Calibration Procedure : ASTM E 542 - 01

Calibrated by : Panward Pramklam

Approved by :

() Pornthipa Tameyakul
() Malee Bulkruea
(x) Ponpan Palpin
() Sriuda Khamsi

Approved Signatory

Issue Date : 31 August 2022

The Uncertainties are for a confidence probability of approximately 95%

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

A 0044607



Equipment : Burette
Received Date : 26 August 2022
Condition As-Received : Used Item
Calibration Date : 30 August 2022
Reference : 2208-091BSC-2

Cert. No.: 22CG3154
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	AE200S	N03679	140RC001	21MM429	NIMT	22 Sep 2022
2) Thermo-Hygrometer	THDX-CE	00016540	140EC001	22H1243	NIST, NIMT	09 June 2023
3) Thermometer	-	1594592	140EC010	22I181	NIMT	10 Feb 2023

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	49.9959	0.010	2.00

Remark mL = cm³

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

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Metrological Center

SCI ECO Services Company Limited

33/2 Moo 3, T. Banpa, A. Kaengkhon, Saraburi 18110, Thailand.
Saraburi Tel : +66 3627 3096 Fax : +66 3627 3100
Bangkok Tel : +668 9205 6851 , +668 8247 2360
Website : www.scieco.co.th E-Mail : calibrate@scg.co.th



Certificate No. T221644

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 : Environmental Laboratory

Date of Receipt : 27 June 2022

Calibrated By : Sujjar Naknakred (Site Calibration Manager)

Approved By : / Boonchai Suriyawong (Site Calibration Manager)

Date of Issue : 6 JUL 2022

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

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

FM-L1411701-02-64

Certificate No. T221644

Page 2 of 4

Calibration Report

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

Condition of this results of calibration :

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 (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	30 July 2022
TC	TYPE T	TN171-TN180	T210009	30 July 2022
DATA LOGGER	34970A	T149	T210009	30 July 2022

3. This certificate is traceable to :

National Institute of Metrology (Thailand) through Metrological Center (NSC-TIS1-TIS 17025 CALIBRATION 0244)

4. Condition of calibrated item : good

Equipment Description :

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

5. Adjustment :

() without adjustment (X) after adjustment

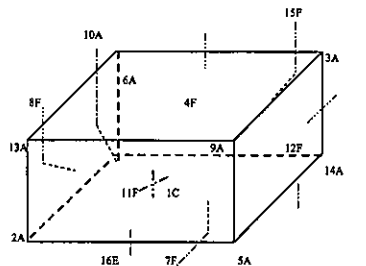
Approved By:

FM-L15 11/15-05-63

Certificate No. T221644

Page 3 of 4

Calibration Report



C = Centre, F = Centre of Face, A = Corner, E = Centre of Edge

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

Approved By:

FM-L15 11/15-05-63

Certificate No. T221644

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
3	2.71	2.82	2.75	2.89	2.95	3.08	3.02	2.96
	TN171	TN172	TN173	TN174	TN175	TN176		
	2.97	3.02	2.89	3.04	2.97	3.33		

Chamber (Cold Room)			Temperature Distribution				
Setting (°C)	Reading (°C)		Average (°C)	Stability (± °C)	Uniformity (°C)	Uncertainty (± °C)	Coverage Factor k
	Min, Max	Average					
3.0	2.9, 4.0	3.2	2.59	1.05	1.30	1.66	2.00

* The quoted uncertainty exclude * uniformity *

The calibration result apply only the above calibrated item.

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

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

Approved By:

FM-L15 11/15-05-63

Certificate of Calibration

Represent to Certificate of Calibration : PTC/07/22071

Certificate No.: PTC/07/22071 Page: 1 of 2
Equipment: Digital Balance Condition: Normal
Manufacturer: Sartorius Serial No: 26207042
Model: MSE224-100-DU ID No: BKK_EN0002
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 21.5 °C ± 0.7 °C
Humidity 61.8 %RH ± 4.7 %RH
Air density 1.19 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 cp. 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

(Mr. Kongsak Kalasin)
Reviewed by

Approved By:
(Mr. Kongsak Kalasin)
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.

The calibration certificate shall not be reproduced except in full only, without written approval from penta calibration co., ltd

PTC/07/22071

Represent to Certificate of Calibration: PTC/07/22071

Certificate No.: PTC/07/22071

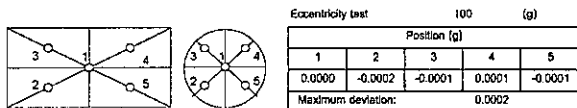
Page: 2 of 2

Measurement Results:

Without Adjustment:

Function Calibration: Non Adjustment

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



Repeatability Test: Weight to be $1/2 \leq L_1 \leq$ Maximum capacity

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

Nominal test value (g)	Standard Deviation
200	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
0	0.00000	0.0000	0.0000	0.00016	2.52
0.1	0.10000	0.1000	0.0000	0.00017	2.20
0.5	0.50000	0.5000	0.0000	0.00016	2.26
1	1.00001	1.0000	0.0000	0.00016	2.28
2	2.00001	2.0000	0.0000	0.00016	2.28
5	5.00001	5.0000	0.0000	0.00015	2.28
10	10.00002	10.0000	0.0000	0.00016	2.28
20	20.00002	20.0000	0.0000	0.00016	2.23
50	50.00001	50.0000	0.0000	0.00017	2.15
100	100.00002	99.9999	0.0001	0.00020	2.06
120	120.00004	120.0000	0.0000	0.00023	2.03
150	150.00003	150.0000	0.0000	0.00026	2.00
200	200.00003	199.9999	0.0001	0.00030	2.00

Note: Weight of adjust (g)

The End of Certificate

PTC (TC-07-02) 9 Feb 2020

Certificate No. 7220139

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: Watcharapong Sangtong (Technician)

Approved By: / Sujjar Naknakred (Site Calibration Manager)

Date of Issue: 08 FEB 2022

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

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

FM-L14 117/01-02-64

Certificate No. 7220139

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:

1. 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 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	M34 (CII-1-CII-5)	T210115	2 February 2022
DATA LOGGER	34970A	T47	T210115	2 February 2022

3. This certificate is traceable to:

National Institute of Metrology (Thailand) through Metrological Center (NSC-TIS-TIS 17025 CALIBRATION 05/4.)

4. Condition of calibrated item: good

Equipment Description:

Time Constant: 1 Hour - Minute At: 60 °C

5. Adjustment:

(X) without adjustment

() after adjustment

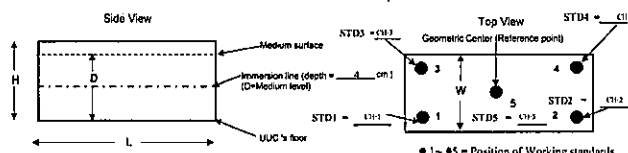
Approved By:

FM-L15 117/15-05-63

Certificate No. 7220139

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	59.93	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	93.29

Liquid Bath (Water)			Temperature Distribution			
Setting (°C)	Reading (°C)		Stability (±°C)	Uniformity (±°C)	Uncertainty (±°C)	Coverage Factor k
	Min	Max				
61.0	60.9	61	0.10	0.19	0.25	2.00
86.0	85.9	86.1	0.12	0.39	0.32	2.06
95.0	94.8	95.1	0.14	0.51	0.38	2.11

* 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



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
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534/4 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG BANGKOK 10250
TEL. 0-2717-3000-27 FAX. 0-2719-9484



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

Certificate of Calibration

Equipment: Hot Air Oven

Manufacturer: Memmert

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: (28 ± 10) °C

Relative Humidity: (50 ± 30) %

Calibrated by: Khet Ruttanaprapachal

Approved by:

() Pornthippa Tameyakul
(x) Malee Bulkruea
() Suwit Imjai

Issue Date: 7 December 2021

The Uncertainties are for a confidence probability of approximately 95%

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

A 0032815



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

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

Procedure Used :-

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

The temperature scale used was based on ITS-90.

Condition of this result of calibration

1. Reference standard Instrument:-

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

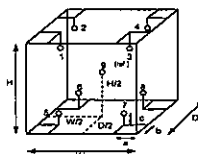
2. This certificate is valid only to the item calibrated on date and place of calibration.

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 = 0.56 m
c = 5.0 cm H = 0.46 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.: 0 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	0.80	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	120.638	120.519	120.661	120.524	121.162	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	179.792	179.374	179.575	179.376	180.643	180.061	180.174	179.217	180.014

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

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

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

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

UUC* : Unit Under Calibration

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

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

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a 1085617



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

Cert.No.: 22TW122
Page: 1 of 2

Certificate of Testing

Equipment: DO Meter

Manufacturer: YSI

Model: 5000-230V

Serial No.: 09J101147

ID No.: BKK_EN0017

Received Date: 20 May 2022

Test Date: 24 May 2022

Reference: 2205-0638DSC-8

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

Laboratory Condition :

Temperature : (25 ± 5) °C

Humidity : (50 ± 20) %

In - house method : CP-CH9

by Comparison Technique with Azide Modification Method

Tested by: Warakorn Lemgatrakul

Approved by:

(x) Malee Bulkruea
() Salhip Meangmai
() Warakorn Lemgatrakul

Issue Date: 31 May 2022

b 0285244



Cert.No.: 22TW122
Page: 2 of 2

Condition of this result of calibration

1. Reference Standard Instruments :

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

Instruments	Serial No.	ID No.	Certificate No.	Due Date
1) Burette	-	130BU10	21CG1389	25 Mar 2023
2) Balance	1126143764	140RC004	21MM430	21 Sep 2022

2. Standard Material :-

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

Result : Dissolved Oxygen Meter Adjustment With Air 100 %

Dissolved Oxygen Probe No.: 16K100498

Titration Method (Azide Modification Method) (mg/L)	DO Meter Reading (mg/L)	Standard Deviation (mg/L)
8.12	8.13	0.015

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

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a 1110482



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
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3344 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG BANGKOK 10250
TEL: 0-2717-3008-21 FAX: 0-2719-9444



Cert. No.: 22LM83
Page: 1 of 2

Certificate of Calibration

Equipment : DO Meter with Sensor

Manufacturer : YSI

Model : 5000-230V

Serial No. : 09J 101147

ID No. : BKK_EN0017

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

Location : TPA On Site Calibration Laboratory

Received Order : 20 May 2022

Calibrated Date : 30 May 2022

Ambient Temperature : (26 ± 10) °C

Relative Humidity : (50 ± 30) %

AC Line Voltage : (220 ± 22) V

Calibrated by : Tawatchai Pama

Approved by :
Approved Signatory

() Pornthippa Tameyaku
(✓) Maiee Bulkruea
() Suwit Imjai

Issue Date : 31 May 2022

The Uncertainties are for a confidence probability of approximately 95%

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

A 0039957



Equipment : DO Meter with Sensor
Condition As-Received : Used Item
Reference : Z205-0638DSG-10

Cert. No.: 22LM83
Page: 2 of 2

Procedure Used :-

Calibration were conducted using In-house calibration procedure CP-0701 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	1502A	A08204	22/B	04 Jan 2023

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 thermistor sensor, ID No.: 16K100498

Calibration Point (°C)	Immersion Depth (mm)	Standard Temperature (°C)	UUC* Reading (°C)	Error (°C)	Uncertainty (± °C)	Coverage Factor k
20.00	60	20.003	20.01	0.007	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 1090806



Metrological Center

SCI ECO Services Company Limited

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

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

Bangkok Tel: +668 8205 6851, +668 8247 2360

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., Khwaeng Phatthanakan,
Khet Suan Luang, Bangkok 10250

Customer Location : Wet Chemistry Lab2

Date of Receipt : 1 October 2021

Calibrated By : Sujjar Naknakred (Site Calibration Manager)

Approved By : / 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.

PKS-L14 117-01-02-84



Metrological Center

SCI ECO Services Company Limited

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



NSC-TISI-TIS 17025
CALIBRATION 0244

Certificate No. 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 AS1853-1986). 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
RTD	100 ohm	29-CH1-10	T210118	2 February 2022
DATA LOGGER	34970A	747	T210118	2 February 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 : 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 11/715-05-63



Metrological Center

SCI ECO Services Company Limited

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

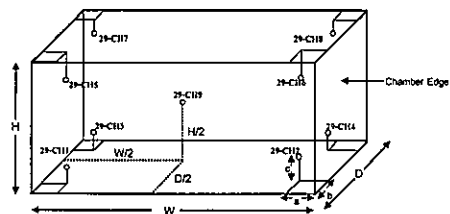


NSC-TISI-TIS 17025
CALIBRATION 0244

Certificate No. 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 = 55cm/2

Measurement Results

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

Setting (°C)	Chamber (Incubator)		Temperature Distribution			
	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	0.96	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 t-distribution, providing a level of confidence of approximately 95 % .

Approved By :

FM-L15 11/715-05-63



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
CORPORATE SERVICES & EQUIPMENT CALIBRATION AND TESTING SERVICES
534-3 PATTANAKARN ROAD, SUKH, SUANLUANG, NAKHONSI Thammarath 40120
TEL. 0-2713-3040-27 FAX. 0-2719-9484



Cert.No.: 22CH957

Page: 1 of 2

Certificate of Calibration

Equipment : pH Meter
Manufacturer : Mattier Toledo
Model : Seven2Go
Serial No. : B608134788
ID No. : BKK_LG00023
Condition As-Received: Used Item
Received Date : 15 July 2022
Calibration Date : 18 July 2022
Reference : 2207-0412DSC-2
Submitted by : ALS Laboratory Group (Thailand) Co., Ltd
104 Phatthanakan 40, Phatthanakan Rd.,
Khaeng Phatthanakan, Khet Suan Luang,
Bangkok 10250 Thailand
Ambient Temperature : (25 ± 2.5) °C
Relative Humidity : (50 ± 15) %
Calibration Procedure : In - house method :
- CP-CHS by direct measurement with standard
voltage calibrator and direct measurement
with certified reference material (CRM)

REVIEW BY :
APPROVED BY :
NEXT CAL DATE : 18/07/23

Calibrated by : Warakorn Lemngagrakul

Approved by :
Approved Signatory

(/) Malee Bulkruea
() Sathip Moengmai
() Warakorn Lemngagrakul

Issue Date : 20 July 2022

The Uncertainties are for a confidence probability of approximately 95%

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Approval of the head of Corporate Services & Equipment Calibration and Testing Services

A 0043465



Cert. No.: 22CH957

Page: 2 of 2

Condition of this calibration result

1. Reference Standard Instrument :-

Instrument	Serial No.	ID No.	Cert. No.	Due Date
Document Process Calibrator	54030049	130RC118	21E2882	25 Aug 2022

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

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

Buffer Solution	Manufacturer	Lot No.	Exp. date
pH 4.008	CPA chem	794120	14 Feb 2024
pH 6.885	CPA chem	794122	14 Feb 2023
pH 10.008	CPA chem	823323	20 June 2023

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

Calibration Results

Function : mV Measurement

Performing standard curve by Fluke at pH (4,7,10)

Unit Under Calibration	Nominal Value	Standard Voltage Input		Actual Reading		Uncertainty of Measurement (±mV)	Coverage factor k
		pH	mV	mV	pH		
pH Meter S/N: B608134788	4.00	177.48	178	4.00	0.58	0.58	2.00
	7.00	0.00	0	7.00	0.58		
	10.00	-177.48	-178	10.00	0.58		

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: 1471370	4.008	4.00	183	0.0071	2.00
	6.885	6.99	8	0.011	
	10.008	10.00	-168	0.0085	

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

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a 1118337



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3343 PATTANAKARN ROAD SOI 16, SUANLUANG, SUANLUANG BANGKOK 10250
TEL. 0 2119 3400-27 FAX. 0 2119 9484



Cert. No.: 22LM94
Page: 1 of 2

Certificate of Calibration

Equipment : pH Meter with Sensor
Manufacturer : Mettler Toledo
Model : Seven2Go
Serial No. : 8608134788
ID No. : BKK_LG0023
Submitted by : ALS Laboratory Group (Thailand) Co. Ltd.
104 Phatthanakan 40, Phatthanakan Rd.,
Khaeng Phatthanakan, Khut Suan Luang,
Bangkok 10250 Thailand
Location : TPA Onsite Calibration Laboratory
Received Order : 15 July 2022
Calibrated Date : 22 July 2022
Ambient Temperature : $(28 \pm 10) ^\circ\text{C}$
Relative Humidity : $(50 \pm 30) \%$
AC Line Voltage : $(220 \pm 22) \text{ V}$

Calibrated by : Tawachai Pama

Approved by :
Approved Signatory

() Pongthipha Tameyakul
() Maloo Butkruea
() Suwit Imjai

Issue Date : 25 July 2022

The Uncertainties are for a confidence probability of approximately 95%

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

A 0043603



Equipment : pH Meter with Sensor
Condition As-Received : Used Item
Reference : 2207-0412DSC-3
Procedure Used :

Cert. No.: 22LM94
Page: 2 of 2

Calibration was conducted using in-house calibration procedure CP-0701 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	1502A	A52847	2111144	20 Oct 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.: 6351659

Calibration Point (°C)	Immersion Depth (mm)	Standard Temperature (°C)	UUC* Reading (°C)	Error (°C)	Uncertainty (± °C)	Coverage Factor k
20.0	100	19.995	20.2	0.205	0.16	2.00
25.0	100	24.993	25.2	0.207	0.16	2.00
30.0	100	29.995	30.2	0.205	0.16	2.00
35.0	100	35.003	35.3	0.297	0.16	2.00
40.0	100	39.994	40.3	0.308	0.16	2.00
45.0	100	45.003	45.2	0.197	0.16	2.00
50.0	100	49.997	50.2	0.203	0.16	2.00

