ภาคผนวก จ

เอกสารสอบเทียบเครื่องมือ

ภาคผนวก จ-1

เอกสารสอบเทียบเครื่องมือ

บริษัท เอแอลเอส แลบอราทอรี กรุ๊ป (ประเทศไทย) จำกัด

ALS Laboratory Group (Thailand) Co., Ltd.
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Khwaeng Phatthanakan, Khet Suan Luang,
Bangkok 10250 Thailand
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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_FS0387	-	-	On site Calibration
Ambient	Particulate Matter (PM-10)	High Volume	BKK_FS0388	-	-	On site Calibration
Ambient	Particulate Matter (PM-10)	High Volume	BKK_FS0385	-	-	On site Calibration
Ambient	Particulate Matter (PM-10)	Digital Balance	BKK_EN0004	10-Mar-21	10-Mar-22	12
Ambient	Total Suspended Particulate	High Volume	BKK_FS0359	-	-	On site Calibration
Ambient	Total Suspended Particulate	High Volume	BKK_FS0358	-	-	On site Calibration
Ambient	Total Suspended Particulate	High Volume	BKK_FS0368	-	-	On site Calibration
Ambient	Total Suspended Particulate	High Volume	BKK_FS0367	-	-	On site Calibration
Ambient	Total Suspended Particulate	Digital Balance	BKK_EN0004	10-Mar-21	10-Mar-22	12
Ambient	Nitrogen Dioxide	NO_2 Analyzer	BKK_FS1092	4-Jan-22	4-Jul-22	6
Ambient	Nitrogen Dioxide	NO_2 Analyzer	BKK_FS1088	4-Jan-22	4-Jul-22	6
Ambient	Nitrogen Dioxide	NO_2 Analyzer	BKK_FS1072	4-Jan-22	4-Jul-22	6
Ambient	Nitrogen Dioxide	NO_2 Analyzer	BKK_FS0782	4-Jan-22	4-Jul-22	6
Ambient	Sulfur Dioxide	SO_2 Analyzer	BKK_FS1091	4-Jan-22	4-Jul-22	6
Ambient	Sulfur Dioxide	SO_2 Analyzer	BKK_FS1087	4-Jan-22	4-Jul-22	6
Ambient	Sulfur Dioxide	SO_2 Analyzer	BKK_FS1071	4-Jan-22	4-Jul-22	6
Ambient	Sulfur Dioxide	SO_2 Analyzer	BKK_FS0781	4-Jan-22	4-Jul-22	6
Ambient	Wind Speed / Wind Direction	Wind Speed / Wind Direction	BKK_FS0920	8-Oct-21	8-Apr-23	18
Ambient	Wind Speed / Wind Direction	Wind Speed / Wind Direction	BKK_FS0917	1-Nov-21	2-May-23	18
Ambient	Wind Speed / Wind Direction	Wind Speed / Wind Direction	BKK_FS0918	30-Aug-21	28-Feb-23	18
Ambient	Wind Speed / Wind Direction	Wind Speed / Wind Direction	BKK_FS0919	30-Aug-21	28-Feb-23	18
Ambient	Lead	High Volume	BKK_FS0359	-	-	On site Calibration
Ambient	Lead	High Volume	BKK_FS0358	-	-	On site Calibration
Ambient	Lead	High Volume	BKK_FS0368	-	-	On site Calibration
Ambient	Lead	High Volume	BKK_FS0367	-	-	On site Calibration
Ambient	Nickel	High Volume	BKK_FS0359	-	-	On site Calibration
Ambient	Nickel	High Volume	BKK_FS0358	-	-	On site Calibration
Ambient	Nickel	High Volume	BKK_FS0368	-	-	On site Calibration
Ambient	Nickel	High Volume	BKK_FS0367	-	-	On site Calibration
Ambient	Nickel	High Volume	BKK_FS1056	-	-	On site Calibration
Ambient	Arsenic	High Volume	BKK_FS0359	-	-	On site Calibration
Ambient	Arsenic	High Volume	BKK_FS0358	-	-	On site Calibration
Ambient	Arsenic	High Volume	BKK_FS0368	-	-	On site Calibration
Ambient	Arsenic	High Volume	BKK_FS0367	-	-	On site Calibration

รายการเครื่องมือที่ใช้ในการวิเคราะห์ / ทดสอบ

Sample Name	Parameter	Equipment Name	ID No.	Calibrated Date	Next Cal	Freq. Calibrate (Months)
Ambient	Arsenic	High Volume	BKK_FS1056	-	-	On site Calibration
Ambient	Cadmium	High Volume	BKK_FS0359	-	-	On site Calibration
Ambient	Cadmium	High Volume	BKK_FS0358	-	-	On site Calibration
Ambient	Cadmium	High Volume	BKK_FS0368	-	-	On site Calibration
Ambient	Cadmium	High Volume	BKK_FS0367	-	-	On site Calibration
Ambient	Beryllium	High Volume	BKK_FS0359	-	-	On site Calibration
Ambient	Beryllium	High Volume	BKK_FS0358	-	-	On site Calibration
Ambient	Beryllium	High Volume	BKK_FS0368	-	-	On site Calibration
Ambient	Beryllium	High Volume	BKK_FS0367	-	-	On site Calibration
Ambient	Mercury (Particle Phase)	High Volume	BKK_FS0359	-	-	On site Calibration
Ambient	Mercury (Particle Phase)	High Volume	BKK_FS0358	-	-	On site Calibration
Ambient	Mercury (Particle Phase)	High Volume	BKK_FS0368	-	-	On site Calibration
Ambient	Mercury (Particle Phase)	High Volume	BKK_FS0367	-	-	On site Calibration
Noise	Leq 24 hrs	Sound Calibrator	BKK_FS0630	24-Mar-21	24-Mar-22	12
Noise	Leq 24 hrs	Sound Level Meter	BKK_FS0116	14-Dec-21	14-Dec-22	12
Noise	Leq 24 hrs	Sound Level Meter	BKK_FS0926	7-Jul-21	7-Jul-22	12
Noise	Noise Annoyance	Sound Calibrator	BKK_FS0630	24-Mar-21	24-Mar-22	12
Noise	Noise Annoyance	Sound Level Meter	BKK_FS0116	14-Dec-21	14-Dec-22	12
Noise	Noise Annoyance	Sound Level Meter	BKK_FS0926	7-Jul-21	7-Jul-22	12
Noise	Noise Annoyance	Sound Calibrator	BKK_FS0630	24-Mar-21	24-Mar-22	12
Noise	Noise Annoyance	Sound Level Meter	BKK_FS0115	14-Dec-21	14-Dec-22	12
Noise	Leq 5 min	Sound Calibrator	BKK_FS0631	26-Oct-21	26-Oct-22	12
Noise	Leq 5 min	Sound Level Meter	BKK_FS0875	2-Nov-21	2-Nov-22	12
Noise	Leq 8 hrs	Sound Calibrator	BKK_FS0631	26-Oct-21	26-Oct-22	12
Noise	Leq 8 hrs	Sound Level Meter	BKK_FS0968	12-Jan-22	12-Jan-23	12
Noise	Leq 8 hrs	Sound Level Meter	BKK_FS0927	7-Sep-21	7-Sep-22	12
Noise	Leq 8 hrs	Sound Level Meter	BKK_FS0930	12-Jan-22	12-Jan-23	12
Noise	Leq 8 hrs	Sound Level Meter	BKK_FS0969	12-Jan-22	12-Jan-23	12
Noise	Leq 8 hrs	Sound Level Meter	BKK_FS0876	2-Nov-21	2-Nov-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_FS0924	12-Oct-21	12-Oct-22	12
Noise	Noise Dose, TWA	Dose Badge Reader	BKK_FS0627	7-Jul-21	7-Jul-22	12
Heat	Heat Stress	Heat Stress Monitor	BKK_FS0669	7-Jun-21	7-Jun-22	12
Heat	Heat Stress	Heat Stress Monitor	BKK_FS0670	11-Jun-21	11-Jun-22	12
Heat	Heat Stress	Heat Stress Monitor	BKK_FS0661	13-Dec-21	13-Dec-22	12

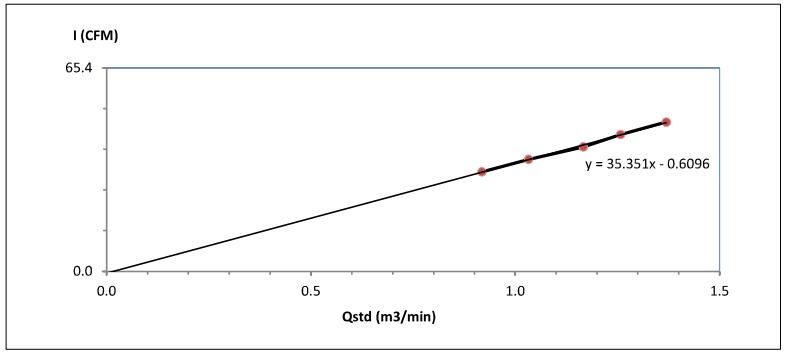
รายการเครื่องมือที่ใช้ในการวิเคราะห์ / ทดสอบ

Sample Name	Parameter	Equipment Name	ID No.	Calibrated Date	Next Cal	Freq. Calibrate (Months)
Heat	Heat Stress	Heat Stress Monitor	BKK_FS0671	30-Sep-21	30-Sep-22	12
Heat	Heat Stress	Heat Stress Monitor	BKK_FS0663	19-May-21	19-May-22	12
Heat	Heat Stress	Heat Stress Monitor	BKK_FS0667	14-Feb-22	14-Feb-23	12
Workplace	Ammonia	Field Rotameter	BKK_FS1016	4-Jan-22	4-Apr-22	3
Workplace	Ammonia	Spectrophotometer	BKK_EN0018	15-Oct-21	15-Oct-22	12
Workplace	Sodium hydroxide as NaOH	Field Rotameter	BKK_FS1016	4-Jan-22	4-Apr-22	3
Workplace	Benzene	Field Rotameter	BKK_FS1014	4-Jan-22	4-Apr-22	3
Workplace	Benzene	GC-MSD	BKK_EN0119	1-Oct-21	1-Apr-23	18
Workplace	Hydrochloric Acid	Field Rotameter	BKK_FS1015	4-Jan-22	4-Apr-22	3
Workplace	Hydrochloric Acid	Ion Chromatography	BKK_EN0069	12-Jan-22	12-Jan-23	12
Workplace	Methanol	Field Rotameter	BKK_FS1014	4-Jan-22	4-Apr-22	3
Workplace	Methanol	GC-FID	BKK_EN0126	21-Oct-21	21-Apr-23	18
Workplace	Total Dust	Field Rotameter	BKK_FS1016	4-Jan-22	4-Apr-22	3
Workplace	Total Dust	Digital Balance	BKK_EN0004	10-Mar-21	10-Mar-22	12
Workplace	Respirable Dust	Field Rotameter	BKK_FS1016	4-Jan-22	4-Apr-22	3
Workplace	Respirable Dust	Digital Balance	BKK_EN0004	10-Mar-21	10-Mar-22	12
Workplace	Toluene	Field Rotameter	BKK_FS1014	4-Jan-22	4-Apr-22	3
Workplace	Toluene	GC-MSD	BKK_EN0119	1-Oct-21	1-Apr-23	18
Workplace	Xylene	Field Rotameter	BKK_FS1014	4-Jan-22	4-Apr-22	3
Workplace	Xylene	GC-MSD	BKK_EN0119	1-Oct-21	1-Apr-23	18

High Volume Air Sampler Calibration Worksheet

Project Site :	Bangpoo Environmental Complex Co., Ltd.	**Barometric Pressure (mm Hg) :**	758
Calibrate Location :	ภายในพื้นที่โครงการฯ (Project area)	**Temperature (°C) :**	31
Calibrate Date :	15-Feb-22	**High Volume ID :**	BKK_FS1062
CalibrationSheet No.:	**C-150222-BKK_FS1062**	**High Volume Model :**	TE-5009X
Calibrator ID:	BKK_FS0624	**High Volume S/N :**	5686
Calibrator Model :	TE-5028A	**Calibrator Slope :**	1.64942
Calibrator S/N :	2584	**Calibrator Intercept :**	-0.02902

Test No.	Delta H_2O (inch)	Q_{std} (m^3/min)	I : Chart (CFM)	Linear Regression
1	2.2	0.9182	32	Slope : 35.3512
2	2.8	1.0321	36	Intercept : -0.6096
3	3.6	1.1664	40	Correlation Coefficient : 0.9985
4	4.2	1.2576	44	
5	5.0	1.3695	48	



Calibrated by Winyou B.

(Mr. Winyou Boontanai)
Field Scientist(1)

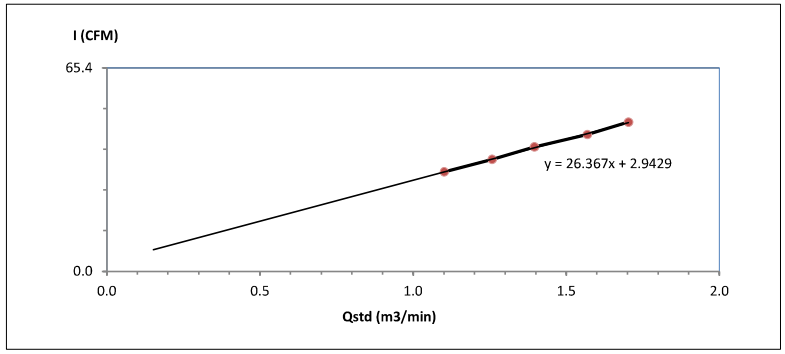
Approved by : Wichan Choonharat

(Mr. Wichan Choonharat)
Manager

High Volume Air Sampler Calibration Worksheet

Project Site :	Bangpoo Environmental Complex Co., Ltd.	**Barometric Pressure (mm Hg) :**	758
Calibrate Location :	ชุมชนบ้านคอต่อ (Community area 2)	**Temperature (°C) :**	31
Calibrate Date :	15-Feb-22	**High Volume ID :**	BKK_FS0387
CalibrationSheet No.:	**C-150222-BKK_FS0387**	**High Volume Model :**	G1051
Calibrator ID:	BKK_FS0624	**High Volume S/N :**	1626
Calibrator Model :	TE-5028A	**Calibrator Slope :**	1.64942
Calibrator S/N :	2584	**Calibrator Intercept :**	-0.02902

Test No.	Delta H_2O (inch)	Q_{std} (m^3/min)	I : Chart (CFM)	Linear Regression
1	3.2	1.1014	32	Slope : 26.3666
2	4.2	1.2576	36	Intercept : 2.9429
3	5.2	1.3960	40	Correlation Coefficient : 0.9994
4	6.6	1.5691	44	
5	7.8	1.7032	48	



Calibrated by Winyou B.

(Mr. Winyou Boontanai)
Field Scientist(1)

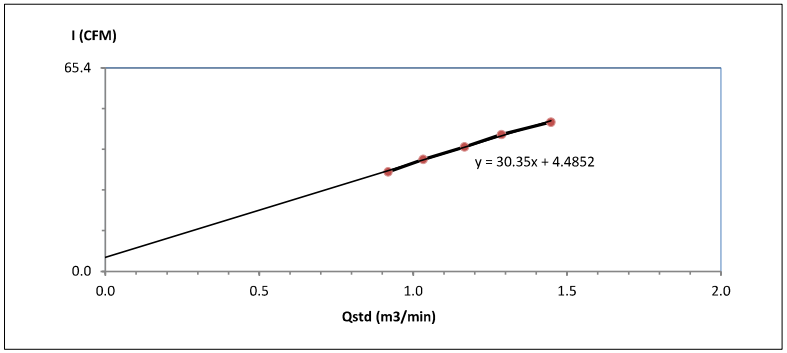
Approved by : Wichan Choonharat

(Mr. Wichan Choonharat)
Manager

High Volume Air Sampler Calibration Worksheet

Project Site :	Bangpoo Environmental Complex Co., Ltd.	**Barometric Pressure (mm Hg) :**	758
Calibrate Location :	วัดหัวลำภูทอง (Community area 3)	**Temperature (°C) :**	31
Calibrate Date :	15-Feb-22	**High Volume ID :**	BKK_FS0388
CalibrationSheet No.:	**C-150222-BKK_FS0388**	**High Volume Model :**	TE-5009X
Calibrator ID:	BKK_FS0624	**High Volume S/N :**	5328
Calibrator Model :	TE-5028A	**Calibrator Slope :**	1.64942
Calibrator S/N :	2584	**Calibrator Intercept :**	-0.02902

Test No.	Delta H_2O (inch)	Q_{std} (m^3/min)	I : Chart (CFM)	Linear Regression
1	2.2	0.9182	32	Slope : 30.3504
2	2.8	1.0321	36	Intercept : 4.4852
3	3.6	1.1664	40	Correlation Coefficient : 0.9982
4	4.4	1.2865	44	
5	5.6	1.4476	48	



Calibrated by Winyou B.

(Mr. Winyou Boontanai)
Field Scientist(1)

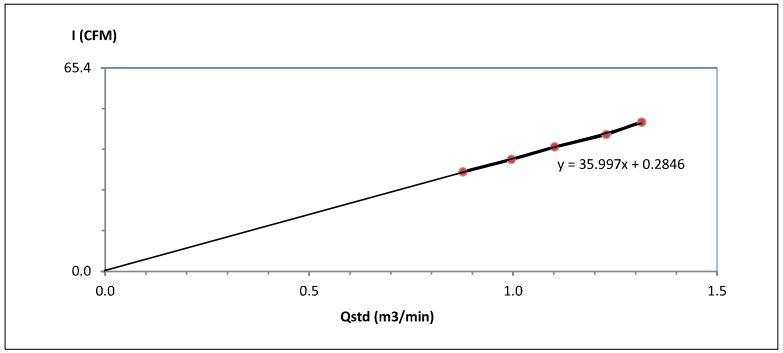
Approved by : Wichan Choonharat

(Mr. Wichan Choonharat)
Manager

High Volume Air Sampler Calibration Worksheet

Project Site :	Bangpoo Environmental Complex Co., Ltd.	**Barometric Pressure (mm Hg) :**	758
Calibrate Location :	ชุมชนเอื้ออาทร 2 (Community area 4)	**Temperature (°C) :**	31
Calibrate Date :	15-Feb-22	**High Volume ID :**	BKK_FS0385
CalibrationSheet No.:	**C-150222-BKK_FS0385**	**High Volume Model :**	TE-5009X
Calibrator ID:	BKK_FS0624	**High Volume S/N :**	4789
Calibrator Model :	TE-5028A	**Calibrator Slope :**	1.64942
Calibrator S/N :	2584	**Calibrator Intercept :**	-0.02902

Test No.	Delta H_2O (inch)	Q_{std} (m^3/min)	I : Chart (CFM)	Linear Regression
1	2.0	0.8768	32	Slope : 35.9970
2	2.6	0.9956	36	Intercept : 0.2846
3	3.2	1.1014	40	Correlation Coefficient : 0.9986
4	4.0	1.2280	44	
5	4.6	1.3147	48	



Calibrated by Winyou B.

(Mr. Winyou Boontanai)
Field Scientist(1)

Approved by : Wichan Choonharat

(Mr. Wichan Choonharat)
Manager

BKK_EN0004

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Tel: +66 2643 8361-6 , e-mail: service.thailand@sartorius.com

NSC-TISI-TIS-17025
CALIBRATION 0219

ilac-MRA

SARTORIUS

REVIEW BY Sinlak P.
APPROVED BY
NEXT CAL. DATE 10/3/22

Certificate of Calibration

Model Number :	XP105DU	Certificate No. :	21BCI0084
Description :	Semi-micro Balance	Issued Date :	Friday, March 12, 2021
Serial Number :	1123091884	Reference No. :	501611
Manufacturer :	Mettler Toledo	Page No. :	1 Of 3

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

Calibrated Place : Lab Room

Calibrated By : Mr. Chonchai Inthana
Calibration Date : Wednesday, March 10, 2021

Calibration Procedure No. : This calibration was conducted by
Using in-house calibration procedure number (WI-003)
Based on UKAS LAB 14

Metrological data :
Capacity : 31/120 g Readability : 0.01/0.1 mg

Ambients Conditions:

Temperature :	22.0 °C	±	5.0 °C
Humidity :	57.0 % RH	±	10.0 % RH
Pressure	_	±	_

Reasons for calibration
☐ New Installation ☐ Service / Repaired ☑ Re-calibration/ Maintenance

Equipment Condition: ☑ Good Operate ☐ Fair

Measurement Method UKAS Publication Ref :Lab 14

The measurement uncertainty stated is the expended uncertainty which is obtained from the standard uncertainty multiplied by the coverage factor (k=2) to provide a level of confidence of approximately 95%. It is determined in accordance with the Guide to Expression of Uncertainty in Measurement (GUM). The calibration certificate documents the traceability to National Standards, which realise the unit of measurement according to the International Standard System of Units (SI).

Traceability:

Model Number	Description	Traceability	Cetificate No.	Due Date
YCS011-522-00	Sartorius weight set 1mg - 200g E2,YCS011-522-00	Sartorius	119934 D-K-19398-01-00	10-Sep-2021
MHB-382SD	Humidity/Barometer/Temp Lutron MHB-382SD	SPC-RT	C19203076	1-Sep-2021

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

Mr.Chonchai Inthana(Technical Manager)

STAMP

SARTORIUS (THAILAND) CO., LTD. CAL sartorius ISO/IEC 17025 Cert no. 13007 / C219

Sartorius (Thailand) Co., Ltd.
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SARTORIUS

Certificate of Calibration

Model Number :	XP105DU	Certificate No. :	21BCI0084
Description :	Semi-micro Balance	Issued Date :	Friday, March 12, 2021
Serial Number :	1123091884	Reference No. :	501611
Manufacturer :	Mettler Toledo	Page No. :	2 of 3

Calibration Results : Without Adjustment

Repeatability

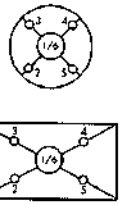
The reproducibility is the ability of a weighing instrument to display nearly identical readouts under constant test conditions when the same load within a measurement series is placed repeatedly on the weighing pan in the same manner. The standard deviation is used to express reproducibility quantitatively.

Nominal Value : (Low Load)	2.00002	20.00001
2 g	2.00002	20.00002
Tolerance	2.00001	20.00001
N/A g	2.00003	20.00001
	2.00003	20.00002
Nominal Value : (High Load)	2.00001	20.00002
20 g	2.00002	20.00001
Tolerance	2.00003	20.00000
N/A g	2.00003	20.00001
	2.00003	20.00002
Standard Deviation	0.000008	0.000007

Eccentricity (Off-center loading error)

The off-center loading error is yielded by the difference between the readout of the load, i.e. 1/3 or 1/4 of maximum capacity, placed in the middle of the weighing pan and between each of four additional measurement points (positions defined according to OIML R76).

Nominal value : 20 g
Tolerance N/A g



	Difference
1	_
2	-0.00001
3	-0.00003
4	0.00002
5	0.00002
6	_

Linearity

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

Tolearance N/A g

Nominal Value (g)	Conventional Mass Value (g)	Displayed Value (g)	Deviation (g)	Uncertainty (g)
0.1	0.10000	0.10001	0.00001	0.000021
0.5	0.50000	0.50001	0.00001	0.000022
1	1.00000	1.00000	0.00000	0.000023
2	2.00001	2.00000	-0.00001	0.000024
5	5.00002	5.00002	0.00000	0.000027
10	10.00003	10.00002	-0.00001	0.000032
15	15.00004	15.00005	0.00001	0.000049
20	20.00001	20.00002	0.00001	0.000049
25	25.00003	25.00005	0.00002	0.000089
30	30.00004	30.00006	0.00002	0.000089

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SARTORIUS

Certificate of Calibration

Model Number :	XP105DU	Certificate No. :	21BCI0084
Description :	Semi-micro Balance	Issued Date :	Friday, March 12, 2021
Serial Number :	1123091884	Reference No. :	501611
Manufacturer :	Mettler Toledo	Page No. :	3 of 3

Calibration Results : Without Adjustment

Repeatability

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

Nominal Value : (Low Load)
g
Tolerance
N/A g

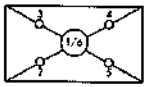
Nominal Value : (High Load)
100 g
Tolerance
N/A g

100.0000
100.0000
100.0000
100.0000
100.0000
100.0000
100.0000
100.0000
100.0000
100.0001
Standard Deviation 0.00003

Eccentricity (Off-center loading error)

The off-center loading error is yielded by the difference between the readout of the load, i.e. 1/3 or 1/4 of maximum capacity, placed in the middle of the weighing pan and between each of four additional measurement points (positions defined according to OIML R76).

Nominal value : g
Tolerance N/A g



	Difference
1	–
2	–
3	–
4	–
5	–
6	–

Linearity

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

Tolearance N/A g

Nominal Value (g)	Conventional Mass Value (g)	Displayed Value (g)	Deviation (g)	Uncertainty (g)
50	50.0001	50.0000	-0.0001	0.00015
55	55.0001	55.0001	0.0000	0.00015
60	60.0001	60.0001	0.0000	0.00015
65	65.0001	65.0001	0.0000	0.00015
70	70.0001	70.0000	-0.0001	0.00015
80	80.0001	80.0001	0.0000	0.00016
90	90.0001	90.0000	-0.0001	0.00017
100	100.0001	100.0000	-0.0001	0.00017
110	110.0001	110.0000	-0.0001	0.00026
120	120.0001	120.0000	-0.0001	0.00026

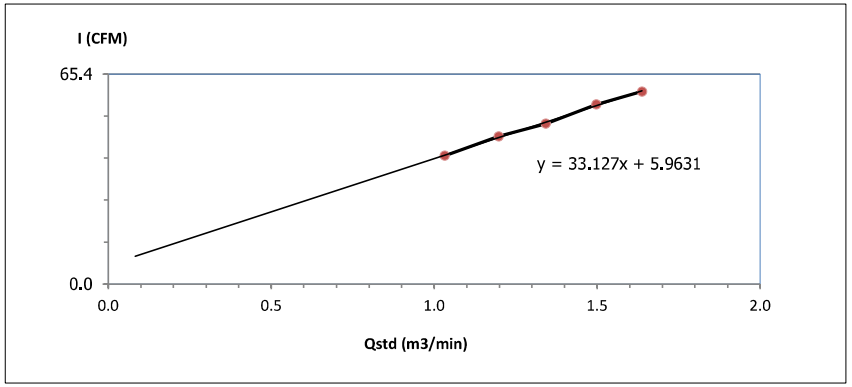
End of Report.

ALS

High Volume Air Sampler Calibration Worksheet

Project Site :	Bangpoo Environmental Complex Co., Ltd.	**Barometric Pressure (mm Hg) :**	758
Calibrate Location :	ภายในพื้นที่โครงการฯ (Project area)	**Temperature (°C) :**	31
Calibrate Date :	15-Feb-22	**High Volume ID :**	BKK_FS0359
CalibrationSheet No.:	C-150222-BKK_FS0359	**High Volume Model :**	TE-5009X
Calibrator ID:	BKK_FS0624	**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_2O (inch)	Q_{std} (m^3/min)	I : Chart (CFM)	Linear Regression
1	2.8	1.0321	40	Slope : 33.1269
2	3.8	1.1976	46	Intercept : 5.9631
3	4.8	1.3424	50	Correlation Coefficient : 0.9989
4	6.0	1.4974	56	
5	7.2	1.6376	60	



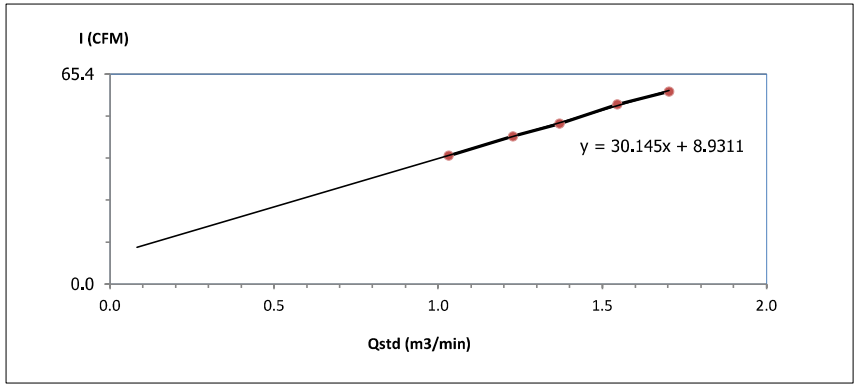
Calibrated by Winyou B.
(Mr. Winyou Boontanai)
Field Scientist(1)

Approved by : Wichan Chunharat
(Mr. Wichan Choonharat)
Manager

High Volume Air Sampler Calibration Worksheet

Project Site :	Bangpoo Environmental Complex Co., Ltd.	**Barometric Pressure (mm Hg) :**	758
Calibrate Location :	ชุมชนบ้านคอต่อ (Community area 2)	**Temperature (°C) :**	31
Calibrate Date :	15-Feb-22	**High Volume ID :**	BKK_FS0358
CalibrationSheet No.:	**C-150222-BKK_FS0358**	**High Volume Model :**	TE-5009X
Calibrator ID:	BKK_FS0624	**High Volume S/N :**	5193
Calibrator Model :	TE-5028A	**Calibrator Slope :**	1.64942
Calibrator S/N :	2584	**Calibrator Intercept :**	-0.02902

Test No.	Delta H_2O (inch)	Q_{std} (m^3/min)	I : Chart (CFM)	Linear Regression
1	2.8	1.0321	40	Slope : 30.1445
2	4.0	1.2280	46	Intercept : 8.9311
3	5.0	1.3695	50	Correlation Coefficient : 0.9993
4	6.4	1.5456	56	
5	7.8	1.7032	60	



Calibrated by Winyou B.

(Mr. Winyou Boontanai)
Field Scientist(1)

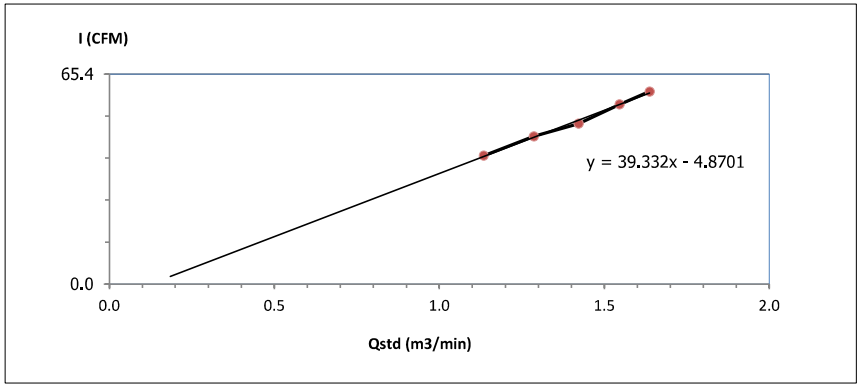
Approved by : Wichan Choonharat

(Mr. Wichan Choonharat)
Manager

High Volume Air Sampler Calibration Worksheet

Project Site :	Bangpoo Environmental Complex Co., Ltd.	**Barometric Pressure (mm Hg) :**	758
Calibrate Location :	วัดหัวลำภุทอง (Community area 3)	**Temperature (°C) :**	31
Calibrate Date :	15-Feb-22	**High Volume ID :**	BKK_FS0368
CalibrationSheet No.:	**C-150222-BKK_FS0368**	**High Volume Model :**	TE-5009X
Calibrator ID:	BKK_FS0624	**High Volume S/N :**	4165
Calibrator Model :	TE-5028A	**Calibrator Slope :**	1.64942
Calibrator S/N :	2584	**Calibrator Intercept :**	-0.02902

Test No.	Delta H_2O (inch)	Q_{std} (m^3/min)	I : Chart (CFM)	Linear Regression
1	3.4	1.1344	40	Slope : 39.3324
2	4.4	1.2865	46	Intercept : -4.8701
3	5.4	1.4221	50	Correlation Coefficient : 0.9970
4	6.4	1.5456	56	
5	7.2	1.6376	60	



Calibrated by Winyou B.

(Mr. Winyou Boontanai)
Field Scientist(1)

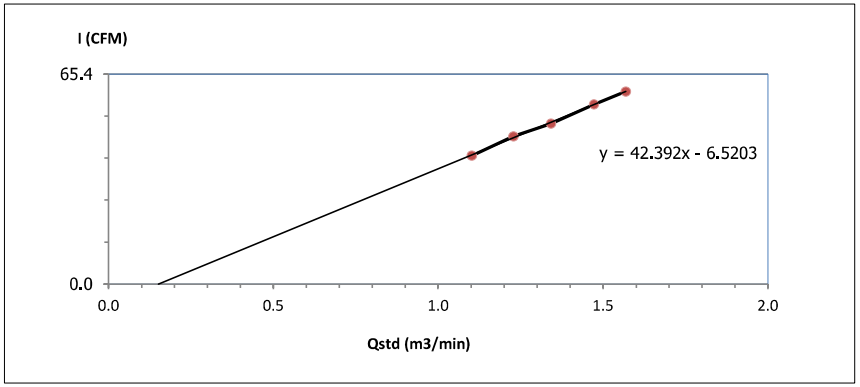
Approved by : Wichan Choonharat

(Mr. Wichan Choonharat)
Manager

High Volume Air Sampler Calibration Worksheet

Project Site :	Bangpoo Environmental Complex Co., Ltd.	**Barometric Pressure (mm Hg) :**	758
Calibrate Location :	ชุมชนเอื้ออาทร 2 (Community area 4)	**Temperature (°C) :**	31
Calibrate Date :	15-Feb-22	**High Volume ID :**	BKK_FS0367
CalibrationSheet No.:	**C-150222-BKK_FS0367**	**High Volume Model :**	TE-5009X
Calibrator ID:	BKK_FS0624	**High Volume S/N :**	4162
Calibrator Model :	TE-5028A	**Calibrator Slope :**	1.64942
Calibrator S/N :	2584	**Calibrator Intercept :**	-0.02902

Test No.	Delta H_2O (inch)	Q_{std} (m^3/min)	I : Chart (CFM)	Linear Regression
1	3.2	1.1014	40	Slope : 42.3923
2	4.0	1.2280	46	Intercept : -6.5203
3	4.8	1.3424	50	Correlation Coefficient : 0.9992
4	5.8	1.4727	56	
5	6.6	1.5691	60	



Calibrated by

(Mr. Winyou Boontanai)
Field Scientist(1)

Approved by :

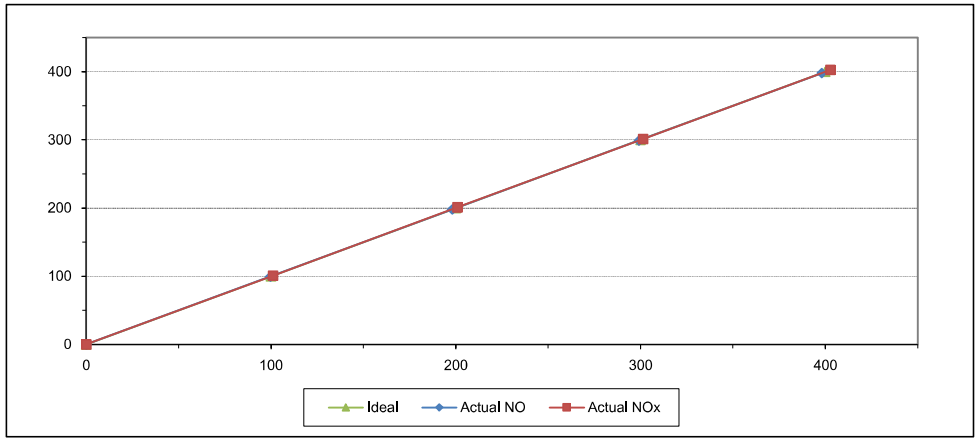
(Mr. Wichan Choonharat)
Manager

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

MULTIPOINT CALIBRATION REPORT

Calibration Date	4-Jan-22	**Equipment Name**	NOx Analyzer
Manufacturer	HORIBA	**Model**	APNA-370
Serial No.	XLTWRBSJ	**Equipment ID**	BKK_FS1092
Calibrator Manufacturer	Teledyne API	**Model**	700
Serial No.	947		
Std. Gas Concentration (PPM)	51.33	**Cylinder No.**	LL36633
Cylinder Pressure (psi)	1200	**Certified By**	Airgas Inc.
Certified Date	18-Mar-14	**Expired Date**	18-Mar-22

Point	CALIBRATION RESULTS						
	Ideal	Actual NO	Error NO	%Error NO	Actual NOx	Error NOx	%Error NOx
ZERO	0.00	0.10	0.10	0.10	0.10	0.10	0.10
1	100.00	99.70	-0.30	-0.30	101.00	1.00	1.00
2	200.00	198.10	-1.90	-0.95	201.00	1.00	0.50
3	300.00	299.10	-0.90	-0.30	301.40	1.40	0.47
4	400.00	398.20	-1.80	-0.45	402.80	2.80	0.70
AVERAGE (%)				-0.38			0.55



Calibrated By

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

Approved By

(Mr.Sarayuth Jittranont)
Assistant General Manager

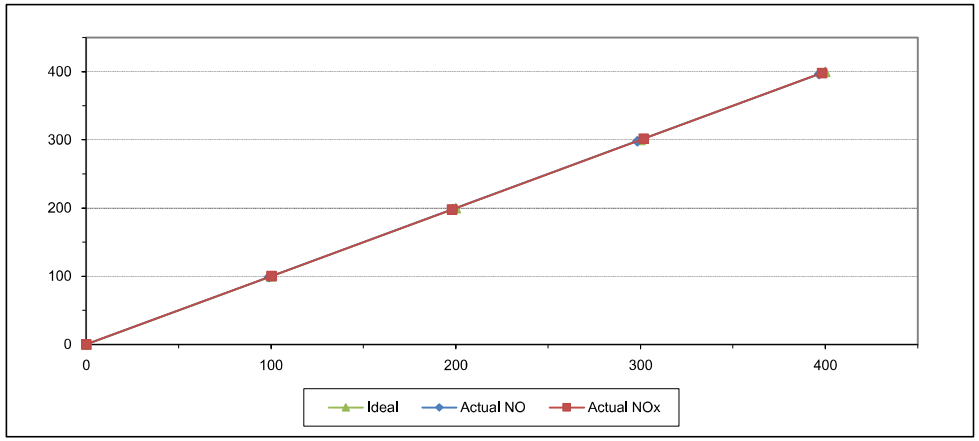
ALS Laboratory Group

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

MULTIPOINT CALIBRATION REPORT

Calibration Date	4-Jan-22	Equipment Name	NOx Analyzer
Manufacturer	HORIBA	Model	APNA-370
Serial No.	PX13CWA0	Equipment ID	BKK_FS1088
Calibrator Manufacturer	Teledyne API	Model	700
Serial No.	947		
Std. Gas Concentration (PPM)	51.33	Cylinder No.	LL36633
Cylinder Pressure (psi)	1200	Certified By	Airgas Inc.
Certified Date	18-Mar-14	Expired Date	18-Mar-22

Point	CALIBRATION RESULTS						
	Ideal	Actual NO	Error NO	%Error NO	Actual NOx	Error NOx	%Error NOx
ZERO	0.00	0.10	0.10	0.10	0.10	0.10	0.10
1	100.00	99.00	-1.00	-1.00	100.30	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	396.70	-3.30	-0.83	398.30	-1.70	-0.42
AVERAGE (%)				-0.62			-0.08



Calibrated By

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

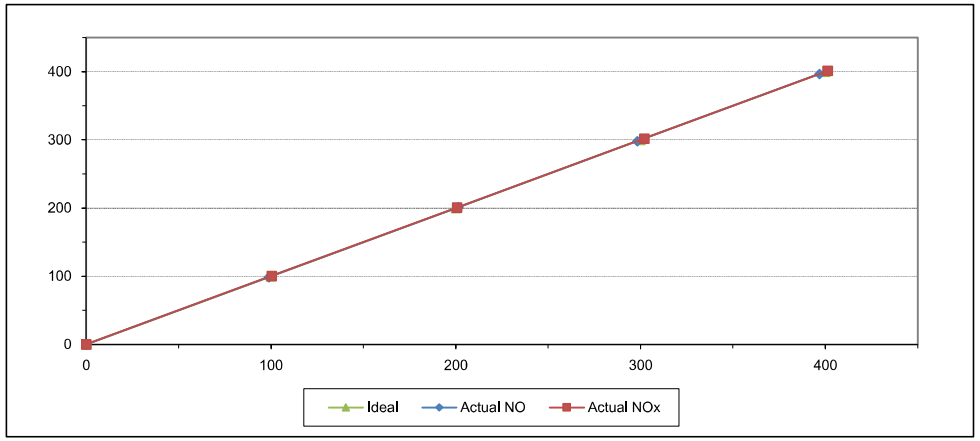
Approved By

(Mr.Sarayuth Jittranont)
Assistant General Manager

MULTIPOINT CALIBRATION REPORT

Calibration Date	4-Jan-22	Equipment Name	NOx Analyzer
Manufacturer	HORIBA	Model	APNA-370
Serial No.	PHD13MC7	Equipment ID	BKK_FS1072
Calibrator Manufacturer	Teledyne API	Model	700
Serial No.	947		
Std. Gas Concentration (PPM)	51.33	Cylinder No.	LL36633
Cylinder Pressure (psi)	1200	Certified By	Airgas Inc.
Certified Date	18-Mar-14	Expired Date	18-Mar-22

Point	CALIBRATION RESULTS						
	Ideal	Actual NO	Error NO	%Error NO	Actual NOx	Error NOx	%Error NOx
ZERO	0.00	0.10	0.10	0.10	0.10	0.10	0.10
1	100.00	98.80	-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	396.90	-3.10	-0.78	401.30	1.30	0.33
AVERAGE (%)				-0.35			0.40



Calibrated By

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

Approved By

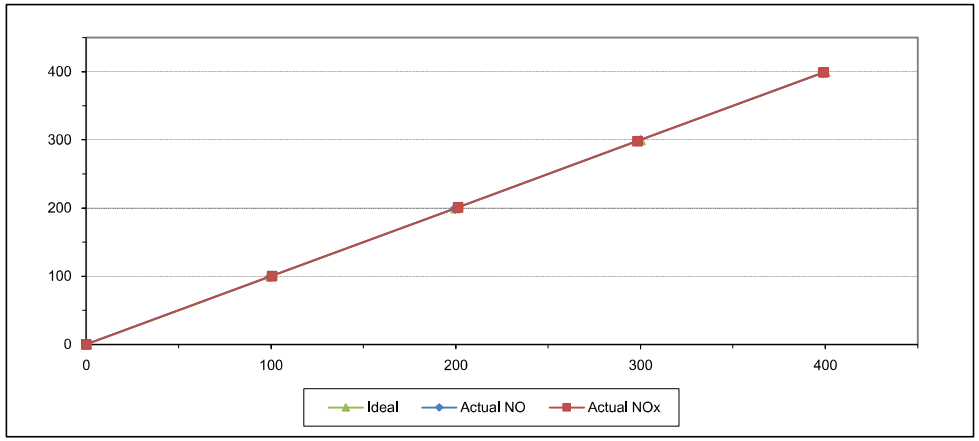
(Mr.Sarayuth Jittranont)
Assistant General Manager

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

MULTIPOINT CALIBRATION REPORT

Calibration Date	4-Jan-22	Equipment Name	NOx Analyzer
Manufacturer	HORIBA	Model	APNA-370
Serial No.	WPY0JMWD	Equipment ID	BKK_FS0782
Calibrator Manufacturer	Teledyne API	Model	700
Serial No.	947		
Std. Gas Concentration (PPM)	51.33	Cylinder No.	LL36633
Cylinder Pressure (psi)	1200	Certified By	Airgas Inc.
Certified Date	18-Mar-14	Expired Date	18-Mar-22

Point	CALIBRATION RESULTS						
	Ideal	Actual NO	Error NO	%Error NO	Actual NOx	Error NOx	%Error NOx
ZERO	0.00	0.10	0.10	0.10	0.10	0.10	0.10
1	100.00	99.60	-0.40	-0.40	100.60	0.60	0.60
2	200.00	199.70	-0.30	-0.15	201.30	1.30	0.65
3	300.00	298.50	-1.50	-0.50	298.30	-1.70	-0.57
4	400.00	398.70	-1.30	-0.33	399.00	-1.00	-0.25
AVERAGE (%)				-0.26			0.11



Calibrated By

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

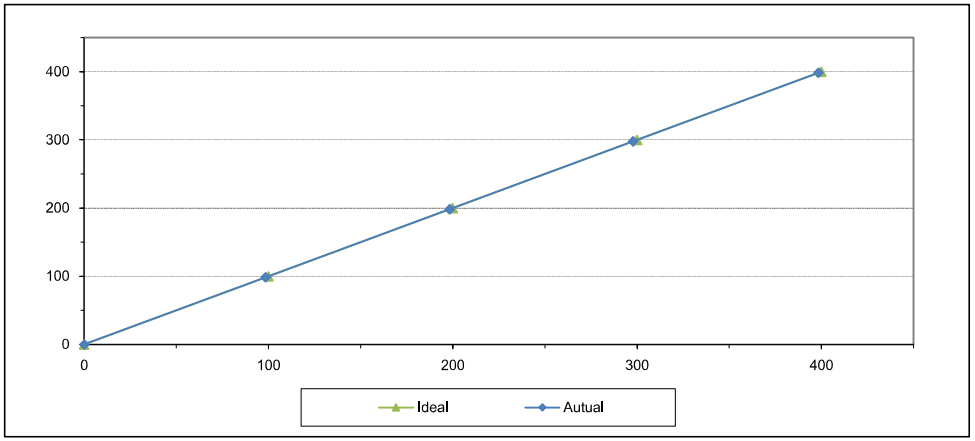
Approved By

(Mr.Sarayuth Jittranont)
Assistant General Manager

MULTIPOINT CALIBRATION REPORT

Calibration Date	4-Jan-22	Equipment Name	SO2 Analyzer
Manufacturer	HORIBA	Model	APSA-370
Serial No.	6BVW9P1K	Equipment ID	BKK_FS1091
Calibrator Manufacturer	Teledyne API	Model	700
Serial No.	947		
Std. Gas Concentration (PPM)	50.87	Cylinder No.	LL36633
Cylinder Pressure (psi)	1200	Certified By	Airgas Inc.
Certified Date	18-Mar-14	Expired Date	18-Mar-22

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



Calibrated By

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

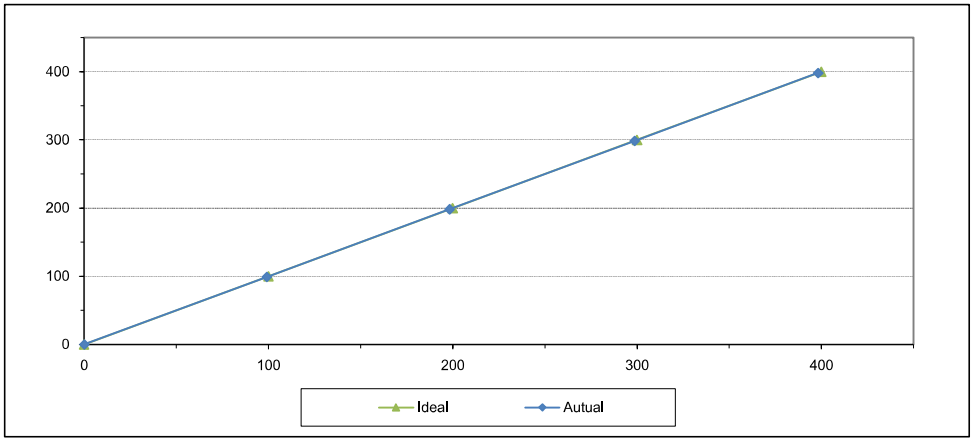
Approved By

(Mr.Sarayuth Jittranont)
Assistant General Manager

MULTIPOINT CALIBRATION REPORT

Calibration Date	4-Jan-22	Equipment Name	SO2 Analyzer
Manufacturer	HORIBA	Model	APSA-370
Serial No.	XHV1S59F	Equipment ID	BKK_FS1087
Calibrator Manufacturer	Teledyne API	Model	700
Serial No.	947		
Std. Gas Concentration (PPM)	50.87	Cylinder No.	LL36633
Cylinder Pressure (psi)	1200	Certified By	Airgas Inc.
Certified Date	18-Mar-14	Expired Date	18-Mar-22

Point	CALIBRATION RESULTS			
	Ideal	Autual	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.Jirawut Sakarn)
Field Environmental Scientist (3)

Approved By

(Mr.Sarayuth Jittranont)
Assistant General Manager

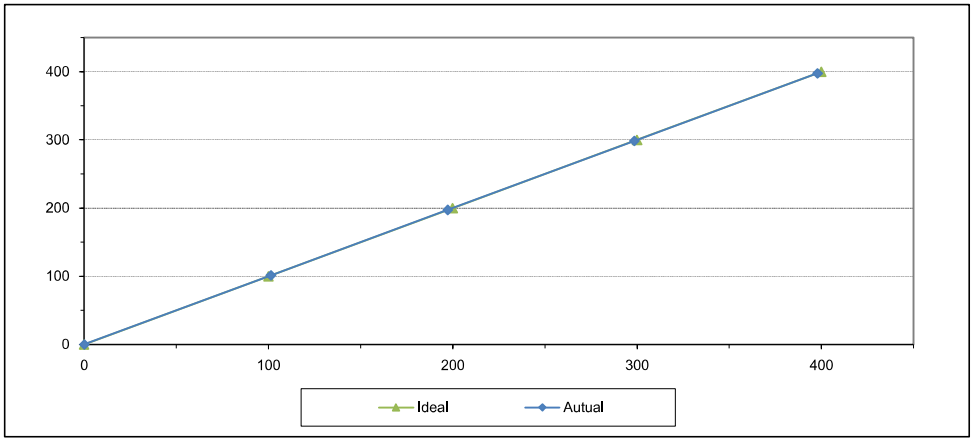
ALS Laboratory Group

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

MULTIPOINT CALIBRATION REPORT

Calibration Date	4-Jan-22	Equipment Name	SO2 Analyzer
Manufacturer	HORIBA	Model	APSA-370
Serial No.	R0H40S60	Equipment ID	BKK_FS1071
Calibrator Manufacturer	Teledyne API	Model	700
Serial No.	947		
Std. Gas Concentration (PPM)	50.87	Cylinder No.	LL36633
Cylinder Pressure (psi)	1200	Certified By	Airgas Inc.
Certified Date	18-Mar-14	Expired Date	18-Mar-22

Point	CALIBRATION RESULTS			
	Ideal	Autual	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 (%)				-0.19



Calibrated By

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

Approved By

(Mr.Sarayuth Jittranont)
Assistant General Manager

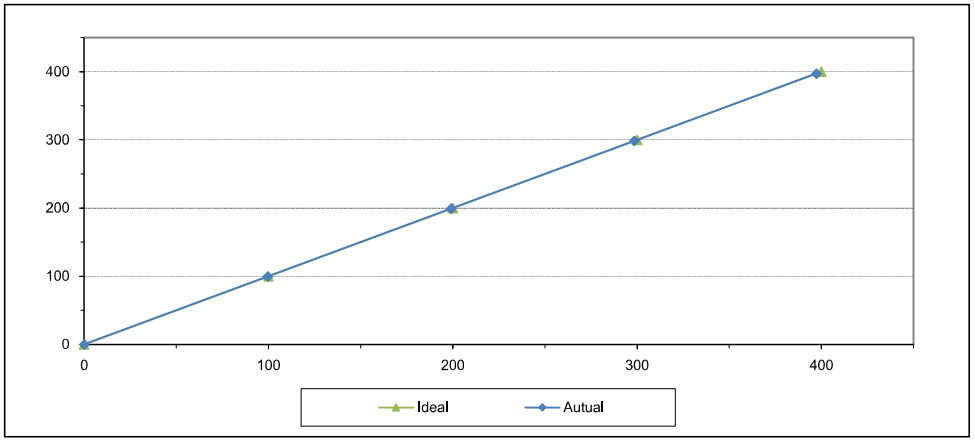
ALS Laboratory Group

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

MULTIPOINT CALIBRATION REPORT

Calibration Date	4-Jan-22	Equipment Name	SO2 Analyzer
Manufacturer	HORIBA	Model	APSA-370
Serial No.	Y53SNSFB	Equipment ID	BKK_FS0781
Calibrator Manufacturer	Teledyne API	Model	700
Serial No.	947		
Std. Gas Concentration (PPM)	50.87	Cylinder No.	LL36633
Cylinder Pressure (psi)	1200	Certified By	Airgas Inc.
Certified Date	18-Mar-14	Expired Date	18-Mar-22

Point	CALIBRATION RESULTS			
	Ideal	Autual	Error	%Error
ZERO	0.00	0.10	0.10	0.10
1	100.00	99.70	-0.30	-0.30
2	200.00	199.20	-0.80	-0.40
3	300.00	298.50	-1.50	-0.50
4	400.00	397.40	-2.60	-0.65
AVERAGE (%)				-0.35



Calibrated By

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

Approved By

(Mr.Sarayuth Jittranont)
Assistant General Manager

ALS Laboratory Group

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

JNAC
JIRANATE ASSOCIATES CO.,LTD.
63/14-15,67/35-36, Soi Petchkasem7,7/1, Petchkasem Rd,
Watthapra, Bangkokyai,Bangkok 10600 Thailand.
Tel.: (66) 02-8680812#13 Fax.: (66) 02-8680860 www.jiranatee.com

CERTIFICATE OF CALIBRATION

Certificate No: WS-02102021
Page 1 of 2 pages

REVIEW BY Narakom P.
APPROVED BY
NEXT CAL. DATE 8/4/23

Measurement Item : Cup anemometer with data logger.

Manufacturer
: Data logger: Novalynx.
: Cup anemometer: Novalynx.

Model/Type
: Data logger: 200-WS-25LB
: Cup anemometer: WS-02P

Serial Number
: Data logger: A5380
: Cup anemometer: -

ID No
: Data logger: BKK_FS0920
: Cup anemometer: -

Customer
: ALS laboratory group (Thailand) co., ltd.
: 104 Phatthanakan 40, Phatthanakan Rd, Khwaeng Suan Luang, Khet Suan Luang, Bangkok 10250 Thailand.

Test Conditions

: Wind tunnel cross test section area	900	cm^2
: Anemometer frontal area	100	cm^2
: Diameter of mounting pipe	-	mm
: Blockage ratio of test object	0.111	[-]

Test Conditions

: Air temperature	23.3	±0.8 °C
: Air pressure	1007.5	±0.4 hPa
: Relative air humidity	46.9	±3.6 %RH

Calibration Procedure
Calibration was carried out base on;
IEC 61400-12-1 ED.1: 2005-Power Performance Measurements of Electricity Producing Wind Turbines;
MEASNET Anemometer Calibration Procedure – Version 2: 2009;

Traceability
This calibration documents the traceable to national standard, Which realize the unit of measurements according to the international system of units (SI) through National Institute of Metrology Thailand (NIMT).

Measurement Date : Oct 08, 2021.
Issued Date : Oct 11, 2021.

Calibrated by
☑ Mr. Sorawit Thachalad
☐ Miss Orathai Wiwatwittaya

JNAC
JIRANATE ASSOCIATES CO., LTD.

Approved Signatory:
Mr. Parinya Boonchoroen
Technical Support
and Calibration Manager

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

63/14-15,67/35-36, Soi Petchkasem7,7/1, Petchkasem Rd,
Watthapra, Bangkokyai,Bangkok 10600 Thailand.
Tel.: (66) 02-8680812#13 Fax.: (66) 02-8680860 www.jiranatee.com

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_{STD} Reading m/s	V_{UUC*} Reading m/s	Error (m/s)	Uncertainty (%)
2.040	2.0	0.0	2.7
4.090	4.0	-0.1	1.3
5.97	6.0	0.0	0.99
8.02	8.0	0.0	0.98
10.01	10.1	0.1	1.2
12.01	12.1	0.1	0.65
14.00	14.2	0.2	0.69
15.99	16.2	0.2	1.1
14.98	15.2	0.2	0.72
13.00	13.1	0.1	0.94
11.02	11.0	0.0	1.1
9.01	9.0	0.0	0.88
7.01	7.0	0.0	1.1
5.083	5.1	0.0	0.98
2.984	3.0	0.0	1.7
1.007	0.8	-0.2	4.6

UUC*: Unit Under Calibration

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

Appendix 1: Instrumentations

NO	Sensor	Manufacturer	Model/Type	Calibration Date	Certificate Report Number	Range
1	Pitot static	TESTO INC.	06352145	Aug 07, 2021	MW-0034-21	5 – 30 m/s
2	Precision Differential Pressure Meter	Zoglab	DPM2500	Aug 07, 2021	MW-0034-21	5 – 30 m/s
3	Air velocity transducer (hot wire)	TSI INC.	8455-12	Aug 08, 2021	MW-0035-21	0 - 5 m/s
4	Temperature	Zoglab	DSR-THP	March 30, 2021	CL-027-64	-30 - 70°C
5	Relative humidity	Zoglab	DSR-THP	March 30, 2021	RH-03032021	0 – 100 %RH
6	Atmospheric pressure	Zoglab	DSR-THP	March 30, 2021	BP-01032021	500 – 1100 hPa
7	Wind tunnel	ESSOM	MP330D	-	-	0 – 50 Hz

End of certificate of calibration

JIRANATE ASSOCIATES CO., LTD.

63/14-15,67/35-36, Soi Petchkasem7,7/1, Petchkasem Rd,
Watthapra, Bangkokyai,Bangkok 10600 Thailand.
Tel.: (66) 02-8680812#13 Fax.: (66) 02-8680860 www.jiranatee.com

CERTIFICATE OF CALIBRATION

Measurement Item : Wind direction sensor with data logger.

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

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

Serial Number : Data logger: A5380
: Wind direction sensor: -

ID No : Data logger: BKK_FS0920
: Wind direction sensor: -

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 (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 line 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.: CC563-07-0045, Certificate No.: KWS64/0025.

Measurement Date : Oct 08, 2021.
Issued Date : Oct 11, 2021.

Performed by
☑ Mr. Sorawit Thachalad
☐ Miss Orathai Wiwatwittaya

JIRANATE ASSOCIATES CO., LTD.

Approved Signatory:

Mr. Parinya Booncharoen.
Technical Support
and Calibration Manager

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Tel.: (66) 02-8680812#13 Fax.: (66) 02-8680860 www.jiranatee.com

Continuation of Certificate of Calibration Number

Certificate No: WD-02102021

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

NO	Turning Direction	Nominal Angle (°)	Standard Reading (°)	UUC* Reading (°)	Error (°)	Uncertainty ±(°)
1	Clockwise	0/360	360	359	-1	3.0
2		45	45	42	-3	3.0
3		90	90	87	-3	3.0
4		135	135	132	-3	3.0
5		180	180	179	-1	3.0
6		225	225	226	1	3.0
7		270	270	272	2	3.0
8		315	315	318	3	3.0
9	Counter Clockwise	0/360	360	359	-1	3.0
10		45	45	42	-3	3.0
11		90	90	87	-3	3.0
12		135	135	132	-3	3.0
13		180	180	179	-1	3.0
14		225	225	226	1	3.0
15		270	270	272	2	3.0
16		315	315	318	3	3.0

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 of Calibration

JIRANATE ASSOCIATES CO., LTD.

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Watthapra, Bangkokyai,Bangkok 10600 Thailand.
Tel.: (66) 02-8680812#13 Fax.: (66) 02-8680860 www.jiranatee.com

CERTIFICATE OF CALIBRATION

Certificate No.: WD-01112021

Measurement Item : Wind direction sensor with data logger.

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

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

Serial Number : Data logger: A5377
: Wind direction sensor: -

ID No : Data logger: BKK_FS0917
: Wind direction sensor: -

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

REVIEW BY Wanakorn P.
APPROVED BY
NEXT CAL. DATE 2/6/23

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 line 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.: KWS64/0025.

Measurement Date : Nov 01, 2021.
Issued Date : Nov 01, 2021.

Performed by
☑ Mr. Sorawit Thachalad
☐ Miss Orathai Wiwatwittaya

JIRANATE ASSOCIATES CO., LTD.

Approved Signatory:
Mr. Parinya Booncharoen.
Calibration Department Manager

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Watthapra, Bangkokyai,Bangkok 10600 Thailand.
Tel.: (66) 02-8680812#13 Fax.: (66) 02-8680860 www.jiranatee.com

Continuation of Certificate of Calibration Number

Certificate No: WD-01112021

Result of calibration: ☐ Without adjustment ☑ With adjustment.

Calibration in the range of 0 - 360 ° at a calibration interval of 45°.

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

NO	Turning Direction	Nominal Angle (°)	Standard Reading (°)	UUC* Reading (°)	Error (°)	Uncertainty ±(°)
1	Clockwise	0/360	360	359	-1	3.0
2		45	45	41	-4	3.0
3		90	90	87	-3	3.0
4		135	135	135	0	3.0
5		180	180	183	3	3.0
6		225	225	229	4	3.0
7		270	270	274	4	3.0
8		315	315	320	5	3.0
9	Counter Clockwise	0/360	360	359	-1	3.0
10		45	45	41	-4	3.0
11		90	90	87	-3	3.0
12		135	135	135	0	3.0
13		180	180	183	3	3.0
14		225	225	229	4	3.0
15		270	270	274	4	3.0
16		315	315	320	5	3.0

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 of Calibration

JIRANATE ASSOCIATES CO., LTD.

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Watthapra, Bangkokyai,Bangkok 10600 Thailand.
Tel.: (66) 02-8680812#13 Fax.: (66) 02-8680860 www.jiranatee.com

CERTIFICATE OF CALIBRATION

Certificate No: WS-01112021

Measurement Item	: Cup anemometer with data logger.
Manufacturer	: Data logger: Novalynx. : Cup anemometer: Novalynx.
Model/Type	: Data logger: 200-WS-25LB : Cup anemometer: WS-02F
Serial Number	: Data logger: A5377 : Cup anemometer: -
ID No	: Data logger: BKK_FS0917 : Cup anemometer: -
Customer	: ALS laboratory group (Thailand) co., ltd. : 104 Phatthanakan 40, Phatthanakan Rd, Khwaeng Suan Luang, Khet Suan Luang, Bangkok 10250 Thailand.
Test Conditions	: Wind tunnel cross test section area 900 cm^2 : Anemometer frontal area 100 cm^2 : Diameter of mounting pipe - mm : Blockage ratio of test object 0.111 [-]
Test Conditions	: Air temperature 25.4 ±0.8 °C : Air pressure 1015.1 ±0.4 hPa : Relative air humidity 47.9 ±3.5 %RH
Calibration Procedure	Calibration was carried out base on; IEC 61400-12-1 ED.1: 2005-Power Performance Measurements of Electricity Producing Wind Turbines; MEASNET Anemometer Calibration Procedure – Version 2: 2009;
Traceability	This calibration documents the traceable to national standard, Which realize the unit of measurements according to the International system of units (SI) through National Institute of Metrology Thailand (NIMT).
Measurement Date	: Nov 01, 2021.
Issued Date	: Nov 01, 2021.

Calibrated by

☑ Mr. Sorawit Thachatad

☐ Miss Orathai Wiwetwittaya

JIRANATE ASSOCIATES CO., LTD.

Approved Signatory: .....

Mr. Parinya Boonchoroen

Calibration Department Manager

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Watthapra, Bangkokyai,Bangkok 10600 Thailand.
Tel.: (66) 02-8680812#13 Fax.: (66) 02-8680860 www.jiranatee.com

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_{STD} Reading m/s	V_{UUC^*} Reading m/s	Error (m/s)	Uncertainty (%)
1.994	1.9	-0.1	2.5
4.002	4.0	0.0	1.2
6.00	6.0	0.0	0.95
8.02	8.0	0.0	0.73
10.01	10.1	0.1	0.63
12.00	12.1	0.1	0.74
13.99	14.1	0.1	0.76
16.01	16.3	0.3	0.80
15.01	15.3	0.3	0.64
13.00	13.1	0.1	0.45
11.01	11.1	0.1	0.57
9.02	9.0	0.0	0.64
7.02	7.0	0.0	0.98
4.992	5.0	0.0	1.2
2.980	2.9	-0.1	1.5
0.996	0.9	-0.1	4.6

UUC*: Unit Under Calibration

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

Appendix 1: Instrumentations

NO	Sensor	Manufacturer	Model/Type	Calibration Date	Certificate Report Number	Range
1	Pitot static	TESTO INC.	06352145	Aug 07, 2021	MW-0034-21	5 - 30 m/s
2	Precision Differential Pressure Meter	Zoglab	DPM2500	Aug 07, 2021	MW-0034-21	5 - 30 m/s
3	Air velocity transducer (hot wire)	TSI INC.	8455-12	Aug 08, 2021	MW-0035-21	0 - 5 m/s
4	Temperature	Zoglab	DSR-THP	March 30, 2021	CL-027-64	-30 - 70°C
5	Relative humidity	Zoglab	DSR-THP	March 30, 2021	RH-03032021	0 - 100 %RH
6	Atmospheric pressure	Zoglab	DSR-THP	March 30, 2021	BP-01032021	500 - 1100 hPa
7	Wind tunnel	CSSOM	MP330D	-	-	0 - 50 Hz

End of certificate of calibration

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Watthapra, Bangkokyai,Bangkok 10600 Thailand.
Tel.: (66) 02-8680812#13 Fax.: (66) 02-8680860 www.jiranatee.com

CERTIFICATE OF CALIBRATION

REVIEW BY .....
APPROVED BY .....
NEXT CAL. DATE 28/2/23

Measurement Item : Cup anemometer with data logger.

Manufacturer : Data logger: Novalynx.
: Cup anemometer: Novalynx.

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

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

ID No : Data logger: BKK_FS0918.
: Cup anemometer: -.

Customer : ALS laboratory group (Thailand) co., ltd.
: 104 Phatthanakan 40, Phatthanakan Rd, Khwaeng Suan Luang, Khet Suan Luang, Bangkok 10250 Thailand.

Test Conditions

: Wind tunnel cross test section area	900	cm^2
: Anemometer frontal area	100	cm^2
: Diameter of mounting pipe	-	mm
: Blockage ratio of test object	0.111	[-]

Test Conditions

: Air temperature	22.6	±0.8 °C
: Air pressure	1009.6	±0.4 hPa
: Relative air humidity	50.4	±3.5 %RH

Calibration Procedure: Calibration was carried out base on;
IEC 61400-12-1 ED.1: 2005-Power Performance Measurements of Electricity Producing Wind Turbines;
MEASNET Anemometer Calibration Procedure – Version 2: 2009;

Traceability: This calibration documents the traceable to national standard, Which realize the unit of measurements according to the International system of units (SI) through National Institute of Metrology Thailand (NIMT).

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

Calibrated by
☑ Mr. Sorawit Thachalad
☐ Miss Orathai Wiwatwittaya

JIRANATE ASSOCIATES CO., LTD.

