

ภาคผนวก ค

เอกสารสอบเทียบเครื่องมือ



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	Apex Instruments, USA.	XC-572-V 0807047	Envl 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 60899617	Entech Industrial Sulation Co., Ltd.	G 640549	31 Aug 21	30 Aug 22	-

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
Ambient									
1	Office Transfer Standard Calibrator	Total Suspended Particulate (TSP) Particulate Matter < 10 µm (PM10)	Andersen Instruments, Inc.	G25A 1901	Tisch Environmental Inc.	22062020	22 Jun 20	21 Jun 22	-
2	U-Tube Manometer	Total Suspended Particulate (TSP) Particulate Matter < 10 µm (PM10)	Dwyer	1221-36-W/M	Technology Promotion Association (Thailand-Japan)	22P800	12 Mar 22	11 Mar 23	-
3	Aneroid Barometer	Total Suspended Particulate (TSP) Particulate Matter < 10 µm (PM10)	Barigo, Germany	-	Technology Promotion Association (Thailand-Japan)	21P2501	21 Jul 21	20 Jul 22	-
4	Dial Thermo-Hygrometer	Total Suspended Particulate (TSP) Particulate Matter < 10 µm (PM10)	Barigo, Germany	-	Technology Promotion Association (Thailand-Japan)	22H772	5 Apr 22	4 Apr 23	-
5	Nitrogen Dioxide Analyzer	Nitrogen Dioxide	Thermo Scientific	42i 1201778107	UAE Consultant Co.,Ltd.	17112021	17 Nov 21	16 Nov 22	-
6	Nitrogen Dioxide Analyzer	Nitrogen Dioxide	Thermo Scientific	42i 1201778108	UAE Consultant Co.,Ltd.	08122021	8 Dec 21	7 Dec 22	-
7	Nitrogen Dioxide Analyzer	Nitrogen Dioxide	Thermo Scientific	42i 1201778109	UAE Consultant Co.,Ltd.	08122021	8 Dec 21	7 Dec 22	-
8	Nitrogen Dioxide Analyzer	Nitrogen Dioxide	Thermo Scientific	42i 1201778110	UAE Consultant Co.,Ltd.	08122021	8 Dec 21	7 Dec 22	-
9	Nitrogen Dioxide Analyzer	Nitrogen Dioxide	Thermo Scientific	42i 1200636462	UAE Consultant Co.,Ltd.	10112021	10 Nov 21	9 Nov 22	-
10	Standard Gases (Mixture)	Nitrogen Dioxide	Airgas	EB0143262 2015PSIG	Airgas an Air Liquide company	E04N199E15A01D3	21 Jun 21	21 Jun 24	-
11	Sulphur Dioxide Analyzer	Sulphur Dioxide	Thermo Scientific	43i 1182920016	UAE Consultant Co.,Ltd.	29112021	29 Nov 21	28 Nov 22	-
12	Sulphur Dioxide Analyzer	Sulphur Dioxide	Thermo Scientific	43i 1182920017	UAE Consultant Co.,Ltd.	29112021	29 Nov 21	28 Nov 22	-
13	Sulphur Dioxide Analyzer	Sulphur Dioxide	Thermo Scientific	43i 1180540065	UAE Consultant Co.,Ltd.	09112021	9 Nov 21	8 Nov 22	-
14	Sulphur Dioxide Analyzer	Sulphur Dioxide	Thermo Scientific	43i 1180540066	UAE Consultant Co.,Ltd.	09112021	9 Nov 21	8 Nov 22	-
15	Sulphur Dioxide Analyzer	Sulphur Dioxide	Thermo Scientific	43i 1180540067	UAE Consultant Co.,Ltd.	09112021	9 Nov 21	8 Nov 22	-

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
Ambient									
16	Standard Gases (Mixture)	Sulphur Dioxide	Airgas	EB0143262 2015PSIG	Airgas an Air Liquide company	E04NI99E15A01D3	21 Jun 21	21 Jun 24	-
17	Wind Speed/Wind Direction	WS/WD	Scarlet Tech Ltd.	WL-21 2111DT0004	Scarlet Tech Ltd.	22022022	22 Feb 22	21 Feb 23	-
18	Sound Level Calibrator (Acoustic Calibrator)	Calibrate Sound Level Meter	01dB	CAL31 84065	Innovative Instrument Co.,Ltd.	21-ACT-264	20 Jul 21	19 Jul 22	-
19	Sound Level Meter	LAeq 24 hours, LA _{Adn} , LA90, LA _{max}	Larson Davis	LX _{T2} 0006614	Innovative Instrument Co.,Ltd.	22-ACT-104	11 Feb 22	10 Feb 23	-
20	Sound Level Meter	LAeq 24 hours, LA _{Adn} , LA90, LA _{max}	Larson Davis	LX _{T2} 0006615	Innovative Instrument Co.,Ltd.	22-ACT-102	11 Feb 22	10 Feb 23	-
21	Sound Level Meter	LAeq 24 hours, LA _{Adn} , LA90, LA _{max}	Larson Davis	LX _{T2} 0006617	Innovative Instrument Co.,Ltd.	22-ACT-100	11 Feb 22	10 Feb 23	-

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
Workplace									
1	Air Flow Meter	Calibrate personal pump	TSL Inc	4146 41461813030	Innovative Instrument Co.,Ltd.	21-AFM-073	23 Jul 21	22 Jul 22	-
2	Flow Meter	Calibrate personal pump	TSL Inc	4146 41461922007	Innovative Instrument Co.,Ltd.	21-AFM-052	8 Jun 21	7 Jun 22	-
3	Aneroid Barometer	Sodium Hypochloride Total Dust Sodium Hydroxide Sulphuric Acid Total Hydrocarbons Respirable Dust	Barigo, Germany	-	Technology Promotion Association (Thailand-Japan)	21P1156	31 Mar 21	30 Mar 22	-
4	Dial Thermo-Hygrometer	Sodium Hypochloride Total Dust Sodium Hydroxide Sulphuric Acid Total Hydrocarbons Respirable Dust	Barigo, Germany	-	Technology Promotion Association (Thailand-Japan)	22H401	17 Feb 22	16 Feb 23	-
5	Total Hydrocarbons Analyzer	Total Hydrocarbons	HORIBA	APHA-370 KWWV1R96	UAE Consultant Co.,Ltd.	09062021	9 Jun 21	8 Jun 22	-
6	Standard Gas	Total Hydrocarbons	Linde	D824432	Linde	09042013	4 Aug 20	4 Aug 28	-
7	Sound Level Meter	$L_{Aeq} 5 \text{ min}$ L_{Amax}	Rion, Japan	NL-42 00709656	Innovative Instrument Co.,Ltd.	22-ACT-065	3 Feb 22	2 Feb 23	-
8	Sound Level Meter	$L_{Aeq} 5 \text{ min}$ L_{Amax}	Rion, Japan	NL-42 00408980	Innovative Instrument Co.,Ltd.	22-ACT-064	3 Feb 22	2 Feb 23	-
9	Sound Level Meter	$L_{Aeq} 5 \text{ min}$ L_{Amax}	Rion, Japan	NL-42 01000182	Sithiporn Associates Co., Ltd.	ACL22076	25 Jan 22	24 Jan 23	-
10	Thermal Environment Monitor	Heat Meter	Quest Technologies, Inc	QuesTemp 34 TEB060015	Innovative Instrument Co.,Ltd.	21-TPM-223	2 Aug 21	1 Aug 22	-
11	Thermal Environment Monitor	Heat Meter	3M	QuesTemp 32 TPS030004	Innovative Instrument Co.,Ltd.	21-TPM-304	9 Nov 21	8 Nov 22	-
12	Thermal Environment Monitor	Heat Meter	TSI QUEST	QuesTemp 32 TPT030008	Innovative Instrument Co.,Ltd.	21-TPM-305	9 Nov 21	8 Nov 22	-

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
Workplace									
13	Sound Level Calibrator (Noise Dosimeter)	Noise Dosimeter	Svantek	SV36 107224	Innovative Instrument Co.,Ltd.	21-ACT-326	24 Aug 21	23 Aug 22	-
14	Noise Dosimeter	Noise Dosimeter	Svantek	SV 104 91923	Innovative Instrument Co.,Ltd.	22-ACT-114	17 Feb 22	16 Feb 23	-
15	Noise Dosimeter	Noise Dosimeter	Svantek	SV 104 91925	Innovative Instrument Co.,Ltd.	22-ACT-033	21 Jan 22	20 Jan 23	-

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	YSI	pH100A JC02719	Technology Promotion Association (Thailand-Japan)	21CHI467	21 Oct 21	20 Oct 22	-
2	DO Meter	DO	YSI	Pro 20i 18C104193	Technology Promotion Association (Thailand-Japan)	21TW182	2 Sep 21	1 Sep 22	-

Enviro-Service Co., Ltd.

110/254 Moo 3, Tambon Bang Rak Phatthana, Amphur Bang Bua Thong, Nonthaburi 11110
Tel. 098 362 9152, 089 478 7885
E-mail: sales@enviro-service.com

Certificate No. : E21-0813
Page : 2 of 6

Certificate No. : E21-0813
Page : 1 of 6

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 (SI).

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 Manager

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

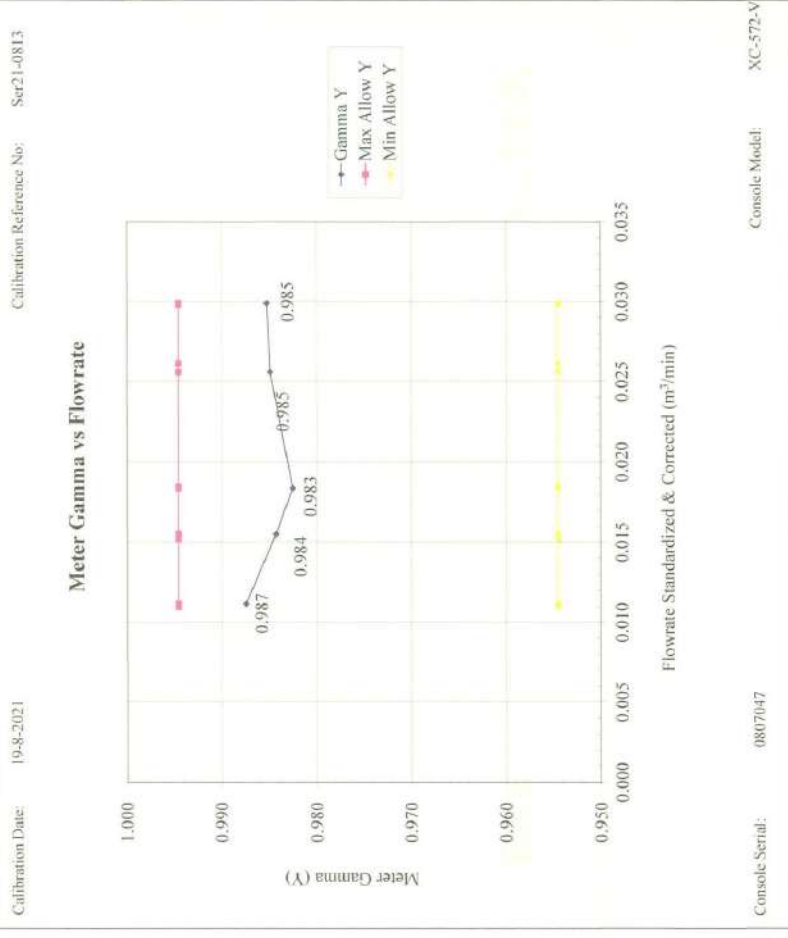
Meter Console Information			Calibration Conditions			Factors/Conversions	
Console Model Number	XC-572-V		Date	Time	19/8/2021	01:00 PM	
Console Serial Number	0807047		Calibration Reference No.				
DGM Model Number	SK25EX		Barometric Pressure		761.00	mm Hg	
DGM Serial Number	00003580		Calibration Meter Gamma		0.999		
Console Leak Check							PASS

Calibration Data											
Metering Console				Calibration Meter							
Run Time	DGM Orifice	Volume Initial	Volume Final	Outlet Temp Initial	Outlet Temp Final	Volume Initial	Volume Final	Outlet Temp Initial	Outlet Temp Final	Volume Initial	Volume Final
Elapsed (Q)	(P _m)	(V _m)	(V _{ref})	(t _m)	(t _{ref})	(V _{ref})	(V _{ref})	(t _m)	(t _{ref})	(V _{ref})	(V _{ref})
min	mm H ₂ O	m ³	m ³	°C	°C	m ³	m ³	°C	°C	m ³	m ³
12.17	13.0	3.3600	3.5000	23	23	23.01236	23.15126	26	26	26	26
12.30	13.0	3.5000	3.6400	23	23	23.15126	23.28948	26	26	26	26
8.72	26.0	3.6490	3.7890	24	24	23.29826	23.43644	26	26	26	26
8.88	26.0	3.7890	3.9290	24	24	23.43644	23.57434	26	26	26	26
14.83	40.0	3.9350	4.2150	25	25	23.58012	23.85818	26	26	26	26
14.67	40.0	4.2150	4.4950	25	25	23.85818	24.13456	26	26	26	26
10.37	70.0	4.5080	4.7880	25	25	24.14158	24.41250	26	26	26	26
10.13	70.0	4.7880	5.0680	26	26	24.41250	24.68290	26	26	26	26
8.90	90.0	5.0750	5.3550	27	27	24.68856	24.96012	26	26	26	26
8.88	90.0	5.3550	5.6350	27	27	24.96012	25.23050	26	26	26	26

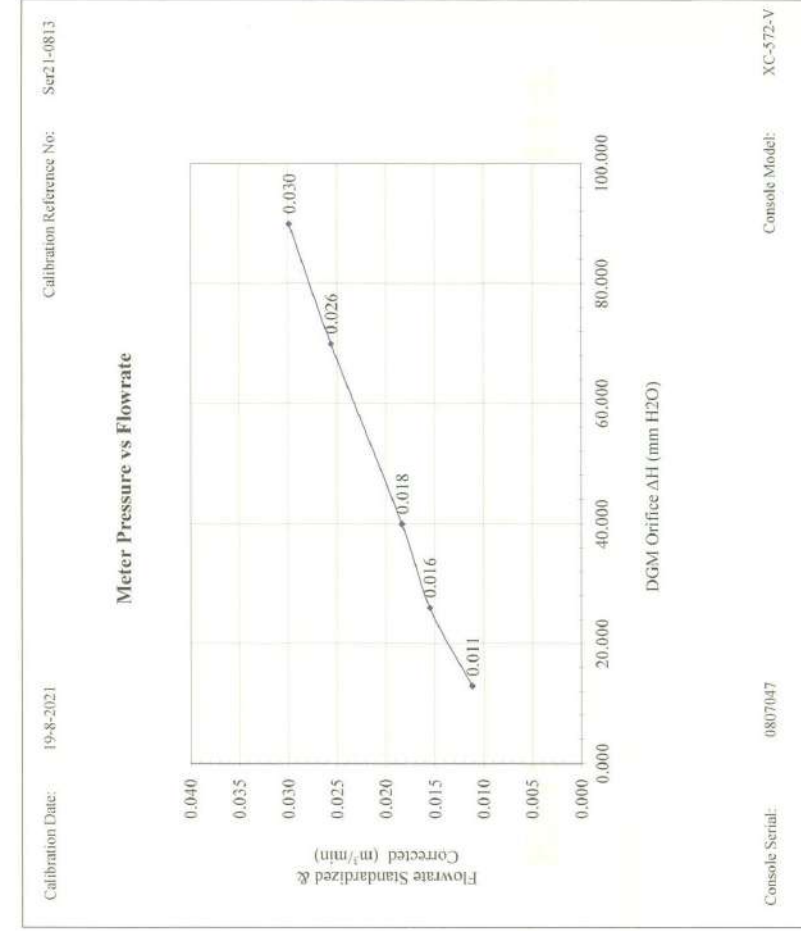
METHOD 5 CONSOLE CALIBRATION
USING REFERENCE WET GAS METER W-NK-2.5-B-Z No.547425
5-POINT METRIC UNIT

Calibration Data									
Results									
Standardized Data				Dry Gas Meter					
Dry Gas Meter		Calibration Meter		Calibration Factor		Flowrate		Variation	
(V _{std})	(Q _{std})	(V _{ref})	(Q _{ref})	Value	Variation	Std & Corr	.0212 m ³ /min	(ΔH _g)	(ΔH _g)
m ³	m ³ /min	m ³	m ³ /min	(Y)	(ΔY)	(Q _{std/corr})	m ³ /min	mm H ₂ O	
0.138	0.011	0.136	0.011	0.990	0.015	0.011	0.011	46.043	-2.056
0.138	0.011	0.135	0.011	0.985	0.010	0.011	0.011	47.522	-0.577
0.138	0.016	0.135	0.016	0.984	0.009	0.016	0.016	47.880	-0.219
0.138	0.016	0.135	0.015	0.982	0.007	0.015	0.015	49.931	1.832
0.276	0.019	0.273	0.018	0.988	0.014	0.018	0.018	52.821	4.722
0.276	0.019	0.271	0.018	0.982	0.008	0.018	0.018	52.270	4.171
0.277	0.027	0.266	0.026	0.960	-0.014	0.026	0.026	47.835	-0.264
0.277	0.027	0.265	0.026	0.958	-0.016	0.026	0.026	45.881	-2.217
0.277	0.031	0.266	0.030	0.961	-0.014	0.030	0.030	45.290	-2.809
0.277	0.031	0.265	0.030	0.956	-0.018	0.030	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 ΔH_g, orifice pressure differential that equates to 0.75 cfm (0.0212 m³/min) at standard temperature and pressure, acceptable tolerance of individual values from the average is ±0.2 inches (5.1mm) H₂O.



THERMOCOUPLES SYSTEM CALIBRATION



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

Results									
Console Thermocouple Simulator									
Channel and test point	Meter Box Channel Temperature Reading (°C)								
	-18.0	25.0	38.0	93.0	149.0	260.0	371.0	482.0	593.0
Stack	-17.0	24.0	37.0	93.0	149.0	259.0	371.0	482.0	594.0
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	Probe	Filter	± 1.50%	± 3.0 °C	± 3.0 °C	Absolute	Meter	± 3.0 °C	± 2.0 °C
								Exit		

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Certificate No: G 640549
Date of issue: 01-Sep-21

Instrument description : Flue gas Analyzer
Instrument model : Testo 350 New
Instrument serial no. : 60899617
ID no. or control no. : UAE.EFM. 007/2560
Manufacturer : testo SE
Probe description : -
Probe model : -
Probe serial : -
Customer name : United Analyst and Engineering Consultant Co., Ltd.
Customer address : 81 Soi Udomsuk 41, Sukhumvit Rd., Bangchak, Phrakhanong, Bangkok 10260

Total pages of certificate : 3 Pages
Receiving no. : L-212423
Receiving date. : 26-Aug-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 10.19,80.62,202.2 ppm)

Condition of UUC. : Used
Ambient condition : All of the Measurement were carried out the stabilized laboratory
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 measurement 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 reproduced 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 traceability to national standards, which realize measurement according to the International System of Units (SI).

Date of calibration : 31-Aug-21

Kwanthai K.

Mr. Kwanthai Khandoung
Calibration Technician

Nongluck W.