UUC* : Unit Under Calibration

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

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a 1116096

HACH COMPANY

C/O AS Scies (Thailand) Limited, Building D Room No. D3 11, 3rd Floor, No. 735/4, Srinakharin Road, Pattanakarn, Suanluang, Bangkok
[Phone +66 (0)2 026-3529 Ext. 0] [Fax +66 (0)2 026-3572] www.as-scies.com

LABX 2200107

Test Report

Customers	: ALS Laboratory Group (Thailand) Co., Ltd.	Manufacturer	: HACH
Equipment	: Chlorine Meter	ID No.	: BKK_LG0042
Controller Model	: DR300	Sensor Serial No.	: -
Controller Serial No.	: 20040A01732	Period	: -
Date of test	: 23/07/2022	Humidity	: 58.0 %RH
Environment temperature	: 25.0 °C		

Results

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)	6.0 VDC	6.0 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 list	<input checked="" type="checkbox"/> None <input type="checkbox"/> Appeal	<input checked="" type="checkbox"/> None <input type="checkbox"/> Appeal

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 (0.94 ± 0.10 mg/l)	0.86 mg/l	0.90 mg/l	
10	Standard C2 No. 3 (1.72 ± 0.14 mg/l)	1.63 mg/l	1.87 mg/l	
11	Blank (0.0 mg/l)	0.0 mg/l	0.0 mg/l	
12	Standard C2 No. 1 (0.25 ± 0.2 mg/l)	2.1 mg/l	2.2 mg/l	
13	Standard C2 No. 2 (4.1 ± 0.5 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

APPROVED BY

NEXT CAL. DATE 28/1/23



HACH COMPANY

C/O AS Scies (Thailand) Limited, Building D Room No. D3 11, 3rd Floor, No. 735/4, Srinakharin Road, Pattanakarn, Suanluang, Bangkok
[Phone +66 (0)2 026-3529 Ext. 0] [Fax +66 (0)2 026-3572] www.as-scies.com

LABX 2200107

Summary of checked

- ☒ The instrument can work normally and efficiently. (เครื่องมือวัดสามารถทำงานได้ปกติและวัดค่าได้อย่างถูกต้อง)
☐ The instrument can work but it's resulting in maintenance. (เครื่องมือวัดสามารถทำงานได้แต่ต้องบำรุงรักษา)
☐ The instrument could not work it's resulting in repair. (เครื่องมือวัดไม่สามารถทำงานได้และต้องซ่อมแซม)

Remark:

Standard Equipment Used

Equipment	Equipment ID
Standard Chlorine DPD-CHLORINE-LR	Lot No. A0197 Exp. date: Jun-22
Standard Chlorine DPD-CHLORINE-HR	Lot No. A0164 Exp. date: Jun-22
Digital multi meter	S/N. 21190056 Due date: 19-Mar-22
Thermo hygonometer	S/N. 45146347 Due date: 30-Jun-22

Test By : WILAIJAK S.
(Miss Wilajak Sawangpun)
Service Engineer

Approved by :
(Mr. Suanun Sanyangkool)
Position : Assistant Service Division Manager





TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
CALIBRATION AND TESTING EQUIPMENT SERVICES
534/4 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG RANGKON, 10250
TEL: 0-2713-3004-24 FAX: 0-2719-9484

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

Certificate of Calibration

Equipment : Conductivity Meter
Manufacturer : Mettler Toledo
Model : SevenCompact
Serial No. : B429832167
ID No. : BKK_EN0065
Condition As-Received: Used Item
Received Date : 17 November 2021
Calibration Date : 19 November 2021
Reference : 2111-0586DSC-6
Submitted by : ALS Laboratory Group (Thailand) Co., Ltd.
104 Phatthanakan 40, Phatthanakan Rd.,
Khwang Phatthanakan, Khel Suan Luang,
Bangkok 10250 Thailand
Ambient Temperature : (25 ± 2.5) °C
Relative Humidity : (50 ± 15) %
Calibration Procedure : In-house method :
- CP-CH6 : based on direct measurement by
using reference material (RM)

Calibrated by : Walalak Sirithean

Approved by :
() Malee Butruwa
() Salhip Meangmal
() Warakorn Lemgegrakul

Issue Date : 23 November 2021

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

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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 16 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 µS/cm	Thermo Scientific	081/02	23 Feb 2022
1413.0 µS/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±0.1) °C

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

Calibration results

Function : Conductivity Measurement

(*) After Adjustment at 1413 µS/cm

Conductivity Electrode Serial No.: 5821270404

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

Remark - UUC* = Unit Under Calibration

- Adjustment Cell constant = 0.559929 cm⁻¹

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

-00-

a 1083372

BKK_EL0037

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Agilent CrossLab Compliance Services

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
EOP Name: AgilentRecommended
EOP Revision: ES.02.50
Overall Qualification Status: Pass

Preparation

Pass

Instrument Tests

Pass

Autosampler Operation

Pass

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

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

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Agilent CrossLab Compliance Services

Instrument Details

Purpose

This section describes the as found system configuration.

Details

Spectrometer 1

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

Chiller 1

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

Autosampler 1

Manufacturer: Agilent Technologies
Name: SPS4
Model Number: G8410A
Serial Number: AU15440764

Switching Valve Accessory 1

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

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

Electronic Signature

Purpose

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

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Full Name of Signer: Kanyasorn Sukpathrajarn
 Logged On User Name: phimpapha.jearaphong@agilent.com
 Signature Creation Date: September 13, 2021
 Reason for Signature: Executed protocol and published this original version of document

Regulatory Disclaimer

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

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

Page 3 / 5

User Name: phimpapha.jearaphong System ID: MY16010005
 Username: ALS/CKW0328 Print Date: September 13, 2021 5:49:13 PM

QDHW 6106 ICPQES ALS 08Sep21 Transaction Log:

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
September 8, 2021 8:45:55 AM	Audit	Session Created	Session	None
September 8, 2021 8:48:55 AM	Start	Configuration	Session	None
September 8, 2021 8:49:25 AM	Audit	Enrollment	Licensing	User is Field Engineer and does not require an unlock code
September 8, 2021 8:57:00 AM	Audit	Exploaded	Session	EOP details for primary technique [E] - File path: [ProtocolPath\Eu\Configure] ewe02.00\Eu\02.00.scp, EOP File Name: [Ea-02.00.scp], EOP Name: [AgilentRecommended]
September 8, 2021 9:07:11 AM	End	Configuration	Session	None
September 8, 2021 9:07:15 AM	Start	Qualification	Session	OQ
September 8, 2021 9:07:15 AM	Start	Execution	Preparation: 5100 (VOW); Qualitative Test - No setpoints associated	None
September 8, 2021 9:24:55 AM	End	Execution	Preparation: 5100 (VOW); Qualitative Test - No setpoints associated	Run Count: 1
September 8, 2021 9:24:59 AM	Start	Execution	Instrument Tests: 5100 (VOW); Qualitative Test - No setpoints associated	None
September 8, 2021 9:31:27 AM	End	Execution	Instrument Tests: 5100 (VOW); Qualitative Test - No setpoints associated	Run Count: 1

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

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User Name: phimpapha.jearaphong System ID: MY16010005
 Username: ALS/CKW0328 Print Date: September 13, 2021 5:49:13 PM

QDHW 6106 ICPQES ALS 08Sep21 Transaction Log:

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
September 8, 2021 8:51:00 AM	Start	Execution	Autosampler Operation: Autosampler 1 - 0P04; Qualitative Test - No setpoints associated	None
September 8, 2021 8:51:34 AM	End	Execution	Autosampler Operation: Autosampler 1 - 0P04; Qualitative Test - No setpoints associated	Run Count: 1
September 8, 2021 9:01:34 AM	End	Qualification	Session	OQ
September 8, 2021 9:51:39 AM	Start	Reporting	Session	None
September 8, 2021 10:05:40 AM	Audit	AnnClosed	Session	None
September 13, 2021 5:01:28 PM	Audit	AnnRestarted	Session	None
September 13, 2021 5:01:28 PM	Audit	SessionReloaded	Session	None
September 13, 2021 5:01:28 PM	Start	Qualification	Session	OQ
September 13, 2021 5:47:25 PM	Audit	Reporting	Session	Report Generated: Certificate

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 System ID: MY16010005

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Agilent CrossLab Compliance Services

Agilent
CrossLab
Enabling Quality Control

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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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 ECR.

Details

Test	Status	Runs
Preparation : S100 SVDV	Pass	1
Instrument Tests : S100 SVDV	Pass	1
Autosampler Operation : Autosampler 1 - SPS4	Pass	1

Overall Qualification Status

Pass

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

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Service Details

Purpose

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

General Details

Service Order No./Request: 6004623273
EQP Name: AgilentRecommended
EQP Revision: ES.02.50
Report Type: Report

Organization Details

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

Local Contact Details

Name: Khun Thilma Boonpeng
Job Title: Scientist 2, Life Sciences
Qualification Location: ICP Room

Operator Details

Name: Kanyakorn sukpathrajareon
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

Date: September 13, 2021 5:50:41 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: S100 SVDV
Model Number: G6010A
Sample Introduction: Double pass glass cyclonic spraychamber and nebulizer
Serial Number: MY16010005
Firmware Revision: 5365

Chiller 1

Manufacturer: Agilent Technologies
Name: Other Unspecified
Other Unspecified Name: Chiller
Model Number: Other Unspecified
Other Unspecified Model Number: G3292-80201
Serial Number: 2005-00158

Autosampler 1

Manufacturer: Agilent Technologies
Name: SPS4
Model Number: G6410A
Serial Number: AU15440764

Switching Valve Accessory 1

Manufacturer: Agilent Technologies
Name: SVS 2+
Model Number: G8485A
Serial Number: AU180403115

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

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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

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

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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.: G801DA 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

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

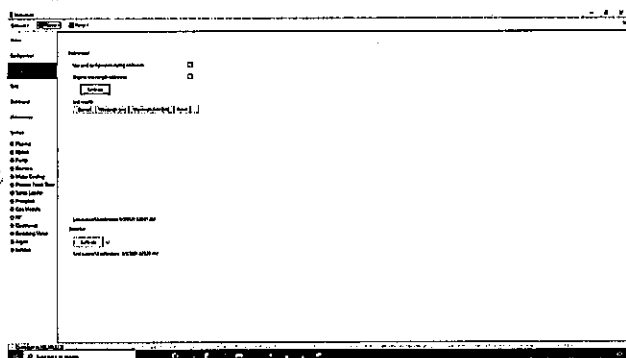
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Test Evidence

Image Details: Was the detector calibration performed and completed successfully?

Date and Time: September 8, 2021 9:07:42 AM

Host Name: ASBKXWX328



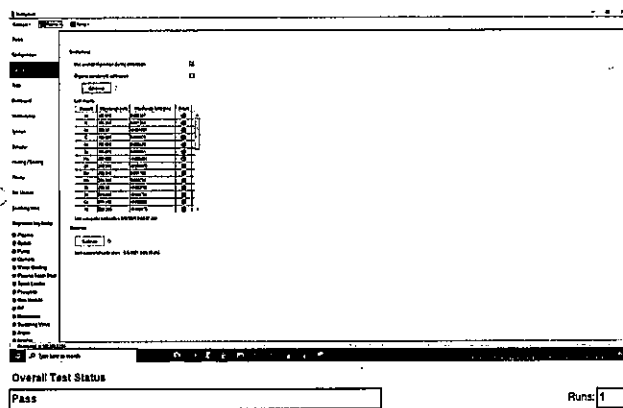
Date: September 13, 2021 5:50:41 PM
System ID: MY16010005

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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: ASBKXWX328



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

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Instrument Tests

Purpose

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

Configuration Details

Model/Serial No.: G8010A MY16010005

Results	Observed Result	Expected Result	Status
---------	-----------------	-----------------	--------

Are the Functional Tests results within acceptance criteria?

Subsystem Communications

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

Date: September 13, 2021 6:50:41 PM
System ID: MY16010005

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Autosampler Operation

Purpose

This test verifies that the autosampler operates properly.

Configuration Details

Model/Serial No.: G8410A AU15440784

Results	Observed Result	Expected Result	Status
---------	-----------------	-----------------	--------

Does the autosampler successfully move to the specified location(s)?

Yes	Yes	Pass
-----	-----	------

Overall Test Status

Pass Runs: 1

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

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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 13, 2021 6:50:41 PM
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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	6
EQR	General	Instrument's Test Report	4

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

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General

Document Name: Certificate of Qualification for ACE



Agilent Compliance Engine Self Qualification

 Order: September 8, 2021 10:10:10 AM
 Drive Serial #: EAFM572 Plateau Revision: A.03.01

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

Technique Type	Tests Completed	Result
UV/Vis Spectrophotometer	10	Confirms
Atomic Absorption	7	Confirms
Capillary Electrophoresis	10	Confirms
Isotopes	6	Confirms
Emission Spectroscopy	3	Confirms
Infrared Spectroscopy	7	Confirms

Overall Qualification Status

Confirms

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

Document Name: Certificate of Qualification for ACE



Certificate of Completion

Learner Name: Kanykorn Sukphatjorn

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

Completion Date: June 25, 2020

Certified By Company: Learning at Agilent

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

A certificate for Service and Support training is only valid while employed by Agilent Technologies or while working as an Agilent-authorized service provider, through which the service employee has ongoing access to Agilent's Safety Alerts, Service Notes, Internal technical updates, updates training, current 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.

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

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General

Document Name: Operator's training certificate and qualifications



Certificate of Completion

Learner Name: Kanykorn Sukphatjorn

Title Of Course: ANV-CE-ICP-OES-3-008-A: Agilent 5100 ICP-OES Support Neophyte 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, updates training, current 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.

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

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Materials

Document Name: Certificate of Analysis Wavelength calibration solution



CERTIFICATE OF ANALYSIS

 Agilent Product Name: Wavelength Calibration Solution for ICP-OES & MP-AES, 8 mg/L, 10mL
 Agilent Part No: 843600100
 Lot No: 001070041

Analysis	Starting Material	CME 9	Calculated Conc.	Analysis	Starting Material	CME 9	Calculated Conc.
As	AsH ₃ Gas	716.912	2.000 ± 0.000 mg/L	Se	SeH ₄ Gas	143.893	1.000 ± 0.000 mg/L
B	B ₂ H ₆ Gas	716.912	1.000 ± 0.000 mg/L	Si	SiH ₄ Gas	134.744	1.000 ± 0.000 mg/L
Br	BrH ₃ Gas	1095.313	1.000 ± 0.000 mg/L	Te	TeH ₄ Gas	126.724	1.000 ± 0.000 mg/L
Ca	Ca	854.304	1.000 ± 0.000 mg/L	Th	ThH ₄ Gas	117.913	1.000 ± 0.000 mg/L
Cl	Cl ₂	326.732	1.000 ± 0.000 mg/L	Ti	TiH ₄ Gas	111.482	1.000 ± 0.000 mg/L
Co	Co	346.401	1.000 ± 0.000 mg/L	U	UH ₄ Gas	103.624	1.000 ± 0.000 mg/L
Cu	Cu	327.401	1.000 ± 0.000 mg/L	V	VH ₄ Gas	103.624	1.000 ± 0.000 mg/L
Cr	Cr	313.343	1.000 ± 0.000 mg/L	W	WH ₄ Gas	103.624	1.000 ± 0.000 mg/L
Cs	Cs	852.013	1.000 ± 0.000 mg/L	Zn	ZnH ₄ Gas	103.624	1.000 ± 0.000 mg/L
F	F ₂	770.253	1.000 ± 0.000 mg/L				