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

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Watthapra, Bangkokyai,Bangkok 10600 Thailand.
Tel.: (66) 02-8680812#13 Fax.: (66) 02-8680860 www.jiranatee.com

Continuation of Certificate of Calibration Number

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_{STD} Reading m/s	V_{UUC*} Reading m/s	Error (m/s)	Uncertainty (%)
2.021	1.8	-0.2	2.9
4.074	3.9	-0.2	1.6
5.98	6.0	0.0	0.99
8.03	8.0	0.0	0.84
10.03	10.2	0.2	0.66
11.99	12.3	0.3	0.95
13.98	14.4	0.4	0.47
16.00	16.6	0.6	0.48
15.02	15.5	0.5	0.69
12.98	13.4	0.4	0.67
10.99	11.2	0.2	0.69
8.97	9.0	0.0	0.97
7.01	7.0	0.0	0.90
5.085	5.0	-0.1	0.96
2.970	3.0	0.0	1.7
1.019	0.7	-0.3	5.4

UUC*: Unit Under Calibration

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

Appendix 1: Instrumentations

NO	Sensor	Manufacturer	Model/Type	Calibration Date	Certificate Report Number	Range
1	Pitot static	TESTO INC.	06352145	Aug 07, 2021	MW-0034-21	5 – 30 m/s
2	Precision Differential Pressure Meter	Zoglab	DPM2500	Aug 07, 2021	MW-0034-21	5 – 30 m/s
3	Air velocity transducer (hot wire)	TSI INC.	8455-12	Aug 08, 2021	MW-0035-21	0 - 5 m/s
4	Temperature	Zoglab	DSR-THP	March 30, 2021	CL-027-64	-30 - 70°C
5	Relative humidity	Zoglab	DSR-THP	March 30, 2021	RH-03032021	0 – 100 %RH
6	Atmospheric pressure	Zoglab	DSR-THP	March 30, 2021	BP-01032021	500 – 1100 hPa
7	Wind tunnel	ESSOM	MP3300	-	-	0 – 50 Hz

End of certificate of calibration

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Tel.: (66) 02-8680812#13 Fax.: (66) 02-8680860 www.jiranatee.com

CERTIFICATE OF CALIBRATION

Measurement Item : Wind direction sensor with data logger.

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

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

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

ID No : Data logger: BKK_FS0918.
: Wind direction sensor: -.

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 (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 line 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.: CC563-07-0045, Certificate No.: KWS63/0044.

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

Performed by
☑ Mr. Sorawit Thachalad
☐ Miss Orathai Wiwatwittaya

JNAC JIRANATE ASSOCIATES CO.,LTD.

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

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Tel.: (66) 02-8680812#13 Fax.: (66) 02-8680860 www.jiranatee.com

Continuation of Certificate of Calibration Number

Certificate No: WD-07082021

Result of calibration: ☐ Without adjustment ☑ With adjustment.

Calibration in the range of 0 – 360 ° at a calibration interval of 45°.

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

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

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

End of Certificate of Calibration

JIRANATE ASSOCIATES CO., LTD.

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CERTIFICATE OF CALIBRATION

Certificate No: WS-09082021

REVIEW BY .....
APPROVED BY .....
NEXT CAL. DATE 28/2/23

Measurement Item : Cup anemometer with data logger.

Manufacturer : Data logger: Novalynx.
: Cup anemometer: Novalynx.

Model/Type : Data logger: 200-WS-26LB.
: Cup anemometer: WS-02F.

Serial Number : Data logger: A5379.
: Cup anemometer: -.

ID No : Data logger: BKK_FS0919.
: Cup anemometer: -.

Customer : ALS laboratory group (Thailand) co., ltd.
: 104 Phatthanakan 40, Phatthanakan Rd, Khwaeng Suan Luang, Khet Suan Luang, Bangkok 10250 Thailand.

Test Conditions

: Wind tunnel cross test section area	900	cm^2
: Anemometer frontal area	100	cm^2
: Diameter of mounting pipe	-	mm
: Blockage ratio of test object	0.111	[-]

Test Conditions

: Air temperature	22.7	±0.8 °C
: Air pressure	1008.3	±0.4 hPa
: Relative air humidity	45.8	±3.6 %RH

Calibration Procedure Calibration was carried out base on;
IEC 61400-12-1 ED.1: 2005-Power Performance Measurements of Electricity Producing Wind Turbines;
MEASNET Anemometer Calibration Procedure – Version 2: 2009;

Traceability This calibration documents the traceable to national standard, Which realize the unit of measurements according to the international system of units (SI) through National Institute of Metrology Thailand (NIMT).

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

Calibrated by
☑ Mr. Sorawit Thachalad
☐ Miss Orathai Wiwatwittaya

JIRANATE ASSOCIATES CO., LTD.

Approved Signatory: .....
Mr. Parinya Booncharoen
Technical Support
and Calibration Meneger

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Tel.: (66) 02-8680812#13 Fax.: (66) 02-8680860 www.jiranatee.com

Continuation of Certificate of Calibration Number

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_{STD} Reading m/s	V_{UUC*} Reading m/s	Error (m/s)	Uncertainty (%)
2.060	2.0	-0.1	2.7
4.064	4.1	0.0	1.3
5.99	6.0	0.0	0.98
8.00	8.0	0.0	0.74
10.01	10.2	0.2	0.66
11.98	12.3	0.3	0.48
14.03	14.4	0.4	0.47
15.98	16.6	0.6	0.39
15.00	15.4	0.4	0.51
12.98	13.4	0.4	0.55
10.99	11.2	0.2	0.53
8.97	9.0	0.0	0.65
6.97	7.0	0.0	0.84
5.062	5.1	0.0	0.93
2.972	3.1	0.1	1.6
1.021	0.9	-0.1	5.3

UUC*: Unit Under Calibration

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

Appendix 1: Instrumentations

NO	Sensor	Manufacturer	Model/Type	Calibration Date	Certificate Report Number	Range
1	Pitot static	TESTO INC.	06352145	Aug 07, 2021	MW-0034-21	5 – 30 m/s
2	Precision Differential Pressure Meter	Zoglab	DPM2500	Aug 07, 2021	MW-0034-21	5 – 30 m/s
3	Air velocity transducer (hot wire)	TSI INC.	8455-12	Aug 08, 2021	MW-0035-21	0 – 5 m/s
4	Temperature	Zoglab	DSR-THP	March 30, 2021	CL-027-64	-30 – 70°C
5	Relative humidity	Zoglab	DSR-THP	March 30, 2021	RH-03032021	0 – 100 %RH
6	Atmospheric pressure	Zoglab	DSR-THP	March 30, 2021	BP-01032021	500 – 1100 hPa
7	Wind tunnel	CSSOM	MP330D	-	-	0 – 50 Hz

End of certificate of calibration

JIRANATE ASSOCIATES CO., LTD.

63/14-15,67/35-36, Soi Petchkasem7,7/1, Petchkasem Rd,
Watthapra, Bangkokyai,Bangkok 10600 Thailand.
Tel.: (66) 02-8680812#13 Fax.: (66) 02-8680860 www.jiranatee.com

CERTIFICATE OF CALIBRATION

Measurement Item : Wind direction sensor with data logger.

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

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

Serial Number : Data logger: A5379.
: Wind direction sensor: -.

ID No : Data logger: BKK_FS0919.
: Wind direction sensor: -.

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 (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 line 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.: CC563-07-0045, Certificate No.: KWS63/0044.

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

Performed by
☑ Mr. Sorawit Thachalad
☐ Miss Orathai Wiwatwittaya

JIRANATE ASSOCIATES CO., LTD.

Approved Signatory.....

Mr. Parinya Booncharoen.
Technical Support
and Calibration Manager

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

63/14-15,67/35-36, Soi Petchkasem7,7/1, Petchkasem Rd,
Watthapra, Bangkokyai,Bangkok 10600 Thailand.
Tel.: (66) 02-8680812#13 Fax.: (66) 02-8680860 www.jiranatee.com

Continuation of Certificate of Calibration Number

Certificate No: WD-08082021

Result of calibration: ☐ Without adjustment ☑ With adjustment.

Calibration in the range of 0 – 360 ° at a calibration interval of 45°.

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

NO	Turning Direction	Nominal Angle (°)	Standard Reading (°)	UUC* Reading (°)	Error (°)	Uncertainty ±(°)
1	Clockwise	0/360	360	359	-1	3.0
2		45	45	41	-4	3.0
3		90	90	86	-4	3.0
4		135	135	133	-2	3.0
5		180	180	178	-2	3.0
6		225	225	227	2	3.0
7		270	270	273	3	3.0
8		315	315	318	3	3.0
9	Counter Clockwise	0/360	360	359	-1	3.0
10		45	45	41	-4	3.0
11		90	90	86	-4	3.0
12		135	135	133	-2	3.0
13		180	180	178	-2	3.0
14		225	225	227	2	3.0
15		270	270	273	3	3.0
16		315	315	318	3	3.0

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 of Calibration

JNAC JIRANATE ASSOCIATES CO.,LTD.

ELECTRICAL AND ELECTRONICS INSTITUTE
FOUNDATION FOR INDUSTRIAL DEVELOPMENT
975 Moo 4, Bangpoo Industrial Estate, Soi 8, Sukhumvit Road km 37,
Phraek Sa, Mueang Samut Prakan, Samut Prakan 10280
Tel: +66 2709 4860-8 Fax: +66 2324 0917-8

NSC-TISI-TIS 17025 CALIBRATION 0119

Certificate No.: 0146SV21
Operation No.: CP2021030033

Certificate of Calibration

Equipment:	Sound Calibrator
Manufacturer:	RION
Model/Type:	NC-74
Serial No.:	34178117
ID No.:	BKK_FS0630
Customer:	ALS Labolatory Group (Thailand) Co.,Ltd.
Address:	104 Phatthanakan 40, Phatthanakan Rd., Khwaeng Phatthanakan Khet Suan Luang, Bangkok 10250 Thailand
Received Date:	19 March 2021
Calibrated Date:	24 March 2021
Issued Date:	25 March 2021
Calibrated by:	Ms. Juntaporn Kunhakom

REVIEW BY Wanlem P.
APPROVED BY
NEXT CAL. DATE 24/3/22

Approved by: (Mr. Sittichai Swaksuriyawong)
Group Manager

The reported uncertainty of measurement was based on standard uncertainty multiplied by a coverage factor $k = 2.00$, providing a level of confidence of approximately 95%. This certificate may not be reproduced other than in full except with the prior written approval of the Electrical and Electronics Institute, Foundation for Industrial Development.

F-CAL-004 Ed.0

Certificate No.: 0146SV21

Calibration Report

Equipment: Sound Calibrator
Manufacturer: RION
Model/Type: NC-74
Serial No.: 34178117
ID No.: BKK_FS0630
Ambient Temperature: (23 ± 2) °C
Relative Humidity: (50 ± 15) %
Pressure: (101.3 ± 1.5) kPa
Method of Calibration :-
IEC 60942:2017

Condition of this result of calibration

1. Reference standards instrument :-

Instrument	Model	Serial No.	Cert. No.	Due Date
1) Standard microphone	4180	2661000	AA-1013-20	12 May 2021
2) Waveform Generator	33511B	MY52302264	0100RF20	17 June 2021
3) Audio Analyzing DMM	2015-P	000136E	E1U203927	16 November 2021
4) Pressure humidity and Temperature Transmitter	PTU301	F0640002	CL1-P200051 0305TE20	31 May 2021 29 June 2021

2. This result of calibration was found accurate as shown on date and place of calibration only.
3. This certification is traceable to the international system of unit maintained at :-
   Reference standards instrument for Acoustic function
   - National Institute of Metrology (Thailand)
   Reference standards instrument for Electrical function
   - Electrical and Electronics Institute; ONSC Accredited Calibration No.0119

Result of Calibration:-

1. Function : Sound pressure level

Norminal Frequency (Hz)	Specified Sound Pressure level (dB)	Measured value (dB)	Deviated value[1] (dB)	Acceptance limit[3] (dB)
1000	94	94.10	0.10	±0.25

2. Function : Frequency

Norminal Sound Pressure level (dB)	Specified Frequency (Hz)	Measured value (Hz)	Deviated value[2] (%)	Acceptance limit[3] (%)
94	1000	1001.7	0.2	±.0.7

Certificate No.: 0146SV21

Calibration Report

3. Function : Total distortion + noise

Norminal Sound Pressure level (dB)	Norminal Frequency (Hz)	Measured value[4] (%)	Acceptance limit[5] (%)
94	1000	3.0	2.5

Uncertainty of measurement

Function	Uncertainty	Maximum-permitted uncertainty of measurement
Sound pressure level	0.10 dB	0.15 dB
Frequency	0.10 %	0.20 %
Total distortion + noise	0.40 %	0.50 %

Note: [1] The deviated value is the absolube valule of the difference between the measured value and the corresponding specified sound pressure level.
[2] The deviated value is the absolube valule of the difference in percent between the measured value and the corresponding specified frequency.
[3] The acceptance limit is for the deviated value.
[4] The measured value is the total distortion + noise, measured over the frequency range from 20 Hz to 20 kHz.
[5] The acceptance limit is for the Measured value.

Remarks: 1. Using the 1/2-inch microphone adaptor NC-74-002.
2. Acceptance limit was IEC 60942:2017 Class 1.

- - End of Report - -

SITHIPORN ASSOCIATES CO.,LTD.
CALIBRATION LABORATORY

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

NSC-TISI-TIS 17025
CALIBRATION 0394

Calibration Certificate

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

Condition As Found : GOOD

Customer : ALS LABORATORY GROUP (THAILAND) CO., LTD.
104 PHATTHANAKAN 40, PHATTHANAKAN ROAD,
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) %

REVIEW BY Wanakorn P.
APPROVED BY
NEXT CAL. DATE 14/12/22

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

Calibrated by : Nathakorn Pisutpaisan

Approved by :

(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.

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-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).

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

T. Petch.

Result of calibration :

1. Absolute sensitivity

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

2. Self-generated noise

2.1 Normal test

Measured Value (dB)
15.1

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

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

3. Acoustical signal tests of frequency weightings

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

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)			
	Flat	C-weight	A-weight	Acceptance Limits
125	0.2	0.2	0.2	± 1.5
1000	0.1	0.0	0.0	± 1.0
8000	1.9	2.0	2.0	±5.0

T. Petch.

4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)			
	Flat	C-weight	A-weight	Acceptance Limits
63	0.0	-0.2	-0.1	±2.0
125	0.0	0.0	-0.1	±1.5
250	0.0	0.0	-0.1	±1.5
500	0.0	0.0	-0.1	±1.5
1000	0.0	0.0	0.0	±1.0
2000	0.0	0.0	0.0	±2.0
4000	0.1	0.0	0.0	±3.0
8000	0.1	0.0	0.0	±5.0

5. Frequency and time weightings at 1 kHz

5.1 Frequency weightings at 1 kHz

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

5.2 Time weighting at 1 kHz

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

6. Long - term stability

Frequency Weighting	SLM Display at initial (dB)	SLM Display at final (dB)	Deviated Value (dB)	Acceptance Limits (dB)
A - weight	93.9	94.0	0.1	± 0.3

T. Petch.

7. Level linearity on the reference level range

Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
137.0	137.0	0.0	± 1.1
136.0	136.1	0.1	± 1.1
135.0	135.1	0.1	± 1.1
134.0	134.1	0.1	± 1.1
133.0	133.0	0.0	± 1.1
132.0	132.0	0.0	± 1.1
131.0	131.0	0.0	± 1.1
129.0	129.0	0.0	± 1.1
124.0	124.0	0.0	± 1.1
119.0	119.1	0.1	± 1.1
114.0	114.1	0.1	± 1.1
109.0	109.1	0.1	± 1.1
104.0	104.1	0.1	± 1.1
99.0	99.0	0.0	± 1.1
94.0	94.0	0.0	± 1.1
89.0	89.0	0.0	± 1.1
84.0	84.0	0.0	± 1.1
79.0	79.0	0.0	± 1.1
74.0	74.0	0.0	± 1.1
69.0	69.0	0.0	± 1.1
64.0	64.0	0.0	± 1.1
59.0	59.0	0.0	± 1.1
54.0	54.0	0.0	± 1.1
49.0	49.0	0.0	± 1.1
44.0	44.0	0.0	± 1.1
39.0	39.0	0.0	± 1.1
34.0	34.0	0.0	± 1.1
30.0	29.9	-0.1	± 1.1
29.0	28.9	-0.1	± 1.1
28.0	27.9	-0.1	± 1.1
27.0	26.9	-0.1	± 1.1
26.0	25.9	-0.1	± 1.1
25.0	24.9	-0.1	± 1.1

T. Petch.

8. Level linearity including the level range control

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

9. Tone burst response

Time Weighting	Tone burst duration, Tb (ms)	Cycle	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Fast	0.25	1	108.0	107.9	-0.1	1.5 ; -5.0
	2	8	117.0	116.9	-0.1	1.0 ; -2.5
	200	800	134.0	134.0	0.0	±1.0
Slow	2	8	108.0	108.0	0.0	1.5 ; -5.0
	200	800	127.6	127.6	0.0	±1.0
SEL	0.25	1	99.0	98.8	-0.2	1.5 ; -5.0
	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, Lcpeak (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.0	0.0	-
One	136.4	136.4	0.0	±3.0

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

T. Petch.

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 lavel of confidence of approximately 95 %

End of Calibration Certificate

T. Petch.

SITHIPORN ASSOCIATES CO.,LTD.
CALIBRATION LABORATORY

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

NSC-TISI-TIS 17025
CALIBRATION 0394

Calibration Certificate

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

Condition As Found : GOOD

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

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

REVIEW BY .....
APPROVED BY .....
NEXT CAL. DATE 7/7/22

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

Calibrated by : Nathakorn Pisutpaisan

Approved by :
(Thanakul Petchurai)

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.

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	33461A	MY53220116	EEL.BP. 04/0264	10-Feb-22
Programmable Attenuator	MAT-1070	62100114	1500-07774E	08-Mar-22
Condenser Microphone	4180	2977900	AA-1008-21	05-Feb-22
Measuring Amplifier	NA-42KAI	34560495	AA-3003-21	16-Feb-22

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).

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

Result of calibration :

1. Absolute sensitivity

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

2. Self-generated noise

2.1 Normal test

Measured Value (dB)
13.4

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

Frequency Weighting	Measured value (dB)
A - weight	11.6
C - weight	18.4
Flat	23.8

3. Acoustical signal tests of frequency weightings

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

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

4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

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

5. Frequency and time weightings at 1 kHz

5.1 Frequency weightings at 1 kHz

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

5.2 Time weighting at 1 kHz

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

6. Long - term stability

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

T. Potah.

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

T. Potah.

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, Lcpeak (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

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 lavel of confidence of approximately 95 %

End of Calibration Certificate

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CALIBRATION LABORATORY

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NSC-TISI-TIS 17025
CALIBRATION 0394

Calibration Certificate

Equipment : SOUND LEVEL METER
Manufacturer : RION
Model : NL-42/ Microphone UC-52 / Preamplifier NH-24
Serial No.: 00858525 / 158776 / 58777
ID No.: BKK_FS0115

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) %

REVIEW BY Nonakorn P.
APPROVED BY
NEXT CAL. DATE 14/12/22

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

Calibrated by : Nathakorn Pisutpaisan

Approved by :

(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.

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-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).

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

T. Petch.

Result of calibration :

1. Absolute sensitivity

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

2. Self-generated noise

2.1 Normal test

Measured Value (dB)
13.4

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

Frequency Weighting	Measured value (dB)
A - weight	11.6
C - weight	17.8
Flat	23.2

3. Acoustical signal tests of frequency weightings

Meter free-field acoustic response at a level of 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	-0.1	-0.1	-0.1	± 1.0
8000	-2.8	-2.7	-2.7	±5.0

T. Petch.

4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

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

5. Frequency and time weightings at 1 kHz

5.1 Frequency weightings at 1 kHz

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

5.2 Time weighting at 1 kHz

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

6. Long - term stability

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

T. Petch.

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

T. Petch.

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, Lcpeak (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

T. Petch.

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 lavel of confidence of approximately 95 %

End of Calibration Certificate

T. Petch.

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NSC-TISI-TIS 17025
CALIBRATION 0394

Calibration Certificate

Equipment : SOUND CALIBRATOR
Manufacturer : RION
Model : NC-74
Serial No.: 34178118
ID No.: BKK_FS0631

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) %

REVIEW BY Aranakorn P.
APPROVED BY
NEXT CAL. DATE 26/10/22

Received Date : 08 OCTOBER 2021
Calibration Date : 26 OCTOBER 2021
Date of Issue : 26 OCTOBER 2021

Calibrated by : Nathakorn Pisutpaisan

Approved by :
(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.

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	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
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).

Result of calibration :

1. Sound pressure level

Specified sound pressure level (dB)	Measured value (dB)	Deviated value (dB)	Uncertainty (dB)	Tolerance limit (dB)
94	94.15	0.15	0.14	0.40

2. Frequency

Specified Frequency (Hz)	Measured value (Hz)	Deviated value (%)	Uncertainty (%)	Tolerance limit (%)
1000	1001.6	0.2	0.1	1.0

3. Total distortion

Measured value (%)	Uncertainty (%)	Tolerance limit (%)
1.76	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 lavel of confidence of approximately 95 %

End of Calibration Certificate

T. Petch...

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CALIBRATION LABORATORY

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NSC-TISI-TIS 17025
CALIBRATION 0394

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_FS0875

Condition As Found : GOOD

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

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

REVIEW BY Nanakorn P.
APPROVED BY
NEXT CAL. DATE 2/11/22

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

Calibrated by : Nathakorn Pisutpaisan

Approved by : T. Petchurai.
(Thanakul Petchurai)

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.

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-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).

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

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 84 dB

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

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

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

T. Petch.

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, Lcpeak (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

T. Petch.

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 lavel of confidence of approximately 95 %

End of Calibration Certificate

T. Petch.

SITHIPORN ASSOCIATES CO.,LTD.
CALIBRATION LABORATORY

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

NSC-TISI-TIS 17025
CALIBRATION 0394

Calibration Certificate

Equipment : SOUND LEVEL METER
Manufacturer : RION
Model : NL-42/ Microphone UC-52 / Preamplifier NH-24
Serial No.: 00296511 / 179112 / 87520
ID No.: BKK_FS0968

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) %

REVIEW BY Nlorakorn P.
APPROVED BY
NEXT CAL. DATE 12/1/23

Received Date : 05 JANUARY 2022
Calibration Date : 12-14 JANUARY 2022
Date of Issue : 17 JANUARY 2022

Calibrated by : Nathakorn 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.

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	34461A	MY60024273	1-15180725251-1	15-Sep-22
Programmable Attenuator	MAT-1070	62100114	1500-07774E	08-Mar-22
Condenser Microphone	4180	2977900	AA-1008-21	05-Feb-22
Measuring Amplifier	NA-42KAI	34560495	AA-3003-21	16-Feb-22

2. This result of calibration was found accurate as shown on date and place of calibration for this calibrated item only.
3. This certificate is traceable to the international system of unit maintained at :
   3.1 National Institute of Metrology (Thailand).
   3.2 Thailand Institute of Scientific and Technological Research (TISTR).

T. Petch

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

T. Petch

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	12.6
C - weight	19.0
Flat	24.1

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	0.4	0.4	0.4	± 1.5
1000	0.0	0.0	0.0	± 1.0
8000	-1.2	-1.1	-1.1	±5.0

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	0.1	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

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	28.9	-0.1	± 1.1
28.0	28.0	0.0	± 1.1
27.0	26.9	-0.1	± 1.1
26.0	26.0	0.0	± 1.1
25.0	24.9	-0.1	± 1.1

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	128.1	0.1	±1.0

10. Peak C sound level

Number of cycle in test signal	Anticipated Value (dB)	Measured Value, Lcpeak (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.0	0.0	-
One	136.4	135.4	-1.0	±3.0

Number of cycle in test signal	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.0	0.0	-
Positive half cycle	135.4	135.2	-0.2	±2.0
Negative half cycle	135.4	135.2	-0.2	±2.0

11. Overload indication

Measured value (dB)		Deviated Value (dB)	Acceptance Limits (dB)
Positive one-half cycle	Negative one-half cycle		
89.7	89.6	-0.1	±1.5

12. High level stability

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

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

End of Calibration Certificate

T. Petch.

SITHIPORN ASSOCIATES CO.,LTD.
CALIBRATION LABORATORY

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

NSC-TISI-TIS 17025
CALIBRATION 0394

Cert. No. : ACL21094
Pages : 1 of 8

Calibration Certificate

Equipment : SOUND LEVEL METER
Manufacturer : RION
Model : NL-42/ Microphone UC-52 / Preamplifier NH-24
Serial No.: 00672737 / 170325 / 73077
ID No.: BKK_FS0927

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) %

REVIEW BY Nanakorn P.
APPROVED BY
NEXT CAL. DATE 4/8/9/22

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

Calibrated by : Nathakorn 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.

Calibration Procedure : CP-AC-01

Calibration Method :

This equipment was calibrated by based on IEC-61672-3 (2013) Standard for sound level meter (SLM).

The SLM had tests to Acoustical and Electrical signal tests of frequency weighting with Anechoic chamber and Reference Standard Instruments.

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

Condition of this result of calibration :

1. Reference Standard Instruments :

Instrument	Model	Serial No.	Cert. No.	Due Date
Waveform Generator	33210A	MY48017076	EF-0012-21	10-Feb-22
Waveform Generator	33511B	MY52302742	EF-0011-21	10-Feb-22
Digital Multimeter	33461A	MY53220104	EEL.BP. 05/0264	10-Feb-22
Digital Multimeter	8846A	1997025	EEL.BP. 06/0264	05-Feb-22
Digital Multimeter	33461A	MY53220116	EEL.BP. 04/0264	10-Feb-22
Programmable Attenuator	MAT-1070	62100114	1500-07774E	08-Mar-22
Condenser Microphone	4180	2977900	AA-1008-21	05-Feb-22
Measuring Amplifier	NA-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).

T. Petch.

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

T. Petch.

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	18.6
Flat	24.5

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	0.4	0.4	± 1.5
1000	0.0	0.0	0.0	± 1.0
8000	-0.3	-0.2	-0.2	±5.0

T. Petch.

4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

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

T. Petch.

7. Level linearity on the reference level range

Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
137.0	137.0	0.0	± 1.1
136.0	136.0	0.0	± 1.1
135.0	135.0	0.0	± 1.1
134.0	134.0	0.0	± 1.1
133.0	132.9	-0.1	± 1.1
132.0	131.9	-0.1	± 1.1
131.0	130.9	-0.1	± 1.1
129.0	129.0	0.0	± 1.1
124.0	124.0	0.0	± 1.1
119.0	119.0	0.0	± 1.1
114.0	114.0	0.0	± 1.1
109.0	109.0	0.0	± 1.1
104.0	104.0	0.0	± 1.1
99.0	99.0	0.0	± 1.1
94.0	94.0	0.0	± 1.1
89.0	89.0	0.0	± 1.1
84.0	84.0	0.0	± 1.1
79.0	79.0	0.0	± 1.1
74.0	74.0	0.0	± 1.1
69.0	69.0	0.0	± 1.1
64.0	64.0	0.0	± 1.1
59.0	59.0	0.0	± 1.1
54.0	54.0	0.0	± 1.1
49.0	49.0	0.0	± 1.1
44.0	44.0	0.0	± 1.1
39.0	39.0	0.0	± 1.1
34.0	34.0	0.0	± 1.1
30.0	30.0	0.0	± 1.1
29.0	29.0	0.0	± 1.1
28.0	28.0	0.0	± 1.1
27.0	27.0	0.0	± 1.1
26.0	26.0	0.0	± 1.1
25.0	25.0	0.0	± 1.1

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, Lcpeak (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

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 lavel of confidence of approximately 95 %

End of Calibration Certificate

T. Petch.

SITHIPORN ASSOCIATES CO.,LTD.
CALIBRATION LABORATORY

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

NSC-TISI-TIS 17025
CALIBRATION 0394

Cert. No. : ACL22043
Pages : 1 of 8

Calibration Certificate

Equipment : SOUND LEVEL METER
Manufacturer : RION
Model : NL-42/ Microphone UC-52 / Preamplifier NH-24
Serial No.: 00873053 / 171587 / 73329
ID No.: BKK_FS0930

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) %

REVIEW BY Narakon P.
APPROVED BY
NEXT CAL. DATE 12/1/23

Received Date : 05 JANUARY 2022
Calibration Date : 12-14 JANUARY 2022
Date of Issue : 17 JANUARY 2022

Calibrated by : Nathakorn 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.

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	34461A	MY60024273	1-15180725251-1	15-Sep-22
Programmable Attenuator	MAT-1070	62100114	1500-07774E	08-Mar-22
Condenser Microphone	4180	2977900	AA-1008-21	05-Feb-22
Measuring Amplifier	NA-42KAI	34560495	AA-3003-21	16-Feb-22

2. This result of calibration was found accurate as shown on date and place of calibration for this calibrated item only.
3. This certificate is traceable to the international system of unit maintained at :
   3.1 National Institute of Metrology (Thailand).
   3.2 Thailand Institute of Scientific and Technological Research (TISTR).

T. Petch..

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

T. Petch..

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	13.1
C - weight	19.4
Flat	24.7

3. Acoustical signal tests of frequency weightings

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

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

T. Rotch.

4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

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

5. Frequency and time weightings at 1 kHz

5.1 Frequency weightings at 1 kHz

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

5.2 Time weighting at 1 kHz

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

6. Long - term stability

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

T. Rotch.

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	69.1	0.1	± 1.1
64.0	64.0	0.0	± 1.1
59.0	59.1	0.1	± 1.1
54.0	54.0	0.0	± 1.1
49.0	49.0	0.0	± 1.1
44.0	44.0	0.0	± 1.1
39.0	39.0	0.0	± 1.1
34.0	34.0	0.0	± 1.1
30.0	30.0	0.0	± 1.1
29.0	29.0	0.0	± 1.1
28.0	28.0	0.0	± 1.1
27.0	27.0	0.0	± 1.1
26.0	25.9	-0.1	± 1.1
25.0	25.0	0.0	± 1.1

T. Petch.

8. Level linearity including the level range control

Range	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Auto	94.0	93.9	-0.1	±1.1

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, Lcpeak (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.0	0.0	-
One	136.4	136.3	-0.1	±3.0

Number of cycle in test signal	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.0	0.0	-
Positive half cycle	135.4	135.1	-0.3	±2.0
Negative half cycle	135.4	135.2	-0.2	±2.0

T. Petch.

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 lavel of confidence of approximately 95 %

End of Calibration Certificate

T. Petch

SITHIPORN ASSOCIATES CO.,LTD.
CALIBRATION LABORATORY

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

NSC-TISI-TIS 17025
CALIBRATION 0394

Cert. No. : ACL22036
Pages : 1 of 8

Calibration Certificate

Equipment : SOUND LEVEL METER
Manufacturer : RION
Model : NL-42/ Microphone UC-52 / Preamplifier NH-24
Serial No.: 00296512 / 179113 / 87521
ID No.: BKK_FS0969

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) %

REVIEW BY Nanakorn P.
APPROVED BY
NEXT CAL. DATE 12/1/23

Received Date : 05 JANUARY 2022
Calibration Date : 12-14 JANUARY 2022
Date of Issue : 17 JANUARY 2022

Calibrated by : Nathakorn 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.

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	34461A	MY60024273	1-15180725251-1	15-Sep-22
Programmable Attenuator	MAT-1070	62100114	1500-07774E	08-Mar-22
Condenser Microphone	4180	2977900	AA-1008-21	05-Feb-22
Measuring Amplifier	NA-42KAI	34560495	AA-3003-21	16-Feb-22

2. This result of calibration was found accurate as shown on date and place of calibration for this calibrated item only.
3. This certificate is traceable to the international system of unit maintained at :
   3.1 National Institute of Metrology (Thailand).
   3.2 Thailand Institute of Scientific and Technological Research (TISTR).

T. Rotch.

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

T. Rotch.

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	13.1
C - weight	19.1
Flat	24.6

3. Acoustical signal tests of frequency weightings

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

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

T. Petch.

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	0.1	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

T. Petch.

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	28.9	-0.1	± 1.1
28.0	27.9	-0.1	± 1.1
27.0	26.9	-0.1	± 1.1
26.0	26.0	0.0	± 1.1
25.0	24.9	-0.1	± 1.1

T. Petcha.

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	128.1	0.1	±1.0

10. Peak C sound level

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

Number of cycle in test signal	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.0	0.0	-
Positive half cycle	135.4	135.2	-0.2	±2.0
Negative half cycle	135.4	135.2	-0.2	±2.0

T. Petch.

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 lavel of confidence of approximately 95 %

End of Calibration Certificate

T. Petch.

SITHIPORN ASSOCIATES CO.,LTD.
CALIBRATION LABORATORY

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

NSC-TISI-TIS 17025
CALIBRATION 0394

Cert. No. : ACL21144
Pages : 1 of 8

Calibration Certificate

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

Condition As Found : GOOD

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

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

REVIEW BY Narakorn P.
APPROVED BY
NEXT CAL. DATE 2/11/22

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)

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.

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-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).

T. Petch.

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

T. Petch.

Result of calibration :

1. Absolute sensitivity

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

2. Self-generated noise

2.1 Normal test

Measured Value (dB)
15.7

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

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

3. Acoustical signal tests of frequency weightings

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

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)			
	Flat	C-weight	A-weight	Acceptance Limits
125	0.4	0.4	0.4	± 1.5
1000	0.0	0.0	0.0	± 1.0
8000	-1.0	-1.0	-0.9	±5.0

T. Petch.

4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

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

5. Frequency and time weightings at 1 kHz

5.1 Frequency weightings at 1 kHz

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

5.2 Time weighting at 1 kHz

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

6. Long - term stability

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

T. Petch.

7. Level linearity on the reference level range

Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
137.0	137.0	0.0	± 1.1
136.0	136.0	0.0	± 1.1
135.0	135.0	0.0	± 1.1
134.0	134.0	0.0	± 1.1
133.0	133.0	0.0	± 1.1
132.0	132.0	0.0	± 1.1
131.0	131.0	0.0	± 1.1
129.0	129.0	0.0	± 1.1
124.0	124.0	0.0	± 1.1
119.0	119.0	0.0	± 1.1
114.0	114.0	0.0	± 1.1
109.0	109.0	0.0	± 1.1
104.0	104.0	0.0	± 1.1
99.0	99.0	0.0	± 1.1
94.0	94.0	0.0	± 1.1
89.0	89.1	0.1	± 1.1
84.0	84.1	0.1	± 1.1
79.0	79.0	0.0	± 1.1
74.0	74.1	0.1	± 1.1
69.0	69.1	0.1	± 1.1
64.0	64.0	0.0	± 1.1
59.0	59.1	0.1	± 1.1
54.0	54.0	0.0	± 1.1
49.0	49.0	0.0	± 1.1
44.0	44.0	0.0	± 1.1
39.0	39.0	0.0	± 1.1
34.0	34.0	0.0	± 1.1
30.0	30.0	0.0	± 1.1
29.0	29.0	0.0	± 1.1
28.0	28.0	0.0	± 1.1
27.0	27.0	0.0	± 1.1
26.0	26.0	0.0	± 1.1
25.0	24.9	-0.1	± 1.1

T. Peter.

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, Lcpeak (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.0	0.0	-
One	136.4	136.1	-0.3	±3.0

Number of cycle in test signal	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.0	0.0	-
Positive half cycle	135.4	135.1	-0.3	±2.0
Negative half cycle	135.4	135.2	-0.2	±2.0

T. Peter.

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 lavel of confidence of approximately 95 %

End of Calibration Certificate

T. Petch-

SITHIPORN ASSOCIATES CO.,LTD.
CALIBRATION LABORATORY

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

NSC-TISI-TIS 17025
CALIBRATION 0394

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) %

REVIEW BY Narakorn P.
APPROVED BY
NEXT CAL. DATE 12/1/23

Received Date : 05 JANUARY 2022
Calibration Date : 12-14 JANUARY 2022
Date of Issue : 17 JANUARY 2022

Calibrated by : Nathakorn 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.

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	34461A	MY60024273	1-15180725251-1	15-Sep-22
Programmable Attenuator	MAT-1070	62100114	1500-07774E	08-Mar-22
Condenser Microphone	4180	2977900	AA-1008-21	05-Feb-22
Measuring Amplifier	NA-42KAI	34560495	AA-3003-21	16-Feb-22

2. This result of calibration was found accurate as shown on date and place of calibration for this calibrated item only.
3. This certificate is traceable to the international system of unit maintained at :
   3.1 National Institute of Metrology (Thailand).
   3.2 Thailand Institute of Scientific and Technological Research (TISTR).

T. Petch.

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

T. Petch.

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	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

T. Petch.

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

T. Petch.

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

T. Petch.

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, Lcpeak (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

T. Petch.

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 lavel of confidence of approximately 95 %

End of Calibration Certificate

SITHIPORN ASSOCIATES CO.,LTD.
CALIBRATION LABORATORY

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

NSC-TISI-TIS 17025
CALIBRATION 0394

Cert. No. : ACL21123
Pages : 1 of 8

Calibration Certificate

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

Condition As Found : GOOD

Customer : ALS LABORATORY GROUP (THAILAND) CO., LTD.
104 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) %

REVIEW BY Manakorn P.
APPROVED BY
NEXT CAL. DATE 12/10/22

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

Calibrated by : Nathakorn Pisutpaisan

Approved by :

(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.

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-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).

T. Petch.

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

T. Petch.

Result of calibration :

1. Absolute sensitivity

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

2. Self-generated noise

2.1 Normal test

Measured Value (dB)
17.2

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

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

3. Acoustical signal tests of frequency weightings

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

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)			
	Flat	C-weight	A-weight	Acceptance Limits
125	0.5	0.5	0.5	± 1.5
1000	0.0	0.0	0.0	± 1.0
8000	-1.0	-0.9	-0.9	±5.0

4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

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

5. Frequency and time weightings at 1 kHz

5.1 Frequency weightings at 1 kHz

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

5.2 Time weighting at 1 kHz

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

6. Long - term stability

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

7. Level linearity on the reference level range

Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
137.0	137.0	0.0	± 1.1
136.0	136.0	0.0	± 1.1
135.0	135.1	0.1	± 1.1
134.0	134.1	0.1	± 1.1
133.0	133.0	0.0	± 1.1
132.0	132.0	0.0	± 1.1
131.0	131.0	0.0	± 1.1
129.0	129.0	0.0	± 1.1
124.0	124.0	0.0	± 1.1
119.0	119.1	0.1	± 1.1
114.0	114.0	0.0	± 1.1
109.0	109.0	0.0	± 1.1
104.0	104.1	0.1	± 1.1
99.0	99.0	0.0	± 1.1
94.0	94.0	0.0	± 1.1
89.0	89.0	0.0	± 1.1
84.0	84.0	0.0	± 1.1
79.0	79.0	0.0	± 1.1
74.0	74.0	0.0	± 1.1
69.0	69.0	0.0	± 1.1
64.0	64.0	0.0	± 1.1
59.0	59.0	0.0	± 1.1
54.0	54.0	0.0	± 1.1
49.0	49.0	0.0	± 1.1
44.0	44.0	0.0	± 1.1
39.0	39.0	0.0	± 1.1
34.0	34.0	0.0	± 1.1
30.0	30.0	0.0	± 1.1
29.0	29.1	0.1	± 1.1
28.0	28.1	0.1	± 1.1
27.0	27.1	0.1	± 1.1
26.0	26.1	0.1	± 1.1
25.0	25.2	0.2	± 1.1

T. Petch.

8. Level linearity including the level range control

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

9. Tone burst response

Time Weighting	Tone burst duration, Tb (ms)	Cycle	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Fast	0.25	1	108.0	107.9	-0.1	1.5 ; -5.0
	2	8	117.0	116.9	-0.1	1.0 ; -2.5
	200	800	134.0	134.0	0.0	±1.0
Slow	2	8	108.0	107.9	-0.1	1.5 ; -5.0
	200	800	127.6	127.6	0.0	±1.0
SEL	0.25	1	99.0	98.8	-0.2	1.5 ; -5.0
	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, Lcpeak (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.0	0.0	-
One	136.4	136.4	0.0	±3.0

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

T. Petch.

11. Overload indication

Measured value (dB)		Deviated Value (dB)	Acceptance Limits (dB)
Positive one-half cycle	Negative one-half cycle		
89.8	89.5	-0.3	±1.5

12. High level stability

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

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

End of Calibration Certificate

CERTIFICATE OF CALIBRATION

ISSUED BY **Cirrus Research plc**

DATE OF ISSUE **07/07/21** CERTIFICATE NUMBER **159633**

Cirrus Research plc
Acoustic House
Bridlington Road
Hunmanby
North Yorkshire
YO14 0PH
United Kingdom

Test engineer:
Nigel Smith
Electronically signed:

doseBadge Reader

Instrument

Manufacturer: Cirrus Research plc
Model Number: RC:110A
Serial Number: 77670
Notes:

Calibration Procedure

The tests were carried out in accordance with the requirements of IEC 60942:2003 where applicable.

Date of Calibration: 07 July 2021

Functionality Results

Function	Result
Keypad	Pass
Battery Power	Pass
Display	Pass
Communication	Pass
2 way IR link	Pass
Clock	Pass

REVIEW BY Marakom P.
APPROVED BY
NEXT CAL. DATE 7/7/22

Calibration Results

	Level (dB)	Frequency (Hz)	Distortion (% THD + Noise)
Initial	113.80	1000.0	0.26
Adjusted	114.00	1000.0	0.26
Uncertainty	± 0.11	± 0.14	± 0.10
Tolerances	± 0.60	± 2.00	± 4.00

Environmental Conditions

Pressure: 100.10 kPa
Temperature: 21.7 °C
Humidity: 60.6 %

Notes

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CERTIFICATE OF CALIBRATION

Equipment Name : Heat Stress Monitor with Sensor
Manufacturer. : DeltaOHM
Model: HD32.2
Serial No: 15006698
ID No: BKK_FS0669

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

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

REVIEW BY Narakorn P.
APPROVED BY
NEXT CAL. DATE 7/6/22

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

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

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

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

Calibrated by
☐ Mr. Sorawit Thachalad
☑ Miss Orathai Wiwatwittaya

Approved Signatory: Orathai
Mr. Parinya Booncharoen
Technical Support
And Calibration Manager

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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: 15015840.
Dimension : Diameter 14 mm. Length 170 mm.

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
30	20.039	20.2	0.2	0.14
30	25.037	25.2	0.2	0.14
30	30.026	30.2	0.2	0.14
30	35.015	35.2	0.2	0.14
30	40.004	40.2	0.2	0.14

Table 2: This equipment was connected with temperature probe Model: TP3207.2 S/N: 15015490.
Dimension : Diameter 14 mm. Length 150 mm.

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
70	20.052	20.5	0.4	0.17
70	24.875	25.1	0.2	0.14
70	29.824	29.9	0.1	0.14
70	34.767	34.7	-0.1	0.14
70	39.715	39.6	-0.1	0.14

Table 3: This equipment was connected with Globe thermometer probe Model: TP3276.2 S/N: 20019644.
Dimension : Diameter 8 mm. Length 170 mm.

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
110	20.039	20.1	0.1	0.14
110	25.037	25.1	0.1	0.14
110	30.026	30.1	0.1	0.14
110	35.015	35.2	0.2	0.17
110	40.004	40.2	0.2	0.14

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

*** End of Certificate ***

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CERTIFICATE OF CALIBRATION

Equipment Name : Heat Stress Monitor with Sensor
Manufacturer. : DeltaOHM
Model: HD32.2
Serial No: 15006704
ID No: BKK_FS0670

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 : 04 June 2021
Calibration date : 11 June 2021
Issue date : 11 June 2021

REVIEW BY Narakon P.
APPROVED BY
NEXT CAL. DATE 11/6/2022

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 : 20 May 2021

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

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

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

Calibrated by
☐ Mr. Sorawit Thachalad
☑ Miss Orathai Wiwatwittaya

Approved Signatory: Orathai Cuma
Mr. Parinya Boonchareon
Technical Support
And Calibration Manager

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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: 15017681.
Dimension : Diameter 14 mm. Length 170 mm.

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
30	20.044	20.1	0.1	0.14
30	25.029	25.1	0.1	0.14
30	30.016	30.1	0.1	0.14
30	35.003	35.1	0.1	0.14
30	39.984	40.1	0.1	0.14

Table 2: This equipment was connected with temperature probe Model: TP3207.2 S/N: 15015488.
Dimension : Diameter 14 mm. Length 150 mm.

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
70	20.043	20.2	0.2	0.14
70	24.853	24.9	0.0	0.14
70	29.812	29.7	-0.1	0.17
70	34.773	34.6	-0.1	0.19
70	39.715	39.5	-0.2	0.14

Table 3: This equipment was connected with Globe thermometer probe Model: TP3276.2 S/N: 15021838.
Dimension : Diameter 8 mm Length 170 mm.

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
110	20.043	20.1	0.1	0.14
110	25.029	25.1	0.1	0.14
110	30.016	30.1	0.1	0.14
110	35.003	35.1	0.1	0.14
110	39.984	40.1	0.1	0.14

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

*** End of Certificate ***

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NSC - TISI - TIS 17025 CALIBRATION 0367

CERTIFICATE OF CALIBRATION

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

Equipment Name : Heat Stress Monitor with Sensor
Manufacturer. : DeltaOHM
Model: HD32.2
Serial No: 15006300
ID No: BKK_FS0661

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

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

Reference Used During Calibration
1.Standard Temperature Probe Model: STS-100 A500, Serial No.: 667682-09, Due date: 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 Nanakorn P.
APPROVED BY
NEXT CAL. DATE 13/12/22

Calibrated by
☑ Mr. Sorawit Thachalad
☐ Miss Orathai Wiwatwittaya

JIRANATE ASSOCIATES CO., LTD.

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

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Result of Calibration:- ☑ Without Adjustment ☐ With Adjustment

Calibration Range: 20 – 40 °C

Function:

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

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

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

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

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

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

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

* End of Certificate *

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CERTIFICATE OF CALIBRATION

Equipment Name : Heat Stress Monitor with Sensor
Manufacturer. : DeltaOHM
Model: HD32.2
Serial No: 15006708
ID No: BKK_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 Nirakorn P.
APPROVED BY
NEXT CAL. DATE 30/9/22

Calibrated by
☐ Mr. Sorawit Thachalad
☑ Miss Orathai Wiwatwittaya

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

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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%.

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NSC - TISI - TIS 17025 CALIBRATION 0367

CERTIFICATE OF CALIBRATION

Certificate No. : CL-032-64

Equipment Name : Heat Stress Monitor with Sensor
Manufacturer. : Delta OHM
Model: HD32.2
Serial No: 15006302
ID No: BKK_FS0663

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 : 14 MAY 2021
Calibration date : 19 MAY 2021
Issue date : 21 MAY 2021

REVIEW BY .....
APPROVED BY .....
EXT CAL. DATE 19/5/22

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

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

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

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

Calibrated by
☐ Mr. Sorawit Thachalad
☑ Mr. Bongkoch Malithong

Approved Signatory: .....
Mr. Parinya Booncharoen
Technical Support
And Calibration Manager

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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: 15003284.
Dimension : Diameter 14 mm. Length 170 mm.

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
30	20.041	20.1	0.1	0.10
30	25.035	25.0	0.0	0.16
30	30.018	30.0	0.0	0.10
30	35.004	35.0	0.0	0.10
30	39.988	40.0	0.0	0.10

Table 2: This equipment was connected with temperature probe Model: TP3207.2 S/N: 15008018.
Dimension : Diameter 14 mm. Length 150 mm.

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
70	20.041	20.3	0.3	0.13
70	25.034	25.0	0.0	0.13
70	30.019	29.8	-0.2	0.13
70	35.004	34.7	-0.3	0.17
70	39.991	39.5	-0.5	0.13

Table 3: This equipment was connected with Globe thermometer probe Model: TP3276.2 S/N: 15008170.
Dimension : Diameter 8 mm. Length 170 mm.

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
110	20.078	20.3	0.2	0.28
110	25.034	25.3	0.3	0.10
110	30.018	30.3	0.3	0.10
110	35.005	35.3	0.3	0.10
110	39.989	40.3	0.3	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

Equipment Name: Heat Stress Monitor with Sensor
Manufacturer.: DeltaOHM
Model: HD32.2
Serial No: 15006309
ID No: BKK_FS0667

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: 14 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-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 Wirakorn P.
APPROVED BY
NEXT CAL. DATE 14/2/23

Calibrated by
☐ Mr. Sorawit Thachalad
☑ Miss Orathai Wiwatwittaya

Approved Signatory:
Mr. Parinya Booncharoen
Calibration Department Manager

JIRANATE ASSOCIATES CO., LTD.

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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: 15017683.
Dimension: Diameter 14 mm. Length 170 mm.

Immersion Depth (mm)	Standard Reading (˚C)	UUC Reading (˚C)	Error (˚C)	Uncertainty (˚C)
30	20.056	20.2	0.1	0.099
30	25.046	25.2	0.2	0.099
30	30.036	30.2	0.2	0.099
30	35.032	35.2	0.2	0.099
30	40.027	40.2	0.2	0.099

Table 2: This equipment was connected with temperature probe Model: TP3207.2 S/N: 15015506.
Dimension: Diameter 14 mm. Length 150 mm.

Immersion Depth (mm)	Standard Reading (˚C)	UUC Reading (˚C)	Error (˚C)	Uncertainty (˚C)
70	20.050	20.1	0.1	0.099
70	24.970	24.9	-0.1	0.099
70	29.932	29.8	-0.1	0.099
70	34.876	34.6	-0.3	0.099
70	39.805	39.5	-0.3	0.099

Table 3: This equipment was connected with Globe thermometer probe Model: TP3276.2 S/N: 15009822.
Dimension: Diameter 8 mm. Length 170 mm.

Immersion Depth (mm)	Standard Reading (˚C)	UUC Reading (˚C)	Error (˚C)	Uncertainty (˚C)
110	20.055	20.0	-0.1	0.099
110	25.045	25.0	0.0	0.099
110	30.037	30.0	0.0	0.099
110	35.033	35.0	0.0	0.099
110	40.027	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 *

JIRANATE ASSOCIATES CO., LTD.

ROTA METER CALIBRATION RESULT JANUARY 2021

Rotameter ID.	Calibration Date	Regression Result	Coefficient (R^2)
BKK_FS0577	04 Jan 21	Y = 1.5816x - 11.072	0.9924
BKK_FS0579	04 Jan 21	Y = 1.0782x - 5.4528	1.0000
BKK_FS0583	04 Jan 21	Y = 0.9961x - 1.6228	0.9989
BKK_FS0584	04 Jan 21	Y = 1.0457x - 25.58	0.9978
BKK_FS0585	04 Jan 21	Y = 0.9194x + 3.669	0.9429
BKK_FS0586	04 Jan 21	Y = 1.0487x - 3.6038	0.9999
BKK_FS0587	04 Jan 21	Y = 0.9611x + 22.64	0.9951
BKK_FS0588	04 Jan 21	Y = 0.8525x + 28.083	0.9131
BKK_FS0589	04 Jan 21	Y = 0.9846x + 2.2929	0.9848
BKK_FS0590	04 Jan 21	Y = 0.9896x + 1.1571	0.9999
BKK_FS0591	04 Jan 21	Y = 1.0586x - 154.323	0.9983
BKK_FS0592	04 Jan 21	Y = 1.0243x - 130.39	0.9951
BKK_FS0593	04 Jan 21	Y = 1.0118x - 46.331	0.9991
BKK_FS0594	04 Jan 21	Y = 1.0068x - 16.51	0.9996
BKK_FS0595	04 Jan 21	Y = 1.0142x - 44.708	0.9990
BKK_FS0596	04 Jan 21	Y = 1.0026x - 12.106	0.9999
BKK_FS0597	04 Jan 21	Y = 1.0124x - 31.882	0.9999
BKK_FS1004	01 Jan 21	Y = 1.018x + 6.4121	0.9998
BKK_FS1005	01 Jan 21	Y = 0.9653x + 20.281	0.9977
BKK_FS1006	01 Jan 21	Y = 1.2167x - 6.4807	0.9992
BKK_FS1007	04 Jan 21	Y = 0.9928x - 2.3044	0.9997
BKK_FS1008	04 Jan 21	Y = 0.9867x - 1.2	0.9988
BKK_FS1009	04 Jan 21	Y = 1.1108x - 5.5888	0.9965
BKK_FS1010	04 Jan 21	Y = 1.0071x + 0.4769	0.9722
BKK_FS1011	04 Jan 21	Y = 1.0505x - 8.134	0.9998
BKK_FS1012	04 Jan 21	Y = 1.0119x - 7.4569	0.9999
BKK_FS1013	04 Jan 21	Y = 1.0003x - 31.261	0.9998
BKK_FS1014	04 Jan 21	Y = 0.9497x - 4.162	0.9942
BKK_FS1015	04 Jan 21	Y = 0.9737x - 3.7733	0.9996
BKK_FS1016	04 Jan 21	Y = 0.9883x + 3.7911	0.9996
BKK_FS1017	04 Jan 21	Y = 1.0689x - 5.2468	0.9998
BKK_FS1018	04 Jan 21	Y = 1.009x - 3.9231	0.9995
BKK_FS1019	04 Jan 21	Y = 1.0079x - 106.39	0.9992
BKK_FS1020	04 Jan 21	Y = 1.1045x - 11.412	0.9776
BKK_FS1021	04 Jan 21	Y = 0.8797x + 31.9	0.9617
BKK_FS1022	04 Jan 21	Y = 1.0179x - 55.217	0.9999
BKK_FS1023	04 Jan 21	Y = 1.0856x - 6.2755	0.9973
BKK_FS1024	04 Jan 21	Y =0.8119x + 54.124	0.9771
BKK_FS1025	04 Jan 21	Y = 1.0353x - 100.17	0.9998

ROTA METER CALIBRATION RESULT JANUARY 2021

Rotameter ID.	Calibration Date	Regression Result	Coefficient (R^2)
BKK_FS1026	04 Jan 21	Y = 1.1049x - 4.335	0.9989
BKK_FS1027	04 Jan 21	Y = 0.9684x + 13.807	0.9992
BKK_FS1028	04 Jan 21	Y = 1.0279x - 60.396	0.9998
BKK_FS1029	04 Jan 21	Y = 1.0303x - 5.0748	0.9883
BKK_FS1030	04 Jan 21	Y = 1.0215x - 25.512	0.9897
BKK_FS1031	04 Jan 21	Y = 1.0211x - 51.359	0.9998
BKK_FS1039	01 Jan 21	Y = 0.9959x + 15.57	0.9998
BKK_FS1040	01 Jan 21	Y = 1.0061x - 1.3876	0.9999
BKK_FS1041	01 Jan 21	Y = 1.0987x - 4.5109	0.9992
BKK_FS1042	01 Jan 21	Y = 0.9554x + 25.905	0.9970
BKK_FS1043	01 Jan 21	Y = 0.9967x + 14.697	0.9997
BKK_FS1044	01 Jan 21	Y = 1.0401x - 1.0979	0.9992
RYG_FS0197	01 Jan 21	Y = 1.0031x + 6.9733	0.9999
RYG_FS0198	01 Jan 21	Y = 0.9837x + 68.26	0.9995
RYG_FS0199	01 Jan 21	Y = 0.9851x + 1.3543	0.9960

Review By :

(Mr. Wichan Choonharat)

Enviro Field Services Manager

Approved By :

(Mr.Sarayuth Jittranont)

Assistant General Manager

Bara Scientific
Solution of Success

Bara Scientific Co., Ltd.
968 U Chu Liang Building Floor7 Rama4 Road
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Tel : 02-6324300 Fax : 02-6375496-7
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NSC-TISI-TIS 17025
CALIBRATION 0299

Certificate of Calibration

Certificate No.	BSCC-UV-290/21
Equipment	UV/Vis Spectrophotometer
Model	UV-1800
Manufacturer	Shimadzu
Serial No.	A11454908533CD
ID No.	BKK_EN0018
Date of receipt	15 October 2021
Date of calibration	15 October 2021
Date of issue	25 October 2021

CHECKED BY Sirilak P.
APPROVED BY KL AD
NEXT CAL. DATE 15 Oct 22

Customer name	ALS Laboratory Group (Thailand) Co., Ltd.
Address	104 Soi Phatthanakan 40, Phatthanakan Road, Phatthanakan, Suan Luang, Bangkok 10250
Temperature	(25.0 - 26.4) °C (On site)
Humidity	(49.5 - 53.4) %RH (On site)
Equipment condition	Good Operation
Calibration Location	Organic Prep
Calibration Procedure	In-house method WI-UV-702-01 based on ASTM E275-01
Traceability	Wavelength Accuracy is traceable to certificate No. 87839 and 87844 Photometric Accuracy is traceable to certificate No. 87846 and 87877 Stray Light is traceable to certificate No. 87825 The above certificate are traceble to SI unit through Starna Scientific Ltd. (UKAS accredited calibration laboratory NO. 0659)
Calibrated by	Mr.Wanchana Janloey

Approved by

Mr.Kanchit Choothep
Technical Manager

The above results are valid exclusively for the calibrated item(s) as mention in this report / certificate.
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NSC-TISI-TIS 17025
CALIBRATION 0299

Certificate of Calibration

Calibration Results:

1.Wavelength Accuracy

Certified Wavelength (nm)	UUC (nm)	Error (nm)	Uncertainty (±nm)
241.70	241.55	-0.15	0.18
334.02	333.80	-0.22	0.18
418.53	418.40	-0.13	0.18
572.99	572.85	-0.14	0.18
879.41	879.15	-0.26	0.18

2.Photometric Accuracy (UV)

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

*CNR = Customer not request

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NSC-TISI-TIS 17025
CALIBRATION 0209

Certificate of Calibration

Certificate No. BSCC-UV-290/21

Number of Page(s) 3 of 3

Calibration Results:

3.Photometric Accuracy (Visible)

Wavelength (nm)	Certified Absorbance (A)	UUC (A)	Error (A)	Uncertainty (±A)
420.0	0.0000	0.0000	0.0000	0.0042
	0.5631	0.5570	-0.0061	0.0042
	0.7390	0.7334	-0.0056	0.0042
	1.0863	1.0816	-0.0047	0.0042
440.0	0.0000	0.0000	0.0000	0.0042
	0.5524	0.5469	-0.0055	0.0042
	0.7217	0.7166	-0.0051	0.0042
	1.0606	1.0570	-0.0036	0.0042
465.0	0.0000	0.0000	0.0000	0.0042
	0.5018	0.4966	-0.0052	0.0042
	0.6657	0.6610	-0.0047	0.0042
	0.9775	0.9740	-0.0035	0.0042
546.1	0.0000	0.0000	0.0000	0.0042
	0.5147	0.5113	-0.0034	0.0042
	0.6743	0.6705	-0.0038	0.0042
	0.9909	0.9890	-0.0019	0.0042
590.0	0.0000	0.0000	0.0000	0.0042
	0.5427	0.5394	-0.0033	0.0042
	0.7037	0.7001	-0.0036	0.0042
	1.0338	1.0323	-0.0015	0.0042
635.0	0.0000	0.0000	0.0000	0.0042
	0.5268	0.5235	-0.0033	0.0042
	0.6720	0.6685	-0.0035	0.0042
	0.9864	0.9847	-0.0017	0.0042

*CNR = Customer not request

4.Stray Light*

Standard	Unit Under Calibration(UUC)		
cut-off wavelenght (nm)	Wavelength (nm)	Transmission (%T)	Absorbance (A)
200.91±0.11nm	200.31	0.9399	2.0274

The Stray light transmission reference is less than 1.0%T and Stray light absorbance reference is greater than 2.00A
***Stray Light not NSC-ONSC Accredited.**

The measurement uncertainty is base on a 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 System Qualification

GC-OQ + GCMS-OQ

REVIEW BY Sararat M.
APPROVED BY
NEXT CAL. DATE 1 April 23

System ID:	GM-2
Organization Name:	ALS Laboratory Group (Thailand) Co., Ltd.
Organization Location:	104 Phatthanakan 40, Phattanakan Rd., Kheiwaeng Suan Luang, Khet Suan Luang, Bangkok 10250
Date:	October 1, 2021 1:10:17 PM
EQP Name:	AgilentRecommended , AgilentRecommended
EQP Revision:	GC.02.51, GCMS.02.51
Overall Qualification Status:	Pass

System Inspection and Basic Safety and Operation

Name:	7890
Setpoint Status:	**Pass**

Overall System Inspection and Basic Safety and Operation Test Status

Pass

Inlet Pressure Accuracy

Name:	7890
	Front MMI
Setpoint Status:	**Pass**

	Setpoint		Actual	
Inlet Pressure:	25.0	psi	24.9	psi
Accuracy:			0.1	psi
Agilent Recommended:			<= 1.2	

Overall Inlet Pressure Accuracy Test Status

Pass

GC Oven Temperature Accuracy

Name:	7890

Setpoint Status: Pass
Zone: Oven

	Setpoint	Actual	
Temperature:	230.0	230.5	°C

Accuracy: 0.5 °C

Agilent Recommended:					
>=	-1.0	% setpoint in K	(	-5.0	°C)
<=	1.0	% setpoint in K	(	5.0	°C)

Setpoint Status: Pass
Zone: Oven

	Setpoint	Actual	
Temperature:	100.0	101.5	°C

Accuracy: 1.5 °C

Agilent Recommended:					
>=	-1.0	% setpoint in K	(	-3.7	°C)
<=	1.0	% setpoint in K	(	3.7	°C)

Overall GC Oven Temperature Accuracy Test Status
Pass

GC Oven Temperature Stability

Name: 7890
Setpoint Status: Pass

	Setpoint	Average	
Temperature:	100.0	101.5	°C

Stability: 0.0 °C
Agilent Recommended: <= 0.5

Overall GC Oven Temperature Stability Test Status
Pass

Log Amp

Tested Combination1 Front MMI / External SQ
Name: 5975C inert XL with TAD
Setpoint Status: Pass

Overall Log Amp Test Status
Pass

RFPA

Tested Combination1 Front MMI / External SQ
Name: 5975C inert XL with TAD
Setpoint Status: Pass

Amu: 1050 m/z

	Drift After Five Minutes:					RFPA Voltage:	
	6 mV					461 mV	
Agilent Recommended:	>=	-100	and	<=	100	<=	1100

Overall RFPA Test Status
Pass

Tune EI

Tested Combination1 Front MMI / External SQ
Name: 5975C inert XL with TAD
Setpoint Status: Pass
Filament: 1
Setpoint Status: Pass
Filament: 2

Overall Tune EI Test Status
Pass

Scouting Run

Tested Combination1 Front MMI / External SQ
Injection Tower
Name: 7693A
Source: EI - Inert

Setpoint Status: Completed

Injection Volume on Column: 1.0 uL

Overall Scouting Run Status

Completed

Signal to Noise EI

Tested Combination1 Front MMI / External SQ

Name: 5975C inert XL with TAD

Source: EI - Inert Filament: 1

Setpoint Status: Pass

Signal to Noise: 619

Agilent Recommended: >= 320

Source: EI - Inert Filament: 2

Setpoint Status: Pass

Signal to Noise: 647

Agilent Recommended: >= 320

Overall Signal to Noise EI Test Status

Pass

Injection Precision

Tested Combination1 Front MMI / External SQ

Name: 7693A

Source: EI - Inert

Setpoint Status: Pass

Injection Volume on Column: 1.0 uL

Area RSD: 4.75 % Retention Time RSD: 0.02 %

Agilent Recommended: <= 5.00 <= 1.00

Overall Injection Precision Test Status

Pass

Mass Ratio Precision

Tested Combination1 Front MMI / External SQ

Injection Tower

Name: 7693A

Source: EI - Inert

Setpoint Status: Pass

Injection Volume on Column: 1.0 uL

	Area Mass 1 Abundance*s	Mass Ratio
RSD:	4.75 %	0.81 %
Agilent Recommended:	<= 5.00	<= 5.00
	Pass	Pass

Overall Mass Ratio Precision Test Status

Pass

Instrument Details

Purpose

This section describes the as found system configuration.