Mrs. Nongluck Wongsettee
Technical Manager



Certificate No.: G 640549

Standard References (Table 1)

Standard	Certificate No.	Vendor	Due date
Oxygen (O ₂) 2.501 % Vol	2431/19	Linde	16-Jul-23
Oxygen (O ₂) 10.00 % Vol	2453/19	Linde	18-Jul-23
Oxygen (O ₂) 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 (SO ₂) 50.04 ppm	3205/21	Linde	25-Jul-23
Sulphur Dioxide (SO ₂) 100.9 ppm	4942/20	Linde	20-Nov-22
Sulphur Dioxide (SO ₂) 601.1 ppm	3204/21	Linde	20-Jul-23
Nitrogen Dioxide (NO ₂) 10.19 ppm	3372/21	Linde	02-Aug-23
Nitrogen Dioxide (NO ₂) 80.62 ppm	3240/21	Linde	25-Jul-23
Nitrogen Dioxide (NO ₂) 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 : 1,200 ml/min Gas pressure : 1021.6 mbar

Calibration Results Before Adjustment (Table 2)

Parameter of Standard	Standard Values		Mean of UUC	Error	Uncertainty (±)
O ₂ (%Vol)	2.501		2.46	-0.041	0.20
O ₂ (%Vol)	10.00		9.88	-0.12	0.40
O ₂ (%Vol)	21.00		21.09	0.09	0.80
CO (ppm)	80.97		88	7.03	2.8
CO (ppm)	309.9		337	27.1	11
CO (ppm)	1003		1073	70	34
NO (ppm)	10.08		10	-0.08	3.0
NO (ppm)	150.9		150	-0.9	5.0
NO (ppm)	320.6		313	-7.6	10
SO ₂ (ppm)	50.04		52	1.96	5.0
SO ₂ (ppm)	100.9		104	3.1	5.0
SO ₂ (ppm)	601.1		618	16.9	14
NO ₂ (ppm)	10.19		11.1	0.91	1.5
NO ₂ (ppm)	80.62		80.9	0.28	5.0
NO ₂ (ppm)	202.2		205.1	2.9	5.0

Calibration Results After Adjustment (Table 3)

Parameter of Standard	Standard Values	Mean of UUC	Error	Uncertainty (±)
O2 (%Vol)	2.501	2.46	-0.041	0.20
O2 (%Vol)	10.00	9.88	-0.12	0.40
O2 (%Vol)	21.00	21.09	0.09	0.80
CO (ppm)	80.97	81	0.03	2.8
CO (ppm)	310	310	0.1	11
CO (ppm)	309.9	1005	0	34
CO (ppm)	1003	10	-0.08	3.0
NO (ppm)	10.08	10	-0.9	5.0
NO (ppm)	150.9	150	-7.6	5.0
NO (ppm)	320.6	313	1.96	5.0
SO2 (ppm)	50.04	52	3.1	5.0
SO2 (ppm)	100.9	104	16.9	14
NO2 (ppm)	601.1	618	0.91	1.5
NO2 (ppm)	10.19	11.1	0.28	5.0
NO2 (ppm)	80.62	80.9	2.9	5.0
NO2 (ppm)	202.2	205.1		

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

End of Report

Certificate of Calibration

Calibration Certification Information			
Cal. Date:	June 22, 2020	Rootsometer S/N: 438320	Ta: 296 °K
Operator:	Jim Tisch		Pa: 748.0 mm Hg
Calibration Model #:	G25A	Calibrator S/N: 1901	

Run	Vol. Init (m3)	Vol. Final (m3)	ΔVol. (m3)	ΔTime (min)	ΔP (mm Hg)	ΔH (in H2O)
1	1	2	1	1.3620	3.2	2.00
2	3	4	1	0.9580	6.4	4.00
3	5	6	1	0.8590	7.9	5.00
4	7	8	1	0.8160	8.8	5.50
5	9	10	1	0.6750	12.8	8.00

Data Tabulation

Vstd (m3)	Qstd (x-axis)	$\sqrt{\Delta H \left(\frac{Pa}{Pstd} \right) \left(\frac{Tstd}{Ta} \right)}$ (y-axis)	Va	Qa (x-axis)	$\sqrt{\Delta H \left(\frac{Ta}{Pa} \right)}$ (y-axis)
0.9867	0.7244	1.4078	0.9957	0.7311	0.8896
0.9824	1.0255	1.9909	0.9914	1.0349	1.2581
0.9804	1.1414	2.2259	0.9894	1.1518	1.4066
0.9792	1.2001	2.3345	0.9882	1.2111	1.4753
0.9739	1.4429	2.8155	0.9829	1.4561	1.7792
QSTD	m= 1.95981		QA	m= 1.22720	
	b= -0.01429			b= -0.00903	
	r= 0.99998			r= 0.99998	

Calculations

Vstd=	$\Delta Vol((Pa-\Delta P)/Pstd)(Tstd/Ta)$	Va=	$\Delta Vol((Pa-\Delta P)/Pa)$
Qstd=	Vstd/ΔTime	Qa=	Va/ΔTime
For subsequent flow rate calculations:			
Qstd=	$1/m \left(\sqrt{\Delta H \left(\frac{Pa}{Pstd} \right) \left(\frac{Tstd}{Ta} \right)} - b \right)$	Qa=	$1/m \left(\sqrt{\Delta H \left(\frac{Ta}{Pa} \right)} - b \right)$

Standard Conditions

Tstd:	298.15 °K
Pstd:	760 mm Hg
Key	
ΔH:	calibrator manometer reading (in H2O)
ΔP:	rootsometer manometer reading (mm Hg)
Ta:	actual absolute temperature (°K)
Pa:	actual barometric pressure (mm Hg)
b:	intercept
m:	slope

RECALIBRATION

US EPA recommends annual recalibration per 1998 40 Code of Federal Regulations Part 50 to 51, Appendix B to Part 50, Reference Method for the Determination of Suspended Particulate Matter in the Atmosphere, 9.2.17, page 30

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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. 0-2717-3000-24 FAX. 0-2719-9484

Certificate of Calibration

Certificate No. : 22P800
Page : 1 of 2

Equipment : U-Tube Manometer
Manufacturer : Dwyer
Model : 1221-36-W/M
Serial No. : -
ID No. : UAE.EFM.022/2560
Condition As-Received: Used Item
Received Date: 03 March 2022
Calibration Date: 12 March 2022

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

Submitted by: United Analyst and Engineering Consultant Co.,Ltd.

Reference: 2203-0131WSC
Ambient Temperature: (23 ± 2) °C
Relative Humidity: (50 ± 15) %
Atmospheric Pressure: 1010 mbar
81 Soi Udomsuk 41, Sukhumvit Road, Bangkok,
Phraekhanong, Bangkok 10260

Procedure used: The calibration was conducted by direct comparison method against Pressure Measuring Instruments
Standard according to in-house calibration procedure CP-P04, using " DKD-R 6-1 : Calibration of Pressure
Gauges, Edition 03/2014 " as a guidelines.

Condition of this result of calibration

1.Reference standards instruments :

Instrument	Model	Serial No.	Certificate No.	Due Date
1) Pressure Calibrator	PC106P	1189	MP-0110-21	09 Aug 2022

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

3.Scale and conversion factor is 1 kPa = 4,0146293 inH₂O

4.This instrument was used clean air as pressure media.

5.This instrument was calibrated by applied pressure to high-port (+) side and low-port (-) side open to atmospheric pressure.

6.This instrument was installed in vertical orientation and top of the pressure port was used as the reference level.

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

8.This Certification is traceable to the International System of Unit maintained at:-

-National Institute of Metrology Thailand (NIMT)

Calibrated by : Suwit Aussanee
Issue Date : 14 March 2022

Approved Signatory : Attapol P.
[] Phalinee Prabsipal
[] Sura Suwanasri
✓ Attapol Panurach

เอกสารไม่ควบคุม

B 0282413



Cert.No.: 22P800
Page: 2 of 2

Result of calibration:- Without adjustment
Function:- Pressure Measurement
Increasing Pressure
Range : 0 inH₂O to 36 inH₂O
Scale interval : 0.1 inH₂O(The Fifth Estimate)

Applied Pressure (inH ₂ O)	UUC Indication		Error (inH ₂ O)
	High-port side (inH ₂ O)	Low-port side (inH ₂ O)	
0.00	0.00	0.00	0.00
2.00	1.00	-1.00	0.00
4.00	2.00	-2.00	0.00
6.00	3.00	-3.00	0.00
8.00	4.00	-4.00	0.00
10.00	5.00	-5.02	0.02
12.00	6.00	-6.02	0.02
14.00	7.00	-7.04	0.04
16.00	8.00	-8.04	0.04
18.00	9.00	-9.04	0.04
20.00	10.00	-10.04	0.04
22.00	11.00	-11.02	0.02
24.00	12.00	-12.02	0.02
26.00	13.00	-13.02	0.02
28.00	14.00	-14.04	0.04
30.00	15.00	-15.04	0.04
32.00	16.00	-16.04	0.04
34.00	16.98	-17.06	0.04
35.80	17.98	-18.00	0.18

The uncertainty of measurement was ± 0.11 inH₂O

* UUC = Unit Under Calibration

* ΔP = High-port side - Low-port side

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

-o-o-

เอกสารไม่ควบคุม

a 1099526



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES
534/41 PATTANAKARN ROAD SOI 18, SUANLUANG, BANGKOK 10250
TEL. 0-2717-3000-24 FAX. 0-2719-9484



NSC-TS-17025
CALIBRATION 0008

Certificate of Calibration

Certificate No. : 21P2501
Page : 1 of 2

Equipment : Aneroid Barometer
Manufacturer : Barigo
Model : -
Serial No. : -
ID No. : UAE/ANV/124/2550
Condition As-Received: Used Item
Received Date: 20 July 2021
Calibration Date: 21 July 2021

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.

Submitted by: United Analyst and Engineering Consultant Co., Ltd.

81 Soi Udomsuk 41, Sukhumvit Road, Bangkok,
Phrakhanong, Bangkok 10260

Reference: 2107-A570WSC

Ambient Temperature: (23 ± 2) °C

Relative Humidity: (50 ± 15) %

Atmospheric Pressure: 1009 mbar

Procedure used: The calibration was conducted by direct comparison method against Pressure Measuring Instruments
Standard according to in-house calibration procedure CP-P10, using "DKD-R 6-1 : Calibration of Pressure
Gauges, Edition 03/2014" as a guidelines.

Condition of this result of calibration

1. Reference standards instruments :

Instrument	Model	Serial No.	Certificate No.	Due Date
1) Standard Barometer	DPI142	1422505046	MP-0053-21	08 Apr 2022

2. This instrument was installed in vertical orientation and center of the dial was used as the reference level.

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

4. This instrument was used clean air as pressure media.

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

6. This Certification is traceable to the International System of Unit maintained at:-

-National Institute of Metrology Thailand (NIMT)

Calibrated by : Suwit Aussarree
Issue Date : 22 July 2021

Approved Signatory : Attapol P.
☐ Phallinee Prabpaipal
☐ Sura Suwannasri
☒ Attapol Panurach

เอกสารไม่ควบคุม

B 0264464



Cert.No.: 21P2501
Page: 2 of 2

Result of calibration:- Without adjustment
Function:- Absolute Pressure Measurement
Scale Interval: 1 hPa(The Fifth Estimate)
Range: 980 hPa to 1030 hPa

Increasing Pressure	958.69	969.60	980.32	990.60	1000.69	1010.73	1020.58	1030.55
Applied Pressure (hPa)	958.69	969.60	980.32	990.60	1000.69	1010.73	1020.58	1030.55
UUC* Indication (hPa)	960.0	970.0	980.0	990.0	1000.0	1010.0	1020.0	1030.0
Error (hPa)	1.31	0.40	-0.32	-0.60	-0.69	-0.73	-0.58	-0.55

Decreasing Pressure	1030.66	1020.50	1010.63	1000.57	990.45	980.19	969.47	958.64
Applied Pressure (hPa)	1030.66	1020.50	1010.63	1000.57	990.45	980.19	969.47	958.64
UUC* Indication (hPa)	1030.0	1020.0	1010.0	1000.0	990.0	980.0	970.0	960.0
Error (hPa)	-0.66	-0.50	-0.63	-0.57	-0.45	-0.19	0.53	1.46

The uncertainty of measurement was ± 0.30 hPa

* UUC = Unit Under Calibration

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

-000-

เอกสารไม่ควบคุม
Attapol P.
B 1062242



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES
534/4 PATTANAKARN ROAD SOI 18, SUANLUANG, BANGKOK 10250
TEL. 0-2717-3000-24 FAX. 0-2719-9484



NSC-TIS-10517025
CALIBRATION 0025

Certificate of Calibration

Certificate No. : 22H772
Page : 1 of 2

Equipment: Dial Thermo-Hygrometer
Manufacturer: Barigo
Model: -
Serial No.: -
ID No.: UAE-ANV.001/2548
Condition As-Received: Used Item
Received Date: 30 March 2022
Calibration Date: 01 April 2022
Reference: 2203-1124WSC
Ambient Temperature: (25 ± 3) °C
Relative Humidity: (50 ± 20) %

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.

Submitted by: United Analyst and Engineering Consultant Co., Ltd.

81 Soi Udomsuk 41, Sukhumvit Road, Bangkok,
Phrakhanong, Bangkok 10260

Procedure used: Calibration were conducted using in-house calibration procedure CP-H02 according to comparison
with standard chilled mirror sensor for humidity measurement function and comparison with standard
temperature probe for temperature measurement function into humidity / temperature chamber.

Condition of this result of calibration

1. Reference standards instruments :

Instrument	Model	Serial No.	Certificate No.	Due Date
1) Standard Chilled Mirror Hygrometer Sensor	Dew Prime II	31863	19714	17 Sep 2022
2) Standard Humidity/Temperature Meter	400	10203027	TH-0063-21	01 Jul 2022

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

3. This Certification is traceable to the International System of Unit maintained at:-

-National Institute of Standards and Technology (NIST), The United States of America

-National Institute of Metrology Thailand (NIMT)

Calibrated by : Somchai Dumwor
Issue Date : 08 April 2022

Approved Signatory :

[✓] Chakrit Waewanjua
[] Pornthippa Tameyakul
[] Viporn Tantiyawutti

Chakrit Waewanjua

เอกสารไม่ควบคุม

B 0285424



Cert. No.: 22H772
Page.: 2 of 2

Result of Calibration:-			
Function:	Humidity measurement.	Without Adjustment	
Reference Temperature	Standard Humidity	UUC* Reading	Uncertainty of Measurement
(°C)	(%R.H.)	(%R.H.)	(±%R.H.)
25.0	40.1	40	1.6
25.0	60.0	60	1.8
25.0	80.0	76	2.0

Result of Calibration:-			
Function:	Temperature measurement.	Without Adjustment	
Standard Temperature	UUC* Reading	Error	Uncertainty of Measurement
(°C)	(°C)	(°C)	(±°C)
20.02	21.5	1.48	0.72
29.98	30.0	0.02	0.72
40.03	39.5	-0.53	0.72

UUC* : Unit Under Calibration

The reported uncertainty of measurement was base on standard uncertainty multiplied
by coverage factor k = 2.00, providing confidence level approximately 95%.

-000-

Chakrit Waewanjua

เอกสารไม่ควบคุม

B 1104140

MULTI-POINT GAS TEST REPORT

Test Date : Nov 17, 2021

Equipment : Gas Analyzer (NO₂) Model : 421
Manufacturer : Thermo Scientific Serial Number : 1201778107

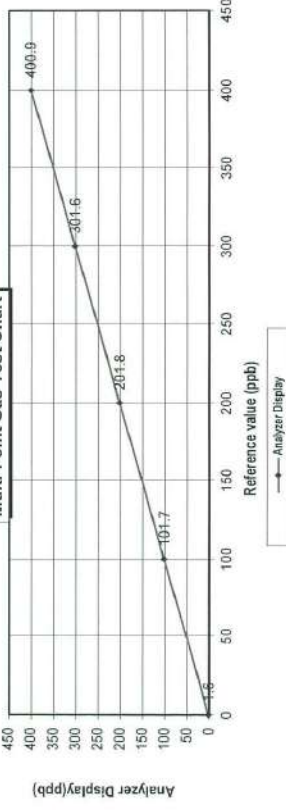
Standard Gas Concentration

Sulphur Dioxide (SO ₂)	44.75	PPM	Manufacturer :	Thermo Scientific
Nitric Oxide (NO)	45.35	PPM	Model :	1461
Methane (CH ₄)	-	PPM	Serial Number :	1180540071
Carbon Monoxide (CO)	1007			
Cylinder No. :	CC159599			
Expiration Date :	Jul 30, 2022			

Multi-point gas test data

Reference Value (ppb)	Analyzer Display (ppb)	Difference Error	Percent Error	% Error]
Level 1 Zero	0.0	1.6	1.60	1.60
Level 2 20.00%	101.7	1.70	1.67	1.67
Level 3 40.00%	201.8	1.80	0.89	0.89
Level 4 60.00%	301.6	1.60	0.53	0.53
Level 5 80.00%	400.9	0.90	0.22	0.22
Remark : Measuring Range 500.0 ppb		Average Difference (%)		0.98
		:Acceptable Limit $\pm 5\%$		

Multi-Point Gas Test Chart



Calculate by
S. Pichai Y.
17/11/2021

Approve by
S. Pichai Y.
17/11/2021

MULTI-POINT GAS TEST REPORT

Test Date : Dec 8, 2021

Equipment : Gas Analyzer (NO₂) Model : 421
Manufacturer : Thermo Scientific Serial Number : 1201778108

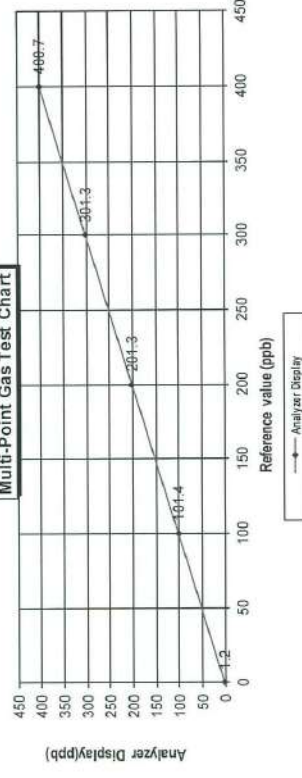
Standard Gas Concentration

Sulphur Dioxide (SO ₂)	44.75	PPM	Manufacturer :	Thermo Scientific
Nitric Oxide (NO)	45.35	PPM	Model :	1461
Methane (CH ₄)	-	PPM	Serial Number :	1180540071
Carbon Monoxide (CO)	1007			
Cylinder No. :	CC159599			
Expiration Date :	Jul 30, 2022			

Multi-point gas test data

Reference Value (ppb)	Analyzer Display (ppb)	Difference Error	Percent Error	% Error]
Level 1 Zero	0.0	1.2	1.20	1.20
Level 2 20.00%	101.4	1.40	1.38	1.38
Level 3 40.00%	201.3	1.30	0.65	0.65
Level 4 60.00%	301.3	1.30	0.43	0.43
Level 5 80.00%	400.7	0.70	0.17	0.17
Remark : Measuring Range 500.0 ppb		Average Difference (%)		0.77
		:Acceptable Limit $\pm 5\%$		

Multi-Point Gas Test Chart



Calculate by
S. Pichai Y.
8/12/2021

Approve by
S. Pichai Y.
8/12/2021

MULTI-POINT GAS TEST REPORT

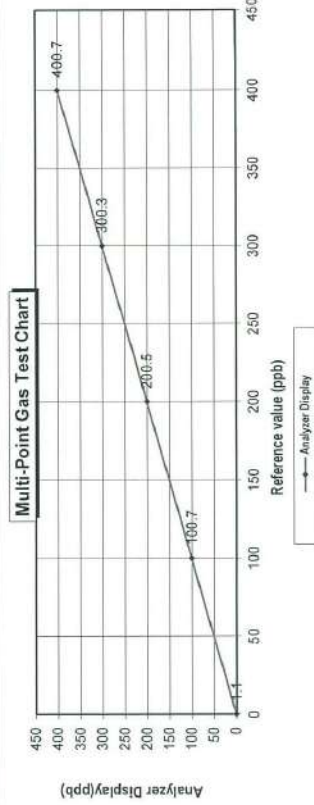
Test Date : Dec 8, 2021

Equipment : Gas Analyzer (NO₂) Model : 42i
Manufacturer : Thermo Scientific Serial Number : 1201778109

Standard Gas Concentration
Sulphur Dioxide (SO₂) 44.75 PPM Manufacturer : Thermo Scientific
Nitric Oxide (NO) 45.35 PPM Model : 146i
Methane (CH₄) - PPM Serial Number : 1180540071
Carbon Monoxide (CO) 1007
Cylinder No. : CC159599
Expiration Date : Jul 30, 2022

Multi-point gas test data

Reference Value (ppb)	Analyzer Display (ppb)	Difference Error	Percent Error	% Error]
Level 1 Zero	0.0	1.1	1.10	1.10
Level 2 20.00%	100.0	100.7	0.70	0.70
Level 3 40.00%	200.0	200.5	0.50	0.25
Level 4 60.00%	300.0	300.3	0.30	0.10
Level 5 80.00%	400.0	400.7	0.70	0.17
Remark : Measuring Range 500.0 ppb		Average Difference (%)		
		Acceptable Limit $\pm 5\%$		
		0.46		



Calculate by
S. Vichaiy.
8, Dec 8, 2021

Approve by
S. Vichaiy.
8, Dec 8, 2021

MULTI-POINT GAS TEST REPORT

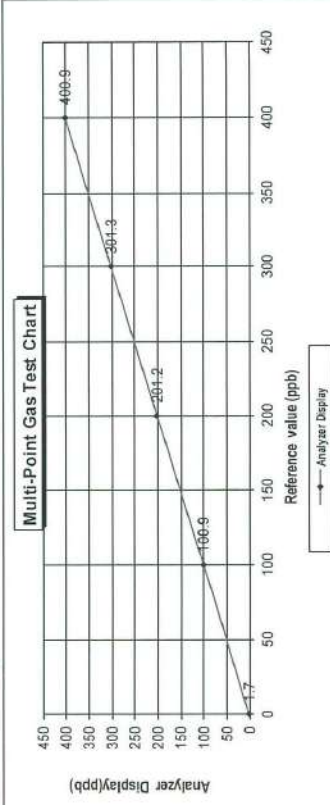
Test Date : Dec 8, 2021

Equipment : Gas Analyzer (NO₂) Model : 42i
Manufacturer : Thermo Scientific Serial Number : 1201778110

Standard Gas Concentration
Sulphur Dioxide (SO₂) 44.75 PPM Manufacturer : Thermo Scientific
Nitric Oxide (NO) 45.35 PPM Model : 146i
Methane (CH₄) - PPM Serial Number : 1180540071
Carbon Monoxide (CO) 1007
Cylinder No. : CC159599
Expiration Date : Jul 30, 2022