Master: 843600100

Notes: This solution is intended for use as a certified reference material in laboratories that are registered for ISO 17025 and ISO 17025. This CRM was prepared in the certified concentration shown above by gravimetric methods using high-purity reagents that were certified using the "High Purity Reference" process developed by NIST and are directly traceable to the NIST CRM data base. This solution was stabilized using high-purity water and 0.000% and stored with Ethanol (C₂H₅OH) at 4°C. The solution used in the preparation of this CRM was certified regularly with traceability to NIST. All reagents and solvents are purchased in Class A certified containers. The certified concentration was determined based upon gravimetric methods. Secondary verification of the certified concentration was performed using ICP-OES. This was calibrated and/or referenced against NIST SRM 3103a, 3103b, 3103c, 3103d, 3103e, 3103f, 3103g, 3103h, 3103i, 3103j, 3103k, 3103l, 3103m, 3103n, 3103o, 3103p, 3103q, 3103r, 3103s, 3103t, 3103u, 3103v, 3103w, 3103x, 3103y, 3103z, 3104, 3105, 3106, 3107, 3108, 3109, 3110, 3111, 3112, 3113, 3114, 3115, 3116, 3117, 3118, 3119, 3120, 3121, 3122, 3123, 3124, 3125, 3126, 3127, 3128, 3129, 3130, 3131, 3132, 3133, 3134, 3135, 3136, 3137, 3138, 3139, 3140, 3141, 3142, 3143, 3144, 3145, 3146, 3147, 3148, 3149, 3150, 3151, 3152, 3153, 3154, 3155, 3156, 3157, 3158, 3159, 3160, 3161, 3162, 3163, 3164, 3165, 3166, 3167, 3168, 3169, 3170, 3171, 3172, 3173, 3174, 3175, 3176, 3177, 3178, 3179, 3180, 3181, 3182, 3183, 3184, 3185, 3186, 3187, 3188, 3189, 3190, 3191, 3192, 3193, 3194, 3195, 3196, 3197, 3198, 3199, 3200, 3201, 3202, 3203, 3204, 3205, 3206, 3207, 3208, 3209, 3210, 3211, 3212, 3213, 3214, 3215, 3216, 3217, 3218, 3219, 3220, 3221, 3222, 3223, 3224, 3225, 3226, 3227, 3228, 3229, 3230, 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3397, 3398, 3399, 3400, 3401, 3402, 3403, 3404, 3405, 3406, 3407, 3408, 3409, 3410, 3411, 3412, 3413, 3414, 3415, 3416, 3417, 3418, 3419, 3420, 3421, 3422, 3423, 3424, 3425, 3426, 3427, 3428, 3429, 3430, 3431, 3432, 3433, 3434, 3435, 3436, 3437, 3438, 3439, 3440, 3441, 3442, 3443, 3444, 3445, 3446, 3447, 3448, 3449, 3450, 3451, 3452, 3453, 3454, 3455, 3456, 3457, 3458, 3459, 3460, 3461, 3462, 3463, 3464, 3465, 3466, 3467, 3468, 3469, 3470, 3471, 3472, 3473, 3474, 3475, 3476, 3477, 3478, 3479, 3480, 3481, 3482, 3483, 3484, 3485, 3486, 3487, 3488, 3489, 3490, 3491, 3492, 3493, 3494, 3495, 3496, 3497, 3498, 3499, 3500, 3501, 3502, 3503, 3504, 3505, 3506, 3507, 3508, 3509, 3510, 3511, 3512, 3513, 3514, 3515, 3516, 3517, 3518, 3519, 3520, 3521, 3522, 3523, 3524, 3525, 3526, 3527, 3528, 3529, 3530, 3531, 3532, 3533, 3534, 3535, 3536, 3537, 3538, 3539, 3540, 3541, 3542, 3543, 3544, 3545, 3546, 3547, 3548, 3549, 3550, 3551, 3552, 3553, 3554, 3555, 3556, 3557, 3558, 3559, 3560, 3561, 3562, 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3729, 3730, 3731, 3732, 3733, 3734, 3735, 3736, 3737, 3738, 3739, 3740, 3741, 3742, 3743, 3744, 3745, 3746, 3747, 3748, 3749, 3750, 3751, 3752, 3753, 3754, 3755, 3756, 3757, 3758, 3759, 3760, 3761, 3762, 3763, 3764, 3765, 3766, 3767, 3768, 3769, 3770, 3771, 3772, 3773, 3774, 3775, 3776, 3777, 3778, 3779, 3780, 3781, 3782, 3783, 3784, 3785, 3786, 3787, 3788, 3789, 3790, 3791, 3792, 3793, 3794, 3795, 3796, 3797, 3798, 3799, 3800, 3801, 3802, 3803, 3804, 3805, 3806, 3807, 3808, 3809, 3810, 3811, 3812, 3813, 3814, 3815, 3816, 3817, 3818, 3819, 3820, 3821, 3822, 3823, 3824, 3825, 3826, 3827, 3828, 3829, 3830, 3831, 3832, 3833, 3834, 3835, 3836, 3837, 3838, 3839, 3840, 3841, 3842, 3843, 3844, 3845, 3846, 3847, 3848, 3849, 3850, 3851, 3852, 3853, 3854, 3855, 3856, 3857, 3858, 3859, 3860, 3861, 3862, 3863, 3864, 3865, 3866, 3867, 3868, 3869, 3870, 3871, 3872, 3873, 3874, 3875, 3876, 3877, 3878, 3879, 3880, 3881, 3882, 3883, 3884, 3885, 3886, 3887, 3888, 3889, 3890, 3891, 3892, 3893, 3894, 3895, 3896, 3897, 3898, 3899, 3900, 3901, 3902, 3903, 3904, 3905, 3906, 3907, 3908, 3909, 3910, 3911, 3912, 3913, 3914, 3915, 3916, 3917, 3918, 3919, 3920, 3921, 3922, 3923, 3924, 3925, 3926, 3927, 3928, 3929, 3930, 3931, 3932, 3933, 3934, 3935, 3936, 3937, 3938, 3939, 3940, 3941, 3942, 3943, 3944, 3945, 3946, 3947, 3948, 3949, 3950, 3951, 3952, 3953, 3954, 3955, 3956, 3957, 3958, 3959, 3960, 3961, 3962, 3963, 3964, 3965, 3966, 3967, 3968, 3969, 3970, 3971, 3972, 3973, 3974, 3975, 3976, 3977, 3978, 3979, 3980, 3981, 3982, 3983, 3984, 3985, 3986, 3987, 3988, 3989, 3990, 3991, 3992, 3993, 3994, 3995, 3996, 3997, 3998, 3999, 4000, 4001, 4002, 4003, 4004, 4005, 4006, 4007, 4008, 4009, 4010, 4011, 4012, 4013, 4014, 4015, 4016, 4017, 4018, 4019, 4020, 4021, 4022, 4023, 4024, 4025, 4026, 4027, 4028, 4029, 4030, 4031, 4032, 4033, 4034, 4035, 4036, 4037, 4038, 4039, 4040, 4041, 4042, 4043, 4044, 4045, 4046, 4047, 4048, 4049, 4050, 4051, 4052, 4053, 4054, 4055, 4056, 4057, 4058, 4059, 4060, 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4227, 4228, 4229, 4230, 4231, 4232, 4233, 4234, 4235, 4236, 4237, 4238, 4239, 4240, 4241, 4242, 4243, 4244, 4245, 4246, 4247, 4248, 4249, 4250, 4251, 4252, 4253, 4254, 4255, 4256, 4257, 4258, 4259, 4260, 4261, 4262, 4263, 4264, 4265, 4266, 4267, 4268, 4269, 4270, 4271, 4272, 4273, 4274, 4275, 4276, 4277, 4278, 4279, 4280, 4281, 4282, 4283, 4284, 4285, 4286, 4287, 4288, 4289, 4290, 4291, 4292, 4293, 4294, 4295, 4296, 4297, 4298, 4299, 4300, 4301, 4302, 4303, 4304, 4305, 4306, 4307, 4308, 4309, 4310, 4311, 4312, 4313, 4314, 4315, 4316, 4317, 4318, 4319, 4320, 4321, 4322, 4323, 4324, 4325, 4326, 4327, 4328, 4329, 4330, 4331, 4332, 4333, 4334, 4335, 4336, 4337, 4338, 4339, 4340, 4341, 4342, 4343, 4344, 4345, 4346, 4347, 4348, 4349, 4350, 4351, 4352, 4353, 4354, 4355, 4356, 4357, 4358, 4359, 4360, 4361, 4362, 4363, 4364, 4365, 4366, 4367, 4368, 4369, 4370, 4371, 4372, 4373, 4374, 4375, 4376, 4377, 4378, 4379, 4380, 4381, 4382, 4383, 4384, 4385, 4386, 4387, 4388, 4389, 4390, 4391, 4392, 4393, 4394, 4395, 4396, 4397, 4398, 4399, 4400, 4401, 4402, 4403, 4404, 4405, 4406, 4407, 4408, 4409, 4410, 4411, 4412, 4413, 4414, 4415, 4416, 4417, 4418, 4419, 4420, 4421, 4422, 4423, 4424, 4425, 4426, 4427, 4428, 4429, 4430, 4431, 4432, 4433, 4434, 4435, 4436, 4437, 4438, 4439, 4440, 4441, 4442, 4443, 4444, 4445, 4446, 4447, 4448, 4449, 4450, 4451, 4452, 4453, 4454, 4455, 4456, 4457, 4458, 4459, 4460, 4461, 4462, 4463, 4464, 4465, 4466, 4467, 4468, 4469, 4470, 4471, 4472, 4473, 4474, 4475, 4476, 4477, 4478, 4479, 4480, 4481, 4482, 4483, 4484, 4485, 4486

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 instrument has not been tampered with. During the period of validity, the purchaser will be notified if this product is recalled due to any significant changes in the quality of the solution.

Sample lot number

[Signature]
Quality Assurance, Calibration & Flow

Date of release: 8 April 2021
Date of expiration: 3 October 2022

Date: September 13, 2021 6:50:41 PM
System ID: MY18010005

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Document Name: Certificate of Analysis Wavelength calibration solution



Related Information: Refer to the Safety Data Sheet (SDS), which can be obtained at www.agilent.com/crosslab.

Integrity: This solution was formulated in the laboratory by procedures associated with the requirements of ISO 17025 and ISO 9001:2015. The solution was prepared in the laboratory of the manufacturer, and the solution was tested to ensure that it meets the requirements of the specification.

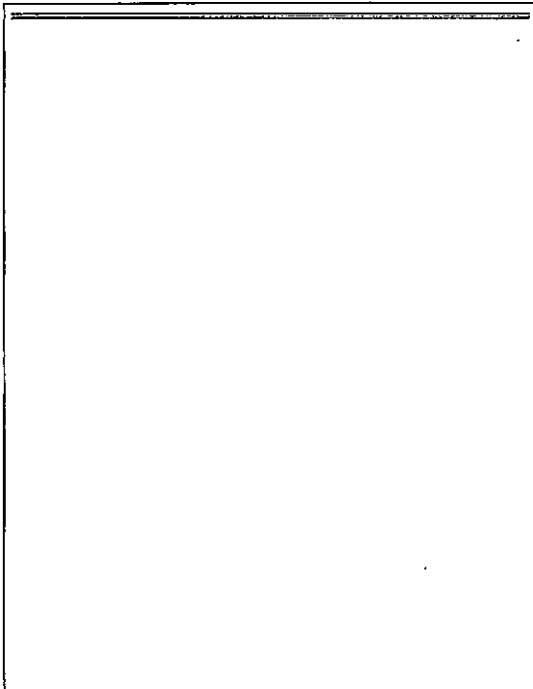
Further Information: Please contact Agilent for further information about this ODS.

Ready for Use: This ODS was prepared under a quality management system that is:
• Registered to ISO 17025 - Quality Management Systems - Requirements for Calibration Laboratories (Agilent, Inc. 6118 18010005)
• Accredited to ISO 17025 - General Requirements for the Competence of Calibration Laboratories (Agilent, Inc. 6118 18010005)
• ISO 17025 reference additional requirements specified in ISO 9001:2015 and ISO 9001:2015
• Accredited to ISO 9001:2015 - General Requirements for the Competence of Testing and Calibration Laboratories (Agilent, Inc. 6118 18010005)

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Document Name: Certificate of Analysis Wavelength calibration solution



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Comments

Date/Time:	September 13, 2021 6:27:56 PM
Test:	General
Comment:	Start OQ on 08 Sep 21 and found water flow fail, So repair job complete for 13 Sep 21 and OQ continue to complete.

Date: September 13, 2021 6:50:41 PM
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General

Document Name: Instrument's Test Report

Report Summary

Instrument Model	Agilent 8100S110 SVDVICH-OES
Instrument ID	0810A0M014A
Instrument Serial Number	MY16010005
Software Version	7.5.3.11953
Firmware Version	5505
Tested By	Kanyakam B.
Test started on	9/9/2021 9:51:21 AM
Test Completed On	9/9/2021 9:56:35 AM

Result Summary

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

Subsystem Communications Test Pass

Optics Test Pass

Element	Wavelength	Ratio	Standard	Blank
Intensity	3082.110	2150550	2419285	
Wavelength	737.212	737.212	737.212	

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Document Name: Instrument's Test Report

Element Wavelength	Specification	Measured Value % RSD
Al (174.213 nm)	± 0.40	7.54
As (188.380 nm)	± 0.20	5.43
Co (160.077 nm)	± 11.50	3.29
Fe (202.032 nm)	± 0.20	6.50
Cr (204.168 nm)	± 13.40	11.03
Cu (214.459 nm)	± 2.70	2.27
Pb (220.353 nm)	± 0.20	7.52
Cd (226.610 nm)	± 17.20	10.66
Mn (273.810 nm)	± 0.40	7.50
Na (285.310 nm)	± 15.30	8.29
Na (285.389 nm)	± 20.20	16.63
Cr (287.718 nm)	± 11.00	8.53
Cu (324.754 nm)	± 25.00	16.14
Co (327.368 nm)	± 14.20	11.75
Se (335.711 nm)	± 33.50	26.94
Se (435.403 nm)	± 44.00	33.67
Se (480.733 nm)	± 35.00	22.38
Se (493.408 nm)	± 35.00	25.86
Se (514.371 nm)	± 42.00	28.49
Ar (875.293 nm)	± 74.00	62.68
K (766.491 nm)	± 50.00	56.42

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Document Name: Instrument's Test Report

Sensitivity Test Pass

Element Wavelength	Specification	Method	Ratio	Standard	Blank
Al (188.380 nm)	± 0.80	SRBR	88.6	90.1	94.9
Se (196.078 nm)	± 0.10	SRBR	88.6	75.84	113.8
Zn (213.817 nm)	± 7421.0	SRBR	2665.3	26974.4	197.9
Pb (220.353 nm)	± 0.80	SRBR	160.8	1582.6	152.2
Mn (273.810 nm)	± 3518.0	SRBR	6941.7	137413.8	368.9
Al (296.192 nm)	± 3.4	SR	6.3	24237.9	3041.8
Se (493.408 nm)	± 34.0	SR	95.1	1015419.2	10583.7
K (766.491 nm)	± 1.8	SR	4.4	82043.9	15321.8

Blank

Element Wavelength	Specification	Method	Ratio	Standard	Blank
Al (188.380 nm)	± 208.0	SRBR	282.4	5168.8	273.5
Se (196.078 nm)	± 186.0	SRBR	199.9	2993.9	321.0
Zn (213.817 nm)	± 2413.0	SRBR	793.6	12458.9	537.0
Pb (220.353 nm)	± 1743.0	SRBR	4924.9	130862.8	896.4
Cd (214.459 nm)	± 4227.0	SRBR	4006.0	87892.4	376.1
Pb (220.353 nm)	± 320.0	SRBR	327.3	7853.1	450.3
Mn (273.810 nm)	± 10628.0	SRBR	18008.8	632961.9	1104.7
Cr (287.718 nm)	± 1048.0	SRBR	4115.3	173069.6	1761.9
Cu (324.754 nm)	± 19.0	SR	48.8	185303.3	2960.0
Al (296.192 nm)	± 3.0	SR	18.7	105802.5	5377.5
Se (480.733 nm)	± 60.0	SR	169.0	5374078.7	51797.8
K (766.491 nm)	± 21.0	SR	54.8	2030137.0	33664.6

Precision Test Pass

Element Wavelength	Specification	Measured Value % RSD
Al (188.380 nm)	± 2.00	1.68
Se (196.078 nm)	± 2.00	1.38
Zn (213.817 nm)	± 1.50	0.82
Pb (220.353 nm)	± 2.00	0.72
Mn (273.810 nm)	± 1.50	0.44

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Element Wavelength	Specification	Measured Value % RSD
Al (188.380 nm)	± 1.50	0.43
Se (493.408 nm)	± 1.50	0.48
K (766.491 nm)	± 1.50	0.34

Report Detail

Test Run - Operator: Kanyakam B.