Details

System

System ID	GM-2
Manufacturer	Agilent Technologies
Name	7890
Flow Data Input	Manual Data
Temperature Data Input	Manual Data or Other Data Logging

Tested Combination1

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

Sampler 1

Manufacturer	Agilent Technologies
Type	Injection Tower
Name	7693A
Model Number	G4513A
Serial Number	CN10120123
Firmware Revision	A.10.08
Usage	Sample Injection
Location	Front
Syringe Volume (µL)	10

Sampler 2

Manufacturer	Agilent Technologies
Type	Tray
Name	7693A
Model Number	G4514A
Serial Number	CN10060099
Firmware Revision	A.10.16
Vial Heater	Not installed

Mainframe 1

Manufacturer	Agilent Technologies
Name	7890
Model Number	G3440A
Serial Number	CN10141049
Firmware Revision	A.01.16
Oven Type	Standard

Inlet 1

Manufacturer	Agilent Technologies
Name	7890
Type	MMI
Location	Front
Carrier Gas	Helium
Control Type	Electronic Pressure Control (EPC)
Purged Inlet	Yes

Detector 1

Manufacturer	Agilent Technologies
Name	Mass Spectrometer
Type	Mass Spectrometer
Location	External

Mass Spectrometer 1

Manufacturer	Agilent Technologies
Type	SQ
Name	5975C inert XL with TAD
Serial Number	US10153217
Firmware Revision	5.02.12
High Vacuum System	Turbo Pump
Scouting Run Standard	OFN Std

MS EI Source 1

Manufacturer	Agilent Technologies
Source Type	EI - Inert
Number of filaments	2

Electronic Signature

Purpose

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Details

Full Name of Signer:	Supasak Nimsongtham
Logged On User Name:	supasak.nimsongtham@agilent.com
Signature Creation Date:	October 1, 2021
Reason for Signature:	Executed protocol and published this original version of document

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User Name: supasak.nimsongtham
Hostname: 5CG1115HKC

System Id: GM-2
Print Date: October 1, 2021 1:10:19 PM

ALS_GM2 Transaction log :

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
October 1, 2021 12:42:37 PM	Audit	SessionCreated	Session	None
October 1, 2021 12:42:37 PM	Start	Configuration	Session	None
October 1, 2021 12:42:37 PM	Audit	Entitlement	Licensing	User is FieldEngineer and does not require an unlock code
October 1, 2021 12:44:21 PM	Audit	EqpLoaded	Session	EQP details for primary technique [Gc] - File path: [ProtocolPacks/Gc/Configurations/02.51/Gc.02.51.eqp], EQP File Name: [Gc.02.51.eqp], EQP Name: [AgilentRecommended] EQP details for hyphenated technique [GcMs] - File path: [ProtocolPacks/GcMs/Configurations/02.51/GcMs.02.51.eqp], EQP File Name: [GcMs.02.51.eqp], EQP Name: [AgilentRecommended]
October 1, 2021 12:44:24 PM	End	Configuration	Session	None
October 1, 2021 12:44:28 PM	Start	Qualification	Session	OQ
October 1, 2021 12:44:28 PM	Start	Execution	System Inspection and Basic Safety and Operation - 7890: - Qualitative Test - No setpoints associated	None

Page 1 / 7

User Name: supasak.nimsongtham
Hostname: 5CG1115HKC

System Id: GM-2
Print Date: October 1, 2021 1:10:19 PM

ALS_GM2 Transaction log :

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
October 1, 2021 12:47:35 PM	End	Execution	System Inspection and Basic Safety and Operation - 7890: - Qualitative Test - No setpoints associated	Run Count : 1
October 1, 2021 12:47:37 PM	Start	Execution	Inlet Pressure Accuracy - Front MMI: - Pressure Controlled Inlet - S: 25.0 psi - L: <= 1.2 psi	None
October 1, 2021 12:47:42 PM	End	Execution	Inlet Pressure Accuracy - Front MMI: - Pressure Controlled Inlet - S: 25.0 psi - L: <= 1.2 psi	Run Count : 1
October 1, 2021 12:47:44 PM	Start	Execution	GC Oven Temperature Accuracy - 7890: - Temperature : Oven - S: 230.0°C - L: >= -1.0 AND <= 1.0 % setpoint in K	None
October 1, 2021 12:48:04 PM	Audit	Data	GC Oven Temperature Accuracy - 7890: - Temperature : Oven - S: 230.0°C - L: >= -1.0 AND <= 1.0 % setpoint in K	Manual Data Entry
October 1, 2021 12:48:05 PM	End	Execution	GC Oven Temperature Accuracy - 7890: - Temperature : Oven - S: 230.0°C - L: >= -1.0 AND <= 1.0 % setpoint in K	Run Count : 1
October 1, 2021 12:48:07 PM	Start	Execution	GC Oven Temperature Accuracy - 7890: - Temperature : Oven - S: 100.0°C - L: >= -1.0 AND <= 1.0 % setpoint in K	None
October 1, 2021 12:48:34 PM	Audit	Data	GC Oven Temperature Accuracy - 7890: - Temperature : Oven - S: 100.0°C - L: >= -1.0 AND <= 1.0 % setpoint in K	Manual Data Entry
October 1, 2021 12:48:36 PM	End	Execution	GC Oven Temperature Accuracy - 7890: - Temperature : Oven - S: 100.0°C - L: >= -1.0 AND <= 1.0 % setpoint in K	Run Count : 1

Page 2 / 7

User Name: supasak.nimsongtham
Hostname: 5CG1115RKC

System Id: GM-2
Print Date: October 1, 2021 1:10:19 PM

ALS_GM2 Transaction log :

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
October 1, 2021 12:48:38 PM	Start	Execution	GC Oven Temperature Stability - 7890: - Temperature : Oven - S: 100.0°C - L: <= 0.5°C	None
October 1, 2021 12:49:34 PM	Audit	Data	GC Oven Temperature Stability - 7890: - Temperature : Oven - S: 100.0°C - L: <= 0.5°C	Manual Data Entry
October 1, 2021 12:49:36 PM	End	Execution	GC Oven Temperature Stability - 7890: - Temperature : Oven - S: 100.0°C - L: <= 0.5°C	Run Count : 1
October 1, 2021 12:49:37 PM	Start	Execution	Log Amp - 5975C Inert XL with TAD SQ: - Source: EI - Inert	None
October 1, 2021 12:49:47 PM	End	Execution	Log Amp - 5975C Inert XL with TAD SQ: - Source: EI - Inert	Run Count : 1
October 1, 2021 12:49:48 PM	Start	Execution	RFPA - 5975C Inert XL with TAD SQ: - Source: EI - Inert	None
October 1, 2021 12:50:23 PM	End	Execution	RFPA - 5975C Inert XL with TAD SQ: - Source: EI - Inert	Run Count : 1
October 1, 2021 12:50:25 PM	Start	Execution	Tune EI - 5975C Inert XL with TAD SQ: - Source: - EI - Inert Filament 1 (Qualitative - No setpoints associated)	None
October 1, 2021 12:50:49 PM	End	Execution	Tune EI - 5975C Inert XL with TAD SQ: - Source: - EI - Inert Filament 1 (Qualitative - No setpoints associated)	Run Count : 1
October 1, 2021 12:50:50 PM	Start	Execution	Tune EI - 5975C Inert XL with TAD SQ: - Source: - EI - Inert Filament 2 (Qualitative - No setpoints associated)	None
October 1, 2021 12:50:59 PM	End	Execution	Tune EI - 5975C Inert XL with TAD SQ: - Source: - EI - Inert Filament 2 (Qualitative - No setpoints associated)	Run Count : 1

Page 3 / 7

User Name: supasak.nimsongtham
Hostname: 5CG1115RKC

System Id: GM-2
Print Date: October 1, 2021 1:10:19 PM

ALS_GM2 Transaction log :

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
October 1, 2021 12:51:01 PM	Start	Execution	Scouting Run - Injection Tower, Front MMI, SQ: - Source: - EI - Inert- Part of GCMS System Preparation	None
October 1, 2021 12:51:18 PM	Audit	Data	Scouting Run - Injection Tower, Front MMI, SQ: - Source: - EI - Inert- Part of GCMS System Preparation	Data files Path : E:\GM2OQ2021\SCOUTING RUN001.D\DATA.MS
October 1, 2021 12:51:42 PM	Audit	Data	Scouting Run - Injection Tower, Front MMI, SQ: - Source: - EI - Inert- Part of GCMS System Preparation	Data files Path : E:\GM2OQ2021\SCOUTING RUN001.D\DATA.MS
October 1, 2021 12:52:42 PM	Audit	Data	Scouting Run - Injection Tower, Front MMI, SQ: - Source: - EI - Inert- Part of GCMS System Preparation	Data files Path : E:\GM2OQ2021\SCOUTING RUN001.D\DATA.MS
October 1, 2021 12:53:25 PM	End	Execution	Scouting Run - Injection Tower, Front MMI, SQ: - Source: - EI - Inert- Part of GCMS System Preparation	Run Count : 1
October 1, 2021 12:53:27 PM	Start	Execution	Signal to Noise EI - Injection Tower, Front MMI, SQ: - Source: EI - Inert using Filament 1 - L: >= 320	None
October 1, 2021 12:53:40 PM	Audit	Data	Signal to Noise EI - Injection Tower, Front MMI, SQ: - Source: EI - Inert using Filament 1 - L: >= 320	Data files Path : E:\GM2OQ2021\SNF1_001.D \DATA.MS
October 1, 2021 12:53:56 PM	End	Execution	Signal to Noise EI - Injection Tower, Front MMI, SQ: - Source: EI - Inert using Filament 1 - L: >= 320	Run Count : 1

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User Name: supasak.nimsongtham
Hostname: 5CG1115HKC

System Id: GM-2
Print Date: October 1, 2021 1:10:19 PM

ALS_GM2 Transaction log :

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
October 1, 2021 12:53:59 PM	Start	Execution	Signal to Noise EI - Injection Tower, Front MMI, SQ: - Source: EI - Inert using Filament 2 - L: >= 320	None
October 1, 2021 12:54:04 PM	Audit	Data	Signal to Noise EI - Injection Tower, Front MMI, SQ: - Source: EI - Inert using Filament 2 - L: >= 320	Data files Path : E:\GM2OQ2021\SNF2_001.D\DATA.MS
October 1, 2021 12:54:22 PM	End	Execution	Signal to Noise EI - Injection Tower, Front MMI, SQ: - Source: EI - Inert using Filament 2 - L: >= 320	Run Count : 1
October 1, 2021 12:54:26 PM	Start	Execution	Injection Precision - Injection Tower, Front MMI, SQ: - Source: - EI - Inert L (Area): <= 5.00% - L (Rel. Time): <= 1.00%	None
October 1, 2021 12:54:37 PM	Audit	Data	Injection Precision - Injection Tower, Front MMI, SQ: - Source: - EI - Inert L (Area): <= 5.00% - L (Rel. Time): <= 1.00%	Data files Path : E:\GM2OQ2021\IP_MRP003.D\DATA.MS
October 1, 2021 12:54:37 PM	Audit	Data	Injection Precision - Injection Tower, Front MMI, SQ: - Source: - EI - Inert L (Area): <= 5.00% - L (Rel. Time): <= 1.00%	Data files Path : E:\GM2OQ2021\IP_MRP004.D\DATA.MS
October 1, 2021 12:54:37 PM	Audit	Data	Injection Precision - Injection Tower, Front MMI, SQ: - Source: - EI - Inert L (Area): <= 5.00% - L (Rel. Time): <= 1.00%	Data files Path : E:\GM2OQ2021\IP_MRP005.D\DATA.MS
October 1, 2021 12:54:37 PM	Audit	Data	Injection Precision - Injection Tower, Front MMI, SQ: - Source: - EI - Inert L (Area): <= 5.00% - L (Rel. Time): <= 1.00%	Data files Path : E:\GM2OQ2021\IP_MRP006.D\DATA.MS

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User Name: supasak.nimsongtham
Hostname: 5CG1115HKC

System Id: GM-2
Print Date: October 1, 2021 1:10:19 PM

ALS_GM2 Transaction log :

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
October 1, 2021 12:54:37 PM	Audit	Data	Injection Precision - Injection Tower, Front MMI, SQ: - Source: - EI - Inert L (Area): <= 5.00% - L (Rel. Time): <= 1.00%	Data files Path : E:\GM2OQ2021\IP_MRP007.D\DATA.MS
October 1, 2021 12:54:37 PM	Audit	Data	Injection Precision - Injection Tower, Front MMI, SQ: - Source: - EI - Inert L (Area): <= 5.00% - L (Rel. Time): <= 1.00%	Data files Path : E:\GM2OQ2021\IP_MRP008.D\DATA.MS
October 1, 2021 12:54:52 PM	End	Execution	Injection Precision - Injection Tower, Front MMI, SQ: - Source: - EI - Inert L (Area): <= 5.00% - L (Rel. Time): <= 1.00%	Run Count : 1
October 1, 2021 12:54:55 PM	Start	Execution	Mass Ratio Precision - Injection Tower, Front MMI, SQ: - Source: EI - Inert - L (RSD): <= 5.00%	None
October 1, 2021 12:55:06 PM	Audit	Data	Mass Ratio Precision - Injection Tower, Front MMI, SQ: - Source: EI - Inert - L (RSD): <= 5.00%	Data files Path : E:\GM2OQ2021\IP_MRP003.D\DATA.MS
October 1, 2021 12:55:06 PM	Audit	Data	Mass Ratio Precision - Injection Tower, Front MMI, SQ: - Source: EI - Inert - L (RSD): <= 5.00%	Data files Path : E:\GM2OQ2021\IP_MRP004.D\DATA.MS
October 1, 2021 12:55:06 PM	Audit	Data	Mass Ratio Precision - Injection Tower, Front MMI, SQ: - Source: EI - Inert - L (RSD): <= 5.00%	Data files Path : E:\GM2OQ2021\IP_MRP005.D\DATA.MS
October 1, 2021 12:55:06 PM	Audit	Data	Mass Ratio Precision - Injection Tower, Front MMI, SQ: - Source: EI - Inert - L (RSD): <= 5.00%	Data files Path : E:\GM2OQ2021\IP_MRP006.D\DATA.MS

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User Name: supasak.nimsongtham
Hostname: 5CG1115HKC

System Id: GM-2
Print Date: October 1, 2021 1:10:19 PM

ALS_GM2 Transaction log :

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
October 1, 2021 12:55:06 PM	Audit	Data	Mass Ratio Precision - Injection Tower, Front MMI, SQ: - Source: EI - Inert - L (RSD): <= 5.00%	Data files Path : E:\GM2OQ2021\P_MRP007.D\DATA.MS
October 1, 2021 12:55:06 PM	Audit	Data	Mass Ratio Precision - Injection Tower, Front MMI, SQ: - Source: EI - Inert - L (RSD): <= 5.00%	Data files Path : E:\GM2OQ2021\P_MRP008.D\DATA.MS
October 1, 2021 12:55:10 PM	End	Execution	Mass Ratio Precision - Injection Tower, Front MMI, SQ: - Source: EI - Inert - L (RSD): <= 5.00%	Run Count : 1
October 1, 2021 12:55:13 PM	End	Qualification	Session	OQ
October 1, 2021 12:55:13 PM	Start	Reporting	Session	None
October 1, 2021 1:09:11 PM	Audit	Reporting	Session	Report Generated : Certificate

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REVIEW BY Autcharawan S.
APPROVED BY Sarasat M.
NEXT CAL. DATE 12/Jan/23 ~~12/Jan/22~~

ARCHEMICA

Certificate of Calibration

ICS-2100: Anion (ID#659)

This certificate is to verify that instrument below are calibrated

by Archemica Lab Co., Ltd.

ICS-2100 S/N: 15010977

AS-HV S/N: 5450A36659

For

ALS Laboratory Group (Thailand) Co., Ltd.

ARCHEMICA LAB
บริษัท อาร์เคม่ิก้า แลบ จำกัด
ARCHEMICA LAB CO.,LTD

Operator Signature: _____ Date: Jan 12, 2022

(Mr.Thitipong Piromkripuk)

Applications Chemist

Certificate of System Qualification

GC-OQ

System ID:	GC-6
Organization Name:	ALS Laboratory Group (Thailand) Co., Ltd.
Organization Location:	104 Phattanakan 40, Phattanakan Rd., Suan Luang, Bangkok 10250
Date:	October 21, 2021 10:05:40 AM
EQP Name:	AgilentRecommended
EQP Revision:	GC.02.50
Overall Qualification Status:	Pass

REVIEW BY Suchada T.
APPROVED BY Sarayat M.
NEXT CAL. DATE 21 Apr 2023

System Inspection and Basic Safety and Operation

Name: 7890

Setpoint Status: **Pass**

Overall System Inspection and Basic Safety and Operation Test Status

Pass

Inlet Pressure Decay

Name: 7890
Front SSL

Setpoint Status: **Pass**

Pressure: 25.0 psi

Pressure Change: 0.0 psi /5 minutes

Agilent Recommended: >= -2.0 and <= 0.5

Overall Inlet Pressure Decay Test Status

Pass

Inlet Pressure Accuracy

Name: 7890
Front SSL

Setpoint Status: **Pass**

	Setpoint		Actual	
Inlet Pressure:	25.0	psi	24.9	psi

Accuracy: 0.1 psi

Agilent Recommended: <= 1.2

Overall Inlet Pressure Accuracy Test Status

Pass

Inlet Pressure Decay

Name: 7890
Back SSL

Setpoint Status: **Pass**

Pressure: 25.0 psi

Pressure Change: 0.0 psi /5 minutes

Agilent Recommended: >= -2.0 and <= 0.5

Overall Inlet Pressure Decay Test Status

Pass

Inlet Pressure Accuracy

Name: 7890
Back SSL

Setpoint Status: **Pass**

	Setpoint		Actual	
Inlet Pressure:	25.0	psi	24.9	psi

Accuracy: 0.1 psi

Agilent Recommended: <= 1.2

Overall Inlet Pressure Accuracy Test Status

Pass

Detector Flow Accuracy

Name: 7890
Front FID

Setpoint Status: Pass

Flow Type: Fuel
Setpoint: 30.0 mL/min Measured Flow: 30.5 mL/min

Accuracy: 0.5 mL/min
Agilent Recommended: <= 10.0 % setpoint (3.0 ml/min)
Limit is percentage of setpoint or 0.5 ml/minute, whichever is largest.

Setpoint Status: Pass

Flow Type: Oxidizer
Setpoint: 400.0 mL/min Measured Flow: 394.0 mL/min

Accuracy: 6.0 mL/min
Agilent Recommended: <= 10.0 % setpoint (40.0 ml/min)
Limit is percentage of setpoint or 0.5 ml/minute, whichever is largest.

Setpoint Status: Pass

Flow Type: Makeup
Setpoint: 25.0 mL/min Measured Flow: 24.2 mL/min

Accuracy: 0.8 mL/min
Agilent Recommended: <= 10.0 % setpoint (2.5 ml/min)
Limit is percentage of setpoint or 0.5 ml/minute, whichever is largest.

Overall Detector Flow Accuracy Test Status

Pass

Detector Flow Accuracy

Name: 7890
Back FID

Setpoint Status: Pass

Flow Type: Fuel
Setpoint: 30.0 mL/min Measured Flow: 29.1 mL/min

Accuracy: 0.9 mL/min
Agilent Recommended: <= 10.0 % setpoint (3.0 ml/min)
Limit is percentage of setpoint or 0.5 ml/minute, whichever is largest.

Setpoint Status: Pass

Flow Type: Oxidizer
Setpoint: 400.0 mL/min Measured Flow: 397.3 mL/min

Accuracy: 2.7 mL/min
Agilent Recommended: <= 10.0 % setpoint (40.0 ml/min)
Limit is percentage of setpoint or 0.5 ml/minute, whichever is largest.

Setpoint Status: Pass

Flow Type: Makeup
Setpoint: 25.0 mL/min Measured Flow: 24.4 mL/min

Accuracy: 0.6 mL/min
Agilent Recommended: <= 10.0 % setpoint (2.5 ml/min)
Limit is percentage of setpoint or 0.5 ml/minute, whichever is largest.

Overall Detector Flow Accuracy Test Status

Pass

GC Oven Temperature Accuracy

Name: 7890

Setpoint Status:	**Pass**						
Zone:	Oven						
	Setpoint/Actual						
Temperature:	230.0	231.5	°C				
Accuracy:		1.5	°C				
Agilent Recommended:	>=	-1.0	% setpoint in K	(	-5.0	°C	)
	<=	1.0	% setpoint in K	(	5.0	°C	)

Setpoint Status:	**Pass**						
Zone:	Oven						
	Setpoint/Actual						
Temperature:	100.0	100.5	°C				
Accuracy:		0.5	°C				
Agilent Recommended:	>=	-1.0	% setpoint in K	(	-3.7	°C	)
	<=	1.0	% setpoint in K	(	3.7	°C	)

Overall GC Oven Temperature Accuracy Test Status

Pass

GC Oven Temperature Stability

Name:	7890		
Setpoint Status:	**Pass**		
	Setpoint/Average		
Temperature:	100.0	100.4667	°C
Stability:		0.1	°C
Agilent Recommended:	<=	0.5	

Overall GC Oven Temperature Stability Test Status

Pass

Scouting Run

Tested Combination1	Front	SSL	/ Front	FID
	Injection Tower			
Name:	7693A			

Setpoint Status:	**Completed**	
Injection Volume on Column:	1.0	uL

Overall Scouting Run Status

Completed

Noise and Drift

Tested Combination1	Front	SSL	/ Front	FID		
Name:	7890					
Setpoint Status:	**Pass**					
Base Signal:	12.7	pA				
		ASTM Noise			Drift	
		pA			pA/Hr	
		0.06			0.10	
Agilent Recommended:	<=	0.10		<=	2.50	
Status:	Pass			Pass		

Overall Noise and Drift Test Status

Pass

Injection Precision

Tested Combination1	Front	SSL	/ Front	FID			
Name:	7693A						
Setpoint Status:	**Pass**						
Injection Volume on Column:	1.0	uL					
Area RSD:		0.42	%	Retention Time RSD:		0.16	%
Agilent Recommended:	<=	3.00			<=	1.00	

Overall Injection Precision Test Status

Pass

Signal to Noise

Tested Combination1	Front	SSL	/ Front	FID
	Injection Tower			
Name:	7890			

Setpoint Status: Pass

Signal to Noise:		1174861
Agilent Recommended:	>=	300000

Overall Signal to Noise Test Status

Pass

Scouting Run

Tested Combination2	Back	SSL	/ Back	FID
	Injection Tower			
Name:	7693A			

Setpoint Status: Completed

Injection Volume on Column: 1.0 uL

Overall Scouting Run Status

Completed

Noise and Drift

Tested Combination2	Back	SSL	/ Back	FID
Name:	7890			

Setpoint Status: Pass

Base Signal: 10.4 pA

		ASTM Noise pA		Drift pA/Hr
		0.05		0.00
Agilent Recommended:	<=	0.10	<=	2.50
Status:	Pass		Pass	

Overall Noise and Drift Test Status

Pass

Injection Precision

Tested Combination2	Back	SSL	/ Back	FID
Name:	7693A			

Setpoint Status: Pass

Injection Volume on Column: 1.0 uL

Area RSD:		1.16 %	Retention Time RSD:		0.12 %
Agilent Recommended:	<=	3.00		<=	1.00

Overall Injection Precision Test Status

Pass

Signal to Noise

Tested Combination2	Back	SSL	/ Back	FID
	Injection Tower			
Name:	7890			

Setpoint Status: Pass

Signal to Noise:		805466
Agilent Recommended:	>=	300000

Overall Signal to Noise Test Status

Pass

Instrument Details

Purpose

This section describes the as found system configuration.

Details

System

System ID	GC-6
Manufacturer	Agilent Technologies
Name	7890
Flow Data Input	Manual Data
Temperature Data Input	Manual Data or Other Data Logging

Tested Combination1

Injection Technique	Injection Tower
Sampler Identifier	Sampler 2
Inlet	Front
Detector	Front
LTM Included?	No

Tested Combination2

Injection Technique	Injection Tower
Sampler Identifier	Sampler 3
Inlet	Back
Detector	Back
LTM Included?	No

Sampler 1

Manufacturer	Agilent Technologies
Type	Tray
Name	7693A
Model Number	G4514A
Serial Number	CN15380030
Firmware Revision	A.11.01
Vial Heater	Not installed

Sampler 2

Manufacturer	Agilent Technologies
Type	Injection Tower
Name	7693A
Model Number	G4513A
Serial Number	CN10340103
Firmware Revision	A.10.09
Usage	Sample Injection
Location	Front
Syringe Volume (µL)	10

Sampler 3

Manufacturer	Agilent Technologies
Type	Injection Tower
Name	7693A
Model Number	G4513A
Serial Number	CN16280128
Firmware Revision	A.10.09
Usage	Sample Injection
Location	Back
Syringe Volume (µL)	10

Mainframe 1

Manufacturer	Agilent Technologies
Name	7890
Model Number	G3440A
Serial Number	CN11461066
Firmware Revision	Version 4.27
Component ID/Asset No.	GC-6
Oven Type	Standard

Inlet 1

Manufacturer	Agilent Technologies
Name	7890
Type	SSL
Location	Front
Carrier Gas	Helium
Control Type	Electronic Pressure Control (EPC)
Purged Inlet	Yes

Inlet 2

Manufacturer	Agilent Technologies
Name	7890
Type	SSL
Location	Back
Carrier Gas	Helium
Control Type	Electronic Pressure Control (EPC)
Purged Inlet	Yes

Detector 1

Manufacturer	Agilent Technologies
Name	7890
Type	FID
Adapter	Capillary
Control Type	Electronic Pressure Control (EPC)
Location	Front
Makeup Gas	Nitrogen

Detector 2

Manufacturer	Agilent Technologies
Name	7890
Type	FID
Adapter	Capillary
Control Type	Electronic Pressure Control (EPC)
Location	Back
Makeup Gas	Nitrogen

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 logon to access ACE and electronically sign this document. (Other e-signatures can be applied to this document using a Document Content Management or other suitable method defined in your data access and control procedures.)

Details

Full Name of Signer:	Suriya Thongkaew
Logged On User Name:	suriya.thongkaew@non.agilent.com
Signature Creation Date:	October 21, 2021
Reason for Signature:	Executed protocol and published this original version of document

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User Name: suriya.thongkaew
Hostname: ASBKKW7015

System Id: GC-6
Print Date: October 21, 2021 10:05:46 AM

OQ GC ALS CN11461066 Transaction log :

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
October 20, 2021 12:18:50 PM	Audit	SessionCreated	Session	None
October 20, 2021 12:18:50 PM	Start	Configuration	Session	None
October 20, 2021 12:18:50 PM	Audit	Entitlement	Licensing	User is Nonpaying and does not require an unlock code
October 20, 2021 12:24:57 PM	Audit	EqpLoaded	Session	EQP details for primary technique [Gc] - File path: [ProtocolPacks/Gc/Configurations/02.51/Gc.02.51.eqp], EQP File Name: [Gc.02.51.eqp], EQP Name: [AgilentRecommended]
October 20, 2021 12:25:02 PM	End	Configuration	Session	None
October 20, 2021 12:25:09 PM	Start	Qualification	Session	OQ
October 20, 2021 12:25:09 PM	Start	Execution	System Inspection and Basic Safety and Operation - 7890: - Qualitative Test - No setpoints associated	None
October 20, 2021 12:30:25 PM	End	Execution	System Inspection and Basic Safety and Operation - 7890: - Qualitative Test - No setpoints associated	Run Count : 1
October 20, 2021 12:56:29 PM	Start	Execution	Inlet Pressure Decay - Front SSL: - Pressure Controlled Inlet - S: 25.0 psi - L: >= -2.0 psi and <= 0.5 psi	None

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User Name: suriya.thongkaew
Hostname: ASBKKW7015

System Id: GC-6
Print Date: October 21, 2021 10:05:46 AM

OQ GC ALS CN11461066 Transaction log :

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
October 20, 2021 1:02:16 PM	End	Execution	Inlet Pressure Decay - Front SSL: - Pressure Controlled Inlet - S: 25.0 psi - L: >= -2.0 psi and <= 0.5 psi	Run Count : 1
October 20, 2021 1:02:18 PM	Start	Execution	Inlet Pressure Accuracy - Front SSL: - Pressure Controlled Inlet - S: 25.0 psi - L: <= 1.2 psi	None
October 20, 2021 1:02:26 PM	End	Execution	Inlet Pressure Accuracy - Front SSL: - Pressure Controlled Inlet - S: 25.0 psi - L: <= 1.2 psi	Run Count : 1
October 20, 2021 1:02:29 PM	Start	Execution	Inlet Pressure Decay - Back SSL: - Pressure Controlled Inlet - S: 25.0 psi - L: >= -2.0 psi and <= 0.5 psi	None
October 20, 2021 1:04:21 PM	End	Execution	Inlet Pressure Decay - Back SSL: - Pressure Controlled Inlet - S: 25.0 psi - L: >= -2.0 psi and <= 0.5 psi	Run Count : 1
October 20, 2021 1:07:53 PM	Start	Execution	Inlet Pressure Accuracy - Back SSL: - Pressure Controlled Inlet - S: 25.0 psi - L: <= 1.2 psi	None
October 20, 2021 1:08:11 PM	End	Execution	Inlet Pressure Accuracy - Back SSL: - Pressure Controlled Inlet - S: 25.0 psi - L: <= 1.2 psi	Run Count : 1
October 20, 2021 1:08:16 PM	Start	Execution	Detector Flow Accuracy - Front FID: - Type : Fuel - S: 30.0 mL/min - L: <= 10.0% setpoint	None
October 20, 2021 1:20:23 PM	Audit	Data	Detector Flow Accuracy - Front FID: - Type : Fuel - S: 30.0 mL/min - L: <= 10.0% setpoint	Manual Data Entry
October 20, 2021 1:20:26 PM	End	Execution	Detector Flow Accuracy - Front FID: - Type : Fuel - S: 30.0 mL/min - L: <= 10.0% setpoint	Run Count : 1

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User Name: suriya.thongkaew
Hostname: ASBKKW7015

System Id: GC-6
Print Date: October 21, 2021 10:05:46 AM

OQ GC ALS CN11461066 Transaction log :

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
October 20, 2021 1:20:29 PM	Start	Execution	Detector Flow Accuracy - Front FID: - Type : Oxidizer - S: 400.0 mL/min - L: <= 10.0% setpoint	None
October 20, 2021 1:23:27 PM	Audit	Data	Detector Flow Accuracy - Front FID: - Type : Oxidizer - S: 400.0 mL/min - L: <= 10.0% setpoint	Manual Data Entry
October 20, 2021 1:23:29 PM	End	Execution	Detector Flow Accuracy - Front FID: - Type : Oxidizer - S: 400.0 mL/min - L: <= 10.0% setpoint	Run Count : 1
October 20, 2021 1:23:31 PM	Start	Execution	Detector Flow Accuracy - Front FID: - Type : Makeup - S: 25.0 mL/min - L: <= 10.0% setpoint	None
October 20, 2021 1:27:40 PM	Audit	Data	Detector Flow Accuracy - Front FID: - Type : Makeup - S: 25.0 mL/min - L: <= 10.0% setpoint	Manual Data Entry
October 20, 2021 1:27:42 PM	End	Execution	Detector Flow Accuracy - Front FID: - Type : Makeup - S: 25.0 mL/min - L: <= 10.0% setpoint	Run Count : 1
October 20, 2021 1:27:46 PM	Start	Execution	Detector Flow Accuracy - Back FID: - Type : Fuel - S: 30.0 mL/min - L: <= 10.0% setpoint	None
October 20, 2021 1:32:10 PM	Audit	Data	Detector Flow Accuracy - Back FID: - Type : Fuel - S: 30.0 mL/min - L: <= 10.0% setpoint	Manual Data Entry
October 20, 2021 1:32:12 PM	End	Execution	Detector Flow Accuracy - Back FID: - Type : Fuel - S: 30.0 mL/min - L: <= 10.0% setpoint	Run Count : 1
October 20, 2021 1:32:14 PM	Start	Execution	Detector Flow Accuracy - Back FID: - Type : Oxidizer - S: 400.0 mL/min - L: <= 10.0% setpoint	None
October 20, 2021 1:34:13 PM	Audit	Data	Detector Flow Accuracy - Back FID: - Type : Oxidizer - S: 400.0 mL/min - L: <= 10.0% setpoint	Manual Data Entry

User Name: suriya.thongkaew
Hostname: ASBKKW7015

System Id: GC-6
Print Date: October 21, 2021 10:05:46 AM

OQ GC ALS CN11461066 Transaction log :

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
October 20, 2021 1:34:16 PM	End	Execution	Detector Flow Accuracy - Back FID: - Type : Oxidizer - S: 400.0 mL/min - L: <= 10.0% setpoint	Run Count : 1
October 20, 2021 1:34:46 PM	Start	Execution	Detector Flow Accuracy - Back FID: - Type : Makeup - S: 25.0 mL/min - L: <= 10.0% setpoint	None
October 20, 2021 1:36:33 PM	Audit	Data	Detector Flow Accuracy - Back FID: - Type : Makeup - S: 25.0 mL/min - L: <= 10.0% setpoint	Manual Data Entry
October 20, 2021 1:36:36 PM	End	Execution	Detector Flow Accuracy - Back FID: - Type : Makeup - S: 25.0 mL/min - L: <= 10.0% setpoint	Run Count : 1
October 20, 2021 1:36:38 PM	Start	Execution	GC Oven Temperature Accuracy - 7890: - Temperature : Oven - S: 230.0°C - L: >= -1.0 AND <= 1.0 % setpoint in K	None
October 20, 2021 2:04:31 PM	Audit	Data	GC Oven Temperature Accuracy - 7890: - Temperature : Oven - S: 230.0°C - L: >= -1.0 AND <= 1.0 % setpoint in K	Manual Data Entry
October 20, 2021 2:04:32 PM	End	Execution	GC Oven Temperature Accuracy - 7890: - Temperature : Oven - S: 230.0°C - L: >= -1.0 AND <= 1.0 % setpoint in K	Run Count : 1
October 20, 2021 2:04:34 PM	Start	Execution	GC Oven Temperature Accuracy - 7890: - Temperature : Oven - S: 100.0°C - L: >= -1.0 AND <= 1.0 % setpoint in K	None
October 20, 2021 2:10:47 PM	Audit	Data	GC Oven Temperature Accuracy - 7890: - Temperature : Oven - S: 100.0°C - L: >= -1.0 AND <= 1.0 % setpoint in K	Manual Data Entry

User Name: suriya.thongkaew
Hostname: ASBKKW7015

System Id: GC-6
Print Date: October 21, 2021 10:05:46 AM

OQ GC ALS CN11461066 Transaction log :

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
October 20, 2021 2:10:49 PM	End	Execution	GC Oven Temperature Accuracy - 7890: - Temperature : Oven - S: 100.0°C - L: >= -1.0 AND <= 1.0 % setpoint in K	Run Count : 1
October 20, 2021 2:10:51 PM	Start	Execution	GC Oven Temperature Stability - 7890: - Temperature : Oven - S: 100.0°C - L: <= 0.5°C	None
October 20, 2021 2:31:39 PM	Audit	Data	GC Oven Temperature Stability - 7890: - Temperature : Oven - S: 100.0°C - L: <= 0.5°C	Manual Data Entry
October 20, 2021 2:31:41 PM	End	Execution	GC Oven Temperature Stability - 7890: - Temperature : Oven - S: 100.0°C - L: <= 0.5°C	Run Count : 1
October 20, 2021 2:31:44 PM	Start	Execution	GC Scouting Run - Injection Tower, Front SSL, Front FID: - Part of System Preparation - No limits associated	None
October 20, 2021 2:43:06 PM	Audit	AceClosed	Session	None
October 21, 2021 9:18:59 AM	Audit	AceRestarted	Session	None
October 21, 2021 9:19:02 AM	Audit	SessionReloaded	Session	None
October 21, 2021 9:19:09 AM	Start	Qualification	Session	OQ
October 21, 2021 9:19:09 AM	Start	Execution	GC Scouting Run - Injection Tower, Front SSL, Front FID: - Part of System Preparation - No limits associated	None
October 21, 2021 9:19:41 AM	Audit	AceClosed	Session	None

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User Name: suriya.thongkaew
Hostname: ASBKKW7015

System Id: GC-6
Print Date: October 21, 2021 10:05:46 AM

OQ GC ALS CN11461066 Transaction log :

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
October 21, 2021 9:20:08 AM	Audit	AceRestarted	Session	None
October 21, 2021 9:20:09 AM	Audit	SessionReloaded	Session	None
October 21, 2021 9:20:13 AM	Start	Qualification	Session	OQ
October 21, 2021 9:20:13 AM	Start	Execution	GC Scouting Run - Injection Tower, Front SSL, Front FID: - Part of System Preparation - No limits associated	None
October 21, 2021 9:29:45 AM	Audit	Data	GC Scouting Run - Injection Tower, Front SSL, Front FID: - Part of System Preparation - No limits associated	Data files Path : C:\Chem32\1\DATA\OQPV2021\OQPV2021_F 2021-10-20 15-49-01\SCOUT_F001.D\FID1A.ch
October 21, 2021 9:30:05 AM	End	Execution	GC Scouting Run - Injection Tower, Front SSL, Front FID: - Part of System Preparation - No limits associated	Run Count : 1
October 21, 2021 9:30:08 AM	Start	Execution	Noise and Drift - Front FID: - Detector FID - L (Noise): <= 0.10 pA - L (Drift): <= 2.50 pA/hour	None
October 21, 2021 9:30:41 AM	Audit	Data	Noise and Drift - Front FID: - Detector FID - L (Noise): <= 0.10 pA - L (Drift): <= 2.50 pA/hour	Data files Path : C:\Chem32\1\DATA\OQPV2021\OQPV2021_F 2021-10-20 15-49-01\SIGNSDRF_F001.D\FID1A.ch
October 21, 2021 9:31:10 AM	End	Execution	Noise and Drift - Front FID: - Detector FID - L (Noise): <= 0.10 pA - L (Drift): <= 2.50 pA/hour	Run Count : 1

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User Name: suriya.thongkaew
Hostname: ASBKKW7015

System Id: GC-6
Print Date: October 21, 2021 10:05:46 AM

OQ GC ALS CN11461066 Transaction log :

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
October 21, 2021 9:31:42 AM	Start	Execution	Injection Precision - Injection Tower, Front SSL, Front FID: - GC - L (Area): <= 3.00% - L (Ret. Time): <= 1.00%	None
October 21, 2021 9:32:55 AM	Audit	Data	Injection Precision - Injection Tower, Front SSL, Front FID: - GC - L (Area): <= 3.00% - L (Ret. Time): <= 1.00%	Data files Path : C:\Chem32\1\DATA\OQPV2021\OQPV2021_F 2021-10-20 16-51-16\INJPREC_F002.D\FID1A.ch
October 21, 2021 9:32:55 AM	Audit	Data	Injection Precision - Injection Tower, Front SSL, Front FID: - GC - L (Area): <= 3.00% - L (Ret. Time): <= 1.00%	Data files Path : C:\Chem32\1\DATA\OQPV2021\OQPV2021_F 2021-10-20 16-51-16\INJPREC_F003.D\FID1A.ch
October 21, 2021 9:32:56 AM	Audit	Data	Injection Precision - Injection Tower, Front SSL, Front FID: - GC - L (Area): <= 3.00% - L (Ret. Time): <= 1.00%	Data files Path : C:\Chem32\1\DATA\OQPV2021\OQPV2021_F 2021-10-20 16-51-16\INJPREC_F004.D\FID1A.ch
October 21, 2021 9:32:56 AM	Audit	Data	Injection Precision - Injection Tower, Front SSL, Front FID: - GC - L (Area): <= 3.00% - L (Ret. Time): <= 1.00%	Data files Path : C:\Chem32\1\DATA\OQPV2021\OQPV2021_F 2021-10-20 16-51-16\INJPREC_F005.D\FID1A.ch
October 21, 2021 9:32:56 AM	Audit	Data	Injection Precision - Injection Tower, Front SSL, Front FID: - GC - L (Area): <= 3.00% - L (Ret. Time): <= 1.00%	Data files Path : C:\Chem32\1\DATA\OQPV2021\OQPV2021_F 2021-10-20 16-51-16\INJPREC_F006.D\FID1A.ch
October 21, 2021 9:32:56 AM	Audit	Data	Injection Precision - Injection Tower, Front SSL, Front FID: - GC - L (Area): <= 3.00% - L (Ret. Time): <= 1.00%	Data files Path : C:\Chem32\1\DATA\OQPV2021\OQPV2021_F 2021-10-20 16-51-16\INJPREC_F007.D\FID1A.ch

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User Name: suriya.thongkaew
Hostname: ASBKKW7015

System Id: GC-6
Print Date: October 21, 2021 10:05:46 AM

OQ GC ALS CN11461066 Transaction log :

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
October 21, 2021 9:33:07 AM	End	Execution	Injection Precision - Injection Tower, Front SSL, Front FID: - GC - L (Area): <= 3.00% - L (Ret. Time): <= 1.00%	Run Count : 1
October 21, 2021 9:33:23 AM	Start	Execution	Signal to Noise - Injection Tower, Front SSL, Front FID: - Detector FID - L: >= 300000	None
October 21, 2021 9:34:01 AM	Audit	Data	Signal to Noise - Injection Tower, Front SSL, Front FID: - Detector FID - L: >= 300000	Data files Path : C:\Chem32\1\DATA\OQPV2021\OQPV2021_F 2021-10-20 16-51-16\SIGTONS_F001.D\FID1A.ch
October 21, 2021 9:34:15 AM	End	Execution	Signal to Noise - Injection Tower, Front SSL, Front FID: - Detector FID - L: >= 300000	Run Count : 1
October 21, 2021 9:34:19 AM	Start	Execution	GC Scouting Run - Injection Tower, Back SSL, Back FID: - Part of System Preparation - No limits associated	None
October 21, 2021 9:35:04 AM	Audit	Data	GC Scouting Run - Injection Tower, Back SSL, Back FID: - Part of System Preparation - No limits associated	Data files Path : C:\Chem32\1\DATA\OQPV2021\OQPV2021_B 2021-10-20 17-13-45\SCOUT_B001.D\FID2B.ch
October 21, 2021 9:35:27 AM	End	Execution	GC Scouting Run - Injection Tower, Back SSL, Back FID: - Part of System Preparation - No limits associated	Run Count : 1
October 21, 2021 9:35:32 AM	Start	Execution	Noise and Drift - Back FID: - Detector FID - L (Noise): <= 0.10 pA - L (Drift): <= 2.50 pA/hour	None

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User Name: suriya.thongkaew
Hostname: ASBKKW7015

System Id: GC-6
Print Date: October 21, 2021 10:05:46 AM

OQ GC ALS CN11461066 Transaction log :

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
October 21, 2021 9:36:06 AM	Audit	Data	Noise and Drift - Back FID: - Detector FID - L (Noise): <= 0.10 pA - L (Drift): <= 2.50 pA/hour	Data files Path : C:\Chem32\1\DATA\OQPV2021\OQPV2021_B 2021-10-20 17-13-45\SIGNSDRF_B001.D\FID2B.ch
October 21, 2021 9:36:16 AM	End	Execution	Noise and Drift - Back FID: - Detector FID - L (Noise): <= 0.10 pA - L (Drift): <= 2.50 pA/hour	Run Count : 1
October 21, 2021 9:36:20 AM	Start	Execution	Injection Precision - Injection Tower, Back SSL, Back FID: - GC - L (Area): <= 3.00% - L (Ret. Time): <= 1.00%	None
October 21, 2021 9:38:57 AM	Audit	Data	Injection Precision - Injection Tower, Back SSL, Back FID: - GC - L (Area): <= 3.00% - L (Ret. Time): <= 1.00%	Data files Path : C:\Chem32\1\DATA\OQPV2021\OQPV2021_B 2021-10-20 17-13-45\INJPREC_B002.D\FID2B.ch
October 21, 2021 9:38:57 AM	Audit	Data	Injection Precision - Injection Tower, Back SSL, Back FID: - GC - L (Area): <= 3.00% - L (Ret. Time): <= 1.00%	Data files Path : C:\Chem32\1\DATA\OQPV2021\OQPV2021_B 2021-10-20 17-13-45\INJPREC_B003.D\FID2B.ch
October 21, 2021 9:38:57 AM	Audit	Data	Injection Precision - Injection Tower, Back SSL, Back FID: - GC - L (Area): <= 3.00% - L (Ret. Time): <= 1.00%	Data files Path : C:\Chem32\1\DATA\OQPV2021\OQPV2021_B 2021-10-20 17-13-45\INJPREC_B004.D\FID2B.ch
October 21, 2021 9:38:57 AM	Audit	Data	Injection Precision - Injection Tower, Back SSL, Back FID: - GC - L (Area): <= 3.00% - L (Ret. Time): <= 1.00%	Data files Path : C:\Chem32\1\DATA\OQPV2021\OQPV2021_B 2021-10-20 17-13-45\INJPREC_B005.D\FID2B.ch

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User Name: suriya.thongkaew
Hostname: ASBKKW7015

System Id: GC-6
Print Date: October 21, 2021 10:05:46 AM

OQ GC ALS CN11461066 Transaction log :

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
October 21, 2021 9:38:57 AM	Audit	Data	Injection Precision - Injection Tower, Back SSL, Back FID: - GC - L (Area): <= 3.00% - L (Ret. Time): <= 1.00%	Data files Path : C:\Chem32\1\DATA\OQPV2021\OQPV2021_B 2021-10-20 17-13-45\INJPREC_B006.D\FID2B.ch
October 21, 2021 9:38:57 AM	Audit	Data	Injection Precision - Injection Tower, Back SSL, Back FID: - GC - L (Area): <= 3.00% - L (Ret. Time): <= 1.00%	Data files Path : C:\Chem32\1\DATA\OQPV2021\OQPV2021_B 2021-10-20 17-13-45\INJPREC_B007.D\FID2B.ch
October 21, 2021 9:39:06 AM	End	Execution	Injection Precision - Injection Tower, Back SSL, Back FID: - GC - L (Area): <= 3.00% - L (Ret. Time): <= 1.00%	Run Count : 1
October 21, 2021 9:39:11 AM	Start	Execution	Signal to Noise - Injection Tower, Back SSL, Back FID: - Detector FID - L: >= 300000	None
October 21, 2021 9:39:28 AM	Audit	Data	Signal to Noise - Injection Tower, Back SSL, Back FID: - Detector FID - L: >= 300000	Data files Path : C:\Chem32\1\DATA\OQPV2021\OQPV2021_B 2021-10-20 17-13-45\SIGTONS_B001.D\FID2B.ch
October 21, 2021 9:39:39 AM	End	Execution	Signal to Noise - Injection Tower, Back SSL, Back FID: - Detector FID - L: >= 300000	Run Count : 1
October 21, 2021 9:39:43 AM	End	Qualification	Session	OQ
October 21, 2021 9:39:43 AM	Start	Reporting	Session	None
October 21, 2021 10:04:15 AM	Audit	Reporting	Session	Report Generated : Certificate

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ภาคผนวก จ-2

เอกสารสอบเทียบเครื่องมือ

บริษัท ยูไนเต็ด แอนนาลิสต์ แอนด์ เอ็นจิเนียริ่ง คอนซัลแตนท์ จำกัด

List of Instruments Certification for Air & Noise Quality Analysis

No.	Instrument/Equipment	Parameter	Manufacturer	Model/Serial No.	Calibrator	Certification No.	Date of Calibration	Due date of Calibration	Remark
Stack									
1	Pre-Test Console	Total Suspended Particulate Hydrogen Chloride Dioxin/Furans-TEQ Mercury Cadmium Lead Arsenic Berylium Chromium	Apex Instruments, USA.	XC-572-V 0807047	Envi Equipment Service Co., Ltd.	E21-0813	19 Aug 21	18 Aug 22	-
2	Flue gas Analyzer	Sulphur Dioxide Oxide of Nitrogen as Nitrogen Dioxide Carbon Monoxide	Testo	Testo 350 60899456	Entech Industrial Sulution Co., Ltd.	G 640441	5 Aug 21	4 Aug 22	-

List of Opacity Training Certification for Opacity Mesurement

No.	Name	Training Couse	Train	Date	Remark
1	Mr.Apiwich Toungtee	Opacity	Pollution Control Department	12-13 March 2015	-
2	Mr.Ronnapob Putragulpattana	Opacity	Pollution Control Department	22-23 March 2018	-

List of Instruments Certification for Water Quality Analysis

No.	Instrument/Equipment	Parameter	Manufacturer	Model/Serial No.	Calibrator	Certification No.	Date of Calibration	Due date of Calibration	Remark
Water									
1	pH Meter	pH	Horiba	LAQUA-PH210 HA0C0025	Technology Promotion Association (Thailand-Japan)	22CH639	11 May 22	10 May 23	-
2	DO Meter	DO	Horiba	LAQUA-DO210 HE9M0013	Technology Promotion Association (Thailand-Japan)	22TW73	18 Mar 22	17 Mar 23	-
3	Conductivity Meter	Conductivity	Horiba	LAQUA-EC210 HC9L0014	Technology Promotion Association (Thailand-Japan)	22CH580	27 Apr 24	26 Apr 23	-

Envi Equipment Service Co., Ltd.
110/254 Moo 3, Tumbon Bang Rak Phatthana, Amphur Bang Bua Thong, Nonthaburi 11110
Tel. 098 362 9152, 089 478 7885
E-mail: sales@envi-ees.com

CERTIFICATE OF CALIBRATION

Customer	:	United Analyst and Engineering Consultant Co., Ltd.
Address	:	81 Soi Udomsuk 41, Sukhumvit Road, Bangchak, Phrakhanong, Bangkok 10260
Description of Equipment	:	Console meter
Manufacturer	:	Apex Instrument
Model Number	:	XC-572-V
Serial Number	:	0807047
ID./Control No.	:	-
Environment Conditions	:	Temperature (25 ± 2) °C
	:	Humidity (50 ± 15) % RH
Cal. Date	:	19/08/2021
Issue Date	:	19/08/2021

Calibration Method or Calibration Procedure Used

US EPA Method (United State Environmental Protection Agency)

This certificate is traceable to national standard, which realize the units of measurement according to the International System of Units (IS).

Result of Calibration

This certificate may not be reproduced other than in full except with prior Written approval of the Technical Manager, Envi Equipment Service Company Limited.

These reported uncertainties of measurement are expanded by a coverage factor of k=2, providing a 95% confidence level.

Calibrated by : Mr. Sanya Sangnil

Approved by : (Mr. Mana Fuekhud)
Technical Manger

เอกสารไม่ควบคุม

METHOD 5 CONSOLE CALIBRATION
USING REFERENCE WET GAS METER W-NK-2.5-B-Z No.547425
5-POINT METRIC UNIT

Meter Console Information	
Console Model Number	XC-572-V
Console Serial Number	0807047
DGM Model Number	SK25EX
DGM Serial Number	00003580

Calibration Conditions			
Date	Time	19/8/2021	01:00 PM
Calibration Reference No.		-	
Barometric Pressure		761.00	mm Hg
Calibration Meter Gamma		0.999	

Factors/Conversions		
Std Temp	293	K
Std Press	760	mm Hg
K_1	0.386	
Console Leak Check	PASS	

Calibration Data									
Run Time	Metering Console					Calibration Meter			
Elapsed	DGM Orifice DH	Volume Initial	Volume Final	Outlet Temp Initial	Outlet Temp Final	Volume Initial	Volume Final	Outlet Temp Initial	Outlet Temp Final
(Q)	(P_m)	(V_{mi})	(V_{mf})	(t_{mi})	(t_{mf})	(Vwi)	(Vwf)	(t_{wi})	(t_{wf})
min	mm H_2O	m^3	m^3	°C	°C	m^3	m^3	°C	°C
12.17	13.0	3.3600	3.5000	23	23	23.01236	23.15126	26	26
12.30	13.0	3.5000	3.6400	23	23	23.15126	23.28948	26	26
8.72	26.0	3.6490	3.7890	24	24	23.29826	23.43644	26	26
8.88	26.0	3.7890	3.9290	24	24	23.43644	23.57434	26	26
14.83	40.0	3.9350	4.2150	25	25	23.58012	23.85818	26	26
14.67	40.0	4.2150	4.4950	25	25	23.85818	24.13456	26	26
10.37	70.0	4.5080	4.7880	25	25	24.14158	24.41250	26	26
10.13	70.0	4.7880	5.0680	26	26	24.41250	24.68290	26	26
8.90	90.0	5.0750	5.3550	27	27	24.68856	24.96012	26	26
8.88	90.0	5.3550	5.6350	27	27	24.96012	25.23050	26	26

เอกสารไม่ควบคุม

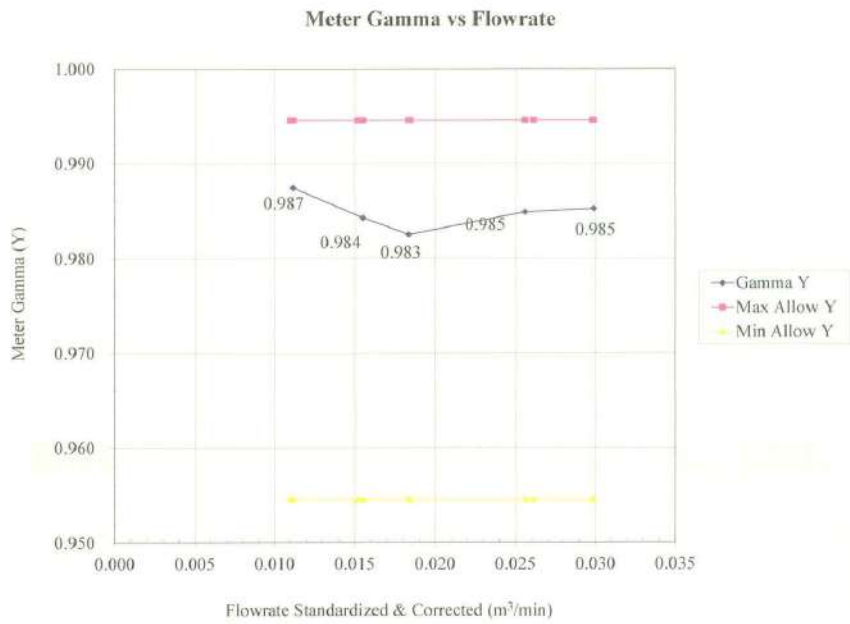
METHOD 5 CONSOLE CALIBRATION
USING REFERENCE WET GAS METER W-NK-2.5-B-Z No.547425
5-POINT METRIC UNIT

Calibration Data								
Results								
Standardized Data				Dry Gas Meter				
				Calibration Factor		Flowrate		
Dry Gas Meter		Calibration Meter		Value	Variation	Std & Corr	.0212 m^3_{std}/min	Variation
($V_{m(std)}$)	($Q_{m(std)}$)	($V_{W(std)}$)	($Q_{W(std)}$)	(Y)	(△Y)	($Q_{m(std)(corr)}$)	(△$H_@$)	(△$H_@$)
m^3	m^3/min	m^3	m^3/min			m^3/min	mm H_2O	
0.138	0.011	0.136	0.011	0.990	0.015	0.011	46.043	-2.056
0.138	0.011	0.135	0.011	0.985	0.010	0.011	47.522	-0.577
0.138	0.016	0.135	0.016	0.984	0.009	0.016	47.880	-0.219
0.138	0.016	0.135	0.015	0.982	0.007	0.015	49.931	1.832
0.276	0.019	0.273	0.018	0.988	0.014	0.018	52.821	4.722
0.276	0.019	0.271	0.018	0.982	0.008	0.018	52.270	4.171
0.277	0.027	0.266	0.026	0.960	-0.014	0.026	47.835	-0.264
0.277	0.027	0.265	0.026	0.958	-0.016	0.026	45.881	-2.217
0.277	0.031	0.266	0.030	0.961	-0.014	0.030	45.290	-2.809
0.277	0.031	0.265	0.030	0.956	-0.018	0.030	45.515	-2.583
				0.975	Y Average		48.099	DH@ Average

Note: For Calibration Factor Y, the ratio of the reading of the calibration meter to the dry gas meter, acceptable tolerance of individual values from the average is ±0.02.
For △$H_@$, orifice pressure differential that equates to 0.75 cfm (0.0212 m^3/min) at standard temperature and pressure, acceptable tolerance of individual values from the average is ±0.2 inches (5.1mm) H_2O.

เอกสารไม่ควบคุม

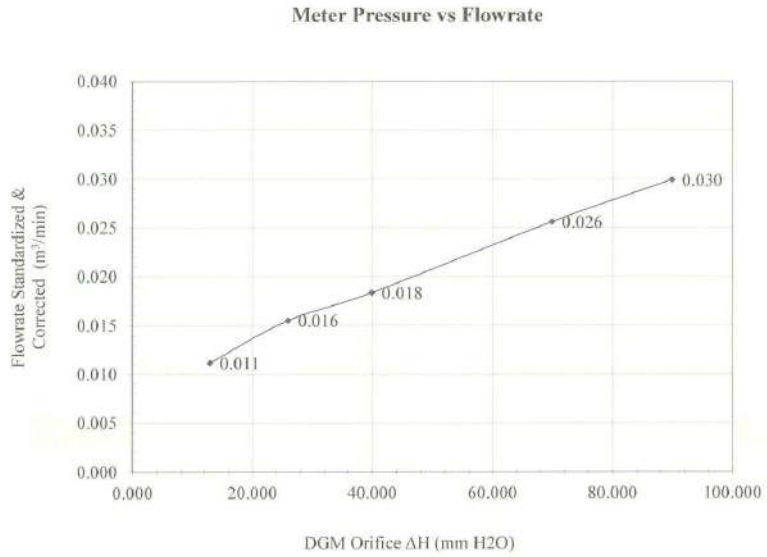
Calibration Date: 19-8-2021 Calibration Reference No: Ser21-0813



Console Serial: 0807047 Console Model: XC-572-V

เอกสารไม่ควบคุม

Calibration Date: 19-8-2021 Calibration Reference No: Ser21-0813



Console Serial: 0807047 Console Model: XC-572-V

THERMOCOUPLES SYSTEM CALIBRATION

Sampling System Equipment Information	
Console Model Number	XC-572-V
Console Serial Number	0807047
DGM Model Number	SK25EX
DGM Serial Number	00003580
Meter Box Model Number	JENCO 765 KF
Meter Box Serial Number	JC 17073

Calibration Conditions			
Date	Time	19/8/2021	03:00 PM
Calibration Reference No.			
Reference Thermometer		DIGICON	
Serial Number		183169105	

Results

Channel and test point	Console Thermocouple Simulator — Meter Box Channel Temperature Reading (°C)										
	-18.0	25.0	38.0	93.0	149.0	260.0	371.0	482.0	593.0	816.0	1038.0
Stack	-17.0	24.0	37.0	93.0	149.0	259.0	371.0	482.0	594.0	817.0	1040.0
Aux	-17.0	24.0	37.0	93.0	149.0						
Probe	-18.0	24.0	37.0	93.0	149.0						
Filter	-18.0	24.0	37.0	93.0	149.0						
Oven	-	-	-	-	-						
Exit	-18.0	24.0	37.0								

Tolerance Range

Stack	± 1.50%	Absolute	Meter	± 3.0 °C
Probe	± 3.0 °C		Exit	± 2.0 °C
Filter	± 3.0 °C			

ENTECH
Difference For Greater Value

Calibration Certificate

Certificate No: G 640441
Date of issue : 05-Aug-21

Instrument description	:	Flue gas Analyzer
Instrument model	:	Testo 350 New
Instrument serial no.	:	60899456
ID no. or control no.	:	UAE.EFM.005/2560
Manufacturer	:	testo SE
Probe description	:	-
Probe model	:	-
Probe serial	:	-
Customer name	:	UNITED ANALYST AND ENGINEERING CONSULTANT CO.,LTD.
Customer address	:	81 SOI UDOMSUK41,SUKHUMVIT ROAD,BANGCHAK PRAKANONG BANGKOK 10260
Total pages of certificate	:	2 Pages
Receiving no.	:	L-211963
Receiving date.	:	14-Jul-21
Parameter of calibration	:	Gas Calibration(Oxygen 2.501,10.00,21.00 %vol, Carbon Monoxide 80.23,309.9,1003 ppm, Nitric Oxide 10.08,150.9,320.6 ppm, Sulphur Dioxide 50.04,100.9,601.1 ppm, Nitrogen Dioxide 10.20,80.62,202.2 ppm)
Condition of UUC.	:	Used
Ambient condition	:	All of the Measurment ware caried out the stabilized labotary Temperature : 23 ±5 °C Humidity : 55 ± 15 %RH
Calibration place	:	17/121 Soi Ngamwongwan 47 Yaek 48, Toongsonghong, Laksi, Bangkok 10210
Calibration procedure no.	:	WI-CL-28-C

The calibration certificate expanded uncertainty of measurement is stated as the standard uncertainty of measurent Multiplied by coverage factor k=2, which for a normal distribution corresponds to a coverage probability of approximately 95%.

This certificate is applied only to item under test Environmental condition.

This Calibration Certificate may not be reporduced other than in full except with the permission of the issuing laboratory. Calibration certificates without signature and seal not valid.

This calibration certificate documents are tracebility to national standards, which realize measurement according to the International System of Units (SI).

Date of calibration : 04-Aug-21

Mr. Kwanchai Khamdoung
Calibration Technician

Mrs. Nongluck Wongsettee
Technical Manager

ENTECH INDUSTRIAL SOLUTION CO.,LTD.
17/121 Soi Ngamwongwan 47 Yaek 48, Toongsonghong, Laksi, Bangkok 10210 THAILAND Tel. 0-2779-8888 Fax. 0-2779-8899 info@entech.co.th
Tax ID : 0105536035591 www.entech.co.th

เอกสารไม่ควบคุม

ENTECH
Difference For Greater Value

Calibration Certificate

Standard References (Table 1)

Standard	Certificate No.	Vendor	Due date
Oxygen (O2) 2.501 % Vol	2431/19	Linde	16-Jul-23
Oxygen (O2) 10.00 % Vol	2453/19	Linde	18-Jul-23
Oxygen (O2) 21.00 % Vol	2426/19	Linde	16-Jul-23
Carbon monoxide (CO) 80.97 ppm	2842/21	Linde	24-Jun-23
Carbon monoxide (CO) 309.9 ppm	2803/21	Linde	22-Jun-23
Carbon monoxide (CO) 1003 ppm	2829/21	Linde	23-Apr-23
Nitric Oxide (NO) 10.08 ppm	3241/21	Linde	25-Jul-23
Nitric Oxide (NO) 150.9 ppm	2857/21	Linde	27-Jun-23
Nitric Oxide (NO) 320.6 ppm	2944/21	Linde	02-Jul-23
Sulphur Dioxide (SO2) 50.04 ppm	3205/21	Linde	25-Jul-23
Sulphur Dioxide (SO2) 100.9 ppm	4942/20	Linde	20-Nov-22
Sulphur Dioxide (SO2) 601.1 ppm	3204/21	Linde	20 Jul 23
Nitrogen Dioxide (NO2) 10.20 ppm	2929/19	Linde	27-Aug-21
Nitrogen Dioxide (NO2) 80.62 ppm	3240/21	Linde	25-Jul-23
Nitrogen Dioxide (NO2) 202.2 ppm	3239/21	Linde	20-Jul-23

Measured room conditions

Temperature : 23.2 °C Humidity : 53.8 %RH Pressure : 1016.3 mbar

Calibration conditions

Gas Temperature : 23 °C Flow rate : 1,100 ml/min Gas pressure : 1021.6 mbar

Calibration Results (without adjustment) (Table 2)

Parameter of Standard	Standard Values	Mean of UUC	Error	Uncertainty (±)
O2 (%Vol)	2.501	2.47	-0.031	0.20
O2 (%Vol)	10.00	9.86	-0.14	0.40
O2 (%Vol)	21.00	21.14	0.14	0.80
CO (ppm)	80.97	82	1.03	2.8
CO (ppm)	309.9	310	0.1	11
CO (ppm)	1003	999	-4	34
NO (ppm)	10.08	9	-1.08	3.0
NO (ppm)	150.9	151	0.1	5.0
NO (ppm)	320.6	322	1.4	10
SO2 (ppm)	50.04	49	-1.04	5.0
SO2 (ppm)	100.9	101	0.1	5.0
SO2 (ppm)	601.1	599	-2.1	14
NO2 (ppm)	10.20	9.9	-0.30	1.5
NO2 (ppm)	80.62	80.3	-0.32	5.0
NO2 (ppm)	202.2	198.9	-3.3	5.0

Remark : 1 cmol/mol = 1 %vol. , 1 µmol/mol = 1 ppm.

End of Report

ENTECH INDUSTRIAL SOLUTION CO.,LTD.
17/121 Soi Ngamwongwan 47 Yaek 48, Toongsonghong, Laksi, Bangkok 10210 THAILAND Tel. 0-2779-8888 Fax. 0-2779-8899 info@entech.co.th
Tax ID : 0105536035591 www.entech.co.th

เอกสารไม่ควบคุม

กรมควบคุมมลพิษ
POLLUTION CONTROL DEPARTMENT

ขอมอบประกาศนียบัตรนี้เพื่อแสดงว่า

นายรณภพ ภู่ตระกูลพัฒนา

ได้ผ่านการฝึกอบรมและทดสอบผู้ตรวจวัดความทึบแสงของเขม่าควันด้วยสายตา
และการใช้แผนภูมิเขม่าควันของริงเกิลมานน์ ประจำปี ๒๕๖๑

ระหว่างวันที่ ๒๒ – ๒๓ มีนาคม ๒๕๖๑

จัดโดย สำนักจัดการคุณภาพอากาศและเสียง กรมควบคุมมลพิษ
ให้ไว้ ณ วันที่ ๒๓ มีนาคม ๒๕๖๑

(นางสุณี ปิยะพันธุ์พงศ์)
อธิบดีกรมควบคุมมลพิษ

ขอมอบประกาศนียบัตรนี้เพื่อแสดงว่า

นายอภิวิชญ์ ท่วงที

ได้ผ่านการฝึกอบรมและทดสอบผู้ตรวจวัดความทึบแสงของเขม่าควันด้วยสายตา
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กรมควบคุมมลพิษ
POLLUTION CONTROL DEPARTMENT

(นายวิเชียร จุ้งรุ่งเรือง)
อธิบดีกรมควบคุมมลพิษ

TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES
534/4 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG BANGKOK 10250
TEL. 0-2717-3000-27 FAX. 0-2719-9484

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NSC-TISI-TIS17025
CALIBRATION 0008

PASS
NOT PASS
Remarks Temp ± 0.5 (Std. Thermometer)
mV ± 0.1 (Std. Voltage Input)
pH ± 0.1 (Std Buffer Solution)
(สกุลชื่อ) Verificate
(มีนาคม) Approve

Cert.No.: 22CH639
Page.: 1 of 3

Certificate of Calibration

Equipment :	pH Meter
Manufacturer :	Horiba
Model :	LAQUA-PH210
Serial No. :	HA0C0025
ID No. :	UAE.EFM.117/2563 (ENV.pH.07/63)
Condition As-Received:	Used Item
Received Date :	10 May 2022
Calibration Date :	11 May 2022
Reference :	2205-0278WSC-1
Submitted by :	United Analyst and Engineering Consultant Co.,Ltd. 3 Soi Udomsuk 41, Sukhumvit Road, Bangchak, Phrakhanong, Bangkok 10260
Ambient Temperature :	(25 ± 2.5) °C
Relative Humidity :	(50 ± 15) %
Calibration Procedure :	In - house method : - CP-CH5 by direct measurement with standard voltage calibrator and direct measurement with certified reference material (CRM) - CP-CH8 by comparison with standard thermometer
Calibrated by :	Uthen Kankawi
Approved by :	Approved Signatory

(√) Malee Butkruea
( ) Saithip Meangmai
( ) Warakorn Lerngagtrakul

Issue Date :	17 May 2022

The Uncertainties are for a confidence probability of approximately 95%

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เอกสารไม่ควบคุม

A 0041145

เอกสารไม่ควบคุม

Condition of this calibration result

1. Reference Standard Instrument : -

Instrument	Serial No.	ID No.	Cert. No.	Due Date
1) Document Process Calibrator	46530031	130RC098	21E3245	07 Oct 2022
2) Ref. Standard Thermometer	2188080	130RC044	21I1273	21 Nov 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	788995	01 Jan 2024
pH 6.983	CPA chem	766822	04 Sep 2022
pH 10.015	CPA chem	794124	14 Feb 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)(7,10)

Unit Under Calibration	Nominal Value	Standard Voltage Input	Actual Reading		Uncertainty of Measurement	Coverage factor
	pH	mV	mV	pH	(±mV)	*k*
pH Meter	4.00	177.48	177.5	4.00	0.058	2.00
S/N.: HA0C0025	7.00	0.00	0.0	7.00	0.058	2.00
	7.00	0.00	0.0	7.00	0.058	2.00
	10.00	-177.48	-177.5	10.00	0.058	2.00

Maku.

เอกสารไม่ควบคุม

Calibration Results

Function : pH Measurement

Performing three buffers standard curve by using buffer nominal pH (4,7)(7,10)

Unit Under Calibration	Standard pH Buffer Solution	Actual pH Reading	Actual mV Reading (mV)	Uncertainty of pH measurement (±)	Coverage factor *k*
pH Electrode	4.008	4.00	131.4	0.0085	2.05
S/N.: 990C0199	6.983	6.98	-43.5	0.015	2.15
	6.983	6.98	-43.5	0.014	2.13
	10.015	10.02	-215.1	0.0096	2.00

Function : Temperature Measurement

(*) Without adjustment

This equipment was connected with Temperature Probe;

- Model : 9652
- Serial No. : 990C0199

Dimension of probe;

- Length : 95 mm.
- Diameter : 12 mm.
- Immersion Depth : 100 mm.

Calibration Point (°C)	Standard Temperature (°C)	UUC* Reading (°C)	Error (°C)	Uncertainty of measurement (± °C)	Coverage factor *k*
25.0	24.995	25.1	0.105	0.13	2.00
30.0	29.999	30.0	0.001	0.13	2.00
35.0	35.004	35.0	-0.004	0.13	2.00

Remark : - UUC* = Unit Under Calibration

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

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Maku.

เอกสารไม่ควบคุม

TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
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Certificate of Testing

Equipment :	DO Meter
Manufacturer :	Horiba
Model :	LAQUA-DO210
Serial No. :	HE9M0013
ID No. :	UAE.EFM.016/2563 (EFM.DO.05/63)
Received Date :	15 March 2022
Test Date :	18 March 2022
Reference :	2203-0596WSC-5
Submitted by :	United Analyst and Engineering Consultant Co.,Ltd. 3 Soi Udomsuk 41, Sukhumvit Road, Bangchak, Phrakhanong, Bangkok 10260
Laboratory Condition :	Temperature (25 ± 5) °C Humidity (50 ± 20) %
Test Procedure :	In - house method : CP-CH9 by Comparison Technique with Azide Modification Method
Tested by :	Walalak Sirithean
Approved by :	Approved Signatory

(✓) Malee Butkruea
( ) Saithip Meangmai
( ) Warakorn Lerngagtrakul

Issue Date : 22 March 2022

เอกสารไม่ควบคุม

Result : **Dissolved Oxygen Meter Adjustment With Air 100 %**

Dissolved Oxygen Probe No.: 9K9G0097

Titration Method (Azide Modification Method) (mg/L)	DO Meter Reading (mg/L)	Standard Deviation (mg/L)
8.04	8.03	0.0084

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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NSC-TISI-TIS17025 CALIBRATION 0008

Certificate of Calibration

Equipment :	DO Meter with Sensor
Manufacturer :	Horiba
Model :	LAQUA-DO210
Serial No. :	HE9M0013
ID No. :	UAE.EFM.016/2563(EFM.DO.05/63)
Submitted by :	United Analyst and Engineering Consultant Co.,Ltd. 3 Soi Udomsuk 41, Sukhumvit Road, Bangchak, Phrakhanong, Bangkok 10260
Location :	TPA On Site Calibration Laboratory
Received Order :	15 March 2022
Calibrated Date :	21 March 2022
Ambient Temperature :	(26 ± 10) °C
Relative Humidity :	(50 ± 30) %
AC Line Voltage :	(220 ± 22) V
Calibrated by :	Malee Butkruea
Approved by :	Approved Signatory

( ) Pornthippa Tameyakul
(✓) Suwit Imjai

Issue Date : 23 March 2022

The Uncertainties are for a confidence probability of approximately 95%

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เอกสารไม่ควบคุม

Equipment : DO Meter with Sensor
Condition As-Received : Used Item
Reference : 2203-0596WSC-6

Procedure Used :-

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

The temperature scale used was based on ITS-90.