Multi-point gas test data

Reference Value (ppb)	Analyzer Display (ppb)	Difference Error	Percent Error	% Error]
Level 1 Zero	0.0	1.7	1.70	1.70
Level 2 20.00%	100.0	100.9	0.90	0.89
Level 3 40.00%	200.0	201.2	1.20	0.60
Level 4 60.00%	300.0	301.3	1.30	0.43
Level 5 80.00%	400.0	400.9	0.90	0.22
Remark : Measuring Range 500.0 ppb		Average Difference (%)		
		Acceptable Limit $\pm 5\%$		
		0.77		



Calculate by
S. Vichaiy.
8, Dec 8, 2021

Approve by
S. Vichaiy.
8, Dec 8, 2021

MULTI-POINT GAS TEST REPORT

Test Date : Nov 10, 2021

Equipment : Gas Analyzer (NO₂) Model : 421
Manufacturer : Thermo Scientific Serial Number : 1200636462

Standard Gas Concentration

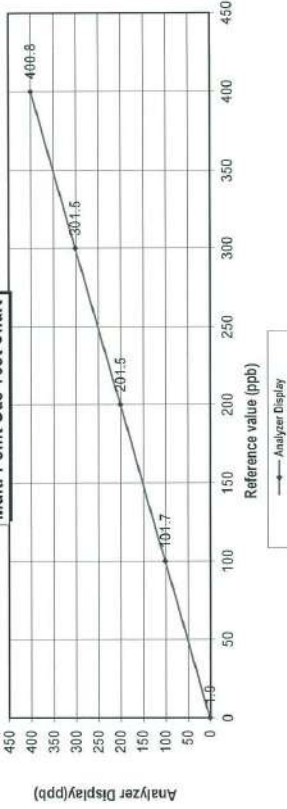
Sulphur Dioxide (SO₂) 44.75 PPM Thermo Scientific
Nitric Oxide (NO) 45.35 PPM 1461
Methane (CH₄) - PPM 1180540071
Carbon Monoxide (CO) 1007 PPM
Cylinder No. : CC159599
Expiration Date : Jul 30, 2022

Multi-point gas test data

Level	Reference Value (ppb)	Analyzer Display (ppb)	Difference Error (ppb)	Percent Error	[% Error]
Level 1	Zero	0.0	1.9	1.90	1.90
Level 2	20.00%	100.0	101.7	1.67	1.67
Level 3	40.00%	200.0	201.5	0.74	0.74
Level 4	60.00%	300.0	301.5	0.50	0.50
Level 5	80.00%	400.0	400.8	0.20	0.20

Remark : Measuring Range 500.0 ppb
Acceptable Limit $\pm 5\%$

Multi-Point Gas Test Chart



Calculate by
Srichai Y.
20, Nov, 2021

Approve by
Srichai Y.
20, Nov, 2021

CERTIFICATE OF ANALYSIS
Grade of Product: EPA Protocol

Part Number: E04NI99E15A01D3
Cylinder Number: E80143262
Laboratory: 124 - Durham (SAP) - NC
PGVP Number: B22021
Gas Code: CO, NO, NO₂, SO₂, BALN
Reference Number: 122-402135167-1
Cylinder Volume: 144.4 CF
Cylinder Pressure: 2015 PSIG
Valve Outlet: 560
Certification Date: Jun 21, 2021
Expiration Date: Jun 21, 2024

Certification performed in accordance with EPA Testability Protocol for Assay and Certification of Gaseous Calibration Standards (May 2012) document EPA 800/R-12/531, using the assay procedures listed. Analytical Methodology does not require correction for analytical interference. This cylinder has a total analytical uncertainty as stated below with a confidence level of 95%. There are no significant impurities which affect the use of this calibration mixture. All concentrations are on a mole/mole basis unless otherwise noted.

Do Not Use This Cylinder below 100 psig, 18, 0.7 megapascals.

ANALYTICAL RESULTS					
Component	Requested Concentration	Actual Concentration	Protocol Method	Total Relative Uncertainty	Assay Dates
NO ₂	45.00 PPM	45.96 PPM	G1	$\pm 1.4\%$ NIST Traceable	06/14/2021, 06/21/2021
NITRIC OXIDE	45.00 PPM	45.34 PPM	G1	$\pm 1.4\%$ NIST Traceable	06/14/2021, 06/21/2021
SULFUR DIOXIDE	45.00 PPM	44.68 PPM	G1	$\pm 1.0\%$ NIST Traceable	06/14/2021, 06/21/2021
CARBON MONOXIDE	1000 PPM	984.8 PPM	G1	$\pm 0.7\%$ NIST Traceable	06/14/2021
NITROGEN	Balance				

CALIBRATION STANDARDS			
Type	Lot ID	Cylinder No	Expiration Date
NITRM	20061120	CC708068	Feb 02, 2025
PPM	12386	D685025	Feb 20, 2020
GMS	40742383102	CC305581	Feb 18, 2023
NITRM	16011043	CC473277	Jun 17, 2022
NITRM	14060119	CC434277	Nov 15, 2025

ANALYTICAL EQUIPMENT		
Instrument/Make/Model	Analytical Principle	Last Multipoint Calibration
Nicolet 6700 AHR0801333 CO	FTIR	Jun 03, 2021
Nicolet 6700 AHR0801333 NO	FTIR	Jun 03, 2021
Nicolet 6700 AHR0801333 NO ₂	FTIR	Jun 03, 2021
Nicolet 6700 AHR0801333 SO ₂	FTIR	Jun 03, 2021

Triad Data Available Upon Request

NOTES: PO #5221002807

GROSS WT: 28.40kg

NET WT: 4.73kg



CERT 3082.01

เอกสารไม่ควบคุม

The analytical test results reported on this certificate relate only to the cylinder number specified above. This concludes the test report.

Signature

Approved for Release

MULTI-POINT GAS TEST REPORT

Test Date : Nov 29, 2021

Equipment : Gas Analyzer (SO₂) Model : 43i
Manufacturer : Thermo SCIENTIFIC Serial Number : 1182920016

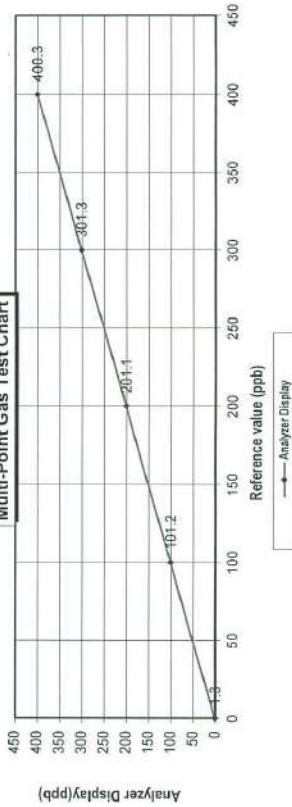
Standard Gas Concentration

Sulphur Dioxide (SO ₂)	44.75	PPM	Manufacturer :	Thermo SCIENTIFIC
Nitric Oxide (NO)	45.35	PPM	Model :	146i
Methane (CH ₄)	-	PPM	Serial Number :	1180540071
Carbon Monoxide (CO)	1007			
Cylinder No. :	CC159599			
Expiration Date :	Jul 30, 2022			

Multi-point gas test data

Reference Value (ppb)	Analyzer Display (ppb)	Difference Error	Percent Error	[% Error]
Level 1 Zero	0.0	1.3	1.30	1.30
Level 2 20.00%	101.2	1.20	1.19	1.19
Level 3 40.00%	201.1	1.10	0.55	0.55
Level 4 60.00%	301.3	1.30	0.43	0.43
Level 5 80.00%	400.3	0.30	0.07	0.07
Remark : Measuring Range 500.0 ppb				
:Acceptable Limit $\pm 5\%$				
Average Difference (%)				
0.71				

Multi-Point Gas Test Chart



Calculate by
Srichai Y.
29.11.2021

Approve by
Pattana K.
29.11.2021

MULTI-POINT GAS TEST REPORT

Test Date : Nov 29, 2021

Equipment : Gas Analyzer (SO₂) Model : 43i
Manufacturer : Thermo SCIENTIFIC Serial Number : 1182920017

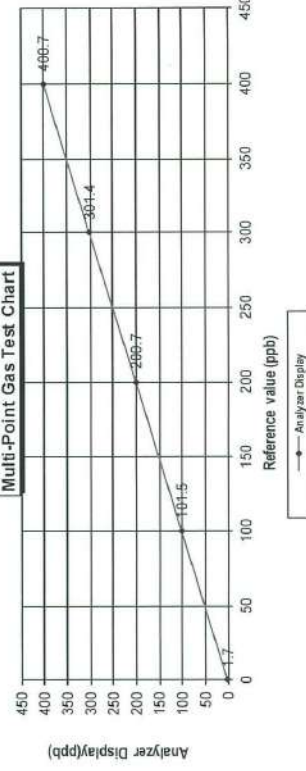
Standard Gas Concentration

Sulphur Dioxide (SO ₂)	44.75	PPM	Manufacturer :	Thermo SCIENTIFIC
Nitric Oxide (NO)	45.35	PPM	Model :	146i
Methane (CH ₄)	-	PPM	Serial Number :	1180540071
Carbon Monoxide (CO)	1007			
Cylinder No. :	CC159599			
Expiration Date :	Jul 30, 2022			

Multi-point gas test data

Reference Value (ppb)	Analyzer Display (ppb)	Difference Error	Percent Error	[% Error]
Level 1 Zero	0.0	1.7	1.70	1.70
Level 2 20.00%	101.5	1.50	1.48	1.48
Level 3 40.00%	200.7	0.70	0.35	0.35
Level 4 60.00%	301.4	1.40	0.46	0.46
Level 5 80.00%	400.7	0.70	0.17	0.17
Remark : Measuring Range 500.0 ppb				
:Acceptable Limit $\pm 5\%$				
Average Difference (%)				
0.83				

Multi-Point Gas Test Chart



Calculate by
Srichai Y.
29.11.2021

Approve by
Pattana K.
29.11.2021

MULTI-POINT GAS TEST REPORT

Test Date : Nov 9, 2021

Equipment : Gas Analyzer (SO₂) Model : 43i
Manufacturer : Thermo SCIENTIFIC Serial Number : 1180540065

Standard Gas Concentration

Sulphur Dioxide (SO ₂)	44.75	PPM	Manufacturer :	Thermo SCIENTIFIC
Nitric Oxide (NO)	45.35	PPM	Model :	146i
Methane (CH ₄)	-	PPM	Serial Number :	1180540071
Carbon Monoxide (CO)	1007			
Cylinder No. :	CC159599			
Expiration Date :	Jul 30, 2022			

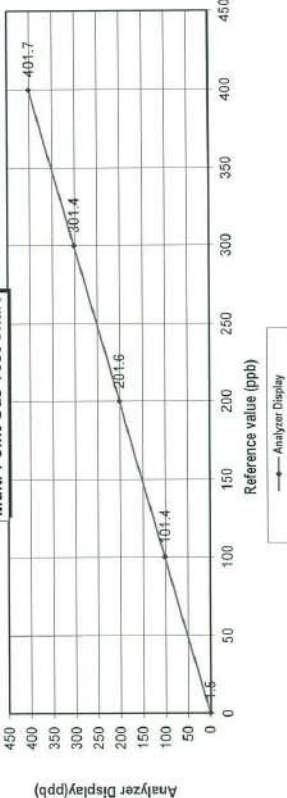
Dilutor Detail

Sulphur Dioxide (SO ₂)	44.75	PPM	Manufacturer :	Thermo SCIENTIFIC
Nitric Oxide (NO)	45.35	PPM	Model :	146i
Methane (CH ₄)	-	PPM	Serial Number :	1180540071
Carbon Monoxide (CO)	1007			
Cylinder No. :	CC159599			
Expiration Date :	Jul 30, 2022			

Multi-point gas test data

Reference Value (ppb)	Analyzer Display (ppb)	Difference Error	Percent Error	% Error]
Level 1 Zero	0.0	1.5	1.50	1.50
Level 2 20.00%	100.0	101.4	1.38	1.38
Level 3 40.00%	200.0	201.6	0.79	0.79
Level 4 60.00%	300.0	301.4	0.46	0.46
Level 5 80.00%	400.0	401.7	0.42	0.42
Remark : Measuring Range	500.0 ppb			
Acceptable Limit ± 5%				0.91

Multi-Point Gas Test Chart



Calculate by
Srichai Y.
9, 11, 14

Approve by
Pakorn N.
9, Nov, 2021

MULTI-POINT GAS TEST REPORT

Test Date : Nov 9, 2021

Equipment : Gas Analyzer (SO₂) Model : 43i
Manufacturer : Thermo SCIENTIFIC Serial Number : 1180540066

Standard Gas Concentration

Sulphur Dioxide (SO ₂)	44.75	PPM	Manufacturer :	Thermo SCIENTIFIC
Nitric Oxide (NO)	45.35	PPM	Model :	146i
Methane (CH ₄)	-	PPM	Serial Number :	1180540071
Carbon Monoxide (CO)	1007			
Cylinder No. :	CC159599			
Expiration Date :	Jul 30, 2022			

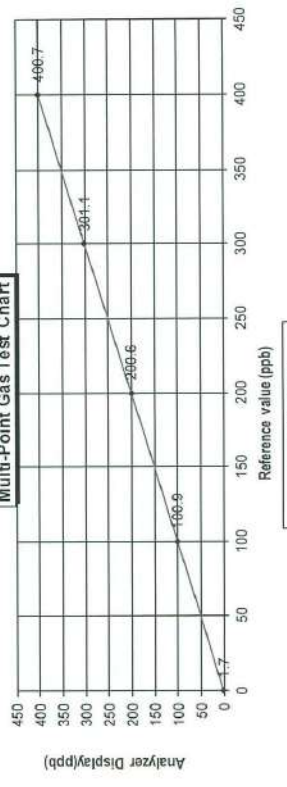
Dilutor Detail

Sulphur Dioxide (SO ₂)	44.75	PPM	Manufacturer :	Thermo SCIENTIFIC
Nitric Oxide (NO)	45.35	PPM	Model :	146i
Methane (CH ₄)	-	PPM	Serial Number :	1180540071
Carbon Monoxide (CO)	1007			
Cylinder No. :	CC159599			
Expiration Date :	Jul 30, 2022			

Multi-point gas test data

Reference Value (ppb)	Analyzer Display (ppb)	Difference Error	Percent Error	% Error]
Level 1 Zero	0.0	1.7	1.70	1.70
Level 2 20.00%	100.0	100.9	0.89	0.89
Level 3 40.00%	200.0	200.6	0.30	0.30
Level 4 60.00%	300.0	301.1	0.37	0.37
Level 5 80.00%	400.0	400.7	0.17	0.17
Remark : Measuring Range	500.0 ppb			
Acceptable Limit ± 5%				0.69

Multi-Point Gas Test Chart



Calculate by
Srichai Y.
9, 11, 14

Approve by
Pakorn N.
9, Nov, 2021

MULTI-POINT GAS TEST REPORT

Test Date : Nov 9, 2021

Equipment : Gas Analyzer (SO₂) Model : 43i
Manufacturer : Thermo SCIENTIFIC Serial Number : 1180540067

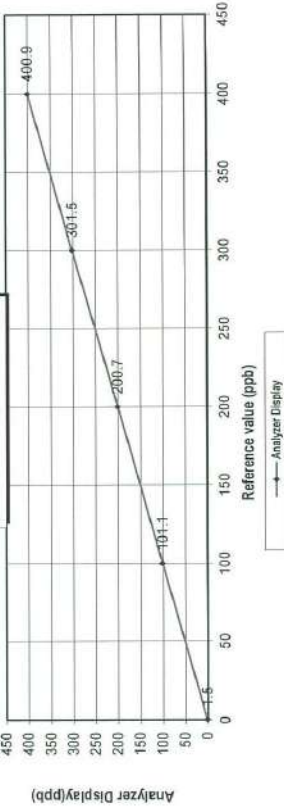
Standard Gas Concentration
Sulphur Dioxide (SO₂) 44.75 PPM Manufacturer : Thermo SCIENTIFIC
Nitric Oxide (NO) 45.35 PPM Model : 146i
Methane (CH₄) - PPM Serial Number : 1180540071
Carbon Monoxide (CO) 1007 PPM
Cylinder No. : CCL59599
Expiration Date : Jul 30, 2022

Multi-point gas test data

Level	Reference Value (ppb)	Analyzer Display (ppb)	Difference Error	Percent Error	% Error
Level 1	Zero	1.5	1.50	1.50	1.50
Level 2	20.00%	101.1	1.10	1.09	1.09
Level 3	40.00%	200.7	0.70	0.35	0.35
Level 4	60.00%	301.5	1.50	0.50	0.50
Level 5	80.00%	400.9	0.90	0.22	0.22
Average Difference (%)					0.73

Remark : Measuring Range 500.0 ppb
Acceptable Limit $\pm 5\%$

Multi-Point Gas Test Chart



Calculate by
SriChai 7
9/11/21

Approve by
SriChai 2
9/11/21

CERTIFICATE OF ANALYSIS
Grade of Product: EPA Protocol

Part Number: E04NI99E16A01D3 Reference Number: 122-402136167-1
Cylinder Number: EB0143262 Cylinder Volume: 144.4 CF
Laboratory: 124 - Durham (SAP) - NC Cylinder Pressure: 2015 PSIG
PGVP Number: B22021 Valve Outlet: 560
Gas Code: CO, NO, NOX, SO₂, BALN Certification Date: Jun 21, 2021
Expiration Date: Jun 21, 2024

Certification performed in accordance with EPA Testability Protocol for Assay and Certification of Gaseous Calibration Standards (May 2012) document EPA 800/R-12/031, using the assay procedures listed. Analytical Methodology does not require correction for analytical interference. This cylinder has a total analytical uncertainty as stated below with a confidence level of 95%. There are no significant impurities which affect the use of this calibration mixture. All concentrations are on a mole/mole basis unless otherwise noted.

Do Not Use This Cylinder below 100 psig, 18, 0.7 megapascals.

ANALYTICAL RESULTS

Component	Requested Concentration	Actual Concentration	Protocol Method	Total Relative Uncertainty	Assay Dates
NOX	45.00 PPM	45.96 PPM	G1	$\pm 1.4\%$ NIST Traceable	06/14/2021, 06/21/2021
NITRIC OXIDE	45.00 PPM	45.34 PPM	G1	$\pm 1.4\%$ NIST Traceable	06/14/2021, 06/21/2021
SULFUR DIOXIDE	45.00 PPM	44.68 PPM	G1	$\pm 1.0\%$ NIST Traceable	06/14/2021, 06/21/2021
CARBON MONOXIDE	1000 PPM	984.8 PPM	G1	$\pm 0.7\%$ NIST Traceable	06/14/2021, 06/21/2021
NITROGEN	Balance				06/14/2021

CALIBRATION STANDARDS

Type	Lot ID	Cylinder No	Concentration	Uncertainty	Expiration Date
NITRM	20061120	CC708068	49.82 PPM NITRIC OXIDE/NITROGEN	$\pm 1.0\%$	Feb 02, 2025
PPM	12386	D685025	9.91 PPM NITROGEN DIOXIDE/AIR	$\pm 2.0\%$	Feb 20, 2020
GMS	407423638102	CC305581	4.348 PPM NITROGEN DIOXIDE/NITROGEN	± 2.1	Feb 18, 2023
NITRM	16011043	CC473277	49.02 PPM SULFUR DIOXIDE/NITROGEN	$\pm 0.8\%$	Jun 17, 2022
NITRM	14060119	CC434277	990.9 PPM CARBON MONOXIDE/NITROGEN	$\pm 0.8\%$	Nov 15, 2025

The SRM, PPM or RGM noted above is only in reference to the GMS used in the assay and not part of the analysis.

ANALYTICAL EQUIPMENT

Instrument/Make/Model	Analytical Principle	Last Multipoint Calibration
Nicolet 6700 AHR0801333 CO	FTIR	Jun 03, 2021
Nicolet 6700 AHR0801333 NO	FTIR	Jun 03, 2021
Nicolet 6700 AHR0801333 NO2	FTIR	Jun 03, 2021
Nicolet 6700 AHR0801333 SO2	FTIR	Jun 03, 2021

Triad Data Available Upon Request

NOTES: PO #5221002807

GROSS WT: 28.40kg

NET WT: 4.73kg



CERT 3082.01
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The analytical test results reported on this certificate relate only to the cylinder number specified above. This concludes the test report.

Signature

Approved for Release



SCARLET TECH

Certificate of Calibration

WL-21 Wireless Anemometer

Scarlet Tech Ltd. hereby certifies that the WL-21 wireless anemometer listed below was thoroughly calibrated, tested and inspected following the standard calibration procedure (st-wl-21) and is within manufacturer's specification at the time when the calibration is done.

Client: Envir Service Co., Ltd.