Subsystem Communications Test - Started

Subsystem Status

Main Power Module - Passed

Gas Control Module - Passed

RF Generator - Passed

Pre-oxidation Module - Passed

Optics/Camera Control Module - Passed

Peristaltic Pump - Passed

Subsystem Communications Test Completed - Passed

Optics Test - Started

Test View Mode Intensity Status

LED Off - Passed

Shutter opened - Passed

Peak Intensity Radial mode 2022175.14 - Passed

Shutter closed - Passed

Peak Intensity (closed shutter) Radial mode 55.30 - Passed

Shutter opened - Passed

Control Argon Ratio: Controlled Value = 0.55, Factory Value = 2.50

Peak Intensity Axial mode 312050.45 - Passed

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Document Name: Instrument's Test Report

Radio-Axis Intensity Ratio (Range 0-100) - 1.00 - Passed
Peak Intensity Simultaneous mode 24/18287.63 - Passed
Shutter closed - Passed
Optics Test Completed - Passed
Instrument Performance - Started
Instrument Performance Completed - Passed

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General

Document Name: Instrument's Test Report

Report Summary
Instrument Model: Agilent 6100/5110 BVDV ICP-OES
Instrument ID: 0801DAV0214A
Instrument Serial Number: MY16010005
Software Version: 7.5.3.11953
Firmware Version: 5395
Tested By: Kanyahom S.
Test started on: 9/13/2021 5:33:48 PM
Test Completed On: 9/13/2021 5:46:58 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: Stopped
Resolution Test: Stopped
Sensitivity Test: Stopped
Precision Test: Stopped

Subsystem Communications Test: Pass

Air Flow Test: Pass

30% Air Flow (relative speed)	30% Air Flow (relative speed)
11.00	18.00

Water Flow Test: Pass

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

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Document Name: Instrument's Test Report

Gas Flows Test: Pass
Nebulizer Target Flow: 0.70 (0.71) 276.73 2.00 2.00 106.21
Makeup Target Flow: 2.00 2.00 108.63 18.00 17.98 19.75

RF Generator Test: Pass
RF Power Supply Test: Passed
RF Power Supply (V): 130.332
RF Oscillator Test: Passed
RF Oscillator Frequency (MHz): 25.917
Work Cell Current (A): 44.873
RF Power Supply Current (A): 1.98

Camera Test: Pass
Black Level Test: Passed
Noise Test: Passed
Photo Response Test: Passed

Optics Test: Pass
Intensity: 165633
Wavelength: 737.212

Report Detail
Tests Run - Operator: Kanyahom S.
Subsystem Communications Test - Started
Subsystem Status
Main Power Module - Passed
Gas Control Module - Passed
RF Generator - Passed
Preoptics Module - Passed
Optics/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 (%) Air Flow (relative speed) Status
30% 11 - Passed
30% 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) (L/min) = 2.00
Water Flow Completed - Passed
Gas Flows - Started
Channel Target Actual Pressure Failure Status
Auxiliary Gas 0.00 0.00 N/A - Passed
Auxiliary Gas 2.00 2.00 N/A - Passed
Nebulizer Gas 0.00 0.00 0.00 N/A - Passed
Nebulizer Gas 0.70 0.71 276.73 N/A - Passed
Makeup Gas 0.00 1.18 N/A - Passed
Makeup Gas 18.00 17.98 N/A - Passed
Makeup Gas 0.00 0.00 N/A - Passed
Makeup Gas 2.00 2.00 N/A - Passed
Purge Gas 0.70 0.70 N/A - Passed
Purge Gas 0.70 0.70 N/A - Passed
All Channel Flows On - Passed
All Channel Flows Off - Passed
Gas Flows Completed - Passed
RF Generator - Started
RF generator turned on - Passed
RF generator turned on - Passed
RF Power Supply - RF Value = 150V, Actual Value = 130.33V - Passed
RF Oscillator Started - Passed
RF Oscillator Frequency (MHz) = 25.92, Work Cell Current (Amps) = 44.87, RF Power Supply Current (Amps) = 1.98 - Passed
RF generator turned off - Passed
RF generator turned off - Passed
Camera Test - Started
Black level test - PASSED
Noise test - PASSED
Photo response test - PASSED
Camera Test Completed - Passed
Optics Test - Started
Test View Mode Information Status
LED ON - Passed

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Document Name: Instrument's Test Report

Plasma Ignite Started - Passed
 Waiting 5 min for plasma warmup - Passed
 Shutter opened - Passed
 Peak Intensity (closed shutter) Radial mode 55.48 - Passed
 Shutter closed - Passed
 Peak Intensity (closed shutter) Radial mode 55.48 - Passed
 Shutter opened - Passed
 Optical Argon Radial: Calculated Value = 2.53, Factory Value = 2.60
 Peak Intensity Axial mode 200967.25 - Passed
 Radial-Axial Intensity Ratio (Range 0-100) = 1.01 - Passed
 Peak Intensity Simultaneous mode 2286038.40 - Passed
 Shutter closed - Passed
 Optics Test Completed - Passed

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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.)

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Full Name of Signer: Kanyakorn Sukprathajarn
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 Signature Creation Date: September 13, 2021
 Reason for Signature: Executed protocol and published this original version of document

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User Name: phimpapha.jeepraphong
 Hostname: ABBX00X1328
 System ID: MY18010005
 Print Date: September 13, 2021 8:50:44 PM

GDHW 51M KPODES ALB 04Sep21 Transaction log:

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
September 8, 2021 8:48:58 AM	Auth	Session Created	Session	None
September 8, 2021 8:49:58 AM	Start	Configuration	Session	None
September 8, 2021 8:49:58 AM	Auth	Enrollment	Licensing	User is PACE Engineer and does not require an unlock code
September 8, 2021 9:57:06 AM	Auth	ExpLoaded	Session	EOP details for primary technique (Ex) - File path: [ProtocolPacks\EuConfigured on 07.20Vx.02.00 exp]. EOP File Name: [EA.02.00.00]. EOP Name: [AgilentRecommended]
September 8, 2021 9:57:11 AM	End	Configuration	Session	None
September 8, 2021 9:57:15 AM	Start	Qualification	Session	OQ
September 8, 2021 9:57:15 AM	Start	Execution	Preparation: 5100 SVGV; Qualitative Test - No response associated	None
September 8, 2021 9:54:36 AM	End	Execution	Preparation: 5100 SVGV; Qualitative Test - No response associated	Run Count: 1
September 8, 2021 9:54:36 AM	Start	Execution	Instrument Tests: 6100 SVGV; Qualitative Test - No response associated	None
September 8, 2021 9:51:27 AM	End	Execution	Instrument Tests: 6100 SVGV; Qualitative Test - No response associated	Run Count: 1

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 System ID: MY18010005

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User Name: phimpapha.jeepraphong
 Hostname: ABBX00X1328
 System ID: MY18010005
 Print Date: September 13, 2021 8:50:44 PM

GDHW 51M KPODES ALB 04Sep21 Transaction log:

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
September 8, 2021 9:51:00 AM	Start	Execution	Autosampler Operation: Autosampler 1 - 8PM; Qualitative Test - No response associated	None
September 8, 2021 9:51:06 AM	End	Execution	Autosampler Operation: Autosampler 1 - 8PM; Qualitative Test - No response associated	Run Count: 1
September 8, 2021 9:51:58 AM	End	Qualification	Session	OQ
September 8, 2021 9:51:58 AM	Start	Reporting	Session	None
September 8, 2021 10:59:40 AM	Auth	AccClosed	Session	None
September 13, 2021 9:01:25 PM	Auth	AccRestricted	Session	None
September 13, 2021 9:01:25 PM	Auth	SessionRefreshed	Session	None
September 13, 2021 9:01:25 PM	Start	Qualification	Session	OQ
September 13, 2021 9:47:55 PM	Auth	Reporting	Session	Report Generated: Certificate

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 System ID: MY18010005

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User Name: phlompapha.jeeponhong
 Hostname: ASB0000326
 System ID: MY16010005
 Print Date: September 13, 2021 5:52:44 PM

COHV B130 KPOER ALS 06Sept21 Transaction Log

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
September 13, 2021 5:42:13 PM	Audit	Reporting	Session	Report Signed: Certificate PDF Name: COHV B130 KPOER ALS 06Sept21_20210913_Certific M_1.pdf User Name: phlompapha.jeeponhong@sgl.com Full Name of Signer: Kanyakon Supapongkarn Reason for signature: Executed protocol and published the original version of document
September 13, 2021 5:49:25 PM	Audit	Reporting	Session	Report Generated: Report

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

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Metrological Center

SCI ECO Services Company Limited

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

Telephone : +66 2 586 5792-4 Fax : +66 2 586 5109

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

Certificate No. T220730

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Certificate of Calibration

Equipment : HEATING BLOCK
 Manufacturer : Environmental Express
 Model : SC 196
 Serial No. : 6974CECW3285
 Customer Code : BKK_EL0054
 ID No. : T5306A3
 Customer : ALS Laboratory Group (Thailand) Co., Ltd.
 104 Phatthanakan 40, Phatthanakan Rd., Khwaeng Phatthanakan,
 Khet Suan Luang, Bangkok 10250

REVIEW BY Tattaporn C.
 APPROVED BY Sangtong
 NEXT CAL DATE 7/10/22

Customer Location : Acid Digestion Lab
 Date of Receipt : 30 March 2022
 Calibrated By : Watcharapon Sangtong (Technician)
 Approved By : [Signature] / Sujjar Nakhakred (Site Calibration Manager)
 Date of Issue : 12 APR 2022

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

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

FM-L12 108/30-05-57



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Telephone : +66 2 586 5792-4 Fax : +66 2 586 5109

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

Certificate No. T220730

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Calibration Report

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 :

- 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 .
- Reference Standard Instrument :

Instrument	Model	Instrument No.	Certificate No.	Due Date
TC	TYPE T	TN221-TN230	T210008	06 June 2022
TC	TYPE T	TN231-TN240	T210008	06 June 2022
DATA LOGGER	34970A	T149	T210008	06 June 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 2 Hour 25 Minute At 95 °C
 Fresh Air Damper ☐ Open ☐ Min ☐ Medium ☐ Max
☐ Close
☒ Not Available
- Adjustment :
 () without adjustment (X) after adjustment

Approved By [Signature]

FM-L13 108/30-05-57



Metrological Center

SCI ECO Services Company Limited

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

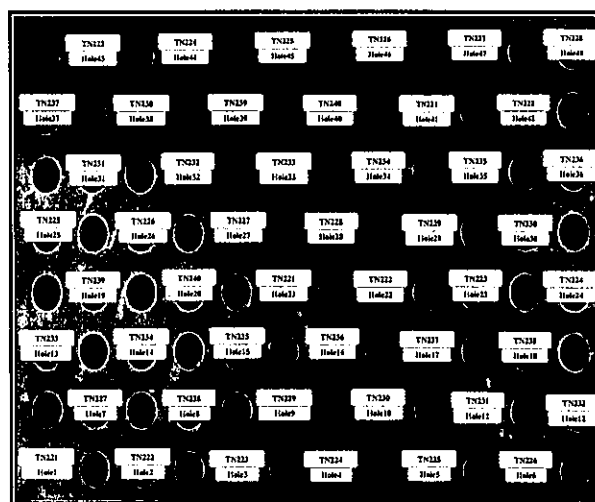
Telephone : +66 2 586 5792-4 Fax : +66 2 586 5109

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

Certificate No. T220730

Page 3 of 6

Calibration Report





Certificate No. T220730

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Calibration Report

Measurement Results

Calibration Point		Average Standard Reading at each position (°C)					
R1 Hole1-Hole6		TN221	TN222	TN223	TN224	TN225	TN226
CAL POINT	Max	93.60	93.82	94.05	94.20	94.36	94.26
	Min	93.07	93.26	93.51	93.66	93.82	93.71
	Average	93.33	93.54	93.78	93.93	94.09	93.98
R2 Hole7-Hole12		TN227	TN228	TN229	TN230	TN231	TN232
	Max	94.59	94.79	94.63	94.55	94.82	95.00
	Min	94.05	94.25	94.08	93.97	94.26	94.44
	Average	94.32	94.52	94.36	94.26	94.54	94.72
R3 Hole13-Hole18		TN233	TN234	TN235	TN236	TN237	TN238
	Max	95.03	94.54	94.78	94.84	95.06	94.73
	Min	94.46	93.98	94.20	94.28	94.49	94.18
	Average	94.74	94.26	94.49	94.56	94.78	94.45
R4 Hole19-Hole24		TN239	TN240	TN241	TN242	TN243	TN244
	Max	94.89	94.82	95.73	95.85	95.73	96.10
	Min	94.33	94.26	95.51	95.62	95.51	95.83
	Average	94.61	94.54	95.62	95.73	95.62	95.97
R5 Hole25-Hole30		TN245	TN246	TN247	TN248	TN249	TN250
	Max	96.28	96.39	96.37	96.54	96.19	96.04
	Min	96.01	96.10	96.02	96.20	95.89	95.71
	Average	96.15	96.24	96.20	96.37	96.04	95.88
R6 Hole31-Hole36		TN251	TN252	TN253	TN254	TN255	TN256
	Max	96.84	96.97	97.03	96.48	96.33	95.76
	Min	96.53	96.65	96.71	96.08	95.98	95.43
	Average	96.68	96.81	96.87	96.28	96.16	95.60
R7 Hole37-Hole42		TN257	TN258	TN259	TN260	TN261	TN262
	Max	96.46	96.15	96.19	96.06	96.95	97.09
	Min	96.13	95.84	95.85	95.73	96.64	96.78
	Average	96.30	95.99	96.02	95.89	96.80	96.93
R8 Hole43-Hole48		TN263	TN264	TN265	TN266	TN267	TN268
	Max	95.91	96.38	96.13	96.19	96.34	96.19
	Min	95.55	96.21	95.80	95.87	96.03	95.88
	Average	95.73	96.40	95.96	96.03	96.18	96.03

Approved By.

FM-L13 IOR/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	104.47	104.65	104.79	105.31	105.47	105.46
	Min	104.15	104.27	104.45	104.58	105.14	105.20
	Average	104.31	104.46	104.62	105.15	105.31	105.33
R2 Hole7-Hole12		TN227	TN228	TN229	TN230	TN231	TN232
	Max	105.55	105.73	105.65	105.84	105.97	106.07
	Min	105.28	105.43	105.35	105.52	105.68	105.83
	Average	105.42	105.58	105.50	105.68	105.82	105.95
R3 Hole13-Hole18		TN233	TN234	TN235	TN236	TN237	TN238
	Max	106.14	106.06	105.81	106.05	105.81	105.87
	Min	105.85	105.81	105.55	105.80	105.53	105.64
	Average	106.00	105.94	105.68	105.92	105.67	105.75
R4 Hole19-Hole24		TN239	TN240	TN241	TN242	TN243	TN244
	Max	105.86	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		TN245	TN246	TN247	TN248	TN249	TN250
	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		TN251	TN252	TN253	TN254	TN255	TN256
	Max	105.44	105.45	105.61	104.95	104.84	104.42
	Min	105.27	105.27	105.44	104.76	104.66	104.23
	Average	105.36	105.36	105.53	104.86	104.75	104.33
R7 Hole37-Hole42		TN257	TN258	TN259	TN260	TN261	TN262
	Max	105.17	104.70	104.59	104.51	105.22	105.53
	Min	105.00	104.55	104.41	104.35	105.04	105.37
	Average	105.08	104.62	104.50	104.43	105.13	105.45
R8 Hole43-Hole48		TN263	TN264	TN265	TN266	TN267	TN268
	Max	105.61	105.45	105.10	104.77	104.87	105.02
	Min	105.44	105.28	104.92	104.60	104.70	104.83
	Average	105.53	105.37	105.01	104.69	104.79	104.93

Approved By.

FM-L13 IOR/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 IOR/30-05-57

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Agilent CrossLab Compliance Services



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 4:07:16 PM
Report Type: Report
Org. Name: ALS Laboratory Group (Thailand) Co., Ltd.
Org. Location: 104 Phattanakom 40, Suan Luang, Bangkok 10250.

REVIEW BY
APPROVED BY
NEXT CAL. DATE 29 March 2022

Date: September 30, 2021 4:07:16 PM
System ID: JP15471169

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Date: September 30, 2021 4:07:18 PM
System ID: JP15471189

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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 : SP54	Pass	1
Integrated Sample Introduction System (ISIS) Check : ISIS3	Pass	1
Autotune : G8403A	Pass	1
Background (No Gas Mode) : G8403A	Pass	1
Background (Gas Mode) : G8403A	Pass	1
20-Minute Stability (No Gas Mode) : G8403A	Pass	1

Overall Qualification Status

Pass

Date: September 30, 2021 4:07:18 PM
System ID: JP15471189

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Service Details

Purpose

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

General Details

Service Order No./Request: 8004837154
EQP Name: AgilentRecommended
EQP Revision: ICPMS.02.50
Report Type: Report

Organization Details

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

Local Contact Details

Name: Chalchana Komarskul
Job Title: Manager
Qualification Location: Laboratory

Operator Details

Name: Penchep Kurasathien
Job Title: Field Service Engineer.

Data Acquisition Details

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

Customer Data System (CDS):

ICPMS: MassHunter

Date: September 30, 2021 4:07:18 PM
System ID: JP15471189

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Instrument Details

Purpose

This section describes the as found system configuration.

Details

ICP-MS 1

Manufacturer: Agilent Technologies
Name: 7500
Model Number: G8403A
Installed Options: #100H: Standard Package with Hydrogen option
Detector Type: SQ
Nebulizer: Mist Mat (G3161)
Spray Chamber: Quartz
Torch: Quartz
Sampling Cone: NI
Skimmer Cone: NI
Serial Number: JP15471188
Firmware Revision: C.01.04

ISIS 1

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

Autosampler 1

Manufacturer: Agilent Technologies
Name: SP54
Model Number: G8410A
Serial Number: AU15430722

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

Manufacturer	Agilent Technologies
Name	Chiller
Model Number	G3292A
Serial Number	SU1610713

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.