Condition of this result of calibration

1. Reference standard instrument:-

Instrument	Model	Serial No.	Cert. No.	Due Date
1) Digital Thermometer	1523	2188080	21I1273	22 Nov 2022

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

Result of Calibration :- (*) Without Adjustment

Function : Temperature measurement.

This instrument was connected with temperature sensor, S/N.: 9K9G0097

Calibration Point (°C)	Immersion Depth (mm)	Standard Temperature (°C)	UUC* Reading (°C)	Error (°C)	Uncertainty (± °C)	Coverage Factor *k*
25.0	80	24.998	25.0	0.002	0.16	2.00
30.0	80	29.999	30.0	0.001	0.16	2.00
35.0	80	34.997	34.9	-0.097	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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เอกสารไม่ควบคุม

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NSC-TISI-TIS17025
CALIBRATION 0008

Certificate of Calibration

Equipment :	Conductivity Meter
Manufacturer :	Horiba
Model :	LAQUA-EC210
Serial No. :	HC9L0014
ID No. :	UAE.EFM.007/2563(EFM.SCT.01/63)
Condition As-Received:	Used Item
Received Date :	26 April 2022
Calibration Date :	27 April 2022
Reference :	2204-0676WSC-1
Submitted by :	United Analyst and Engineering Consultant Co.,Ltd. 3 Soi Udomsuk 41, Sukhumvit Road, Bangchak, Phrakhanong, Bangkok 10260
Ambient Temperature :	(25 ± 2.5) °C
Relative Humidity :	(50 ± 15) %
Calibration Procedure:	In -house method : - CP-CH6 by direct measurement with certified reference material (CRM) - CP-CH8 by comparison with standard thermometer
Calibrated by :	Warakorn Lerngagtrakul
Approved by :	Saithip Approved Signatory

( ) Malee Butkruea
(✓) Saithip Meangmai
( ) Warakorn Lerngagtrakul

Issue Date :	6 May 2022

The Uncertainties are for a confidence probability of approximately 95%

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เอกสารไม่ควบคุม

Condition of this result of calibration

1. Reference Standard Instrument :-

Instrument	Serial No.	ID No.	Certificate No.	Due date
1) Thermometer	1963878	130RC095	21I977	17 Sep 2022
2) Ref. Std.Thermometer	4982054	110RC044	21I1201	26 Oct 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, CPA chem Ltd., The measurement results are traceable to SI through CPA chem Ltd., ANSI-ASQ National Accreditation Board, Accredited No. AR-1835

Conductivity Solution	Manufacturer	Lot No.	Exp. date
1413.0 µS/cm	CPA Chem	766815	04 Sep 2022
12.880 mS/cm	CPA Chem	761022	02 Aug 2022

- 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 1413.0 µS/cm

Conductivity Electrode Serial No.: 9B9F0064

Standard Conductivity Solution	Before Adjustment UUC* Reading	After Adjustment UUC* Reading	Uncertainty of Measurement (±)	Coverage factor k
1413.0 µS/cm	996.2 µS/cm	1413 µS/cm	9.2 µS/cm	2.00
12.880 mS/cm	9.01 mS/cm	12.78 mS/cm	0.086 mS/cm	2.00

Remark - UUC* = Unit Under Calibration

Saithip

เอกสารไม่ควบคุม

Calibration Results

Function : Temperature Measurement

(*) Without adjustment

This equipment was connected with Temperature Probe;

- Model : 9383
- Serial No. 9B9F0064

Dimension of probe;

- Length : 90 mm.
- Diameter : 9 mm.
- Immersion Depth : 80 mm.

Calibration Point (°C)	Standard Temperature (°C)	UUC* Reading (°C)	Error (°C)	Uncertainty of Measurement (±°C)	Coverage factor *k*
25.0	25.002	25.0	-0.002	0.13	2.00
30.0	30.002	30.0	-0.002	0.13	2.00
35.0	35.003	35.0	-0.003	0.13	2.00

Remark : - UUC* = Unit Under Calibration

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

-o0o-

Saithip

เอกสารไม่ควบคุม

รายการเครื่องมือหลักประจำห้องปฏิบัติการวิเคราะห์ สำหรับตรวจวิเคราะห์คุณภาพสิ่งแวดล้อม

No.	Instrument/Equipment	Parameter	Manufacturer	Model/Serial No.	Calibrator	Certification No.	Date of Calibration	Due date of Calibration*	Remark
Laboratory Instrument/Equipments.(คุณภาพอากาศ และน้ำ)									
1	Analytical Balance (Readability 0.1 mg)	ฝุ่นละอองรวม (Particulate)	Mettler-Toledo	AB204-S / 1128312528	Mettler-Toledo (Thailand) Ltd.	TH2058-097-040722-ACC-TH	7 Apr 22	6 Apr 23	-
2	Analytical Balance (Readability 0.1 mg)		Mettler-Toledo	AB204-S/FACT / B108115858	Mettler-Toledo (Thailand) Ltd.	TH2058-098-040722-ACC-TH	7 Apr 22	6 Apr 23	-
3	Ion Chromatrography (IC)	ไฮโดรเจนคลอไรด์ (HCl)	Dionex	DX-120 / 03010223	Archemica Lab Co.Ltd.	Qualification Report Anion (ID#042)	8 Dec 21	7 Dec 22	-
4	UV-VIS Spectrophotometer	สี (Color), สารซักฟอก (Surfactant) ซีโอดี (COD), โครเมียมไตรวาเล้นท์	Agilent Technologies	Cary60 G6860A / MY15410009	DQE Services Co.,Ltd.	SP22-016	31 May 22	30 May 23	-
5	UV-VIS Spectrophotometer	ไซยาไนด์ (Cyanide) ฟอร์มาลดีไฮด์ (Formaldehyde)	Hitachi	U-1900 / 2021-064	DQE Services Co.,Ltd.	SP22-007	20 Jan 22	19 Jan 23	-
6	UV-VIS Spectrophotometer	สารประกอบฟีนอล (Phenol Compound), Phosphate, ออกไซด์ของไนโตรเจนในรูปของไนโตรเจนไดออกไซด์ (NO_x as NO_2), ไนเตรตในหน่วยไนโตรเจน (NO_3) แอมโมเนียในหน่วยไนโตรเจน (NH_3)	Hitachi	U-2900 / 21E22-009	DQE Services Co.,Ltd.	SP22-008	20 Jan 22	19 Jan 23	-
7	Atomic Absorption Spectrometer (AAS)	ปรอท (Hg), ทองแดง (Cu), แคดเมียม (Cd), สังกะสี (Zn), ตะกั่ว (Pb), โครเมียมไตรวาเล้นท์	Agilent Technologies	System ID:G8432A AA240FS / MY13160001	Thailand Institute of Scientific and Technological Research (TISTR).	MTC.ACL. No. 486/65	7 Mar 22	6 Mar 23	-
8	Inductively Coupled Plasma (ICP)	(Cr^{3+}), สารหนู (As) แบริลเลียม (Be), โครเมียมเฮกซะ-วาเล้นท์ (Cr^{6+}), โครเมียม (Cr)	Agilent Technologies	System ID:G8015A G8015AA / MY18030001	Agilent Technologies (Thailand) Co.,Ltd.	Preventive Maintenance Checklist	9 Dec 21	8 Dec 22	-

รายการเครื่องมือหลักประจำห้องปฏิบัติการวิเคราะห์ สำหรับตรวจวิเคราะห์คุณภาพสิ่งแวดล้อม

No.	Instrument/Equipment	Parameter	Manufacturer	Model/Serial No.	Calibrator	Certification No.	Date of Calibration	Due date of Calibration*	Remark
		นิกเกิล (Ni), แบเรียม (Ba), ซีลีเนียม (Se), แมงกานีส (Mn), เงิน (Ag), เหล็กทั้งหมด (Total Iron), Total Chromium							
9	pH Meter	ความเป็นกรดและด่าง (pH) อุณหภูมิ (Temperature)	Mettler-Toledo	Seven Easy S20 / 1231155210	National Food Institute, Ministry of Industry, Thailand	2201793-001-01	1 Mar 22	28 Feb 23	
10	pH Meter		Mettler-Toledo	Seven Easy S20 / 1230525212	National Food Institute, Ministry of Industry, Thailand	2202093-001-01	16 Mar 22	15 Mar 23	
11	Analytical Balance (Readability 0.01 mg)	ของแข็งละลายน้ำทั้งหมด (TDS) ของแข็งแขวนลอยทั้งหมด (TSS)	Mettler-Toledo	XSR205DU / C210685394	Mettler-Toledo (Thailand) Ltd.	TH2058-043-050622-ACC-TH	9 May 22	8 May 23	-
12	Hot Air Oven		Memmert	UF55 / B216.1666	Technology Promotion Association (Thailand-Japan)	21TM1876	29 Oct 21	28 Oct 22	-
13	BOD Incubator	บีโอดี (BOD)	Arco	UC4-1320 / (UAE.WAO.015/2561)	Technology Promotion Association (Thailand-Japan)	22TM90	17 Feb 22	16 Feb 23	-
14	BOD Incubator		Arco	UR-1320 / (UAE.WAO.018/2551)	Technology Promotion Association (Thailand-Japan)	22TM305	7 Apr 22	6 Apr 23	-
15	COD Reactor (Heating Block)	ซีโอดี (COD)	Hanna	HI839800-02 / H018500I	Technology Promotion Association (Thailand-Japan)	HIT-2209-0184	1 Mar 22	1 Mar 23	-
16	Analytical Balance (Readability 0.1 mg)	น้ำมันและไขมัน (Fat Oil & Grease)	Mettler-Toledo	AB-204S/FACT / 1129361010	National Food Institute, Ministry of Industry, Thailand	2203120-001-01	1 Jun 22	31 May 23	-
17	Digestor Unit	ทีเคเอ็น (TKN)	FOSS TECATOR	2520auto / 91794469	National Food Institute, Ministry of Industry, Thailand	2202361-001-01	4 Apr 22	3 Apr 23	-

รายการเครื่องมือหลักประจำห้องปฏิบัติการวิเคราะห์ สำหรับตรวจวิเคราะห์คุณภาพสิ่งแวดล้อม

No.	Instrument/Equipment	Parameter	Manufacturer	Model/Serial No.	Calibrator	Certification No.	Date of Calibration	Due date of Calibration*	Remark
18	Distillation Unit (Kjeldahl Method)	ทีเคเอ็น (TKN)	FOSS TECATOR	KT200 / 91790524	FOSS South East Asia	5874	30 Nov 21	29 Nov 22	-
19	Gas Chromatrography (GC)	สารฆ่าศัตรูพืชและสัตว์ (Pesticide)	Agilent Technologies	System ID:CN11021007 7890 / CN11021007	Agilent Technologies (Thailand) Co.,Ltd.	Certificate of System Qualification GC-OQ	11 Feb 22	10 Feb 23	-
20	Conductivity Meter	ค่าความนำไฟฟ้า (EC)	SI Analytics	Lab955 / 16300356	SPC Calibration Center Co.,Ltd.	C24220084	22 Mar 22	21 Mar 23	
21	Incubator	แบคทีเรียกลุ่มโคลิฟอร์มทั้งหมด (Total Coliform Bacteria)	Binder	KB400 / 20200000015535	Technology Promotion Association (Thailand-Japan)	22TM347	27 May 22	26 May 23	-
22	Incubator	แบคทีเรียกลุ่มฟีคอลโคลิฟอร์ม (Fecal Coliform Bacteria)	Memmert	IPP 260 / V616.0066	Technology Promotion Association (Thailand-Japan)	22TM672	5 May 22	4 May 23	
23	Water Bath		Memmert	WNE 14 / L416.0606	Technology Promotion Association (Thailand-Japan)	22TM333	17 Feb 22	16 Feb 23	-
24	Water Bath		Memmert	WNE 14 / L416.0612	Technology Promotion Association (Thailand-Japan)	22TM334	17 Feb 22	16 Feb 23	-
25	Analytical Balance		Mettler-Toledo	MS603S / B0070110311	Mettler-Toledo (Thailand) Ltd.	TH2058-096-040722-ACC-TH	7 Apr 22	6 Apr 23	-
26	Auto Clave		ALP	CL-40L / 802664	Technology Promotion Association (Thailand-Japan)	22TM89	17 Feb 22	16 Feb 23	-

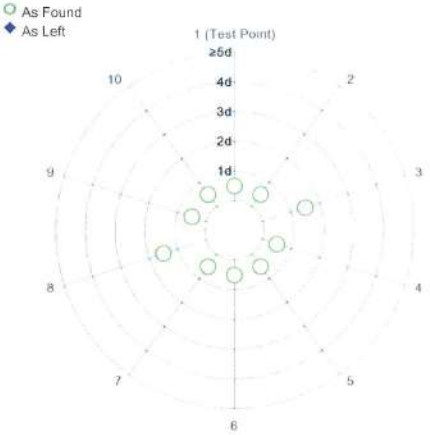
Due Date of Calibration* : Schedule the program once a year at least once a year.

Measurement Results

Repeatability

Test Load: 100 g

	As Found	As Left
1	99.9999 g	N/A
2	100.0000 g	N/A
3	99.9998 g	N/A
4	100.0000 g	N/A
5	99.9999 g	N/A
6	100.0000 g	N/A
7	99.9999 g	N/A
8	100.0001 g	N/A
9	99.9999 g	N/A
10	100.0000 g	N/A
Standard Deviation	0.00008 g	N/A



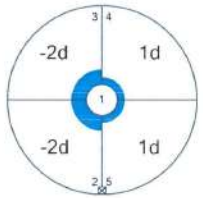
The "d" in the graph represents the readability of the range/interval in which the test was performed.

The results of this graph are based upon the absolute values of the differences from the mean value.

Eccentricity

Test Load: 100 g

Position	As Found	As Left
1	100.0000 g	N/A
2	99.9998 g	N/A
3	99.9998 g	N/A
4	100.0001 g	N/A
5	100.0001 g	N/A
Maximum Deviation	0.0002 g	N/A



As Found

The "d" in the graph represents the readability of the range/interval in which the test was performed.

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Mettler-Toledo (Thailand) Ltd.
846/4 - 846/5 Lasalle Rd., Bangna Tai Sub-District
Bangna District, Bangkok 10260
+66 2723 0382
MT-TH.ServiceSupport@mt.com

NSC-TISI-TIS 17025
CALIBRATION 0062

Accuracy Calibration Certificate

Customer

Company:	United Analyst and Engineering Consultant Co., Ltd.		
Address:	3 Soi Udom Suk 41, Sukhumvit Rd., Bang Chak		
City:	Phra Khanong	Contact:	Suwit Chotnok
Zip / Postal:	10260		
State / Province:	Bangkok		
Order Number:	*0332423906*		

Weighing Device

Manufacturer:	Mettler Toledo	Instrument Type:	Weighing Instrument
Model:	AB204-S	Asset Number:	UAE.AIR.019/2550
Serial No.:	1128312528	Terminal Model:	N/A
Building:	N/A	Terminal Serial No.:	N/A
Floor:	2	Terminal Asset No.:	N/A
Room:	Balance Room 2 (206)		

Range	Max. Capacity	Readability (d)
1	220 g	0.0001 g

Procedure

Calibration Guideline:	EURAMET cg-18 v. 4.0 (11/2015)
METTLER TOLEDO Work Instruction:	CP/W002/20

This calibration certificate contains measurements for As Found calibration. No As Left calibration was performed because the device was not modified after As Found calibration. Therefore, results for As Left correspond to As Found.

The sensitivity/span of the weighing instrument was adjusted before calibration with a built-in weight.

In accordance with EURAMET cg-18 (11/2015), the test loads were selected to reflect the specific use of the weighing device or to accommodate specific calibration conditions.

	Temperature		Humidity	
As Found	Start: 22.5 °C	End: 21.4 °C	Start: 56.1 %	End: 63.2 %

As Found Calibration Date:	07-Apr-2022	Calibrator:	Sirawit Chamchan
As Left Calibration Date:	N/A		
Issue Date:	08-Apr-2022	Approved Signatory:	☑ Kassakorn Tassanachaisakul ☐ Santi Jitniyom ☐ Surachet Sukkate

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Remarks

Equipment condition: Good

Next calibration according to customer's procedure

Calibration data not decide by calibration laboratory

Test weight by Filter pan : 1 g = 0.9999 g, 3 g = 3.0000 g, 5 g = 5.0000 g

End of Accredited Section

The information below and any attachments to this calibration certificate are not part of the accredited calibration.

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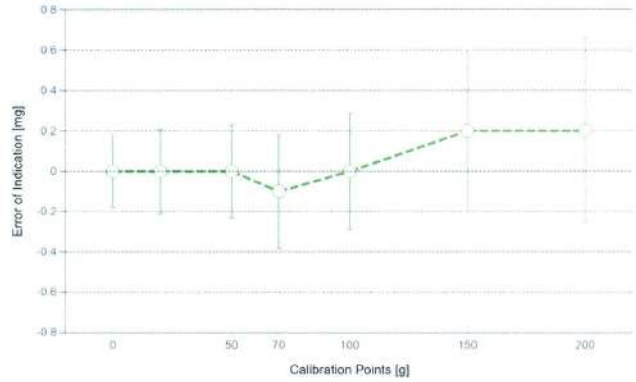
เอกสารไม่ควบคุม

Error of Indication

As Found

	Reference Value	Indication	Error of Indication	Expanded Uncertainty	k
1	0.0000 g	0.0000 g	0.0000 g	0.18 mg	2
2	0.1000 g	0.1000 g	0.0000 g	0.19 mg	2
3	1.0000 g	0.9999 g	-0.0001 g	0.19 mg	2
4	5.0000 g	5.0000 g	0.0000 g	0.19 mg	2
5	10.0000 g	9.9999 g	-0.0001 g	0.20 mg	2
6	20.0000 g	20.0000 g	0.0000 g	0.21 mg	2
7	50.0000 g	50.0000 g	0.0000 g	0.23 mg	2
8	70.0001 g	70.0000 g	-0.0001 g	0.28 mg	2
9	100.0000 g	100.0000 g	0.0000 g	0.29 mg	2
10	150.0000 g	150.0002 g	0.0002 g	0.40 mg	2
11	200.0001 g	200.0003 g	0.0002 g	0.46 mg	2



As Found

As Left

For improved legibility of the graphics only increasing measurement points are shown and measurement points close to zero are not displayed.

The uncertainty stated is the expanded uncertainty at calibration obtained by multiplying the standard combined uncertainty by the coverage factor k – which can be larger than 2 according to EURAMET cg-18. The value of the measurand lies within the assigned range of values with a probability of approximately 95%.

The user is responsible for maintaining environmental conditions and the settings of the weighing instrument when it was calibrated.

Test Equipment

All weights used for metrological testing are traceable to national or international standards. The weights were calibrated and certified by an accredited calibration laboratory.

Weight Set 1: OIML E2

Weight Set No.:	WS80	Date of Issue:	23-Feb-2022
Certificate Number:	C208581631	Calibration Due Date:	14-Aug-2023

Thermo Hygrometer

Equipment No.:	IN161	Date of Issue:	14-Jun-2021
Certificate Number:	21H1220	Calibration Due Date:	01-Jun-2022

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METTLER TOLEDO

Mettler-Toledo (Thailand) Ltd.
846/4 - 846/5 Lasalle Rd., Bangna Tai Sub-District
Bangna District, Bangkok 10260
+66 2723 0382
MT-TH.ServiceSupport@mt.com

NSC-TISI-TIS 17025
CALIBRATION 0062

Accuracy Calibration Certificate

Customer

Company:	United Analyst and Engineering Consultant Co., Ltd.		
Address:	3 Soi Udom Suk 41, Sukhumvit Rd., Bang Chak		
City:	Phra Khanong	Contact:	Suwit Chotnok
Zip / Postal:	10260		
State / Province:	Bangkok		
Order Number:	*0332423906*		

Weighing Device

Manufacturer:	Mettler Toledo	Instrument Type:	Weighing Instrument
Model:	AB204-S/FACT	Asset Number:	UAE.AIR.016/2555
Serial No.:	B108115858	Terminal Model:	N/A
Building:	N/A	Terminal Serial No.:	N/A
Floor:	2	Terminal Asset No.:	N/A
Room:	Balance Room 2 (206)		

Range	Max. Capacity	Readability (d)
1	220 g	0.0001 g

Procedure

Calibration Guideline:	EURAMET cg-18 v. 4.0 (11/2015)
METTLER TOLEDO Work Instruction:	CP/W002/20

This calibration certificate contains measurements for As Found and As Left calibrations.

The sensitivity/span of the weighing instrument was adjusted before As Found and As Left calibrations with a built-in weight.

In accordance with EURAMET cg-18 (11/2015), the test loads were selected to reflect the specific use of the weighing device or to accommodate specific calibration conditions.

	Temperature		Humidity	
As Found	Start: 22.6 °C	End: 22.1 °C	Start: 56.0 %	End: 51.9 %
As Left	Start: 22.3 °C	End: 22.4 °C	Start: 46.2 %	End: 55.8 %

As Found Calibration Date:	07-Apr-2022	Calibrator:	Sirawit Chamchan
As Left Calibration Date:	07-Apr-2022		
Issue Date:	08-Apr-2022	Approved Signatory:	☑ Kassakorn Tassanachaisakul ☐ Santi Jitniyom ☐ Surachet Sukkate

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METTLER TOLEDO Service

Measurement Uncertainty of the Weighing Instrument in Use

Stated is the expanded uncertainty with k=2 in use. The formula shall be used for the estimation of the uncertainty under consideration of the errors of indication. The value R represents the net load indication in the unit of measure of the device.

Temperature coefficient for the evaluation of the measurement uncertainty in use: $3.0 \cdot 10^{-6}$ / K

Temperature range on site for the evaluation of the measurement uncertainty in use: 3 K

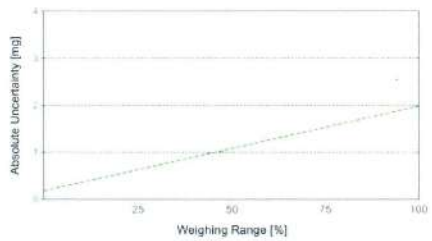
Linearization of Uncertainty Equation

Range			As Found	As Left
	d	Max		
1	0.0001 g	220 g	U_1 = 0.19 mg + 0.00817 mg/g · R	N/A

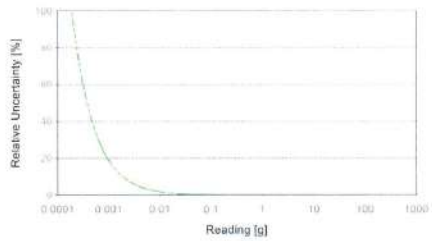
To optimize the stability of the linearization, besides of the zero load only increasing measurement points with a test load of 5% of the measurement range or larger are taken for the calculation of the linear equation.

Absolute and Relative Measurement Uncertainty in Use for Various Net Indications (Examples)

Net Indication	As Found		As Left	
0.0220 g	0.19 mg	0.86%	N/A	N/A
0.2200 g	0.19 mg	0.087%	N/A	N/A
2.2000 g	0.21 mg	0.0095%	N/A	N/A
22.0000 g	0.37 mg	0.0017%	N/A	N/A
220.0000 g	2.0 mg	0.00090%	N/A	N/A



As Found



As Left

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เอกสารไม่ควบคุม

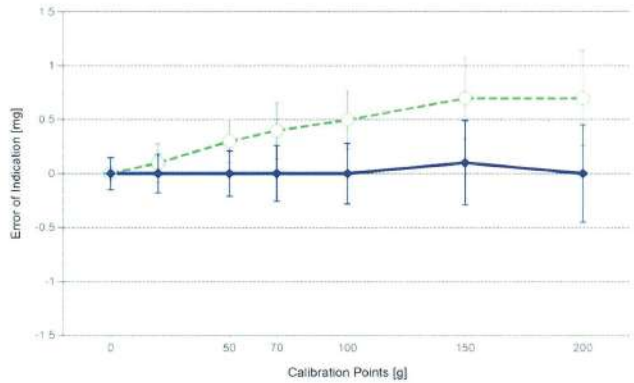
Error of Indication

As Found

	Reference Value	Indication	Error of Indication	Expanded Uncertainty	k
1	0.0000 g	0.0000 g	0.0000 g	0.15 mg	2
2	0.1000 g	0.1001 g	0.0001 g	0.16 mg	2
3	1.0000 g	0.9999 g	-0.0001 g	0.16 mg	2
4	5.0000 g	5.0000 g	0.0000 g	0.16 mg	2
5	10.0000 g	10.0001 g	0.0001 g	0.17 mg	2
6	20.0000 g	20.0001 g	0.0001 g	0.18 mg	2
7	50.0000 g	50.0003 g	0.0003 g	0.20 mg	2
8	70.0001 g	70.0005 g	0.0004 g	0.26 mg	2
9	100.0000 g	100.0005 g	0.0005 g	0.27 mg	2
10	150.0000 g	150.0007 g	0.0007 g	0.38 mg	2
11	200.0001 g	200.0008 g	0.0007 g	0.44 mg	2

As Left

	Reference Value	Indication	Error of Indication	Expanded Uncertainty	k
1	0.0000 g	0.0000 g	0.0000 g	0.15 mg	2
2	0.1000 g	0.1000 g	0.0000 g	0.16 mg	2
3	1.0000 g	0.9999 g	-0.0001 g	0.17 mg	2
4	5.0000 g	5.0000 g	0.0000 g	0.17 mg	2
5	10.0000 g	10.0000 g	0.0000 g	0.17 mg	2
6	20.0000 g	20.0000 g	0.0000 g	0.18 mg	2
7	50.0000 g	50.0000 g	0.0000 g	0.21 mg	2
8	70.0001 g	70.0001 g	0.0000 g	0.26 mg	2
9	100.0000 g	100.0000 g	0.0000 g	0.28 mg	2
10	150.0000 g	150.0001 g	0.0001 g	0.39 mg	2
11	200.0001 g	200.0001 g	0.0000 g	0.45 mg	2



As Found

As Left

For improved legibility of the graphics only increasing measurement points are shown and measurement points close to zero are not displayed.

The uncertainty stated is the expanded uncertainty at calibration obtained by multiplying the standard combined uncertainty by the coverage factor k – which can be larger than 2 according to EURAMET cg-18. The value of the measurand lies within the assigned range of values with a probability of approximately 95%.

The user is responsible for maintaining environmental conditions and the settings of the weighing instrument when it was calibrated.

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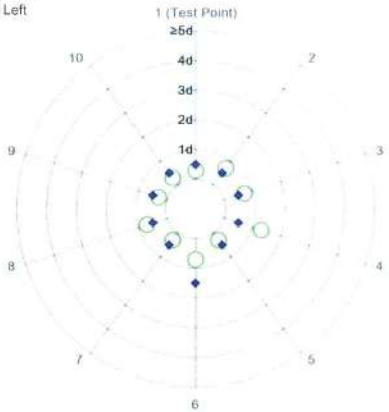
Measurement Results

Repeatability

Test Load: 100 g

	As Found	As Left
1	100.0005 g	99.9999 g
2	100.0004 g	100.0000 g
3	100.0004 g	99.9999 g
4	100.0006 g	100.0000 g
5	100.0005 g	99.9999 g
6	100.0004 g	99.9998 g
7	100.0005 g	100.0000 g
8	100.0004 g	100.0000 g
9	100.0005 g	100.0000 g
10	100.0005 g	100.0000 g
Standard Deviation	0.00007 g	0.00007 g

As Found
As Left



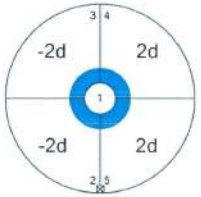
The "d" in the graph represents the readability of the range/interval in which the test was performed.

The results of this graph are based upon the absolute values of the differences from the mean value.

Eccentricity

Test Load: 100 g

Position	As Found	As Left
1	100.0005 g	100.0000 g
2	100.0003 g	99.9999 g
3	100.0003 g	99.9998 g
4	100.0007 g	100.0001 g
5	100.0007 g	100.0002 g
Maximum Deviation	0.0002 g	0.0002 g



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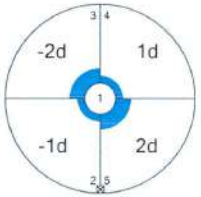

As Left

The "d" in the graph represents the readability of the range/interval in which the test was performed.

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Measurement Uncertainty of the Weighing Instrument in Use

Stated is the expanded uncertainty with k=2 in use. The formula shall be used for the estimation of the uncertainty under consideration of the errors of indication. The value R represents the net load indication in the unit of measure of the device.

Temperature coefficient for the evaluation of the measurement uncertainty in use: $2.5 \cdot 10^{-6}$ / K

Temperature range on site for the evaluation of the measurement uncertainty in use: 3 K

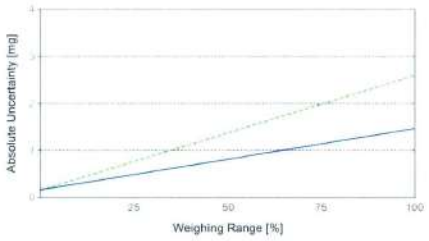
Linearization of Uncertainty Equation

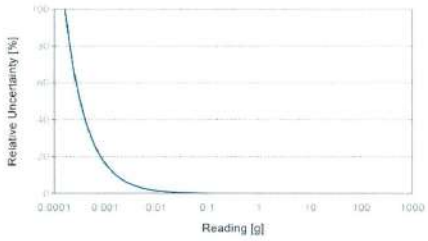
	Range		As Found	As Left
	d	Max		
1	0.0001 g	220 g	U_1 = 0.16 mg + 0.0111 mg/g · R	U_1 = 0.16 mg + 0.00592 mg/g · R

To optimize the stability of the linearization, besides of the zero load only increasing measurement points with a test load of 5% of the measurement range or larger are taken for the calculation of the linear equation.

Absolute and Relative Measurement Uncertainty in Use for Various Net Indications (Examples)

Net Indication	As Found		As Left	
0.0220 g	0.16 mg	0.73%	0.16 mg	0.73%
0.2200 g	0.16 mg	0.074%	0.16 mg	0.073%
2.2000 g	0.18 mg	0.0084%	0.17 mg	0.0079%
22.0000 g	0.40 mg	0.0018%	0.29 mg	0.0013%
220.0000 g	2.6 mg	0.0012%	1.5 mg	0.00066%





As Found — As Left

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Test Equipment

All weights used for metrological testing are traceable to national or international standards. The weights were calibrated and certified by an accredited calibration laboratory.

Weight Set 1: OIML E2

Weight Set No.:	WS80	Date of Issue:	23-Feb-2022
Certificate Number:	C208581631	Calibration Due Date:	14-Aug-2023

Thermo Hygrometer

Equipment No.:	IN161	Date of Issue:	14-Jun-2021
Certificate Number:	21H1220	Calibration Due Date:	01-Jun-2022

Remarks

FACT adjustment functionality activated

Value of the built-in weight adjusted

Equipment condition: Good

Next calibration according to customer's procedure

Calibration data not decide by calibration laboratory

Test weight by Filter pan : 1 g = 1.0000 g, 3 g = 3.0000 g, 5 g = 5.0000 g

End of Accredited Section

The information below and any attachments to this calibration certificate are not part of the accredited calibration.

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Qualification Report

PM Check list ,CM_OQ and PQ
DX-120 : Anion (ID#042)
For
UAE
(2nd Contract)

เอกสารไม่ควบคุม

ARCHEMICA

Certificate of Calibration

DX-120 : Anion (ID#042)

This certificate is to verify that instrument below are calibrated

by Archemica Lab Co.,Ltd.

DX-120 S/N : 03010223

for

UAE

บริษัท อาร์เคมีก้า แลบ จำกัด
ARCHEMICA LAB CO.,LTD

Operator Signature : K. CHANNARONG Date : Dec 08, 2021

(Mr.Channarong Khiao-un)

Test Engineer

เอกสารไม่ควบคุม

Dionex Ion Chromatography
Preventive Maintenance Report

Customer Organization	Name/ Department
UAE (2nd Contract)	Khun.Suwan
Engineer Name	**Date**
Mr.Channarong Khiao-un	8-Dec-2021

Instrument Detail

Instrument Model	Application
DX-120 (ID#042)	Anion
Instrument components	**Serial Number**
DX-120	03010223

Consumable Detail

Columns	Guard Columns	Suppressors	Concentrators	Etc.
AS22	AG22	ASRS 300	-	-

Remark:

Perform By
Archemica Lab Co.,Ltd

K.CHANNARONG
Archemica Lab Co.,Ltd
8-Dec-21
Date

บริษัท อาร์เคมีก้า แลบ จำกัด
ARCHEMICA LAB CO.,LTD

Suwan
Customer
8-Dec-21
Date

Preventive Maintenance Check List

เอกสารไม่ควบคุม

เอกสารไม่ควบคุม

Chromeleon Operational Qualification (CM_OQ)

เอกสารไม่ควบคุม

General Inspection Checklist

Item	Description	Result		Action Taken	N.A.
		Pass	Fail		
1	Power line 220 Vac	☒	☐	Check	☐
2	Pneumatic Line	☒	☐	Check	☐
3	Pressure outlet 80-100 psi	☒	☐	Check	☐
4	Barbed fitting and tee fitting	☒	☐	Check	☐
5	Crimped and blocked tubing	☒	☐	Check	☐
6	Rheodyne Valve for Leak	☒	☐	Check&Clean	☐
7	Slider valve for leak	☐	☐	-	☒
8	Inspect slider	☐	☐	-	☒
9	Inspect port face	☐	☐	-	☒
10	Inspect pressure bolt	☐	☐	-	☒
11	Inspect fitting and ferrule	☐	☐	-	☒
12	Suppressor for leak	☒	☐	Check	☐
13	Cell for leak	☒	☐	Check	☐
14	Electronic cable connected	☒	☐	Check	☐
15	Column selection valve for leak	☐	☐	-	☒
16	Inspect all fitting and line	☒	☐	Check	☐
17	Eluent reservoir	☒	☐	Check	☐
18	Inspect cap o-ring	☒	☐	Check	☐
19	Inspect air for leak	☒	☐	Check	☐
20	Piston seal has been replaced	☒	☐	Check	☐
21	Back up seal has been replaced	☒	☐	Check	☐
22	Pump Lubricate	☒	☐	Check	☐
23	Front panel test	☒	☐	Check	☐
24	Low limit alarm	☒	☐	Check	☐
25	Hi limit alarm	☒	☐	Check	☐
26	Conductivity electronic test 160+/-1 uS	☒	☐	Check	☐
27	Check noise for suppressor (pk to pk <0.005uS)	☒	☐	Check	☐
28	Check column	☒	☐	Check	☐
29	Check suppressor	☒	☐	Check&Clean	☐
30	Check pump	☒	☐	Check	☐
31	Check cell	☒	☐	Check	☐
32	Check leak sensor	☒	☐	Check	☐
33	Flow rate	☒	☐	Check	☐
34	System pressure	☒	☐	Check	☐
35	Detector background	☒	☐	Check	☐

เอกสารไม่ควบคุม

DIONEX

Chromeleon Operational Qualification, Part 1

Verification of Selected Results

Calibration Type:	LOff
Integration Type:	Area
Standard Method:	External
Calibration Mode:	Total
Auto Recalibrate:	ON

Report Variable	*Peak Name*	*Status*
Offset (c0)	n.a.	ok
	n.a.	ok
	n.a.	ok
Slope (c1)	Methylparabene	ok
	Ethylparabene	ok
	Propylparabene	ok
Correlation Coeffi.	Methylparabene	ok
	Ethylparabene	ok
	Propylparabene	ok
Variance	Methylparabene	ok
	Ethylparabene	ok
	Propylparabene	ok
Std. Deviation	Methylparabene	ok
	Ethylparabene	ok
	Propylparabene	ok
Rel. Std. Dev.	Methylparabene	ok
	Ethylparabene	ok
	Propylparabene	ok
Variance Coeff.	Methylparabene	ok
	Ethylparabene	ok
	Propylparabene	ok

เอกสารไม่ควบคุม

DIONEX

Chromeleon Operational Qualification

General Information

Computer Name (Server):	LAB-IC
Computer Name (Client):	LAB-IC
Version Number:	6.80 SR12 Build 3578 (207169)
Operator:	Mr.Channarong Khiao-Un

General System Suitability Test: *Test passed*

Comparison Formats:

All Parameters: (Exeptions see below)	Significant Digits: (They must match exactly)	10
Time Related Frac. Coll. Parameters: [The parameters are marked with *).]	Max. Deviation:	0.02 s

Simon 8-Dec-21
Reviewer's Signature // Date

K.CHANNARONG 8-Dec-21
Operator's Signature // Date

เอกสารไม่ควบคุม

DIONEX

Chromeleon Operational Qualification, Part 1

Verification of Selected Results

Report Variable	Peak Name	Status
Theoretical Plates (EP)	Methylparabene	ok
	Ethylparabene	ok
	Propylparabene	ok
Theoretical Plates (USP)	Methylparabene	ok
	Ethylparabene	ok
	Propylparabene	ok
Theoretical Plates (JP)	Methylparabene	ok
	Ethylparabene	ok
	Propylparabene	ok

Test Result: ***Passed***

Suman 8-Dec-21
Reviewer's Signature // Date

K.Chamnarong 8-Dec-21
Operator's Signature // Date

เอกสารไม่ควบคุม

DIONEX

Chromeleon Operational Qualification, Part 1

Verification of Selected Results

Report Variable	Peak Name	Status
Calibration Point X	Methylparabene	ok
	Ethylparabene	ok
	Propylparabene	ok
Calibration Point Y	Methylparabene	ok
	Ethylparabene	ok
	Propylparabene	ok
Amount [ng]	Methylparabene	ok
	Ethylparabene	ok
	Propylparabene	ok
Resolution (EP)	Methylparabene	ok
	Ethylparabene	ok
Resolution (USP)	Methylparabene	ok
	Ethylparabene	ok
Peak Asymmetry (EP/USP)	Methylparabene	ok
	Ethylparabene	ok
	Propylparabene	ok
Peak Asymmetry (AIA)	Methylparabene	ok
	Ethylparabene	ok
	Propylparabene	ok

เอกสารไม่ควบคุม

DIONEX

Chromeleon Operational Qualification, Part 2

Most Frequently Used Parameters: Comparison with Expected Results

Variable Category	Report Variable	Peak Name	Status
Peak Results	Ret.Dev.(abs)	Methylparabene	ok
	Ret.Dev.(abs)	Ethylparabene	ok
	Ret.Dev.(abs)	Propylparabene	ok
	Ret.Dev.(rel)	Methylparabene	ok
	Ret.Dev.(rel)	Ethylparabene	ok
	Ret.Dev.(rel)	Propylparabene	ok
	Area	Methylparabene	ok
	Area	Ethylparabene	ok
	Area	Propylparabene	ok
	Rel.Area (Total)	Methylparabene	ok
	Rel.Area (Total)	Ethylparabene	ok
	Rel.Area (Total)	Propylparabene	ok
	Height	Methylparabene	ok
	Height	Ethylparabene	ok
	Height	Propylparabene	ok
	Rel.Height (Total)	Methylparabene	ok
	Rel.Height (Total)	Ethylparabene	ok
	Rel.Height (Total)	Propylparabene	ok
	Amount	Methylparabene	ok
	Amount	Ethylparabene	ok
	Amount	Propylparabene	ok
	Concentration	Methylparabene	ok
	Concentration	Ethylparabene	ok
	Concentration	Propylparabene	ok
	Rel.Amount	Methylparabene	ok
	Rel.Amount	Ethylparabene	ok
	Rel.Amount	Propylparabene	ok
	Peak Width (0%)	Methylparabene	ok
	Peak Width (0%)	Ethylparabene	ok
	Peak Width (0%)	Propylparabene	ok
	Peak Width (5%)	Methylparabene	ok
	Peak Width (5%)	Ethylparabene	ok
	Peak Width (5%)	Propylparabene	ok
	Peak Width (10%)	Methylparabene	ok
	Peak Width (10%)	Ethylparabene	ok
	Peak Width (10%)	Propylparabene	ok

เอกสารไม่ควบคุม

DIONEX

Chromeleon Operational Qualification, Part 2

Most Frequently Used Parameters: Comparison with Expected Results

Calibration Type: LOff
Integration Type: Area
Standard Method: External
Calibration Mode: Total
Auto Recalibrate: ON

Variable Category	Report Variable	Peak Name	Status
Sample	No.		ok
	Name		ok
	Sample Type		ok
	Position		ok
	Status		ok
	Inj.Vol.		ok
	Dil.Fac.		ok
	Weight		ok
	Amount		ok
	Program		ok
	Quantification Method		ok
Chromatogram	Channel		ok
	No. of Peaks		ok
	Start Time		ok
	Signal Min.		ok
	Signal Max.		ok
	Signal Dimension		ok
	Noise 2.1-2.3		ok
Peak Results	No.	Methylparabene	ok
	No.	Ethylparabene	ok
	No.	Propylparabene	ok
	Peak Name	Methylparabene	ok
	Peak Name	Ethylparabene	ok
	Peak Name	Propylparabene	ok
	Ret.Time	Methylparabene	ok
	Ret.Time	Ethylparabene	ok
	Ret.Time	Propylparabene	ok

เอกสารไม่ควบคุม

DIONEX

Chromeleon Operational Qualification, Part 2

Most Frequently Used Parameters: Comparison with Expected Results

Variable Category	Report Variable	Peak Name	Status
Peak Results	Asymmetry(AIA)	Methylparabene	ok
	Asymmetry(AIA)	Ethylparabene	ok
	Asymmetry(AIA)	Propylparabene	ok
	Theoretical Plates(EP)	Methylparabene	ok
	Theoretical Plates(EP)	Ethylparabene	ok
	Theoretical Plates(EP)	Propylparabene	ok
	Theoretical Plates(USP)	Methylparabene	ok
	Theoretical Plates(USP)	Ethylparabene	ok
	Theoretical Plates(USP)	Propylparabene	ok
	Theoretical Plates(JP)	Methylparabene	ok
	Theoretical Plates(JP)	Ethylparabene	ok
	Theoretical Plates(JP)	Propylparabene	ok
Peak Calibration	Cal.Mode	Methylparabene	ok
	Cal.Mode	Ethylparabene	ok
	Cal.Mode	Propylparabene	ok
	Auto.Recal.	Methylparabene	ok
	Auto.Recal.	Ethylparabene	ok
	Auto.Recal.	Propylparabene	ok
	Cal.Type	Methylparabene	ok
	Cal.Type	Ethylparabene	ok
	Cal.Type	Propylparabene	ok
	Weights	Methylparabene	ok
	Weights	Ethylparabene	ok
	Weights	Propylparabene	ok
	Offset	Methylparabene	ok
	Offset	Ethylparabene	ok
	Offset	Propylparabene	ok
	Slope	Methylparabene	ok
	Slope	Ethylparabene	ok
	Slope	Propylparabene	ok
	RF-Value	Methylparabene	ok
	RF-Value	Ethylparabene	ok
	RF-Value	Propylparabene	ok
	No. of Points	Methylparabene	ok
	No. of Points	Ethylparabene	ok

เอกสารไม่ควบคุม

DIONEX

Chromeleon Operational Qualification, Part 2

Most Frequently Used Parameters: Comparison with Expected Results

Variable Category	Report Variable	Peak Name	Status
Peak Results	Peak Width (50%)	Methylparabene	ok
	Peak Width (50%)	Ethylparabene	ok
	Peak Width (50%)	Propylparabene	ok
	Left Width (0%)	Methylparabene	ok
	Left Width (0%)	Ethylparabene	ok
	Left Width (0%)	Propylparabene	ok
	Right Width (0%)	Methylparabene	ok
	Right Width (0%)	Ethylparabene	ok
	Right Width (0%)	Propylparabene	ok
	Peak Start	Methylparabene	ok
	Peak Start	Ethylparabene	ok
	Peak Start	Propylparabene	ok
	Peak Stop	Methylparabene	ok
	Peak Stop	Ethylparabene	ok
	Peak Stop	Propylparabene	ok
	Peak Start Value	Methylparabene	ok
	Peak Start Value	Ethylparabene	ok
	Peak Start Value	Propylparabene	ok
	Peak Stop Value	Methylparabene	ok
	Peak Stop Value	Ethylparabene	ok
	Peak Stop Value	Propylparabene	ok
	BL-Value Peak Start	Methylparabene	ok
	BL-Value Peak Start	Ethylparabene	ok
	BL-Value Peak Start	Propylparabene	ok
	BL-Value Peak Stop	Methylparabene	ok
	BL-Value Peak Stop	Ethylparabene	ok
	BL-Value Peak Stop	Propylparabene	ok
	Type	Methylparabene	ok
	Type	Ethylparabene	ok
	Type	Propylparabene	ok
	Resolution(EP)	Methylparabene	ok
	Resolution(EP)	Ethylparabene	ok
	Resolution(USP)	Methylparabene	ok
	Resolution(USP)	Ethylparabene	ok
	Asymmetry(EP)	Methylparabene	ok
	Asymmetry(EP)	Ethylparabene	ok
	Asymmetry(EP)	Propylparabene	ok

เอกสารไม่ควบคุม

DIONEX

Chromeleon Operational Qualification, Part 2

Most Frequently Used Parameters: Comparison with Expected Results

Variable Category	Report Variable	Peak Name	Status
Peak Calibration	Residual for Cal.Point X	Methylparabene	ok
	Residual for Cal.Point X	Ethylparabene	ok
	Residual for Cal.Point X	Propylparabene	ok
	Calibration Point Status	Methylparabene	ok
	Calibration Point Status	Ethylparabene	ok
	Calibration Point Status	Propylparabene	ok
	Amount	Methylparabene	ok
	Amount	Ethylparabene	ok
	Amount	Propylparabene	ok
Peak Table	Peak Tab. Cal.Type	Methylparabene	ok
	Peak Tab. Peak Type	Methylparabene	ok
	Peak Tab. Left Limit	Methylparabene	ok
	Peak Tab. Right Limit	Methylparabene	ok
	Peak Tab. Group	Methylparabene	ok
	Peak Tab. Resp.Factor	Methylparabene	ok
	Peak Tab. Amount	Methylparabene	ok
	Peak Tab. Amnt.Dim	Methylparabene	ok

เอกสารไม่ควบคุม

DIONEX

Chromeleon Operational Qualification, Part 2

Most Frequently Used Parameters: Comparison with Expected Results

Variable Category	Report Variable	Peak Name	Status
Peak Calibration	No. of Points	Propylparabene	ok
	No. of Points(disabled)	Methylparabene	ok
	No. of Points(disabled)	Ethylparabene	ok
	No. of Points(disabled)	Propylparabene	ok
	Variance	Methylparabene	ok
	Variance	Ethylparabene	ok
	Variance	Propylparabene	ok
	Var.Coeff	Methylparabene	ok
	Var.Coeff	Ethylparabene	ok
	Var.Coeff	Propylparabene	ok
	Std.Dev.	Methylparabene	ok
	Std.Dev.	Ethylparabene	ok
	Std.Dev.	Propylparabene	ok
	Rel.Std.Dev.	Methylparabene	ok
	Rel.Std.Dev.	Ethylparabene	ok
	Rel.Std.Dev.	Propylparabene	ok
	Corr.Coeff.	Methylparabene	ok
	Corr.Coeff.	Ethylparabene	ok
	Corr.Coeff.	Propylparabene	ok
	Coeff.Det.	Methylparabene	ok
	Coeff.Det.	Ethylparabene	ok
	Coeff.Det.	Propylparabene	ok
	Adj. Coeff.Det.	Methylparabene	ok
	Adj. Coeff.Det.	Ethylparabene	ok
	Adj. Coeff.Det.	Propylparabene	ok
	X	Methylparabene	ok
	X	Ethylparabene	ok
	X	Propylparabene	ok
	Y	Methylparabene	ok
	Y	Ethylparabene	ok
	Y	Propylparabene	ok
	W	Methylparabene	ok
	W	Ethylparabene	ok
	W	Propylparabene	ok
	F(X)	Methylparabene	ok
	F(X)	Ethylparabene	ok
	F(X)	Propylparabene	ok

เอกสารไม่ควบคุม

DIONEX

Chromeleon Operational Qualification, Part 2

Most Frequently Used Parameters: Comparison with Expected Results

Variable Category	Report Variable	Peak Name	Status
Peak Purity	PPI	Methylparabene	ok
	PPI	Ethylparabene	ok
	PPI	Propylparabene	ok
	RSD PPI	Methylparabene	ok
	RSD PPI	Ethylparabene	ok
	RSD PPI	Propylparabene	ok
	Match	Methylparabene	ok
	Match	Ethylparabene	ok
	Match	Propylparabene	ok
	RSD Match	Methylparabene	Deviation
	RSD Match	Ethylparabene	Deviation
	RSD Match	Propylparabene	Deviation
	Rel.Max at	Methylparabene	ok
	Rel.Max at	Ethylparabene	ok
	Rel.Max at	Propylparabene	ok

Test Result: ***Failed***

ARCHEMICA LAB
บริษัท อาร์เคมีก้า แล็บ จำกัด
ARCHEMICA LAB CO.,LTD

Suman 8-Dec-21
Reviewer's Signature // Date

K.Khanthapong 8-Dec-21
Operator's Signature // Date

เอกสารไม่ควบคุม

DIONEX

Chromeleon Operational Qualification, Part 3

Post-Acquisition Steps: Comparison with Expected Results

Calibration Type:	LOff
Integration Type:	Area
Standard Method:	External
Calibration Mode:	Total
Auto Recalibrate:	ON

Channel Name	Report Variable	Peak Name	Status
Extract UV Channel:			
EXT230NM	Area	Methylparabene	ok
	Area	Ethylparabene	ok
	Area	Propylparabene	ok
	Height	Methylparabene	ok
	Height	Ethylparabene	ok
	Height	Propylparabene	ok
	Base Peak Width	Methylparabene	ok
	Base Peak Width	Ethylparabene	ok
	Base Peak Width	Propylparabene	ok
EXT290NM	Area	Methylparabene	ok
	Area	Ethylparabene	ok
	Area	Propylparabene	ok
	Height	Methylparabene	ok
	Height	Ethylparabene	ok
	Height	Propylparabene	ok
	Base Peak Width	Methylparabene	ok
	Base Peak Width	Ethylparabene	ok
	Base Peak Width	Propylparabene	ok
Smooth Data:			
UV_VIS_1_MA_005_001	Noise (1.9-2.4 min)		ok
UV_VIS_1_OL_051_001	Noise (1.9-2.4 min)		ok
EXT290NM_SG_005_010	Noise (1.9-2.4 min)		ok

เอกสารไม่ควบคุม

DIONEX

Chromeleon Operational Qualification, Part 3

Post-Acquisition Steps: Comparison with Expected Results

Channel Name	*Report Variable*	*Peak Name*	*Status*
Arith. Comb. of Channels:			
ADD_UV_VIS_1_UV_VIS_1	Area	Methylparabene	ok
ADD_UV_VIS_1_UV_VIS_1	Area	Ethylparabene	ok
ADD_UV_VIS_1_UV_VIS_1	Area	Propylparabene	ok
MUL_UV_VIS_1_UV_VIS_1	Area	Methylparabene	ok
MUL_UV_VIS_1_UV_VIS_1	Area	Ethylparabene	ok
MUL_UV_VIS_1_UV_VIS_1	Area	Propylparabene	ok

Test Result: ***Passed***

บริษัท อาร์เคมีก้า แลบ จำกัด
ARCHEMICA LAB CO.,LTD

Suwan 8-Dec-21
Reviewer's Signature // Date

K.Chaowaporn 8-Dec-21
Operator's Signature // Date

เอกสารไม่ควบคุม

DIONEX

Chromeleon Operational Qualification, Part 4

System Suitability Test: Comparison with Expected Results

Calibration Type: LOff
Integration Type: Area
Standard Method: External
Calibration Mode: Total
Auto Recalibrate: ON

Variable Category	*Report Variable*	*Status*
SST	Test No.	ok
	Test Name	ok
	Sample Condition	ok
	Sample Condition Result	ok
	Test Condition	ok
	Peak Condition	ok
	Aggregate Condition	ok
	Compare Operator	ok
	Compare Value	ok
	Result of Compare Value	ok
	Channel	ok
	Aggregated Samples	ok
	List of Aggr. Smp.	ok
	Result List for Aggr. Smp.	ok
	Result of Test Condition or Aggregate	ok
	N.A.	ok
	Test Result	ok
	Fail-Action	ok

Test Result: ***Passed***

บริษัท อาร์เคมีก้า แลบ จำกัด
ARCHEMICA LAB CO.,LTD

Suwan 8-Dec-21
Reviewer's Signature // Date

K.Chaowaporn 8-Dec-21
Operator's Signature // Date

เอกสารไม่ควบคุม

Performance Qualification (PQ)

DIONEX

Chromeleon Operational Qualification, Part 5

Fraction Collection: Comparison with Expected Results

Calibration Type: LOff
Integration Type: Area
Standard Method: External
Calibration Mode: Total
Auto Recalibrate: ON

Variable Category	*Report Variable*	*Status*
Fraction Report	Fract. No.	ok
	Fract. Starttime *)	ok
	Fract. Endtime *)	ok
	No. of Tubes	ok
	Position	ok
	Peak Name	ok
	No. of Peaks	ok
Tube Report	Position	ok
	Tube Starttime *)	ok
	Tube Endtime *)	ok
	Max.Tube Volume	ok
	Peak Name	ok
	No. of Peaks	ok
	Fract. No.	ok
	Fract. Starttime *)	ok
	Fract. Endtime *)	ok
	No. of Tubes	ok
	No. of Peaks	ok

Test Result: ***Passed***

CHEMICA LAB CO.,LTD

Suwan 8-Dec-21
Reviewer's Signature // Date

Kittiwaporn 8-Dec-21
Operator's Signature // Date

เอกสารไม่ควบคุม

เอกสารไม่ควบคุม

Limits:

Test	Customized Limits	Dionex Recommended Limits
DX120 Conductivity Noise (nS)	2	2
DX120 Conductivity Drift (nS/hr)	20	20
Injector Precision (Area %RSD)	1.0	1.0
Injector Carry Over (Area %)	0.1	0.1
DX120 Detector Linearity (Corr.)	0.999	0.999
DX120 Detector Linearity (%RSD)	5	5

Additional Information:

Customer/Company:	**UAE Consultant Co.,Ltd.**	Date:	**8-Dec-2021**
Qualification Executor:	**Mr.Channarong / Archemica**	Period between Qualifications:	**6 months**
		Next Qualification:	**Jun-2022**

Customer Signature | Qualification Executor | Date: 8-Dec-21

เอกสารไม่ควบคุม

DIONEX

Performance Qualification

Instruments:

Instrument Name	*Model*	*Supplier*	*Serial Number*	*Moduleware Version*
Pump	DX120	Dionex	03010223	3.03
Detector	DX120	Dionex	03010223	3.03
Autosampler	AS40 or man. inj.	Dionex	n.a.	0.00
Eluent Generator	n.a.	Dionex	n.a.	0.00
Chromeleon	6.80 SR12 Build 3578 (207169)	Dionex	33308	n.a.

Accessories:

Name	*Description*	*Lot / Serial Number*	*Expire Date*
Backpressure Tubing	0.13 mm (0.005") ID PEEK, 13 m (512")	n.a.	n.a.
Blank	Water	n.a.	n.a.
Sample 1	Nitrate, 5 ppm	210719	Jul-2022
Sample 2	Nitrate, 10 ppm	210719	Jul-2022
Sample 3	Nitrate, 25 ppm	210719	Jul-2022
Sample 4	Nitrate, 50 ppm	210719	Jul-2022
Sample 5	Nitrate, 100 ppm	210719	Jul-2022
Sample 6	Nitrate, 1000 ppm	210719	Jul-2022
Eluent	Water	n.a.	n.a.
Autosampler Reservoir A	Water	n.a.	n.a.

Customer Signature | Qualification Executor | Date: 8-Dec-21

Customer signature indicates that all information in the following reports has been reviewed and accepted.

เอกสารไม่ควบคุม

Data for detector noise

Segment number	Noise, nS
1	2.696
2	2.231
3	1.111
4	2.130
5	2.284
6	0.960
7	2.415
8	2.031
9	2.138
10	2.622
11	0.719
12	1.270
13	1.671
14	1.444
15	1.699
16	2.892
17	1.850
18	1.950
19	1.379
20	2.205
Average, nS	**1.885**
Limit, nS	**2**
Result	**PASS**

Data for detector drift

20 Minute drift, nS	Drift, nS/hr	Limit, nS/hr	Result
0.427	1.280	20.000	PASS

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ARCHEMICA LAB CO.,LTD

Customer Signature | Qualification Executor | 8-Dec-21 Date

เอกสารไม่ควบคุม

DIONEX

Performance Qualification

Detector Noise and Drift

Instruments:

Instrument Name	Model	Supplier	Serial Number	Moduleware Version
Pump	DX120	Dionex	03010223	3.03
Detector	DX120	Dionex	03010223	3.03
Autosampler	AS40 or man. inj.	Dionex	n.a.	0.00
Eluent Generator	n.a.	Dionex	n.a.	0.00

Accessories

Name	Description
Backpressure Tubing	0.13 mm (0.005") ID PEEK, 13 m (512")
Eluent	Water

Additional Information

Customer/Company:	**UAE Consultant Co.,Ltd.**	Date:	**8-Dec-2021**
Qualification Executor:	**Mr.Channarong / Archemica**	Next Qualification:	**Jun-2022**

Test Results Summary

Test	Result
DX120 Conductivity Noise (nS)	PASS
DX120 Conductivity Drift (nS/hr)	PASS

บริษัท อาร์เคมิกา แลบ จำกัด
ARCHEMICA LAB CO.,LTD

Customer Signature | Qualification Executor | 8-Dec-21 Date

เอกสารไม่ควบคุม

DIONEX

Performance Qualification

Injector Precision

Instruments:

Instrument Name	Model	Supplier	Serial Number	Moduleware Version
Pump	DX120	Dionex	03010223	3.03
Detector	DX120	Dionex	03010223	3.03
Autosampler	AS40 or man. inj.	Dionex	n.a.	0.00
Eluent Generator	n.a.	Dionex	n.a.	0.00

Accessories

Name	Description
Backpressure Tubing	0.13 mm (0.005") ID PEEK, 13 m (512")
Sample 5	Nitrate, 100 ppm
Eluent	Water

Additional Information

Customer/Company:	**UAE Consultant Co.,Ltd.**	Date:	**8-Dec-2021**
Qualification Executor:	**Mr.Channarong / Archemica**	Next Qualification:	**Jun-2022**

Test Results Summary

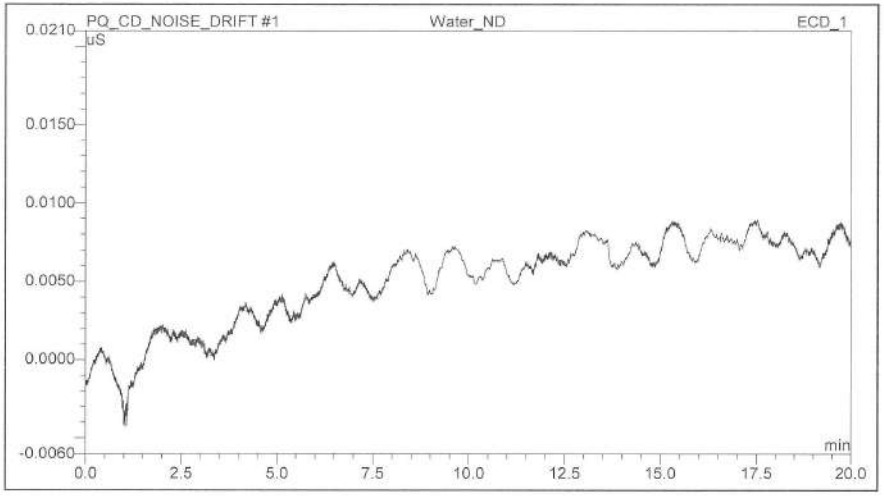
Test	Result
Injector Precision (Area %RSD)	PASS

บริษัท อาร์เคมีก้า แล็บ จำกัด
ARCHEMICA LAB CO.,LTD

Customer Signature | Qualification Executor | Date: 8-Dec-21

เอกสารไม่ควบคุม

Chromatogram of Detector Noise and Drift



บริษัท อาร์เคมีก้า แล็บ จำกัด
ARCHEMICA LAB CO.,LTD

Customer Signature | Qualification Executor | Date: 8-Dec-21.

เอกสารไม่ควบคุม

DIONEX

Performance Qualification

Injector Carry Over

Instruments:

Instrument Name	Model	Supplier	Serial Number	Moduleware Version
Pump	DX120	Dionex	03010223	3.03
Detector	DX120	Dionex	03010223	3.03
Autosampler	AS40 or man. inj.	Dionex	n.a.	0.00
Eluent Generator	n.a.	Dionex	n.a.	0.00

Accessories

Name	Description
Backpressure Tubing	0.13 mm (0.005") ID PEEK, 13 m (512")
Sample 6	Nitrate, 1000 ppm
Blank	Water
Eluent	Water

Additional Information

Customer/Company:	UAE Consultant Co.,Ltd.	Date:	8-Dec-2021
Qualification Executor:	Mr.Channarong / Archemica	Next Qualification:	Jun-2022

Test Results Summary

Test	Result
Injector Carry Over (Area %)	PASS

Suwan
Customer Signature

Channarong
Qualification Executor

8-Dec-21.
Date

เอกสารไม่ควบคุม

Data for Injector Precision test

Name	Area uS*min Nitrate ECD_1
Inj Precision_1	1.665
Inj Precision_2	1.688
Inj Precision_3	1.691
Inj Precision_4	1.698
Inj Precision_5	1.699
Inj Precision_6	1.699
Inj Precision_7	1.689
Inj Precision_8	1.711
Inj Precision_9	1.711
Inj Precision_10	1.700
Average:	**1.695**
Std. Dev:	**0.013**
% RSD:	**0.783 %**
Limit:	**1.0 %**
Result:	**PASS**

Suwan
Customer Signature

Channarong
Qualification Executor

8-Dec-21.
Date

เอกสารไม่ควบคุม

DIONEX

Performance Qualification

Detector Linearity

Instruments:

Instrument Name	Model	Supplier	Serial Number	Moduleware Version
Pump	DX120	Dionex	03010223	3.03
Detector	DX120	Dionex	03010223	3.03
Autosampler	AS40 or man. inj.	Dionex	n.a.	0.00
Eluent Generator	n.a.	Dionex	n.a.	0.00

Accessories

Name	Description
Backpressure Tubing	0.13 mm (0.005") ID PEEK, 13 m (512")
Sample 1	Nitrate, 5 ppm
Sample 2	Nitrate, 10 ppm
Sample 3	Nitrate, 25 ppm
Sample 4	Nitrate, 50 ppm
Sample 5	Nitrate, 100 ppm
Eluent	Water

Additional Information

Customer/Company:	**UAE Consultant Co.,Ltd.**	Date:	**8-Dec-2021**
Qualification Executor:	**Mr.Channarong / Archemica**	Next Qualification:	**Jun-2022**

Test Results Summary

Test	Result
DX120 Detector Linearity (Corr.)	**PASS**
DX120 Detector Linearity (%RSD)	**PASS**

Suwan. — Customer Signature

K.Channarong — Qualification Executor

8-Dec-21 — Date

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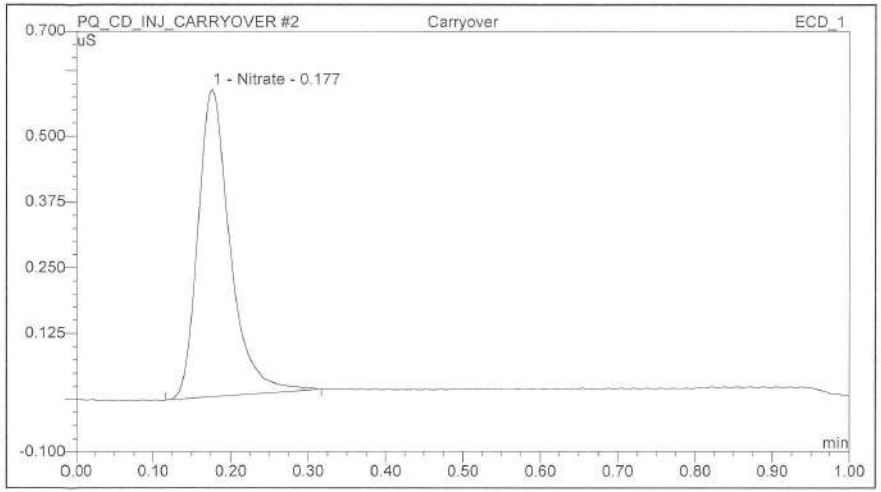
Chromatogram for Carry Over test



Data for Carry Over test

Name	Ret.Time (detected) min Nitrate ECD_1	Area uS*min Nitrate ECD_1
High Level	0.18	30.991
Carryover	0.18	0.028
Water	0.18	0.022
Carry over:		***0.070 %***
Limit:		***0.1 %***
Result:		***PASS***

Suwan. — Customer Signature

K.Channarong — Qualification Executor

8-Dec-21 — Date

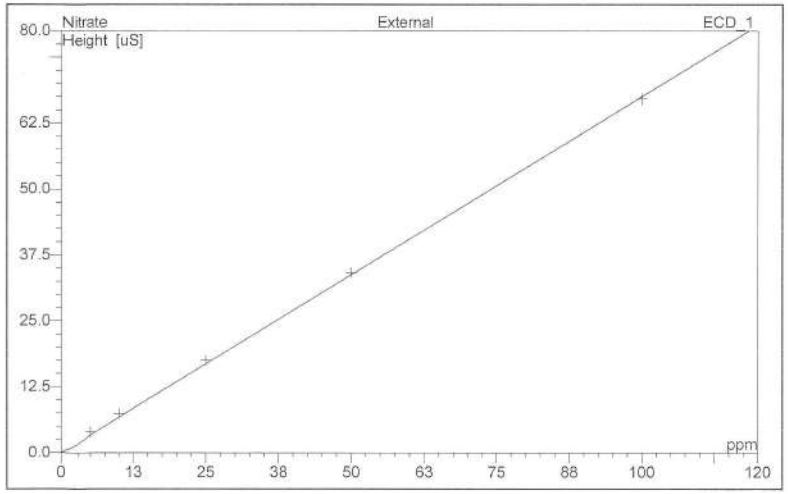
เอกสารไม่ควบคุม

CERTIFICATE

Data for Detector Linearity

Name	Amount ppm Nitrate ECD_1	Height uS Nitrate ECD_1
Detector linearity_1	5.000	3.962
Detector linearity_2	10.000	7.384
Detector linearity_3	25.000	17.462
Detector linearity_4	50.000	34.143
Detector linearity_5	100.000	67.127

Linearity Plot



Calibration Type	Number of Points	Offset	Slope
Lin	5	0.000	0.675

	Correlation Coefficient	% RSD
Linearity:	1.000	2.260
Limit:	**0.999**	**5**
Result:	**PASS**	**PASS**

Customer Signature

Qualification Executor

8-Dec-21
Date

เอกสารไม่ควบคุม

เอกสารไม่ควบคุม

ThermoFisher SCIENTIFIC

Certificate of Completion

This certifies that

Channarong Khiao-Un

Has successfully completed

eLearn: RPG IC-Specific Qualification Service Training

บริษัท อาร์เคมิกา แลบ จำกัด
ARCHEMICA LAB CO.,LTD

K.Channarong 2016

8-Dec-21

Valid for 3 years from:

Nov/19/2021

Issued electronically and approved by:

TFS - Learning Management System, Training, Mentoring, and Certification Group
tmc.training@thermofisher.com

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The world leader in serving science

Important note: The certificate is only valid during employment with the Thermo Fisher Scientific including its subsidiaries and certified contractors.