Serial No.: 2111DT0004

Calibration Date: 2022/2/22

Calibration Expiry Date: 2023/2/21

The Result of Calibration

Velocity	Measured Value (m/s)	Actual Value (m/s)	Deviation	Tolerance	Result
1.0		0.9	0.1	0.9 - 1.1	Pass
2.0		2	0	1.8 - 2.2	Pass
5.0		4.8	0.2	4.7 - 5.3	Pass
7.0		7.1	0.1	6.0 - 8.0	Pass
10.0		9.7	0.3	9.5 - 10.5	Pass
20.0		20	0	19.0 - 21.0	Pass

Wind Direction	Measured Value	Actual Value	Deviation	Tolerance	Result
45°		48	3	42 - 48	Pass
135°		134	1	132 - 138	Pass
225°		227	2	222 - 228	Pass
315°		315	0	312 - 318	Pass
0°		1	1	357 - 3	Pass

Inspection Room Temp	Actual Value	Deviation	Tolerance	Result
22.5°C	22.1	0.4	21.5-23.5	Pass

Atmospheric Pressure Inspection	Actual Value	Deviation	Tolerance	Result
998	1000	2	994-1002	Pass

Environment conditions :

Air temperature: 24 °C
Relative humidity: 58 %
Static pressure: 118.3 kPa

Jim Lin

Performed by:

Certified by
Head of Engineering department

This certificate may not be published or reproduced, except in full, unless obtaining permission in writing form from Scarlet Tech Ltd.

4F-3, No. 3/2, 2nd Sec., Heping E. Rd., Daan Dist. Taipei City 106, Taiwan

เอกสารไม่ควบคุม

INNOVATIVE INSTRUMENT CALIBRATION LAB
INNOVATIVE INSTRUMENT CO., LTD. HEAD OFFICE
7/139 MOO 13, SOI SINTINAKORN 11 TAMBON BANG KAPO,
AMPHOE BANG PHI SAMUT PRAKAN PROVINCE 10540 THAILAND
TEL: (66)0-2116-5860-1 FAX: (66)0-2116-7140



ANAB
ANAB National Accreditation Board
A C C R E D I T E D
CALIBRATION LABORATORY
AC/2561

Page 1 of 2.

Certificate of Calibration

Customer

Name : UNITED ANALYST AND ENGINEERING CONSULTANT CO.,LTD. Certificate No : 21-ACT-264
Address : 81 Soi Udomsuk 41, Sukhumvit Road, Bangchak, Request No : Req-2021-0793
Prakanong, Bangkok 10260

Unit Under Calibration Details

Measurement item : Acoustic Calibrator Class : I
Manufacturer : 01dB Range : 94 dB / 1000 Hz
Model : CAL31 Instrument Status : Used
Serial Number : 84065
ID : UAE.EFM.167/2561

Calibration Environment and Details

Temperature : (23 ±2 °C)
Humidity : (50 ± 20 %RH)
Barometric Pressure : (1013 ±10.0 hPa)
Received Date : 22 June 2021
Calibration Date : 20 July 2021
Location of Calibration : LAB 1 Acoustic
Calibration Procedure : In-house method CP-ACT-02 based on IEC 60942:2017 Electroacoustics - Sound calibrators

Reference Standard	Model	Serial Number	Traceable	Due Calibration
Sound Calibrator	SV 35A	58079	EEL	14 May 2022
THD Multimeter	2015	1047765	NIMT	21 January 2022

Traceability

: This certificate provides traceability of measurement to recognized national standard, and to the realization of the international System of Units (SI).

Note

The reported uncertainty is based on standard uncertainty multiplied by the Coverage Factor k=2, providing a level of confidence approximately 95 %.

Calibrated By :

Mr. Noppadon Luangart

Service Calibration Engineer

Approved By :

Mr. Pacit Madhavorn

Calibration Engineer Supervisor

Issue Date :

20 July 2021

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval from Scarlet Tech Ltd.
PM-700-ACT-702 Rev.0.0 Issue 06.01/07/19

เอกสารไม่ควบคุม

Certificate of Calibration

Customer

Name

: UNITED ANALYST AND ENGINEERING CONSULTANT CO.,LTD.

Certificate No :

22-ACT-104

Address

: 81 Soi Udonsuk 41, Sukhumvit Road, Bangchak, Prakanong, Bangkok 10260

Request No :

Req-2022-0232

Unit Under Calibration Details

Measurement item :

: Sound Level Meter

Manufacturer

: LARSON DAVIS

Model

: LX2

Serial Number

: 0006614

ID

: UAE.EFM.04572564

Resolution

: 0.1 dB

Microphone Class :

2

Microphone Model :

375A04

Microphone SN :

329353

Preamplifier Model :

PRMLXT2C

Preamplifier SN :

071534

Instrument Status :

Used

Calibration Environment and Details

Temperature

: 23 °C ± 2 °C

Humidity

: 50 %RH ± 20 %RH

Barometric Pressure

: 1013 hPa ± 10 hPa

Received Date

: 31 January 2022

Calibrated Date

: 11 February 2022

Calibration Procedure

: In-house method CP-SLM-01 based on IEC 61672-3 : 2013 Electroacoustics - Sound level meters - Part 3: Periodic tests

Location of Calibration

: Lab Acoustic

Reference Standard

Instrument	Brand	Model	SN,	Due calibration	Traceability
Standard Microphone	GRAS	40AN	188273	15 September 2022	GRAS
Multifrequency Calibrator	Quest	Quest-cal	EFA000234	14 June 2022	TSI
Audio Generator	SvanteK	Svan401	131	18 October 2022	WK Electric

Note

The reported uncertainty is based on standard uncertainty multiplied by the Coverage Factor $k = 2$, providing a level of confidence approximately 95 %.

Calibrated By :

Mr. Noppadon Luangart

Calibration Officer

Approved By :

Mr. Puchi Mahavorn

Calibration Engineer Supervisor

Issue Date :

11 February 2022

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the Innovative Instrument Co., Ltd

FM-708-SLM-01 Rev.0 Issue date 01/07/19

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Certificate No : 21-ACT-264

Request No : Req-2021-0793

Calibration Results : Without Adjustment

Calibration Range (dB)	Without Adjustment (dB)		Uncertainty (± dB)	Acceptance limit Class 1 (± dB)
	Measured	Error		
94 dB / 1000 Hz	93.88	-0.12	0.12	0.25

Frequency of Sound pressure level

Calibration Range (Hz)	Without Adjustment		Adjustment Error (%)	Uncertainty (± %)	Acceptance limit Class 1 (± %)
	Measured (Hz)	Error (%)			
94 dB / 1000 Hz	1000.00	0.00	-	0.10	0.70

Total Harmonic Distortion plus Noise of Sound pressure level (THD+N %)

Calibration Range (Hz)	Without Adjustment		Adjustment Measured (%)	Uncertainty (± %)	Acceptance limit Class 1 (± %)
	Measured (%)	Error (%)			
94 dB / 1000 Hz	0.14	-	-	0.40	2.5

Note :

- Acceptance limit was IEC60942:2017 Class 1
- The calibration results exclude the calibrator pressure correction
- The calibration results exclude the microphone volume correction

End of Calibration

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the Innovative Instrument Co., Ltd.

FM-708-SLM-01 Rev.0 Issue date 01/07/19

เอกสารไม่ควบคุม

Certificate No : 22-ACT-104

Request No : Req-2022-0232

7. Long Term Stability

UUC Setting	Measured		UNCERTAINTY (± dB)	Acceptance Limit (± dB)
	UUC (dB)			
FAST / A / 37-139				
STD Setting				
Initial	114.0			
Final	114.0			
Deviated	0.0		0.1	0.3

8. Level linearity on the reference level range

UUC Setting	Anticipated REF (dB)	Deviation		UNCERTAINTY (± dB)	Acceptance Limit (± dB)
		UUC (dB)	ERR (dB)		
FAST / A / 37-139					
STD dB					
140.00	140	140.0	0.0		1.1
139.00	139	139.0	0.0		1.1
134.00	134	134.0	0.0		1.1
129.00	129	129.0	0.0		1.1
124.00	124	124.0	0.0		1.1
119.00	119	119.0	0.0		1.1
114.00	114	114.0	0.0		1.1
109.00	109	109.0	0.0		1.1
104.00	104	104.0	0.0		1.1
99.00	99	99.0	0.0		1.1
94.00	94	94.0	0.0		1.1
89.00	89	89.0	0.0	0.3	1.1
84.00	84	84.0	0.0		1.1
79.00	79	79.0	0.0		1.1
74.00	74	74.0	0.0		1.1
69.00	69	69.0	0.0		1.1
64.00	64	64.0	0.0		1.1
59.00	59	59.0	0.0		1.1
54.00	54	54.0	0.0		1.1
49.00	49	49.0	0.0		1.1
44.00	44	44.1	0.1		1.1
39.00	39	39.3	0.3		1.1

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the Innovative Instrument Co., Ltd

FM-708-SLM-01 Rev.0 Issue date 01/07/15

เอกสารไม่ควบคุม

Certificate No : 22-ACT-104

Request No : Req-2022-0232

9. Level linearity including the level range control

UUC Setting	STD REF (dB)	Measured		UNCERTAINTY (± dB)	Acceptance Limit (± dB)
		UUC (dB)	ERR (dB)		
FAST / A					
UUC Range					
	44.1	43.7	-0.4		1.1
37-139	114	114.0	0.0	0.3	1.1

10. Tone burst response

UUC Setting	STD Toneburst (ms)	Anticipated Ref (dB)	Measured		UNCERTAINTY (± dB)	Acceptance Limit (± dB)
			UUC (dB)	ERR (dB)		
A / 37-139						
UUC Time Response						
	200	135.0	135.0	0.0		1.0
	2	118.0	117.9	-0.1		+1.0, -2.5
	0.25	109.0	108.7	-0.3		+1.5, -5.0
Fast						
	200	128.6	128.5	-0.1	0.3	1.0
	2	109.0	108.8	-0.2		+1.0, -5.0
Slow						
	200	129.0	129.0	0.0		1.0
	2	109.0	109.1	+0.1		+1.0, -2.5
SEL						
	0.25	100.0	99.7	-0.3		+1.5, -5.0

11. Peak C Sound level

UUC Setting	Anticipated REF (dB)	Measured		UNCERTAINTY (± dB)	Acceptance Limit (± dB)
		UUC (dB)	ERR (dB)		
FAST / C / 95-142					
STD Setting					
Complete cycle	137.4	136.7	-0.70		3.0
Positive half cycle	136.4	136.2	-0.20	0.2	2.0
Negative half cycle	136.4	136.2	-0.20		2.0

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the Innovative Instrument Co., Ltd

FM-708-SLM-01 Rev.0 Issue date 01/07/15

เอกสารไม่ควบคุม

Certificate No : 22-ACT-102
Request No : Req-2022-0233

Page: 2/6

1. Indication at the calibration check frequency

UUC Setting	Nominal		Before Adjust		Adjust		UNCERTAINTY (± dB)	Acceptance Limit (± dB)
	Level (dB)		UUC (dB)	ERR (dB)	UUC (dB)	ERR (dB)		
Calibrator Setting								
1000 Hz 114.00 dB	113.85		113.9	+0.05	113.9	0.05	0.20	0.3

Note : Absolute sensitivity was established by the use of Sound Calibrator Brand SVANTEK, Model SV 35A, SN.58079

2. Self-generated noise, Microphone installed

UUC Setting	Measured		UNCERTAINTY (± dB)
	FAST / 37-139		
UUC Weighting			
A	27.8		0.10

3. Self-generated noise, Microphone replaced by the electrical input signal device

UUC Setting	Measured		UNCERTAINTY (± dB)
	FAST / 37-139		
UUC Weighting			
A	27.7		0.10
C	27.5		0.10
Z	34.0		0.10

4. Acoustic signal test of frequency weightings (Without Windscreen)

UUC Setting	Deviation from various Frequency Weighting Response curve				UNCERTAINTY (± dB)	Acceptance Limit (± dB)
	A	C	Z			
FAST / 37-139						
STD Setting						
125 Hz	-0.1	0.1	0.1	0.50	2.0	
1000 Hz	0.0	0.0	0.0	0.60	1.0	
4000 Hz	0.5	0.5	0.6	0.60	3.0	
8000 Hz	0.3	0.3	0.4	0.70	5.0	

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the Innovative Instrument Co., Ltd

FM-708-SLM-01 Rev.0 Issue date 01/07/15

เอกสารไม่ควบคุม

Certificate No : 22-ACT-102
Request No : Req-2022-0233

Page: 3/6

5. Electrical signal test of frequency weightings, Weighting network response with relative to 1 kHz

UUC Setting	Deviation from various Frequency Weighting Response curve				UNCERTAINTY (± dB)	Acceptance Limit (± dB)
	FAST / 37-139					
STD Setting						
63 Hz	-0.2	0.0	0.0	0.0	2.0	
125 Hz	-0.1	0.0	0.0	0.0	1.5	
250 Hz	-0.1	0.0	0.0	0.0	1.5	
500 Hz	-0.1	0.0	0.0	0.0	1.5	
1000 Hz	0.0	0.0	0.0	0.0	1.0	
2000 Hz	0.0	0.0	0.0	0.0	2.0	
4000 Hz	0.0	0.0	0.0	0.0	3.0	
8000 Hz	0.0	0.0	0.0	0.0	5.0	
16000 Hz	-0.1	-0.1	-0.1	-0.1	+5, -INF.	

6. Frequency and time weightings at 1kHz

UUC Setting	STD	Measured		UNCERTAINTY (± dB)	Acceptance Limit (± dB)
		REF	ERR		
FAST / 37-139					
UUC Weighting					
A	114.00	114.0	0.0	0.2	
C	114.00	114.0	0.0	0.2	
Z	114.00	114.0	0.0	0.2	

UUC Setting	STD	Measured		UNCERTAINTY (± dB)	Acceptance Limit (± dB)
		REF	ERR		
37-139 / A					
UUC Time Response					
Fast	114.00	114.0	0.0	0.1	
Slow	114.00	114.0	0.0	0.1	
Leq	114.00	114.0	0.0	0.1	

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the Innovative Instrument Co., Ltd

FM-708-SLM-01 Rev.0 Issue date 01/07/15

เอกสารไม่ควบคุม

Certificate No : 22-ACT-102
Request No : Req-2022-0233

7. Long Term Stability

UUC Setting	Measured	UNCERTAINTY	Acceptance Limit
FAST / A / 37-139	UUC (dB)	(± dB)	(± dB)
STD Setting			
Initial	114.0		
Final	114.0		
Deviated	0.0	0.1	0.3

8. Level linearity on the reference level range

UUC Setting	Anticipated	Deviation	UNCERTAINTY	Acceptance Limit
FAST / A / 37-139	REF (dB)	UUC (dB)	(± dB)	(± dB)
STD dB		ERR (dB)		
140.00	140	140.0	0.0	1.1
139.00	139	139.0	0.0	1.1
134.00	134	134.0	0.0	1.1
129.00	129	129.0	0.0	1.1
124.00	124	124.0	0.0	1.1
119.00	119	119.0	0.0	1.1
114.00	114	114.0	0.0	1.1
109.00	109	109.0	0.0	1.1
104.00	104	104.0	0.0	1.1
99.00	99	99.0	0.0	1.1
94.00	94	93.9	-0.1	1.1
89.00	89	88.9	-0.1	1.1
84.00	84	83.9	-0.1	1.1
79.00	79	78.9	-0.1	1.1
74.00	74	73.9	-0.1	1.1
69.00	69	68.9	-0.1	1.1
64.00	64	63.9	-0.1	1.1
59.00	59	58.9	-0.1	1.1
54.00	54	53.9	-0.1	1.1
49.00	49	48.9	-0.1	1.1
44.00	44	44.0	0.0	1.1
39.00	39	39.2	0.2	1.1
38.00	38	38.3	0.3	1.1

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FM-708-SLM-01 Rev.0 Issue date 01/07/11

เอกสารไม่ควบคุม

Certificate No : 22-ACT-102
Request No : Req-2022-0233

9. Level linearity including the level range control

UUC Setting	STD	Measured	UNCERTAINTY	Acceptance Limit
FAST / A	REF (dB)	UUC (dB)	ERR (dB)	(± dB)
UUC Range				
	43.2	42.9	-0.3	1.1
37-139	114	114.0	0.0	1.1

10. Tone burst response

UUC Setting	STD	Anticipated	Measured	UNCERTAINTY	Acceptance Limit
A / 37-139	Toneburst (ms)	Ref (dB)	UUC (dB)	ERR (dB)	(± dB)
UUC Time Response					
	200	135.0	135.0	0.0	1.0
	2	118.0	117.8	-0.2	+1.0, -2.5
	0.25	109.0	108.6	-0.4	+1.5, -5.0
Slow	200	128.6	128.5	-0.1	1.0
	2	109.0	108.9	-0.1	+1.0, -5.0
	200	129.0	129.0	0.0	1.0
SEL	2	109.0	109.0	0.0	+1.0, -2.5
	0.25	100.0	99.8	-0.2	+1.5, -5.0

11. Peak C Sound level

UUC Setting	Anticipated	Measured	UNCERTAINTY	Acceptance Limit
FAST / C / 95-142	REF	UUC (dB)	ERR (dB)	(± dB)
STD Setting				
Complete cycle	137.4	136.8	-0.60	3.0
Positive half cycle	136.4	136.2	-0.20	2.0
Negative half cycle	136.4	136.2	-0.20	2.0

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the Innovative Instrument Co., Ltd

FM-708-SLM-01 Rev.0 Issue date 01/07/11

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12. Overload indication

UUC Setting		Measured	UNCERTAINTY	Acceptance Limit
FAST / A / 37-139		UUC	(± dB)	(± dB)
STD Setting		(dB)		
Positive one-half cycle		141.7		
Negative one-half cycle		141.7		
Deviated		0.0	0.2	1.5

13. High Level Stability

UUC Setting		Measured	UNCERTAINTY	Acceptance Limit
FAST / A / 37-139		UUC	(± dB)	(± dB)
STD Setting		(dB)		
Initial		138.0		
Final		138.0		
Deviated		0.0	0.1	0.3

End of Certificate

Certificate No : 22-ACT-100
Request No : Req-2022-0234

7. Long Term Stability

UUC Setting		Measured	UNCERTAINTY	Acceptance Limit
FAST / A / 37-139	STD dB	UUC (dB)	(± dB)	(± dB)
		Initial	114.0	
Final	Deviated	114.0	0.1	0.3

8. Level linearity on the reference level range

UUC Setting		Anticipated	Deviation		UNCERTAINTY	Acceptance Limit
FAST / A / 37-139	STD dB	REF (dB)	UUC (dB)	ERR (dB)	(± dB)	(± dB)
		140	140.0	0.0	0.3	1.1
139.00	134.00	139	139.0	0.0		1.1
		134	134.0	0.0		1.1
129.00	124.00	129	129.0	0.0		1.1
		124	124.0	0.0		1.1
119.00	114.00	119	119.0	0.0		1.1
		114	114.0	0.0		1.1
109.00	104.00	109	109.0	0.0		1.1
		104	104.0	0.0		1.1
99.00	89.00	99	99.0	0.0		1.1
		94	94.0	0.0		1.1
89.00	79.00	89	89.0	0.0		1.1
		84	84.0	0.0		1.1
79.00	69.00	79	79.0	0.0		1.1
		74	74.0	0.0		1.1
69.00	64.00	69	69.0	0.0		1.1
		64	64.0	0.0		1.1
59.00	49.00	59	59.0	0.0		1.1
		54	54.0	0.0		1.1
49.00	44.00	49	49.0	0.0		1.1
		44	44.1	0.1		1.1
39.00		39	39.4	0.4		1.1

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FM-708-SLM-01 Rev.0 Issue date 01/07/15

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Certificate No : 22-ACT-100
Request No : Req-2022-0234

9. Level linearity including the level range control

UUC Setting		STD	Measured	UNCERTAINTY	Acceptance Limit
FAST / A	UUC Range	REF (dB)	UUC (dB)	ERR (dB)	(± dB)
		43.9	43.6	-0.3	1.1
37-139		114	114.0	0.0	1.1

10. Tone burst response

UUC Setting		STD	Anticipated	Measured	UNCERTAINTY	Acceptance Limit
A / 37-139	UUC Time Response	Toneburst (ms)	Ref (dB)	UUC (dB)	ERR (dB)	(± dB)
		200	135.0	134.9	-0.1	1.0
Fast		2	118.0	117.6	-0.4	+1.0, -2.5
		0.25	109.0	108.7	-0.3	+1.5, -5.0
Slow		200	128.6	128.5	-0.1	1.0
		2	109.0	108.9	-0.1	+1.0, -5.0
SEL		200	129.0	129.0	0.0	1.0
		2	109.0	109.1	+0.1	+1.0, -2.5
		0.25	100.0	99.9	-0.1	+1.5, -5.0

11. Peak C Sound level

UUC Setting		Anticipated REF (dB)	Measured		UNCERTAINTY (± dB)	Acceptance Limit (± dB)
FAST / C / 95-142	STD Setting		UUC (dB)	ERR (dB)		
Complete cycle		137.4	136.8	-0.60	0.2	3.0
Positive half cycle		136.4	136.2	-0.20		2.0
Negative half cycle		136.4	136.2	-0.20		2.0

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the Innovative Instrument Co., Ltd

FM-708-SLM-01 Rev.0 Issue date 01/07/15

เอกสารไม่ควบคุม

Certificate No : 21-AFM-073
 Request No : Req-2021-0791

Result of Calibration :

Flow Setting	STD Flow Reading	UUC Flow Reading	Correction Flow	Uncertainty
LPM	LPM	LPM	LPM	LPM
0.02	0.01919	0.022	-0.00307	0.00086
0.05	0.05084	0.053	-0.00216	0.00093
0.10	0.1047	0.102	0.0027	0.0019
0.20	0.2013	0.197	0.0043	0.0036
0.5	0.5020	0.493	0.0095	0.0073
1.0	1.008	1.002	0.006	0.017
1.7	1.699	1.679	0.020	0.024
2.0	2.006	1.999	0.007	0.031

Note

STD : Standard

UUC : Unit Under Calibration

* Indicates non accredited

End of Certificate

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the Innovative Instrument Co., Ltd.