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.02.60	Autotune
ICPMS.02.60	Background (Gas Modes)
ICPMS.02.60	Background (No Gas Mode)
ICPMS.02.50	Integrated Sample Introduction System (ISIS) Check

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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 4:07:18 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		Runs: 1
Overall Integrated Sample Introduction System (ISIS) Check Test Status			
Pass			

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

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Autotune

Purpose

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

Setpoint

Results

Peakwidth Mass 7	6.719	AMU
Agilent Recommended:	>= 0.65	
	<= 0.80	
Status:	Pass	
Peakwidth Mass 89	0.750	AMU
Agilent Recommended:	>= 0.65	
	<= 0.80	
Status:	Pass	
Peakwidth Mass 205	0.713	AMU
Agilent Recommended:	>= 0.65	
	<= 0.80	
Status:	Pass	
Mass Axis 7	7.05	AMU
Agilent Recommended:	>= 6.9	
	<= 7.1	
Status:	Pass	
Mass Axis 89	88.55	AMU
Agilent Recommended:	>= 88.0	
	<= 89.1	
Status:	Pass	
Mass Axis 205	205.00	AMU
Agilent Recommended:	>= 204.0	
	<= 205.1	
Status:	Pass	

Date: September 30, 2021 4:07:18 PM
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Mass 7 Sensitivity No Gas	64.20	Mcps/ppm
Agilent Recommended:	>= 25.5	
Status:	Pass	
Mass 89 Sensitivity No Gas	307.15	Mcps/ppm
Agilent Recommended:	>= 127.5	
Status:	Pass	
Mass 205 Sensitivity No Gas	203.77	Mcps/ppm
Agilent Recommended:	>= 75.5	
Status:	Pass	
Mass 59 Sensitivity He	28.35	Mcps/ppm
Agilent Recommended:	>= 23.8	
Status:	Pass	
Mass 89 Sensitivity H2	1120.27	Mcps/ppm
Agilent Recommended:	>= 88	
Status:	Pass	
Oxide Ratio 156/140	1.047	%
Agilent Recommended:	<= 1.39	
Status:	Pass	
Doubly Charged Species Ratio 70/140	1.482	%
Agilent Recommended:	<= 2.3	
Status:	Pass	
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):	7	89	205
Measured Value:	3.200	3.300	3.900
Agilent Recommended:	<= 6.9	<= 4.6	<= 11.5
Status:	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:	78	AMU
Integration Time:	1.0	sec
Cycles:	20	
Measurements and Results		
Mass (AMU):	78	
Measured Value:	142.8500	cps
Agilent Recommended:	≤ 115	
Status:	Pass	
Setpoint Status:	Pass	Runs: 1

Setpoint	Gas Mode:	Hydrogen
Conditions		
Mass:	78	AMU
Integration Time:	1.0	sec
Cycles:	20	
Measurements and Results		
Mass (AMU):	78	
Measured Value:	2.1600	cps
Agilent Recommended:	≤ 4.5	
Status:	Pass	
Setpoint Status:	Pass	Runs: 1

Overall Background (Gas Mode) Test Status

Pass

Date: September 30, 2021 4:07:18 PM
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Declaration of Change Control

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

Date: September 30, 2021 4:07:18 PM
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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:	0 points/peak
Repetitions:	20
Sweeps/Replicates:	100
Measurements and Results	
Masses (AMU):	7, 6, 59, 89, 140, 205
Stability RSD:	0.98400, 0.51425, 0.73011 %
Agilent Recommended:	≤ 2.5, ≤ 2.5, ≤ 2.5
Status:	Pass
Setpoint Status:	Pass
Runs:	1

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

Pass

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

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General

Document Name: Certificate of System Qualification



Agilent Technologies

Agilent Compliance Engine Self Qualification

Date: September 14, 2021 4:59:15 PM
Drive Serial #: ACA253C9 Platform Revision: ACE 3.11

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

Technique Type	Tests Completed	Result
Atomic Absorption	7	Conforms
Capillary Electrophoresis	10	Conforms
Dissemination	8	Conforms
Emission Spectroscopy	3	Conforms
Gas Chromatography - GCMS	17	Conforms
Gas Chromatography	28	Conforms
Gas Permeation Chromatography	9	Conforms
ICP-MS	6	Conforms
Infrared Spectroscopy	7	Conforms
Liquid Chromatography	17	Conforms
Liquid Chromatography - LCMS	8	Conforms
Microfluidics	15	Conforms
Sample Preparation - Gas Chromatography	8	Conforms
Sample Preparation - Liquid Chromatography	8	Conforms
Supercritical Fluid Chromatography	18	Conforms
Software	6	Conforms
UV-Vis Spectrophotometer	13	Conforms

Overall Qualification Status:
ConformsDate: September 30, 2021 4:07:18 PM
System ID: JP15471169

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General

Document Name: Operator's training certificate and qualifications



Agilent Technologies

Certificate of Completion

Learner Name: Pandey, Kamaachala

Title Of Course: AN-CE-ICPMS-2-018-A-Agilent 7900 ICPMS FSE update training

Completion Date: June 7, 2024

Certified By Company: Learning at Agilent

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

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

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

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General

Document Name: Certificate of Qualification for ACE



Agilent Technologies

Certificate of Completion

Learner Name: Pandey, Kamaachala

Title Of Course: AN-CE-SS-1-020-A: ACE 3.11 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 Notes, internal technical updates, update training, current documentation, technical support, current parts, and parts updates. Completion of training alone, without being employed by Agilent Technologies, does not qualify an individual to safely install, service or maintain Agilent products.

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System ID: JP15471169

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General

Document Name: Certificate of Qualification for ACE



Agilent Technologies

Certificate of Completion

Learner Name: Pandey, Kamaachala

Title Of Course: AN-CE-ICPMS-2-015-D: CrossLab Compliance Hardware Specific Delivery for Agilent ICP-MS Systems

Completion Date: October 31, 2020

Certified By Company: Learning at Agilent

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

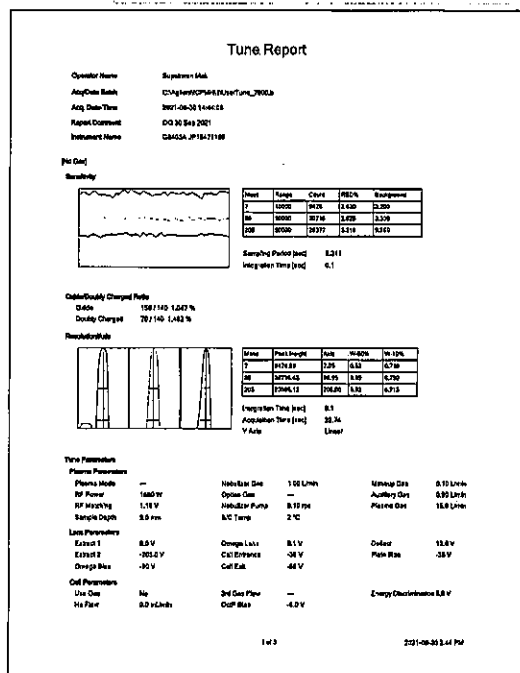
A certificate for Service and Support training is only valid while employed by Agilent Technologies or while working as an Agilent-authorized service provider, through which the service employee has ongoing access to Agilent's Safety Alerts, Service Notes, internal technical updates, update training,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

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System ID: JP15471169

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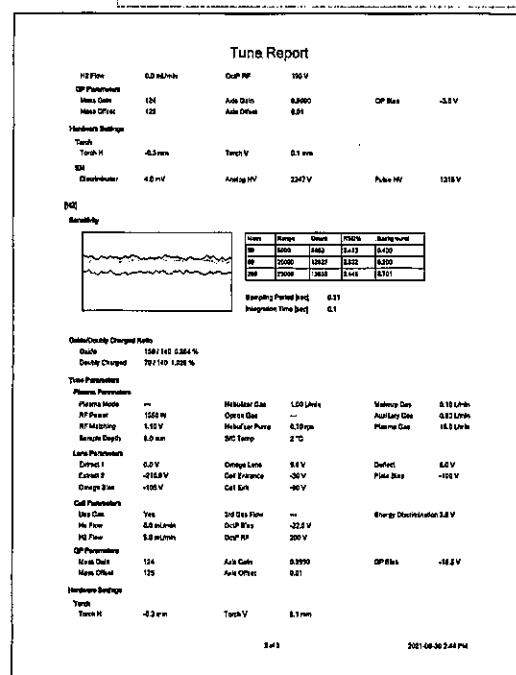
General

Document Name: Tune reports

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

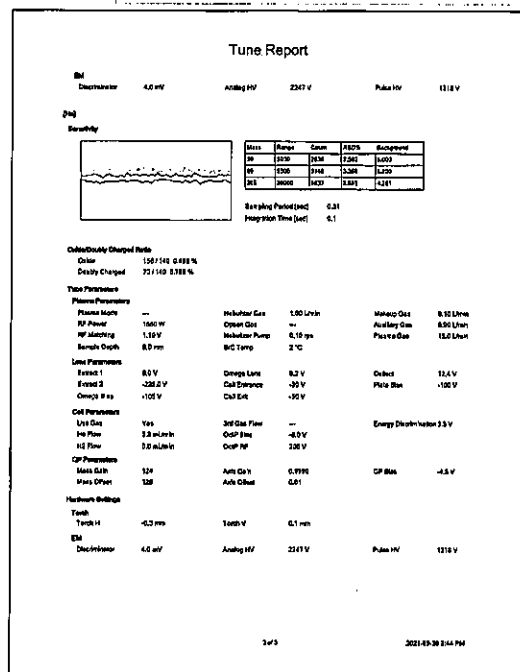
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Document Name: Tune reports

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

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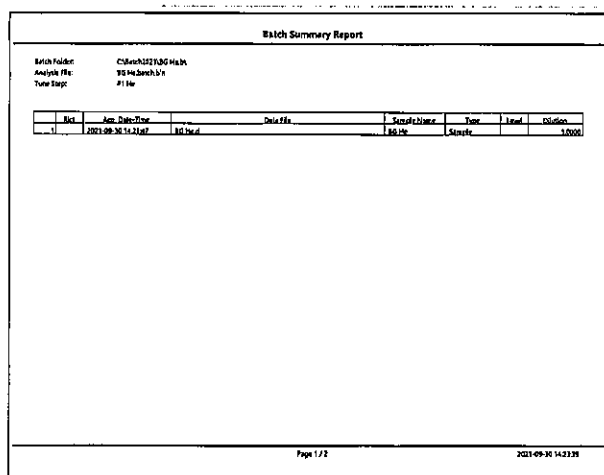
Document Name: Tune reports

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

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General

Document Name: Test Report

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

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Document Name:

Test Report

Batch Summary Report

Analyte Table	
Sample Name	JP15471169
Sample ID	JP15471169

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2021-09-30 14:23:49

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\Server\DO 30 Sep 2021\121421\15471169
Analyte File: 15471169\batch\15471169
Time Step: 15471169

Run	Acq. Date/Time	Batch ID	Sample Name	Time	Level	Injection
1	2021-09-30 15:08:56	15471169	15471169	15:09:00	15471169	1.0000

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2021-09-30 15:18:31

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

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Document Name:

Test Report

Batch Summary Report

Analyte Table	
Sample Name	JP15471169
Sample ID	JP15471169

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2021-09-30 15:10:11

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\Server\DO 30 Sep 2021\121421\15471169
Analyte File: 15471169\batch\15471169
Time Step: 15471169

Run	Acq. Date/Time	Batch ID	Sample Name	Time	Level	Injection
1	2021-09-30 15:12:41	15471169	15471169	15:12:45	15471169	1.0000

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2021-09-30 15:46:42

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

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Test Board

Analyte Table							
	7 Nitro Gasol	9 Nitro Gasol	90 Nitro Gasol	99 Nitro Gasol	100 Nitro Gasol	205 Nitro Gasol	205 Nitro Gasol
Sample Name	CP8 B50	CP8 B50	CP8 B50	CP8 B50	CP8 B50	CP8 B50	CP8 B50
1 223.00	0.96400	7.21454	0.41617	0.51095	0.47344	0.70013	0.70013

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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 Agent representative who has delivered this service understands the meaning and legal status of an electronic signature. As a trained official operator, the Agent 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 available method defined in your data access and control procedures.)

Full Name of Signer:	Panihep Kurassethain
Logged On User Name:	panihep_kurassethain@agilent.com
Signature Creation Date:	September 30, 2021
Reason for Signature:	Executed protocol and published the

Executed protocol and published this original version of document

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. Agent Technologies makes no promises or representations as to its sufficiency for any specific regulatory program.

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Print Date: September 20, 2021 4:57:23 PM

Time	Transaction Name	Activity Performed	Type of Transaction	Optional Information
September 30, 2021 3:50:57 PM	Audit	Session Created	Session	None
September 30, 2021 3:59:07 PM	Start	Configuration	Session	None
September 30, 2021 3:55:07 PM	Audit	Enrollment	Library	User is Field Engineer and does not require an unlock code
September 30, 2021 3:52:53 PM	Audit	Exp/Loaded	Session	EDP details for primary technique (table): File path: [Protocol]PocExploitConf/serato62.36Exploit.02 564 os, EDP File Name: [ipMs.02.02_Asp], EDP Name: [ipMsRecommendes]
September 30, 2021 3:52:54 PM	End	Configuration	Session	None
September 30, 2021 3:52:57 PM	Start	Qualification	Session	QQ
September 30, 2021 3:52:57 PM	Start	Execution	Automated Check: EP54: Automated Check	None
September 30, 2021 3:53:03 PM	End	Execution	Automated Check: EP54: Automated Check	Run Count: 1
September 30, 2021 3:53:04 PM	Start	Execution	Integrated Sample Introduction System (15-3) Check: 1853: Integrated Sample Introduction System (15-3) Check	None
September 30, 2021 3:53:09 PM	End	Execution	Integrated Sample Introduction System (18-5) Check: 1853: Integrated Sample Introduction System (18-5) Check	Run Count: 1

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System Id: JPI547116W
Print Date: September 30, 2024 4:07:22 PM

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
September 30, 2021 9:33:19 PM	Start	Execution	Activate (GAS43A; Autoclave 1)	None
September 30, 2021 9:55:06 PM	End	Execution	Activate (GAS43A; Autoclave 1)	Run Count: 1
September 30, 2021 9:55:12 PM	Start	Execution	Background (No Gas Mode): GAS43A; No Gas Mode Background 1	None
September 30, 2021 9:55:43 PM	End	Execution	Background (No Gas Mode): GAS43A; No Gas Mode Background 1	Run Count: 1
September 30, 2021 9:56:43 PM	Start	Execution	Background (Gas Modes): GAS43A; Gas Mode Background Hydrogen	None
September 30, 2021 9:56:47 PM	End	Execution	Background (Gas Modes): GAS43A; Gas Mode Background Hydrogen	Run Count: 1
September 30, 2021 9:59:19 PM	Start	Execution	Background (Gas Modes): GAS43A; Gas Mode Background Hydrogen	None
September 30, 2021 9:59:56 PM	End	Execution	Background (Gas Modes): GAS43A; Gas Mode Background Hydrogen	Run Count: 1
September 30, 2021 9:56:41 PM	Start	Execution	30 Minute Stability (No Gas Mode): GAS43A; 30-Minute Stability (No Gas Mode) 1	None
September 30, 2021 9:57:22 PM	End	Execution	30-Minute Stability (No Gas Mode): GAS43A; 30-Minute Stability (No Gas Mode) 1	Run Count: 1
September 30, 2021 9:57:24 PM	End	Qualification	Session	OQ
September 30, 2021	Start	Reporting	Session	None

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User Name: penDrs_Tarasathan
Hostname: ASDXXXX015System ID: JP15471168
Print Date: September 30, 2021 4:57:25 PM

ALB OGHW 7560 308mp21 Transaction log:

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
September 30, 2021 4:03:27 PM	Audit	Reporting	Session	Report Generated: Certificate
September 30, 2021 4:03:17 PM	Audit	Reporting	Session	Report Generated: Report
September 30, 2021 4:03:09 PM	Start	QualKaton	Session	OO
September 30, 2021 4:04:08 PM	End	QualKaton	Session	OO
September 30, 2021 4:04:08 PM	Start	Reporting	Session	None
September 30, 2021 4:04:26 PM	Audit	Reporting	Session	Report Generated: Certificate
September 30, 2021 4:04:36 PM	Audit	Reporting	Session	Report Generated: Report

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ภาคผนวก จ

สำเนาหนังสืออนุญาตขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์เอกชน



ที่ กค ๐๓๑๐(๑)/ ๑๐๖๕

กรมโรงงานอุตสาหกรรม
ถนนพระรามที่ ๖ เขตราชเทวี
กรุงเทพมหานคร ๑๐๖๐๐

๒๔ มกราคม ๒๕๖๕

เรื่อง คออายุหนังสือรับขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์เอกชน
เรียน กรรมการผู้จัดการ บริษัท เอนเนลอส แลบบอราทอรี กรุ๊ป (ประเทศไทย) จำกัด
อ้างถึง คำขอขึ้นทะเบียน/ต่ออายุ/เปลี่ยนแปลงบุคลากร และชนิดสารเคมีของห้องปฏิบัติการวิเคราะห์เอกชน
ลงวันที่ ๓๐ กรกฎาคม ๒๕๖๓

สิ่งที่ส่งมาด้วย ๑. รายชื่อผู้ควบคุมดูแลห้องปฏิบัติการวิเคราะห์ จำนวน ๑ แผ่น
๒. รายชื่อเจ้าหน้าที่ประจำห้องปฏิบัติการวิเคราะห์ จำนวน ๕ แผ่น
๓. ขอบข่ายสารเคมีที่ได้รับขึ้นทะเบียนจากกรมโรงงานอุตสาหกรรม จำนวน ๓๓ แผ่น
ตามหนังสือที่อ้างถึง บริษัท เอนเนลอส แลบบอราทอรี กรุ๊ป (ประเทศไทย) จำกัด ขอต่ออายุ
หนังสือรับขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์เอกชน เลขทะเบียน ๖-๒๐๕ สดแทนที่เลขที่ ๓๐๕
ขอยืมพัฒนาการ ๔๐ ถนนพัฒนาการ แขวงพัฒนาการ เขตสวนหลวง กรุงเทพมหานคร
ต่อกรมโรงงานอุตสาหกรรม นั้น

กรมโรงงานอุตสาหกรรมพิจารณาแล้ว ให้บริษัท เอนเนลอส แลบบอราทอรี กรุ๊ป (ประเทศไทย)
จำกัด คออายุหนังสือรับขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์เอกชน โดยมีองค์ประกอบดังนี้
ก. ผู้ควบคุมดูแลห้องปฏิบัติการวิเคราะห์ จำนวน ๖ ราย ตามสิ่งที่ส่งมาด้วย ๑
ข. เจ้าหน้าที่ประจำห้องปฏิบัติการวิเคราะห์ จำนวน ๑๖๒ ราย ตามสิ่งที่ส่งมาด้วย ๒
ค. ขอบข่ายสารเคมีที่ได้รับขึ้นทะเบียนให้วิเคราะห์ในน้ำเสีย จำนวน ๕๔ รายการ น้ำได้ดิน
จำนวน ๑๒๖ รายการ อากาศเสีย ๑๖ รายการ สิ่งปฏิกูลหรือวัสดุที่ไม่ได้เสีย จำนวน ๓๕ รายการ และดิน
จำนวน ๑๒๕ รายการ รวมทั้งสิ้นจำนวน ๓๖๓ รายการ ตามสิ่งที่ส่งมาด้วย ๓