เอกสารไม่ควบคุม

Better Separations Through Better Chemistry

Certificate of Analysis

Dionex Nitrate OQ/PQ IC Standards Kit
(Set of 6)

Product Number 060254
Certificate of Analysis

Lot Number 210719

Expiration of Certification
July 2022

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

บริษัท อาร์เคมิกา แลบ จำกัด
ARCHEMICA LAB CO.,LTD

K.Channarong 2016

8-Dec-21

Dionex Nitrate Standard

Vial #	Concentration (mg/L)
1	5.07 ± 0.03
2	9.95 ± 0.07
3	24.49 ± 0.10
4	49.16 ± 0.13
5	99.0 ± 1
6	993 ± 4

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

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

Document No. 078690-01 20-Dec-2011

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thermoscientific.com/dionex

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

NSC-TISI-TIS 17025 CALIBRATION 0404

REPORT OF CALIBRATION

Certificate No. : SP22-016

Environment Condition : Ambient Temperature 25 ± 5 °C

Relative humidity 55 ± 20 %RH

Calibration method : In-house method CP-01 Based on ASTM E275-08

Certified Reference Materials :

Material	Serial No.	Certificate No.	Due date
Absobance Standard set	25760	95935	22 October 2023
Absobance Standard set	25757	95929	22 October 2023
Wavelength Standard set	25806	95916	22 October 2023
Wavelength Standard set	25758	95915	22 October 2023

Traceability : This certification is traceable to the International System of Unit maintained at National - Institute of Standards and Technology (NIST) through Starna Scientific Limited

Spectral Band Width of UUC : 1.5 nm.

Scan Speed of UUC : 90 nm/min

Scan Interval of UUC : 0.15 nm.

Resolution of UUC : Photometric 0.0001 Abs.

Wavelength 0.1 nm.

เอกสารไม่ควบคุม

DQE Services Co.,Ltd.
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NSC-TISI-TIS 17025 CALIBRATION 0404

CERTIFICATE OF CALIBRATION

Certificate No. : SP22-016

Customer : United Analyst and Engineering Consultant Co.,Ltd. (Head Office)

Address : 3 Soi Udomsuk 41, Sukhumvit Road, Bangchak, Phrakhanong, Bangkok 10260

Location of calibration : Laboratory 315

Equipment : UV-Vis Spectrophotometer

Manufacturer : Agilent Technologies

Model : Cary 60

Serial No. : MY15410009

ID No. : N/A

Received Date : 23 May 2022

Calibration Date : 23 May 2022

Issue Date : 26 May 2022

Condition Instrument : Good

Calibrated by : (Mr.Tanawut Rittidach)
Technical Manager

Approved by : (Ms. Chonthicha Sangngern)
Quality Manager

The calibration result is applied only to the above calibrated item and was found accurate as shown on date and place of calibration only.

The measurement capability of the laboratory and its traceability to recognized national standards and to the unit of measurement realized at the corresponding national standards laboratory. This certificate may not be reproduced other than in full except with the prior written approval of the DQE Services Co., Ltd.

เอกสารไม่ควบคุม

FM-708-02 R01 1/11/2021

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NSC-TISI-TIS 17025 CALIBRATION 0404

REPORT OF CALIBRATION

Certificate No. : SP22-016

Photometric Accuracy :

Wavelength (nm.)	CRMs Values (Abs)	UUC Reading (Abs)	Correction (Abs)	Uncertainty (Abs)	Coverage factor *k*
235	0.0000	0.0001	-0.0001	0.0050	2.00
	0.7478	0.7421	0.0057	0.0056	2.00
257	0.0000	0.0000	0.0000	0.0050	2.00
	0.8686	0.8619	0.0067	0.0059	2.00
313	0.0000	0.0000	0.0000	0.0050	2.00
	0.2912	0.2896	0.0016	0.0051	2.00
350	0.0000	0.0000	0.0000	0.0050	2.00
	0.6448	0.6403	0.0045	0.0055	2.00

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NSC-TISI-TIS 17025 CALIBRATION 0404

REPORT OF CALIBRATION

Certificate No. : SP22-016

Calibration Results : Without adjustment

Photometric Accuracy :

Wavelength (nm.)	CRMs Values (Abs)	UUC Reading (Abs)	Correction (Abs)	Uncertainty (Abs)	Coverage factor *k*
420	0.0000	0.0000	0.0000	0.0028	2.00
	0.5787	0.5755	0.0032	0.0031	2.00
	1.0490	1.0436	0.0054	0.0029	2.00
	2.1900	2.1847	0.0053	0.0075	2.00
440	0.0000	0.0000	0.0000	0.0028	2.00
	0.5607	0.5588	0.0019	0.0034	2.00
	1.0247	1.0232	0.0015	0.0035	2.00
	2.1229	2.1211	0.0018	0.0082	2.00
465	0.0000	0.0000	0.0000	0.0028	2.00
	0.5236	0.5197	0.0039	0.0029	2.00
	0.9634	0.9625	0.0009	0.0028	2.00
	1.9763	1.9752	0.0011	0.0070	2.00
546.1	0.0000	-0.0001	0.0001	0.0028	2.00
	0.5191	0.5171	0.0020	0.0031	2.00
	1.0003	0.9984	0.0019	0.0033	2.00
	1.9987	1.9946	0.0041	0.0084	2.00
590	0.0000	0.0000	0.0000	0.0028	2.00
	0.5523	0.5509	0.0014	0.0030	2.00
	1.0809	1.0799	0.0010	0.0029	2.00
	2.0391	2.0329	0.0062	0.0080	2.00
635	0.0000	0.0000	0.0000	0.0028	2.00
	0.5601	0.5584	0.0017	0.0031	2.00
	1.0512	1.0498	0.0014	0.0029	2.00
	1.9294	1.9265	0.0029	0.0082	2.00

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NSC-TISI-TIS 17025 CALIBRATION 0404

CERTIFICATE OF CALIBRATION

Certificate No. : SP22-007

Customer : United Analyst and Engineering Consultant Co.,Ltd. (Head Office)

Address : 3 Soi Udomsuk 41, Sukhumvit Road, Bangchak, Phrakhanong, Bangkok 10260

Location of calibration : Laboratory 315

Equipment : UV-Vis Spectrophotometer

Manufacturer : Hitachi

Model : U-1900

Serial No. : 2021-064

ID No. : UAE.WAS.006/2552

Received Date : 20 January 2022

Calibration Date : 20 January 2022

Issue Date : 24 January 2022

Condition Instrument : Good

Calibrated by : ธนวุฒิ
(Mr.Tanawut Rittidach)
Technical Manager

Approved by : ชลธิชา
(Ms. Chonthicha Sangngern)
Quality Manager

The calibration result is applied only to the above calibrated item and was found accurate as shown on date and place of calibration only.

The measurement capability of the laboratory and its traceability to recognized national standards and to the unit of measurement realized at the corresponding national standards laboratory. This certificate may not be reproduced other than in full except with the prior written approval of the DQE Services Co., Ltd.

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NSC-TISI-TIS 17025 CALIBRATION 0404

REPORT OF CALIBRATION

Certificate No. : SP22-016

Wavelength Accuracy :

CRMs Values (nm.)	UUC Reading (nm.)	Correction (nm.)	Uncertainty (nm.)	Coverage factor *k*
241.72	242.0	-0.28	0.18	2.00
279.45	279.5	-0.05	0.18	2.00
287.81	287.5	0.31	0.18	2.00
334.06	333.5	0.56	0.18	2.00
360.93	360.5	0.43	0.18	2.00
418.59	418.0	0.59	0.18	2.00
445.94	445.4	0.54	0.18	2.00
453.66	453.2	0.46	0.18	2.00
460.02	459.7	0.32	0.18	2.00
536.59	536.2	0.39	0.18	2.00
637.98	638.3	-0.32	0.18	2.00
431.38	431.0	0.38	0.18	2.00
472.50	472.5	0.00	0.18	2.00
513.47	513.5	-0.03	0.18	2.00
528.88	528.5	0.38	0.18	2.00
573.17	573.0	0.17	0.18	2.00
585.35	585.0	0.35	0.20	2.00
684.40	684.7	-0.30	0.18	2.00
740.72	740.8	-0.08	0.20	2.00
748.55	748.5	0.05	0.18	2.00
807.03	807.3	-0.27	0.18	2.00
879.28	879.0	0.28	0.18	2.00

Remark : - UUC = Unit Under Calinration

- N/A = Not Avaiable
- The result expanded uncertainty of measurement U is stated as the standard uncertainty of measurement multiplied by the coverage factor *k*, which for a normal distribution corresponds to a coverage probability of approximately 95%
- * Indicates non TISI accredited

- End of Certificate -

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

REPORT OF CALIBRATION

Certificate No. : SP22-007

Calibration Results : Without adjustment

Photometric Accuracy :

Wavelength (nm.)	CRMs Values (Abs)	UUC Reading (Abs)	Correction (Abs)	Uncertainty (Abs)	Coverage factor *k*
420	0.0000	0.000	0.0000	0.0028	2.00
	0.5787	0.577	0.0017	0.0031	2.00
	1.0490	1.050	-0.0010	0.0029	2.00
	2.1900	2.183	0.0070	0.0080	2.00
440	0.0000	0.000	0.0000	0.0028	2.00
	0.5607	0.560	0.0007	0.0034	2.00
	1.0247	1.023	0.0017	0.0035	2.00
	2.1229	2.118	0.0049	0.0079	2.00
465	0.0000	0.000	0.0000	0.0028	2.00
	0.5236	0.521	0.0026	0.0030	2.00
	0.9634	0.963	0.0004	0.0029	2.00
	1.9763	1.974	0.0023	0.0070	2.00
546.1	0.0000	0.000	0.0000	0.0028	2.00
	0.5191	0.518	0.0011	0.0031	2.00
	1.0003	1.000	0.0003	0.0033	2.00
	1.9987	1.996	0.0027	0.0084	2.00
590	0.0000	0.000	0.0000	0.0028	2.00
	0.5523	0.552	0.0003	0.0030	2.00
	1.0809	1.082	-0.0011	0.0030	2.00
	2.0391	2.033	0.0061	0.0079	2.00
635	0.0000	0.000	0.0000	0.0028	2.00
	0.5601	0.562	-0.0019	0.0031	2.00
	1.0512	1.052	-0.0008	0.0030	2.00
	1.9294	1.925	0.0044	0.0079	2.00

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REPORT OF CALIBRATION

Certificate No. : SP22-007

Environment Condition : Ambient Temperature 25 ± 5 °C

Relative humidity 55 ± 20 %RH

Calibration method : In-house method CP-01 Based on ASTM E275-08

Certified Reference Materials :

Material	Serial No.	Certificate No.	Due date
Absobance Standard set	25760	95935	22 October 2023
Absobance Standard set	25757	95929	22 October 2023
Wavelength Standard set	25806	95916	22 October 2023
Wavelength Standard set	25758	95915	22 October 2023

Traceability This certification is traceable to the International System of Unit maintained at National - Institute of Standards and Technology (NIST) through Starna Scientific Limited

Spectral Band Width of UUC : 4.0 nm.

Scan Speed of UUC : 200 nm/min

Scan Interval of UUC : 0.1 nm.

Resolution of UUC : Photometric 0.001 Abs.

Wavelength 0.1 nm.

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DQE Services Co.,Ltd.
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REPORT OF CALIBRATION

Certificate No. : SP22-007

Wavelength Accuracy :

CRMs Values (nm.)	UUC Reading (nm.)	Correction (nm.)	Uncertainty (nm.)	Coverage factor *k*
241.54	240.8	0.74	0.18	2.00
279.40	278.5	0.90	0.18	2.00
288.70	288.0	0.70	0.18	2.00
334.22	333.5	0.72	0.18	2.00
361.26	360.5	0.76	0.18	2.00
418.48	418.0	0.48	0.18	2.00
446.70	446.0	0.70	0.18	2.00
453.20	453.0	0.20	0.18	2.00
460.06	459.5	0.56	0.18	2.00
536.90	536.0	0.90	0.18	2.00
637.94	637.2	0.74	0.18	2.00
440.74	440.0	0.74	0.18	2.00
472.22	471.6	0.62	0.18	2.00
513.70	513.0	0.70	0.18	2.00
528.72	528.0	0.72	0.18	2.00
574.60	573.8	0.80	0.18	2.00
585.48	584.6	0.88	0.20	2.00
684.63	684.0	0.63	0.18	2.00
740.27	739.8	0.47	0.20	2.00
748.28	747.8	0.48	0.18	2.00
807.16	806.4	0.76	0.18	2.00
879.70	878.8	0.90	0.18	2.00

Remark : - UUC = Unit Under Calinration

- N/A = Not Avaiable
- The result expanded uncertainty of measurement U is stated as the standard uncertainty of measurement multiplied by the coverage factor *k* , which for a normal distribution corresponds to a coverage probability of approximately 95%
- * Indicates non TISI accredited

- End of Certificate -

เอกสารไม่ควบคุม

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

REPORT OF CALIBRATION

Certificate No. : SP22-007

Photometric Accuracy :

Wavelength (nm.)	CRMs Values (Abs)	UUC Reading (Abs)	Correction (Abs)	Uncertainty (Abs)	Coverage factor *k*
235	0.0000	0.000	0.0000	0.0050	2.00
	0.7478	0.746	0.0018	0.0057	2.00
257	0.0000	0.000	0.0000	0.0050	2.00
	0.8686	0.861	0.0076	0.0059	2.00
313	0.0000	0.000	0.0000	0.0050	2.00
	0.2912	0.291	0.0002	0.0051	2.00
350	0.0000	0.000	0.0000	0.0050	2.00
	0.6448	0.638	0.0068	0.0055	2.00

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

NSC-TISI-TIS 17025 CALIBRATION 0404

REPORT OF CALIBRATION

Certificate No. : SP22-008

Environment Condition : Ambient Temperature 25 ± 5 °C

Relative humidity 55 ± 20 %RH

Calibration method : In-house method CP-01 Based on ASTM E275-08

Certified Reference Materials :

Material	Serial No.	Certificate No.	Due date
Absobance Standard set	25760	95935	22 October 2023
Absobance Standard set	25757	95929	22 October 2023
Wavelength Standard set	25806	95916	22 October 2023
Wavelength Standard set	25758	95915	22 October 2023

Traceability This certification is traceable to the International System of Unit maintained at National - Institute of Standards and Technology (NIST) through Starna Scientific Limited

Spectral Band Width of UUC : 1.5 nm.

Scan Speed of UUC : 200 nm/min

Scan Interval of UUC : 0.1 nm.

Resolution of UUC : Photometric 0.001 Abs.

Wavelength 0.1 nm.

เอกสารไม่ควบคุม

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

NSC-TISI-TIS 17025 CALIBRATION 0404

CERTIFICATE OF CALIBRATION

Certificate No. : SP22-008

Customer : United Analyst and Engineering Consultant Co.,Ltd. (Head Office)

Address : 3 Soi Udomsuk 41, Sukhumvit Road, Bangchak, Phrakhanong, Bangkok 10260

Location of calibration : Laboratory 213

Equipment : UV-Vis Spectrophotometer

Manufacturer : Hitachi

Model : U-2900

Serial No. : 21E22-009

ID No. : UAE.WAT.051/2564

Received Date : 20 January 2022

Calibration Date : 20 January 2022

Issue Date : 24 January 2022

Condition Instrument : Good

Calibrated by : (Mr.Tanawut Rittidach)
Technical Manager

Approved by : (Ms. Chonthicha Sangngern)
Quality Manager

The calibration result is applied only to the above calibrated item and was found accurate as shown on date and place of calibration only.

The measurement capability of the laboratory and its traceability to recognized national standards and to the unit of measurement realized at the corresponding national standards laboratory. This certificate may not be reproduced other than in full except with the prior written approval of the DQE Services Co., Ltd.

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NSC-TISI-TIS 17025 CALIBRATION 0404

REPORT OF CALIBRATION

Certificate No. : SP22-008

Photometric Accuracy :

Wavelength (nm.)	CRMs Values (Abs)	UUC Reading (Abs)	Correction (Abs)	Uncertainty (Abs)	Coverage factor *k*
235	0.0000	0.000	0.0000	0.0050	2.00
	0.7478	0.747	0.0008	0.0057	2.00
257	0.0000	0.000	0.0000	0.0050	2.00
	0.8686	0.865	0.0036	0.0059	2.00
313	0.0000	0.000	0.0000	0.0050	2.00
	0.2912	0.290	0.0012	0.0051	2.00
350	0.0000	0.000	0.0000	0.0050	2.00
	0.6448	0.640	0.0048	0.0055	2.00

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NSC-TISI-TIS 17025 CALIBRATION 0404

REPORT OF CALIBRATION

Certificate No. : SP22-008

Calibration Results : Without adjustment

Photometric Accuracy :

Wavelength (nm.)	CRMs Values (Abs)	UUC Reading (Abs)	Correction (Abs)	Uncertainty (Abs)	Coverage factor *k*
420	0.0000	0.000	0.0000	0.0028	2.00
	0.5787	0.576	0.0027	0.0031	2.00
	1.0490	1.046	0.0030	0.0029	2.00
	2.1900	2.182	0.0080	0.0075	2.00
440	0.0000	0.000	0.0000	0.0028	2.00
	0.5607	0.559	0.0017	0.0034	2.00
	1.0247	1.023	0.0017	0.0035	2.00
	2.1229	2.116	0.0069	0.0079	2.00
465	0.0000	0.000	0.0000	0.0028	2.00
	0.5236	0.521	0.0026	0.0030	2.00
	0.9634	0.962	0.0014	0.0029	2.00
	1.9763	1.970	0.0063	0.0070	2.00
546.1	0.0000	0.000	0.0000	0.0028	2.00
	0.5191	0.519	0.0001	0.0031	2.00
	1.0003	0.999	0.0013	0.0033	2.00
	1.9987	1.992	0.0067	0.0084	2.00
590	0.0000	0.000	0.0000	0.0028	2.00
	0.5523	0.552	0.0003	0.0030	2.00
	1.0809	1.080	0.0009	0.0030	2.00
	2.0391	2.031	0.0081	0.0079	2.00
635	0.0000	0.000	0.0000	0.0028	2.00
	0.5601	0.560	0.0001	0.0031	2.00
	1.0512	1.052	-0.0008	0.0030	2.00
	1.9294	1.922	0.0074	0.0079	2.00

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Request No. 25-65 / 0398

MTC. ACL.No. 486 / 65

CALIBRATION CERTIFICATE

NOMENCLATURE : 1. Atomic Absorption Spectrophotometer "Agilent Technologies"
Model AA240FS, Serial No. MY13160001
2. Working standard solution "Inorganic Ventures"
Multi Analyte Custom Grade Solution, Lot No. P2-MEB675610

SUBMITTED BY : United Analyst and Engineering Consultant Co., Ltd.
3 Soi Udomsuk41, Sukhumvit Road, Bangchak, Prakanong, Bangkok 10260

CALIBRATION PROCEDURE : 1. Performance Verification of Atomic Absorption Spectrophotometer (WI-500-02-30)
2. Estimation Uncertainty of Measurement in Analytical Chemistry (QP-513)

REFERENCE MATERIAL : Traceable to NIST "Agilent Technologies", "Carlo Erba"
Cadmium Lot No. 0108047046, Chromium Lot No. 0106315418, Copper Lot No. 0107480530, Iron Lot No. 0104697566, Lead Lot No. 0104659473, Manganese Lot No. T109228A, Nickel Lot No. 0104978044, Zinc Lot No. 0100792297

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

AMBIENT CONDITIONS : Temperature 22 °C Relative humidity 60 %

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

Calibrated by .....
(Mr. Danai Srithongkum)

Approved by.....
for (Mrs. Thippaya Junvee Fortune)
Director of Analytical Chemistry Laboratory
Ref. 2025265020400522001
Calibration Date : 3 February 2022

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NSC-TISI-TIS 17025 CALIBRATION 0404

REPORT OF CALIBRATION

Certificate No. : SP22-008

Wavelength Accuracy :

CRMs Values (nm.)	UUC Reading (nm.)	Correction (nm.)	Uncertainty (nm.)	Coverage factor *k*
241.72	241.0	0.72	0.18	2.00
279.45	279.0	0.45	0.18	2.00
287.81	287.0	0.81	0.18	2.00
334.06	333.5	0.56	0.18	2.00
360.93	360.0	0.93	0.18	2.00
418.59	418.0	0.59	0.18	2.00
445.94	445.5	0.44	0.18	2.00
453.66	453.0	0.66	0.18	2.00
460.02	459.5	0.52	0.18	2.00
536.59	536.0	0.59	0.18	2.00
637.98	637.5	0.48	0.18	2.00
431.38	431.0	0.38	0.18	2.00
472.50	472.0	0.50	0.18	2.00
513.47	513.0	0.47	0.18	2.00
528.88	528.5	0.38	0.18	2.00
573.17	573.0	0.17	0.18	2.00
585.35	585.0	0.35	0.20	2.00
684.40	684.0	0.40	0.18	2.00
740.72	740.5	0.22	0.20	2.00
748.55	748.5	0.05	0.18	2.00
807.03	807.0	0.03	0.18	2.00
879.28	879.5	-0.22	0.18	2.00

Remark : - UUC = Unit Under Calinration
- N/A = Not Avaiable
- The result expanded uncertainty of measurement U is stated as the standard uncertainty of measurement multiplied by the coverage factor *k* , which for a normal distribution corresponds to a coverage probability of approximately 95%
- * Indicates non TISI accredited

- End of Certificate -

FM-708-02 R01 1/11/2021

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2. Precision

Element	Conc. (mg/l)	Absorbance										Ave. Abs.	SD	%RSD
Cd	0.02	0.0074	0.0062	0.0065	0.0062	0.0070	0.0068	0.0070	0.0065	0.0065	0.0069	0.007	0.0004	5.76
	0.30	0.0952	0.0959	0.0951	0.0957	0.0952	0.0950	0.0952	0.0948	0.0956	0.0943	0.095	0.0005	0.49
	0.70	0.2213	0.2180	0.2203	0.2208	0.2234	0.2211	0.2196	0.2219	0.2201	0.2194	0.221	0.0015	0.67
Cr	0.10	0.0096	0.0098	0.0097	0.0102	0.0106	0.0097	0.0098	0.0099	0.0103	0.0093	0.010	0.0004	3.83
	0.30	0.0309	0.0302	0.0300	0.0316	0.0306	0.0299	0.0309	0.0297	0.0311	0.0296	0.030	0.0007	2.20
	0.70	0.0659	0.0667	0.0664	0.0648	0.0656	0.0662	0.0658	0.0638	0.0638	0.0669	0.066	0.0011	1.70
Cu	0.05	0.0080	0.0075	0.0078	0.0075	0.0077	0.0081	0.0080	0.0075	0.0074	0.0076	0.008	0.0003	3.26
	0.30	0.0417	0.0419	0.0412	0.0421	0.0424	0.0420	0.0423	0.0403	0.0418	0.0415	0.042	0.0006	1.47
	0.70	0.0969	0.0965	0.0972	0.0957	0.0961	0.0958	0.0961	0.0963	0.0959	0.0972	0.096	0.0006	0.58
Fe	0.10	0.0090	0.0105	0.0078	0.0099	0.0091	0.0093	0.0096	0.0094	0.0093	0.0084	0.009	0.0007	8.11
	0.50	0.0462	0.0470	0.0464	0.0464	0.0467	0.0462	0.0467	0.0460	0.0468	0.0466	0.047	0.0003	0.67
	1.00	0.0867	0.0886	0.0910	0.0892	0.0897	0.0873	0.0892	0.0885	0.0888	0.0874	0.089	0.0013	1.43
Pb	0.20	0.0091	0.0095	0.0088	0.0087	0.0082	0.0094	0.0090	0.0087	0.0082	0.0090	0.009	0.0004	4.94
	0.70	0.0322	0.0321	0.0324	0.0318	0.0335	0.0326	0.0327	0.0315	0.0336	0.0321	0.032	0.0007	2.09
	1.50	0.0653	0.0645	0.0663	0.0664	0.0652	0.0671	0.0662	0.0666	0.0657	0.0648	0.066	0.0008	1.28
Mn	0.05	0.0092	0.0092	0.0097	0.0087	0.0085	0.0079	0.0096	0.0085	0.0084	0.0099	0.009	0.0007	7.33
	0.30	0.0616	0.0630	0.0632	0.0633	0.0634	0.0628	0.0640	0.0633	0.0640	0.0629	0.063	0.0007	1.08
	0.70	0.1396	0.1366	0.1386	0.1377	0.1386	0.1386	0.1396	0.1380	0.1374	0.1383	0.138	0.0009	0.67
Ni	0.10	0.0102	0.0092	0.0097	0.0104	0.0091	0.0105	0.0105	0.0096	0.0098	0.0102	0.010	0.0005	5.22
	0.50	0.0488	0.0489	0.0489	0.0495	0.0484	0.0490	0.0481	0.0492	0.0495	0.0492	0.049	0.0004	0.91
	1.00	0.0976	0.0979	0.0975	0.0992	0.0977	0.0973	0.0986	0.0962	0.0985	0.0982	0.098	0.0008	0.85
Zn	0.05	0.0340	0.0349	0.0340	0.0352	0.0337	0.0351	0.0344	0.0346	0.0349	0.0343	0.035	0.0005	1.49
	0.30	0.1669	0.1653	0.1628	0.1642	0.1657	0.1637	0.1659	0.1652	0.1654	0.1657	0.165	0.0012	0.72
	0.70	0.3456	0.3467	0.3445	0.3430	0.3422	0.3444	0.3437	0.3438	0.3435	0.3438	0.344	0.0013	0.37

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CALIBRATION DATA

1. Noise Level in term of standard deviation

Element	Cd	Cr	Cu	Fe	Pb	Mn	Ni	Zn
Absorbance	-0.0004	0.0002	0.0007	0.0002	-0.0016	-0.0001	-0.0004	-0.0001
	0.0002	-0.0005	0.0010	0.0007	0.0000	-0.0003	0.0007	-0.0014
	-0.0002	0.0001	0.0008	0.0000	-0.0001	-0.0003	-0.0012	-0.0006
	0.0000	-0.0007	0.0007	0.0000	-0.0005	-0.0004	-0.0004	-0.0012
	0.0001	0.0004	0.0013	0.0014	-0.0001	-0.0001	0.0003	-0.0008
	0.0000	-0.0004	0.0003	-0.0012	-0.0005	-0.0007	-0.0004	-0.0008
	0.0000	-0.0009	0.0009	-0.0002	-0.0010	-0.0008	0.0007	-0.0003
	-0.0004	-0.0003	0.0015	0.0010	-0.0005	-0.0003	-0.0002	-0.0004
	0.0004	0.0008	0.0014	-0.0004	-0.0014	-0.0005	-0.0006	-0.0003
	-0.0006	-0.0013	0.0012	-0.0006	-0.0006	-0.0006	-0.0007	-0.0007
	0.0005	-0.0003	0.0014	-0.0004	-0.0008	-0.0003	-0.0006	-0.0011
	-0.0007	-0.0014	0.0004	-0.0001	-0.0001	0.0000	0.0000	-0.0003
	0.0008	0.0004	0.0005	-0.0006	-0.0008	0.0000	-0.0005	-0.0009
	0.0011	0.0002	0.0005	0.0017	-0.0016	-0.0008	0.0004	-0.0005
	0.0002	0.0010	0.0014	-0.0002	-0.0010	-0.0010	0.0002	-0.0001
	0.0001	-0.0011	0.0011	-0.0003	-0.0011	-0.0003	-0.0008	-0.0012
	0.0000	-0.0015	0.0009	-0.0010	-0.0011	-0.0013	0.0000	-0.0004
	0.0015	-0.0012	0.0005	0.0002	-0.0017	-0.0001	0.0005	-0.0002
	0.0006	0.0014	0.0010	0.0002	-0.0003	0.0001	-0.0006	-0.0010
	0.0001	0.0003	0.0003	-0.0001	-0.0004	-0.0002	-0.0001	-0.0001
Average Absorbance	0.000	0.000	0.001	0.000	-0.001	0.000	0.000	-0.001
Standard Deviation	0.0005	0.0008	0.0004	0.0007	0.0005	0.0004	0.0005	0.0004

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

Element	Standard Value of RM (mg/l)	Reading (mg/l)	Error of Measurement (mg/l)	Error of Measurement (%)	Uncertainty (mg/l)
Fe	0.1003	0.106	0.006	5.68	± 0.008
	0.5015	0.522	0.021	4.09	± 0.017
	1.0030	0.993	-0.010	1.00	± 0.032

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

Element	Standard Value of RM (mg/l)	Reading (mg/l)	Error of Measurement (mg/l)	Error of Measurement (%)	Uncertainty (mg/l)
Pb	0.1988	0.197	-0.002	0.91	± 0.014
	0.6958	0.722	0.026	3.77	± 0.022
	1.4910	1.463	-0.028	1.88	± 0.041

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

Element	Standard Value of RM (mg/l)	Reading (mg/l)	Error of Measurement (mg/l)	Error of Measurement (%)	Uncertainty (mg/l)
Mn	0.04955	0.054	0.004	8.98	± 0.004
	0.29730	0.317	0.0197	6.63	± 0.006
	0.69370	0.682	-0.0117	1.69	± 0.012

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3. Trueness

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

Element	Standard Value of RM (mg/l)	Reading (mg/l)	Error of Measurement (mg/l)	Error of Measurement (%)	Uncertainty (mg/l)
Cd	0.02004	0.019	-0.001	5.19	± 0.004
	0.30060	0.291	-0.010	3.19	± 0.006
	0.70140	0.678	-0.023	3.34	± 0.012

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

Element	Standard Value of RM (mg/l)	Reading (mg/l)	Error of Measurement (mg/l)	Error of Measurement (%)	Uncertainty (mg/l)
Cr	0.1002	0.101	0.001	0.80	± 0.007
	0.3006	0.298	-0.003	0.86	± 0.012
	0.7014	0.635	-0.066	9.47	± 0.023

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

Element	Standard Value of RM (mg/l)	Reading (mg/l)	Error of Measurement (mg/l)	Error of Measurement (%)	Uncertainty (mg/l)
Cu	0.0502	0.046	-0.004	8.37	± 0.004
	0.3012	0.295	-0.006	2.06	± 0.010
	0.7028	0.694	-0.009	1.25	± 0.021

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Customer Information

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

Service Engineer's Responsibilities

- Only complete/printout pages that relate to the system being serviced.
- Complete empty fields with the relevant information.
- Complete the relevant checkboxes in the checklist using a "X" or tick mark "✓" in the checkbox.
- Complete Not Applicable check boxes to indicate services not delivered, as needed.
- Complete the PM service in the order of the tasks listed.
- Complete the Service Review section together with the customer.

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TISTR

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

Element	Standard Value of RM (mg/l)	Reading (mg/l)	Error of Measurement (mg/l)	Error of Measurement (%)	Uncertainty (mg/l)
Ni	0.099	0.102	0.003	3.03	± 0.007
	0.495	0.489	-0.006	1.21	± 0.010
	0.990	0.975	-0.015	1.52	± 0.020

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

Element	Standard Value of RM (mg/l)	Reading (mg/l)	Error of Measurement (mg/l)	Error of Measurement (%)	Uncertainty (mg/l)
Zn	0.050	0.050	0.000	0.00	± 0.012
	0.300	0.307	0.007	2.33	± 0.011
	0.700	0.660	-0.040	5.71	± 0.015

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

Calibrated by.....
(Mr. Danai Srithongkum)

Approved by.....
(Mrs. Thippaya Junvee Fortune)
Director of Analytical Chemistry Laboratory
Calibration date : 3 February 2022

INDUSTRIAL METROLOGY AND TESTING SERVICE CENTRE

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General Preparation

- ☑ Discuss any specific questions or issues with the customer prior to starting.
- ☑ Review the instrument logbook.
- ☑ Perform general external inspection of system for cleanliness.
- ☑ Check for proper installation of safety-related parts, assemblies, sensors etc.
- ☑ Check for required firmware/software updates and verify with customers if they would like it installed.
- ☐ For HF application systems, if standard sample introduction system was not installed, ask the customer to install it. NA
- ☑ Run Instrument Performance test and record results in Instrument Performance Test Results Table - Pre PM.

Inspect and clean the system

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

Agilent Water Recirculator

- ☐ **Section NOT Applicable**
- ☑ Drain cooling fluid and remove any particles from the chiller reservoir
- ☑ Remove, clean, and reinstall water inlet metal mesh filter if present.
- ☑ Re fill with Polyclear Plus cooling fluid.
- ☑ Clean the cooling system Air filter and the condenser.

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System Information

Instrument system name and ID	ICP-OES 5110 VDV
Instrument system site and location	UAE Consultant
List system component product numbers	**List the serial numbers of each component**
1. G8015A	1. MY19030001
2.	2.
3.	3.
4.	4.
5.	5.
6.	6.
7.	7.
8.	8.
9.	9.
10.	10.

ICP-OES Configuration table	**Circle the type or write in the type if other**
Nebulizer Type	SeaSpray | OneNeb | other
Spray Chamber	Cyclonic Single Pass | Cyclonic Double Pass | other
Torch	Radial | Dual View | other
Injector Diameter	2.4mm | 1.8mm | 1.4mm | 0.8mm | other
Injector Material	Quartz | Ceramic | other

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SPS 3 Auto Sampler

☑ **Section NOT Applicable**

- ☐ Power cycle the autosampler and verify successful initialization.
- ☐ Inspect X and Z axis belts for wear. Replace is necessary.
- ☐ Clean X and Z axis slide shafts.
- ☐ Using customer's racks and the Agilent software move the sample probe to the 4 outermost corners and rinse port, ensure that the probe is approximately centered in the vial.

SPS 4 Auto Sampler

☑ **Section NOT Applicable**

- ☐ Clean the spill tray, rack location mat, end frames and chassis with a damp soft cloth and diluted mild detergent.
- ☐ Clean the auto sampler cover panels, if cover kit is installed, with domestic window cleaner
- ☐ Check the X-axis and Z-axis drive belts for cracks, splits, damaged teeth, excessive fraying, color changes or degradation from fumes.
- ☐ Check the X-axis, Theta-axis and Z-axis FFC cables for cracks, incorrect positioning, damaged edges or damaged connectors.
- ☐ Pump Tubing Replacement. Replace peristaltic pump tubing. Replace all tubing that goes from the rinse station to the pump and from the pump to the waste/rinse bottles

AVS 4, 6, 7

☑ **Section NOT Applicable**

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

Instrument Adjustment

- ☑ Check position of Zn peak, adjust if required.
- ☑ Check Argon Ratio, adjust to specified value if required.
- ☑ Perform Detector Calibration.
- ☑ Perform Instrument Calibration.
- ☑ Run Instrument Performance Test and record results in Instrument Performance Test Results Table - Post PM.
- ☑ For systems using ICP Expert version 7.3 and above run the following Instrument tests and record the result in the Instrument Test Results Table
  - ☑ Subsystem Communications Test
  - ☑ Air Flow

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- ☑ Water Flow
- ☑ Gas Flows
- ☑ RF Generator
- ☑ Camera Test
- ☑ Optics Test
- ☑ Nebulizer Test

Instrument Performance Test Results Table

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

	Pre PM Sensitivity Check		Post PM Sensitivity Check	
	Radial	Axial *	Radial	Axial*
Zn 213.857 nm SRBR	4092.3	7856.1	4192.8	7920.7
Mn 257.610 nm SRBR	11415.2	30884.7	11993.6	34460.9
Al 396.152 nm SBR	7.8	15.7	8.7	13.5
K 766.491 nm SBR	5.3	39.9	5.7	44.6

* Axial result is not applicable for G8016AA, G8012AA Radial View instruments.

Instrument Test Results Table

Note: The Instrument Test results are for systems using ICP Expert version 7.3 and above only.

Instrument Test	Result
Subsystem Communications Test	PASS
Air Flow	PASS
Water Flow	PASS
Gas Flows	PASS
RF Generator	PASS
Camera Test	PASS
Optics Test	PASS
Nebulizer test	PASS

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ICP-OES Parts List Table

Part description	Part Number	Product /Model # where used	Quantity Consumed
Axial Pre-Optic Window	G8010-68014	G8010A, G8011A, G8014A/G8015A	1
Radial Pre-Optic Window	G8010-68015	All	1
Polyclear Plus Cooling Fluid	G3292-80012	Agilent Water Recirculator	–
Purge Gas Filter	G8010-60136	All	1
Air inlet filter	G8000-68002	All	1
High Capacity Air Filter	G8010-60189	Optional	–
Rotor seal for 6-7 port valve for AVS6/7	G8494-60002	G8494A/G8495	–
Rotor seal for 4 port valve for AVS4	G8493-60002	G8493A	–
Rinse solution to rinse station 2.5mm id x 1m	G8410-80123	SPS 4	–
Barb connector 2.5mm-1.5mm ID	G8410-80124	SPS 4	–
PVC waste tubing,8mm od x 5mm id, 2m	G8410-80122	SPS 4	–
Additional Parts may be required from engineers stock:			
X axis drive belt	5410047500	SPS 3	–
Z axis drive belt	5410047400	SPS 3	–
Peristaltic pump tubing, PVC SolvaFlex, 3 bridged,	3710049000	SPS 4	–

Restore system

For HF applications, ask the customer to reinstall their sample introduction system.

Leave system in an idle state: on and purging.

Guidance: If the PM service is performed prior to a qualification service, then use the qualification procedure as a guide for final instrument set up and checkout.

Service Review

- ☑ Affix the PM sticker to the system or instrument logbook based on the customer's request.
- ☑ Complete the Service Engineer Comments section below if there are additional comments.

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ICP-OES Status Results Table

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

Measurement	Standby Mode		Plasma On	
Mains Voltage	225.767	VAC	194.510	VAC
Mains Current	0.229	A	8.233	A
Instrument Temperature	23.4	°C	23.5	°C
RF Air Flow (sensor speed)	14.0	Hz	19.0	Hz
Plasma Exhaust Temperature	No measurement		65.0	°C
Water Flow Oscillator	No measurement		2.03	L/min
Water Flow Detector	0.00	L/min	1.37	L/min
Water Inlet Temperature	19.2	°C	17.8	°C
Polychromator Temperature	35.0	°C	35.0	°C
CCD Temperature	26.9	°C	-39.7	°C
Thermal Stabilizer	35.0	°C	35.0	°C
Argon Supply Pressure	634.25	kPa	629.52	kPa
Purge Gas Supply Pressure*1	691.74	kPa	655.67	kPa
Option Gas Supply Pressure*1	–	kPa	–	kPa
Nebulizer Flow	No measurement		0.90	L/min
Nebulizer Back Pressure	No measurement		202.05	kPa
Plasma Gas Flow	No measurement		15.00	L/min
Auxiliary Gas Flow	No measurement		1.20	L/min
RF Power	No measurement		1207.1	W
RF Supply Current	No measurement		8.233	A
RF Supply Voltage	No measurement		194.510 V	V

*1 If option installed

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Re PM

Report Summary

Instrument Model	Agilent 5100/5110 VDV ICP-OES
Instrument ID	G8011A/G8015A
Instrument Serial Number	MY18030001
Software Version	7.3.1.9507
Firmware Version	3442
Tested By	Nukoon L.
Test Completed On	12/9/2021 9:14:59 AM

Result Summary

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

เอกสารไม่ควบคุม

Agilent Technologies

Agilent 5110 and 5100 ICP-OES
Preventive Maintenance Checklist

- ☑ Review the service and any test results with the customer.
- ☑ If the Instrument firmware was updated, record the details of the change in the Service Engineer's Comments box below or if necessary, in the customer's IQ records.

Service Engineer Comments (optional)

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

Other Important Customer Web Links

How to get information on your product:

- ❑ Literature Library - http://www.agilent.com/en-us/products/icp-oes/icp-oes-systems/5110-icp-oes#literature
- ❑ Need to know more? - http://www.agilent.com/crosslab/university/
- ❑ Need technical support, FAQs? - http://www.agilent.com/en-us/support/landing/icp-oes
- ❑ Need supplies? - www.agilent.com/chem/supplies

Service Completion

Service request number 6004387217 Date service completed 09/12/21

Agilent signature Nukoon L. Customer signature Aphorn Onkong

Document part number: G8014-90075

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Sensitivity Test **Pass**

Radial

Element Wavelength	Specification	Method	Ratio	Standard	Blank
As (188.980 nm)	≥ 46.0	SRBR	167.2	1131.3	42.4
Se (196.026 nm)	≥ 41.0	SRBR	119.1	1177.1	84.2
Zn (213.857 nm)	≥ 1421.0	SRBR	4082.3	49908.2	148.6
Pb (220.353 nm)	≥ 46.0	SRBR	191.1	2682.8	172.6
Mn (257.610 nm)	≥ 3518.0	SRBR	11415.2	265002.2	536.8
Al (396.152 nm)	≥ 3.4	SBR	7.8	49838.0	5676.5
Ba (493.408 nm)	≥ 34.0	SBR	116.1	1999041.4	17066.5
K (766.491 nm)	≥ 1.8	SBR	5.3	101078.4	16104.6

Axial

Element Wavelength	Specification	Method	Ratio	Standard	Blank
As (188.980 nm)	≥ 208.0	SRBR	252.9	3214.2	147.0
Se (196.026 nm)	≥ 159.0	SRBR	216.2	3839.7	272.2
Zn (206.200 nm)	≥ 234.0	SRBR	1203.3	14046.1	133.7
Zn (213.857 nm)	≥ 1743.0	SRBR	7856.1	171323.1	472.9
Cd (214.439 nm)	≥ 4227.0	SRBR	7054.9	129539.3	335.4
Pb (220.353 nm)	≥ 320.0	SRBR	531.7	13218.2	566.2
Mn (257.610 nm)	≥ 10625.0	SRBR	30884.7	1314844.0	1807.4
Cr (267.716 nm)	≥ 1048.0	SRBR	4442.1	174420.3	1515.1
Cu (324.754 nm)	≥ 19.0	SBR	50.7	374603.6	7249.0
Al (396.152 nm)	≥ 6.0	SBR	15.7	279915.3	16790.4
Ba (493.408 nm)	≥ 60.0	SBR	209.7	10899956.6	51728.3
K (766.491 nm)	≥ 24.0	SBR	38.9	1983197.5	49746.6

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Resolution Test **Pass**

Element Wavelength	Specification	Width
N (174.213 nm)	≤ 9.40	7.27
As (188.980 nm)	≤ 8.20	6.23
C (193.027 nm)	≤ 11.50	8.26
Mo (202.032 nm)	≤ 8.20	6.42
Cr (206.158 nm)	≤ 13.40	9.27
Zn (213.857 nm)	≤ 8.70	6.77
Pb (220.353 nm)	≤ 9.50	7.12
Co (228.615 nm)	≤ 17.20	11.88
Ba (230.424 nm)	≤ 9.40	7.36
Mn (257.610 nm)	≤ 13.30	9.52
Mn (260.568 nm)	≤ 20.30	14.30
Cr (267.716 nm)	≤ 11.00	7.99
Cu (324.754 nm)	≤ 25.00	19.06
Cu (327.395 nm)	≤ 14.20	11.32
Sr (338.071 nm)	≤ 33.50	24.39
Ba (455.403 nm)	≤ 44.00	33.86
Sr (460.733 nm)	≤ 36.00	17.38
Ba (493.408 nm)	≤ 36.00	25.53
Ba (614.171 nm)	≤ 42.00	24.99
Ar (675.283 nm)	≤ 74.00	59.49
K (766.491 nm)	≤ 80.00	65.27

เอกสารไม่ควบคุม

Post PM

Report Summary

Instrument Model	Agilent 5100/5110 VDV ICP-OES
Instrument ID	G8011A/G8015A
Instrument Serial Number	MY18030001
Software Version	7.3.1.9507
Firmware Version	3442
Tested By	Nukoon L.
Test Completed On	12/9/2021 12:55:49 PM

Result Summary

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

Optics Test

Pass

	Radial	Axial
Intensity	5296135	5755042
Wavelength	737.212	737.212

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Precision Test

Pass

Radial

Element Wavelength	Specification	Measured Value % RSD
As (188.980 nm)	≤ 2.60	0.81
Se (196.026 nm)	≤ 2.60	1.21
Zn (213.857 nm)	≤ 1.50	0.39
Pb (220.353 nm)	≤ 2.60	0.41
Mn (257.610 nm)	≤ 1.50	0.45
Al (396.152 nm)	≤ 1.50	0.41
Ba (493.408 nm)	≤ 1.50	0.51
K (766.491 nm)	≤ 1.50	0.36

Axial

Element Wavelength	Specification	Measured Value % RSD
As (188.980 nm)	≤ 1.50	0.51
Se (196.026 nm)	≤ 1.50	0.73
Zn (206.200 nm)	≤ 1.50	0.30
Zn (213.857 nm)	≤ 1.50	0.37
Cd (214.439 nm)	≤ 1.50	0.36
Pb (220.353 nm)	≤ 1.50	0.28
Mn (257.610 nm)	≤ 1.50	0.63
Cr (267.716 nm)	≤ 1.50	0.30
Cu (324.754 nm)	≤ 1.50	0.54
Al (396.152 nm)	≤ 1.50	0.45
Ba (493.408 nm)	≤ 1.50	0.64
K (766.491 nm)	≤ 1.50	0.56

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Sensitivity Test **Pass**

Radial

Element Wavelength	Specification	Method	Ratio	Standard	Blank
As (188 980 nm)	> 46.0	SRBR	154.8	1242 3	58.5
Se (196.026 nm)	≥ 41.0	SRBR	117.4	1259.6	97.9
Zn (213 857 nm)	≥ 1421.0	SRBR	4192.8	52402.6	155 3
Pb (220.353 nm)	≥ 46.0	SRBR	196.4	2814.2	179.9
Mn (257.610 nm)	≥ 3518 0	SRBR	11993.6	281210.1	547.6
Al (396.152 nm)	≥ 3.4	SBR	8.7	55103.6	5662.9
Ba (493.408 nm)	≥ 34.0	SBR	125.4	2152916.9	17032.2
K (766 491 nm)	≥ 1.8	SBR	5.7	107906.7	16079.8

Axial

Element Wavelength	Specification	Method	Ratio	Standard	Blank
As (188.980 nm)	≥ 208.0	SRBR	297.5	4054 8	170.4
Se (196.026 nm)	≥ 159.0	SRBR	260.2	4794.9	298.5
Zn (206.200 nm)	≥ 234.0	SRBR	1305.9	16162.3	150 3
Zn (213.857 nm)	≥ 1743.0	SRBR	8920.7	200915.6	504.7
Cd (214.439 nm)	≥ 4227 0	SRBR	7958.3	149327.5	350.4
Pb (220.353 nm)	≥ 320.0	SRBR	606.7	15244.5	584.0
Mn (257 610 nm)	≥ 10625.0	SRBR	34460.9	1493092.8	1872.5
Cr (267 716 nm)	≥ 1048.0	SRBR	5018.6	198000.6	1532.6
Cu (324 754 nm)	≥ 19.0	SBR	57.5	423683.7	7248.6
Al (396.152 nm)	≥ 8.0	SBR	18 5	320004.9	16441 4
Ba (493 408 nm)	≥ 60.0	SBR	233.3	11882915.4	50714.5
K (766.491 nm)	≥ 24.0	SBR	44.6	2218974.4	48657.9

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Resolution Test **Pass**

Element Wavelength	Specification	Width
N (174.213 nm)	≤ 9.40	7.22
As (188.980 nm)	≤ 8.20	6.15
C (193.027 nm)	≤ 11.50	8.22
Mo (202.032 nm)	≤ 8.20	6.33
Cr (206 158 nm)	≤ 13.40	9.21
Zn (213.857 nm)	≤ 8 70	6.87
Pb (220 353 nm)	≤ 9 50	7.02
Co (228.615 nm)	≤ 17.20	11.81
Ba (230.424 nm)	≤ 9.40	7.46
Mn (257 610 nm)	≤ 13 30	9.49
Mn (260.568 nm)	≤ 20 30	14.19
Cr (267.716 nm)	≤ 11.00	7 90
Cu (324.754 nm)	≤ 25.00	18.92
Cu (327.395 nm)	≤ 14.20	11.32
Sr (338 071 nm)	≤ 33.50	24.29
Ba (455.403 nm)	≤ 44 00	33.68
Sr (460.733 nm)	≤ 36 00	17.64
Ba (493.408 nm)	≤ 36.00	25.56
Ba (614 171 nm)	≤ 42 00	24.75
Ar (675.283 nm)	≤ 74.00	59.18
K (766.491 nm)	≤ 80.00	65 19

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Report Summary

Instrument Model	Agilent 5100/5110 VDV ICP-OES
Instrument ID	G8011A/G8015A
Instrument Serial Number	MY18030001
Software Version	7.3 1.9507
Firmware Version	3442
Tested By	Nukoon L.
Test Completed On	12/9/2021 1:34.10 PM

Result Summary

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

Subsystem Communications Test **Pass**

Air Flow Test **Pass**

30% Air Flow (relative speed)	75% Air Flow (relative speed)
15.00	19.00

Water Flow Test **Pass**

RF Water Flow(L/min)	Camera Water Flow (L/min)	Water Inlet Temperature (°C)
1.98	1.36	17.16

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Precision Test **Pass**

Radial

Element Wavelength	Specification	Measured Value % RSD
As (188.980 nm)	≤ 2.60	1.38
Se (196.026 nm)	≤ 2.60	0.91
Zn (213.857 nm)	≤ 1.50	0.38
Pb (220.353 nm)	≤ 2.60	0.44
Mn (257.610 nm)	≤ 1.50	0.43
Al (396.152 nm)	≤ 1.50	0.38
Ba (493.408 nm)	≤ 1.50	0.66
K (766.491 nm)	≤ 1.50	0.36

Axial

Element Wavelength	Specification	Measured Value % RSD
As (188.980 nm)	≤ 1.50	0.61
Se (196.026 nm)	≤ 1.50	0.52
Zn (206.200 nm)	≤ 1.50	0.36
Zn (213.857 nm)	≤ 1.50	0.33
Cd (214.439 nm)	≤ 1.50	0.41
Pb (220.353 nm)	≤ 1.50	0.36
Mn (257.610 nm)	≤ 1.50	0.74
Cr (267.716 nm)	≤ 1.50	0.25
Cu (324.754 nm)	≤ 1.50	0.71
Al (396.152 nm)	≤ 1.50	0.44
Ba (493.408 nm)	≤ 1.50	0.73
K (766.491 nm)	≤ 1.50	0.97

เอกสารไม่ควบคุม

National Food Institute, Ministry of Industry, Thailand
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NSC-TISI-TIS 17025 CALIBRATION 0061

Calibration Certificate

Certificate No.: 2201793-001-01
Client name: UNITED ANALYST AND ENGINEERING CONSULTANT CO.,LTD.
Address: 3 Soi Udomsuk 41, Sukhumvit Road, Bangchack, Prakhanong, Bangkok 10260

Equipment: pH Meter

Manufacturer: METTLER TOLEDO

Model: SevenEasy pH

Serial No.: 1231155210

ID No.: UAE.WAT.010/2553

Order No.: 2201793

Operation No.: 2201793-001

Date of Receipt: 21 February 2022

Date of Calibration: 1 March 2022

Calibrated by Mr.Pheraphat Tuanjit
Scientist

Approved by (Mr.Nuttapol Niyomchart) (for)
Specialist, Division of Calibration Laboratory
Responsible for the Technical Management Team

Date of Issue: 1 March 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 standards laboratory. This certificate may not be reproduced other than in full except with the prior written approval of the National Food Institute.

เอกสารไม่ควบคุม

Gas Flows Test — **Pass**

Nebulizer Target Flow	Actual Flow	Back Pressure	Auxiliary Target Flow	Actual Flow	Back Pressure
0.70	0.70	203.80	2.00	1.99	108.66

Makeup Target Flow	Actual Flow	Back Pressure	Plasma Target Flow	Actual Flow	Back Pressure
2.00	2.00	113.89	18.00	17.93	24.24

RF Generator Test — **Pass**

RF Power Supply Test	Passed
RF Power Supply (V)	141.475
RF Oscillator Test	Passed
RF Oscillator Frequency (MHz)	25.874
Work Coil Current (A)	45.931
RF Power Supply Current (A)	2.000

Camera Test — **Pass**

	Integration Time (ms)	Standard Deviation	Status
Electronic Offset Test	1000	5.261	Passed
Dark Current Test	6000	0.734	Passed
Array Test	5	0.024	Passed
Linearity Test		0.118	Passed

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Tel +66 (0) 2422 8688 Fax +66 (0) 2422 8558 Website www.nfi.orth E-mail cal@nfi.orth
NSC-TISI-TIS 17025 CALIBRATION 0061

Calibration Report

Certificate No.: 2201793-001-01

Equipment: pH Meter — **Resolution:** 0.01 pH ; 1 mV

Manufacturer: METTLER TOLEDO — **Model:** SevenEasy pH

Serial No.: 1231155210 — **Type:** Bench top

ID No.: UAE.WAT.010/2553

Date of Calibration: 1 March 2022

Calibration Results:

1. Calibration of pH Meter (Manual Temperature Compensation at 25 °C)

Nominal pH	DC Voltage Standard (mV)	Average Indicator Reading		Uncertainty (±mV)	Coverage Factor (k)
		mV	pH		
0.00	414.117	414	0.00	0.58	2.00
2.00	295.811	296	2.00	0.58	2.00
4.00	177.462	178	4.00	0.58	2.00
6.00	59.159	59	6.00	0.58	2.00
7.00	-0.001	0	7.00	0.58	2.00
8.00	-59.159	-59	8.00	0.58	2.00
10.00	-177.463	-177	10.00	0.58	2.00
12.00	-295.812	-296	12.00	0.58	2.00
14.00	-414.119	-414	14.00	0.58	2.00

2. Calibration of pH Meter with Electrode (Manual Temperature Compensation at 25 °C)

Equipment: pH Electrode — **Type:** Combined Electrode

Manufacturer: METTLER TOLEDO — **Model:** InLabSolids

Serial No.: 1156882 — **ID.No.** N/A

Performance of Electrode system (Three-Point Calibration at pH4, pH7 and pH10)

Certified Value @25 °C (pH)	Average Indicator Reading		Relative Slope (%)	Uncertainty (± pH)	Coverage Factor (k)
	pH	mV			
4.008	4.00	180	96.25	0.0076	2.00
6.866	6.88	16	-	0.0079	2.00
10.012	10.01	-162	96.13	0.0094	2.00
6.985	7.00	9	-	0.0097	2.00

P. Jaenghanlit
1 March 2022

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NSC-TISI-TIS 17025 CALIBRATION 0061

Calibration Report

Certificate No.: 2201793-001-01

Equipment: pH Meter — **Resolution:** 0.01 pH ; 1 mV

Manufacturer: METTLER TOLEDO — **Model:** SevenEasy pH

Serial No.: 1231155210 — **Type:** Bench top

ID No.: UAE.WAT.010/2553

Date of Calibration: 1 March 2022

Location: Chemical Calibration Laboratory, NATIONAL FOOD INSTITUTE

Environment Condition: **Ambient Temperature:** (23.5 ± 1.5) °C **Relative Humidity:** (53 ± 5) %

Condition of Equipment: Good Condition

Condition of this Results of Calibration

1.Calibration Method — In house method : W-CC-002 based on direct measurement by using standard voltage calibrator and certified reference material (CRM)

2. Reference Standards / Certified Reference Material

Instruments	Serial / ID No.	Manufacturer	Certificate No.	Due Date
2.1 DC Voltage Calibrator	2709007	Fluke	SCL-21F-0687	24 June 2022
2.2 Digital Thermometer	2709007	Fluke	CC-640599-01	30 October 2022
2.3 Thermo-Hygro Meter	NFI.BTH004/18	PONPE	QR22-0195	27 January 2023

Certified Reference Material	Lot. No.	Manufacturer	Ref N	Expire Date
2.4 pH buffer 4.008 (Primary pH buffer Solution)	741339	CPAchem	PH216.L5	19 April 2023
2.5 pH buffer 6.865 (Primary pH buffer Solution)	741340	CPAchem	PH217.L5	19 April 2023
2.6 pH buffer 10.01 (Primary pH buffer Solution)	741342	CPAchem	PH220.L5	19 April 2022
2.7 pH buffer 7.00 (Standard pH buffer Solution)	735836	CPAchem	PH107.L5	16 March 2022

3. This certification is traceable to The International System of Unit (SI Unit)

3.1 Instruments No.2.1	through	NSC-TISI-TIS 17025 Laboratory Accredition of Calibration No.0075
3.2 Instruments No.2.2	through	NSC-TISI-TIS 17025 Laboratory Accredition of Calibration No.0061
3.3 Instruments No.2.3	through	NSC-TISI-TIS 17025 Laboratory Accredition of Calibration No.0292
3.4 Certified Reference Material No. 2.4 to 2.6	traceable to	Primary measurement method- Hamed cell using calibrated thermometer, barometer, and nanovoltmeter.The Standard Solution preparation and certified by CPAchem Ltd is accredited to ISO 17034 and ISO/IEC 17025
3.5 Certified Reference Material No. 2.7	traceable to	BIM RefN HI-7 LotN 30.04.2020; BIM RefN HI-9 LotN 28.05.2020; BIM RefN HI-8 LotN 30.04.2020; BIM RefN HI-10 LotN 28.05.2020. The Standard Solution preparation and certified by CPAchem Ltd is accredited to ISO 17034 and ISO/IEC 17025

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

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

P. Jaenghanlit
1 March 2022

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NSC-TISI-TIS 17025 CALIBRATION 0061
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Calibration Report

Certificate No.: 2201793-001-01

Equipment: Digital Thermometer with RTD (pH Meter)

Resolution: 0.1 °C Model: SevenEasy pH

Serial No.: 1231155210 ID No.: UAE.WAT.010/2553

Manufacturer: METTLER TOLEDO

Date of Calibration: 1 March 2022

Calibration point: 15.0, 25.0 and 35.0 °C

Calibration result:

- The probe was immersed in liquid bath or dry bath to a minimum depth of 100 mm.
- Description of probe, model : N/A S/N : N/A

Dimension of probe : Diameter 4 mm., Length 100 mm.,

Sheath material : Stainless Steel

UUC* Reading (°C)	Standard Temperature (°C)	Correction Value (°C)	Uncertainty ± (°C)
15.1	15.006	-0.1	0.099
25.1	25.004	-0.1	0.099
35.1	35.003	-0.1	0.099

P. Jaenghanlit
1 March 2022

Note

- UUC* : Unit Under Calibration

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

--------- End ---------

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NSC-TISI-TIS 17025 CALIBRATION 0061
National Food Institute, Ministry of Industry, Thailand
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Tel +66 (0) 2422 8688 Fax +66 (0) 2422 8558 Website www.nfi.orth E-mail cal@nfi.orth

Calibration Report

Certificate No.: 2201793-001-01

Equipment: Digital Thermometer with RTD (pH Meter)

Resolution: 0.1 °C Model: SevenEasy pH

Serial No.: 1231155210 ID No.: UAE.WAT.010/2553

Manufacturer: METTLER TOLEDO

Date of Calibration: 1 March 2022

Location: Chemical Calibration Laboratory, NATIONAL FOOD INSTITUTE

Environment Condition: Ambient Temperature 24 °C ± 1 °C

Relative Humidity 53 % ± 2 %

Condition of this results of Calibration:

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

Instrument	Model	Serial No.	Certificate No.	Due Date	Through
HANDHELD THERMOMETER	1523	2118154	PSL-T 0851/64	03-Jun-22	TISTR
Platinum Resistance Thermometer (PRT)	5627A	877332			

Support Equipment : - Low Temperature Bath (ISOCAL-6), Model: Europa-6 Plus Basic, S/N: 341592/2

3. This certificate is traceable to International System of Units (SI Units).
4. This certificate was certified only for the instrument we calibrated.
5. This result of calibration was found accurate as shown on date and place of calibration only.
6. Condition of Calibrated item : Good
7. Result of Calibration : [X] Without adjustment [ ] After adjustment

P. Jaenghanlit
1 March 2022

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NSC-TISI-TIS 17025 CALIBRATION 0061

Calibration Report

Certificate No.: 2202093-001-01

Equipment: pH Meter — **Resolution:** 0.01 pH ; 1 mV

Manufacturer: METTLER TOLEDO — **Model:** SevenEasy pH

Serial No.: 1230525212 — **Type:** Bench top

ID No.: UAE.WAS.003/2553

Date of Calibration: 16 March 2022

Location: Chemical Calibration Laboratory, National Food Institute.

Environment Condition: **Ambient Temperature:** (23.0 ± 1.5) °C **Relative Humidity:** (49.5 ± 5) %

Condition of Equipment: Good Condition

Condition of this Results of Calibration

1.Calibration Method: In house method : W-CC-002 based on direct measurement by using standard voltage calibrator and certified reference material (CRM)

2. Reference Standards / Certified Reference Material

Instruments	Serial / ID No.	Manufacturer	Certificate No.	Due Date
2.1 DC Voltage Calibrator	2709007	Fluke	SCL-21F-0687	24 June 2022
2.2 Digital Thermometer	2709007	Fluke	CC-640599-01	30 October 2022
2.3 Thermo-Hygro Meter	ana.khl.BTH 005/58	PONPE	QR21-2787	15 November 2022

Certified Reference Material	Lot. No.	Manufacturer	Ref N	Expire Date
2.4 pH buffer 4.008 (Primary pH buffer Solution)	780012	CPAchem	PH216.L5	21 November 2023
2.5 pH buffer 6.865 (Primary pH buffer Solution)	780013	CPAchem	PH217.L5	21 November 2023
2.6 pH buffer 10.01 (Primary pH buffer Solution)	780015	CPAchem	PH220.L5	21 November 2022
2.7 pH buffer 7.00 (Standard pH buffer Solution)	776840	CPAchem	PH107.L5	8 November 2022

3. This certification is traceable to The International System of Unit (SI Unit)

3.1 Instruments No.2.1	through	NSC-TISI-TIS 17025 Laboratory Accredition of Calibration No.0075
3.2 Instruments No.2.2	through	NSC-TISI-TIS 17025 Laboratory Accredition of Calibration No.0061
3.3 Instruments No.2.3	through	NSC-TISI-TIS 17025 Laboratory Accredition of Calibration No.0292
3.4 Certified Reference Material No. 2.4 to 2.6	traceable to	Primary measurement method- Harned cell using calibrated thermometer, barometer, and nanovoltmeter.The Standard Solution preparation and certified by CPAchem Ltd is accredited to ISO 17034 and ISO/IEC 17025
3.5 Certified Reference Material No. 2.7	traceable to	BIM RefN HI-7 LotN 30.04.2020; BIM RefN HI-9 LotN 28.05.2020; BIM RefN HI-8 LotN 30.04.2020; BIM RefN HI-10 LotN 28.05.2020. The Standard Solution preparation and certified by CPAchem Ltd is accredited to ISO 17034 and ISO/IEC 17025

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

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

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NSC-TISI-TIS 17025 CALIBRATION 0061

Calibration Certificate

Certificate No.: 2202093-001-01

Client name: UNITED ANALYST AND ENGINEERING CONSULTANT CO.,LTD.

Address: 3 Soi Udomsuk 41, Sukhumvit Road, Bangchack, Prakhanong, Bangkok 10260

Equipment: pH Meter

Manufacturer: METTLER TOLEDO

Model: SevenEasy pH

Serial No.: 1230525212

ID No.: UAE.WAS.003/2553

Order No.: 2202093

Operation No.: 2202093-001

Date of Receipt: 11 March 2022

Date of Calibration: 16 March 2022

Calibrated by Mr.Manas Somsak, Specialist

Approved by (Mr.Pheraphat Tuanjit), Manager, Division of Calibration Laboratory, Responsible for the Technical Management Team

Date of Issue: 21 March 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 standards laboratory. This certificate may not be reproduced other than in full except with the prior written approval of the National Food Institute.

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NSC-TISI-TIS 17025 CALIBRATION 0061

Calibration Report

Certificate No.: 2202093-001-01

Equipment: Digital Thermometer with RTD (pH Meter)

Resolution: 0.1 °C Model: SevenEasy pH

Serial No.: 1230525212 ID No.: UAE.WAS.003/2553

Manufacturer: METTLER TOLEDO

Date of Calibration: 16 March 2022

Location: Chemical Calibration Laboratory, National Food Institute.

Environment Condition: Ambient Temperature (23.0 ± 1.0) °C

Relative Humidity (50 ± 4) %

Condition of this results of Calibration:

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

Instrument	Model	Serial No.	Certificate No.	Due Date	Through
HANDHELD THERMOMETER	1523	2118154	PSL-T 0851/64	24-Jun-22	TISTR
Platinum Resistance Thermometer (PRT)	5627A	877332			

Support Equipment : - Low Temperature Bath (ISOCAL-6), Model: Europa-6 Plus Basic, S/N: 341592/2

3. This certificate is traceable to International System of Units (SI Units).
4. This certificate was certified only for the instrument we calibrated.
5. This result of calibration was found accurate as shown on date and place of calibration only.
6. Condition of Calibrated item : Good
7. Result of Calibration : [X] Without adjustment [ ] After adjustment

เอกสารไม่ควบคุม

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NSC-TISI-TIS 17025 CALIBRATION 0061

Calibration Report

Certificate No.: 2202093-001-01

Equipment: pH Meter

Resolution: 0.01 pH ; 1 mV

Manufacturer: METTLER TOLEDO Model: SevenEasy pH

Serial No.: 1230525212 Type: Bench top

ID No.: UAE.WAS.003/2553

Date of Calibration: 16 March 2022

Calibration Results:

1. Calibration of pH Meter (Manual Temperature Compensation at 25 °C)

Nominal pH	DC Voltage Standard (mV)	Average Indicator Reading		Uncertainty (±mV)	Coverage Factor (k)
		mV	pH		
0	414.117	414	0.00	0.58	2.00
2	295.811	296	2.00	0.58	2.00
4	177.462	178	4.00	0.58	2.00
6	59.159	59	6.00	0.58	2.00
7	-0.001	0	7.00	0.58	2.00
8	-59.159	-59	8.00	0.58	2.00
10	-177.463	-177	10.00	0.58	2.00
12	-295.812	-296	12.00	0.58	2.00
14	-414.119	-414	14.00	0.58	2.00

2. Calibration of pH Meter with Electrode (Manual Temperature Compensation at 25 °C)

Equipment: pH Electrode Type: Combined Electrode

Manufacturer: METTLER TOLEDO Model: InLab Solids

Serial No.: 9453943 ID.No. N/A

Performance of Electrode system (Three-Point Calibration at pH4, pH7 and pH10)

Certified Value @25 °C (pH)	Average Indicator Reading		Relative Slope (%)	Uncertainty (± pH)	Coverage Factor (k)
	pH	mV			
4.008	4.01	172	98.1	0.0071	2.00
6.866	6.87	6	-	0.0074	2.00
10.015	10.01	-175	97.4	0.0090	2.00
6.983	6.98	-3	-	0.0092	2.00

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Calibration Certificate ID
TH2058-043-050622-ACC-TH

METTLER TOLEDO

Mettler-Toledo (Thailand) Ltd.
846/4 - 846/5 Lasalle Rd., Bangna Tai Sub-District
Bangna District, Bangkok 10260
+66 2723 0382
MT-TH.ServiceSupport@mt.com

NSC-TISI-TIS 17025
CALIBRATION 0062

Accuracy Calibration Certificate

Customer

Company:	United Analyst and Engineering Consultant Co., Ltd.		
Address:	3 Soi Udom Suk 41, Sukhumvit Rd., Bang Chak		
City:	Phra Khanong	Contact:	Suwit Chotnok
Zip / Postal:	10260		
State / Province:	Bangkok		
Order Number:	*0370192766*		

Weighing Device

Manufacturer:	Mettler Toledo	Instrument Type:	Weighing Instrument
Model:	XSR205DU	Asset Number:	UAE.WAO.010/2565
Serial No.:	C210685394	Terminal Model:	SRAT
Building:	N/A	Terminal Serial No.:	C210685394
Floor:	2	Terminal Asset No.:	N/A
Room:	Balance Room		

Range	Max. Capacity	Readability (d)
1	81 g	0.00001 g
2	220 g	0.0001 g

Procedure

Calibration Guideline:	EURAMET cg-18 v. 4.0 (11/2015)
METTLER TOLEDO Work Instruction:	CP/W002/20

This calibration certificate contains measurements for As Found calibration. No As Left calibration was performed because the device was not modified after As Found calibration. Therefore, results for As Left correspond to As Found.