FM-708-AFM-01 Rev.00 Issue date 01/07/19

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Certificate of Calibration

Customer

Certificate No : 21-AFM-052
 Request No : Req-2021-522

Name : UNITED ANALYST AND ENGINEERING CONSULTANT
 CO.,LTD.

Address : 81 Soi Udomsak 41, Sukhumvit Road, Bangchak, Prakanong, Bangkok 10260

Unit Under Calibration Details

Measurement Item : Mass flow meter
 Manufacturer : TSI
 Model : 4146
 Serial Number : 41461922007
 ID : UAE.EFM.223/2562

Location of Calibration : LAB 4 AIR VELOCITY METER

Calibration Environment and Details

Temperature : (23 ± 3) °C
 Humidity : (55 ± 15) %RH
 Barometric Pressure : (1010 ± 10) hpa
 Received Date : 27 April 2021
 Calibration Date : 8 June 2021

Calibration Procedure : In-house method CP-AFM-01 by Comparison technique with Standard Primary Flow Calibrator

Reference Standard	Model	Serial Number	Traceable	Due Calibration
Air Flow Meter	Gilibrator 3 Standard flow	21151012015	Sensidyne	21 April 2022
Air Flow Meter	Gilibrator 3 High flow	18501012012	Sensidyne	21 April 2022

Traceability :

This certificate provides traceability of measurement to recognized national standard, and to the realization of the international System of

Units (SI)

Note :

The reported uncertainty is based on standard uncertainty multiplied by the Coverage Factor k=2, providing a level of confidence approximately 95 %.

Calibration By :

Mr. Noppadon Luangart
 Service Calibration Engineer

Approved By :

Mr. Paet Mathavorn
 Calibration Engineer Supervisor

Issue Date : 8 June 2021

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the Innovative Instrument Co., Ltd.
 FM-708-AFM-01 Rev.00 Issue date 01/07/19
 เอกสารไม่ควบคุม

Result of Calibration :

Flow Setting	STD Flow Reading		LUC Flow Reading		Correction Flow	Uncertainty
	LPM	LPM	LPM	LPM		
LPM						
0.02		0.02005		0.019	0.00105	0.00065
0.05		0.05006		0.047	0.00306	0.00092
0.1		0.1013		0.098	0.0033	0.0019
0.2		0.2006		0.198	0.0026	0.0031
0.5		0.5005		0.503	-0.0025	0.008
1.0		1.002		0.998	0.004	0.015
1.7		1.702		1.692	0.010	0.025
2.0		2.003		1.991	0.012	0.029

Note

STD : Standard

UUC : Unit Under Calibration

End of Certificate



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
CORPORATE SERVICES 3; EQUIPMENT CALIBRATION AND TESTING SERVICES
534/4 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG, BANGKOK 10250
TEL. 0-2717-3000-24 FAX. 0-2719-9484



Certificate of Calibration

Certificate No.: 21P1156
Page: 1 of 2

Equipment: Aneroid Barometer

Manufacturer:

Manufacturer: Bariqo

Model : 111MS

Serial No.:

ID No.: UAE.EMA2.065/2552

Condition As-Received: Used Item

Received Date: 29 March 2021

Calibration Date: 31 March 2021

Submitted by: United Analyst and Engineering Consultant Co., Ltd.

Ambient Temperature: $(23 \pm 2) ^\circ\text{C}$

Relative Humidity: (50 ± 15) %

Atmospheric Pressure: 1007 mbar

Procedure used:

Procedure used: The calibration was conducted by direct comparison method against Pressure Measuring Instruments Standard according to in-house calibration procedure CP-P10, using "DKD-R 6-1 : Calibration of Pressure Gauges, Edition 03/2014 " as a guidelines.

Condition of this result of calibration

1. Reference standards instruments :

<u>Instrument</u>	<u>Model</u>	<u>Serial No.</u>	<u>Certificate No.</u>	<u>Due Date</u>
1) Standard Barometer	DPI142	1422505046	MP-0053-20	05 Apr 2021

2 This instrument was installed in vertical orientation and center of the dial was used as the reference level.

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

4. Scale and conversion factor is 1 kPa = 7.50062 mmHg

5. This instrument was used clean air as pressure media.

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

7. This Certification is traceable to the International System of Unit maintained at:-

National Institute of Metrology Thailand (NIMT)

Calibrated by : Suksan Khankaew
Issue Date : 31 March 2021

Approved Signatory: Attapol P.

[] Phalinee Prabpaipal

[] Sura Suwannasri

[x] Attapol Panurach

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B 0256510



CertNo.: 21P1156
Page: 2 of 2

Result of calibration:- Without adjustment
Function:- Absolute Pressure Measurement
Range: 720 mmHg to 770 mmHg
Scale Interval: 1 mmHg (The Fifth Estimate)

Increasing Pressure									
Applied Pressure (mmHg)	714.29	725.74	737.41	748.82	761.02	773.03			
UUC* Indication (mmHg)	720.0	730.0	740.0	750.0	760.0	770.0			
Error (mmHg)	5.71	4.26	2.59	1.18	-1.02	-3.03			

Decreasing Pressure									
Applied Pressure (mmHg)	772.94	760.65	748.21	737.18	725.53	714.45			
UUC* Indication (mmHg)	770.0	760.0	750.0	740.0	730.0	720.0			
Error (mmHg)	-2.94	-0.65	1.79	2.82	4.47	5.55			

The uncertainty of measurement was ± 0.24 mmHg
* UUC = Unit Under Calibration
The reported uncertainty of measurement was based on a standard uncertainty multiplied by a coverage factor $k = 2$, providing a level of confidence of approximately 95 %.

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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: 0-2717-3000-24 FAX: 0-2719-9484



Certificate of Calibration

Certificate No.: 22H401
Page: 1 of 2

Equipment: Dial Thermo-Hygrometer

Manufacturer: Barigo

Model: -

Serial No.: -

ID No.: UAE.ANV.132/2550

Condition As-Received: Used Item

Received Date: 03 February 2022

Calibration Date: 06 February 2022
to 18 February 2022

Reference: 2002-0051WSC

Ambient Temperature: (25 ± 3) °C

Relative Humidity: (50 ± 20) %

Submitted by: United Analyst and Engineering Consultant Co., Ltd.

81 Sol Udomsuk 41, Sukhumvit Road, Bangkok,
Phra Khanong, Bangkok 10260

Procedure used:

Calibration were conducted using in-house calibration procedure CP-H02 according to comparison with standard chilled mirror sensor for humidity measurement function and comparison with standard temperature probe for temperature measurement function into humidity / temperature chamber.

Condition of this result of calibration

1. Reference standards instruments:

Instrument	Model	Serial No.	Certificate No.	Due Date
1) Handheld Thermometer With Sensor	1521	A5A339	191867	17 Jul 2022
2) Chilled Mirror Hygrometer	Dew Master	44730	17017	07 Mar 2022

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:-

-National Institute of Metrology Thailand (NIMT)

-National Institute of Standards and Technology (NIST), The United States of America

Calibrated by: Surasit Phansudnoi
Issue Date: 20 February 2022

Approved Signatory:

(✓) Chakrit Waewanjua

() Ponthipha Tameyakul

() Pitak Srimongkol

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Att: Pol P.

เอกสารไม่ควบคุม

a 1046546

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Cert. No.: 22H401
Page.: 2 of 2

Result of Calibration:-

Function:

Humidity measurement.

Reference Temperature (°C)	Standard Humidity (%R.H.)	UUC* Reading (%R.H.)	Error (%R.H.)	Uncertainty of Measurement (±%R.H.)
25.0	40.1	46	5.9	1.7
25.0	60.0	63	3.0	1.9
25.0	80.0	77	-3.0	2.0

Result of Calibration:-

Function:

Humidity measurement.

Reference Temperature (°C)	Standard Humidity (%R.H.)	UUC* Reading (%R.H.)	Error (%R.H.)	Uncertainty of Measurement (±%R.H.)
25.0	40.1	43	2.9	1.7
25.0	60.0	60	0.0	1.9
25.0	80.0	74	-6.0	2.0

Result of Calibration:-

Function:

Temperature measurement.

Reference Temperature (°C)	Standard Temperature (°C)	UUC* Reading (°C)	Error (°C)	Uncertainty of Measurement (±°C)
20.06	20.06	21.0	0.994	0.72
24.991	24.991	25.5	0.509	0.72
30.046	30.046	30.5	0.454	0.72
34.988	34.988	35.0	0.012	0.72
39.988	39.988	40.0	0.012	0.72

Result of Calibration:-

Function:

Temperature measurement.

Reference Temperature (°C)	Standard Temperature (°C)	UUC* Reading (°C)	Error (°C)	Uncertainty of Measurement (±°C)
20.041	20.041	20.0	-0.041	0.72
25.002	25.002	25.0	-0.002	0.72
30.011	30.011	29.5	-0.511	0.72
35.033	35.033	34.0	-1.033	0.72
39.989	39.989	39.0	-0.989	0.72

UUC* : Unit Under Calibration

The reported uncertainty of measurement was based on standard uncertainty multiplied by coverage factor k = 2.00, providing confidence level approximately 95%.

Signature

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-00-

MULTI-POINT GAS TEST REPORT

Test Date : June 9, 2021

Equipment : Hydrocarbon Analyzer Model : APHA-370
Manufacturer : HORIBA Serial Number : KWWW1R96

Standard Gas Concentration

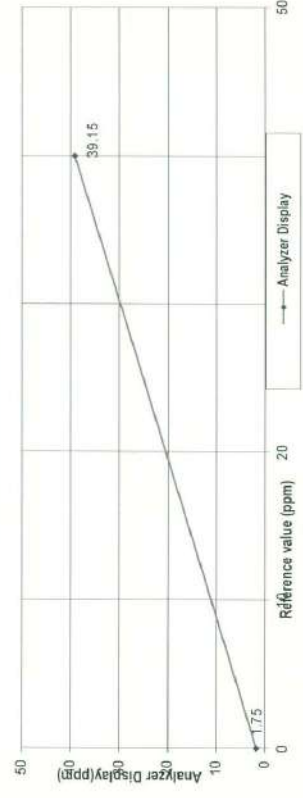
Sulphur Dioxide (SO ₂)	-	PPM	Dilutor Detail
Nitric Oxide (NO)	-	PPM	Manufacturer :
Methane (CH ₄)	39.8	PPM	Model :
Carbon Monoxide (CO)	-	PPM	Serial Number :
Cylinder No. :	D824432		
Expiration Date :	Aug 4, 2028		

Multi-point gas test data

Reference Value (ppm)	Analyzer Display (ppm)	Difference Error	Percent Error	[% Error]
Level 1 Zero	0.00	1.75	1.75	1.75
Level 2 80.00%	40.00	-0.85	-2.17	2.17
Average Difference (%)				1.96

Remark : Measuring Range 50.00 ppm
Acceptable Limit ± 5%

Multi-Point Gas Test Chart



Calculate by
Signature

10 June 2021

Approve by
Signature

16 June 2021



Certificate of Analysis
Special Gases Mixture

Customer Details
Name: United Analyst & Engineering Co., Ltd.
Address: 31 Soi Udomsak 41, Sukhumvit Rd., Bang Chak, Khet Phra Khanong, Bangkok 10260
Customer Tag No.

Certificate details
Number: 3384/20
Date of issue: 4-Aug-2020
Expiry date: 4-Aug-2028
Material Details
Production Order: 90161442
Material Code: 400400-AI-34
Cylinder No.: D824432
Gas content: 6.60 M³
Filling pressure: 137.0 bar
Valve: CGA 590 BRASS
Cylinder Owner: LINDE
Cylinder Material: Aluminum
Cylinder Size: 50 L

Laboratory Report
Analytical Result
Component: Methane
In Air
Nominal Concentration: 40.0 ppm
Analysis Result: 39.8 ppm
Uncertainty: ± 1% relative
Method of Analysis: (6) HPB-352
Assay Date: 4-Aug-2020

Reference Standard used in Assay
Reference Standard: Methane
In Nitrogen
Cylinder number: 25599956
Concentration: 49.28 ± 0.39 ppm
Expiry date: 4-Oct-2020

Analytical Instruments used in Assay
Analytical Principle: FTIR-CH4
Instrument/Make/Model: FTIR Spectrometers Nicolet iS50
L351 Multipoint Calibration
4-Aug-2020

Recommend usage condition
Minimum utilization: 5% of actual content or before expiry date whichever comes first.
Storage condition: Keep in well ventilation and secure area.

Comments
When reordering, please quote the material number
Note:
1. All results expressed in this report are on mole/mole basis, unless otherwise specified. The Assay of this Standard has been performed in accordance with the EPA Traceability Protocol of EPA-600/8-12/531 for the Assay and Certification of Gaseous Calibration Standards using procedure G1.
2. The reported expanded uncertainty is based on a standard uncertainty multiplied by a coverage factor k=2, providing a level of confidence of approximately 95%.
The measurement of this material is traceable to the SI through the reference gas standard which is traceable to Swiss Federal Standard of Mass or other recognized national metrology institutes.
(1) Gas Chromatography, (2) Potentiometric, Oxygen Analyzers, (3) Electrochemical Oxygen Analyzers, (4) Electrochemical Hydrogen Analyzers, (5) Total Hydrocarbon Analyzers, (6) Other - Specified

Page 1 of 1
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บริษัท สันติ (ประเทศไทย) จำกัด (มหาชน)
เลขที่ 15 ถนนรามคำแหง 2/7 หมู่ 14 แขวงคลองเตย จ. กทม. 10110
เบอร์โทร 02-238-6100 โทรสาร 02-238-6100 โทรสาร 02-238-6333
เบอร์โทร 02-238-6100 โทรสาร 02-238-6100 โทรสาร 02-238-6333
เบอร์โทร 02-238-6100 โทรสาร 02-238-6100 โทรสาร 02-238-6333
เบอร์โทร 02-238-6100 โทรสาร 02-238-6100 โทรสาร 02-238-6333
เบอร์โทร 02-238-6100 โทรสาร 02-238-6100 โทรสาร 02-238-6333

Sukanya Panyasasontorn
Signatory for and on behalf of Linde (Thailand) Co., Ltd.
Linde (Thailand) Public Company Limited
15th Floor, Bangkok Tower A, 271 Moo 14, Bangna Road, 6.5 Road, Bangkok
Bangkok, Thailand 10540 Tel: (66) 2386-6100 Fax: (66) 2386-6333
Bangkok Branch: 105 Moo 5, Bangna Road, Bangkok, Thailand
Tel: (66) 2386-6100 Fax: (66) 2386-6333

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Certificate of Calibration

Customer
Name: UNITED ANALYST AND ENGINEERING CONSULTANT CO.,LTD.
Address: 81 Soi Udomsak 41, Sukhumvit Road, Bangchak, Prakanong, Bangkok 10260
Certificate No.: 22-ACT-065
Request No.: Req-2022-0227

Unit Under Calibration Details

Measurement item: Sound Level Meter
Manufacturer: RION
Model: NL-42
Serial Number: 00709656
ID: UAE-EFM.021/2564
Resolution: 0.1 dB
Microphone Class: 2
Microphone Model: UC-52
Microphone S/N: 189028
Preamplifier Model: NH-24
Preamplifier S/N: 01207
Instrument Status: Used

Calibration Environment and Details

Temperature: 23 °C ± 2 °C
Humidity: 50 %RH ± 20 %RH
Barometric Pressure: 1013 hPa ± 10 hPa
Received Date: 31 January 2022
Calibrated Date: 3 February 2022
Calibration Procedure: In-house method CP-SLM-01 based on IEC 61672-1 : 2013 Electroacoustics - Sound level meters - Part 3: Periodic tests
Location of Calibration: Lab Acoustic

Reference Standard

Instrument	Brand	Model	SN.	Due calibration	Traceability
Standard Microphone	GRAS	40AN	188273	15 September 2022	GRAS
Multifrequency Calibrator	Quest	Quest-cal	EFA00024	14 June 2022	TSI
Audio Generator	Svanisk	Stan-401	131	18 October 2022	WK Electric

Note

The reported uncertainty is based on standard uncertainty multiplied by the Coverage Factor k = 2, providing a level of confidence approximately 95 %.

Calibrated By:

Mr. Noppadol Luangart
Calibration Officer

Approved By:

Mr. Paet Mathavom
Calibration Engineer Supervisor
Issue Date: 3 February 2022

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Certificate No.	: 22-ACT-065
Request No.	: Req-2022-022

1. Indication at the calibration check frequency

Measurement of the comparison between the two	UUC Setting		Nominal		Before Adjust		Adjust		UNCERTAINTY (\pm dB)	Acceptance Limit (\pm dB)
	FAST7 A / 25 - 138	Calibrator Setting	Level (dB)	UUC (dB)	ERR (dB)	UUC (dB)	ERR (dB)			
			93.95	93.8	-0.15	93.9	-0.05	0.0	0.3	

Note: Absolute sensitivity was established by the use of Sound Calibrator Brand Svantek, Model SV 35A. SN. 58079.

2. Self-generated noise, Microphone Installed

UUC Setting	Measured		UNCERTAINTY (\pm dB)
FAST / 25 - 138			
UUC Weighting			
A	15.0		0.10

3. Self-generated noise, Microphone replaced by the electrical input signal device

	Measured		UNCERTAINTY (\pm dB)
	UUC Setting	FAST / 25 - 138	
	UUC Weighing		
A		11.9	0.10
C		17.2	0.10
Z		22.7	0.10

4. Acoustic signal test of frequency weightings (Without Windscreen)

UUC Setting	Deviation from various Frequency Weighting Response curve				UNCERTAINTY (\pm dB)	Acceptance Limit (\pm dB)
	Weighting Response curve					
	A (dB)	C (dB)	Z (dB)			
FAST/25 - 138						
STD Setting						
125 Hz	0.1	0.2	0.2		0.50	1.5
1000 Hz	0.0	0.0	0.0		0.60	1.0
4000 Hz	0.2	0.2	0.2		0.60	3.0
8000 Hz	-0.8	-0.8	-0.9		0.70	5.0

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5. Electrical signal test of frequency weightings, Weighting network response with relative to 1 kHz

UIC Setting	Deviation from various frequency				UNCERTAINTY (± dB)	Acceptance Limit (± dB)
	Weighting Response curve					
FAST / 25 - 138	A (dB)	C (dB)	Z (dB)			
STD Setting						
63 Hz	-0.1	-0.1	0.0			2.0
125 Hz	-0.1	0.0	0.0			1.5
250 Hz	0.0	0.0	0.0			1.5
500 Hz	0.0	0.0	0.0			1.5
1000 Hz	0.0	0.0	0.0		0.2	1.0
2000 Hz	0.0	0.0	0.0			2.0
4000 Hz	0.0	0.0	0.0			3.0
8000 Hz	0.1	0.1	0.0			5
16000 Hz	-1.2	-1.3	0.0			+5, -1NF.