หนังสือฉบับนี้จะมีผลในวันที่ ๒ กันยายน ๒๕๖๕ หากประสงค์จะต่ออายุหนังสือ
รับขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์เอกชน ให้ยื่นคำขอต่ออายุหรือขอเอกสารประกอบคำขอ
ต่อกรมโรงงานอุตสาหกรรม ภายใน ๓๐ วัน ก่อนวันสิ้นอายุของหนังสือรับขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์
เอกชน ซึ่งคำขอต่ออายุดังกล่าวขอรับได้ที่กรมโรงงานอุตสาหกรรม

จึงเรียนมาเพื่อทราบ

ขอแสดงความนับถือ

(นายศิระ จันทร์เกิด)

อธิบดีกรมโรงงานอุตสาหกรรม
ผู้อำนวยการกองส่งเสริมและสนับสนุนโรงงาน
ผู้ชำนาญการพิเศษและโฆษกประจำกรม
ผู้ปฏิบัติงานและสนับสนุนกรมโรงงานอุตสาหกรรม

กองวิจัยและเคมียุทธศาสตร์โรงงาน

กลุ่มมาตรฐานวิธีการวิเคราะห์ทดสอบและทะเบียนห้องปฏิบัติการ

โทร. ๐ ๒๖๒๒ ๕๔๕๖ ๐ ๒๖๒๒ ๕๐๐๖

โทรสาร ๐ ๒๖๕๕ ๓๖๐๘ ๐ ๒๖๕๕ ๓๕๔๕

เอกสารแนบท้ายหนังสือรับต่ออายุขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์เอกชน

บริษัท เอนเนลอส แลบบอราทอรี กรุ๊ป (ประเทศไทย) จำกัด

เลขทะเบียน ๖-๒๐๕

ที่ กค ๐๓๑๐(๑)/

ลงวันที่ ๒๔ มกราคม ๒๕๖๕

ก. ผู้ควบคุมดูแลห้องปฏิบัติการวิเคราะห์ จำนวน ๖ ราย

๑) นางสาวพาฬพร จันทะรัง

ทะเบียนเลขที่ ๖-๒๐๕-๕-๕๖๐๐

๒) นางสาวชัชฌิยา โภณาการณ

ทะเบียนเลขที่ ๖-๒๐๕-๕-๕๖๐๑

๓) นายศราวุธ จิตราภรณ์

ทะเบียนเลขที่ ๖-๒๐๕-๕-๕๖๐๒

๔) นางสาวกนกกร เอนก

ทะเบียนเลขที่ ๖-๒๐๕-๕-๖๓๓๑

๕) นายสุริยา สอนแก้ว

ทะเบียนเลขที่ ๖-๒๐๕-๕-๖๓๓๒

๖) นายวิชาญ ชุมพรี

ทะเบียนเลขที่ ๖-๒๐๕-๕-๖๓๓๓

(นายศิระ จันทร์เกิด)

อธิบดีกรมโรงงานอุตสาหกรรม
ผู้อำนวยการกองส่งเสริมและสนับสนุนโรงงาน
ผู้ชำนาญการพิเศษและโฆษกประจำกรม
ผู้ปฏิบัติงานและสนับสนุนกรมโรงงานอุตสาหกรรม

เอกสารแนบท้ายหนังสือรับต่ออายุขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์เอกชน

บริษัท เอนเนลอส แลบบอราทอรี กรุ๊ป (ประเทศไทย) จำกัด

เลขทะเบียน ๖-๒๐๕

ที่ กค ๐๓๑๐(๑)/ ๑๐๖๕

ลงวันที่ ๒๔ มกราคม ๒๕๖๕

ข. เจ้าหน้าที่ประจำห้องปฏิบัติการวิเคราะห์ จำนวน ๑๖๒ ราย

๑) นางสาวจินดา ไชยธรรม

ทะเบียนเลขที่ ๖-๒๐๕-๕-๕๖๐๔

๒) นางสาวสวริศ น้อยเงิน

ทะเบียนเลขที่ ๖-๒๐๕-๕-๕๖๐๕

๓) นางสาวเชษฐาญณ์ อิมขม

ทะเบียนเลขที่ ๖-๒๐๕-๕-๕๖๐๖

๔) นางสาวปัทมา สอนแก้ว

ทะเบียนเลขที่ ๖-๒๐๕-๕-๕๖๐๗

๕) นางสาวนันทิยา สอนแก้ว

ทะเบียนเลขที่ ๖-๒๐๕-๕-๕๖๐๘

๖) นางสาวศรัณยา เสนีอักษร

ทะเบียนเลขที่ ๖-๒๐๕-๕-๕๖๐๙

๗) นางสาวสรวิชัย มงคลจิราวุธ

ทะเบียนเลขที่ ๖-๒๐๕-๕-๕๖๑๐

๘) นางสาวศิริลักษณ์ หึงแหง

ทะเบียนเลขที่ ๖-๒๐๕-๕-๕๖๑๑

๙) นายณพกร จันทร์บุรี

ทะเบียนเลขที่ ๖-๒๐๕-๕-๕๖๑๒

๑๐) นายณรเศรษฐ์ โภมากร

ทะเบียนเลขที่ ๖-๒๐๕-๕-๕๖๑๓

๑๑) นายธนากร อธิราช

ทะเบียนเลขที่ ๖-๒๐๕-๕-๕๖๑๔

๑๒) นางสาวกนกพร แก้วมณี

ทะเบียนเลขที่ ๖-๒๐๕-๕-๕๖๑๕

๑๓) นางสาวสุวิมล ชัยเรืองวุฒิ

ทะเบียนเลขที่ ๖-๒๐๕-๕-๕๖๑๖

๑๔) นางสาวสุภาวธ ธรรมสาร

ทะเบียนเลขที่ ๖-๒๐๕-๕-๕๖๑๗

๑๕) นางสาวณิชา ชัยเดชอนกุล

ทะเบียนเลขที่ ๖-๒๐๕-๕-๕๖๑๘

๑๖) นางสาวศศิธร หนูสวัสดิ์

ทะเบียนเลขที่ ๖-๒๐๕-๕-๕๖๑๙

๑๗) นางสาวเสาวลักษณ์ ภู่อำพร

ทะเบียนเลขที่ ๖-๒๐๕-๕-๕๖๒๐

๑๘) นายอภิสิทธิ์ สิงหา

ทะเบียนเลขที่ ๖-๒๐๕-๕-๕๖๒๑

๑๙) นายศักดิ์สิทธิ์ ไพศาลศิริ

ทะเบียนเลขที่ ๖-๒๐๕-๕-๕๖๒๒

๒๐) ว่าที่ร้อยตรีหญิง พรรณิภา จันทร์เจริญ

ทะเบียนเลขที่ ๖-๒๐๕-๕-๕๖๒๓

๒๑) นายจิรา ศักดิ์แก้ว

ทะเบียนเลขที่ ๖-๒๐๕-๕-๕๖๒๔

๒๒) นางสาวอรรณพ รักษ์

ทะเบียนเลขที่ ๖-๒๐๕-๕-๕๖๒๕

๒๓) นางสาวพรวิมล อัมมกรานต์

ทะเบียนเลขที่ ๖-๒๐๕-๕-๕๖๒๖

๒๔) นายฤทธิเดช วรินทร์

ทะเบียนเลขที่ ๖-๒๐๕-๕-๕๖๒๗

๒๕) นางสาวศุภากร รุ่งคำ

ทะเบียนเลขที่ ๖-๒๐๕-๕-๕๖๒๘

๒๖) นายณร ชูเจริญ

ทะเบียนเลขที่ ๖-๒๐๕-๕-๕๖๒๙

๒๗) นายปัทมา นามเจด

ทะเบียนเลขที่ ๖-๒๐๕-๕-๕๖๓๐

๒๘) นายพรมณ์ ศรีนิเทศ

ทะเบียนเลขที่ ๖-๒๐๕-๕-๕๖๓๑

๒๙) นายสุทธิ อภิรมย์

ทะเบียนเลขที่ ๖-๒๐๕-๕-๕๖๓๒

๓๐) ว่าที่ร้อยตรี เสนีเกียรติ อมศรีธรรม

ทะเบียนเลขที่ ๖-๒๐๕-๕-๕๖๓๓

๓๑) นางสาววิภา สว่างนา

ทะเบียนเลขที่ ๖-๒๐๕-๕-๕๖๓๔

๓๒) นายอนุพงษ์ รัตนศิริประเสริฐ

ทะเบียนเลขที่ ๖-๒๐๕-๕-๕๖๓๕

๓๓) นางสาวจุฑารัตน์ โอนสันเพียร

ทะเบียนเลขที่ ๖-๒๐๕-๕-๕๖๓๖

๓๔) นางสาวจรรยาพร วัฒนศิริกุล

ทะเบียนเลขที่ ๖-๒๐๕-๕-๕๖๓๗

(นายศิระ จันทร์เกิด)

อธิบดีกรมโรงงานอุตสาหกรรม
ผู้อำนวยการกองส่งเสริมและสนับสนุนโรงงาน
ผู้ชำนาญการพิเศษและโฆษกประจำกรม
ผู้ปฏิบัติงานและสนับสนุนกรมโรงงานอุตสาหกรรม

๓๕) นางสาวปรางค์ทิพย์...

๓๕) นางสาวปรางค์ทิพย์ กิจไพศาลศักดิ์

ทะเบียนเลขที่ ๖-๒๐๕-๕-๕๖๓๘

๓๖) นางสาวเดือนใจ หางกลาง

ทะเบียนเลขที่ ๖-๒๐๕-๕-๕๖๓๙

๓๗) นางสาวจิราพร ศิริเวช

ทะเบียนเลขที่ ๖-๒๐๕-๕-๕๖๔๐

๓๘) นายวรากร ลูกจันทร์

ทะเบียนเลขที่ ๖-๒๐๕-๕-๕๖๔๑

๓๙) นายทง วิริยะศักดิ์

ทะเบียนเลขที่ ๖-๒๐๕-๕-๕๖๔๒

๔๐) นายอนันต์ เจริญ

ทะเบียนเลขที่ ๖-๒๐๕-๕-๕๖๔๓

๔๑) นายศศิธร จำพูน

ทะเบียนเลขที่ ๖-๒๐๕-๕-๕๖๔๔

๔๒) นายอรรถพล นิยมวิทย์พันธ์

ทะเบียนเลขที่ ๖-๒๐๕-๕-๕๖๔๕

๔๓) นายสุวิทย์ พรหมสอาด

ทะเบียนเลขที่ ๖-๒๐๕-๕-๕๖๔๖

๔๔) นายธนกร โภคาพิพัฒน์

ทะเบียนเลขที่ ๖-๒๐๕-๕-๕๖๔๗

๔๕) นายชวฤทธิ์ วงษ์จันทร์

ทะเบียนเลขที่ ๖-๒๐๕-๕-๕๖๔๘

๔๖) นายอาทิตย์ ศรีสม

ทะเบียนเลขที่ ๖-๒๐๕-๕-๕๖๔๙

๔๗) นายเจษฎาพร คงศักดิ์ไทย

ทะเบียนเลขที่ ๖-๒๐๕-๕-๕๖๕๐

๔๘) นายจิรัช บุญธิ

ทะเบียนเลขที่ ๖-๒๐๕-๕-๕๖๕๑

๔๙) นายอนันต์ เจริญ

ทะเบียนเลขที่ ๖-๒๐๕-๕-๕๖๕๒

๕๐) นายอภินันท์ พูนบุญ

ทะเบียนเลขที่ ๖-๒๐๕-๕-๕๖๕๓

๕๑) นางสาวสุภาวธ วิญญู

ทะเบียนเลขที่ ๖-๒๐๕-๕-๕๖๕๔

๕๒) นางสาววิมล ขวาลสมบูรณ์

ทะเบียนเลขที่ ๖-๒๐๕-๕-๕๖๕๕

๕๓) นางสาววิมล บุญเพ็ญ

ทะเบียนเลขที่ ๖-๒๐๕-๕-๕๖๕๖

๕๔) นางสาวกนกกร เจริญ

ทะเบียนเลขที่ ๖-๒๐๕-๕-๕๖๕๗

๕๕) นางสาวพัชรา พันธ์ศิริ

ทะเบียนเลขที่ ๖-๒๐๕-๕-๕๖๕๘

๕๖) นางสาวภาวิดา สุวงศ์ศรีบุญ

ทะเบียนเลขที่ ๖-๒๐๕-๕-๕๖๕๙

๕๗) นางสาวภาณุมาศ นามวัฒน์

ทะเบียนเลขที่ ๖-๒๐๕-๕-๕๖๖๐

๕๘) นางสาวอุไรรัตน์ พิธีสร้างเป็น

ทะเบียนเลขที่ ๖-๒๐๕-๕-๕๖๖๑

๕๙) นายธีรวัฒน์ ปวงสุข

ทะเบียนเลขที่ ๖-๒๐๕-๕-๕๖๖๒

๖๐) นายธีรวิทย์ ยงใจ

ทะเบียนเลขที่ ๖-๒๐๕-๕-๕๖๖๓

๖๑) นายประพนธ์ วรรณชัย

ทะเบียนเลขที่ ๖-๒๐๕-๕-๕๖๖๔

๖๒) นายชเชษฐ พงษ์ทิพย์

ทะเบียนเลขที่ ๖-๒๐๕-๕-๕๖๖๕

๖๓) นางสาวกนกวรรณ ชื่นบาท

ทะเบียนเลขที่ ๖-๒๐๕-๕-๕๖๖๖

๖๔) นางสาวนภาพร พลิกบุญ

ทะเบียนเลขที่ ๖-๒๐๕-๕-๕๖๖๗

๖๕) นายสิทธิโชค ธงเงิน

ทะเบียนเลขที่ ๖-๒๐๕-๕-๕๖๖๘

๖๖) นางกนกวรรณ ใจบุญ

ทะเบียนเลขที่ ๖-๒๐๕-๕-๕๖๖๙

๖๗) นางสาวพรรณิศา พุ่มคง

ทะเบียนเลขที่ ๖-๒๐๕-๕-๕๖๗๐

๖๘) นางสาวศรัณย์ ยิ่ง

ทะเบียนเลขที่ ๖-๒๐๕-๕-๕๖๗๑

๖๙) นายณภัทร ศรีวิริยะ

ทะเบียนเลขที่ ๖-๒๐๕-๕-๕๖๗๒

๗๐) นายสุวิภา ทองอ่อน

ทะเบียนเลขที่ ๖-๒๐๕-๕-๕๖๗๓

๗๑) นายวิญญู บุญชนะ

ทะเบียนเลขที่ ๖-๒๐๕-๕-๕๖๗๔

(นายศิระ จันทร์เกิด)

อธิบดีกรมโรงงานอุตสาหกรรม
ผู้อำนวยการกองส่งเสริมและสนับสนุนโรงงาน
ผู้ชำนาญการพิเศษและโฆษกประจำกรม
ผู้ปฏิบัติงานและสนับสนุนกรมโรงงานอุตสาหกรรม

๗๒) นายสมบุญ...