The sensitivity/span of the weighing instrument was adjusted before calibration with a built-in weight.

In accordance with EURAMET cg-18 (11/2015), the test loads were selected to reflect the specific use of the weighing device or to accommodate specific calibration conditions.

	Temperature		Humidity	
As Found	Start: 22.4 °C	End: 22.4 °C	Start: 47.5 %	End: 46.2 %

As Found Calibration Date:	06-May-2022	Calibrator:	Sirawit Chamchan
As Left Calibration Date:	N/A		
Issue Date:	09-May-2022	Approved Signatory:	Technical Manager / Head of Calibration Center

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NSC-TISI-TIS 17025
CALIBRATION 0061

Calibration Report

Certificate No.:	2202093-001-01			
Equipment:	Digital Thermometer with RTD (pH Meter)			
	Resolution:	0.1 °C	Model:	SevenEasy pH
	Serial No.:	1230525212	ID No.:	UAE.WAS.003/2553
	Manufacturer:	METTLER TOLEDO		
Date of Calibration:	16 March 2022			

Calibration point: 15.0, 25.0 and 35.0 °C

Calibration result:

- The probe was immersed in liquid bath or dry bath to a minimum depth of 120 mm.
- Description of probe, model : N/A S/N : N/A

Dimension of probe : Diameter 3.5 mm., Length 135 mm.,

Sheath material : Stainless Steel

UUC* Reading (°C)	Standard Temperature (°C)	Correction Value (°C)	Uncertainty ± (°C)
15.2	15.001	-0.2	0.099
25.2	25.002	-0.2	0.099
35.2	35.002	-0.2	0.099

Note - UUC* : Unit Under Calibration

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

--------- End ---------

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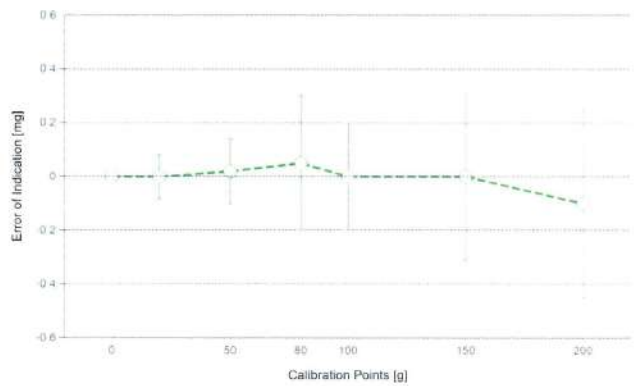
Error of Indication

As Found

	Reference Value	Indication	Error of Indication	Expanded Uncertainty	k
1	0.00000 g	0.00000 g	0.00000 g	0.020 mg	2
2	0.05000 g	0.05001 g	0.00001 g	0.023 mg	2
3	0.10001 g	0.10001 g	0.00000 g	0.025 mg	2
4	1.00000 g	1.00001 g	0.00001 g	0.034 mg	2
5	5.00001 g	5.00001 g	0.00000 g	0.049 mg	2
6	20.00002 g	20.00002 g	0.00000 g	0.082 mg	2
7 *	50.00000 g	50.00002 g	0.00002 g	0.12 mg	2
8	80.00004 g	80.00009 g	0.00005 g	0.25 mg	2
9	100.0000 g	100.0000 g	0.0000 g	0.20 mg	2
10 *	150.0000 g	150.0000 g	0.0000 g	0.31 mg	2
11	200.0000 g	199.9999 g	-0.0001 g	0.35 mg	2

*The calculated uncertainty was replaced by the CMC (Calibration and Measurement Capabilities) value because the calculated uncertainty was smaller than the CMC value.



As Found

As Left

For improved legibility of the graphics only increasing measurement points are shown and measurement points close to zero are not displayed.

The uncertainty stated is the expanded uncertainty at calibration obtained by multiplying the standard combined uncertainty by the coverage factor k – which can be larger than 2 according to EURAMET cg-18. The value of the measurand lies within the assigned range of values with a probability of approximately 95%.

The user is responsible for maintaining environmental conditions and the settings of the weighing instrument when it was calibrated.

Test Equipment

All weights used for metrological testing are traceable to national or international standards. The weights were calibrated and certified by an accredited calibration laboratory.

Weight Set 1: OIML E2

Weight Set No.:	WS54	Date of Issue:	17-Nov-2020
Certificate Number:	170240	Calibration Due Date:	15-May-2022

Thermo Hygrometer

Equipment No.:	IN161	Date of Issue:	14-Jun-2021
Certificate Number:	21H1220	Calibration Due Date:	01-Jun-2022

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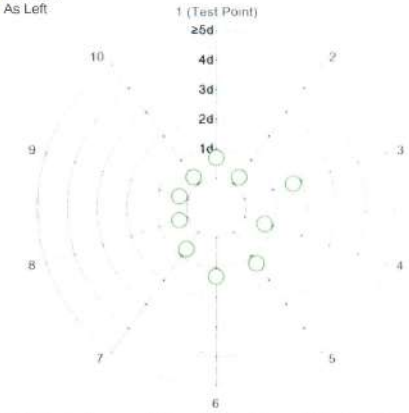
Measurement Results

Repeatability

Test Load: 70 g

	As Found	As Left
1	70.00005 g	N/A
2	70.00006 g	N/A
3	70.00004 g	N/A
4	70.00005 g	N/A
5	70.00007 g	N/A
6	70.00007 g	N/A
7	70.00005 g	N/A
8	70.00006 g	N/A
9	70.00006 g	N/A
10	70.00006 g	N/A
Standard Deviation	0.000009 g	N/A

As Found
As Left



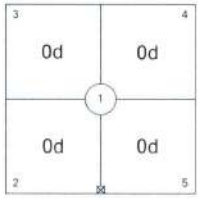
The "d" in the graph represents the readability of the range/interval in which the test was performed.

The results of this graph are based upon the absolute values of the differences from the mean value.

Eccentricity

Test Load: 100 g

Position	As Found	As Left
1	100.0000 g	N/A
2	100.0000 g	N/A
3	100.0000 g	N/A
4	100.0000 g	N/A
5	100.0000 g	N/A
Maximum Deviation	0.0000 g	N/A



As Found

The "d" in the graph represents the readability of the range/interval in which the test was performed.

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Measurement Uncertainty of the Weighing Instrument in Use

Stated is the expanded uncertainty with k=2 in use. The formula shall be used for the estimation of the uncertainty under consideration of the errors of indication. The value R represents the net load indication in the unit of measure of the device.

Temperature coefficient for the evaluation of the measurement uncertainty in use: $1.5 \cdot 10^{-6}$ / K

Temperature range on site for the evaluation of the measurement uncertainty in use: 3 K

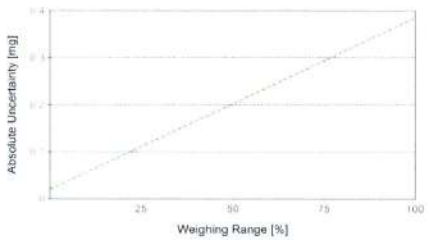
Linearization of Uncertainty Equation

	Range		As Found	As Left
	d	Max		
1	0.00001 g	81 g	U_1 = 0.021 mg + 0.00450 mg/g · R	N/A
2	0.0001 g	220 g	U_2 = 0.06 mg + 0.00448 mg/g · R	N/A

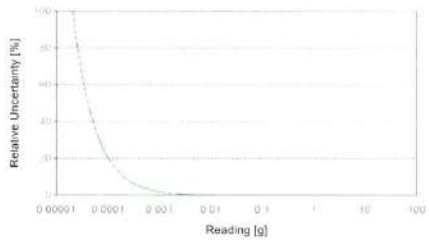
To optimize the stability of the linearization, besides of the zero load only increasing measurement points with a test load of 5% of the measurement range or larger are taken for the calculation of the linear equation.

Absolute and Relative Measurement Uncertainty in Use for Various Net Indications (Examples)

Net Indication	As Found		As Left	
0.00220 g	0.021 mg	0.95%	N/A	N/A
0.02200 g	0.021 mg	0.096%	N/A	N/A
0.22000 g	0.022 mg	0.0100%	N/A	N/A
2.20000 g	0.031 mg	0.0014%	N/A	N/A
220.0000 g	1.0 mg	0.00048%	N/A	N/A



As Found



As Left

The weighing range shown in the absolute uncertainty graph refers to the first interval/range of the device.

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เอกสารไม่ควบคุม

Remarks

FACT adjustment functionality activated

Equipment condition: Good

Calibration after installation

Next calibration according to customer's procedure

Calibration data not decide by calibration laboratory

End of Accredited Section

The information below and any attachments to this calibration certificate are not part of the accredited calibration.

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เอกสารไม่ควบคุม

Equipment : Hot Air Oven
Condition As-Received : Used Item
Reference : 2204-0015OC-1

Cert. No.: 22TM304
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:-

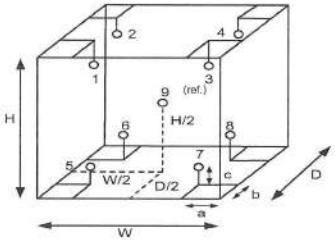
Instrument	Model	Serial No.	Cert. No.	Due Date
1) Data Acquisition	34970A	MY41021843	22LM4	10 Jan 2023

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 of UUC* : Temperature Source

Fresh air setting : Close



Environment during calibration		
	Beginning	Finished
Temp. (°C)	28	28
REL.Humid. (%)	56	55
AC Supply (Volt)	221	224

Position :	Ref. Std. ID No.: @ Calibration Point (°C) (120 ,180)	(104)
1	21-04TC-01	18-04RTD-01
2	21-04TC-02	18-04RTD-02
3	21-04TC-03	18-04RTD-03
4	21-04TC-04	18-04RTD-04
5	21-04TC-05	18-04RTD-05
6	21-04TC-06	18-04RTD-06
7	21-04TC-07	18-04RTD-07
8	21-04TC-08	18-04RTD-08
9 (ref.)	21-04TC-09	18-04RTD-09

Probe Installation Details :

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

Dimension of Chamber :

D =	0.50	m
W =	0.80	m
H =	0.75	m
Capacity =	0.30	m^3

Malu.

เอกสารไม่ควบคุม

a 1104316

TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES
534/4 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG BANGKOK 10250
TEL. 0-2717-3000-27 FAX. 0-2719-9484

ilac-MRA

NSC-TISI-TIS17025 CALIBRATION 0008

Cert. No.: 22TM304
Page.: 1 of 3

Certificate of Calibration

Equipment : Hot Air Oven

Manufacturer : Memmert

Model : UF 55

Serial No. : B212.0411

ID No. : UAE.WAO.005/2556

Submitted by : United Analyst and Engineering Consultant Co.,Ltd.
3 Soi Udomsuk 41, Sukhumvit Road,
Bangchak, Phrakhanong,
Bangkok 10260

Location : Lab Floor 2

Received Order : 7 April 2022
Calibration Date : 7 April 2022
Ambient Temperature : (26 ± 10) °C
Relative Humidity : (50 ± 30) %

Calibrated by : Man Pattanapongpaiboon

Approved by : Malu.
Approved Signatory

( ) Pornthippa Tameyakul
(✓) Malee Butkruea
( ) Suwit Imjai

Issue Date : 18 April 2022

The Uncertainties are for a confidence probability of approximately 95%

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เอกสารไม่ควบคุม

A 0040245

TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES
534/4 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG BANGKOK 10250
TEL. 0-2717-3000-27 FAX. 0-2719-9484

NSC-TISI-TIS17025
CALIBRATION 0008

Cert. No.: 22TM90
Page.: 1 of 3

Certificate of Calibration

Equipment : BOD Incubator

Manufacturer : Arco

Model : UC4-1320

Serial No. : 13URC4S013201

ID No. : UAE.WAO.015/2561

Submitted by : United Analyst and Engineering Consultant Co.,Ltd.
3 Soi Udomsuk 41, Sukhumvit Road,
Bangchak, Phrakhanong,
Bangkok 10260

Location : Lab Floor 2

Received Order : 17 February 2022
Calibration Date : 17 February 2022
Ambient Temperature : (26 ± 10) °C
Relative Humidity : (50 ± 30) %

Calibrated by : Kunchit Promprat

Approved by :

Approved Signatory

(✓) Pornthippa Tameyakul
(✓) Malee Butkruea
( ) Suwit Imjai

Issue Date : 22 February 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.

เอกสารไม่ควบคุม

Equipment : Hot Air Oven
Condition As-Received : Used Item
Reference : 2204-0015OC-1
Result of Calibration :- (*) Without Adjustment
Function of UUC* : Temperature Source
Fresh air setting : Close

Cert. No.: 22TM304
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	0.040	0.57	0.80	0.42	2
120.0	120.0	120.0	0.11	0.82	1.1	1.1	2
180.0	180.0	180.0	0.12	1.4	2.0	1.1	2

Calibration Point (°C)	Measured Temperature (°C) Position								
	1	2	3	4	5	6	7	8	9 (ref.)
104.0	104.403	104.220	104.517	104.474	103.778	103.859	104.292	104.357	104.319
120.0	120.183	119.878	120.238	120.355	119.476	119.455	120.046	120.173	120.199
180.0	180.502	179.929	180.655	180.797	179.012	179.044	180.043	180.305	180.340

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 %.

-o0o-

เอกสารไม่ควบคุม

Equipment : BOD Incubator
Condition As-Received : Used Item
Reference : 2202-0446OC-1

Cert. No.: 22TM90

Result of Calibration :- (*) Without Adjustment

Function of UUC* : Temperature Source

Fresh air setting : Not Available

Calibration Point (°C)	UUC* Setting (°C)	UUC* Reading (°C)	Temperature stability (± °C)	Temperature uniformity (°C)	Overall Variation (°C)	Uncertainty (±°C)	Coverage Factor *k*
20.0	19.5	19.4	0.30	0.58	1.0	0.55	2

Calibration Point (°C)	Measured Temperature (°C) Position								
	1	2	3	4	5	6	7	8	9 (ref.)
20.0	20.154	20.013	20.356	19.939	19.834	19.761	19.817	19.824	19.922

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 %.

-o0o-

เอกสารไม่ควบคุม

Equipment : BOD Incubator
Condition As-Received : Used Item
Reference : 2202-0446OC-1

Cert. No.: 22TM90

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).

The temperature scale used was based on ITS-90.

Condition of this result of calibration

1. Reference standard instrument:-

Instrument	Model	Serial No.	Cert. No.	Due Date
1) Data Acquisition	34970A	MY44035217	21LM30	23 Dec 2022

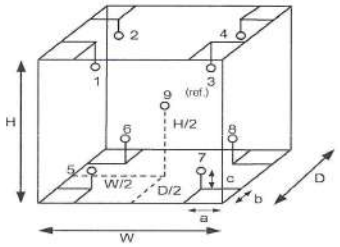
2. This certificate is valid only to the item calibrated on date and place of calibration.
3. This certification is traceable to the International System of Unit.

Result of Calibration :- (*) Without Adjustment

Function of UUC* : Temperature Source

Fresh air setting : Not Available

Environment during calibration	Beginning	Finished
Temp. (°C)	28	28
REL.Humid. (%)	68	75
AC Supply (Volt)	226	226



Position :	Ref. Std. ID No.:
1	18-10RTD-01
2	18-10RTD-02
3	18-10RTD-03
4	18-10RTD-04
5	18-10RTD-05
6	22-10RTD-10
7	18-10RTD-07
8	18-10RTD-08
9 (ref.)	18-10RTD-09

Probe Installation Details :

a =	10	cm
b =	10	cm
c =	10	cm

Dimension of Chamber :

D =	0.62	m
W =	1.2	m
H =	1.2	m
Capacity =	0.89	m³

เอกสารไม่ควบคุม

Equipment : BOD Incubator
Condition As-Received : Used Item
Reference : 2204-0015OC-2

Cert. No.: 22TM305
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).

The temperature scale used was based on ITS-90.

Condition of this result of calibration

1. Reference standard instrument:-

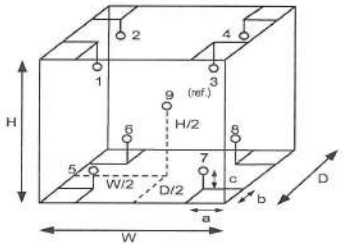
Instrument	Model	Serial No.	Cert. No.	Due Date
1) Data Acquisition	34970A	MY41021843	22LM4	10 Jan 2023

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 of UUC* : Temperature Source

Fresh air setting : Not Available



Environment during calibration		
	Beginning	Finished
Temp. (°C)	27	27
REL.Humid. (%)	56	59
AC Supply (Volt)	222	221

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

Probe Installation Details :

a =	10	cm
b =	10	cm
c =	10	cm

Dimension of Chamber :

D =	0.62	m
W =	1.2	m
H =	1.2	m
Capacity =	0.89	m³

Malu.

เอกสารไม่ควบคุม

a 1104314

TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES
534/4 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG BANGKOK 10250
TEL. 0-2717-3000-27 FAX. 0-2719-9484

NSC-TISI-TIS17025 CALIBRATION 0008

Cert. No.: 22TM305
Page.: 1 of 3

Certificate of Calibration

Equipment : BOD Incubator

Manufacturer : ARCO

Model : UR-1320

Serial No. : -

ID No. : UAE.WAO.018/2551

Submitted by : United Analyst and Engineering Consultant Co.,Ltd.
3 Soi Udomsuk 41, Sukhumvit Road,
Bangchak, Phrakhanong,
Bangkok 10260

Location : Lab Floor 2

Received Order : 7 April 2022
Calibration Date : 7 April 2022
Ambient Temperature : (26 ± 10) °C
Relative Humidity : (50 ± 30) %

Calibrated by : Man Pattanapongpaiboon

Approved by : Malu.
Approved Signatory

( ) Pornthippa Tameyakul
(✓) Malee Butkruea
( ) Suwit Imjai

Issue Date : 18 April 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 3 : Equipment Calibration and Testing Services.

เอกสารไม่ควบคุม

A 0040246

Hanna Instruments (Thailand) Ltd.
410/67-68 Soi Ratchadapisek 24, Ratchadapisek Rd., Samsen-nok,
Huaykwang, Bangkok 10310 Tel: 0-2541-4199 Fax: 0-2541-4198

Certificate No. : HIT-2209-0184

CERTIFICATE OF CALIBRATION

Equipment : COD Test Tube Heater
Meter Model : HI839800-02 **Serial No. :** H0185001
Manufacturer : Hanna Instruments
Made in : Romania
Condition As-Received : Used Product
Reference : RE220234
Customer name : United Analyst and Engineering Consultant Co., Ltd.
3 Soi Udomsuk 41, Sukhumvit Rd., Bangchak,
Phrakhanong, Bangkok 10260
Received date : 21 February 2022
Calibrate date : 1 March 2022
Issue date : 2 March 2022
Ambient Temperature : (25 ± 2)°C
Relative Humidity : (50 ± 15)% RH
Calibrated Location : Hanna Instruments (Thailand) Ltd.

Calibrated by : Pichit.
Mr. Pichit Petthong
Calibration Engineer

Approved by :
Mr. Anan Suwanchaisakul
Authorized Signatory

HANNA Instruments (Thailand) Limited

This certificate was certified only for the instrument we calibrated.
This result of calibration was found accurate on date and place of calibration only.

** This certificate may not be reproduced other than in full, except with the prior written **
approval of the head of Hanna Instrument (Thailand)

เอกสารไม่ควบคุม

Equipment : BOD Incubator
Condition As-Received : Used Item
Reference : 2204-0015OC-2
Result of Calibration :- (*) Without Adjustment
Function of UUC* : Temperature Source
Fresh air setting : Not Available

Cert. No.: 22TM305

Calibration Point (°C)	UUC* Setting (°C)	UUC* Reading (°C)	Temperature stability (± °C)	Temperature uniformity (°C)	Overall Variation (°C)	Uncertainty (±°C)	Coverage Factor *k*
20.0	20.0	20.0	0.50	0.44	1.1	0.64	2

Calibration Point (°C)	Measured Temperature (°C) Position								
	1	2	3	4	5	6	7	8	9 (ref.)
20.0	20.080	20.056	19.866	19.826	19.655	19.656	19.819	19.979	19.899

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 %.

-o0o-

Malu.

เอกสารไม่ควบคุม

a 1104313

Condition of this result of calibration

Reference Standard Instruments :

Instruments	Model	Serial No.	Certificate No.	Traceable
Thermometer With Sensor	HI935005	03250060101	21T167	Technology Promotion Association (Thailand-Japan)

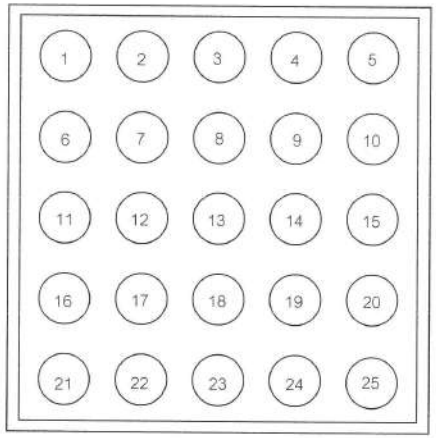
Reference / Procedure :

This equipment was calibration by comparison to the reference standard (Standard platinum resistance thermometer) whose accuracy is traceable to the national standard. The calibration was performed by generating the specified working point of temperature then recorded the temperature reading values against the reference standard according to Hanna Calibration Laboratory work Instruction No. 141.

This temperature scale used was based on ITS-90

All data shown below were as-received values without adjustment.

SITE CALIBRATION



เอกสารไม่ควบคุม

Result of Calibration :

Calibration Point	Unit Under Calibration Setting	Unit Under Calibration Reading	Temperature Stability	Uncertainty of Measurement
150.0 (°C)	- (°C)	150.6 (°C)	1.3 (°C)	± 0.39 (°C)

Calibration Point (°C)	Average Standard Reading (°C)				
	Position				
150.0	**1**	**2**	**3**	**4**	**5**
	150.2	150.4	150.4	150.3	150.2
	6	**7**	**8**	**9**	**10**
	150.4	150.9	151.1	151.1	150.6
	11	**12**	**13**	**14**	**15**
	150.4	151.0	151.5	151.3	150.5
	16	**17**	**18**	**19**	**20**
	150.3	150.8	151.2	151.2	150.5
	21	**22**	**23**	**24**	**25**
	150.2	150.3	150.5	150.4	150.3

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

** End of certificate **

เอกสารไม่ควบคุม

สถาบันอาหาร
กรมส่งเสริมอุตสาหกรรม
Foundation for Industrial Development National Food Institute
Food Industrial Laboratory Service Center

NSC-TISI-TIS 17025
CALIBRATION 0061

Calibration Report

Certificate No.: 2203120-001-01

Equipment: Electronic Balance
Manufacturer: METTLER TOLEDO
Model: AB204-S/FACT
Resolution: 0.0001 g
Serial No.: 1129361010
ID No.: UAE.WAS.002/2552
Capacity: 220 g

Date of Calibration: 1 June 2022

Environment Condition: Ambient Temperature: 19.9 ± 0.3 °C Relative Humidity: 45 ± 1.5 %

Place of Calibration: 108, Balance Room, UNITED ANALYST AND ENGINEERING CONSULTANT CO., LTD.

Condition of Equipment: Good Condition

Condition of This Results of Calibration:

1. Calibration Method: NFI Method W-MA-001 In-House Method based on UKAS Lab 14 : 2019
2. Reference Standards:

Reference Standard	Model	Serial No.	Calibrated By	Certificate No.	Due Date
Standard Weight Class E2	1-500mg	B308068554	TCS	M2201020S	6 January 2023
Standard Weight Class E2	1-500g	B308068128	TCS	M2201021S	6 January 2023
Instrument	**Model**	**Serial No.**	**Calibrated By**	**Certificate No.**	**Due Date**
Thermo-Hygro Meter	PONPE 490	NFI.BTH 010/18	Quality Reborn	QR22-0350	18 February 2023

3. This certification is traceable to SI UNIT
4. This certificate was certified only for the instrument we calibrated.
5. This result of calibration was found accurate as shown on date and place of calibration only.

Calibration Results:

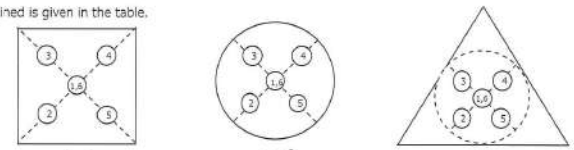
1. Repeatability of Reading:

Nominal Value (g)	Standard Deviation of Reading (g)
100	0.000048
200	0.000052

2. Off-Center Error:

A mass of 50 g was placed and moved to various position on pan.

The balance reading obtained is given in the table.



☐ ☑ ☐

1 (g)	2 (g)	3 (g)	4 (g)	5 (g)	6 (g)	(Maximum Difference) (g)
49.9999	49.9998	49.9998	49.9999	49.9998	49.9998	0.0001

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

เอกสารไม่ควบคุม

2008 ซอยอรุณอมรินทร์ 36 ถนนอรุณอมรินทร์ แขวงบางยี่ขัน เขตบางพลัด กรุงเทพมหานคร 10700
2008 Soi 36, Arun Amarin Road, Bang Yi Khan Subdistrict, Bang Phlat District, Bangkok 10700, Thailand
Tel: +66(0) 2422 8688 Fax: +66(0) 2422 8545
nfi.or.th

สถาบันอาหาร
กรมส่งเสริมอุตสาหกรรม
Foundation for Industrial Development National Food Institute
Food Industrial Laboratory Service Center

NSC-TISI-TIS 17025
CALIBRATION 0061

Calibration Certificate

Certificate No.: 2203120-001-01
Client name: UNITED ANALYST AND ENGINEERING CONSULTANT CO., LTD.
Address: 3 Soi Udomsuk 41, Sukhumvit Road, Bangchack, Prakhanong, Bangkok 10260

Equipment: Electronic Balance

Manufacturer: METTLER TOLEDO

Model: AB204-S/FACT

Serial No.: 1129361010

ID No.: UAE.WAS.002/2552

Order No.: 2203120

Operation No.: 2203120-001

Date of Receipt: 1 June 2022

Date of Calibration: 1 June 2022

Calibrated by Mr.Taveesak Seilee
Scientist

Approved by (Mr.Pheraphat Tuanjit)
Manager, Division of Calibration Laboratory
Responsible for the Technical Management Team

Date of Issue: 7 June 2022

The uncertainties are for a confidence probability of approximately 95%

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

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2008 ซอยอรุณอมรินทร์ 36 ถนนอรุณอมรินทร์ แขวงบางยี่ขัน เขตบางพลัด กรุงเทพมหานคร 10700
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National Food Institute, Ministry of Industry, Thailand
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Tel : +66 (0) 2422 8688 Fax : +66 (0) 2422 8545 Website : www.nfi.or.th E-mail : cal@nfi.or.th

Verification Certificate

Certificate No.: 2202361-001-01
Client name: UNITED ANALYST AND ENGINEERING CONSULTANT CO., LTD.
Address: 3 Soi Udomsuk 41, Sukhumvit Road, Bangchack, Prakhanong, Bangkok 10260

Equipment: HEATING BLOCK DIGESTION
Manufacturer: FOSS
Model: 2520
Serial No.: 91794469
ID No.: UAE.WAS.011/2560
Order No.: 2202361
Operation No.: 2202361-001
Date of Receipt: 4 April 2022
Date of Calibration: 4-6 April 2022

Calibrated by Mr.Nuttapol Niyomchat
Specialist

Approved by (Mr.Pheraphat Tuanjit)
Manager, Division of Calibration Laboratory
Responsible for the Technical Management Team

Date of Issue: 11 April 2022

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

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เอกสารไม่ควบคุม

สถาบันอาหาร
ศูนย์บริการห้องปฏิบัติการสถาบันอาหาร
Foundation for Industrial Development National Food Institute
Food Industrial Laboratory Service Center

ilac-MRA
NSC-TISI-TIS 17025 CALIBRATION 0061

Calibration Report

Certificate No.: 2203120-001-01
Equipment: Electronic Balance
Model: AB204-S/FACT
Serial No.: 1129361010
Capacity: 220 g
Manufacturer: METTLER TOLEDO
Resolution: 0.0001 g
ID No.: UAE.WAS.002/2552

Date of Calibration: 1 June 2022

Calibration Results: (Continued)
Calibration Range: 0 - 200 g
Calibration Adjustment: Internal Calibration

3. Departure from Nominal Value:

Nominal Value (g)	Standard Value (g)	Average Reading (g)	Correction (g)	Uncertainty (± g)	Coverage Factor *k*
Unload	0.00000	0.0000	0.0000	0.000088	2.00
0.01	0.01000	0.0100	0.0000	0.000088	2.00
0.05	0.05000	0.0499	0.0001	0.000088	2.00
0.1	0.10000	0.1000	0.0000	0.000088	2.00
0.2	0.20000	0.2000	0.0000	0.000088	2.00
0.5	0.50000	0.5000	0.0000	0.000088	2.00
1	1.00000	0.9999	0.0001	0.000088	2.00
2	2.00000	1.9999	0.0001	0.000089	2.00
5	5.00000	5.0000	0.0000	0.000089	2.00
10	9.99998	9.9999	0.0001	0.000092	2.00
20	19.99999	19.9999	0.0001	0.000094	2.00
50	49.99990	49.9999	0.0000	0.00012	2.00
70	69.99989	69.9998	0.0001	0.00014	2.00
100	100.00001	99.9999	0.0001	0.00017	2.00
150	149.99991	149.9997	0.0002	0.00022	2.00
200	200.00007	199.9998	0.0003	0.00030	2.00

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

---------- End ----------

เอกสารไม่ควบคุม

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Verification Report

Certificate No.: 2202361-001-01

Equipment: HEATING BLOCK DIGESTION

Model: 2520 Serial No.: 91794469

Resolution: 1 °C ID No.: UAE.WAS.011/2560

Manufacturer: FOSS

Date of Calibration: 4-6 April 2022

Calibration point: 380 °C

Calibration result:

Reporting of Temperature

Block No.	UUC* Setting (°C)	UUC* Reading (°C)	Stability (±°C)	Standard Thermometer (°C)	Uncertainty (±°C)
1	380	380	0.13	376.48	1.5
2	380	380	0.12	376.58	1.5
3	380	380	0.12	376.51	1.5
4	380	380	0.14	376.70	1.6
5	380	380	0.18	376.81	1.6
6	380	380	0.12	377.23	1.6
7	380	380	0.12	377.37	1.5
8	380	380	0.13	376.68	1.5
9	380	380	0.14	376.72	1.5
10	380	380	0.18	378.97	1.6
11	380	380	0.25	378.79	1.6
12	380	380	0.11	377.14	1.6
13	380	380	0.19	379.65	1.6
14	380	380	0.16	379.61	1.6
15	380	380	0.16	378.66	1.6
16	380	380	0.15	379.18	1.6
17	380	380	0.23	377.39	1.6
18	380	380	0.11	377.71	1.6
19	380	380	0.22	376.64	1.6
20	380	380	0.16	376.56	1.6

Note:

- UUC* = Unit Under Calibration
- Immersion depth of standard thermometer in tube level high of sand is equal heater plate of UUC.
- Stability = One-half of the greatest maximum difference of measured temperatures at one sensors, for at least half an hour after reaching steady state.

เอกสารไม่ควบคุม

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Verification Report

Certificate No.: 2202361-001-01

Equipment: HEATING BLOCK DIGESTION

Model: 2520 Serial No.: 91794469

Resolution: 1 °C ID No.: UAE.WAS.011/2560

Manufacturer: FOSS

Date of Calibration: 4-6 April 2022

Location: Laboratory Room, NATIONAL FOOD INSTITUTE

Environment Condition:
Ambient Temperature (25 ± 3) °C
Relative Humidity (55 ± 15) %
Line Voltage (220 ± 10) Volt

Condition of this results of Calibration:

1. This instrument was calibrated by insert standard thermocuples type R into its heating block digestion and compared to temperature obtained from reference standards thermometer at calibrated point.
   - The temperature scale used was based on ITS - 90 .
   - All data show below were final values and the initial data may be obtained upon request.
2. Reference Standard Instrument :

Instrument	Model	Serial No.	Certificate No.	Due Date	Through
Digital Thermometer with Thermocouple	34970A/34901A	MY44045576/MY41194453	TC21/0041	24-Apr-2022	N.M. Technical Center Laboratory
	Type R	TC#101-103 / CH#101-103			

3. This certificate is traceable to international system of units (SI Units).
4. This certificate was certified only for the instrument we calibrated.
5. This result of calibration was found accurate as shown on date and place of calibration only.
6. Condition of Calibrated item : Good
   UUC* Description
   Time of Record - Hour 30 Minute At 380 °C
7. Result of Calibration : [X] Without adjustment [ ] After adjustment

เอกสารไม่ควบคุม

FOSS

FOSS South East Asia
3388 Sirinrat Building, 25th – 26th Floor, Unit No. 3388/90,
Rama IV Road, Klongton , Klongtoey, Bangkok, Thailand 10110

Customer Service Report

Report No:	5874

Date:	30/11/21
Customer:	UAE
Instrument:	KT200
Address:	91 ซ.สุขุมวิท ขาวดาว พระโขนง กรุงเทพ 10260
Serial:	91790524

Hours	Travel To Customer		Labour		Travel From Customer	
Start	8.00	1	9.00		14.00	1
Finish	9.00		14.00		15.00	

Job Type

Application		Special		Standard			
Normal		Courtesy Visit		Installation		Training	
Distributor		PMA Onboarding		Quote		In House	
Internal		Warranty		Repair		PM	X
Digital Service		Sales Support		Remote		Other	

PO/Quote Number:	if applicable
PMA Type: Foss complete Pro	Contract No.: if applicable

Details of Work / Test	Condition / Status
- Check Instrument	OK
- เปลี่ยน PM kit for KT200	Pass
- เปลี่ยน Safety valve	Pass
- เปลี่ยน Rubber Grommet	Pass
- เปลี่ยน Seal	Pass
- เปลี่ยน Heating element	Pass
- เปลี่ยน New panel PCB	Pass
- เปลี่ยน Safety door complete	Pass
- Clean & lubricant	Pass
- Check leakaged	Pass
- Check volum Alkali set 30ml ได้ 28ml	
-	
Instrument Ready for Use: OK / Not OK	if not OK - Comment

Part No:	Batch	Description	Qty
10009965	11235983	Foss PM kit KT200	1
1535-0024	29.09.21	Safety Valve	1
1590028	09.11.20	Rubber Grommet for Heating oil	2
10085-12	02.08.21	Heating Element	1
10002762	16.11.20	Seal	1
60094273	14.09.20	KT200 new panel PCB	1
10009385	22.09.21	Safety door complete	1

I confirm this report is accurate and complete

Signed FOSS		Signed Customer	
Name		Name	

Would you be willing to participate in a brief survey in order to tell us how we performed? Email

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Tel : +66 (0) 2422 8688 Fax : +66 (0) 2422 8545 Website : www.nfi.or.th E-mail : cal@nfi.or.th

Verification Report

Certificate No.:	2202361-001-01
Equipment:	HEATING BLOCK DIGESTION
	Model: 2520 Serial No.: 91794469
	Resolution: 1 °C ID No.: UAE.WAS.011/2560
	Manufacturer: FOSS
Date of Calibration:	4-6 April 2022
Calibration point:	380 °C
Calibration result:	Continued

Figure 1. Location of Reference Standard and Block Diagram of Digestion Unit

TOP VIEW

Sensor Installation Location

Note:

- UUC* = Unit Under Calibration
- Immersion depth of standard thermometer in tube level high of sand is equal heater plate of UUC.
- Stability = One-half of the greatest maximum difference of measured temperatures at one sensors, for at least half an hour after reaching steady state.

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

--------- End ---------

เอกสารไม่ควบคุม

Maintenance Procedure

Exchange of Parts and Cleaning

Step	Action	Part	P/N	OK
1	Replace	Adapter for dig. tube 250 ml	1000 0056	☐
2	Replace	Non return valve	1000 3538	☐
3	Replace valves in alkali pump	Valve kit reagent/water pump	1575 0093	☐
4	Replace steam tubing	Silicone tubing 8/12 mm	1582 0006	☐
5	Replace alkali tubing	Tubing reinforced for alkali	1582 0011	☐
6	Replace water tubing	Tubing PVC 8/11 mm	1582 0004	☐
7	Cleaning	Steam generator		☐
8	Cleaning	Splash head		☐

Check and Adjustments

Step	Action	Module	Measured	Limits	OK
1	Check alkali volume, 10 ml/stroke	Alkali pump	48	At 50 ml -0/+3 ml	☑
2	Check distillation volume		120ml	100 – 150 ml/4 min	☑
3	Check front panel switches				☑
4	Check cables and electrical connections				☑
5	Check level pins in steam generator				☑
6	Check safety door switch				☑

เอกสารไม่ควบคุม

FossCare™

FOSS Preventive Maintenance Protocol

Customer : UAE

Instrument	Kjeltec™ 2100 : Kjeltec 200	
Recommended PM interval (whichever occurs first between interval and no. of samples analysed)	12 months	No. of samples analysed (if applicable):
Preventive maintenance kit (P/N)	10009965	S/N 91790524

Introduction

A maintenance protocol provides systematic and functional means of maintaining a specific instrument type. The recommended PM interval depends on the operational conditions and is based on our extensive experience and knowledge of manufacturing and maintaining analytical instruments.

Apart from sample throughput, the environmental conditions also need to be considered. A demanding environment, such as high ambient temperature, humidity, dirtiness etc can measurably shorten component lifetime and also the maintenance and component replacement intervals.

NOTE!

The content of this protocol is subject to change over time. In order to safeguard that you obtain the correct parts, please make sure to indicate serial no and date of installation when contacting your FOSS representative.

Dedicated Analytical Solutions

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Denmark
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Fax +45 7010 3371
E-mail support@foss.dk
Web www.foss.dk

FOSS Analytical AB
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SE-263 21 Höganäs
Sweden
Tel +46 42 361500
Fax +46 42 340349
E-mail support@foss.dk
Web www.foss.dk

เอกสารไม่ควบคุม

Setpoint Status: Pass

	Setpoint		Actual	
Inlet Pressure:	25.0	psi	25.0	psi

Accuracy: 0.0 psi

Agilent Recommended: <= 1.2

Overall Inlet Pressure Accuracy Test Status

Pass

Detector Flow Accuracy

Name: 7890

Back FID

Setpoint Status: Pass

Flow Type: Fuel

Setpoint: 30.0 mL/min Measured Flow: 30.1 mL/min

Accuracy: 0.1 mL/min

Agilent Recommended: <= 10.0 % setpoint (3.0 ml/min)

Limit is percentage of setpoint or 0.5 ml/minute, whichever is largest.

Setpoint Status: Pass

Flow Type: Oxidizer

Setpoint: 400.0 mL/min Measured Flow: 396.4 mL/min

Accuracy: 3.6 mL/min

Agilent Recommended: <= 10.0 % setpoint (40.0 ml/min)

Limit is percentage of setpoint or 0.5 ml/minute, whichever is largest.

Setpoint Status: Pass

Flow Type: Makeup

Setpoint: 25.0 mL/min Measured Flow: 24.8 mL/min

Accuracy: 0.2 mL/min

Agilent Recommended: <= 10.0 % setpoint (2.5 ml/min)

Limit is percentage of setpoint or 0.5 ml/minute, whichever is largest.

เอกสารไม่ควบคุม

Certificate of System Qualification

GC-OQ

System ID: CN11021007

Organization Name: United Analyst and Engineering Consultan Co.,Ltd.

Organization Location: 3 Soi Udomsuk 41 Sukhumvit Rd., Bangjak, Bangkok Thailand 10260

Date: February 11, 2022 3:57:27 PM

EQP Name: AgilentRecommended

EQP Revision: GC.02.51

Overall Qualification Status: Pass

System Inspection and Basic Safety and Operation

Name: 7890

Setpoint Status: Pass

Overall System Inspection and Basic Safety and Operation Test Status

Pass

Inlet Pressure Decay

Name: 7890

Front SSL

Setpoint Status: Pass

Pressure: 25.0 psi

Pressure Change: -0.1 psi 15 minutes

Agilent Recommended: >= -2.0 and <= 0.5

Overall Inlet Pressure Decay Test Status

Pass

Inlet Pressure Accuracy

Name: 7890

Front SSL

เอกสารไม่ควบคุม

Overall GC Oven Temperature Accuracy Test Status

Pass

GC Oven Temperature Stability

Name:	7890			
Setpoint Status:	**Pass**			
	Setpoint/Average			
Temperature:	100.0	100.2167	°C	
Stability:		0.1	°C	
Agilent Recommended:	<=	0.5		

Overall GC Oven Temperature Stability Test Status

Pass

Scouting Run

Tested Combination1	Front	SSL	/ Back	FID
	Injection Tower			
Name:	7683A			
Setpoint Status:	**Completed**			
Injection Volume on Column:	1.0	uL		

Overall Scouting Run Status

Completed

Noise and Drift

Tested Combination1	Front	SSL	/ Back	FID
Name:	7890			

เอกสารไม่ควบคุม

Overall Detector Flow Accuracy Test Status

Pass

Detector Flow Accuracy

Name:	7890					
	Front	UECD				
Setpoint Status:	**Pass**					
Flow Type:	Makeup					
Setpoint:	25.0	mL/min		Measured Flow:	24.8	mL/min
Accuracy:		0.2	mL/min			
Agilent Recommended:	<=	10.0	% setpoint	(2.5	mL/min	)

Limit is percentage of setpoint or 0.5 ml/minute, whichever is largest.

Overall Detector Flow Accuracy Test Status

Pass

GC Oven Temperature Accuracy

Name:	7890					
Setpoint Status:	**Pass**					
Zone:	Oven					
	Setpoint/Actual					
Temperature:	230.0	230.3	°			
Accuracy:		0.3	°			
Agilent Recommended:	>=	-1.0	% setpoint in K	(-5.0	°C	)
	<=	1.0	% setpoint in K	(5.0	°C	)
Setpoint Status:	**Pass**					
Zone:	Oven					
	Setpoint/Actual					
Temperature:	100.0	100.2	°			
Accuracy:		0.2	°			
Agilent Recommended:	>=	-1.0	% setpoint in K	(-3.7	°C	)
	<=	1.0	% setpoint in K	(3.7	°C	)

เอกสารไม่ควบคุม

Scouting Run

Tested Combination2	Front	SSL	/ Front	UECD
	Injection Tower			
Name:	7683A			

Setpoint Status: **Completed**

Injection Volume on Column: 1.0 uL

Overall Scouting Run Status

Completed

Noise and Drift

Tested Combination2	Front	SSL	/ Front	UECD
Name:	7890			

Setpoint Status: **Pass**

Base Signal: 282.3 Hz

		ASTM Noise		Drift
		Hz		Hz/Hr
		0.60		13.19
Agilent Recommended:	<=	3.00	<=	15.00
Status:		Pass		Pass

Overall Noise and Drift Test Status

Pass

Injection Precision

Tested Combination2	Front	SSL	/ Front	UECD
Name:	7683A			

เอกสารไม่ควบคุม

Setpoint Status: **Pass**

Base Signal: 11.2 pA

		ASTM Noise		Drift
		pA		pA/Hr
		0.06		0.31
Agilent Recommended:	<=	0.10	<=	2.50
Status:		Pass		Pass

Overall Noise and Drift Test Status

Pass

Injection Precision

Tested Combination1	Front	SSL	/ Back	FID
Name:	7683A			

Setpoint Status: **Pass**

Injection Volume on Column: 1.0 uL

Area RSD:		0.38 %	Retention Time RSD:		0.65 %
Agilent Recommended:	<=	3.00		<=	1.00

Overall Injection Precision Test Status

Pass

Signal to Noise

Tested Combination1	Front	SSL	/ Back	FID
	Injection Tower			
Name:	7890			

Setpoint Status: **Pass**

Signal to Noise:		784901
Agilent Recommended:	>=	300000

Overall Signal to Noise Test Status

Pass

เอกสารไม่ควบคุม

Setpoint Status:	**Pass**						
Injection Volume on Column:	1.0		uL				
Area RSD:		1.14	%	Retention Time RSD:		0.04	%
Agilent Recommended:	<=	3.00			<=	1.00	

Overall Injection Precision Test Status

Pass

Signal to Noise

Tested Combination2	Front	SSL	/ Front	UECD
	Injection Tower			
Name:	7890			

Setpoint Status:	**Pass**	
Signal to Noise:		2250
Agilent Recommended:	>=	1500

Overall Signal to Noise Test Status

Pass

เอกสารไม่ควบคุม

Instrument Details

Purpose

This section describes the as found system configuration.

Details

System

System ID	UAE.TOX.007
Manufacturer	Agilent Technologies
Name	7890
Flow Data Input	Manual Data
Temperature Data Input	Manual Data or Other Data Logging

Tested Combination1

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

Tested Combination2

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

Sampler 1

Manufacturer	Agilent Technologies
Type	Injection Tower
Name	7683A
Model Number	G2613A
Serial Number	CN82149436
Firmware Revision	A.11.02
Usage	Sample Injection
Location	Front
Syringe Volume (µL)	10

เอกสารไม่ควบคุม

Sampler 2

Manufacturer	Agilent Technologies
Type	Tray
Name	7683A
Model Number	G2614A
Serial Number	CN82246787
Firmware Revision	A.02.01

Mainframe 1

Manufacturer	Agilent Technologies
Name	7890
Model Number	G3440A
Serial Number	CN11021007
Firmware Revision	A.01.11
Oven Type	Standard

Inlet 1

Manufacturer	Agilent Technologies
Name	7890
Type	SSL
Location	Front
Carrier Gas	Helium
Control Type	Electronic Pressure Control (EPC)
Purged Inlet	Yes

Detector 1

Manufacturer	Agilent Technologies
Name	7890
Type	FID
Adapter	Capillary
Control Type	Electronic Pressure Control (EPC)
Location	Back
Makeup Gas	Nitrogen

เอกสารไม่ควบคุม

Detector 2

Manufacturer	Agilent Technologies
Name	7890
Type	UECD
Serial Number	UI16886
Adapter	Capillary
Control Type	Electronic Pressure Control (EPC)
Location	Front
Makeup Gas	Nitrogen

เอกสารไม่ควบคุม

User Name: saenguthai.tarak
Hostname: LAPTOP-CQ3SKOMV

System Id: CN11021007
Print Date: February 11, 2022 3:57:30 PM

OQ_UAE_TOX.007 Transaction log :

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
February 10, 2022 1:31:02 PM	Audit	SessionCreated	Session	None
February 10, 2022 1:31:02 PM	Start	Configuration	Session	None
February 10, 2022 1:31:02 PM	Audit	Entitlement	Licensing	User is Nonpaying and does not require an unlock code
February 10, 2022 1:39:00 PM	Audit	EqpLoaded	Session	EQP details for primary technique [Gc] - File path: [ProtocolPacks/Gc/Configurations/02.51/Gc.02.51.eqp], EQP File Name: [Gc.02.51.eqp], EQP Name: [AgilentRecommended]
February 10, 2022 1:39:49 PM	Audit	AceClosed	Session	None
February 10, 2022 1:41:08 PM	Audit	AceRestarted	Session	None
February 10, 2022 1:41:08 PM	Audit	SessionReloaded	Session	None
February 10, 2022 1:41:10 PM	Audit	EqpLoaded	Session	EQP details for primary technique [Gc] - File path: [ProtocolPacks/Gc/Configurations/02.51/Gc.02.51.eqp], EQP File Name: [Gc.02.51.eqp], EQP Name: [AgilentRecommended]
February 10, 2022 1:47:12 PM	Audit	AceClosed	Session	None
February 11, 2022 9:04:43 AM	Audit	AceRestarted	Session	None

Page 1 / 10

เอกสารไม่ควบคุม

Electronic Signature

Purpose

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Logged On User Name:	saenguthai.tarak@non.agilent.com
Signature Creation Date:	February 11, 2022
Reason for Signature:	Executed protocol and published this original version of document

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User Name: saengulhai.tarak
Hostname: LAPTOP-CQ3SKOMV

System Id: CN11021007
Print Date: February 11, 2022 3:57:30 PM

OQ_UAE_TOX.007 Transaction log :

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
February 11, 2022 2:07:42 PM	End	Execution	Inlet Pressure Accuracy - Front SSL - Pressure Controlled Inlet - S: 25.0 psi - L: <= 1.2 psi	Run Count : 1
February 11, 2022 2:07:44 PM	Start	Execution	Detector Flow Accuracy - Back FID: - Type : Fuel - S: 30.0 mL/min - L: <= 10.0% setpoint	None
February 11, 2022 2:08:02 PM	Audit	Data	Detector Flow Accuracy - Back FID: - Type : Fuel - S: 30.0 mL/min - L: <= 10.0% setpoint	Manual Data Entry
February 11, 2022 2:08:10 PM	End	Execution	Detector Flow Accuracy - Back FID: - Type : Fuel - S: 30.0 mL/min - L: <= 10.0% setpoint	Run Count : 1
February 11, 2022 2:08:12 PM	Start	Execution	Detector Flow Accuracy - Back FID: - Type : Oxidizer - S: 400.0 mL/min - L: <= 10.0% setpoint	None
February 11, 2022 2:08:48 PM	Audit	Data	Detector Flow Accuracy - Back FID: - Type : Oxidizer - S: 400.0 mL/min - L: <= 10.0% setpoint	Manual Data Entry
February 11, 2022 2:08:52 PM	End	Execution	Detector Flow Accuracy - Back FID: - Type : Oxidizer - S: 400.0 mL/min - L: <= 10.0% setpoint	Run Count : 1
February 11, 2022 2:08:55 PM	Start	Execution	Detector Flow Accuracy - Back FID: - Type : Makeup - S: 25.0 mL/min - L: <= 10.0% setpoint	None
February 11, 2022 2:09:18 PM	Audit	Data	Detector Flow Accuracy - Back FID: - Type : Makeup - S: 25.0 mL/min - L: <= 10.0% setpoint	Manual Data Entry
February 11, 2022 2:09:23 PM	End	Execution	Detector Flow Accuracy - Back FID: - Type : Makeup - S: 25.0 mL/min - L: <= 10.0% setpoint	Run Count : 1

เอกสารไม่ควบคุม

User Name: saengulhai.tarak
Hostname: LAPTOP-CQ3SKOMV

System Id: CN11021007
Print Date: February 11, 2022 3:57:30 PM

OQ_UAE_TOX.007 Transaction log :

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
February 11, 2022 2:06:20 PM	Audit	SessionReloaded	Session	None
February 11, 2022 2:06:21 PM	Audit	EcpLoaded	Session	EQP details for primary technique [Gc] - File path: [ProtocolPacks\GcConfigurations\02.51\Gc.02.51.eqp], EQP File Name: [Gc.02.51.eqp], EQP Name: [AgilentRecommended]
February 11, 2022 2:06:55 PM	End	Configuration	Session	None
February 11, 2022 2:06:59 PM	Start	Qualification	Session	OQ
February 11, 2022 2:06:59 PM	Start	Execution	System Inspection and Basic Safety and Operation - 7890: - Qualitative Test - No setpoints associated	None
February 11, 2022 2:07:19 PM	End	Execution	System Inspection and Basic Safety and Operation - 7890: - Qualitative Test - No setpoints associated	Run Count : 1
February 11, 2022 2:07:21 PM	Start	Execution	Inlet Pressure Decay - Front SSL - Pressure Controlled Inlet - S: 25.0 psi - L: >= -2.0 psi and <= 0.5 psi	None
February 11, 2022 2:07:35 PM	End	Execution	Inlet Pressure Decay - Front SSL - Pressure Controlled Inlet - S: 25.0 psi - L: >= -2.0 psi and <= 0.5 psi	Run Count : 1
February 11, 2022 2:07:37 PM	Start	Execution	Inlet Pressure Accuracy - Front SSL - Pressure Controlled Inlet - S: 25.0 psi - L: <= 1.2 psi	None

เอกสารไม่ควบคุม

User Name: saenguthai.tarak
Hostname: LAPTOP-CO3SKOMV

System Id. CN11021007
Print Date: February 11, 2022 3:57:30 PM

OQ_UAE_TOX.007 Transaction log :

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
February 11, 2022 2:10:43 PM	End	Execution	GC Oven Temperature Accuracy - 7890: - Temperature : Oven - S: 100.0°C - L: >= -1.0 AND <= 1.0 % setpoint in K	Run Count : 1
February 11, 2022 2:10:46 PM	Start	Execution	GC Oven Temperature Stability - 7890: - Temperature : Oven - S: 100.0°C - L: <= 0.5°C	None
February 11, 2022 2:11:37 PM	Audit	Data	GC Oven Temperature Stability - 7890: - Temperature : Oven - S: 100.0°C - L: <= 0.5°C	Manual Data Entry
February 11, 2022 2:11:38 PM	End	Execution	GC Oven Temperature Stability - 7890: - Temperature : Oven - S: 100.0°C - L: <= 0.5°C	Run Count : 1
February 11, 2022 2:11:44 PM	Start	Execution	GC Scouting Run - Injection Tower, Front SSL, Back FID: - Part of System Preparation - No limits associated	None
February 11, 2022 2:14:13 PM	Start	Execution	GC Scouting Run - Injection Tower, Front SSL, Back FID: - Part of System Preparation - No limits associated	None
February 11, 2022 2:14:45 PM	Audit	Data	GC Scouting Run - Injection Tower, Front SSL, Back FID: - Part of System Preparation - No limits associated	Data files Path : E:\OC2022\SC_FID_Back01.D\FID1B.ch
February 11, 2022 2:15:16 PM	End	Execution	GC Scouting Run - Injection Tower, Front SSL, Back FID: - Part of System Preparation - No limits associated	Run Count : 1
February 11, 2022 2:15:22 PM	Start	Execution	Noise and Drift - Back FID: - Detector FID - L (Noise): <= 0.10 pA - L (Drift): <= 2.50 pA/hour	None

เอกสารไม่ควบคุม

User Name: saenguthai.tarak
Hostname: LAPTOP-CO3SKOMV

System Id: CN11021007
Print Date: February 11, 2022 3:57:30 PM

OQ_UAE_TOX.007 Transaction log :

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
February 11, 2022 2:09:25 PM	Start	Execution	Detector Flow Accuracy - Front UECD: - Type : Makeup - S: 25.0 mL/min - L: <= 10.0% setpoint	None
February 11, 2022 2:09:50 PM	Audit	Data	Detector Flow Accuracy - Front UECD: - Type : Makeup - S: 25.0 mL/min - L: <= 10.0% setpoint	Manual Data Entry
February 11, 2022 2:09:54 PM	End	Execution	Detector Flow Accuracy - Front UECD: - Type : Makeup - S: 25.0 mL/min - L: <= 10.0% setpoint	Run Count : 1
February 11, 2022 2:09:56 PM	Start	Execution	GC Oven Temperature Accuracy - 7890: - Temperature : Oven - S: 230.0°C - L: >= -1.0 AND <= 1.0 % setpoint in K	None
February 11, 2022 2:10:19 PM	Audit	Data	GC Oven Temperature Accuracy - 7890: - Temperature : Oven - S: 230.0°C - L: >= -1.0 AND <= 1.0 % setpoint in K	Manual Data Entry
February 11, 2022 2:10:20 PM	End	Execution	GC Oven Temperature Accuracy - 7890: - Temperature : Oven - S: 230.0°C - L: >= -1.0 AND <= 1.0 % setpoint in K	Run Count : 1
February 11, 2022 2:10:22 PM	Start	Execution	GC Oven Temperature Accuracy - 7890: - Temperature : Oven - S: 100.0°C - L: >= -1.0 AND <= 1.0 % setpoint in K	None
February 11, 2022 2:10:41 PM	Audit	Data	GC Oven Temperature Accuracy - 7890: - Temperature : Oven - S: 100.0°C - L: >= -1.0 AND <= 1.0 % setpoint in K	Manual Data Entry

เอกสารไม่ควบคุม

User Name: saengduthai.tarak
Hostname: LAPTOP-CQ3SKOMV

System Id: CN11021007
Print Date: February 11, 2022 3:57:30 PM

OQ_UAE_TOX.007 Transaction log :

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
February 11, 2022 2:17:12 PM	Audit	Data	Injection Precision - Injection Tower, Front SSL, Back FID: - GC - L (Area): <= 3.00% - L (Ret. Time): <= 1.00%	Data files Path : E:\OQ2022\OQ2022 2022-02-10 13-02-14\OQ_GC7890_FID_ Pre0105.D\FID1B.ch
February 11, 2022 2:17:12 PM	Audit	Data	Injection Precision - Injection Tower, Front SSL, Back FID: - GC - L (Area): <= 3.00% - L (Ret. Time): <= 1.00%	Data files Path : E:\OQ2022\OQ2022 2022-02-10 13-02-14\OQ_GC7890_FID_ Pre0106.D\FID1B.ch
February 11, 2022 2:17:12 PM	Audit	Data	Injection Precision - Injection Tower, Front SSL, Back FID: - GC - L (Area): <= 3.00% - L (Ret. Time): <= 1.00%	Data files Path : E:\OQ2022\OQ2022 2022-02-10 13-02-14\OQ_GC7890_FID_ Pre0107.D\FID1B.ch
February 11, 2022 2:17:35 PM	End	Execution	Injection Precision - Injection Tower, Front SSL, Back FID: - GC - L (Area): <= 3.00% - L (Ret. Time): <= 1.00%	Run Count : 1
February 11, 2022 2:17:46 PM	Start	Execution	Signal to Noise - Injection Tower, Front SSL, Back FID: - Detector FID - L: >= 300000	None
February 11, 2022 2:18:06 PM	Start	Execution	Signal to Noise - Injection Tower, Front SSL, Back FID: - Detector FID - L: >= 300000	None
February 11, 2022 2:18:23 PM	Audit	Data	Signal to Noise - Injection Tower, Front SSL, Back FID: - Detector FID - L: >= 300000	Data files Path : E:\OQ2022\OQ2022 2022-02-10 13-02-14\OQ_GC7890_FID_ SN011.D\FID1B.ch
February 11, 2022 2:18:02 PM	Start	Execution	Signal to Noise - Injection Tower, Front SSL, Back FID: - Detector FID - L: >= 300000	None

เอกสารไม่ควบคุม

User Name: saengduthai.tarak
Hostname: LAPTOP-CQ3SKOMV

System Id: CN11021007
Print Date: February 11, 2022 3:57:30 PM

OQ_UAE_TOX.007 Transaction log :

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
February 11, 2022 2:15:57 PM	Audit	Data	Noise and Drift - Back FID: - Detector FID - L (Noise): <= 0.10 pA - L (Drift): <= 2.50 pA/hour	Data files Path : E:\OQ2022\OQ2022 FID_Back01. D\FID1B.ch
February 11, 2022 2:16:06 PM	End	Execution	Noise and Drift - Back FID: - Detector FID - L (Noise): <= 0.10 pA - L (Drift): <= 2.50 pA/hour	Run Count : 1
February 11, 2022 2:16:09 PM	Start	Execution	Injection Precision - Injection Tower, Front SSL, Back FID: - GC - L (Area): <= 3.00% - L (Ret. Time): <= 1.00%	None
February 11, 2022 2:16:47 PM	Start	Execution	Injection Precision - Injection Tower, Front SSL, Back FID: - GC - L (Area): <= 3.00% - L (Ret. Time): <= 1.00%	None
February 11, 2022 2:17:12 PM	Audit	Data	Injection Precision - Injection Tower, Front SSL, Back FID: - GC - L (Area): <= 3.00% - L (Ret. Time): <= 1.00%	Data files Path : E:\OQ2022\OQ2022 2022-02-10 13-02-14\OQ_GC7890_FID_ Pre0102.D\FID1B.ch
February 11, 2022 2:17:12 PM	Audit	Data	Injection Precision - Injection Tower, Front SSL, Back FID: - GC - L (Area): <= 3.00% - L (Ret. Time): <= 1.00%	Data files Path : E:\OQ2022\OQ2022 2022-02-10 13-02-14\OQ_GC7890_FID_ Pre0103.D\FID1B.ch
February 11, 2022 2:17:12 PM	Audit	Data	Injection Precision - Injection Tower, Front SSL, Back FID: - GC - L (Area): <= 3.00% - L (Ret. Time): <= 1.00%	Data files Path : E:\OQ2022\OQ2022 2022-02-10 13-02-14\OQ_GC7890_FID_ Pre0104.D\FID1B.ch

เอกสารไม่ควบคุม

User Name: saenguthaitarak
Hostname: LAPTOP-CQ3SKOMV

System Id: CN11021007
Print Date: February 11, 2022 3:57:30 PM

OQ_UAE_TOX.007 Transaction log :

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
February 11, 2022 3:34:01 PM	Start	Execution	Injection Precision - Injection Tower, Front SSL, Front UECD: - GC - L (Area): <= 3.00% - L (Ret. Time): <= 1.00%	None
February 11, 2022 3:34:42 PM	Audit	Data	Injection Precision - Injection Tower, Front SSL, Front UECD: - GC - L (Area): <= 3.00% - L (Ret. Time): <= 1.00%	Data files Path : E:\OQ2022\OQ_GC7890_uECD_Pre0103.D\ECD1A.ch
February 11, 2022 3:34:42 PM	Audit	Data	Injection Precision - Injection Tower, Front SSL, Front UECD: - GC - L (Area): <= 3.00% - L (Ret. Time): <= 1.00%	Data files Path E:\OQ2022\OQ_GC7890_uECD_Pre0104.D\ECD1A.ch
February 11, 2022 3:34:42 PM	Audit	Data	Injection Precision - Injection Tower, Front SSL, Front UECD: - GC - L (Area): <= 3.00% - L (Ret. Time): <= 1.00%	Data files Path : E:\OQ2022\OQ_GC7890_uECD_Pre0105.D\ECD1A.ch
February 11, 2022 3:34:42 PM	Audit	Data	Injection Precision - Injection Tower, Front SSL, Front UECD: - GC - L (Area): <= 3.00% - L (Ret. Time): <= 1.00%	Data files Path : E:\OQ2022\OQ_GC7890_uECD_Pre0106.D\ECD1A.ch
February 11, 2022 3:34:42 PM	Audit	Data	Injection Precision - Injection Tower, Front SSL, Front UECD: - GC - L (Area): <= 3.00% - L (Ret. Time): <= 1.00%	Data files Path : E:\OQ2022\OQ_GC7890_uECD_Pre0107.D\ECD1A.ch
February 11, 2022 3:34:42 PM	Audit	Data	Injection Precision - Injection Tower, Front SSL, Front UECD: - GC - L (Area): <= 3.00% - L (Ret. Time): <= 1.00%	Data files Path : E:\OQ2022\OQ_GC7890_uECD_Pre0108.D\ECD1A.ch
February 11, 2022 3:35:20 PM	End	Execution	Injection Precision - Injection Tower, Front SSL, Front UECD: - GC - L (Area): <= 3.00% - L (Ret. Time): <= 1.00%	Run Count : 1

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User Name: saenguthaitarak
Hostname: LAPTOP-CQ3SKOMV

System Id: CN11021007
Print Date: February 11, 2022 3:57:30 PM

OQ_UAE_TOX.007 Transaction log :

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
February 11, 2022 3:10:11 PM	End	Execution	Signal to Noise - Injection Tower, Front SSL, Back FID: - Detector FID - L >= 300000	Run Count : 1
February 11, 2022 3:31:48 PM	Start	Execution	GC Scouting Run - Injection Tower, Front SSL, Front UECD: - Part of System Preparation - No limits associated	None
February 11, 2022 3:32:10 PM	Audit	Data	GC Scouting Run - Injection Tower, Front SSL, Front UECD: - Part of System Preparation - No limits associated	Data files Path E:\OQ2022\SC_uECD_Front01.D\ECD1A.ch
February 11, 2022 3:33:01 PM	Audit	Data	GC Scouting Run - Injection Tower, Front SSL, Front UECD: - Part of System Preparation - No limits associated	Data files Path : E:\OQ2022\OQ_GC7890_uECD_SC01.D\ECD1A.ch
February 11, 2022 3:33:33 PM	End	Execution	GC Scouting Run - Injection Tower, Front SSL, Front UECD: - Part of System Preparation - No limits associated	Run Count : 1
February 11, 2022 3:33:36 PM	Start	Execution	Noise and Drift - Front UECD: - Detector UECD - L (Noise): <= 3.00 Hz - L (Drift): <= 15.00 Hz/hour	None
February 11, 2022 3:33:47 PM	Audit	Data	Noise and Drift - Front UECD: - Detector UECD - L (Noise): <= 3.00 Hz - L (Drift): <= 15.00 Hz/hour	Data files Path : E:\OQ2022\ND_uECD_Front12.D\ECD1A.ch
February 11, 2022 3:33:58 PM	End	Execution	Noise and Drift - Front UECD: - Detector UECD - L (Noise): <= 3.00 Hz - L (Drift): <= 15.00 Hz/hour	Run Count : 1

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Agilent CrossLab Compliance Services

Agilent CrossLab
From Insight to Outcome

EQUIPMENT QUALIFICATION REPORT (EQR)

Agilent CrossLab Compliance

Qualification Type:	GC-OQ
System ID:	CN11021007
EQP Name:	AgilentRecommended
EQP Revision:	GC.02.51
EQP Publish Date:	November 2020
Date:	February 11, 2022 4:01:27 PM
Report Type:	Report
Org. Name:	United Analyst and Engineering Consultan Co.,Ltd.
Org. Location:	3 Soi Udomsuk 41 Sukhumvit Rd., Bangjak, Bangkok Thailand 10260

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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
System Inspection and Basic Safety and Operation - 7890	Pass	1
Inlet Pressure Decay - Front SSL	Pass	1
Inlet Pressure Accuracy - Front SSL	Pass	1
Detector Flow Accuracy - Back FID	Pass	1
Detector Flow Accuracy - Front UECD	Pass	1
GC Oven Temperature Accuracy - 7890	Pass	1
GC Oven Temperature Stability - 7890	Pass	1
GC Scouting Run - Injection Tower, Front SSL, Back FID	Pass	1
Noise and Drift - Back FID	Pass	1
Injection Precision - Injection Tower, Front SSL, Back FID	Pass	1
Signal to Noise - Injection Tower, Front SSL, Back FID	Pass	1
GC Scouting Run - Injection Tower, Front SSL, Front UECD	Pass	1
Noise and Drift - Front UECD	Pass	1
Injection Precision - Injection Tower, Front SSL, Front UECD	Pass	1
Signal to Noise - Injection Tower, Front SSL, Front UECD	Pass	1

Overall Qualification Status

Pass

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User Name: saengduan.barak
Hostname: LAPTOP-CQ3SKOMV

System Id: CN11021007
Print Date: February 11, 2022 3:57:30 PM

OQ_UAE_TOX.007 Transaction log :

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
February 11, 2022 3:35:55 PM	Start	Execution	Signal to Noise - Injection Tower, Front SSL Front UECD: - Detector UECD - L: >= 1500	None
February 11, 2022 3:36:13 PM	Audit	Data	Signal to Noise - Injection Tower, Front SSL, Front UECD: - Detector UECD - L: >= 1500	Data files Path : E:\OQ2022\OQ_GC7890 \E CD_SN01.D\ECD1A.ch
February 11, 2022 3:36:35 PM	End	Execution	Signal to Noise - Injection Tower, Front SSL Front UECD: - Detector UECD - L: >= 1500	Run Count : 1
February 11, 2022 3:37:32 PM	End	Qualification	Session	OQ
February 11, 2022 3:37:37 PM	Start	Reporting	Session	None
February 11, 2022 3:53:50 PM	Audit	Reporting	Session	Report Generated : Certificate
February 11, 2022 3:56:02 PM	Audit	Reporting	Session	Report Generated : Report

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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.