6. Frequency and time weightings at 1kHz

UUC Setting	STD	Measured		UNCERTAINTY (± dB)	Acceptance Limit (± dB)
		REF (dB)	ERR (dB)		
FAST / 25 - 138					
UUC Weighting					
A	94.00	94.0	0.0		0.2
C	94.00	94.0	0.0	0.2	0.2
Z	94.00	94.0	0.0		0.2

UUC Setting		STD REF (dB)	Measured		UNCERTAINTY (\pm dB)	Acceptance Limit (\pm dB)
			UUC (dB)	ERR (dB)		
UUC Time Response						
Fast		94.00	94.0	0.0		0.1
Slow		94.00	94.0	0.0	0.2	0.1
Leq		94.00	94.0	0.0		0.1

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เอกสารไม่ควบคุม

Certificate No	: 22-ACT-065
Request No	: Req-2022-022

7. Long Term Stability

	UUC Setting	Measured		UNCERTAINTY (\pm dB)	Acceptance Limit (\pm dB)
			UUC (dB)		
	FAST / A / 25 - 138				
	STD Setting				
	Initial		94.0		
	Final		94.0		
	Deviated		0.0	0.1	0.3

8. Level linearity on the reference level range

UUC Setting				Anticipated REF (dB)	Deviation		UNCERTAINTY (± dB)	Acceptance Limit (± dB)
FAST / A / 25 - 138		STD dB	UUC (dB)		ERR (dB)			
137.00				137	137.0	0.0	0.3	0.8
136.00				136	136.0	0.0		0.8
135.00				135	135.0	0.0		1.1
134.00				134	134.0	0.0		1.1
129.00				129	129.0	0.0		1.1
124.00				124	124.0	0.0		1.1
119.00				119	119.0	0.0		1.1
114.00				114	114.0	0.0		1.1
109.00				109	109.0	0.0		1.1
104.00				104	104.0	0.0		1.1
99.00				99	99.0	0.0		1.1
94.00				94	94.0	0.0		1.1
89.00				89	89.0	0.0		1.1
84.00				84	84.0	0.0		1.1
79.00				79	79.0	0.0		1.1
74.00				74	74.0	0.0		1.1
69.00				69	69.0	0.0		1.1
64.00				64	64.0	0.0		1.1
59.00				59	59.0	0.0		1.1
54.00				54	54.0	0.0		1.1
49.00				49	49.0	0.0	1.1	
44.00				44	44.0	0.0	1.1	
39.00				39	39.0	0.0	1.1	
34.00				34	34.0	0.0	1.1	
29.00				29	29.0	0.0	1.1	
28.00				28	28.0	0.0	1.1	
27.00				27	27.0	0.0	1.1	
26.00				26	25.9	-0.1	1.1	
25.00				25	24.9	-0.1	1.1	

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the Innovative Instrument Co., Ltd

เอกสารไม่ควบคุม

Certificate No	: 22-ACT-065
Request No	: Req-2022-0227

9. Level linearity including the level range control

UIC Setting	STD	Measured		UNCERTAINTY (± dB)	Acceptance Limit (± dB)
		REF (dB)	UIC (dB)		
FAST / A					
UIC Range					
25 - 138	29.5	29.5	29.5	0.3	1.1
	94		94.0		0.0

10. Tone burst response

UUC Setting		STD Toneburst (ms)	Anticipated Ref (dB)	Measured		UNCERTAINTY (+ dB)	Acceptance Limit (± dB)
	A / 25 - 138			UUC (dB)	ERR (dB)		
UUC Time Response							
Fast		200	134.0	134.0	0.0	0.3	1.0
		2	117.0	116.9	-0.1		+1.0, -2.5
		0.25	108.0	107.9	-0.1		+1.5, -5.0
Slow		200	127.6	127.6	0.0		1.0
		2	108.0	108.0	0.0		+1.0, -5.0
		200	128.0	128.0	0.0		1.0
SEL		2	108.0	107.9	-0.1		+1.0, -2.5
		0.25	99.0	98.8	-0.2		+1.5, -5.0

11. Peak C Sound level

UUC Setting	Anticipated REF (dB)	Measured		UNCERTAINTY (\pm dB)	Acceptance Limit (\pm dB)
		UUC (dB)	ERR (dB)		
FAST / C / 25 - 138					
STD Setting					
Complete cycle	133.4	133.4	0.00		3.0
Positive half cycle	132.4	132.1	-0.30	0.2	2.0
Negative half cycle	132.4	132.2	-0.20		2.0

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เอกสารไม่ควบคุม

Certificate No : 22-ACT-065
Request No : Req-2022-0227

12. Overload indication

U/C Setting		Measured	UNCERTAINTY	Acceptance Limit
FAST / A / 25 - 138	U/C	(dB)	(± dB)	(± dB)
	STD Setting	(dB)		
Positive one-half cycle		139.4		
Negative one-half cycle		139.5		
Deviated		-0.1	0.2	1.5

13. High Level Stability

U/C Setting		Measured	UNCERTAINTY	Acceptance Limit
FAST / A / 25 - 138	U/C	(dB)	(± dB)	(± dB)
	STD Setting	(dB)		
Initial		137.0		
Final		137.0		
Deviated		0.0	0.1	0.3

End of Certificate

Certificate of Calibration

Customer
Name : UNITED ANALYST AND ENGINEERING CONSULTANT CO.,LTD.
Address : 81 Soi Udomsuk 41, Sukhumvit Road, Bangchak, Prakanong, Bangkok 10260
Certificate No : 22-ACT-064
Request No : Req-2022-0219

Unit Under Calibration Details

Measurement Item : Sound Level Meter
Manufacturer : RION
Model : NL-42
Serial Number : 00408980
ID : UAE.EFM.007/2564
Resolution : 0.1 dB
Microphone Class : 2
Microphone Model : UC-52
Microphone S/N : 186170
Preamplifier Model : NH-24
Preamplifier S/N : 90425
Instrument Status : Used

Calibration Environment and Details

Temperature : 23 °C ± 2 °C
Humidity : 50 %RH ± 20 %RH
Barometric Pressure : 1013 hPa ± 10 hPa
Received Date : 31 January 2022
Calibrated Date : 3 February 2022

Calibration Procedure : In-house method CP-SLM-01 based on IEC 61672-3 : 2013 Electroacoustics - Sound level meters - Part 3: Periodic tests
Location of Calibration : Lab Acoustic

Reference Standard

Instrument	Brand	Model	SN.	Due calibration	Tracebility
Standard Microphone	GRAS	40AN	188273	15 September 2022	GRAS
Multifrequency Calibrator	Quest	Quest-cal	EFA000234	14 June 2022	TISI
Audio Generator	Svantek	Svan401	131	18 October 2022	WK Electric

Note

The reported uncertainty is based on standard uncertainty multiplied by the Coverage Factor $k = 2$, providing a level of confidence approximately 95 %.

Calibrated By :

Mr. Noppadon Luangart
Calibration Officer

Approved By :

Mr. Pacit Mathavorn
Calibration Engineer Supervisor

Issue Date :

3 February 2022

Certificate No : 22-ACT-064
Request No : Req-2022-0219

1. Indication at the calibration check frequency

UUC Setting	Nominal		Before Adjust		Adjust		UNCERTAINTY (± dB)	Acceptance Limit (± dB)
	Level (dB)		UUC (dB)	ERR (dB)	UUC (dB)	ERR (dB)		
Calibrator Setting								
1000 Hz 114.00 dB	93.95		93.9	-0.05	94.0	+0.05	0.20	0.3

Note : Absolute sensitivity was established by the use of Sound Calibrator Brand Svantek, Model SV 35A, SN. 58079

2. Self-generated noise, Microphone installed

UUC Setting	Measured	UNCERTAINTY
FAST / 25 - 138		
UUC Weighting	(dB)	(± dB)
A	14.4	0.10

3. Self-generated noise, Microphone replaced by the electrical input signal device

UUC Setting	Measured	UNCERTAINTY
FAST / 25 - 138		
UUC Weighting	(dB)	(± dB)
A	11.2	0.10
C	16.9	0.10
Z	23.2	0.10

4. Acoustic signal test of frequency weightings (Without Windscreen)

UUC Setting	Deviation from various Frequency Weighting Response curve					UNCERTAINTY (± dB)	Acceptance Limit (± dB)
	A	C	Z				
FAST / 25 - 138							
STD Setting	(dB)	(dB)	(dB)			(± dB)	
125 Hz	0.1	0.3	0.3		0.50		1.5
1000 Hz	0.0	0.0	0.0		0.60		1.0
4000 Hz	0.4	0.4	0.4		0.60		3.0
8000 Hz	-0.6	-0.6	-0.7		0.70		5.0

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the Innovative Instrument Co., Ltd
FM-708-SLM-01 Rev.0 Issue date 01/07/11

เอกสารไม่ควบคุม

Certificate No : 22-ACT-064
Request No : Req-2022-0219

5. Electrical signal test of frequency weightings, Weighting network response with relative to 1 kHz

UUC Setting	Deviation from various Frequency Weighting Response curve					UNCERTAINTY (± dB)	Acceptance Limit (± dB)
	A	C	Z				
FAST / 25 - 138							
STD Setting	(dB)	(dB)	(dB)			(± dB)	
63 Hz	-0.2	0.0	0.0				2.0
125 Hz	-0.1	0.0	0.0				1.5
250 Hz	-0.1	0.0	0.0				1.5
500 Hz	0.0	0.0	0.0				1.5
1000 Hz	0.0	0.0	0.0			0.2	1.0
2000 Hz	0.0	0.1	0.0				2.0
4000 Hz	0.0	0.0	0.0				3.0
8000 Hz	0.1	0.1	0.0				5
16000 Hz	-1.3	-1.4	0.0				+5, -INF.

6. Frequency and time weightings at 1kHz

UUC Setting	STD	Measured		UNCERTAINTY (± dB)	Acceptance Limit (± dB)
		REF	ERR		
FAST / 25 - 138					
UUC Weighting	(dB)		(dB)		
A	94.00	94.0	0.0		0.2
C	94.00	94.0	0.0	0.2	0.2
Z	94.00	94.0	0.0		0.2

UUC Setting	STD	Measured		UNCERTAINTY (± dB)	Acceptance Limit (± dB)
		REF	ERR		
25 - 138 / A					
UUC Time Response	(dB)		(dB)		
Fast	94.00	94.0	0.0		0.1
Slow	94.00	94.0	0.0	0.2	0.1
Leq	94.00	94.0	0.0		0.1

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FM-708-SLM-01 Rev.0 Issue date 01/07/11

เอกสารไม่ควบคุม

Certificate No : 22-ACT-064
Request No : Req-2022-0219

7. Long Term Stability

UUC Setting	Measured	UNCERTAINTY (± dB)	Acceptance Limit (± dB)
FAST / A / 25 - 138	UUC (dB)		
STD Setting			
Initial	94.0		
Final	94.0		
Deviated	0.0	0.1	0.3

8. Level linearity on the reference level range

UUC Setting	Anticipated	Deviation	UNCERTAINTY (± dB)	Acceptance Limit (± dB)
FAST / A / 25 - 138	REF (dB)	UUC (dB)	ERR (dB)	
STD dB				
137.00	137	137.0	0.0	0.8
136.00	136	136.0	0.0	0.8
135.00	135	135.0	0.0	1.1
134.00	134	134.0	0.0	1.1
129.00	129	129.0	0.0	1.1
124.00	124	124.0	0.0	1.1
119.00	119	119.0	0.0	1.1
114.00	114	114.0	0.0	1.1
109.00	109	109.0	0.0	1.1
104.00	104	104.0	0.0	1.1
99.00	99	99.0	0.0	1.1
94.00	94	94.0	0.0	1.1
89.00	89	89.0	0.0	1.1
84.00	84	84.0	0.0	1.1
79.00	79	79.0	0.0	1.1
74.00	74	74.0	0.0	1.1
69.00	69	69.0	0.0	1.1
64.00	64	64.0	0.0	1.1
59.00	59	59.0	0.0	1.1
54.00	54	54.0	0.0	1.1
49.00	49	49.0	0.0	1.1
44.00	44	44.0	0.0	1.1
39.00	39	39.0	0.0	1.1
34.00	34	34.0	0.0	1.1
29.00	29	29.0	0.0	1.1
28.00	28	28.0	0.0	1.1
27.00	27	27.0	0.0	1.1
26.00	26	25.9	-0.1	1.1
25.00	25	24.9	-0.1	1.1

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FM-708-SLM-01 Rev.0 Issue date 01/07/18

เอกสารไม่ควบคุม

Certificate No : 22-ACT-064
Request No : Req-2022-0219

9. Level linearity including the level range control

UUC Setting	STD	Measured	UNCERTAINTY (± dB)	Acceptance Limit (± dB)
FAST / A	REF (dB)	UUC (dB)	ERR (dB)	
UUC Range				
25 - 138	29.5	29.6	0.1	1.1
	94	94.0	0.0	1.1

10. Tone burst response

UUC Setting	STD	Anticipated	Measured	UNCERTAINTY (± dB)	Acceptance Limit (± dB)
A / 25 - 138	Toneburst (ms)	Ref (dB)	UUC (dB)	ERR (dB)	
UUC Time Response					
Fast	200	134.0	134.0	0.0	1.0
	2	117.0	117.0	0.0	+1.0, -2.5
	0.25	108.0	107.9	-0.1	+1.5, -5.0
Slow	200	127.6	127.6	0.0	1.0
	2	108.0	108.0	0.0	+1.0, -5.0
	200	128.0	128.0	0.0	1.0
SEL	2	108.0	108.0	0.0	+1.0, -2.5
	0.25	99.0	98.9	-0.1	+1.5, -5.0

11. Peak C Sound level

UUC Setting	Anticipated	Measured	UNCERTAINTY (± dB)	Acceptance Limit (± dB)
FAST / C / 25 - 138	REF (dB)	UUC (dB)	ERR (dB)	
STD Setting				
Complete cycle	133.4	133.2	-0.20	3.0
Positive half cycle	132.4	132.1	-0.30	2.0
Negative half cycle	132.4	132.2	-0.20	2.0

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the Innovative Instrument Co., Ltd
FM-708-SLM-01 Rev.0 Issue date 01/07/18

เอกสารไม่ควบคุม

Calibration Certificate

Equipment : SOUND LEVEL METER
Manufacturer : RION
Model : NL-42/ Microphone UC-52 / Preamplifier NH-24
Serial No.: 01000182 / 187202 / 01844
ID No.: -

Condition As Found : GOOD

Customer : UNITED ANALYST AND ENGINEERING CONSULTANT (UAE)
81 SOI UDOMSUK 41, SUKHUMVIT ROAD,
BANGCHAK SUB-DISTRICT,
PHRAKHANONG DISTRICT, BANGKOK 10260
THAILAND.

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

Received Date : 18 JANUARY 2022
Calibration Date : 21-25 JANUARY 2022
Date of Issue : 28 JANUARY 2022

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.

12. Overload Indication

UUC Setting	Measured	UNCERTAINTY	Acceptance Limit
FAST / A / 25 - 138	UUC	(± dB)	(± dB)
STD Setting	(dB)		
Positive one-half cycle	139.4		
Negative one-half cycle	139.4		
Deviated	0.0	0.2	1.5

13. High Level Stability

UUC Setting	Measured	UNCERTAINTY	Acceptance Limit
FAST / A / 25 - 138	UUC	(± dB)	(± dB)
STD Setting	(dB)		
Initial	137.0		
Final	137.0		
Deviated	0.0	0.1	0.3

End of Certificate

Continuation of Calibration Certificate

Calibration Procedure : CP-AC-01
Cert. No. : ACL22076
Job No. : VC65AC0044
Pages : 2 of 8

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).

Continuation of Calibration Certificate

Cert. No. : ACL22076
Job No. : VC65AC0044
Pages : 3 of 8

Summary of Measurement Result :

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

Continuation of Calibration Certificate

Cert. No. : ACL22076
Job No. : VC65AC0044
Pages : 4 of 8

Result of calibration :

1. Absolute sensitivity

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

2. Self-generated noise

2.1 Normal test

Measured Value (dB)
14.6

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

Frequency Weighting	Measured value (dB)
A - weight	10.8
C - weight	17.5
Flat	23.0

3. Acoustical signal tests of frequency weightings

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

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)		
	Flat	C-weight	A-weight
125	0.1	0.2	0.2
1000	-0.1	-0.1	-0.1
8000	0.4	0.4	0.4

Continuation of Calibration Certificate

Cert. No. : ACL22076
Job No. : VC65AC0044
Pages : 5 of 8

4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

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

Continuation of Calibration Certificate

Cert. No. : ACL22076
Job No. : VC65AC0044
Pages : 6 of 8

7. Level linearity on the reference level range

Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
137.0	137.0	0.0	± 1.1
136.0	136.0	0.0	± 1.1
135.0	135.0	0.0	± 1.1
134.0	134.0	0.0	± 1.1
133.0	133.0	0.0	± 1.1
132.0	132.0	0.0	± 1.1
131.0	131.0	0.0	± 1.1
129.0	129.0	0.0	± 1.1
124.0	124.0	0.0	± 1.1
119.0	119.0	0.0	± 1.1
114.0	114.0	0.0	± 1.1
109.0	109.0	0.0	± 1.1
104.0	104.0	0.0	± 1.1
99.0	99.0	0.0	± 1.1
94.0	94.0	0.0	± 1.1
89.0	89.0	0.0	± 1.1
84.0	84.0	0.0	± 1.1
79.0	79.0	0.0	± 1.1
74.0	74.0	0.0	± 1.1
69.0	69.0	0.0	± 1.1
64.0	64.0	0.0	± 1.1
59.0	59.0	0.0	± 1.1
54.0	54.0	0.0	± 1.1
49.0	49.0	0.0	± 1.1
44.0	44.0	0.0	± 1.1
39.0	39.0	0.0	± 1.1
34.0	34.0	0.0	± 1.1
30.0	30.4	0.4	± 1.1
29.0	29.0	0.0	± 1.1
28.0	28.0	0.0	± 1.1
27.0	27.0	0.0	± 1.1
26.0	26.1	0.1	± 1.1
25.0	25.1	0.1	± 1.1

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G. Petch.

Continuation of Calibration Certificate

Cert. No. : ACL22076
Job No. : VC65AC0044
Pages : 7 of 8

8. Level linearity including the level range control

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

9. Tone burst response

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

10. Peak C sound level

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

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

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Continuation of Calibration Certificate

Cert. No. : ACL22076
Job No. : VC65AC0044
Pages : 8 of 8

11. Overload indication

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

12. High level stability

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

The reported uncertainty is based on a standard uncertainty multiplied by coverage factor $k = 2$ or $k = 1.96$ for a level of confidence of approximately 95%.

End of Calibration Certificate

Certificate of Calibration

Customer Name : UNITED ANALYST AND ENGINEERING
CONSULTANT CO. LTD
Certificate No : 21-TPM-223
Request No : Req-2021-09933
Page : 1/2

Address : 81 Soi Udomsuk 41, Sukhumvit Road, Bangchak, Prakanong Bangkok 10260

Unit Under Calibration Details

Calibration Parameter	:	Temperature
Instrument Name	:	Thermal Environment Monitor
Manufacturer	:	Quest Technologies
Model	:	QT-34
Serial Number	:	TEB060015
Resolution	:	0.1 °C
ID Number	:	UAE.EMA2.057/2552
Range Calibration : 20 °C to 60 °C		
Type of Sensor : RTD		
Sensor Diameter (mm) : 4.5		
Calibration Position (mm) : 67.5		
Instrument Status : Used		

Calibration Environment and Details

Temperature	: 23 °C ± 3 °C
Humidity	: 55 %RH ± 15 %RH
Received Date	: 23 July 2021
Calibrated Date	: 2 August 2021
Calibration Procedure	: In-house method CP

Reference Standard

Digital Thermometer with Sensor, Manufacturer: GINGO/GINGO, Model: GT11/RTD100, SN: 12000077, ID: AR-TPM Which was calibrated on 30 March 2021, Calibration Certificate No.: OR21-0719

Traceability

* This Certificate is traceable to SI Unit through Quality Reborn Co., Ltd., NSC-ONSC Accreditation No.: Calibration 0792

Note

The reported uncertainty is based on standard uncertainty multiplied by the Coverage Factor $k=2$, providing a level of confidence approximately 95 %.

Approved By :

10

Mr. Pacit Mathayom

Calibration Engineer Supervisor

Issue Date: 2 August 2021

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20

Calibration Note

UUC Adjustment : Not Adjust

Result of Calibration :

UUC Sensor	Standard Temperature (°C)	UUC Reading (°C)	Correction (°C)	Uncertainty (±°C)
WET	20.003	20.1	-0.1	0.14
	25.004	25.1	-0.1	0.14
	30.004	30.1	-0.1	0.14
	35.008	35.1	-0.1	0.14
	40.006	40.1	-0.1	0.14
	45.004	45.1	-0.1	0.14
	50.003	50.1	-0.1	0.14
DRY	60.007	60.1	-0.1	0.14
	20.005	20.0	0.0	0.14
	25.006	25.0	0.0	0.14
	30.005	30.0	0.0	0.14
	35.002	35.0	0.0	0.14
	40.004	40.0	0.0	0.14
	45.005	45.0	0.0	0.14
GLOHE	50.007	50.0	0.0	0.14
	60.004	60.0	0.0	0.14
	20.003	20.0	0.0	0.14
	25.006	25.0	0.0	0.14
	30.005	30.0	0.0	0.14
	35.005	35.0	0.0	0.14
	40.005	40.0	0.0	0.14
	45.005	45.0	0.0	0.14
	50.006	50.0	0.0	0.14
	60.007	60.0	0.0	0.14

End of Certificate

Calibrated By :

Mr. Sittichok Jirapakdeessakun

Approved By :

Mr. Paet Matthavorn

Calibration Engineer Supervisor

Issue Date :

11 November 2021

Certificate of Calibration

Customer

Name : UNITED ANALYST AND ENGINEERING CONSULTANT

Address : 81 Soi Udomsuk 41, Sukhumvit Road, Bangchak, Prakanong, Bangkok 10260

Certificate No : 21-TPM-304

Request No : Req-2021-1403

Page : 1/2

Unit Under Calibration Details

Calibration Parameter : Temperature

Instrument Name : Thermal Environment Monitor

Manufacturer : 3M

Model : QT-32

Serial Number : TPS030004

Resolution : 0.1 °C

ID Number : -

Range Calibration : 20 °C to 60 °C

Type of Sensor : RTD

Sensor Diameter (mm) : 4.5

Calibration Position (mm) : 67.5

Instrument Status : Used

Calibration Environment and Details

Temperature : 23 °C ± 3 °C

Humidity : 55 %RH ± 1.5 %RH

Received Date : 29 October 2021

Calibrated Date : 9 November 2021

Calibration Procedure : In-house method CP-TPM-01 by Comparison with Standard Thermometer.