ลำดับที่	สารเคมี	วิธีวิเคราะห์
19	Copper	1) Digestion, Inductively Coupled Plasma Method ⁽⁴⁾ 2) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method ⁽⁴⁾
20	Cyanide	Distillation, Colorimetric Method ⁽⁴⁾
21	2,4'-DDD	Liquid-Liquid Extraction, Gas Chromatographic Method ⁽⁴⁾
22	4,4'-DDD	Liquid-Liquid Extraction, Gas Chromatographic Method ⁽⁴⁾
23	2,4'-DDE	Liquid-Liquid Extraction, Gas Chromatographic Method ⁽⁴⁾
24	4,4'-DDE	Liquid-Liquid Extraction, Gas Chromatographic Method ⁽⁴⁾
25	2,4'-DDT	Liquid-Liquid Extraction, Gas Chromatographic Method ⁽⁴⁾
26	4,4'-DDT	Liquid-Liquid Extraction, Gas Chromatographic Method ⁽⁴⁾
27	Dieldrin	Liquid-Liquid Extraction, Gas Chromatographic Method ⁽⁴⁾
28	Endosulfan Sulfate	Liquid-Liquid Extraction, Gas Chromatographic Method ⁽⁴⁾
29	Endosulfan I	Liquid-Liquid Extraction, Gas Chromatographic Method ⁽⁴⁾
30	Endosulfan II	Liquid-Liquid Extraction, Gas Chromatographic Method ⁽⁴⁾
31	Endrin	Liquid-Liquid Extraction, Gas Chromatographic Method ⁽⁴⁾
32	Endrin Aldehyde	Liquid-Liquid Extraction, Gas Chromatographic Method ⁽⁴⁾
33	Formaldehyde	Distillation, Colorimetric Method ⁽⁴⁾
34	Free Chlorine	1) DPD Ferrous Titrimetric Method ⁽⁴⁾ 2) Iodometric Method ⁽⁴⁾
35	Heptachlor	Liquid-Liquid Extraction, Gas Chromatographic Method ⁽⁴⁾
36	Heptachlor epoxide	Liquid-Liquid Extraction, Gas Chromatographic Method ⁽⁴⁾
37	Hexavalent Chromium	Filtration, Colorimetric Method ⁽⁴⁾
38	3-Hydroxycarbofuran	High-Performance Liquid Chromatographic Method ⁽⁴⁾
39	Lead	1) Digestion, Inductively Coupled Plasma Method ⁽⁴⁾ 2) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method ⁽⁴⁾
40	Manganese	1) Digestion, Inductively Coupled Plasma Method ⁽⁴⁾ 2) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method ⁽⁴⁾
41	Mercury	1) Digestion, Cold-Vapor Atomic Absorption Spectrometric Method ⁽⁴⁾ 2) Digestion, Inductively Coupled Plasma/Mass spectrometric Method ⁽⁴⁾
42	Methiocarb	High-Performance Liquid Chromatographic Method ⁽⁴⁾
43	Methoxychlor	Liquid-Liquid Extraction, Gas Chromatographic Method ⁽⁴⁾

วิมล
(นางวิมล วัชรกุลกิจ)
ผู้อำนวยการศูนย์ปฏิบัติการทางเคมีและพิษวิทยา
กรมวิทยาศาสตร์สาธารณสุข

44 Methomyl...

ลำดับที่	สารเคมี	วิธีวิเคราะห์
44	Methomyl	High-Performance Liquid Chromatographic Method ⁽⁴⁾
45	Nickel	1) Digestion, Inductively Coupled Plasma Method ⁽⁴⁾ 2) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method ⁽⁴⁾
46	Oil & Grease	1) Liquid-Liquid, Partition-Gravimetric Method ⁽⁴⁾ 2) Soxhlet Extraction Method ⁽⁴⁾
47	Oxamyl	High-Performance Liquid Chromatographic Method ⁽⁴⁾
48	Propoxur	High-Performance Liquid Chromatographic Method ⁽⁴⁾
49	pH	Electrometric Method ⁽⁴⁾
50	Phenols	1) Distillation, Chloroform Extraction Method ⁽⁴⁾ 2) Distillation, Direct Photometric Method ⁽⁴⁾
51	Selenium	1) Digestion, Inductively Coupled Plasma Method ⁽⁴⁾ 2) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method ⁽⁴⁾
52	Sulfide	Iodometric Method ⁽⁴⁾
53	Temperature	Laboratory and Field Methods ⁽⁴⁾
54	Total Dissolved Solids	Dried at 180 °C ⁽⁴⁾
55	Total Kjeldahl Nitrogen	Semi-Micro Kjeldahl Method ⁽⁴⁾
56	Total Suspended Solids	Dried at 103-105 °C ⁽⁴⁾
57	Toxaphene	Liquid-Liquid Extraction, Gas Chromatographic Method ⁽⁴⁾
58	Trivalent Chromium	1) Digestion, Inductively Coupled Plasma Method; Colorimetric Method; Calculation ⁽⁴⁾ 2) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method; Colorimetric Method; Calculation ⁽⁴⁾
59	Zinc	1) Digestion, Inductively Coupled Plasma Method ⁽⁴⁾ 2) Digestion, Inductively Coupled Plasma/Mass Spectrometric Method ⁽⁴⁾

น้ำดื่ม จำนวน 126 รายการ

ลำดับที่	สารเคมี	วิธีวิเคราะห์
1	Acenaphthene	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
2	Acetone	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾

วิมล
(นางวิมล วัชรกุลกิจ)
ผู้อำนวยการศูนย์ปฏิบัติการทางเคมีและพิษวิทยา
กรมวิทยาศาสตร์สาธารณสุข

3 Aldrin...

ลำดับที่	สารเคมี	วิธีวิเคราะห์
3	Aldrin	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
4	Anthracene	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
5	Antimony	1) Digestion, Inductively Coupled Plasma Method ⁽⁴⁾ 2) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method ⁽⁴⁾
6	Arsenic	1) Digestion, Inductively Coupled Plasma Method ⁽⁴⁾ 2) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method ⁽⁴⁾
7	Atrazine	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
8	Barium	1) Digestion, Inductively Coupled Plasma Method ⁽⁴⁾ 2) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method ⁽⁴⁾
9	Benz(a)anthracene	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
10	Benzene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
11	Benzo(b)fluoranthene	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
12	Benzo(k)fluoranthene	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
13	Benzoic Acid	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
14	Benzo(a)pyrene	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
15	Benzo(g,h,i)perylene	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
16	Beryllium	1) Digestion, Inductively Coupled Plasma Method ⁽⁴⁾ 2) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method ⁽⁴⁾
17	Bis(2-chloroethyl)ether	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾

วิมล
(นางวิมล วัชรกุลกิจ)
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กรมวิทยาศาสตร์สาธารณสุข


18 Bis(2-ethylethyl)phthalate...

ลำดับที่	สารเคมี	วิธีวิเคราะห์
18	Bis(2-ethylethyl)phthalate	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
19	Bromodichloromethane	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
20	Bromoform	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
21	Butanol	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
22	Butyl Benzyl Phthalate	Equilibrium Headspace, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
23	Cadmium	1) Digestion, Inductively Coupled Plasma Method ⁽⁴⁾ 2) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method ⁽⁴⁾
24	Carbazole	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
25	Carbon Disulfide	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
26	Carbon tetrachloride	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
27	Chlordane	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
28	p-Chloroaniline	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
29	Chlorobenzene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
30	Chlorodibromomethane	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
31	Chloroform	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
32	2-Chlorophenol	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
33	Chromium	1) Digestion, Inductively Coupled Plasma Method ⁽⁴⁾ 2) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method ⁽⁴⁾

วิมล
(นางวิมล วัชรกุลกิจ)
ผู้อำนวยการศูนย์ปฏิบัติการทางเคมีและพิษวิทยา
กรมวิทยาศาสตร์สาธารณสุข


34 Chromium (II)...

ลำดับที่	สารเคมี	วิธีวิเคราะห์
34	Chromium (III)	1) Digestion, Inductively Coupled Plasma Method; Colorimetric Method; Calculation ⁽⁴⁾ 2) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method; Colorimetric Method; Calculation ⁽⁴⁾
35	Chromium (VI)	Colorimetric Method ⁽⁴⁾
36	Chrysene	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
37	Cyanide	Distillation, Colorimetric Method ⁽⁴⁾
38	2,4-D	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
39	DDD	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
40	DDE	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
41	DDT	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
42	Dibenz(a,h)anthracene	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
43	Di-n-Butyl Phthalate	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
44	1,2-Dichlorobenzene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
45	1,3-Dichlorobenzene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
46	1,4-Dichlorobenzene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
47	3,3-Dichlorobenzidine	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
48	1,1-Dichloroethane	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
49	1,2-Dichloroethane	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
50	1,1-Dichloroethylene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾


 (นางธิภาญณ์ สัตตะกุลชัย)
 ผู้อำนวยการศูนย์มาตรฐานปฏิบัติการทางเคมีและพิษวิทยา
 กรมวิทยาศาสตร์สิ่งแวดล้อม


51 cis-1,2-Dichloroethylene...

ลำดับที่	สารเคมี	วิธีวิเคราะห์
51	cis-1,2-Dichloroethylene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
52	trans-1,2-Dichloroethylene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
53	2,4-Dichlorophenol	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
54	1,2-Dichloropropane	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
55	1,3-Dichloropropane	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
56	1,3-Dichloropropene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
57	Dieldrin	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
58	Diethyl Phthalate	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
59	2,4-Dimethylphenol	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
60	2,4-Dinitrophenol	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
61	2,4-Dinitrotoluene	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
62	2,6-Dinitrotoluene	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
63	Di-n-Octyl Phthalate	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
64	Endosulfan	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
65	Endrin	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
66	Ethylbenzene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
67	Fluoranthene	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾


 (นางธิภาญณ์ สัตตะกุลชัย)
 ผู้อำนวยการศูนย์มาตรฐานปฏิบัติการทางเคมีและพิษวิทยา
 กรมวิทยาศาสตร์สิ่งแวดล้อม


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⁾


 (นางธิภาญณ์ สัตตะกุลชัย)
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 กรมวิทยาศาสตร์สิ่งแวดล้อม

84 Methanol...

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⁾


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97 Pentachlorophenol...

ลำดับที่	สารเคมี	วิธีการตรวจ
97	Pentachlorophenol	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
98	pH	Electrometric Method ⁽⁴⁾
99	Phenanthrene	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
100	Phenol	1) Distillation, Direct Photometric Method ⁽⁴⁾ 2) Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
101	Pyrene	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
102	Selenium	1) Digestion, Inductively Coupled Plasma Method ⁽⁴⁾ 2) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method ⁽⁴⁾
103	Silver	1) Digestion, Inductively Coupled Plasma Method ⁽⁴⁾ 2) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method ⁽⁴⁾
104	Styrene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
105	1,1,2,2-Tetrachloroethane	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
106	Tetrachloroethylene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
107	Toluene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
108	Toxaphene	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
109	TPH (C ₇ -C ₉)	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ^{(1),(2),(4)}
110	TPH (C ₁₀ -C ₁₆)	Solvent Extraction, Gas Chromatographic Method ^{(2),(4)}
111	TPH (C ₁₆ -C ₃₃)	Solvent Extraction, Gas Chromatographic Method ^{(2),(4)}
112	1,2,4-Trichlorobenzene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
113	1,1,1-Trichloroethane	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾

114 1,1,2-Trichloroethane...

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

ภาคผนวกที่ ๑ (ปลั๊กอะนาล็อก) จำนวน 16 รายการ

ลำดับที่	สารเคมี	วิธีการตรวจ
1	Antimony	Isokinetic, Digestion, Inductively Coupled Plasma Method ⁽⁴⁾
2	Arsenic	Isokinetic, Digestion, Inductively Coupled Plasma Method ⁽⁴⁾

3 Carbon Monoxide...

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

สิ่งแวดล้อม...

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สิ่งแวดล้อมที่ ๒ (ปลั๊กอะนาล็อก) จำนวน 35 รายการ

ลำดับที่	สารเคมี	วิธีการตรวจ
1	Aldrin	1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ^{(1),(2),(3)} 2) Soxhlet Extraction, Gas Chromatographic Method ^{(1),(2),(3)} 3) Automated Soxhlet Extraction, Gas Chromatographic Method ^{(2),(3)}
2	Antimony	1) Waste Extraction, Digestion, Inductively Coupled Plasma Method ^{(1),(4),(5)} 2) Waste Extraction, Digestion, Inductively Coupled Plasma/Mass Spectrometric Method ^{(1),(4),(5)} 3) Digestion, Inductively Coupled Plasma Method ^{(7),(13)} 4) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method ^{(7),(13)}
3	Arsenic	1) Waste Extraction, Digestion, Inductively Coupled Plasma Method ^{(1),(4),(5)} 2) Waste Extraction, Digestion, Inductively Coupled Plasma/Mass Spectrometric Method ^{(1),(4),(5)} 3) Digestion, Inductively Coupled Plasma Method ^{(7),(13)} 4) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method ^{(7),(13)}
4	Barium	1) Waste Extraction, Digestion, Inductively Coupled Plasma Method ^{(1),(4),(5)} 2) Waste Extraction, Digestion, Inductively Coupled Plasma/Mass Spectrometric Method ^{(1),(4),(5)} 3) Digestion, Inductively Coupled Plasma Method ^{(7),(13)} 4) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method ^{(7),(13)}
5	Beryllium	1) Waste Extraction, Digestion, Inductively Coupled Plasma Method ^{(1),(4),(5)} 2) Waste Extraction, Digestion, Inductively Coupled Plasma/Mass Spectrometric Method ^{(1),(4),(5)} 3) Digestion, Inductively Coupled Plasma Method ^{(7),(13)} 4) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method ^{(7),(13)}

6 Cadmium...

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ลำดับที่	สารเคมี	วิธีวิเคราะห์
6	Cadmium	1) Waste Extraction, Digestion, Inductively Coupled Plasma Method ^(1.4.15) 2) Waste Extraction, Digestion, Inductively Coupled Plasma/Mass Spectrometric Method ^(1.4.14) 3) Digestion, Inductively Coupled Plasma Method ^(7.13) 4) Digestion, Inductively Coupled Plasma/Mass Spectrometric Method ^(7.14)
7	Chlordane	1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ^(1.1.9.23) 2) Soxhlet Extraction, Gas Chromatographic Method ^(10.22) 3) Automated Soxhlet Extraction, Gas Chromatographic Method ^(22.3)
8	Chromium	1) Waste Extraction, Digestion, Inductively Coupled Plasma Method ^(1.4.15) 2) Waste Extraction, Digestion, Inductively Coupled Plasma/Mass Spectrometric Method ^(1.4.14) 3) Digestion, Inductively Coupled Plasma Method ^(7.13) 4) Digestion, Inductively Coupled Plasma/Mass Spectrometric Method ^(7.14)
9	Chromium (III)	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 ^(1.4.14,15) 3) Digestion, Inductively Coupled Plasma Method; Alkaline Digestion, Colorimetric Method; Calculation Method ^(7.13,17) 4) Digestion, Inductively Coupled Plasma/Mass Spectrometric Method; Alkaline Digestion, Colorimetric Method; Calculation Method ^(7.14,17)
10	Chromium (VI)	1) Waste Extraction, Colorimetric Method ^(1.4.17) 2) Alkaline Digestion, Colorimetric Method ^(1.17)

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กระทรวงพาณิชย์

11 Cobalt...

ลำดับที่	สารเคมี	วิธีวิเคราะห์
11	Cobalt	1) Waste Extraction, Digestion, Inductively Coupled Plasma Method ^(1.4.15) 2) Waste Extraction, Digestion, Inductively Coupled Plasma/Mass Spectrometric Method ^(1.4.14) 3) Digestion, Inductively Coupled Plasma Method ^(7.13) 4) Digestion, Inductively Coupled Plasma/Mass Spectrometric Method ^(7.14)
12	Copper	1) Waste Extraction, Digestion, Inductively Coupled Plasma Method ^(1.4.15) 2) Waste Extraction, Digestion, Inductively Coupled Plasma/Mass Spectrometric Method ^(1.4.14) 3) Digestion, Inductively Coupled Plasma Method ^(7.13) 4) Digestion, Inductively Coupled Plasma/Mass Spectrometric Method ^(7.14)
13	2,4-D	1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ^(1.1.9.23) 2) Soxhlet Extraction, Gas Chromatographic Method ^(10.22) 3) Automated Soxhlet Extraction, Gas Chromatographic Method ^(22.3)
14	DDD	1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ^(1.1.9.23) 2) Soxhlet Extraction, Gas Chromatographic Method ^(10.22) 3) Automated Soxhlet Extraction, Gas Chromatographic Method ^(22.3)
15	DDE	1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ^(1.1.9.23) 2) Soxhlet Extraction, Gas Chromatographic Method ^(10.22) 3) Automated Soxhlet Extraction, Gas Chromatographic Method ^(22.3)
16	DDT	1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ^(1.1.9.23)

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2) Soxhlet...

ลำดับที่	สารเคมี	วิธีวิเคราะห์
17	Dieldrin	2) Soxhlet Extraction, Gas Chromatographic Method ^(10.22) 3) Automated Soxhlet Extraction, Gas Chromatographic Method ^(22.3) 1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ^(1.1.9.23) 2) Soxhlet Extraction, Gas Chromatographic Method ^(10.22) 3) Automated Soxhlet Extraction, Gas Chromatographic Method ^(22.3)
18	Endrin	1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ^(1.1.9.23) 2) Soxhlet Extraction, Gas Chromatographic Method ^(10.22) 3) Automated Soxhlet Extraction, Gas Chromatographic Method ^(22.3)
19	Heptachlor	1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ^(1.1.9.23) 2) Soxhlet Extraction, Gas Chromatographic Method ^(10.22) 3) Automated Soxhlet Extraction, Gas Chromatographic Method ^(22.3)
20	Lead	1) Waste Extraction, Digestion, Inductively Coupled Plasma Method ^(1.4.15) 2) Waste Extraction, Digestion, Inductively Coupled Plasma/Mass Spectrometric Method ^(1.4.14) 3) Digestion, Inductively Coupled Plasma Method ^(7.13) 4) Digestion, Inductively Coupled Plasma/Mass Spectrometric Method ^(7.14)
21	Lindane	1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ^(1.1.9.23) 2) Soxhlet Extraction, Gas Chromatographic Method ^(10.22) 3) Automated Soxhlet Extraction, Gas Chromatographic Method ^(22.3)
22	Mercury	1) Waste Extraction, Digestion, Cold-Vapor Atomic Absorption Spectrometric Method ^(1.4.10)

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2) Waste Extraction...

ลำดับที่	สารเคมี	วิธีวิเคราะห์
23	Methoxychlor	2) Waste Extraction, Thermal Decomposition Amalgamation and Atomic Absorption Spectrometric Method ^(1.4.10) 3) Waste Extraction, Digestion, Cold-Vapor Atomic Fluorescence Spectrometric Method ^(1.4.20) 4) Digestion, Cold-Vapor Atomic Absorption Spectrometric Method ^(1.4) 5) Thermal Decomposition Amalgamation and Atomic Absorption Spectrometric Method ^(1.4) 6) Digestion, Cold-Vapor Atomic Fluorescence Spectrometric Method ^(2.9)
24	Mirex	1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ^(1.1.9.23) 2) Soxhlet Extraction, Gas Chromatographic Method ^(10.22) 3) Automated Soxhlet Extraction, Gas Chromatographic Method ^(22.3)
25	Molybdenum	1) Waste Extraction, Digestion, Inductively Coupled Plasma Method ^(1.4.15) 2) Waste Extraction, Digestion, Inductively Coupled Plasma/Mass Spectrometric Method ^(1.4.14) 3) Digestion, Inductively Coupled Plasma Method ^(7.13) 4) Digestion, Inductively Coupled Plasma/Mass Spectrometric Method ^(7.14)
26	Nickel	1) Waste Extraction, Digestion, Inductively Coupled Plasma Method ^(1.4.15) 2) Waste Extraction, Digestion, Inductively Coupled Plasma/Mass Spectrometric Method ^(1.4.14) 3) Digestion, Inductively Coupled Plasma Method ^(7.13) 4) Digestion, Inductively Coupled Plasma/Mass Spectrometric Method ^(7.14)

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27 Polychlorinated...