Accuracy $= |X_{av} - X_{set}|$

X_{av} = Mean value
X_{set} = Setpoint

Absolute Accuracy $= |X_{av} - X_{set}|$

X_{av} = Mean value
X_{set} = Setpoint

Average (mean value of n observations) $= \frac{1}{n}\sum_{i=1}^{n} X_i$

X_i = Value, i^{th} observation
n = Total number of observations

% Carry Over $= \frac{X_b}{X_s} \times 100$

X_b = Response of blank injection
X_s = Response of final standard injection

Correlation (r) $= \frac{1}{\sqrt{\Delta_X \Delta_Y}} \times \left(n\sum_{i=1}^{n} X_i Y_i - \sum_{i=1}^{n} X_i \sum_{i=1}^{n} Y_i\right)$

$\Delta_X = n\sum_{i=1}^{n} X_i^2 - \left(\sum_{i=1}^{n} X_i\right)^2$

$\Delta_Y = n\sum_{i=1}^{n} Y_i^2 - \left(\sum_{i=1}^{n} Y_i\right)^2$

n = Number of data points
X_i = X value of ith point
Y_i = Y value of ith point

Drift (slope of the regression) $= \frac{1}{\Delta_X}\left(n\sum_{i=1}^{n} X_i Y_i - \sum_{i=1}^{n} X_i \sum_{i=1}^{n} Y_i\right)$

$\Delta_X = n\sum_{i=1}^{n} X_i^2 - \left(\sum_{i=1}^{n} X_i\right)^2$

n = Number of data points
X_i = Time, i^{th} observation
Y_i = Response, i^{th} observation

Coefficient of Determination $= r^2$

ASTM Noise $= \frac{\sum_{m=1}^{n} X_{Pk-Pk_m}}{n}$

X_{Pk-Pk_m} = Peak to peak noise in segment m
n = Number of segments

Six Sigma Noise $= 6 \times SD$

Raw Noise $= \sqrt{\frac{\sum_{i=1}^{n}(E_i - \bar{E})^2}{(n-1)}}$

E_i = Individual voltage readings
$\bar{E}$ = Average of n measurements

Response Factor $= \frac{Y}{X}$

X = Amount
Y = Response

Parts Per Million (ppm) $= \frac{(M_r - M_t)}{M_t} \times 1{,}000{,}000$

M_r = Reported mass
M_t = Theoretical mass

Stability $= |Y_{max} \quad Y_{min}|$

Y_{max} = Maximum value
Y_{min} = Minimum value

Standard Deviation (SD) $= \sqrt{\frac{1}{(n-1)}\sum_{i=1}^{n}(X_i - X_{av})^2}$

X_i = Value, i^{th} observation
X_{av} = Mean value in n observations
n = Total number of observations

Relative Standard Deviation (% RSD) $= \frac{SD}{X_{av}} \times 100$

SD = Standard deviation
X_{av} = Mean value of observations

NOTE: For many tests performed by the Automated Compliance Engine multi-step calculations are employed to reduce the raw data to a report ready form. These calculations retain the full precision of each intermediate result as the algorithm progresses through the required reduction. Where intermediated or metadata is displayed, these results must be rounded or truncated to provide the proper display values. Attempting to calculate the final value based on these display modified intermediates can result in a small difference in the final result. These intermediates, where presented, are simply used to show algorithmic progress through the calculation and not intended to act as a means of algorithmic validation. Beginning with GC.01.88, results are rounded to use the same number of decimal places as defined in the limit, which must be less than or equal to the resolution provided by the measuring equipment.

Service Details

Purpose

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

General Details

Service Order No./Request:	8004983529
EQP Name:	AgilentRecommended
EQP Revision:	GC.02.51
Report Type:	Report

Organization Details

Name:	United Analyst and Engineering Consultan Co.,Ltd.
Location:	3 Soi Udomsuk 41 Sukhumvit Rd., Bangjak, Bangkok Thailand 10260

Local Contact Details

Name:	Banjawan Viriyothai
Job Title:	Lab manager
Qualification Location:	Laboratory

Operator Details

Name:	Saengduthai Tarak
Job Title:	Field Service Engineer

Data Acquisition Details

Acquisition Software Name:	ChemStation
Acquisition Software Revision:	2.3.54

Customer Data System (CDS):	Gc. OpenLAB CDS

Instrument Details

Purpose

This section describes the as found system configuration.

Details

System

System ID	CN11021007
Manufacturer	Agilent Technologies
Name	7890
Flow Data Input	Manual Data
Temperature Data Input	Manual Data or Other Data Logging

Tested Combination1

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

Tested Combination2

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

Sampler 1

Manufacturer	Agilent Technologies
Type	Injection Tower
Name	7683A
Model Number	G2613A
Serial Number	CN82149436
Firmware Revision	A.11.02
Usage	Sample Injection
Location	Front
Syringe Volume (µL)	10

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
GC.02.51	Detector Flow Accuracy
GC.02.51	GC Oven Temperature Accuracy
GC.02.51	GC Oven Temperature Stability
GC.02.50	GC Scouting Run
GC.02.50	Injection Precision
GC.02.50	Inlet Pressure Accuracy
GC.02.50	Inlet Pressure Decay
GC.02.50	Noise and Drift
GC.02.50	Signal to Noise
GC.02.50	System Inspection and Basic Safety and Operation

System Inspection and Basic Safety and Operation

Purpose

This test verifies that the GC is correctly installed and connected.

Configuration Details

Name: 7890

Setpoint

Results

Criteria	Observed Result	Expected Result	Status
Is the system in good operating condition (no physical damage)?	Yes	Yes	Pass
Are there apparent instrumental or environmental safety concerns?	No	No	Pass
Are required gases present and of appropriate pressure?	Yes	Yes	Pass
Is there continuity between the GC chassis and the ground pin?	Yes	Yes	Pass
Does the power-cycled GC complete the self test without errors (a "not ready" status is considered to be without errors)?	Yes	Yes	Pass
Does the system reject operator entry of oven setpoint of 600°C?	Yes	Yes	Pass
Does a (hydrogen) safety shutdown start in approximately 4 - 10 minutes?	Yes	Yes	Pass

Setpoint Status: Pass Runs: 1

Overall System Inspection and Basic Safety and Operation Test Status

Pass

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Sampler 2

Manufacturer	Agilent Technologies
Type	Tray
Name	7683A
Model Number	G2614A
Serial Number	CN82248787
Firmware Revision	A.02.01

Mainframe 1

Manufacturer	Agilent Technologies
Name	7890
Model Number	G3440A
Serial Number	CN11021007
Firmware Revision	A.01.11
Oven Type	Standard

Inlet 1

Manufacturer	Agilent Technologies
Name	7890
Type	SSL
Location	Front
Carrier Gas	Helium
Control Type	Electronic Pressure Control (EPC)
Purged Inlet	Yes

Detector 1

Manufacturer	Agilent Technologies
Name	7890
Type	FID
Adapter	Capillary
Control Type	Electronic Pressure Control (EPC)
Location	Back
Makeup Gas	Nitrogen

Detector 2

Manufacturer	Agilent Technologies
Name	7890
Type	UECD
Serial Number	UI16686
Adapter	Capillary
Control Type	Electronic Pressure Control (EPC)
Location	Front
Makeup Gas	Nitrogen

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Detector Flow Accuracy

Purpose

Detector flow accuracy is determined by measuring the flows with a calibrated mass flowmeter and comparing them to the test setpoints and the values displayed by the GC (if applicable).

Configuration Details

Name: 7890
Front UECD

Setpoint Flow Type: Makeup 25.0 mL/min

Measurements and Results

Time	Flow
10:41	24.8 mL/min

Accuracy: 0.2 mL/min
Agilent Recommended: <= 10.0 % setpoint (2.5 ml/min)
Limit is percentage of setpoint or 0.5 ml/minute, whichever is largest.

Setpoint Status: Pass Runs: 1

Overall Detector Flow Accuracy Test Status

Pass

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GC Oven Temperature Accuracy

Purpose

This test uses a calibrated digital thermometer to determine the accuracy of the GC oven. Accuracy is calculated as the absolute difference between the measured temperature and setpoint.

Configuration Details

Name: 7890

Setpoint Temperature: 230.0 °C
Zone: Oven

Measurements and Results

Probe: A single probe is used for this service

Time	Temperature
10:50	230.3 °C

Accuracy: 0.3 °C
Agilent Recommended: >= -1.0 % setpoint in K (-5.0 °C)
<= 1.0 % setpoint in K (5.0 °C)

Setpoint Status: Pass Runs: 1

Setpoint Temperature: 100.0 °C
Zone: Oven

Measurements and Results

Probe: A single probe is used for this service

Time	Temperature
10:55	100.2 °C

Accuracy: 0.2 °C
Agilent Recommended: >= -1.0 % setpoint in K (-3.7 °C)
<= 1.0 % setpoint in K (3.7 °C)

Setpoint Status: Pass Runs: 1

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Inlet Pressure Decay

Purpose

This test demonstrates the pressure integrity of the GC inlet (with a valve controlled injection system, if applicable) and all flows controlled by the GC inlet pneumatics.

Configuration Details

Name: 7890
Front SSL

Setpoint Pressure: 25.0 psi

Measurements

Initial Pressure: 25.0 psi
Final Pressure: 24.9 psi

Results

Pressure Change: -0.1 psi /5 minutes
Agilent Recommended: >= -2.0 and <= 0.5

Setpoint Status: Pass Runs: 1

Overall Inlet Pressure Decay Test Status

Pass

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Inlet Pressure Accuracy

Purpose

This test uses a digital calibrated manometer to demonstrate the ability of the system to provide accurate pressure to the head of the column. Accuracy is calculated as the absolute difference between the measured pressure and setpoint.

Configuration Details

Name: 7890
Front SSL

Setpoint Inlet Pressure: 25.0 psi

Measurements

Reading: 25.0 psi

Results

Accuracy: 0.0 psi
Agilent Recommended: <= 1.2

Setpoint Status: Pass

Overall Inlet Pressure Accuracy Test Status

Pass

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Overall GC Oven Temperature Accuracy Test Status

Pass

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GC Oven Temperature Stability

Purpose

This test uses a calibrated digital thermometer to determine the stability of the oven temperature. Stability is expressed as the delta between the highest and lowest measured temperatures.

Configuration Details

Name: 7890

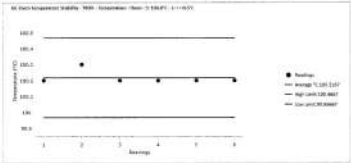
Setpoint Temperature: 100.0 °C
Zone: Oven

Measurements **Results**

Probe: A single probe is used for this service

	Time	Temperature				
1.	10:55	100.2 °C	Average:	100.2 67 °C
2.	10:57	100.3	High:	100.3 °C
3.	11:01	100.2	Low:	100.2 °C
4.	11:03	100.2	Stability:	0.1 °C
5.	11:05	100.2	Agilent Recommended:	<= 0.5
6.	11:07	100.2		

Setpoint Status: Pass Runs: 1



Overall GC Oven Temperature Stability Test Status

Pass

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Detector Flow Accuracy

Purpose

Detector flow accuracy is determined by measuring the flows with a calibrated mass flowmeter and comparing them to the test setpoints and the values displayed by the GC (if applicable).

Configuration Details

Name: 7890
Back FID

Setpoint Flow Type: Fuel 30.0 mL/min

Measurements and Results

Time	Flow
10:02	30.1 mL/min

Accuracy: 0.1 mL/min
Agilent Recommended: <= 10.0 % setpoint (3.0 ml/min)
Limit is percentage of setpoint or 0.5 ml/minute, whichever is largest.

Setpoint Status: Pass Runs: 1

Setpoint Flow Type: Oxidizer 400.0 mL/min

Measurements and Results

Time	Flow
10:10	396.4 mL/min

Accuracy: 3.6 mL/min
Agilent Recommended: <= 10.0 % setpoint (40.0 ml/min)
Limit is percentage of setpoint or 0.5 ml/minute, whichever is largest.

Setpoint Status: Pass Runs: 1

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Setpoint Flow Type: Makeup 25.0 mL/min

Measurements and Results

Time	Flow
10:23	24.8 mL/min

Accuracy: 0.2 mL/min
Agilent Recommended: <= 10.0 % setpoint (2.5 ml/min)
Limit is percentage of setpoint or 0.5 ml/minute, whichever is largest.

Setpoint Status: Pass Runs: 1

Overall Detector Flow Accuracy Test Status

Pass

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Analyzed Data Path: F:\ACE 2.53\Agilent_ACE\Sessions\saenguthai.tarak\OQ_UAE_TOX.007\OQ\Tests\GcNd_0_0\GcNd_0_0_1\PreviousRun\Run1

Acquisition operator: Saenguthai Tarak

Acquisition method: OQ_GC_Back_ND.M

Data file analyzed for this test: ND_FID_Back01.D

Acquisition Date: 10-Feb-22, 12:31:04

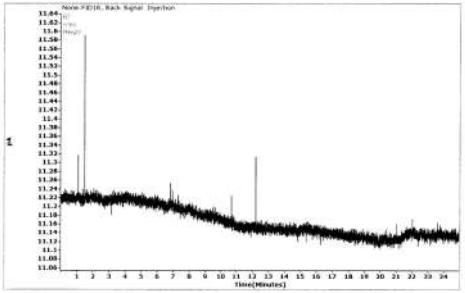
Noise Type: ASTM

Noise Value: 0.05709

Noise start time: 3.0

Noise duration: 20.0

Drift Value: 0.30535



Overall Noise and Drift Test Status

Pass

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Injection Precision

Purpose

This test uses a traceable standard to determine injection precision. The mean, standard deviation, and % RSD of six standard injections are calculated.

Sequence

The sequence has two or eight lines depending upon whether you inject 7 times from the same vial or use 7 separate vials.

Evaluation standard, 1 injection (system equilibration)
Evaluation standard, 1 injection (6 of these)
Sample blank, 1 injection (applies only if carry over is run immediately after precision)

Configuration Details

Tested Combination1 Front SSL / Back FID
Injection Tower

Name: 7683A

Setpoint Injection Volume on Column: 1.0 uL

Conditions

Y-Axis Unit: pA

Configuration

Sample: FID MDL Std Kit, 5188-5372

Evaluated Compound: Sample Peak

Evaluation Standard Concentration: 100 % (from Certificate of Analysis)

Measurements

Area		Retention Time	
11034.75	pA*s	0.07556	minutes
10966.46		0.07472	
10976.09		0.07487	
10989.24		0.07567	
11016.37		0.07558	
10915.54		0.07575	

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Scouting Run

Purpose

This test is used to determine the chromatograms for presence of expected peaks, sufficient run time, and proper integration events prior to the start of the qualification runs.

Sequence

The sequence has one line to perform a single injection of the evaluation standard.

Evaluation standard, 1 injection

Configuration Details

Tested Combination1 Front SSL / Back FID
Injection Tower

Name: 7683A

Setpoint Injection Volume on Column: 1.0 uL

Conditions

Y-Axis Unit: pA

Configuration

Sample: FID MDL Std Kit, 5188-5372

Evaluated Compound: Sample Peak

Evaluation Standard Concentration: 100 % (from Certificate of Analysis)

Measurements

Does the run include sufficient flat baseline for the SN test? Yes

Noise start time for Signal to Noise (minutes): 0

Run time for Signal to Noise (minutes): 5.5

Run time for tests not requiring extra noise interval (minutes): 1

Setpoint Status: Completed Runs: 1

Data Audit Log

Host name: LAPTOP-CQ3SKOMV

Original Data Path: E:\OQ2022

Analyzed Data Path: F:\ACE 2.53\Agilent_ACE\Sessions\saenguthai.tarak\OQ_UAE_TOX.007\OQ\Tests\GcScout_0_0\GcScout_0_0_1\PreviousRun\Run1

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Acquisition operator: Saenguthai Tarak

Acquisition method: OQ_GC_Back_SC.M

Data file analyzed for this test: SC_FID_Back01.D

Acquisition Date: 10-Feb-22, 12:22:55

Integration Parameters :

Type of Integration : Injection

Integration Count 1

Optional Values :

Baseline Correction Mode: Advanced

Initial Slope Sensitivity: 10

Initial Peak Width: 0.01

Initial Area Reject: 0

Initial Height Reject: 100

Timed Event Table :

Integration Type	Value	Time
Integration	Off	0
Integration	On	0.015
Integration	Off	0.15

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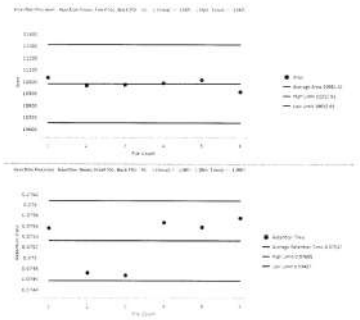
Results	Area		Retention Time	
Average:	10983.41	pA*s	0.07532	minutes
STD Deviation:	41.56665	pA*s	0.00049	minutes
RSD:	0.38	%	0.65	%
Agilent Recommended:	<= 3.00		<= 1.00	
Status:	Pass		Pass	

Setpoint Status: Pass Runs: 1



Data Audit Log

Host name: LAPTOP-CQ3SKOMV

Original Data Path: E:\OQ2022\OQ2022 2022-02-10 13-02-14

Analyzed Data Path: F:\ACE 2.53\Agilent_ACE\Sessions\saenguthai.tarak\OQ_UAE_TOX.007\OQ\Tests\Gclp_0_0\Gclp_0_0_1\PreviousRun\Run1

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Acquisition operator: Saenguthai Tarak

Acquisition method: OQ_GC_Back_Pre.M

Data file analyzed for this test: OQ_GC7890_FID_Pre0102.D

Acquisition Date: 10-Feb-22, 13:05:04

Integration Parameters :

Type of Integration : Injection

Integration Count 1

Optional Values :

Baseline Correction Mode: Advanced

Initial Slope Sensitivity: 10

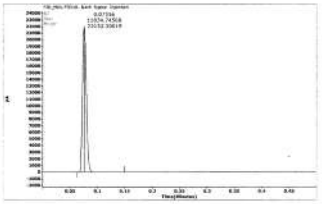
Initial Peak Width: 0.01

Initial Area Reject: 0

Initial Height Reject: 100

Timed Event Table :

Integration Type	Value	Time
Integration	Off	0
Integration	On	0.015
Integration	Off	0.15



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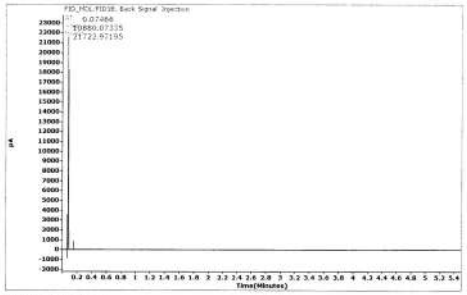

Overall Scouting Run Status

Completed

(Completed is expressed as Pass in the Test Summary section.)

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Noise and Drift

Purpose

This test determines the noise and drift of the detector signal. The base signal is recorded at the beginning of the test, noise is calculated as the average peak-to-peak noise in a number of signal segments, and drift is calculated as the slope of the linear regression for the signal.

Sequence

Line 1: Blank run, 1 injection

Configuration Details

Tested Combination1 Front SSL / Back FID

Name: 7890

Setpoint Base Signal: 11.2 pA

Base signal is not evaluated and for recording purposes only.

Conditions

Noise Evaluation Start Time: 3.0 min

Noise Evaluation Duration: 20.0 min

Sample: Blank run

Oven Temperature: 100.0 °C

Configuration

Y-Axis Unit: pA

Results	ASTM Noise	Drift
	pA	pA/Hr
	0.06	0.31
Agilent Recommended:	<= 0.10	<= 2.50
Status:	Pass	Pass

After data is processed, test-specification limits on this form are rescaled for the CDS used to collect data.

Setpoint Status: Pass Runs: 1

Data Audit Log

Host name: LAPTOP-CQ3SKOMV

Original Data Path: E:\OQ2022

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Host name: LAPTOP-CQ3SKOMV

Original Data Path: E:\OQ2022\OQ2022 2022-02-10 13-02-14

Analyzed Data Path: F:\ACE 2.53\Agilent_ACE\Sessions\saengruthai.tarak\OQ_UAE_TOX.007\OQ\Tests\GcSn_0_0\GcSn_0_0_1\PreviousRun\Run1

Acquisition operator: Saengruthai Tarak

Acquisition method: OQ_GC_Back_SC.M

Data file analyzed for this test: OQ_GC7890_FID_SN011.D

Acquisition Date: 10-Feb-22, 13:25:38

Integration Parameters :

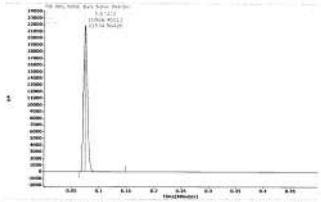
Type of Integration :	Injection	
Integration Count	1	
Optional Values :		
Baseline Correction Mode:	Advanced	
Initial Slope Sensitivity:	10	
Initial Peak Width:	0.01	
Initial Area Reject:	0	
Initial Height Reject:	100	
Timed Event Table :		
Integration Type	Value	Time
Integration	Off	0
Integration	On	0.015
Integration	Off	0.15

Acquisition operator: Saengruthai Tarak

Acquisition method: OQ_GC_Back_Pre.M

Data file analyzed for this test: OQ_GC7890_FID_Pre0103.D

Acquisition Date: 10-Feb-22, 13:08:35

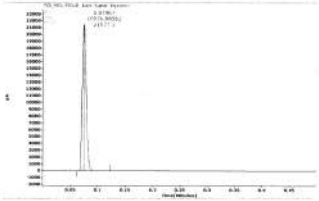


Acquisition operator: Saengruthai Tarak

Acquisition method: OQ_GC_Back_Pre.M

Data file analyzed for this test: OQ_GC7890_FID_Pre0104.D

Acquisition Date: 10-Feb-22, 13:08:09

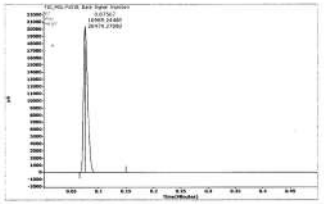


Acquisition operator: Saengruthai Tarak

Acquisition method: OQ_GC_Back_Pre.M

Data file analyzed for this test: OQ_GC7890_FID_Pre0105.D

Acquisition Date: 10-Feb-22, 13:09:41

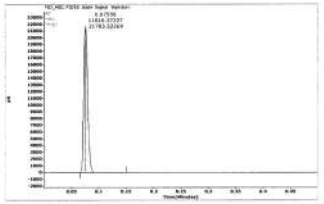


Acquisition operator: Saengruthai Tarak

Acquisition method: OQ_GC_Back_Pre.M

Data file analyzed for this test: OQ_GC7890_FID_Pre0106.D

Acquisition Date: 10-Feb-22, 13:11:12

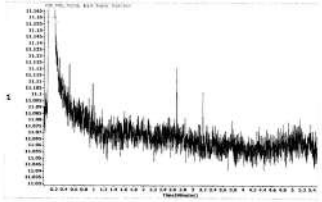


Acquisition operator: Saengruthai Tarak

Acquisition method: OQ_GC_Back_SC.M

Data file analyzed for this test: OQ_GC7890_FID_SN011.D

Acquisition Date: 10-Feb-22, 13:25:38



Overall Signal to Noise Test Status

Pass

Scouting Run

Purpose

This test is used to determine the chromatogram for presence of expected peaks, sufficient run time, and proper integration events prior to the start of the qualification runs.

Sequence

The sequence has one line to perform a single injection of the evaluation standard.

Evaluation standard, 1 injection

Configuration Details

Tested Combination2	Front	SSL	/ Front	UECD
	Injection Tower			
Name:	7683A			

Setpoint Injection Volume on Column: 1.0 uL

Conditions

Y-Axis Unit: Hz

Configuration

Sample: ECD Std Kit, 18713-60040

Evaluated Compound: Lindane

Evaluation Standard Concentration: 0.033 mg/L (from Certificate of Analysis)

Measurements

Does the run include sufficient flat baseline for the SN test? Yes

Noise start time for Signal to Noise (minutes): 1

Run time for Signal to Noise (minutes): 14.5

Run time for tests not requiring extra noise interval (minutes): 1

Setpoint Status: Completed Runs: 1

Data Audit Log

Host name: LAPTOP-CQ3SKOMV

Original Data Path: E:\OQ2022

Analyzed Data Path: F:\ACE 2.53\Agilent_ACE\Sessions\saengruthai.tarak\OQ_UAE_TOX.007\OQ\Tests\GcScout_1_0\GcScout_1_0_1\PreviousRun\Run1

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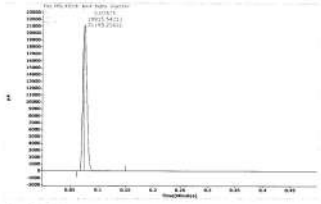
Acquisition operator: Saengruthai Tarak

Acquisition method: OQ_GC_Back_Pre.M

Data file analyzed for this test: OQ_GC7890_FID_Pre0107.D

Acquisition Date: 10-Feb-22, 13:12:43



Overall Injection Precision Test Status

Pass

Signal to Noise

Purpose

This test uses a traceable standard to determine signal to noise.

Sequence:

Line 1: Evaluation standard, 1 injection

Configuration Details

Tested Combination1	Front	SSL	/ Back	FID
	Injection Tower			
Name:	7890			

Setpoint

Conditions

Injection Volume on Column: 1.0 uL

Noise Evaluation Start Time/Duration: 4 min. / 1.0 min.

Configuration

Y-Axis Unit: pA

Sample: FID MDL Std Kit, 5188-5372

Evaluated Compound: Sample Peak

Evaluation Standard Concentration: 100 % (Certificate of Analysis)

Measurements

Noise (Type/Value): ASTM / 0.02835 pA

Retention Time of Evaluated Peak: 0.07534 minutes

Peak Height (Uncorrected/Corrected): 22253.38 pA / 22253.38 pA

(Corrected for attenuation and differences between nominal and reported concentration; analog data is corrected for the applied signal reduction [range/attenuation].)

Results

Signal to Noise: 784901

Agilent Recommended: >= 300000

ACE uses unrounded values in its calculations; only the final result is rounded. Therefore, for high signal-to-noise ratios (high peaks/low noise), ACE calculations may appear to differ slightly from your manual calculations using the reported height and noise.

Setpoint Status: Pass Runs: 1

Data Audit Log

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Injection Precision

Purpose

This test uses a linearity standard to determine injection precision. The mean, standard deviation, and % RSD of six standard injections are calculated.

Sequence

The sequence has two or eight lines depending upon whether you inject 7 times from the same vial or use 7 separate vials.

Evaluation standard, 1 injection (system equilibration)
Evaluation standard, 1 injection (6 of these)
Sample blank, 1 injection (applies only if carry over is run immediately after precision)

Configuration Details

Tested Combination2	Front	SSL	/ Front	UECD
	Injection Trayer			
Name:	7683A			

Setpoint: Injection Volume on Column: 1.0 uL

Conditions

Y-Axis Unit: Hz

Configuration

Sample: ECD Std Kit, 1871348040

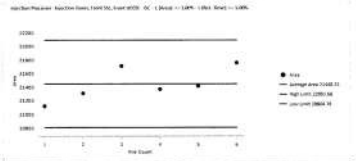
Evaluated Compound: Lindane

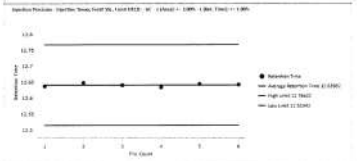
Evaluation Standard Concentration: 0.030 mg/L (from Certificate of Analysis)

Measurements:	Area	Retention Time
	21108.41 Hz*s	12.83919 minutes
	21308.77	12.84934
	21712.17	12.83949
	21536.67	12.83275
	21417.45	12.84277
	21756.90	12.84110

Results	Area		Retention Time	
Average:	21446.23	Hz*s	12.83982	minutes
STD Deviation:	245.2254	Hz*s	0.00490	minutes
RSD:				
Agilent Recommended:	1.14	%	0.04	%
	<= 3.00		<= 1.00	
Status:	Pass		Pass	

Setpoint Status: Pass Runs: 1





Data Audit Log

Host name: LAPTOP-CQ3SKOMV

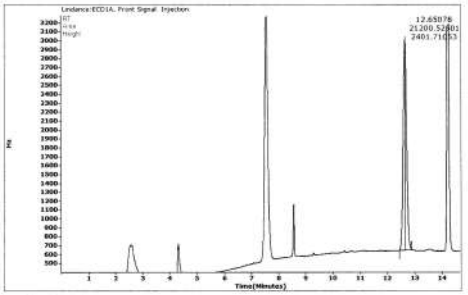
Original Data Path: E:\OQ2022

Analyzed Data Path: F:\ACE 2.53\Agilent_ACE\Sessions\saenguthai.tarak\OQ_UAE_TOX.007\OQ\Tests\Gclp_1_0\Gclp_1_0_1\PreviousRun\Run1

Acquisition operator:	Saenguthai Tarak
Acquisition method:	OQ_GC_Front_SC.M
Data file analyzed for this test:	OQ_GC7890_uECD_SC01.D
Acquisition Date:	11-Feb-22, 12:19:11

Integration Parameters :

Type of Integration :	Injection	
Integration Count	3	
Optional Values :		
Baseline Correction Mode:	Advanced	
Initial Slope Sensitivity:	10	
Initial Peak Width:	0.01	
Initial Area Reject:	0	
Initial Height Reject:	100	
Timed Event Table :		
Integration Type	Value	Time
Integration	OFF	0
Integration	ON	12
Integration	OFF	13



Overall Scouting Run Status

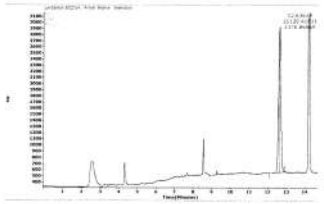
Completed

(Completed is expressed as Pass in the Test Summary section.)

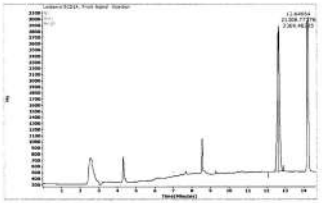
Acquisition operator:	Saenguthai Tarak
Acquisition method:	OQ_GC_Front_SC.M
Data file analyzed for this test:	OQ_GC7890_uECD_Pre0103.D
Acquisition Date:	11-Feb-22, 12:36:39

Integration Parameters :

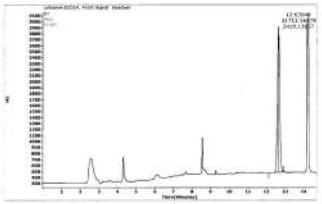
Type of Integration :	Injection	
Integration Count	1	
Optional Values :		
Baseline Correction Mode:	Advanced	
Initial Slope Sensitivity:	10	
Initial Peak Width:	0.08	
Initial Area Reject:	0	
Initial Height Reject:	100	
Timed Event Table :		
Integration Type	Value	Time
Integration	Off	0
Integration	On	12
Integration	Off	13.5



Acquisition operator:	Saenguthai Tarak
Acquisition method:	OQ_GC_Front_SC.M
Data file analyzed for this test:	OQ_GC7890_uECD_Pre0104.D
Acquisition Date:	11-Feb-22, 12:54:07



Acquisition operator:	Saenguthai Tarak
Acquisition method:	OQ_GC_Front_SC.M
Data file analyzed for this test:	OQ_GC7890_uECD_Pre0105.D
Acquisition Date:	11-Feb-22, 13:11:33



เอกสารไม่ควบคุม

Noise and Drift

Purpose

This test determines the noise and drift of the detector signal. The base signal is recorded at the beginning of the test, noise is calculated as the average peak-to-peak noise in a number of signal segments, and drift is calculated as the slope of the linear regression for the signal.

Sequence

Line 1: Blank run, 1 injection

Configuration Details

Tested Combination2	Front	SSL	/ Front	UECD
Name:	7890			

Setpoint Base Signal: 282.3 Hz

Base signal is not evaluated and for recording purposes only.

Conditions

Noise Evaluation Start Time:	3.0	min
Noise Evaluation Duration:	20.0	min
Sample:	Blank run	
Oven Temperature:	100.0	°C

Configuration

Y-Axis Unit: Hz

Results	ASTM Noise	Drift
	Hz	Hz/Hr
	0.60	13.19
Agilent Recommended:	<= 3.00	<= 15.00
Status:	Pass	Pass

After data is processed, test-specification limits on this form are rescaled for the CDS used to collect data.

Setpoint Status: Pass Runs: 1

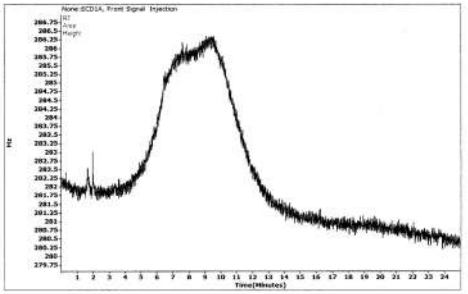
Data Audit Log

Host name: LAPTOP-CQ3SKOMV

Original Data Path: E:\OQ2022

Analyzed Data Path: F:\ACE 2.53\Agilent_ACE\Sessions\saenguthai.tarak\OQ_UAE_TOX.007\OQ\Tests\GcNd_1_0\GcNd_1_0_1\PreviousRun\Run1

Acquisition operator:	Saenguthai Tarak
Acquisition method:	OQ_GC_Front_ND.M
Data file analyzed for this test:	ND_uECD_Front12.D
Acquisition Date:	11-Feb-22, 15:05:13
Noise Type:	ASTM
Noise Value:	0.59728
Noise start time:	3.0
Noise duration:	20.0
Drift Value:	13.18660



Overall Noise and Drift Test Status

Pass

เอกสารไม่ควบคุม

Acquisition operator: Saenguthai Tarak
Acquisition method: OQ_GC_Front_SC.M
Data file analyzed for this test: OQ_GC7890_uECD_SN01.D
Acquisition Date: 11-Feb-22, 14:21:21

Integration Parameters :

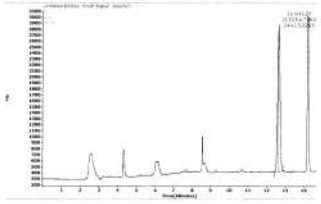
Type of Integration : Injection
Integration Count 1

Optional Values :

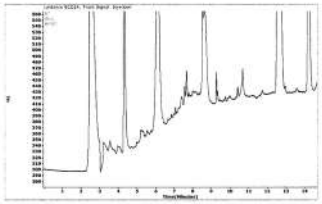
Baseline Correction Mode: Advanced
Initial Slope Sensitivity: 10
Initial Peak Width: 0.01
Initial Area Reject: 0
Initial Height Reject: 100

Timed Event Table :

Integration Type	Value	Time
Integration	Off	0
Integration	On	12
Integration	Off	13.5



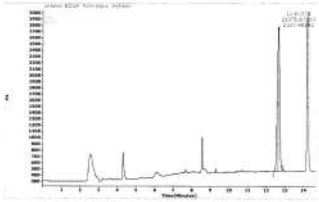
Acquisition operator: Saenguthai Tarak
Acquisition method: OQ_GC_Front_SC.M
Data file analyzed for this test: OQ_GC7890_uECD_SN01.D
Acquisition Date: 11-Feb-22, 14:21:21



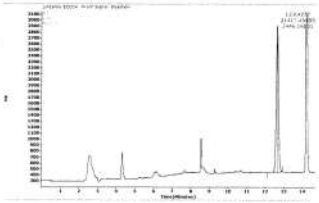
Overall Signal to Noise Test Status

Pass

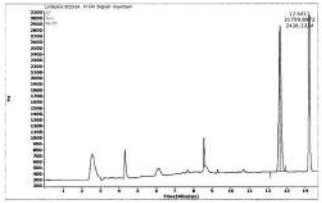
Acquisition operator: Saenguthai Tarak
Acquisition method: OQ_GC_Front_SC.M
Data file analyzed for this test: OQ_GC7890_uECD_Pre0106.D
Acquisition Date: 11-Feb-22, 13:29:00



Acquisition operator: Saenguthai Tarak
Acquisition method: OQ_GC_Front_SC.M
Data file analyzed for this test: OQ_GC7890_uECD_Pre0107.D
Acquisition Date: 11-Feb-22, 13:46:26



Acquisition operator: Saenguthai Tarak
Acquisition method: OQ_GC_Front_SC.M
Data file analyzed for this test: OQ_GC7890_uECD_Pre0108.D
Acquisition Date: 11-Feb-22, 14:03:54



Overall Injection Precision Test Status

Pass

Declaration of Change Control

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

Attachments

Training requirements note: The delivery engineer attaches an ACE technique-specific training certificate to the Equipment Qualification Report (EQR). Obtaining ACE technique-specific certification includes pre-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.

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EQR	Material	Certificate of Analysis ECD std kit, 18713-60040	80
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เอกสารไม่ควบคุม

Signal to Noise

Purpose

This test uses a traceable standard to determine signal to noise.

Sequence:

Line 1: Evaluation standard, 1 injection

Configuration Details

Tested Combination2 Front SSL Front UECD
Injection Tower
Name 7890

Setpoint

Conditions

Injection Volume on Column: 1.0 uL
Noise Evaluation Start Time/Duration: 1 min / 1.0 min

Configuration

Y-Axis Unit: Hz
Sample: ECD Std kit, 18713-60040
Evaluated Compound: Lindane
Evaluation Standard Concentration: 0.030 mg/L (Certificate of Analysis)

Measurements

Noise (Type/Value): ASTM / 1.08610 Hz
Retention Time of Evaluated Peak: 12.64129 minutes
Peak Height (Uncorrected/Corrected): 244.3.523 Hz / 2443.523 Hz
(Corrected for attenuation and differences between nominal and reported concentration, analog data is corrected for the applied signal reduction (range/attenuation).)

Results

Signal to Noise: 2250
Agilent Recommended: >= 1500
ACE uses unrounded values in its calculations; only the final result is rounded. Therefore, for high signal-to-noise ratios (high peaks/low noise), ACE calculations may appear to differ slightly from your manual calculations using the reported height and noise.

Setpoint Status: Pass Run#: 1

Data Audit Log

Host name: LAPTOP-CQ3SKDMV
Original Data Path: E:\OQ2022
Analyzed Data Path: F:\ACE 2.5\Agilent_ACE\Sessions\saenguthai.tarak\OQ_UAE_TOX.007\OQ\Tests\GcSn_1_0\GcSn_1_0_1\PreviousRun\Run1

เอกสารไม่ควบคุม

General

Document Name: Operator's training certificate and qualifications

Agilent Technologies

Certificate of Completion

Learner Name:	Sangathai Tank
Title Of Course:	AN-ASP/CE/CSE-GC-1-001-M: 7890/7820 GC and OL GC Standalone Chemstation IAP/ Service
Completion Date:	November 23, 2014
Certified By Company:	Learning at Agilent

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

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

General

Document Name: Operator's training certificate and qualifications

Agilent Technologies

Certificate of Completion

Learner Name:	Sangathai Saeng Tank
Title Of Course:	AN-ASP/CE/CSE-GC-1-001-M: 7890/7820 GC and OL GC Standalone Chemstation IAP/ Service
Completion Date:	November 23, 2014
Certified By Company:	Learning at Agilent

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General

Document Name: ACE Self Qualification Certificate

Agilent Technologies

Agilent Compliance Engine Self Qualification

Date: August 16, 2021 11:09:22 AM

Drive Serial #: 9FC90045 **Platform Revision:** ACE 3.11

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

Technique Type	Tests Completed	Result
Atomic Absorption	7	Conforms
Capillary Electrophoresis	10	Conforms
Dissolution	6	Conforms
Gas Chromatography - GCMS	17	Conforms
Gel Permeation Chromatography	8	Conforms
Gas Chromatography	28	Conforms
Emission Spectroscopy	3	Conforms
ICP-MS	6	Conforms
Infrared Spectroscopy	7	Conforms
Liquid Chromatography	17	Conforms
Liquid Chromatography - LCMS	8	Conforms
Microfluidics	18	Conforms
Sample Preparation - Gas Chromatography	9	Conforms
Sample Preparation - Liquid Chromatography	8	Conforms
Supercritical Fluid Chromatography	15	Conforms
Software	8	Conforms
UV-Vis Spectrophotometer	10	Conforms

Overall Qualification Status

Conforms

General

Document Name: Operator's training certificate and qualifications

Agilent Technologies

Certificate of Completion

Learner Name:	Sangathai Saeng Tank
Title Of Course:	AN-CE-SS-II-050-A: ACE 3.X User Update Training
Completion Date:	July 9, 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.

Tools

Document Name: Certificate of Calibration Gas Flowmeter

Trescal

Certificate of Calibration

SUPPLEMENTARY TO CERTIFICATE OF CALIBRATION PSYP-21048578

Cert. No. PSYP- 21048578(S)

Page 1 of 2

Instrument	Precision Gas Flow Meter
Date of Calibration	25 Aug 2021
Recalibration Date	24 Aug 2022
Condition of Instrument Before Calibration	Good Physical Condition
After Calibration	Calibrated as Requested by Customer
Location of Calibration	Trescal Laboratory

Reference Standard Used / Reference Instrument	Due Date
Flow Calibrator	04 Jan 2022
Flow Calibrator	15 Dec 2021
Flow Calibrator	19 Mar 2022

Calibrated By

Approved Signatory

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

TRESCAL (MALAYSIA) SDN. BHD.

Document Name: Certificate of Calibration Gas Flowmeter

TERMS AND CONDITIONS

Trescal

CALIBRATION SOLUTIONS TO IMPROVE YOUR PERFORMANCE

เอกสารไม่ควบคุม

General

Document Name: Operator's training certificate and qualifications

Agilent Technologies

Certificate of Completion

Learner Name:	Sangathai Tank
Title Of Course:	AN-CE-GC-II-022-A: Advanced GC Detectors Application and Troubleshooting Labs
Completion Date:	November 25, 2014
Certified By Company:	Learning at Agilent

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

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

General

Document Name: Operator's training certificate and qualifications

Agilent Technologies

Certificate of Completion

Learner Name:	Sangathai Saeng Tank
Title Of Course:	AN-CE-NDS-2-229-A: OpenLab CDS EZChrom Edition Shimadzu GC 2010/2014 RC.NET Driver - selfpaced
Completion Date:	March 9, 2015
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.

เอกสารไม่ควบคุม

Document Name: Certificate of Calibration Manometer

CERTIFICATE OF CALIBRATION

No: CS214115
Date of Issue: 01st September 2021

Digital Manometer
Serial No: 590281297

Page : 2 of 2
Calibration Start Date : 31st August 2021
Calibration End Date : 31st August 2021

Results of Calibration
The results of the calibration are shown in the below table. The expanded uncertainties of the measurement are at a level of confidence at approximately 95% with a coverage factor "k" as mentioned below.

Calibration Results (As Found)

Applied Pressure (psi)	UUT Indicated Values (psi)	Corrections (psi)	Uncertainty (psi)	k-Factor
0.0	0.0	0.0	NA	NA
25.0	25.0	0.0	0.1	2.00
100.0	100.2	-0.2	0.1	2.00
25.0	25.0	0.0	0.1	2.00
0.0	0.0	0.0	NA	NA

Calibration Results (As Left)

Applied Pressure (psi)	UUT Indicated Values (psi)	Corrections (psi)	Uncertainty (psi)	k-Factor
0.0	0.0	0.0	NA	NA
25.0	25.0	0.0	0.1	2.00
100.0	100.2	-0.2	0.1	2.00
25.0	25.0	0.0	0.1	2.00
0.0	0.0	0.0	NA	NA

* Customer's specification tolerance : ± 0.2 % of full scale.
* The accuracy of the instrument was found to be within ± 0.2% of maximum scale value.
* "The results reported herein have been performed in accordance with the terms of accreditation under the Singapore Accreditation Council".

Remarks:
1. No Adjustment/Offset were made during calibration.
2. Although there was no adjustment was made to the UUT, customer instructed to reflect "As Found" and "As Left" results on calibration certificate.

Leslie Chuah
Calibration Officer

Document Name: Certificate of Calibration Manometer

Sombat Sriyoom
22 Sep 2021

Document Name: Certificate of Calibration Gas Flowmeter

Trescal

Certificate of Calibration

SUPPLEMENTARY TO CERTIFICATE OF CALIBRATION PSYP-21048578
Date of Issue : 23 Sep 2021
Control No. CA4838C

Cert. No. PSYP-21048578(S)
Page 2 of 2

Instrument Calibrated

Resolution 0.1 sccm
Readability 0.1
Calibration Gas Air

Standard Temperature 25 °C
Standard Pressure 14.696 psi abs
Specification
± 5.0 % of reading (0 sccm to 5 sccm)
± 2.0 % of reading (5 sccm to 500 sccm)
or 0.2 sccm (whichever greater)

REFERENCE READ	UUT READ	ACCURACY TEST CORRECTION AS LEFT	AS FOUND	SPECIFICATION ±	UNCERTAINTY ±
0.00	0.0	0.0	0.0	0.2	-
2.00	1.9	0.1	0.1	0.2	0.1
50.0	49.0	1.0	1.0	1.0	0.4
100.0	98.2	1.8	1.8	2.0	0.7
500	490.4	9.6	9.6	10.0	4.0

k = 2

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

TRESCAL (MALAYSIA) SDN. BHD.

Document Name: Certificate of Calibration Gas Flowmeter

STANDARD CONDITIONS

Trescal

CALIBRATION SOLUTIONS TO IMPROVE YOUR PERFORMANCE

Sombat Sriyoom
1 Oct 2021

Tools

Document Name: Certificate of Calibration Thermometer

ISOLAB
Excellence In Calibration

CERTIFICATE OF CALIBRATION

No : CS214118
Date of Issue: 20th August 2021

Issue By ISOLAB (SINGAPORE) PTE LTD

Requested by : Agilent Technologies (Thailand) Ltd
U Chu Liang Building,33/F Unit A,D
968 Rama IV Road,Silom,Bangrak,
Bangkok 10500 Thailand

Job Order No : 211774
Ambient Temperature : (22 ± 2) °C
Relative Humidity : (55 ± 10) % Relative Humidity
Page : 1 of 2

Descriptions
Instrument : Digital Thermometer
Brand : Fluke
Model : 51 II
Serial No : 14670616
Calibration Range : (0 to 350) °C @ Type K Simulation for Channel 1
Calibration Start Date : 19th August 2021
Calibration End Date : 19th August 2021
Next Due Date : 19th August 2022

Isolab (S) Pte Ltd and its practices are in compliance with ISO/IEC 17025: 2017. The Quality System practice is in accordance with the Quality Standard ISO 9001.

Method of Calibration
The Digital Thermometer has been calibrated at ISOLAB's laboratory with respect to above ambient conditions also in accordance to the calibration procedure STCP-002-R4. The Digital Thermometer was calibrated by comparison with below mentioned reference standards. The reference standards are traceable to national measurement standards maintained at National Metrology Centre (NMC-Singapore). The calibration was performed in terms of the International Temperature Scale of 1990 (ITS-90).

The following reference standards were used during the calibration:

S.N	Reference Instruments / Equipments	Serial Number	CAL Reference	Next Calibration Due Date
i.	Reference Calibrator	8130082	[illegible]	09th March 2022
ii.	Reference Thermocouple Type K Cold Junction Sensor	379017	TL511706	01st March 2022

Calibrated By: Gerald Quek, Calibration Officer
Approved By: Thanish Nagappan, Approved Signatory

* "The results reported herein have been performed in accordance with the terms of accreditation under the Singapore Accreditation Council".
This certificate may not be reproduced other than in full except with prior written approval of ISOLAB.

Document Name: Certificate of Calibration Thermometer

Note:

1. This calibration / test certificate is prepared based upon the item / artifact submitted, for the calibration and testing services required and the conditions under which the calibration and testing services are performed. [illegible]
2. Unless and otherwise requested, a calibration report / test report shall contain only technical results by means of calibration data. [illegible]
3. Reproduction and transmission of calibration and test certificates by email, fax and or by any other means of soft copies are totally restricted and controlled by ISOLAB (S) PTE LTD's quality management. [illegible]
4. Additional copies of this calibration and test certificates are available to the clients and customers at an additional, minimal fee. [illegible]
5. ISOLAB (S) PTE LTD, shall under no circumstances be liable to the clients or its agents or representatives, in contract, including negligence or breach of statutory duties or otherwise for any direct or indirect loss or damage suffered by the clients, its agents or representatives howsoever arising or whether connected with services provided by ISOLAB (S) PTE LTD.
6. ISOLAB (S) PTE LTD, doesn't guarantee of the malfunction or error in measurements or comparisons with other equipment's and instruments with respect to calibration data provided at the time of calibration. [illegible]
7. ISOLAB (S) PTE LTD, values and honours the inter-laboratory comparison data(s) with same artefact (Instruments and equipment's) are calibrated with same scope of accreditation schedule issued by SAC-SINGLAS. [illegible]
8. ISOLAB (S) PTE LTD, doesn't guarantee the integrity of calibration data, if the instruments and equipment's were malfunctioned, repaired, altered, modified and serviced after calibration as a whole or partly. [illegible]
9. ISOLAB (S) PTE LTD and their performance of the calibration of customer's/client's instruments and equipment's with "as and where condition" and does not constitute any responsibilities for old, used, drifted, damaged, under performance of instruments and equipment's with respect to manufacturers or OEM specifications. [illegible]
10. The combined and expanded uncertainties are based on statistical calculations with respect to the guide for uncertainty measurement (GUM, JCGM), and also calibration and measurement capabilities (CMC) assigned by SAC-SINGLAS at the time of calibration. [illegible]

เอกสารไม่ควบคุม

Tools

Document Name: Certificate of Calibration Manometer

ISOLAB
Excellence In Calibration

CERTIFICATE OF CALIBRATION

No: CS214115
Date of Issue: 01st September 2021

Issue By ISOLAB (SINGAPORE) PTE LTD

Requested by : Agilent Technologies (Thailand) Ltd
U Chu Liang Building,33/F Unit A,D
968 Rama IV Road,Silom,Bangrak,
Bangkok 10500 Thailand

Job Order No : 211772
Ambient Temperature : (20 ± 2) °C
Relative Humidity : (55 ± 10) % Relative Humidity
Page : 1 of 2

Descriptions
Instrument : Digital Manometer
Brand : Digitron
Model : 2023P
Serial No : 590281297
Calibration Range : (0 to 100) psi
Medium Used : Air
Calibration Start Date : 31st August 2021
Calibration End Date : 31st August 2021
Next Due Date : 31st August 2022

Isolab (S) Pte Ltd and its practices are in compliance with ISO/IEC 17025: 2017. The Quality System practice is in accordance with the Quality Standard ISO 9001.

Method of Calibration
The Digital Manometer has been calibrated at ISOLAB's laboratory under the ambient conditions stated above according to in-house calibration procedure SPCP-002-R7. The Digital Manometer was calibrated by comparison with reference standard. The reference standard used is traceable to national measurement standards maintained at National Metrology Centre (NMC-Singapore).

The following reference standard was used during the calibration:

S.N	Reference Instruments / Equipments	Serial Number	CAL Reference	Next Calibration Due Date
i.	Reference Indicator	161X020200 & 1673008113	PL003216	03rd March 2022

Calibrated By: Leslie Chuah, Calibration Officer
Approved By: Simon Minerva Jr., Approved Signatory

* "The results reported herein have been performed in accordance with the terms of accreditation under the Singapore Accreditation Council".
This certificate may not be reproduced other than in full except with prior written approval of ISOLab.

Document Name: Certificate of Calibration Manometer

Notes:

1.–10. [illegible]

เอกสารไม่ควบคุม

CERTIFICATE OF CALIBRATION

No : CS214126
Date of Issue: 25th August 2021

Type K Thermocouple Wire Sensor
Serial No: 1467061b/80Fh-P2

Page : 2 of 2
Calibration Start Date : 20th August 2021
Calibration End Date : 25th August 2021

Results of Calibration
The results of the calibration are shown in the below table. The expanded uncertainties of the measurements are at a level of confidence of approximately 95% with a coverage factor "k" as mentioned below.

Calibration Results (As Found)

Actual Temperature (°C)	UUT Average Values (°C)	Corrections (°C)	Uncertainty (°C)	k-Factor
0.0	0.5	-0.5	0.4	2.00
100.0	99.6	0.4	0.3	2.00
230.0	231.5	-1.5	0.3	2.00

Calibration Results (As Left)

Actual Temperature (°C)	UUT Average Values (°C)	Corrections (°C)	Uncertainty (°C)	k-Factor
0.0	0.5	-0.5	0.4	2.00
100.0	99.6	0.4	0.3	2.00
230.0	231.5	-1.5	0.3	2.00

* Manufacturer's Tolerance: Ø±0.2(K) °C = ±2°C
* The user should determine the suitability of this instrument for its intended use.
* *The results reported herein have been performed in accordance with the terms of accreditation under the Singapore Accreditation Council".

Remarks:
1. No Adjustment/Offset were made during calibration.
2. Although there was no adjustment was made to the UUT, customer instructed to reflect "As Found" and "As Left" results on calibration certificate.

Gerald Goh
Calibration Officer

Sentot Triyoumo
22 Sep 2021

CERTIFICATE OF CALIBRATION

No : CS214118
Date of Issue: 20th August 2021

Digital Thermometer
Serial No: 1467061b

Page : 2 of 2
Calibration Start Date : 19th August 2021
Calibration End Date : 19th August 2021

Results of Calibration
The results of the calibration are shown in the below table. The expanded uncertainties of the measurements are at a level of confidence of approximately 95% with a coverage factor "k" as mentioned below.

Channel 1 Measurement (As Found)

Applied Voltage (mV)	Equivalent Temperature (°C)	Average UUT Indicated Values (°C)	Corrections (°C)	Uncertainty (°C)	k-Factor
0.0000	0.0	0.0	0.0	0.2	2.00
4.0960	100.0	100.0	0.0	0.2	2.00
9.3430	230.0	230.0	0.0	0.2	2.00
14.2930	350.0	350.0	0.0	0.2	2.00

Channel 1 Measurement (As Left)

Applied Voltage (mV)	Equivalent Temperature (°C)	Average UUT Indicated Values (°C)	Corrections (°C)	Uncertainty (°C)	k-Factor
0.0000	0.0	0.0	0.0	0.2	2.00
4.0960	100.0	100.0	0.0	0.2	2.00
9.3430	230.0	230.0	0.0	0.2	2.00
14.2930	350.0	350.0	0.0	0.2	2.00

* The user should determine the suitability of this instrument for its intended use.
* *The results reported herein have been performed in accordance with the terms of accreditation under the Singapore Accreditation Council".

Remarks:
1. No Adjustment/Offset were made during calibration.
2. Although there was no adjustment was made to the UUT, customer instructed to reflect "As Found" and "As Left" results on calibration certificate.

Gerald Goh
Calibration Officer

Sentot Triyoumo
22 Sep 2021

CERTIFICATE OF CALIBRATION

ISOLAB
Excellence in Calibration

No : CS214122
Date of Issue: 04th October 2021

Issue By: ISOLAB (SINGAPORE) PTE LTD

Requested by : Agilent Technologies (Thailand) Ltd
U Chu Liang Building,23/F Unit A,B
968 Rama IV Road,Silom,Bangrak
Bangkok 10500 Thailand

Job Order No : 211772
Ambient Temperature : (22 ± 2) °C
Relative Humidity : (55 ± 10) % Relative Humidity
Page : 1 of 2

Descriptions
Instrument : Type K Thermocouple Needle Probe
Brand : N/A
Model : 1500C-CASS-650C-9MGRD
Serial No : 1467061b/80Fh-P2
Immersion : Approximately 230mm
Calibration Range : 0 to 350 °C
Calibration Start Date : 20th September 2021
Calibration End Date : 22th October 2021
Next Due Date : 22th October 2022
Isolab (S) Pte Ltd and its premises are in compliance with ISO/IEC 17025:2017. The Quality System practices is in accordance with the Quality Standard ISO 9001.

Method of Calibration
The Type K Thermocouple Needle Probe has been calibrated at ISOLAB's laboratory under the ambient conditions stated above according to in-house calibration procedure ITCP-004-R6. The Type K Thermocouple Needle Probe was calibrated by comparison with a Reference Sensor in constant temperature bath. The Reference Sensor and Reference Indicator are traceable to national measurement standards maintained in National Metrology Centre (NMC-Singapore), Northern Temperature Primary Laboratory (NTPL, UKAS) and National Physical Laboratory (NPL). The calibration was performed in terms of the International Temperature Scale of 1990 (ITS-90).

The following reference standards were used during the calibration:

S/N	Reference Instruments / Equipments	Serial Number	CAL Reference	Next Calibration Due Date
i.	Reference Sensor	1320054	CI21004-5	21st October 2021
ii.	Reference Indicator	1723974	CI21-00-5	30 June 2022
iii.	Reference Indicator	19-0120-0002	21-06-108	30th June 2022
iv.	Reference Indicator	5930K1	1E-00-064	07 April 2022
v.	Type K Thermocouple Wire	2994-1	1E-01-98	07 March 2022

Calibrated By: Gerald Goh, Calibration Officer
Approved By: Kevin Monteiro, Approved Signatory

* The results reported herein have been performed in accordance with the terms of accreditation under the Singapore Accreditation Council
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ISOLAB (Singapore) Pte Ltd
2 Ang Mo Kio Street 64 Singapore 569057 Tel: (65) 6480 6311 Fax: (65) 6480 6313
Website: www.isolab.com.sg Email: enquiries@isolab.com.sg

Notes:

1. This calibration / test certificate is prepared based upon the item / artefact submitted, for the calibration and testing services required and the conditions under which the calibration and testing services are performed. This certificate is not intended to be representative or similar or equivalent services, or similar or equivalent items and does not constitute and endorsement by ISOLAB (S) PTE LTD of the item or that ISOLAB (S) PTE LTD in anyway doesn't "guarantee" the later performance of the item. The user should determine the suitability of these instruments and equipment's for their intended purpose of use and application in terms of calibration data, correction, accuracy and uncertainties as well. ISOLAB (S) PTE LTD doesn't guarantee any extrapolation of calibration data beyond and outside the calibrated test point range(s).
2. Unless and otherwise requested, a calibration report / test report shall contain only technical results by means of calibration data. Analysis and interpretation of the results and professional opinions and recommendations expressed thereupon, if required shall be clearly indicated on the basis of national or international standards and guidelines before the calibration task is taken up. Any additional requirements to incorporate, such as, professional opinions and recommendations may or may not be accepted by ISOLAB (S) PTE LTD and these additional requirements may require additional testing, data collection and reports subjected to additional charges to be paid by the clients and customers.
3. Reproduction and transmission of calibration and test certificates by email, fax and or by any other means of soft copies are totally restricted and controlled by ISOLAB (S) PTE LTD's quality management. Under any circumstances the calibration and test certificates shall not be reproduced other than in full except with prior and written approval by ISOLAB (S) PTE LTD. The full reproduction under "special circumstances" is only done by ISOLAB (S) PTE LTD in the form of black and white "Certified True Copies" with an attestation by ISOLAB's quality management or respective approved signatories.
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5. ISOLAB (S) PTE LTD, shall under no circumstances be liable to the clients or its agents or representatives, in contract, including negligence or breach of statutory duties or otherwise for any direct or indirect loss or damage suffered by the client, its agents or representatives howsoever arising or whether connected with services provided by ISOLAB (S) PTE LTD.
6. ISOLAB (S) PTE LTD, doesn't guarantee of the malfunction or error in measurements or comparisons with other equipment's and instruments with respect to calibration data provided at the time of calibration. The instruments and equipment's will be returned to clients "as and where condition" upon completion of calibration, and not responsible for non-working of power adapters, battery packs or sub-accessories in the event of calibration.
7. ISOLAB (S) PTE LTD, values and honours the inter-laboratory comparison data(s) with same artefact (instruments and equipment's) are calibrated with same scope of accreditation schedule issued by SAC-SINGLAS. Any other features and functions are not calibrated or tested in the same artefact is not not falls under the responsibilities of ISOLAB. The same conditions are applicable for customers calibration instruments and equipment's as well.
8. ISOLAB (S) PTE LTD, doesn't guarantee the integrity of calibration data, if the instruments and equipment's (when malfunctioned, repaired, altered, modified and serviced after calibration as a whole or partly. The calibration labels and "void and stickers" shall be maintained at all times on the equipment's and instruments.
9. ISOLAB (S) PTE LTD and their performance of the calibration of customer's/client's instruments and equipment's with "as and where condition" and does not constitute any responsibilities for old, used, drilled, damaged, under performance of instruments and equipment's with respect to manufacturers or OEM specifications. If the instruments and equipment's (when within the adjustment capabilities and available options for adjustments, also with customers clear written agreement to make such adjustments, were made, however no guarantee for the inherent drift and non-linearity of the instruments and equipment's will be warranted.
10. The combined and expanded uncertainties are based on statistical calculations with respect to the guide for uncertainty measurement (GUM, JCGM), and also calibration and measurement capabilities (CMC*) assigned by SAC-SINGLAS at the time of calibration. Expanded uncertainties reported in calibration certificates shall be separately added or subtracted with corrections and errors indicated in the calibration and test certificate(s). These conditions shall follow the guidelines and requirements stated in ILAC-G8 Guidelines.

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CERTIFICATE OF CALIBRATION

ISOLAB
Excellence in Calibration

No : CS214126
Date of Issue: 25th August 2021

Issue By: ISOLAB (SINGAPORE) PTE LTD

Requested by : Agilent Technologies (Thailand) Ltd
U Chu Liang Building,23/F Unit A,B
968 Rama IV Road,Silom,Bangrak
Bangkok 10500 Thailand

Job Order No : 211778
Ambient Temperature : (22 ± 2) °C
Relative Humidity : (55 ± 10) % Relative Humidity
Page : 1 of 2

Descriptions
Instrument : Type K Thermocouple Wire Sensor
Brand : N/A
Model : 80PK Probe
Serial No : 1467061b/80PK-P1
Immersion : Approximately 150 mm
Calibration Range : 0 to 230 °C
Calibration Start Date : 20th August 2021
Calibration End Date : 25th August 2021
Next Due Date : 25th August 2022
Isolab (S) Pte Ltd and its premises are in compliance with ISO/IEC 17025:2017. The Quality System practices is in accordance with the Quality Standard ISO 9001.

Method of Calibration
The Type K Thermocouple Wire Sensor has been calibrated at ISOLAB's laboratory under the ambient conditions stated above according to in-house calibration procedure ITCP-004-R6. The Type K Thermocouple Wire Sensor was calibrated by comparison with a Reference Sensor in constant temperature bath. The Reference Sensor and Reference Indicator are traceable to national measurements standards maintained in National Metrology Centre (NMC-Singapore), Northern Temperature Primary Laboratory (NTPL, UKAS) and National Physical Laboratory (NPL). The calibration was performed in terms of the International Temperature Scale of 1990 (ITS-90).

The following reference standards were used during the calibration:

S/N	Reference Instruments / Equipments	Serial Number	CAL Reference	Next Calibration Due Date
i.	Reference Sensor	1320054	CI21004-5	21st June 2021
ii.	Reference Indicator	19-0446-01,1G1,MV02	21-06-108	30th June 2022
iii.	Reference Thermocouple Type K Cold Junction Sensor	17903-7	7L01-1306	01st March 2022

Calibrated By: Gerald Goh, Calibration Officer
Approved By: Thanesh Nagarajan, Approved Signatory

* The results reported herein have been performed in accordance with the terms of accreditation under the Singapore Accreditation Council
This certificate may not be reproduced other than in full except with prior written approval of ISOLAB.

ISOLAB (Singapore) Pte Ltd
2 Ang Mo Kio Street 64 Singapore 569057 Tel: (65) 6480 6311 Fax: (65) 6480 6313
Website: www.isolab.com.sg Email: enquiries@isolab.com.sg

Notes:

1. This calibration / test certificate is prepared based upon the item / artefact submitted, for the calibration and testing services required and the conditions under which the calibration and testing services are performed. This certificate is not intended to be representative or similar or equivalent services, or similar or equivalent items and does not constitute and endorsement by ISOLAB (S) PTE LTD of the item or that ISOLAB (S) PTE LTD in anyway doesn't "guarantee" the later performance of the item. The user should determine the suitability of these instruments and equipment's for their intended purpose of use and application in terms of calibration data, correction, accuracy and uncertainties as well. ISOLAB (S) PTE LTD doesn't guarantee any extrapolation of calibration data beyond and outside the calibrated test point range(s).
2. Unless and otherwise requested, a calibration report / test report shall contain only technical results by means of calibration data. Analysis and interpretation of the results and professional opinions and recommendations expressed thereupon, if required shall be clearly indicated on the basis of national or international standards and guidelines before the calibration task is taken up. Any additional requirements to incorporate, such as, professional opinions and recommendations may or may not be accepted by ISOLAB (S) PTE LTD and these additional requirements may require additional testing, data collection and reports subjected to additional charges to be paid by the clients and customers.
3. Reproduction and transmission of calibration and test certificates by email, fax and or by any other means of soft copies are totally restricted and controlled by ISOLAB (S) PTE LTD's quality management. Under any circumstances the calibration and test certificates shall not be reproduced other than in full except with prior and written approval by ISOLAB (S) PTE LTD. The full reproduction under "special circumstances" is only done by ISOLAB (S) PTE LTD in the form of black and white "Certified True Copies" with an attestation by ISOLAB's quality management or respective approved signatories.
4. Additional copies of this calibration and test certificates are available to the clients and customers at an additional, minimal fee. This is only available together with calibration artefacts (instruments and equipment's) and also should be requested in writing before calibration task is being carried out. No third party or subcontractors can obtain a copy of this certificate from ISOLAB, unless and otherwise it is a statutory or regulatory requirement initiated by the client and they have authorized in writing to do so to ISOLAB (S) PTE LTD, prior to calibration task.
5. ISOLAB (S) PTE LTD, shall under no circumstances be liable to the clients or its agents or representatives, in contract, including negligence or breach of statutory duties or otherwise for any direct or indirect loss or damage suffered by the client, its agents or representatives howsoever arising or whether connected with services provided by ISOLAB (S) PTE LTD.
6. ISOLAB (S) PTE LTD, doesn't guarantee of the malfunction or error in measurements or comparisons with other equipment's and instruments with respect to calibration data provided at the time of calibration. The instruments and equipment's will be returned to clients "as and where condition" upon completion of calibration, and not responsible for non-working of power adapters, battery packs or sub-accessories in the event of calibration.
7. ISOLAB (S) PTE LTD, values and honours the inter-laboratory comparison data(s) with same artefact (instruments and equipment's) are calibrated with same scope of accreditation schedule issued by SAC-SINGLAS. Any other features and functions are not calibrated or tested in the same artefact is not not falls under the responsibilities of ISOLAB. The same conditions are applicable for customers calibration instruments and equipment's as well.
8. ISOLAB (S) PTE LTD, doesn't guarantee the integrity of calibration data, if the instruments and equipment's (when malfunctioned, repaired, altered, modified and serviced after calibration as a whole or partly. The calibration labels and "void and stickers" shall be maintained at all times on the equipment's and instruments.
9. ISOLAB (S) PTE LTD and their performance of the calibration of customer's/client's instruments and equipment's with "as and where condition" and does not constitute any responsibilities for old, used, drilled, damaged, under performance of instruments and equipment's with respect to manufacturers or OEM specifications. If the instruments and equipment's (when within the adjustment capabilities and available options for adjustments, also with customers clear written agreement to make such adjustments, were made, however no guarantee for the inherent drift and non-linearity of the instruments and equipment's will be warranted.
10. The combined and expanded uncertainties are based on statistical calculations with respect to the guide for uncertainty measurement (GUM, JCGM), and also calibration and measurement capabilities (CMC*) assigned by SAC-SINGLAS at the time of calibration. Expanded uncertainties reported in calibration certificates shall be separately added or subtracted with corrections and errors indicated in the calibration and test certificate(s). These conditions shall follow the guidelines and requirements stated in ILAC-G8 Guidelines.