Reference Standard

: Digital Thermometer with Sensor, Manufacturer: GINGO/INGO, Model: GT11/RTD100, SN: 12000077, ID: AR-TPM Which was calibrated on 30 March 2021, Calibration Certificate No. : QR21-0719

Traceability

: This Certificate is traceable to SI Unit through Quality Reborn Co., Ltd., NSC-ONSAC Accreditation No.: Calibration 0292

Note

The reported uncertainty is based on standard uncertainty multiplied by the Coverage Factor $k=2$, providing a level of confidence approximately 95 %.

Calibration Note

UUC Adjustment : Not Adjust

Certificate No : 21-TPM-304

Request No : Req-2021-1403

Page : 2/2

Result of Calibration :

UUC Sensor	Standard Temperature (°C)	UUC Reading (°C)	Correction (°C)	Uncertainty (± °C)
WET	20.003	20.1	-0.1	0.14
	25.003	25.1	-0.1	0.14
	30.005	30.1	-0.1	0.14
	35.004	35.1	-0.1	0.14
	40.007	40.1	-0.1	0.14
	45.005	45.1	-0.1	0.14
	50.006	50.1	-0.1	0.14
DRY	60.005	60.1	-0.1	0.14
	20.006	20.1	-0.1	0.14
	25.004	25.1	-0.1	0.14
	30.003	30.1	-0.1	0.14
	35.004	35.1	-0.1	0.14
	40.005	40.1	-0.1	0.14
	45.005	45.1	-0.1	0.14
GLOBE	50.006	50.1	-0.1	0.14
	60.007	60.1	-0.1	0.14
	20.004	20.1	-0.1	0.14
	25.007	25.1	-0.1	0.14
	30.007	30.1	-0.1	0.14
	35.005	35.1	-0.1	0.14
	40.006	40.1	-0.1	0.14
	45.007	45.1	-0.1	0.14
	50.004	50.1	-0.1	0.14
	60.003	60.1	-0.1	0.14

End of Certificate

Calibrated By :

Mr. Sittichok Jirapukdesakun

Certificate of Calibration

Customer

Name : UNITED ANALYST AND ENGINEERING CONSULTANT CO.,LTD.

Address : 81 Soi Udomsuk 41, Sukhumvit Road, Bangchak, Prakanong, Bangkok 10260

Certificate No : 21-TPM-305

Request No : Req-2021-1402

Page : 1/2

Unit Under Calibration Details

Calibration Parameter : Temperature

Instrument Name : Thermal Environment Monitor

Manufacturer : TSI QUEST

Model : QT-32

Serial Number : TPT030008

Resolution : 0.1 °C

ID Number : -

Range Calibration : 20 °C to 60 °C

Type of Sensor : RTD

Sensor Diameter (mm) : 4.5

Calibration Position (mm) : 67.5

Instrument Status : Used

Calibration Environment and Details

Temperature : 23 °C ± 3 °C

Humidity : 55 %RH ± 15 %RH

Received Date : 29 October 2021

Calibrated Date : 9 November 2021

Calibration Procedure : In-house method CP-TPM-01 by Comparison with Standard Thermometer.

Reference Standard

Digital Thermometer with Sensor, Manufacturer: GINGO/GINGO, Model: GT11/ RTD100, SN: 12000077, ID: AR-TPM Which was calibrated on 30 March 2021, Calibration Certificate No. : QR21-0719

Traceability

This Certificate is traceable to SI Unit through Quality Reborn Co., Ltd., NSC-ONSC Accreditation No.:

Calibration 0292

Note

The reported uncertainty is based on standard uncertainty multiplied by the Coverage Factor $k=2$, providing a level of confidence approximately 95%.

Approved By :

Mr. Pacit Mathavorn

Calibration Engineer Supervisor

Issue Date :

11 November 2021

Certificate of Calibration

Customer

Name : UNITED ANALYST AND ENGINEERING CONSULTANT CO.,LTD. Certificate No : 21-ACT-326
Address : 81 Soi Udomsuk 41, Sukhumvit Road, Bangchak, Request No : Req-2021-0994
Prakanong, Bangkok 10260

Unit Under Calibration Details

Measurement item : Acoustic Calibrator Class : 1
Manufacturer : SVANTEK Range : 94, 114 dB / 1000 Hz
Model : SV36 Instrument Status : Used
Serial Number : 107224
ID : UAE.EFM.171/2564

Calibration Environment and Details

Temperature : (23 ±2 °C)
Humidity : (50 ± 20 %RH)
Barometric Pressure : (1013 ±10.0 hPa)
Received Date : 22 July 2021
Calibration Date : 24 August 2021
Location of Calibration : LAB 1 Acoustic
Calibration Procedure : In-house method CP-ACT-02 based on IEC 60942:2017 Electroacoustics - Sound calibrators

Reference Standard	Model	Serial Number	Traceable	Due Calibration
Sound Calibrator	SV 35A	58079	EEL	14 May 2022
THD Multimeter	2015	1047765	NIMT	21 January 2022

Traceability : This certificate provides traceability of measurement to recognized national standard, and to the realization of the international System of Units (SI).

Note

The reported uncertainty is based on standard uncertainty multiplied by the Coverage Factor k=2, providing a level of confidence approximately 95 %.

Calibrated By :  Mr. Noppadon Luangart
Service Calibration Engineer
Approved By :  Mr. Paci Mathavorn
Calibration Engineer Supervisor
Issue Date : 24 August 2021


Calibration Note

UUC Adjustment : Not Adjust

Result of Calibration :

UUC Sensor	Standard Temperature (°C)	UUC Reading (°C)	Correction (°C)	Uncertainty (± °C)
WET	20.003	20.3	-0.3	0.14
	25.004	25.3	-0.3	0.14
	30.004	30.3	-0.3	0.14
	35.004	35.3	-0.3	0.14
	40.005	40.3	-0.3	0.14
	45.005	45.3	-0.3	0.14
DRY	50.008	50.3	-0.3	0.14
	60.005	60.3	-0.3	0.14
	20.006	20.3	-0.3	0.14
	25.006	25.3	-0.3	0.14
	30.004	30.3	-0.3	0.14
	35.004	35.3	-0.3	0.14
GLOBE	40.007	40.3	-0.3	0.14
	45.004	45.3	-0.3	0.14
	50.004	50.3	-0.3	0.14
	60.004	60.3	-0.3	0.14
	20.003	20.3	-0.3	0.14
	25.004	25.3	-0.3	0.14

End of Certificate

Calibrated By :  Mr. Sittichok Jirapaksakun

Certificate No : 21-ACT-326

Request No : Req-2021-0994

Calibration Results : Without Adjustment

Sound pressure level

Calibration Range (dB)	Without Adjustment (dB)		Adjustment (dB)		Uncertainty (± dB)	Acceptance limit Class 1 (± dB)
	Measured	Error	Measured	Error		
94 dB / 1000 Hz	94.08	0.08	-	-	0.11	0.25
114 dB / 1000 Hz	114.13	0.13	-	-	0.11	0.25

Frequency of Sound pressure level

Calibration Range (Hz)	Without Adjustment		Adjustment		Uncertainty (± %)	Acceptance limit Class 1 (± %)
	Measured (Hz)	Error (%)	Measured (Hz)	Error (%)		
94 dB / 1000 Hz	999.96	0.004	-	-	0.10	0.70
114 dB / 1000 Hz	999.98	0.002	-	-	0.10	0.70

Total Harmonic Distortion plus Noise of Sound pressure level (THD+N %)

Calibration Range (Hz)	Without Adjustment		Adjustment		Uncertainty (± %)	Acceptance limit Class 1 (± %)
	Measured (%)	Error (%)	Measured (%)	Error (%)		
94 dB / 1000 Hz	0.43	-	-	-	0.40	2.5
114 dB / 1000 Hz	0.35	-	-	-	0.40	2.5

Note :

- Acceptance limit was IEC60942:2017 Class 1
- The calibration results exclude the calibrator pressure correction
- The calibration results exclude the microphone volume correction

End of Calibration

Certificate of Calibration

Customer

Name : UNITED ANALYST AND ENGINEERING CONSULTANT CO.,LTD.
Address : 81 Soi Udomsuk 41, Sukhumvit Road, Bungehak, Prakomong, Bangkok 10260

Certificate No : 22-ACT-114

Request No : Req-2022-0331

Unit Under Calibration Details

Measurement item : Noise dosimeter
Manufacturer : SVANTEK
Model : SV104
Serial Number : 91923
ID : -
Resolution : 0.1 dB
Calibration Environment and Details
Temperature : 23 °C ± 2 °C
Humidity : 50 %RH ± 20 %RH
Barometric Pressure : 1013 hPa ± 10 hPa
Received Date : 14 February 2022
Calibrated Date : 17 February 2022
Calibration Procedure : In-house method CP-NDM-01 based on IEC 61252 : 2017
Location of Calibration : Lab Acoustic

Microphone Class : 2
Microphone Model : SV27
Microphone S/N : 96604
Preamplifier Model : -
Preamplifier S/N : -
Instrument Status : Used

Reference Standard

Instrument	Brand	Model	SN.	Due calibration	Traceability
Multifrequency Calibrator	Quest	Quest-cal	188272	14 June 2022	TSI
Standard Microphone	GRAS	40AN	188273	15 September 2022	GRAS
Sine Generator	SvanteK	Svamp401	131	18 October 2022	WK Electric
Timer	EXTECH	-	05-ACT	29 March 2022	TPA

Note

The reported uncertainty is based on standard uncertainty multiplied by the Coverage Factor $k = 2$, providing a level of confidence approximately 95 %.

Calibrated By :

Mr. Noppadon Luangart

Calibration Officer

Approved By :

Mr. Pacit Mathavorn

Calibration Engineer Supervisor

Issue Date :

17 February 2022

Certificate No : 22-ACT-114
Request No : Req-2022-0331

4. Response to short duration

a. Response for sinusoidal signals - reference level

UUC Setting	Time		Exposure Measurement		Tolerances Limit (Pa ² h)
	Ref (s)	UUC (s)	Ref (Pa ² h)	Error (Pa ² h)	
FAST / A / 55-140	2846	2846	1.00	-0.01	-0.29 - 0.41
Calibrator Setting 4000 Hz 95 dB					

b. Sound exposure meter response for series of toneburst impulses

UUC Setting	Time		Exposure Measurement		Tolerances Limit (%)
	Ref (s)	UUC (s)	Ref (Pa ² h)	Error (%)	
FAST / A / 55-140	2846	2846	1.00	-1.00	-21 - +26
Calibrator Setting Burst 1 ms, 95 dB	900	900	1.00	-1.00	-21 - +41
Burst 1 ms, 100 dB	143	143	1.00	+1.00	-21 - +41

5. Response to unipolar pulse

UUC Setting	Time		Exposure Measurement		Tolerances Limit (%)
	Ref (s)	UUC (s)	Ref (Pa ² h)	Different (%)	
FAST / A / 55-140	2846	2846	1.00	0.00	-21 - +26
Calibrator Setting Continuous Rectangle +	900	900	1.00	-1.00	-21 - +41
Continuous Rectangle -	143	143	1.00	+1.00	-21 - +41

* Indicates non accredited

End of Certificate

Certificate of Calibration

Customer

Name : UNITED ANALYST AND ENGINEERING CONSULTANT CO.,LTD. Certificate No : 22-ACT-033
Address : 81 Soi Udomsuk 41, Sukhumvit Road, Bangchak, Prakanong, Bangkok 10260 Request No : Req-2022-0091

Unit Under Calibration Details

Measurement item : Noise dosimeter Microphone Class : 2
Manufacturer : SVANTEK Microphone Model : SV27
Model : SV104 Microphone S/N : 96602
Serial Number : 91925 Preamplifier Model : -
ID : UAE.EFM.165/2564 Preamplifier S/N : -
Resolution : 0.1 dB Instrument Status : Used

Calibration Environment and Details

Temperature : 23 °C ± 2 °C
Humidity : 50 %RH ± 20 %RH
Barometric Pressure : 1013 hPa ± 10 hPa
Received Date : 14 January 2022
Calibrated Date : 21 January 2022

Calibration Procedure : In-house method CP-NDM-01 based on IEC 61252 : 2017
Location of Calibration : Lab Acoustic

Reference Standard

Instrument	Brand	Model	S/N	Due calibration	Traceability
Multi-frequency Calibrator	Quest	Quest-cal	188272	14 June 2022	TSI
Standard Microphone	GRAS	40AN	188273	15 September 2022	GRAS
Sine Generator	Svante	Svan401	131	18 October 2022	WK Electric
Timer	EXTECH	-	05-ACT	29 March 2022	TPA

Note

The reported uncertainty is based on standard uncertainty multiplied by the Coverage Factor $k = 2$, providing a level of confidence approximately 95 %.

Calibrated By : Mr. Noppadon Luangart

Mr. Noppadon Luangart
Calibration Officer

Approved By : Mr. Pait Mahavorn

Mr. Pait Mahavorn
Calibration Engineer Supervisor

Issue Date : 21 January 2022

Certificate No : 22-ACT-033

Request No : Req-2022-0091

1. Absolute acoustical sensitivity

UUC Setting	Time		Exposure Measurement			Tolerances Limit (%)
	Ref (s)	UUC (s)	Ref (Pa ² h)	UUC (Pa ² h)	Error (%)	
FAST / A / 55-140						
Calibrator Setting						
1000 Hz 114 dB	120.00	120	3.23	3.20	-0.93	3.0

Note : Absolute sensitivity was established by the use of Sound Calibrator Brand SVANTEK, Model SV 35A, SN. 58079

2. Frequency weightings

UUC Setting	Deviation from various Frequency Weighting			UNCERTAINTY (± dB)	Tolerances Limit (± dB)
	A (dB)	C (dB)			
FAST / 55-140					
STD Setting					
*63 Hz	-0.3	-0.3		0.40	2.0
125 Hz	-0.2	-0.2		0.40	1.5
250 Hz	-0.2	-0.1		0.40	1.5
500 Hz	-0.2	-0.2		0.40	1.5
1000 Hz	0.0	0.0		0.40	-
2000 Hz	0.4	0.5		0.40	2.0
4000 Hz	0.2	0.3		0.40	3.0
8000 Hz	-1.8	-1.9		0.40	5.0

Certificate No : 22-ACT-033

Request No : Req-2022-0091

3. Linearity of response to steady signals

a. Sound exposure meter, linearity of response for changes of input sinusoidal signal level

UUC Setting	Ref (dB)	FAST / A / High									
		55.0	80.0	90.0	100.0	110.0	114.0	120.0	130.0	140.0	
1000 Hz	Level A	54.2	80.1	90.1	100.1	110.1	114.0	120.0	130.0	140.0	
	Error	-0.8	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.0	
	Ref (dB)										
8000 Hz	Level A	88.9	108.9	108.9	112.9	118.9	128.9	138.9			
	Error	88.9	98.9	98.9	108.9	112.9	118.9	128.9	138.8		
	Ref (dB)										
63 Hz	Level A	87.8	93.8	103.8	113.8						
	Error	87.8	93.9	103.9	113.9						
	Ref (dB)										
Tolerances Limit		1.0									
UNCERTAINTY		0.27									

b. Sound exposure meter linearity of error

UUC Setting	Ref (s)	Time		Exposure Measurement			UNCERTAINTY (%)	Tolerances Limit (%)
		UUC (s)	Ref (Pa ² h)	UUC (Pa ² h)	Error (%)			
FAST / A / 55-140								
Calibrator Setting								
1000 Hz 110 dB	27	27	0.30	0.30	0.00			
1000 Hz 110 dB	45	45	0.50	0.50	0.00			
1000 Hz 110 dB	90	90	1.00	1.01	+1.00	4.3		
1000 Hz 110 dB	180	180	2.00	2.02	+1.00			
1000 Hz 120 dB	36	36	4.00	4.03	+0.75			
1000 Hz 120 dB	72	72	8.00	8.05	+0.63			-21, +26
1000 Hz 120 dB	90	90	10.00	10.13	+1.30			
1000 Hz 120 dB	180	180	20.00	20.22	+1.10	3.8		
1000 Hz 120 dB	360	360	40.00	40.34	+0.85			
1000 Hz 120 dB	720	720	80.00	80.49	+0.61			

Certificate No : 22-ACT-033
 Request No : Req-2022-0091

4. Response to short duration

a. Response for sinusoidal signals - reference level

UUC Setting	Time	Exposure Measurement	UNCERTAINTY	Tolerances
FAST / A / 55-140	Ref (s)	UUC (Pa ² h)	Error (Pa ² h)	Limit (Pa ² h)
Calibrator Setting	(s)	(Pa ² h)	(Pa ² h)	(Pa ² h)
4000 Hz 95 dB	2846	2846	0.99	-0.01
				-0.29 - 0.41

b. Sound exposure meter response for series of toneburst impulses

UUC Setting	Time	Exposure Measurement	UNCERTAINTY	Tolerances
FAST / A / 55-140	Ref (s)	UUC (Pa ² h)	Error (%)	Limit (%)
Calibrator Setting	(s)	(Pa ² h)	(%)	(%)
Burst 1 ms, 95 dB	2846	1.00	0.99	-1.00
Burst 1 ms, 100 dB	900	1.00	1.00	0.00
Burst 1 ms, 108 dB	143	1.00	1.00	0.00

5. Response to unipolar pulse

UUC Setting	Time	Exposure Measurement	UNCERTAINTY	Tolerances
FAST / A / 55-140	UUC (s)	UUC (Pa ² h)	Different (%)	Limit (%)
Calibrator Setting	(s)	(Pa ² h)	(%)	(%)
Continuous Rectangle +	7	10.86	0.00	-21 - +26
Continuous Rectangle -		10.86		

* Indicates non accredited

End of Certificate



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-TS-1517025
 CALIBRATION 0008

Cert.No.: 21CH1467
 Page.: 1 of 3

Certificate of Calibration

Equipment : pH Meter
 Manufacturer : YSI
 Model : pH100A
 Serial No. : JC02719
 ID No. : UAE.EFM.193/2561(ENV.pH.02/61)
 Condition As-Received: Used Item
 Received Date : 19 October 2021
 Calibration Date : 21 October 2021
 Reference : 2110-0604WSC-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 : Warakorn Lengagtrakul

Approved by : Approved Signatory

() Malee Butkruea
 () Saitip Meangmai
 () Warakorn Lengagtrakul
 Issue Date : 29 October 2021

The Uncertainties are for a confidence probability of approximately 95 %

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



Cert.No.: 21CH1467
Page.: 2 of 3

Condition of this calibration result

- Reference Standard Instrument :

Instrument	Serial No.	ID No.	Cert. No.	Due Date
1) Document Process Calibrator	54030049	130RC116	21E2682	25 Aug 2022
2) Ref. Standard Thermometer	3240076	60RC033	21193	14 Feb 2022

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

Buffer Solution	Manufacturer	Lot No.	Exp. date
pH 4.008	CPA chem	761016	02 Aug 2023
pH 6.982	CPA chem	761017	02 Aug 2022
pH 10.015	CPA chem	761018	02 Aug 2022

- 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 (±mV)	Coverage factor k
			mV	pH		
pH Meter S/N.: JC02719	4.00	177.48	177	4.01	0.58	2.00
	7.00	0.00	0	7.00	0.58	2.00
	10.00	-177.48	-177	10.01	0.58	2.00

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Cert.No.: 21CH1467
Page.: 3 of 3

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 S/N.: 210224SIA605377	4.008	4.01	170	0.0079	2.00
	6.982	6.99	-3	0.011	2.00
	6.982	6.99	-3	0.011	2.00
	10.015	10.01	-175	0.013	2.00

Function : Temperature Measurement

(*) Without adjustment

This equipment was connected with Temperature Probe;

- Model : -
- Serial No. : 210224SIA605377
- Dimension of probe;
 - Length : 110 mm.
 - Diameter : 12 mm.
 - Immersion Depth : 100 mm.

Calibration Point (°C)	Standard Temperature (°C)	UUC* Reading (°C)	Error (°C)	Uncertainty of measurement (± °C)	Coverage factor k
25.0	25.003	24.9	-0.103	0.20	2.00
30.0	30.004	29.9	-0.104	0.20	2.00
35.0	35.002	34.9	-0.102	0.20	2.00

Remark : - UUC* = Unit Under Calibration

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

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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 FAX. 0-2719-9484

Cert.No.: 21TW182
Page.: 1 of 2

Certificate of Testing

Equipment : DO Meter
Manufacturer : YSI
Model : Pro 20 i
Serial No. : 18C104193
ID No. : UAE.EFM.197/2561(ENV.DO.01/61)
Received Date : 30 August 2021
Test Date : 02 September 2021
Reference : 2108-0907WSC-2
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
☐ Saitip Meangmai
☐ Warakorn Lerngagrakul

Issue Date : 10 September 2021

เอกสารไม่ควบคุม



Cert.No.: 21TW182
Page.: 2 of 2

Result : Dissolved Oxygen Meter Adjustment With Air 100 %
Dissolved Oxygen Probe No.: 18C100567

Titration Method (Azide Modification Method) (mg/L)	DO Meter Reading (mg/L)	Standard Deviation (mg/L)
8.18	8.18	0.0055

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

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เอกสารไม่ควบคุม



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



Cert. No.: 21TM1489

Page.: 1 of 2

Certificate of Calibration

Equipment : DO Meter with Sensor
Manufacturer : YSI
Model : Pro 20 i
Serial No. : 18C104193
ID No. : UAE.EFM.197/2561(ENV.DO.01/61)

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 : 30 August 2021
Calibrated Date : 7 September 2021
Ambient Temperature : (26 ± 10) °C
Relative Humidity : (50 ± 30) %
AC Line Voltage : (220 ± 22) V

Calibrated by : Malee Bulkruea

Approved by : 
(☒) Pornthip Pameyakul
(☐) Suwit Imjai

Issue Date : 10 September 2021

The Uncertainties are for a confidence probability of approximately 95%

This certificate may not be reproduced other than in full, except with the prior written

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

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Equipment : DO Meter with Sensor

Condition As-Received : Used Item

Reference : 2108-0907WSC-1

Procedure Used :-

Calibration were conducted using in-house calibration procedure CP-OT01 according to comparison with Industrial Platinum Resistance Thermometer (IPRT) into Temperature Bath.
The temperature scale used was based on ITS-90.