ลำดับที่	สารมลพิษ	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',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',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 ^(1,3,22) 2) Soxhlet Extraction, Gas Chromatographic Method ^(1,22) 3) Automated Soxhlet Extraction, Gas Chromatographic Method ^(22,31)

28 Pentachlorophenol...

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ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
28	Pentachlorophenol	1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ^(1,9,22) 2) Soxhlet Extraction, Gas Chromatographic Method ^(10,22) 3) Automated Soxhlet Extraction, Gas Chromatographic Method ^(22,31)
29	pH	Electrometric Method ^(29,30)
30	Selenium	1) Waste Extraction, Digestion, Inductively Coupled Plasma Method ^(1,4,10) 2) Waste Extraction, Digestion, Inductively Coupled Plasma/Mass Spectrometric Method ^(1,4,10) 3) Digestion, Inductively Coupled Plasma Method ^(7,15) 4) Digestion, Inductively Coupled Plasma/Mass Spectrometric Method ^(7,15)
31	Silver	1) Waste Extraction, Digestion, Inductively Coupled Plasma Method ^(1,4,10) 2) Waste Extraction, Digestion, Inductively Coupled Plasma/Mass Spectrometric Method ^(1,4,10)
32	Thallium	1) Waste Extraction, Digestion, Inductively Coupled Plasma Method ^(1,4,15) 2) Waste Extraction, Digestion, Inductively Coupled Plasma/Mass Spectrometric Method ^(1,4,10) 3) Digestion, Inductively Coupled Plasma Method ^(7,15) 4) Digestion, Inductively Coupled Plasma/Mass Spectrometric Method ^(7,15)
33	Toxaphene	1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ^(1,9,22) 2) Soxhlet Extraction, Gas Chromatographic Method ^(10,22) 3) Automated Soxhlet Extraction, Gas Chromatographic Method ^(22,31)
34	Vanadium	1) Waste Extraction, Digestion, Inductively Coupled Plasma Method ^(1,4,10) 2) Waste Extraction, Digestion, Inductively Coupled Plasma/Mass Spectrometric Method ^(1,4,10) 3) Digestion, Inductively Coupled Plasma Method ^(7,15)

4) Digestion...

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ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
35	Zinc	4) Digestion, Inductively Coupled Plasma/Mass Spectrometric Method ^(7,14) 1) Waste Extraction, Digestion, Inductively Coupled Plasma Method ^(1,4,10) 2) Waste Extraction, Digestion, Inductively Coupled Plasma/Mass Spectrometric Method ^(1,4,10) 3) Digestion, Inductively Coupled Plasma Method ^(7,15) 4) Digestion, Inductively Coupled Plasma/Mass Spectrometric Method ^(7,14)

ดิน จำนวน 125 รายการ

ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
1	Acenaphthene	Automated Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method ^(25,31)
2	Acetone	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^(14,24)
3	Aldrin	1) Soxhlet Extraction, Gas Chromatographic Method ^(10,22) 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 ^(7,14)
6	Arsenic	1) Digestion, Inductively Coupled Plasma Method ^(7,15) 2) Digestion, Inductively Coupled Plasma/Mass Spectrometric Method ^(7,14)
7	Atrazine	1) Soxhlet Extraction, Gas Chromatographic Method ^(10,22) 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 ^(7,14)

9 Benz(a)anthracene...

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ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
9	Benz(a)anthracene	Automated Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method ^(25,31)
10	Benzene	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^(14,24)
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	Benzo(g,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 ^(7,14)
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 ^(14,24)
20	Bromofom	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^(14,24)
21	Butanol	Equilibrium Headspace, Gas Chromatographic/Mass Spectrometric Method ^(12,24)
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 ^(7,14)
24	Carbazole	Automated Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method ^(25,31)
25	Carbon Disulfide	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^(14,24)

26 Carbon tetrachloride...

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ลำดับที่	สารเคมี	วิธีวิเคราะห์
26	Carbon tetrachloride	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ^(14,24)
27	Chlordane	1) Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method ^(10,22) 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 (III)	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 ^(7,8,14,17)
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/ Mass Spectrometric Method ^(10,22) 2) Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method ^(25,31)
39	DDD	1) Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method ^(10,22) 2) Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method ^(25,31)

Signature
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40 DDE...

ลำดับที่	สารเคมี	วิธีวิเคราะห์
40	DDE	1) Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method ^(10,22) 2) Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method ^(25,31)
41	DDT	1) Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method ^(10,22) 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)

Signature
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57 Dieldrin...

ลำดับที่	สารเคมี	วิธีวิเคราะห์
57	Dieldrin	1) Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method ^(10,22) 2) Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method ^(25,31)
58	Diethyl Phthalate	Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method ^(25,31)
59	2,4-Dimethylphenol	Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method ^(25,31)
60	2,4-Dinitrophenol	Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method ^(25,31)
61	2,4-Dinitrotoluene	Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method ^(25,31)
62	2,6-Dinitrotoluene	Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method ^(25,31)
63	Di-n-Octyl Phthalate	Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method ^(25,31)
64	Endosulfan	1) Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method ^(10,22) 2) Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method ^(25,31)
65	Endrin	1) Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method ^(10,22) 2) Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method ^(25,31)
66	Ethylbenzene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ^(14,24)
67	Fluorenone	Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method ^(25,31)
68	Fluorene	Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method ^(25,31)
69	Heptachlor	1) Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method ^(10,22) 2) Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method ^(25,31)
70	Heptachlor Epoxide	1) Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method ^(10,22) 2) Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method ^(25,31)

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71 Hexachlorobenzene...

ลำดับที่	สารเคมี	วิธีวิเคราะห์
71	Hexachlorobenzene	1) Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method ^(10,22) 2) Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method ^(25,31)
72	Hexachloro-1,3-butadiene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ^(14,24)
73	n-Hexane	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ^(14,24)
74	α-HCH	1) Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method ^(10,22) 2) Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method ^(25,31)
75	β-HCH	1) Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method ^(10,22) 2) Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method ^(25,31)
76	γ-HCH	1) Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method ^(10,22) 2) Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method ^(25,31)
77	Hexachlorocyclopentadiene	Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method ^(25,31)
78	Hexachloroethane	Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method ^(25,31)
79	Indeno(1,2,3-cd)pyrene	Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method ^(25,31)
80	Isophorone	Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method ^(25,31)
81	Lead	1) Digestion, Inductively Coupled Plasma Method ^(7,15) 2) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method ^(7,16)
82	Manganese	1) Digestion, Inductively Coupled Plasma Method ^(7,15) 2) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method ^(7,16)
83	Mercury	1) Digestion, Cold-Vapor Atomic Absorption Spectrometric Method ⁽¹¹⁾

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2) Thermal...

ลำดับที่	สารเคมี	วิธีวิเคราะห์
84	Methanol	2) Thermal Decomposition, Amalgamation, and Atomic Absorption Spectrophotometry ⁽¹⁾ 3) Digestion, Cold-Vapor Atomic Fluorescence Spectrometric Method ⁽²⁾
85	Methoxychlor	Equilibrium Headspace, Gas Chromatographic/Mass Spectrometric Method ^(1,2,3) 1) Soxhlet Extraction, Gas Chromatographic Method ^(1,2,3) 2) Automated Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method ^(2,3,1)
86	Methyl Bromide	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^(1,2,3)
87	Methylene Chloride	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^(1,2,3)
88	2-methylphenol	Automated Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method ^(2,3,1)
89	2-Methylnaphthalene	Automated Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method ^(2,3,1)
90	Methyl tert-Butyl Ether	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^(1,2,3)
91	Naphthalene	Automated Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method ^(2,3,1)
92	Nickel	1) Digestion, Inductively Coupled Plasma Method ^(1,2) 2) Digestion, Inductively Coupled Plasma/Mass Spectrometric Method ^(1,2)
93	Nitrobenzene	Automated Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method ^(2,3,1)
94	N-Nitrosodiphenylamine	Automated Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method ^(2,3,1)
95	N-Nitrosodi-n-propylamine	Automated Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method ^(2,3,1)
96	Polychlorinated biphenyls (PCBs) - Aroclor 1016 - Aroclor 1221 - Aroclor 1232	1) Soxhlet Extraction, Gas Chromatographic Method ^(1,2,3) 2) Automated Soxhlet Extraction, Gas Chromatographic Method ^(2,3,1)

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- Aroclor 1242...

ลำดับที่	สารเคมี	วิธีวิเคราะห์
	- Aroclor 1242 - Aroclor 1248 - Aroclor 1254 - Aroclor 1260 - 2-Chlorobiphenyl - 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-Nonachlorobiphenyl - 2,2',3,3',4,4',5,5',6-Nonachlorobiphenyl	
97	Pentachlorophenol	Automated Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method ^(2,3,1)
98	Phenanthrene	Automated Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method ^(2,3,1)
99	Phenol	Automated Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method ^(2,3,1)
100	Pyrene	Automated Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method ^(2,3,1)

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101 Selenium...

ลำดับที่	สารเคมี	วิธีวิเคราะห์
101	Selenium	1) Digestion, Inductively Coupled Plasma Method ^(1,2) 2) Digestion, Inductively Coupled Plasma/Mass Spectrometric Method ^(1,2)
102	Silver	1) Digestion, Inductively Coupled Plasma Method ^(1,2) 2) Digestion, Inductively Coupled Plasma/Mass Spectrometric Method ^(1,2)
103	Styrene	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^(1,2,3)
104	1,1,2,2-Tetrachloroethane	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^(1,2,3)
105	Tetrachloroethylene	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^(1,2,3)
106	Toluene	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^(1,2,3)
107	Toxaphene	1) Soxhlet Extraction, Gas Chromatographic Method ^(1,2,3) 2) Automated Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method ^(2,3,1)
108	TPH (C ₈ -C ₉)	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^(1,2,3)
109	TPH (C ₁₀ -C ₁₃)	1) Solvent Extraction, Gas Chromatographic Method ^(1,2,3) 2) Automated Soxhlet Extraction, Gas Chromatographic Method ^(2,3,1)
110	TPH (C ₁₄ -C ₃₃)	1) Solvent Extraction, Gas Chromatographic Method ^(1,2,3) 2) Automated Soxhlet Extraction, Gas Chromatographic Method ^(2,3,1)
111	1,2,4-Trichlorobenzene	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^(1,2,3)
112	1,1,1-Trichloroethane	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^(1,2,3)
113	1,1,2-Trichloroethane	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^(1,2,3)
114	Trichloroethylene	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^(1,2,3)
115	2,4,5-Trichlorophenol	Automated Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method ^(2,3,1)

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116 2,4,6-Trichlorophenol...

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

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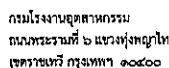
อธิการบดี
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ผู้อำนวยการศูนย์ปฏิบัติการด้านความปลอดภัย

7. United States...

- วิภาณี
(นางวิภาณีย์ นัครฤทธิไธ)
ผู้อำนวยการศูนย์การเรียนรู้และพัฒนาศักยภาพ
บุคลากรในองค์กร

วิมล
(นางวิภาณูญ ธีระสกุลวิไล)
ผู้อำนวยการศูนย์มาตรฐานวิชาการและพัฒนาระบบงาน
กองทะเบียนบัตรประจำตัวประชาชน

กลุ่มเอกสารวิธีการวิเคราะห์ทดสอบเคมีและทะเบียนห้องปฏิบัติการ กองวิจัยและพัฒนาคุณภาพโรงงาน กรมโรงงานอุตสาหกรรม โทร. ๐ ๒๒๐๒ ๕๐๐๖, ๕๔๕๖

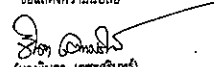


๑๓) นายวัชรภ...

ค. ขอบข่ายสารมลพิษที่ได้รับขึ้นทะเบียนไว้ให้วิเคราะห์ในน้ำเสีย จำนวน ๑๕ รายการ
อากาศเสีย (ปล่อยระบาย) จำนวน ๗ รายการ และน้ำใต้ดิน จำนวน ๓ รายการ รวมทั้งสิ้นจำนวน ๒๕ รายการ
ตามสิ่งที่ส่งมาด้วย

หนังสือฉบับนี้มีอายุ ๓ ปี นับจากวันที่กรมโรงงานอุตสาหกรรมออกหนังสือ หากประสงค์จะต่ออายุหนังสือขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์เอกชน ให้ยื่นคำขอต่ออายุพร้อมเอกสารประกอบคำขอต่อกรมโรงงานอุตสาหกรรมภายใน ๓๐ วัน ก่อนวันสิ้นอายุของหนังสือขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์เอกชน ซึ่งคำขอต่ออายุดังกล่าวขอรับได้ที่กรมโรงงานอุตสาหกรรม

จึงเรียนมาเพื่อทราบ

ขอแสดงความนับถือ

 (นางนงกต เศษการันท์)
 ผู้อำนวยการสำนักงานสิ่งแวดล้อมภาคที่ ๑๑
 จังหวัดขอนแก่น
 ๒๕ มิ.ย. ๒๕๖๕

กองวิจัยและพัฒนาสิ่งแวดล้อมภาคที่ ๑๑
 ศูนย์วิจัยและพัฒนาสิ่งแวดล้อมภาคที่ ๑๑
 โทร. ๐ ๒๕๐๕ ๙๐๖๓-๓
 ไปรษณีย์อิเล็กทรอนิกส์: envs11@mail.go.th

เอกสารแนบท้ายหนังสือรับขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์เอกชน
 บริษัท เอ็นเอสเอส แอนด์อราออร์ กิ๊ปป (ประเทศไทย) จำกัด เลขทะเบียน ๖-๓๓๓
 ที่ อก ๐๓๓๐(๓)/ ๒๕ ๗๐ ลงวันที่ ๒๕ มิถุนายน ๒๕๖๕

ขอแนบรายชื่อสารเคมีที่ได้รับขึ้นทะเบียนจากกรมโรงงานอุตสาหกรรม จำนวน ๒๔ รายการ

น้ำเสีย จำนวน ๑๔ รายการ

ลำดับที่	สารเคมี	วิธีวิเคราะห์
1	Biochemical Oxygen Demand	1) 5-Day BOD Test, Membrane Electrode Method ^[2]
2	Chemical Oxygen Demand	2) 5-Day BOD Test, Azide Modification Method ^[2] 1) Open Reflux, Titrimetric Method ^[2] 2) Closed Reflux, Colorimetric Method ^[2] 3) Closed Reflux, Titrimetric Method ^[2]
3	Color	ADM Weighted - Ordinate Spectrophotometric Method ^[2]
4	Cyanide	Distillation, Colorimetric Method ^[2]
5	Formaldehyde	Distillation, Colorimetric Method ^[2]
6	Free Chlorine	DPD-Ferrous Titrimetric Method ^[2]
7	Oil and Grease	Liquid-Liquid Partition-Gravimetric Method ^[2]
8	pH	Electrometric Method ^[2]
9	Phenols	1) Distillation, Chloroform Extraction Method ^[2] 2) Distillation, Direct Photometric Method ^[2]
10	Sulfide	ZnS Precipitation, Iodometric Method ^[2]
11	Temperature	Laboratory and Field Method ^[2]
12	Total Dissolved Solids	Dried at 180 °C ^[2]
13	Total Kjeldahl Nitrogen	Semi-Micro Kjeldahl Method ^[2]
14	Total Suspended Solids	Dried at 103-105 °C ^[2]

อากาศเสีย (ปล่องระบาย) จำนวน 7 รายการ

ลำดับที่	สารเคมี	วิธีวิเคราะห์
1	Carbon Monoxide	1) Sampling Bag, Non-Dispersive Infrared Method ^[3] 2) Instrumental Analyzer Method ^[4]
2	Hydrogen Sulfide	Absorption Sampling, Iodometric Method ^[4]
3	Opacity	Ringelmann's Method ^[3,4]
4	Oxide of Nitrogen	1) Absorption Sampling, Phenoldisulfonic Acid Method ^[4] 2) Instrumental Analyzer Method ^[3]
5	Sulfur Dioxide	1) Absorption Sampling, Barium-Thorin Titrimetric Method ^[5] 2) Instrumental Analyzer Method ^[3,6]

วิรัตน์ มิ่งคุณ
 (นางสาววิชุดา สัมฤทธิ์ผล)
 ผู้อำนวยการ
 ศูนย์วิจัยและพัฒนาสิ่งแวดล้อมภาคที่ ๑๑ Sulfuric Acid...

ลำดับที่	สารเคมี	วิธีวิเคราะห์
6	Sulfuric Acid	Isokinetic Sampling, Barium - Thorin Titrimetric Method ^[2]
7	Total Suspended Particulate	Isokinetic Sampling, Gravimetric Method ^[2]

น้ำดื่ม จำนวน 3 รายการ

ลำดับที่	สารเคมี	วิธีวิเคราะห์
1	Cyanide	Distillation, Colorimetric Method ^[2]
2	pH	Electrometric Method ^[2]
3	Phenols	Distillation, Direct Photometric Method ^[2]

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