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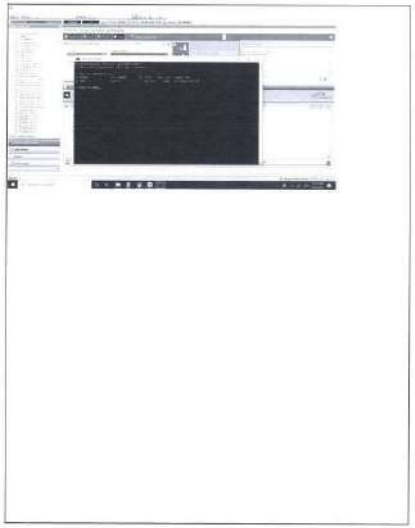
Document Name: Certificate of System Qualification



Document Name: Certificate of System Qualification

Software Verification Report

Date:	Thursday, February 10, 2022	Time:	12:42:49 PM (UTC +07:00:00)	Host Name:	GC404-A
Windows User Name:	GC-404	Base Revision Number:	C.01.03 Update 03 [337]	Product Name:	Agilent OpenLab
Install Type:	Workstation Client Edition	Additional Packages:	Details		

Base Reference File Name: AgilentOpenLabCDS.inst

Summary:

Overall Evaluation of Installation Check : PASS

File Report Summary

No missing files or invalid files found

No system file differences found

GAC File Report Summary

No missing or invalid GAC files found

Files Registration Report Summary

Not registered files: 50/50

No missing registered files found

Registry Report Summary

No invalid registry entries found

Details

ID	Description
04	Agilent OpenLab CDS Chemstation ECMD Drivers 1.8 [D3]
05	Agilent OpenLab Data Provider for ChemStation A.1.03 [D]
06	Agilent OpenLab CDS ChemStation Micro GC Drivers 2.1.3.0
08	Agilent OpenLab Control Panel Chemstation Plugin A.01.10 [D17]
01	Agilent OpenLab CDS ChemStation GC Drivers 3.3 [65]
98	Agilent OpenLab CDS ChemStation LC and CE Drivers 3.2.23
99	Agilent OpenLab CDS ChemStation Edition C.01.10 [337]

Document Name: Certificate of Calibration Thermometer Probe

CERTIFICATE OF CALIBRATION

No : CS214132
Date of Issue: 04th October 2021

Type K Thermocouple Needle Probe
Serial No: 14070510 / HZ68N-P2

Page: 2 of 2
Calibration Start Date : 28th September 2021
Calibration End Date : 02nd October 2021

Results of Calibration
The results of the calibration are shown in the below table. The expanded uncertainties of the measurement are at a level of confidence at approximately 95% with a coverage factor "k" as mentioned below.

Calibration Results (As Found)

Actual Temperature (°C)	UUT Average Value (°C)	Corrections (°C)	Uncertainty (°C)	k-Factor
0.0	0.4	-0.4	0.4	2.00
100.0	99.8	0.2	0.3	2.00
230.1	230.8	-0.7	0.3	2.00
350.1	349.7	0.4	0.7	2.00

Calibration Results (As Left)

Actual Temperature (°C)	UUT Average Value (°C)	Corrections (°C)	Uncertainty (°C)	k-Factor
0.0	0.4	-0.4	0.4	2.00
100.0	99.8	0.2	0.3	2.00
230.1	230.8	-0.7	0.3	2.00
350.1	349.7	0.4	0.7	2.00

* Manufacturer's Tolerance: 0°(±2.2°)°C - > 3°C (0.0°)°C - > 3°C
* The user should determine the suitability of this instrument for its intended use.
* "The results reported herein have been performed in accordance with the terms of accreditation under the Singapore Accreditation Council".

Remarks:
1. No Adjustment/Offset were made during calibration.
2. Although there was no adjustment was made to the UUT, measured results reflect "As Found" and "As Left" results on calibration certificate.

Gopal Gupta
Calibration Officer

Document Name: Certificate of Calibration Thermometer Probe

Gopal Gupta
15 Nov 2021

Document Name: Certificate of System Qualification

Software Verification Report

Date:	Thursday, February 10, 2022	Time:	12:42:50 PM (UTC +07:00:00)	Host Name:	GC404-A
Windows User Name:	GC-404	Base Revision Number:	2.1	Product Name:	Agilent OpenLAB CDS ChemStation ECMD A/D Drivers
Install Type:	N/A	Additional Packages:	Yes		

Base Reference File Name : 19000_EnvFile.inst

Summary:

Overall Evaluation of Installation Check : PASS

File Report Summary

No missing files or invalid files found

No system file differences found

Files Registration Report Summary

File Registration check not required for this product

Registry Report Summary

Registry entries check not required for this product

Document Name: Certificate of System Qualification

Software Verification Report

Date:	Thursday, February 10, 2022	Time:	12:42:50 PM (UTC +07:00:00)	Host Name:	GC404-A
Windows User Name:	GC-404	Base Revision Number:	1.0.0	Product Name:	Agilent Rapid Control INST [1.0.0]
Install Type:	N/A	Additional Packages:	Details		

Base Reference File Name : X:\Tool\Rapid Control\RC.inst

Summary:

Overall Evaluation of Installation Check : PASS

File Report Summary

No missing files or invalid files found

No system file differences found

GAC File Report Summary

No missing or invalid GAC files found

Files Registration Report Summary

File Registration check not required for this product

Registry Report Summary

Registry entries check not required for this product

Details

ID	Description
10011	Agilent Rapid Control Sample Container Manager Merge Module 1.0.19

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Document Name: Certificate of Analysis FID MDL std kit, 5188-5372

Agilent Technologies

Certificate of Analysis

FID MDL Sample

Agilent Part Number: 5188-5372
Sample Lot Number: 0000403129

This analytical reference material was manufactured and certified in accordance with an ISO 9001 registered quality system, and the analytical concentrations were verified by an ISO 17025 accredited laboratory. The certified value for each analyte was determined gravimetrically.

Concentrations:

n-tridecane	2.36 mg/L (± 0.5%)
n-tetradecane	2.37 mg/L (± 0.5%)
n-pentadecane	2.37 mg/L (± 0.5%)
n-hexadecane	23.6 mg/L (± 0.5%)
Solvent: isooctane	

Calibrated Gas: A glycerone and citric/bicitric acid, used in the manufacture of this standard. Balances used in the manufacture of this standard are calibrated with weights traceable to NPL in compliance with ASTM E617, Class 1 and ISO 9001.

Purities:

n-tridecane	98.0%
n-tetradecane	98.1%
n-pentadecane	98%
n-hexadecane	98%
Isooctane	99.9%

Typical Analytical Spectrum or Chromatography
GC Chromatography – n-tridecane, n-tetradecane, n-pentadecane and n-hexadecane in isooctane

Date of release: 29 April 2021
Date of expiration: 31 May 2024

Document Name: Certificate of Analysis ECD std kit, 18713-60040

Agilent Technologies

Certificate of Analysis

Electron Capture Detector Test Sample

Agilent Part Number: 18713-60040
Sample Lot Number: 0000503047

This analytical reference material was manufactured and certified in accordance with an ISO 9001 registered quality system, and the analytical concentrations were verified by an ISO 17025 accredited laboratory. The certified value for each analyte was determined gravimetrically.

Concentrations:

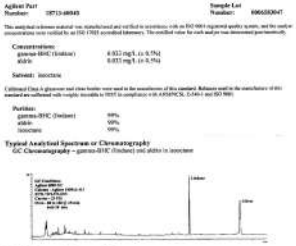
gamma-BHC (lindane)	0.033 mg/L (± 0.5%)
aldrin	0.033 mg/L (± 0.5%)
Solvent: isooctane	

Calibrated Gas: A glycerone and citric/bicitric acid, used in the manufacture of this standard. Balances used in the manufacture of this standard are calibrated with weights traceable to NPL in compliance with ASTM E617, Class 1 and ISO 9001.

Purities:

gamma-BHC (lindane)	99%
aldrin	99%
isooctane	99%

Typical Analytical Spectrum or Chromatography
GC Chromatography – gamma-BHC (lindane) and aldrin in isooctane



Date of release: 20 January 2021
Date of expiration: 28 February 2023

Melanie Bourjeois
QA Representative

เอกสารไม่ควบคุม

Agilent Technologies Materials: GC/GCMS

This section lists details for a set of Agilent materials required for all qualifications. If several part numbers are listed for an item, only the one(s) that apply to the tested configuration are used.

Retention Gap

For SS/TCD, HS/SS/FID, HS/VI/FID tests; for SS/FID tests except Response Linearity.

Part No. 19091-60620(E) or equivalent

G3909-63001 (Intuvo 9000 GC)

Capillary Column

HP-5 30 m x 0.32 mm x 0.25 um; for FID Response Linearity, all other inlet/detector combinations.

Part No. 19091J-413(E) or equivalent

19091J-413-INT or equivalent (Intuvo 9000 GC)

Capillary Column (SCD)

DB-1 30 m x 0.32 mm x 1.0 um; for SCD.

Part No. 123-1033 or equivalent

Capillary Column (SQ, TQ, Q-TOF)

HP-5MS 30 m x 0.25 mm x 0.25 um; for SQ, TQ, and Q-TOF tests.

Part No. 19091S-433(E) or equivalent (5975 and below)

19091S-433UI or equivalent (5973 and up, TQ, and Q-TOF)

Capillary Column (Ion Trap)

HP-4MS 30 m x 0.25 mm x 0.25 um; for Ion Trap tests.

Part No. CP8944 or equivalent

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 logon to access ACE and electronically sign this document. (Other e-signatures can be applied to this document using a Document Content Management or other suitable method defined in your data access and control procedures.)

Details

Full Name of Signer:	Saenguthai Tarak
Logged On User Name:	saenguthai.tarak@non.agilent.com
Signature Creation Date:	February 11, 2022
Reason for Signature:	Executed protocol and published this original version of document

Regulatory Disclaimer

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

Warranty

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General

Document Name: Certificate of System Qualification

Software Verification Report

Summary :

Details

General

Document Name: Certificate of System Qualification

Agilent Technologies

Agilent Compliance Engine Self Qualification

Date: February 11, 2022 3:37:02 PM

Drive Serial #: 5FC8004E Platform Revision: ACE 3.11

Test	Protocol Revision	Result
System Inspection and Basic Safety and Operation - 7890	GC.02.50	Conforms
Inlet Pressure Decay - Front PTV	GC.02.50	Conforms
Inlet Pressure Accuracy - Front PTV	GC.02.50	Conforms
Inlet Pressure Decay - Back On Column	GC.02.50	Conforms
Inlet Pressure Accuracy - Back On Column	GC.02.50	Conforms
Detector Flow Accuracy - Front FID	GC.02.50	Conforms
Detector Flow Accuracy - Back TCD	GC.02.50	Conforms
Headspace Leak - 7697A with Tray (Sampler 1)	GC.02.50	Conforms
Headspace Heated Zones Temperature Accuracy - 7697A with Tray (Sampler 1)	GC.02.50	Conforms
GC Oven Temperature Accuracy - 7890	GC.02.50	Conforms
GC Oven Temperature Stability - 7890	GC.02.50	Conforms
GC Scouting Run - 7697A with Tray Headspace, Front PTV, Front FID	GC.02.50	Conforms
Noise and Drift - Front FID	GC.02.50	Conforms
Signal to Noise - 7697A with Tray Headspace, Front PTV, Front FID	GC.02.50	Conforms
Response Linearity FID - Liquid Injection, Front PTV, Front FID	GC.02.50	Conforms
GC Scouting Run - Manual Injection, Back On Column, Back TCD	GC.02.50	Conforms
Noise and Drift - Back TCD	GC.02.50	Conforms
Signal to Noise - Manual Injection, Back On Column, Back TCD	GC.02.50	Conforms
LTM Basic Operation - 7890, Column 1	GC.02.50	Conforms
LTM Oven Temperature Accuracy - 7890, Column 1	GC.02.50	Conforms

User Name: saenguthai.tarak
Hostname: LAPTOP-CQ3SKOMV

System Id: CN11021007
Print Date: February 11, 2022 4:01:36 PM

OQ_UAE_TOX.897 Transaction log :

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
February 10, 2022 1:31:02 PM	Audit	SessionCreated	Session	None
February 10, 2022 1:31:02 PM	Start	Configuration	Session	None
February 10, 2022 1:31:02 PM	Audit	Entitlement	Licensing	User is fee-paying and does not require an unlock code
February 10, 2022 1:36:00 PM	Audit	EqpLoaded	Session	EQP details for primary technique [Gc] - File path: [ProtocolPacks\Gc\Configurations\02.51\Gc.02.51.eqp], EQP File Name: [Gc.02.51.eqp], EQP Name: [AgilentRecommended]
February 10, 2022 1:38:49 PM	Audit	AceClosed	Session	None
February 10, 2022 1:41:06 PM	Audit	AceRestarted	Session	None
February 10, 2022 1:41:08 PM	Audit	SessionReloaded	Session	None
February 10, 2022 1:41:15 PM	Audit	EqpLoaded	Session	EQP details for primary technique [Gc] - File path: [ProtocolPacks\Gc\Configurations\02.51\Gc.02.51.eqp], EQP File Name: [Gc.02.51.eqp], EQP Name: [AgilentRecommended]
February 10, 2022 1:47:12 PM	Audit	AceClosed	Session	None
February 11, 2022 9:04:43 AM	Audit	AceRestarted	Session	None

Page 1 / 11

User Name: saenguthai.tarak
Hostname: LAPTOP-CQ3SKOMV

System Id: CN11021007
Print Date: February 11, 2022 4:01:36 PM

OQ_UAE_TOX.897 Transaction log :

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
February 11, 2022 2:06:20 PM	Audit	SessionReloaded	Session	None
February 11, 2022 2:06:21 PM	Audit	EqpLoaded	Session	EQP details for primary technique [Gc] - File path: [ProtocolPacks\Gc\Configurations\02.51\Gc.02.51.eqp], EQP File Name: [Gc.02.51.eqp], EQP Name: [AgilentRecommended]
February 11, 2022 2:06:58 PM	End	Configuration	Session	None
February 11, 2022 2:06:58 PM	Start	Qualification	Session	OQ
February 11, 2022 2:06:58 PM	Start	Execution	System Inspection and Basic Safety and Operation - 7890 - Qualitative Test - No setpoints associated	None
February 11, 2022 2:07:19 PM	End	Execution	System Inspection and Basic Safety and Operation - 7890 - Qualitative Test - No setpoints associated	Run Count : 1
February 11, 2022 2:07:21 PM	Start	Execution	Inlet Pressure Decay - Front SSL - Pressure Controlled Inlet - S: 25.0 psi - L: >= -2.0 psi and <= 0.5 psi	None
February 11, 2022 2:07:35 PM	End	Execution	Inlet Pressure Decay - Front SSL - Pressure Controlled Inlet - S: 25.0 psi - L: >= -2.0 psi and <= 0.5 psi	Run Count : 1
February 11, 2022 2:07:37 PM	Start	Execution	Inlet Pressure Accuracy - Front SSL - Pressure Controlled Inlet - S: 25.0 psi - L: <= 1.2 psi	None

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เอกสารไม่ควบคุม

Document Name: Certificate of System Qualification

LTM Oven Temperature Stability - 7890, Column 1	GC.02.50	Conforms
LTM Oven Temperature Ramp - 7890, Column 1	GC.02.50	Conforms
Injection Precision - LTM using 7697A with Tray Headspace, Front PTV, Front FID	GC.02.50	Conforms
Injection Carry Over - LTM using 7697A with Tray Headspace, Front PTV, Front FID	GC.02.50	Conforms
GC Oven Temperature Ramp - 7890	GC.02.50	Conforms
GC Inlet Temperature Accuracy - Front PTV	GC.02.50	Conforms
GC Detector Temperature Accuracy - Front FID	GC.02.50	Conforms
GC Inlet Temperature Accuracy - Back On Column	GC.02.50	Conforms
GC Detector Temperature Accuracy - Back TCD	GC.02.50	Conforms

Overall Qualification Status

Conforms

General

Document Name: Certificate of System Qualification

Agilent Technologies

Agilent Compliance Engine Self Qualification

Date: February 11, 2022 3:37:21 PM

Drive Serial #: 5FC8004E Platform Revision: ACE 3.11

Test	Protocol Revision	Result
Preparation - Agilent ChemStation	SW.02.50	Conforms
Security Basic Access - ChemStation	SW.02.50	Conforms
Reporting and Calculation Algorithm Test - ChemStation	SW.02.50	Conforms
Reporting and Calculation Report - ChemStation	SW.02.50	Conforms
Communication - Instrument 1	SW.02.50	Conforms
CleanUp - Agilent ChemStation	SW.02.50	Conforms

Overall Qualification Status

Conforms

เอกสารไม่ควบคุม

User Name: saengsuthat.tarak System Id: CN11021007
Hostname: LAPTOP-CQ35KOMV Print Date: February 11, 2022 4:01:36 PM

OQ_UAE_TOX.007 Transaction log :

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
February 11, 2022 2:15:57 PM	Audit	Data	Noise and Drift - Back FID: - Detector FID - L (Noise): <= 0.10 pA - L (Drift): <= 2.30 pA/hour	Data files Path : E:\OQ2022\NO_FID_Back01.DXFID1B.ch
February 11, 2022 2:16:06 PM	End	Execution	Noise and Drift - Back FID: - Detector FID - L (Noise): <= 0.10 pA - L (Drift): <= 2.30 pA/hour	Run Count : 1
February 11, 2022 2:16:09 PM	Start	Execution	Injection Precision - Injection Tower, Front SSL, Back FID: - GC - L (Area): <= 3.00% - L (Ret. Time): <= 1.00%	None
February 11, 2022 2:16:47 PM	Start	Execution	Injection Precision - Injection Tower, Front SSL, Back FID: - GC - L (Area): <= 3.00% - L (Ret. Time): <= 1.00%	None
February 11, 2022 2:17:12 PM	Audit	Data	Injection Precision - Injection Tower, Front SSL, Back FID: - GC - L (Area): <= 3.00% - L (Ret. Time): <= 1.00%	Data files Path : E:\OQ2022\OQ2022 2022-02-10 13-02-14\OQ_GC7890_FID_Pre0103.DXFID1B.ch
February 11, 2022 2:17:12 PM	Audit	Data	Injection Precision - Injection Tower, Front SSL, Back FID: - GC - L (Area): <= 3.00% - L (Ret. Time): <= 1.00%	Data files Path : E:\OQ2022\OQ2022 2022-02-10 13-02-14\OQ_GC7890_FID_Pre0103.DXFID1B.ch
February 11, 2022 2:17:12 PM	Audit	Data	Injection Precision - Injection Tower, Front SSL, Back FID: - GC - L (Area): <= 3.00% - L (Ret. Time): <= 1.00%	Data files Path : E:\OQ2022\OQ2022 2022-02-10 13-02-14\OQ_GC7890_FID_Pre0104.DXFID1B.ch

User Name: saengsuthat.tarak System Id: CN11021007
Hostname: LAPTOP-CQ35KOMV Print Date: February 11, 2022 4:01:36 PM

OQ_UAE_TOX.007 Transaction log :

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
February 11, 2022 2:17:12 PM	Audit	Data	Injection Precision - Injection Tower, Front SSL, Back FID: - GC - L (Area): <= 3.00% - L (Ret. Time): <= 1.00%	Data files Path : E:\OQ2022\OQ2022 2022-02-10 13-02-14\OQ_GC7890_FID_Pre0106.DXFID1B.ch
February 11, 2022 2:17:12 PM	Audit	Data	Injection Precision - Injection Tower, Front SSL, Back FID: - GC - L (Area): <= 3.00% - L (Ret. Time): <= 1.00%	Data files Path : E:\OQ2022\OQ2022 2022-02-10 13-02-14\OQ_GC7890_FID_Pre0106.DXFID1B.ch
February 11, 2022 2:17:12 PM	Audit	Data	Injection Precision - Injection Tower, Front SSL, Back FID: - GC - L (Area): <= 3.00% - L (Ret. Time): <= 1.00%	Data files Path : E:\OQ2022\OQ2022 2022-02-10 13-02-14\OQ_GC7890_FID_Pre0107.DXFID1B.ch
February 11, 2022 2:17:35 PM	End	Execution	Injection Precision - Injection Tower, Front SSL, Back FID: - GC - L (Area): <= 3.00% - L (Ret. Time): <= 1.00%	Run Count : 1
February 11, 2022 2:17:46 PM	Start	Execution	Signal to Noise - Injection Tower, Front SSL, Back FID: - Detector FID - L: >= 300000	None
February 11, 2022 2:18:06 PM	Start	Execution	Signal to Noise - Injection Tower, Front SSL, Back FID: - Detector FID - L: >= 300000	None
February 11, 2022 2:18:22 PM	Audit	Data	Signal to Noise - Injection Tower, Front SSL, Back FID: - Detector FID - L: >= 300000	Data files Path : E:\OQ2022\OQ2022 2022-02-10 13-02-14\OQ_GC7890_FID_SNR11.DXFID1B.ch
February 11, 2022 2:19:02 PM	Start	Execution	Signal to Noise - Injection Tower, Front SSL, Back FID: - Detector FID - L: >= 300000	None

User Name: saengsuthat.tarak System Id: CN11021007
Hostname: LAPTOP-CQ35KOMV Print Date: February 11, 2022 4:01:36 PM

OQ_UAE_TOX.007 Transaction log :

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
February 11, 2022 2:07:42 PM	End	Execution	Inlet Pressure Accuracy - Front SSL: - Pressure Controlled Inlet - S: 25.0 psi - L: <= 1.2 psi	Run Count : 1
February 11, 2022 2:07:44 PM	Start	Execution	Detector Flow Accuracy - Back FID: - Type : Fuel - S: 30.0 mL/min - L: <= 10.0% setpoint	None
February 11, 2022 2:08:02 PM	Audit	Data	Detector Flow Accuracy - Back FID: - Type : Fuel - S: 30.0 mL/min - L: <= 10.0% setpoint	Manual Data Entry
February 11, 2022 2:08:10 PM	End	Execution	Detector Flow Accuracy - Back FID: - Type : Fuel - S: 30.0 mL/min - L: <= 10.0% setpoint	Run Count : 1
February 11, 2022 2:08:12 PM	Start	Execution	Detector Flow Accuracy - Back FID: - Type : Oxidizer - S: 400.0 mL/min - L: <= 10.0% setpoint	None
February 11, 2022 2:08:48 PM	Audit	Data	Detector Flow Accuracy - Back FID: - Type : Oxidizer - S: 400.0 mL/min - L: <= 10.0% setpoint	Manual Data Entry
February 11, 2022 2:08:52 PM	End	Execution	Detector Flow Accuracy - Back FID: - Type : Oxidizer - S: 400.0 mL/min - L: <= 10.0% setpoint	Run Count : 1
February 11, 2022 2:08:56 PM	Start	Execution	Detector Flow Accuracy - Back FID: - Type : Makeup - S: 25.0 mL/min - L: <= 10.0% setpoint	None
February 11, 2022 2:09:18 PM	Audit	Data	Detector Flow Accuracy - Back FID: - Type : Makeup - S: 25.0 mL/min - L: <= 10.0% setpoint	Manual Data Entry
February 11, 2022 2:09:23 PM	End	Execution	Detector Flow Accuracy - Back FID: - Type : Makeup - S: 25.0 mL/min - L: <= 10.0% setpoint	Run Count : 1

User Name: saengsuthat.tarak System Id: CN11021007
Hostname: LAPTOP-CQ35KOMV Print Date: February 11, 2022 4:01:36 PM

OQ_UAE_TOX.007 Transaction log :

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
February 11, 2022 3:19:11 PM	End	Execution	Signal to Noise - Injection Tower, Front SSL, Back FID: - Detector FID - L: >= 300000	Run Count : 1
February 11, 2022 3:21:48 PM	Start	Execution	GC Scouting Run - Injection Tower, Front SSL, Front UECD - Part of System Preparation - No limits associated	None
February 11, 2022 3:32:19 PM	Audit	Data	GC Scouting Run - Injection Tower, Front SSL, Front UECD - Part of System Preparation - No limits associated	Data files Path : E:\OQ2022\SC_uECD_Front01.DXECD1A.ch
February 11, 2022 3:33:01 PM	Audit	Data	GC Scouting Run - Injection Tower, Front SSL, Front UECD - Part of System Preparation - No limits associated	Data files Path : E:\OQ2022\OQ_GC7890_uECD_SC01.DXECD1A.ch
February 11, 2022 3:33:33 PM	End	Execution	GC Scouting Run - Injection Tower, Front SSL, Front UECD - Part of System Preparation - No limits associated	Run Count : 1
February 11, 2022 3:33:38 PM	Start	Execution	Noise and Drift - Front UECD: - Detector UECD - L (Noise): <= 3.00 Hz - L (Drift): <= 15.00 Hz/hour	None
February 11, 2022 3:33:47 PM	Audit	Data	Noise and Drift - Front UECD: - Detector UECD - L (Noise): <= 3.00 Hz - L (Drift): <= 15.00 Hz/hour	Data files Path : E:\OQ2022\NO_uECD_Front12.DXECD1A.ch
February 11, 2022 3:38:58 PM	End	Execution	Noise and Drift - Front UECD: - Detector UECD - L (Noise): <= 3.00 Hz - L (Drift): <= 15.00 Hz/hour	Run Count : 1

เอกสารไม่ควบคุม

User Name: saengsuthat.tarak System Id: CN11021007
Hostname: LAPTOP-CQ35KOMV Print Date: February 11, 2022 4:01:36 PM

OQ_UAE_TOX.007 Transaction log :

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
February 11, 2022 2:09:25 PM	Start	Execution	Detector Flow Accuracy - Front UECD: - Type : Makeup - S: 25.0 mL/min - L: <= 10.0% setpoint	None
February 11, 2022 2:09:59 PM	Audit	Data	Detector Flow Accuracy - Front UECD: - Type : Makeup - S: 25.0 mL/min - L: <= 10.0% setpoint	Manual Data Entry
February 11, 2022 2:09:54 PM	End	Execution	Detector Flow Accuracy - Front UECD: - Type : Makeup - S: 25.0 mL/min - L: <= 10.0% setpoint	Run Count : 1
February 11, 2022 2:09:56 PM	Start	Execution	GC Oven Temperature Accuracy - 7890 - Temperature : Oven - S: 230.0°C - L: <= 1.0 AND <= 1.0 % setpoint in K	None
February 11, 2022 2:10:19 PM	Audit	Data	GC Oven Temperature Accuracy - 7890 - Temperature : Oven - S: 230.0°C - L: <= 1.0 AND <= 1.0 % setpoint in K	Manual Data Entry
February 11, 2022 2:10:39 PM	End	Execution	GC Oven Temperature Accuracy - 7890 - Temperature : Oven - S: 230.0°C - L: <= 1.0 AND <= 1.0 % setpoint in K	Run Count : 1
February 11, 2022 2:10:22 PM	Start	Execution	GC Oven Temperature Accuracy - 7890 - Temperature : Oven - S: 100.0°C - L: <= 1.0 AND <= 1.0 % setpoint in K	None
February 11, 2022 2:10:41 PM	Audit	Data	GC Oven Temperature Accuracy - 7890 - Temperature : Oven - S: 100.0°C - L: <= 1.0 AND <= 1.0 % setpoint in K	Manual Data Entry

User Name: saengsuthat.tarak System Id: CN11021007
Hostname: LAPTOP-CQ35KOMV Print Date: February 11, 2022 4:01:36 PM

OQ_UAE_TOX.007 Transaction log :

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
February 11, 2022 2:10:43 PM	End	Execution	GC Oven Temperature Accuracy - 7890 - Temperature : Oven - S: 100.0°C - L: <= 1.0 AND <= 1.0 % setpoint in K	Run Count : 1
February 11, 2022 2:10:46 PM	Start	Execution	GC Oven Temperature Stability - 7890 - Temperature : Oven - S: 100.0°C - L: <= 0.5°C	None
February 11, 2022 2:11:27 PM	Audit	Data	GC Oven Temperature Stability - 7890 - Temperature : Oven - S: 100.0°C - L: <= 0.5°C	Manual Data Entry
February 11, 2022 2:11:38 PM	End	Execution	GC Oven Temperature Stability - 7890 - Temperature : Oven - S: 100.0°C - L: <= 0.5°C	Run Count : 1
February 11, 2022 2:11:44 PM	Start	Execution	GC Scouting Run - Injection Tower, Front SSL, Back FID - Part of System Preparation - No limits associated	None
February 11, 2022 2:14:13 PM	Start	Execution	GC Scouting Run - Injection Tower, Front SSL, Back FID - Part of System Preparation - No limits associated	None
February 11, 2022 2:14:45 PM	Audit	Data	GC Scouting Run - Injection Tower, Front SSL, Back FID - Part of System Preparation - No limits associated	Data files Path : E:\OQ2022\SC_FID_Back01.DXFID1B.ch
February 11, 2022 2:15:18 PM	End	Execution	GC Scouting Run - Injection Tower, Front SSL, Back FID - Part of System Preparation - No limits associated	Run Count : 1
February 11, 2022 2:16:02 PM	Start	Execution	Noise and Drift - Back FID: - Detector FID - L (Noise): <= 0.10 pA - L (Drift): <= 2.30 pA/hour	None

เอกสารไม่ควบคุม

NSC-TISI-TIS 17025
Calibration 0087

Certificate of Calibration

Equipment:	CONDUCTIVITY METER	Certificate No.:	C24220084
Model:	Lab955	Issued Date:	22 March 2022
Serial No. (or ID.):	16300356	Job No.:	KSPR2203267
Manufacturer:	SI Analytics	Page:	1 of 2
Electrode Serial No.	16070067	Model : LF413T	Brand : SI Analytics
Condition:	In Condition		

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

Environment Condition:

Temperature	23	°C	±	2	°C
Humidity	50	%RH	±	15	%RH

Calibration Place: Environment Laboratory, SPC RT Co., Ltd.
1194 Soi Wachirathamsathit 57, Sukhumvit 101/1 Rd.,
Bangchak, Prakhanong, Bangkok 10260 Thailand

Calibration By: Mr. Wasan Nuchnabee

Calibration Date: 22 March 2022

The Method used: In house method, SPCC-WI-49, base on ASTM D 1125-14 and D 5391-14

Traceability: This certificate is traceable to the SI Units maintained by CRM of NIST(SRM) through CPA chem Co., Ltd. (ISO/IEC 17034) Certificate No. 794135, 794136, 772624

บริษัท เอสพีซี อาร์ที จำกัด
SPC RT Co., Ltd.

(Mr. Wasan Nuchnabee)
Person in charge

(Mr. Dumrong Boonsopon)
Authorized signatory

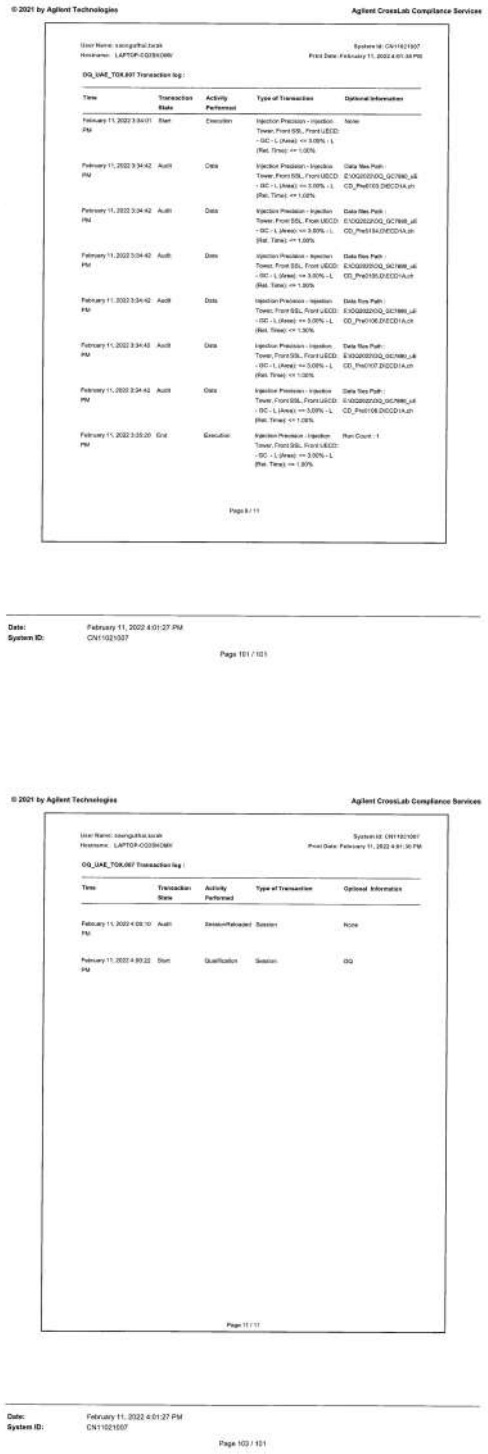
This certificate is issued the units of measurement according to the International System of Units (SI). It provides traceability of measurement to international or national standard or other recognized national standard laboratories.

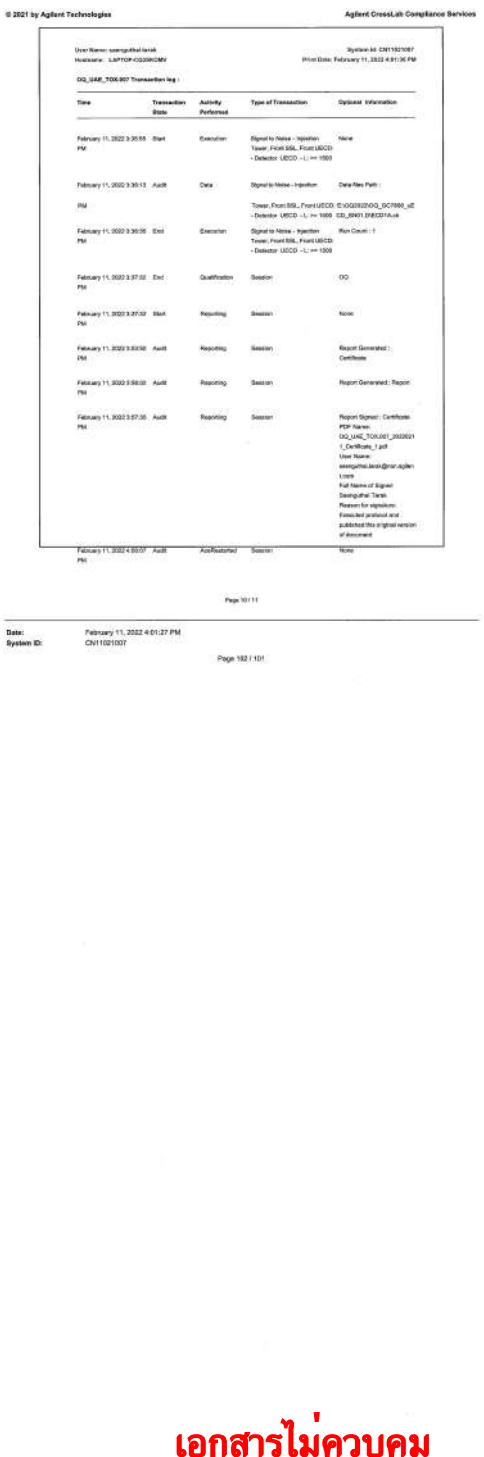
The measurement uncertainty stated is the expanded uncertainty which is obtained from the standard uncertainty multiplied by the coverage factor (k=2) to provide a level of confidence of approximately 95%. It is determined in accordance with the Guide to Expression of Uncertainty in Measurement (GUM).

These results may be affected by deviations from specified conditions. The results relate only to the items tested, calibrated or sampled. The report shall not be reproduced except in full without approval of SPC RT Co., Ltd.

บริษัท เอสพีซี อาร์ที จำกัด
SPC RT CO., LTD.
สาขาที่ 00003 1194 ซอยวิชรธรรมสาธิต 57 ถนนสุขุมวิท 101/1 แขวงบางจาก เขตพระโขนง กรุงเทพมหานคร 10260
Branch 00003 1194 Soi Wachirathamsathit 57, Sukhumvit 101/1 Road, Bangchak, Phrakhanong, Bangkok 10260 Thailand
Tel: 0 2185 4333 Ext. 3300-3308 Fax: 0 2185 4424 E-mail: info.spcc@spc-rt.com Website: www.spc-rt.com

เอกสารไม่ควบคุม





เอกสารไม่ควบคุม

ใบตรวจสอบสภาพเครื่องวัดสิ่งแวดล้อม

เลขที่ใบงาน: KSPR2203267

ชนิดเครื่องมือ: CONDUCTIVITY METER รุ่น: Lab955 หมายเลขเครื่อง: 16300356

ตรวจสอบ (รับ) 22 Mar 2022		รายการตรวจเช็ค	ตรวจสอบ (ส่ง) 22 Mar 2022		หมายเหตุ
ปกติ	ไม่ปกติ		ปกติ	ไม่ปกติ	
		General			
☑	☐	1. ความสมบูรณ์เครื่อง	☑	☐	
☑	☐	2. ความสะอาด (ช่องใส่ตัวอย่าง, ภายใน-นอกเครื่อง)	☑	☐	
☑	☐	3. สวิทช์ ปิด – เปิด เครื่อง (On-Off Swicth)	☑	☐	
☑	☐	4. ปุ่มกด (Keypad)	☑	☐	
☑	☐	5. หน้าจอ (Display, Screen Contrast)	☑	☐	
		Spectrophotometer			
☐	☐	6. แรงดันไฟฟ้า (Battery Backup) >= 2.5 VDC	☐	☐	
☐	☐	7. ตัวหมุนเลือกความยาวคลื่น (Wavelength Control)	☐	☐	
☐	☐	8. ความยาวคลื่น (Wavelength Check)	☐	☐	
☐	☐	9. แหล่งกำเนิดแสง (UV < 3,000 hour)	☐	☐	
☐	☐	10. แหล่งกำเนิดแสง (Visible < 5,000 hour)	☐	☐	
☐	☐	11. ช่องวัดหลายตัวอย่าง (Carousel Module)	☐	☐	
		pH Meter and Conductivity Meter			
☑	☐	12. อิเล็คโทรด (Electrode and Connection Cable)	☑	☐	
☐	☐	13. ระดับสารละลายใน Electrode (Level KCl)	☐	☐	
☐	☐	14. ฝาปิดกันปลาย Electrode (Dust Protection Hood)	☐	☐	
☐	☐	15. ขาจับอิเล็คโทรด (Stand)	☐	☐	
		Turbidimeter			
☐	☐	16. ค่าความขุ่นที่ต่ำสุด (No Sample)	☐	☐	
☐	☐	17. ระดับการส่องสว่างของแสง (>= 2.5 ไม่เกิน 3.0)	☐	☐	
		Automatic titrator			
☐	☐	18. สภาพ Piston Burettes	☐	☐	
☐	☐	19. Function Rinsing and Dosing	☐	☐	
☐	☐	20. ระบบท่อสายยางและอุปกรณ์ประกอบ	☐	☐	

ข้อแนะนำ : Electrode วัดอุณหภูมิได้24.9 °C โดย Control Waterbath ที่ 25.0 ±0.1°C

Mr. Wasan Nuchnabee

Service Engineer

บริษัท เอสพีซี อาร์ทีี จำกัด
SPC RT CO., LTD.
สาขาที่ 00003 1194 ซอยวิชิรธรรมสาธิต 57 ถนนสุขุมวิท 101/1 แขวงบางจาก เขตพระโขนง กรุงเทพมหานคร 10260
Branch 00003 1194 Soi Wachirathamsathit 57, Sukhumvit 101/1 Road, Bangchak, Phrakhanong, Bangkok 10260 Thailand
Tel: 0 2185 4333 Ext. 3300-3308 Fax: 0 2185 4424 E-mail: info.spcc@spc-rt.com Website: www.spc-rt.com

เอกสารไม่ควบคุม

Certificate No.: C24220084 Page: 2 of 2

Calibration Results:

Before Adjustment

Standard Conductivity Solution		Unit Under Calibration Reading		Correction		Coverage Factor (k)	Uncertainty (±)	
25.000	µS/cm	25.9	µS/cm	-0.900	µS/cm	2.00	0.22	µS/cm
1413.0	µS/cm	1444	µS/cm	-31.0	µS/cm	2.00	8.9	µS/cm
111.3	mS/cm	107.9	mS/cm	3.40	mS/cm	2.00	0.66	mS/cm

After Adjustment ; at 1413 µS/cm

Standard Conductivity Solution		Unit Under Calibration Reading		Correction		Coverage Factor (k)	Uncertainty (±)	
25.000	µS/cm	25.0	µS/cm	0.000	µS/cm	2.00	0.22	µS/cm
1413.0	µS/cm	1413	µS/cm	0.0	µS/cm	2.00	8.9	µS/cm
111.3	mS/cm	107.2	mS/cm	4.10	mS/cm	2.00	0.66	mS/cm

The End of Certificate

บริษัท เอสพีซี อาร์ทีี จำกัด
SPC RT CO., LTD.
สาขาที่ 00003 1194 ซอยวิชิรธรรมสาธิต 57 ถนนสุขุมวิท 101/1 แขวงบางจาก เขตพระโขนง กรุงเทพมหานคร 10260
Branch 00003 1194 Soi Wachirathamsathit 57, Sukhumvit 101/1 Road, Bangchak, Phrakhanong, Bangkok 10260 Thailand
Tel: 0 2185 4333 Ext. 3300-3308 Fax: 0 2185 4424 E-mail: info.spcc@spc-rt.com Website: www.spc-rt.com

เอกสารไม่ควบคุม

Equipment : Cooled Incubator
Condition As-Received : Used Item
Reference : 2205-0764OC-1

Cert. No.: 22TM347
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).

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	MY44067817	21LM10	20 Jul 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.

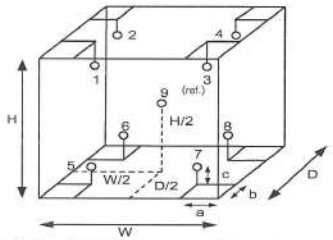
Result of Calibration :- (*) Without Adjustment

Function of UUC* : Temperature Source

Fresh air setting : Not Available

Fan Setting : 100.0%

Environment during calibration		
	Beginning	Finished
Temp. (°C)	21	21
REL.Humid. (%)	67	65
AC Supply (Volt)	233	234



Position :	Ref. Std. ID No.:
1	15RTD2/11
2	15RTD2/12
3	15RTD2/13
4	15RTD2/14
5	15RTD2/15
6	15RTD2/16
7	15RTD2/17
8	15RTD2/18
9 (ref.)	15RTD2/19

Probe Installation Details :

a =	10	cm
b =	10	cm
c =	14	cm

Dimension of Chamber :

D =	0.48	m
W =	0.65	m
H =	1.3	m
Capacity =	0.40	m³

เอกสารควบคุม

TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES
534/4 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG BANGKOK 10250
TEL. 0-2717-3000-27 FAX. 0-2719-9484

ilac-MRA
NSC-TISI-TIS17025 CALIBRATION 0008

Cert. No.: 22TM347
Page.: 1 of 3

Certificate of Calibration

Equipment : Cooled Incubator

Manufacturer : Binder

Model : KB 400 E6

Serial No. : 20200000015535

ID No. : UAE.MIC.018/2564

Submitted by : United Analyst and Engineering Consultant Co.,Ltd.
3 Soi Udomsuk 41, Sukhumvit Road,
Bangchak, Phrakhanong,
Bangkok 10260

Location : Microbiology Laboratory

Received Order : 27 May 2022
Calibration Date : 27 May 2022
Ambient Temperature : (26 ± 10) °C
Relative Humidity : (50 ± 30) %

Calibrated by : Suwit Imjai

Approved by :

Approved Signatory

( ) Pornthippa Tameyakul
(✓) Malee Butkruea

Issue Date : 2 June 2022

The Uncertainties are for a confidence probability of approximately 95%

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NSC-TISI-TI5117025
CALIBRATION 0008

Certificate of Calibration

Equipment :	Incubator
Manufacturer :	Memmert
Model :	IPP 260
Serial No. :	V616.0066
ID No. :	UAE.MIC.032/2559
Submitted by :	United Analyst and Engineering Consultant Co.,Ltd. 3 Soi Udomsuk 41, Sukhumvit Road, Bangchak, Phrakhanong, Bangkok 10260
Location :	Microbiology Laboratory (302)
Received Order :	3 May 2022
Calibration Date :	5 May 2022
Ambient Temperature :	(26 ± 10) °C
Relative Humidity :	(50 ± 30) %
Calibrated by :	Preecha Hlahib

Approved by : Malee
Approved Signatory

( ) Pornthippa Tameyakul
(✓) Malee Butkruea
( ) Suwit Imjai

Issue Date : 11 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

เอกสารไม่ควบคุม

Equipment : Cooled Incubator
Condition As-Received : Used Item
Reference : 2205-0764OC-1
Result of Calibration :- (*) Without Adjustment
Function of UUC* : Temperature Source
Fresh air setting : Not Available

Calibration Point (°C)	UUC* Setting (°C)	UUC* Reading (°C)	Temperature stability (± °C)	Temperature uniformity (°C)	Overall Variation (°C)	Uncertainty (±°C)	Coverage Factor *k*
35.0	34.9	34.9	0.017	0.31	0.38	0.30	2

Calibration Point (°C)	Measured Temperature (°C) Position								
	1	2	3	4	5	6	7	8	9 (ref.)
35.0	34.808	35.139	34.922	35.062	35.109	35.161	35.132	35.129	35.092

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 %.

-o0o-

เอกสารควบคุม

Equipment : Incubator

Condition As-Received : Used Item

Reference : 2205-0003OC-3

Cert. No.: 22TM672

Result of Calibration :- (*) Without Adjustment

Function of UUC* : Temperature Source

Fresh air setting : Not Available

Calibration Point (°C)	UUC* Setting (°C)	UUC* Reading (°C)	Temperature stability (± °C)	Temperature uniformity (°C)	Overall Variation (°C)	Uncertainty (±°C)	Coverage Factor *k*
25.0	25.0	25.0	0.021	0.18	0.33	0.30	2
36.0	36.0	36.0	0.077	0.96	0.33	0.33	2

Calibration Point (°C)	Measured Temperature (°C) Position								
	1	2	3	4	5	6	7	8	9 (ref.)
25.0	25.221	25.146	25.127	25.113	24.968	24.986	24.933	25.017	25.047
36.0	35.637	35.238	36.130	36.515	36.928	36.845	36.630	36.761	36.113

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 %.

-o0o-

เอกสารไม่ควบคุม

Equipment : Incubator

Condition As-Received : Used Item

Reference : 2205-0003OC-3

Cert. No.: 22TM672

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).

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	MY44067817	21LM10	20 Jul 2022

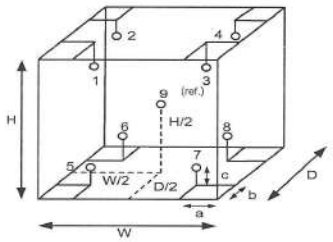
2. This certificate is valid only to the item calibrated on date and place of calibration.
3. This certification is traceable to the International System of Unit.

Result of Calibration :- (*) Without Adjustment

Function of UUC* : Temperature Source

Fresh air setting : Not Available

Environment during calibration	Beginning	Finished
Temp. (°C)	25	23
REL.Humid. (%)	62	57
AC Supply (Volt)	221	221



Probe Installation Details :

a = 5.0 cm

b = 5.0 cm

c = 5.0 cm

Dimension of Chamber :

D = 0.50 m

W = 0.60 m

H = 0.80 m

Capacity = 0.24 m³

Position :	Ref. Std. ID No.:
1	19-15RTD-01
2	19-15RTD-02
3	19-15RTD-03
4	19-15RTD-04
5	19-15RTD-05
6	21-15RTD-06
7	19-15RTD-07
8	19-15RTD-08
9 (ref.)	19-15RTD-09

เอกสารไม่ควบคุม

Equipment : Water Bath
Condition As-Received : Used Item
Reference : 2202-0444OC-3

Cert. No.: 22TM333
Page.: 2 of 3

Procedure Used :-

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

The temperature scale used was based on ITS-90.

Condition of this result of calibration

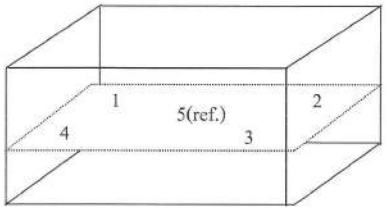
1. Reference standard instrument:-

Instrument	Model	Serial No.	Cert. No.	Due Date
1) Data Acquisition	34970A	MY44067817	21LM10	20 Jul 2022

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

Result of Calibration :- (*) Without Adjustment
Function of UUC* : Temperature Source

	Environmental		AC Voltage Supply
	(°C)	(%R.H.)	(Volt)
Beginning of Calibration	21	65	229
Finished of Calibration	22	58	230



Front

Position :	Ref. Std. ID No.:
1	70RC143
2	70RC144
3	70RC145
4	70RC146
5(ref.)	70RC147

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NSC-TISI-TIS17025 CALIBRATION 0008

Cert. No.: 22TM333
Page.: 1 of 3

Certificate of Calibration

Equipment : Water Bath

Manufacturer : Memmert

Model : WNE 14

Serial No. : L416.0606

ID No. : UAE.MIC.002/2560

Submitted by : United Analyst and Engineering Consultant Co.,Ltd.
3 Soi Udomsuk 41, Sukhumvit Road,
Bangchak, Phrakhanong,
Bangkok 10260

Location : Microbiology Laboratory

Received Order : 17 February 2022
Calibration Date : 17 February 2022
Ambient Temperature : (26 ± 10) °C
Relative Humidity : (50 ± 30) %

Calibrated by : Suwit Imjai

Approved by : Malee.
Approved Signatory

( ) Pornthippa Tameyakul
(✓) Malee Butkruea

Issue Date : 22 February 2022

The Uncertainties are for a confidence probability of approximately 95%

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NSC-TISI-TIS17025
CALIBRATION 0008

Certificate of Calibration

Equipment : Water Bath

Manufacturer : Memmert

Model : WNE 14

Serial No. : L416.0612

ID No. : UAE.MIC.003/2560

Submitted by : United Analyst and Engineering Consultant Co.,Ltd.
3 Soi Udomsuk 41, Sukhumvit Road,
Bangchak, Phrakhanong,
Bangkok 10260

Location : Microbiology Laboratory

Received Order : 17 February 2022
Calibration Date : 17 February 2022
Ambient Temperature : (26 ± 10) °C
Relative Humidity : (50 ± 30) %

Calibrated by : Suwit Imjai

Approved by : Malee
Approved Signatory

( ) Pornthippa Tameyakul
(✓) Malee Butkruea

Issue Date : 22 February 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.

เอกสารไม่ควบคุม

Equipment : Water Bath
Condition As-Received : Used Item
Reference : 2202-0444OC-3
Result of Calibration :- (*) Without Adjustment
Function of UUC* : Temperature Source

Calibration point (°C)	UUC* Setting (°C)	UUC* Reading (°C)	Average* Standard Reading (°C) Position				
			1	2	3	4	5 (ref.)
44.5	44.5	44.5	44.498	44.481	44.482	44.518	44.534

Calibration point (°C)	Uniformity (°C)	Stability (± °C)	Uncertainty (± °C)	Coverage Factor *k*
44.5	0.13	0.057	0.15	2

Average* : The average of 30 values in each position.
Uniformity : The maximum difference of measured temperatures at any sensors and the measured temperature at the reference location which are observed at the same time or at as close an observation time as possible to determine the temperature pattern or homogeneity within the chamber under steady-state conditions.
Stability : One-half of the greatest maximum difference of measured temperature at any one probe.
UUC* : Unit Under Calibration
Note : The reported uncertainty of measurement was included stability and excluded uniformity.

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

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เอกสารไม่ควบคุม

Equipment : Water Bath
Condition As-Received : Used Item
Reference : 2202-0444OC-4
Result of Calibration :- (*) Without Adjustment
Function of UUC* : Temperature Source

Cert. No.: 22TM334

Calibration point (°C)	UUC* Setting (°C)	UUC* Reading (°C)	Average* Standard Reading (°C) Position 1	2	3	4	5 (ref.)
44.5	44.5	44.5	44.572	44.514	44.507	44.530	44.565

Calibration point (°C)	Uniformity (°C)	Stability (± °C)	Uncertainty (± °C)	Coverage Factor *k*
44.5	0.10	0.042	0.15	2

Average* : The average of 30 values in each position.
Uniformity : The maximum difference of measured temperatures at any sensors and the measured temperature at the reference location which are observed at the same time or at as close an observation time as possible to determine the temperature pattern or homogeneity within the chamber under steady-state conditions.
Stability : One-half of the greatest maximum difference of measured temperature at any one probe.
UUC* : Unit Under Calibration
Note : The reported uncertainty of measurement was included stability and excluded uniformity.

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

-o0o-

Malu.

เอกสารไม่ควบคุม

Equipment : Water Bath
Condition As-Received : Used Item
Reference : 2202-0444OC-4

Cert. No.: 22TM334

Procedure Used :-

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

The temperature scale used was based on ITS-90.

Condition of this result of calibration

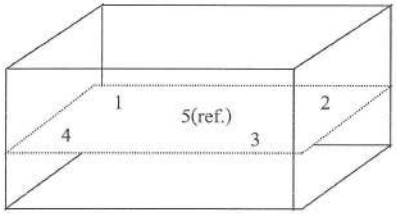
1. Reference standard instrument:-

Instrument	Model	Serial No.	Cert. No.	Due Date
1) Data Acquisition	34970A	MY44067817	21LM10	20 Jul 2022

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

Result of Calibration :- (*) Without Adjustment
Function of UUC* : Temperature Source

	Environmental (°C)	Environmental (%R.H.)	AC Voltage Supply (Volt)
Beginning of Calibration	21	65	229
Finished of Calibration	22	57	230



Front

Position :	Ref. Std. ID No.:
1	70RC143
2	70RC144
3	70RC145
4	70RC146
5(ref.)	70RC147

Malu.

เอกสารไม่ควบคุม

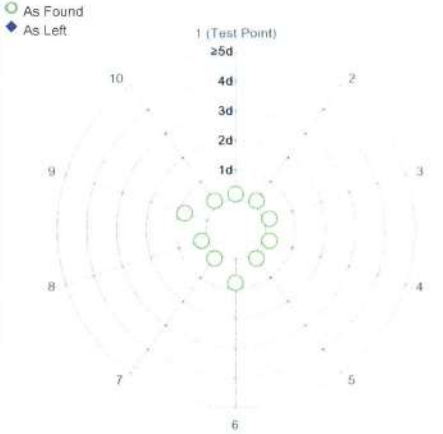
Measurement Results

Repeatability

Test Load: 200 g

	As Found	As Left
1	200.001 g	N/A
2	200.001 g	N/A
3	200.001 g	N/A
4	200.001 g	N/A
5	200.001 g	N/A
6	200.000 g	N/A
7	200.001 g	N/A
8	200.001 g	N/A
9	200.000 g	N/A
10	200.001 g	N/A

Standard Deviation	0.0004 g	N/A



The "d" in the graph represents the readability of the range/interval in which the test was performed.

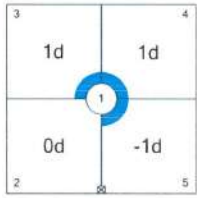
The results of this graph are based upon the absolute values of the differences from the mean value.

Eccentricity

Test Load: 200 g

Position	As Found	As Left
1	200.001 g	N/A
2	200.001 g	N/A
3	200.002 g	N/A
4	200.002 g	N/A
5	200.000 g	N/A

Maximum Deviation	0.001 g	N/A



As Found

The "d" in the graph represents the readability of the range/interval in which the test was performed.

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Mettler-Toledo (Thailand) Ltd.
846/4 - 846/5 Lasalle Rd., Bangna Tai Sub-District
Bangna District, Bangkok 10260
+66 2723 0382
MT-TH.ServiceSupport@mt.com

NSC-TISI-TIS 17025
CALIBRATION 0062

Accuracy Calibration Certificate

Customer

Company:	United Analyst and Engineering Consultant Co., Ltd.		
Address:	3 Soi Udom Suk 41, Sukhumvit Rd., Bang Chak		
City:	Phra Khanong	Contact:	Suwit Chotnok
Zip / Postal:	10260		
State / Province:	Bangkok		
Order Number:	*0332401494*		

Weighing Device

Manufacturer:	Mettler Toledo	Instrument Type:	Weighing Instrument
Model:	MS603S/01	Asset Number:	UAE.MIC.008/2553
Serial No.:	B007010311	Terminal Model:	N/A
Building:	N/A	Terminal Serial No.:	N/A
Floor:	2	Terminal Asset No.:	N/A
Room:	Balance Room (206)		

Range	Max. Capacity	Readability (d)
1	620 g	0.001 g

Procedure

Calibration Guideline:	EURAMET cg-18 v. 4.0 (11/2015)
METTLER TOLEDO Work Instruction:	CP/W002/20

This calibration certificate contains measurements for As Found calibration. No As Left calibration was performed because the device was not modified after As Found calibration. Therefore, results for As Left correspond to As Found.

The sensitivity/span of the weighing instrument was adjusted before calibration with a built-in weight.

In accordance with EURAMET cg-18 (11/2015), the test loads were selected to reflect the specific use of the weighing device or to accommodate specific calibration conditions.

	Temperature		Humidity	
As Found	Start: 22.8 °C	End: 23.0 °C	Start: 49.9 %	End: 58.3 %

As Found Calibration Date:	07-Apr-2022	Calibrator:	Sirawit Chamchan
As Left Calibration Date:	N/A		
Issue Date:	08-Apr-2022	Approved Signatory:	☑ Kassakorn Tassanachaisakul ☐ Santi Jitniyom ☐ Surachet Sukkate

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Test Equipment

All weights used for metrological testing are traceable to national or international standards. The weights were calibrated and certified by an accredited calibration laboratory.

Weight Set 1: OIML F1

Weight Set No.:	WS55	Date of Issue:	09-Jul-2021
Certificate Number:	CCM-0137-21-C	Calibration Due Date:	07-Jul-2022

Weight Set 2: OIML E2

Weight Set No.:	WS80	Date of Issue:	23-Feb-2022
Certificate Number:	C208581631	Calibration Due Date:	14-Aug-2023

Thermo Hygrometer

Equipment No.:	IN161	Date of Issue:	14-Jun-2021
Certificate Number:	21H1220	Calibration Due Date:	01-Jun-2022

Remarks

FACT adjustment functionality activated

Equipment condition: Good

Next calibration according to customer's procedure

Calibration data not decide by calibration laboratory

End of Accredited Section

The information below and any attachments to this calibration certificate are not part of the accredited calibration.

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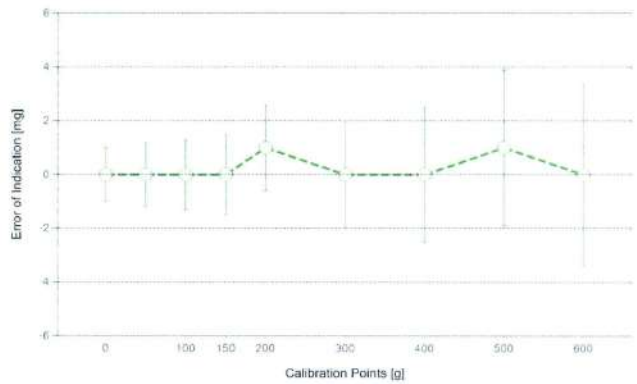
เอกสารไม่ควบคุม

Error of Indication

As Found

	Reference Value	Indication	Error of Indication	Expanded Uncertainty	k
1	0.000 g	0.000 g	0.000 g	1.0 mg	2
2	0.500 g	0.500 g	0.000 g	1.2 mg	2
3	1.000 g	1.000 g	0.000 g	1.2 mg	2
4	50.000 g	50.000 g	0.000 g	1.2 mg	2
5	100.000 g	100.000 g	0.000 g	1.3 mg	2
6	150.000 g	150.000 g	0.000 g	1.5 mg	2
7	200.000 g	200.001 g	0.001 g	1.6 mg	2
8	300.001 g	300.001 g	0.000 g	2.0 mg	2
9	400.001 g	400.001 g	0.000 g	2.5 mg	2
10	500.001 g	500.002 g	0.001 g	2.9 mg	2
11	600.001 g	600.001 g	0.000 g	3.4 mg	2



As Found

As Left

For improved legibility of the graphics only increasing measurement points are shown and measurement points close to zero are not displayed.

The uncertainty stated is the expanded uncertainty at calibration obtained by multiplying the standard combined uncertainty by the coverage factor k – which can be larger than 2 according to EURAMET cg-18. The value of the measurand lies within the assigned range of values with a probability of approximately 95%.

The user is responsible for maintaining environmental conditions and the settings of the weighing instrument when it was calibrated.

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TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES
534/4 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG BANGKOK 10250
TEL. 0-2717-3000-27 FAX. 0-2719-9484

NSC-TISI-TIS17025
CALIBRATION 0008

Certificate of Calibration

Cert. No.: 22TM89
Page.: 1 of 3

Equipment :	Autoclave
Manufacturer :	ALP
Model :	CL-40L
Serial No. :	802664
ID No. :	UAE.MIC.014/2550
Submitted by :	United Analyst and Engineering Consultant Co.,Ltd. 3 Soi Udomsuk 41, Sukhumvit Road, Bangchak, Phrakhanong, Bangkok 10260
Location :	Air Analysis Unit
Received Order :	17 February 2022
Calibration Date :	17 February 2022
Ambient Temperature :	(26 ± 10) °C
Relative Humidity :	(50 ± 30) %
Calibrated by :	Kunchit Promprat
Approved by :	Approved Signatory

( ) Pornthippa Tameyakul
(✓) Malee Butkruea
( ) Suwit Imjai

Issue Date : 22 February 2022

The Uncertainties are for a confidence probability of approximately 95%

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A 0038092

Measurement Uncertainty of the Weighing Instrument in Use

Stated is the expanded uncertainty with k=2 in use. The formula shall be used for the estimation of the uncertainty under consideration of the errors of indication. The value R represents the net load indication in the unit of measure of the device.

Temperature coefficient for the evaluation of the measurement uncertainty in use: $3.0 \cdot 10^{-6}$ / K

Temperature range on site for the evaluation of the measurement uncertainty in use: 3 K

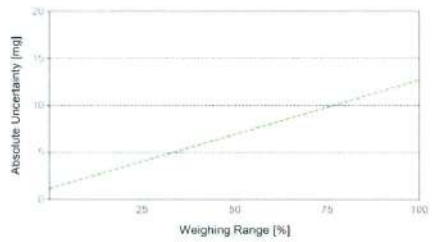
Linearization of Uncertainty Equation

	Range		As Found	As Left
	d	Max		
1	0.001 g	620 g	U_1 = 1.2 mg + 0.0186 mg/g · R	N/A

To optimize the stability of the linearization, besides of the zero load only increasing measurement points with a test load of 5% of the measurement range or larger are taken for the calculation of the linear equation.

Absolute and Relative Measurement Uncertainty in Use for Various Net Indications (Examples)

Net Indication	As Found		As Left	
0.062 g	1.2 mg	1.9%	N/A	N/A
0.620 g	1.2 mg	0.20%	N/A	N/A
6.200 g	1.3 mg	0.021%	N/A	N/A
62.000 g	2.4 mg	0.0038%	N/A	N/A
620.000 g	13 mg	0.0021%	N/A	N/A



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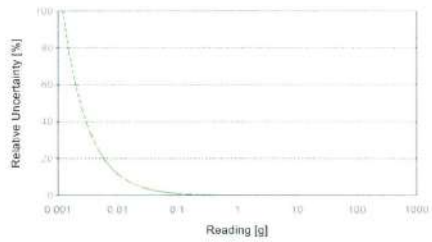

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เอกสารไม่ควบคุม

Equipment : Autoclave
Condition As-Received : Used Item
Reference : 2202-0444OC-1

Cert. No.: 22TM89

Result of Calibration :- (*) Without Adjustment

Operating parameter Set : Temperature = 122 °C
Sterilization period = 30 minute

UUC* Setting (°C)	UUC* Reading (°C)	Position	Average* Standard Reading (°C)	Stability (± °C)	Pressure Reading (MPa)	Uncertainty (± °C)	Coverage Factor *k*
122	122	1	122.373	0.32	0.12	1.2	2
		2	122.421				
		3	122.292				

Average* : The average of 30 values in each position.
Stability : One-half of the greatest maximum difference of measured temperature at any one probe.
UUC* : Unit Under Calibration
Note : The reported uncertainty of measurement was included stability and excluded uniformity .

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

-o0o-

Malu.
เอกสารไม่ควบคุม

Equipment : Autoclave
Condition As-Received : Used Item
Reference : 2202-0444OC-1

Cert. No.: 22TM89

Procedure Used :-

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

The temperature scale used was based on ITS-90.

Condition of this result of calibration

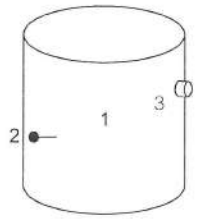
1. Reference standard instrument:-

Instrument	Model	Serial No.	Cert. No.	Due Date
1) Data Acquisition	34970A	MY44035217	21LM30	23 Dec 2022

2. This certificate is valid only to the item calibrated on date and place of calibration.
3. This certification is traceable to the International System of Unit.
4. This result of calibration covers laboratory autoclaves for the sterilization of goods and material which could be infected with organisms categorized as Hazard Group 1, 2 and 3**

(** = Categorization of pathogens according to hazard and categories of containment, second edition, 1990)
It does not cover autoclaves for use with material infect with organisms in Hazard Group 4, for which complete containment and sterilization of infected condensate is considered to be essential.
This result of calibration does not apply to sterilizers or disinfectors used for medical, dental, pharmaceutical or veterinary purposes which are directry concerned with patient care, or those used for fabrics subjected to sterilization which are required to be dry at the end of cycle.

Result of Calibration :- (*) Without Adjustment
Function of UUC* : Temperature Source



	Environmental		
	(°C)	(%R.H.)	(Volt)
Beginning of Calibration	27	68	226
Finished of Calibration	27	65	226

Position	Description	Ref. Std. ID No.:
1 =	Center of chamber	22-10TC-01
2 =	Temperature sensor	22-10TC-02
3 =	Exhaust port	22-10TC-03

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