Condition of this result of calibration

1. Reference standard instrument:-

Instrument **Model** **Serial No.** **Cert. No.** **Due Date**
1) Digital Thermometer 1523 3240076 21193 15 Feb 2022

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

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

Result of Calibration :- (*) Without Adjustment

Function : Temperature measurement.

This instrument was connected with temperature sensor, S/N.: 18C100567

Calibration Point (°C)	Immersion Depth (mm)	Standard Temperature (°C)	UUC* Reading (°C)	Error (°C)	Uncertainty (± °C)	Coverage Factor <i>k</i>
25.0	90	24.997	24.9	-0.097	0.16	2.00
30.0	90	30.007	29.9	-0.107	0.18	2.04
35.0	90	35.001	34.9	-0.101	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

รายงานผลการปฏิบัติงานมาตรฐานป้องกันและแก้ไขผลกระทบสิ่งแวดล้อม และมาตรการติดตามตรวจสอบผลกระทบสิ่งแวดล้อม
โครงการโรงไฟฟ้าเอกชน (ครั้งที่ 2) บริษัท โกลบอล เพาเวอร์ ซินเนอร์ยี่ จำกัด (มหาชน)
ครั้งที่ 1 ประจำปี พ.ศ. 2565 (ไตรมาส-มิถุนายน พ.ศ. 2565)

บัญชีรายการเครื่องมือหลักของห้องปฏิบัติการ สำหรับวิเคราะห์คุณภาพสิ่งแวดล้อม									
No.	Instrument/Equipment	Parameter	Manufacturer	Model/Serial No.	Calibrator	Certification No.	Date of Calibration	Due date of Calibration*	Remark
เครื่องมือหลักวิเคราะห์คุณภาพอากาศ									
1	Analytical Balance (Repeatability 0.1 mg)	ฝุ่นละอองรวม ฝุ่นละอองขนาดเล็กไม่เกิน 10 ไมครอน	Mettler-Toledo	AB204-S / 1128312528	Mettler-Toledo (Thailand) Ltd.	TH2058-097-040722-ACC-TH	7 Apr 22	6 Apr 23	-
2	Analytical Balance (Repeatability 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	UV-VIS Spectrophotometer	กึ่งออกไซด์ของไนโตรเจน ในรูปแบบไดรเจนไดออกไซด์	Agilent Technologies	Cary60 G6860A / MY15410009	DOE Services Co.,Ltd.	SP22-016	31 May 22	30 May 23	-
4	UV-VIS Spectrophotometer		Hitachi	U-1900 / 2021-064	DOE Services Co.,Ltd.	SP22-007	20 Jan 22	19 Jan 23	-
5	Ion Chromatography (IC)	กรดกำมะถัน โซเดียมไฮโปคลอไรท์	Dionex	DX-120 / 03010223	Archemica Lab Co.Ltd.	Qualification Report Anion (ID#042)	8 Dec 21	7 Dec 22	-
Laboratory Instrument/Equipments.(คุณภาพน้ำ)									
1	pH Meter	ความเป็นกรดและด่าง อุณหภูมิ	Hanna Instrument	HI2211 / 8165345	National Food Institute, Ministry of Industry, Thailand	2202097-001-01	16 Mar 22	15 Mar 23	-
2	pH Meter		Mettler-Toledo	Seven Easy S20 / 1231155210	National Food Institute, Ministry of Industry, Thailand	2201793-001-01	1 Mar 22	28 Feb 23	-
3	BOD Incubator	บีโอดี	Arco	UC4-1320 / (UAE.WAO.015/2561)	Technology Promotion Association (Thailand-Japan)	22TM90	17 Feb 22	16 Feb 23	-
4	BOD Incubator		Arco	UR-1320 / (UAE.WAO.018/2551)	Technology Promotion Association (Thailand-Japan)	22TM305	7 Apr 22	6 Apr 23	-
5	Analytical Balance (Repeatability 0.1 mg)	น้ำหนักและอุณหภูมิ	Mettler-Toledo	AB-204S/FACT / 1129361010	National Food Institute, Ministry of Industry, Thailand	2203120-001-01	1 Jun 22	31 May 23	-

รายงานผลการปฏิบัติงานมาตรฐานป้องกันและแก้ไขผลกระทบสิ่งแวดล้อม และมาตรการติดตามตรวจสอบผลกระทบสิ่งแวดล้อม
โครงการโรงไฟฟ้าเอกชน (ครั้งที่ 2) บริษัท โกลบอล เพาเวอร์ ซินเนอร์ยี่ จำกัด (มหาชน)
ครั้งที่ 1 ประจำปี พ.ศ. 2565 (ไตรมาส-มิถุนายน พ.ศ. 2565)

บัญชีรายการเครื่องมือหลักของห้องปฏิบัติการ สำหรับวิเคราะห์คุณภาพสิ่งแวดล้อม							
No.	Instrument/Equipment	Parameter	Manufacturer	Model/Serial No.	Calibrator	Certification No.	Due date of Calibration*
Laboratory Instrument/Equipments.(คุณภาพน้ำ) (ต่อ)							
6	UV-VIS Spectrophotometer	แสงไม่มียูวี	Agilent Technologies	Cary60 G6860A / MW15410009	DQE Services Co.,Ltd.	SP22-016	30 May 23
7	UV-VIS Spectrophotometer		Hitachi	U-1900 / 2021-064	DQE Services Co.,Ltd.	SP22-007	19 Jan 23
8	UV-VIS Spectrophotometer		Hitachi	U-2900 / 21E22-009	DQE Services Co.,Ltd.	SP22-008	19 Jan 23
9	Analytical Balance (Readability 0.01 mg)	สารที่ละลายได้ทั้งหมด สารแขวนลอย	Mettler-Toledo	AX105DR / 1122100406	National Food Institute, Ministry of Industry, Thailand	2200708-001-01	23 Nov 22
10	Hot Air Oven		Memmert	UF55 / B216.1666	Technology Promotion Association (Thailand-Japan)	21TM1876	28 Oct 22
11	Conductivity Meter	ค่าการนำไฟฟ้า	SI Analytics	Lab955 / 16300356	SPC Calibration Center Co.,Ltd.	C24220084	21 Mar 23
							-


Due Date of Calibration* : กำหนดตามแผนการสอบเทียบประจำปี อย่างน้อยปีละ 1 ครั้ง

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



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
Zip / Postal: 10260
State / Province: Bangkok
Order Number: 

Contact: Suwit Chotnok

Weighing Device

Manufacturer: Mettler Toledo
Model: AB204-S
Serial No.: 1128312528
Building: N/A
Floor: 2
Room: Balance Room 2 (206)

Instrument Type: Weighing Instrument
Asset Number: UAE-AIR.019/2550
Terminal Model: N/A
Terminal Serial No.: N/A
Terminal Asset No.: N/A

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

Procedure

Calibration Guideline:

METTLER TOLEDO Work Instruction:

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.

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

As Found Calibration Date: 07-Apr-2022

As Left Calibration Date: N/A

Issue Date: 08-Apr-2022



Sirawit Chiamchan

Approved Signatory:



☒ Kassakorn Tassanachaisakul
☐ Santi Jitinyom
☐ Surachet Sukkate

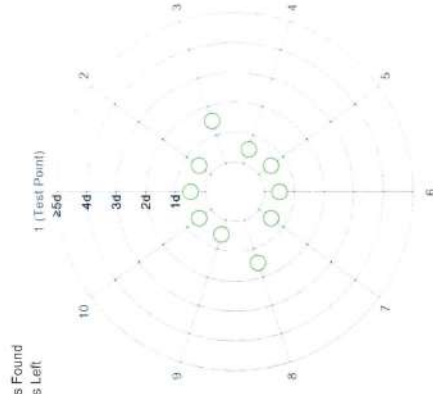
Measurement Results

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
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The "d" in the graph represents the readability of the range interval in which the test was performed.
The results of the 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	99.9999 g	N/A
3	99.9998 g	N/A
4	100.0001 g	N/A
5	100.0001 g	N/A



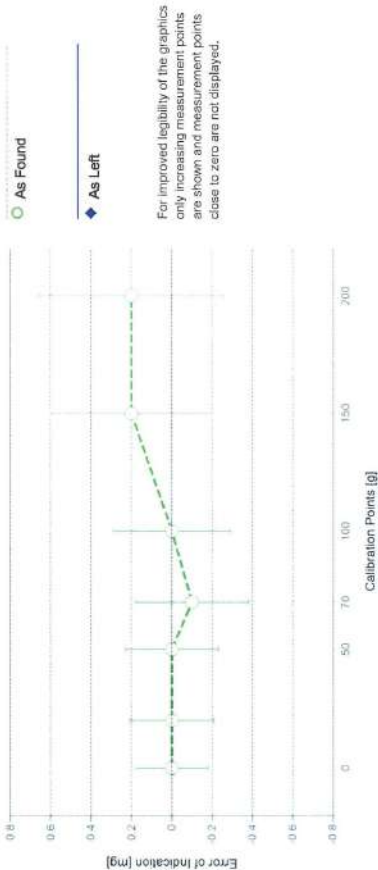
Maximum Deviation	0.00002 g	N/A
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As Found

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

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



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

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.

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 · 10⁻⁴ / K
Temperature range on site for the evaluation of the measurement uncertainty in use: 3 K

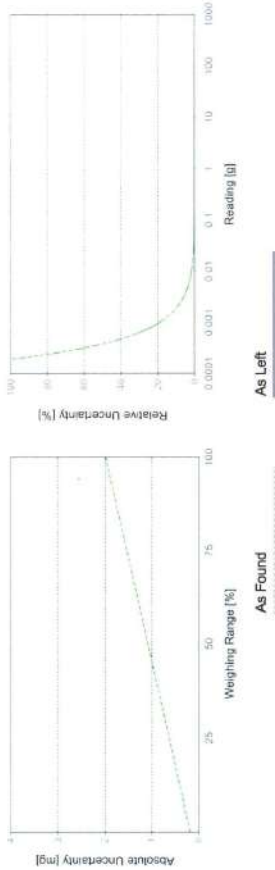
Linearization of Uncertainty Equation

Range		As Found	As Left
d	Max		
1	0.0001 g	220 g	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
0.2200 g	0.19 mg	0.087%	N/A
2.2000 g	0.21 mg	0.0095%	N/A
22.0000 g	0.37 mg	0.0017%	N/A
220.0000 g	2.0 mg	0.00090%	N/A




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



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:	Swit Chonok
Zip / Postal:	10260		
State / Province:	Bangkok		
Order Number:	 * 0 3 3 7 4 2 3 9 6 *		

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:
METTLER TOLEDO Work Instruction:

EURAMET cg-18 v. 4.0 (11/2015)
CPW002/20

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
As Left Calibration Date: 07-Apr-2022
Issue Date: 08-Apr-2022

Calibrator:
Sirawit Chanchan

Approved Signatory:


Kassakorn Tassanachaisakul
☒ Santi Jitriyom
☐ Surachet Sukkate

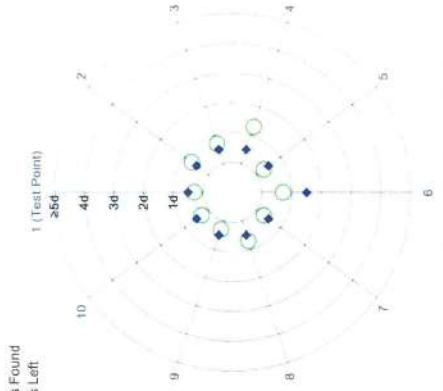
Measurement Results

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
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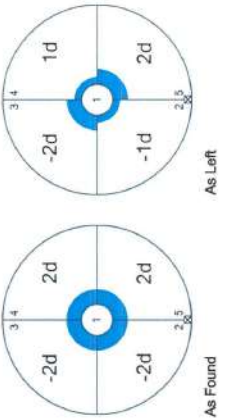
The "g" in the graph represents the readability of the range/interval in which the test was performed.
The results of this graph are based upon the absolute values of the differences from the mean value.

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

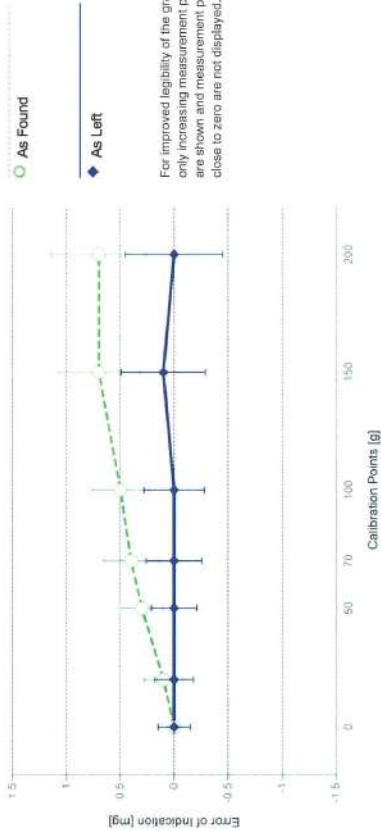
Error of Indication

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



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 $k = 2$ 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

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.

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

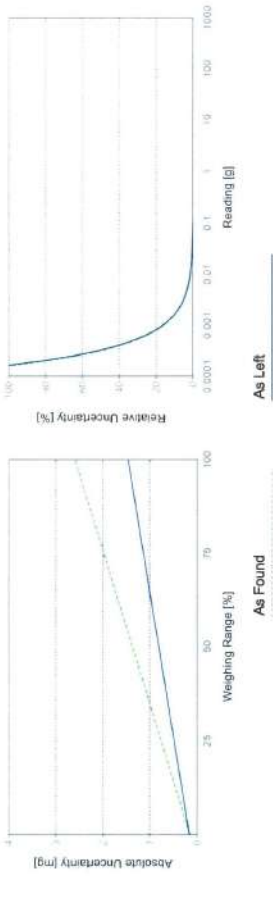
Linearization of Uncertainty Equation

Range		As Found	As Left
d	Max		
1	0.0001 g	220 g	$U_1 = 0.16 \text{ mg} + 0.0111 \text{ mg/g} \cdot R$
			$U_1 = 0.16 \text{ mg} + 0.00592 \text{ mg/g} \cdot R$

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	0.00068%



CERTIFICATE OF CALIBRATION

Page 1 of 5

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 : กฤษณ์ Approved by : ชลธิชา
(Mr. Tanawat Rittidach) (Ms. Chonthicha Sangngern)
Technical Manager 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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FM-708-02 R01 1/11/2021

REPORT OF CALIBRATION

Certificate No. : SP22-016

Page 2 of 5

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
Absorbance Standard set	25760	95935	22 October 2023
Absorbance 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

FM-708-02 R01 1/11/2021

REPORT OF CALIBRATION

Certificate No. : SP22-016

Page 3 of 5

Calibration Results : Without adjustment

Photometric Accuracy :

Wavelength (nm.)	CRMs Values (Abs)	UUC Reading (Abs)	Correction (Abs)	Uncertainty (Abs)	Coverage factor <i>k</i>
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
465	2.1229	2.1211	0.0018	0.0082	2.00
	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
546.1	1.9763	1.9752	0.0011	0.0070	2.00
	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
590	1.9987	1.9946	0.0041	0.0084	2.00
	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
635	2.0391	2.0329	0.0062	0.0080	2.00
	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

เอกสารไม่ควบคุม

REPORT OF CALIBRATION

Certificate No. : SP22-016

Page 4 of 5

Photometric Accuracy :

Wavelength (nm.)	CRMs Values (Abs)	UUC Reading (Abs)	Correction (Abs)	Uncertainty (Abs)	Coverage factor <i>k</i>
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

เอกสารไม่ควบคุม

REPORT OF CALIBRATION

Certificate No. : SP22-016

Page 5 of 5

Wavelength Accuracy :

CRMs Values (nm.)	UUC Reading (nm.)	Correction (nm.)	Uncertainty (nm.)	Coverage factor <i>k</i>
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 Calibration

- N/A = Not Available

- 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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FM-708-02 R01 1/11/2021

CERTIFICATE OF CALIBRATION

Certificate No. : SP22-007

Page 1 of 5

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 : จตุพร

(Mr. Tanawut Ritidach)

Approved by : จุฬารัตน์

(Ms. Chonhicha Sangngern)

Technical Manager

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.

FM-708-02 R01 1/11/2021

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REPORT OF CALIBRATION

Certificate No. : SP22-007

Page 2 of 5

Environment Condition : Ambient Temperature $25 \pm 5^{\circ}\text{C}$

Relative humidity $55 \pm 20\% \text{RH}$

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

Certified Reference Materials :

Material	Serial No.	Certificate No.	Due date
Absorbance Standard set	25760	95935	22 October 2023
Absorbance 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.

REPORT OF CALIBRATION



Certificate No. : SP22-007

Page 3 of 5

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

<div> <div>  <div> <div>DQE Services</div> <div>Services</div> </div> </div> <div> <div>DQE Services Co.,Ltd.</div> <div>32 Soi Ladprao-Wanghin 55, Ladprao-Wanghin Rd., Ladprao, Bangkok 10230</div> <div>Phone : +66 (0)2 538 2054, Email : dqeservicesinfo@gmail.com</div> </div> </div>		<div> <div>  <div> <div>TISI</div> <div>REGISTRATION 17025</div> <div>CALIBRATION DATA</div> </div> </div> </div>		<div> <div> <div>Page 4 of 5</div> <div>REPORT OF CALIBRATION</div> <div>Certificate No. : SP22-007</div> <div>Photometric Accuracy :</div> </div> </div>	
Wavelength (nm.)	CRMs Values (Abs)	UUC Reading (Abs)	Correction (Abs)	Uncertainty (Abs)	Coverage factor <i>k</i>
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



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



บริษัท อีอาร์ เคมี จำกัด
ARCHEMICA LAB CO.,LTD

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

(Mr.Channarong Khiao-un)

Test Engineer

Qualification Report

**PM Check list ,CM_OQ and PQ
DX-120 : Anion (ID#042)**

**For
UAE
(2nd Contract)**

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เอกสารไม่ควบคุม



Dionex Ion Chromatography
Preventive Maintenance Report

Customer Organization	Name/ Department
UAE (2 nd 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



Channarong

Archemica Lab Co.,Ltd
บริษัท อาร์เคมีคา แล็บ จำกัด
ARCHEMICA LAB CO.,LTD

8-Dec-21

Date

Suwan

Customer

8-Dec-21

Date

Preventive Maintenance Check List

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เอกสารไม่ควบคุม



General Inspection Checklist

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

Chromeleon Operational Qualification
(CM_OQ)



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: (Exceptions 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

Operator's Signature // Date

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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 Coeff.	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



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



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

Simon 8-Dec-21

Reviewer's Signature // Date

K. Sathaporn 8-Dec-21

Operator's Signature // Date



เอกสารไม่ควบคุม



Chromeleon Operational Qualification, Part 2

Most Frequently Used Parameters: Comparison with Expected Results

Variable Category		Report Variable	Peak Name	Status
Sample	Calibration Type	LOF		ok
	Integration Type	Area		ok
	Standard Method	External		ok
	Calibration Mode	Total		ok
	Auto Recalibrate	ON		ok
	No.			ok
	Name			ok
	Sample Type			ok
	Position			ok
	Status			ok
Chromatogram	Inj. Vol.	ok		ok
	Dil. Fac.	ok		ok
	Weight	ok		ok
	Amount	ok		ok
	Program	ok		ok
	Quantification Method			ok
	Channel			ok
	No. of Peaks			ok
	Start Time			ok
	Signal Min.			ok
Peak Results	Signal Max.			ok
	Signal Dimension			ok
	Noise 2.1-2.3			ok
	No.		Methylparabene	ok
	No.		Ethylparabene	ok
	No.		Propylparabene	ok
	Peak Name		Methylparabene	ok
	Peak Name		Ethylparabene	ok
	Ret. Time		Propylparabene	ok
	Ret. Time		Ethylparabene	ok

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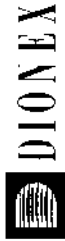


Chromeleon Operational Qualification, Part 2

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
Chromatogram	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
Peak Results	Concentration		Propylparabene	ok
	Concentration		Methylparabene	ok
	Concentration		Ethylparabene	ok
	Rel. Amount		Propylparabene	ok
	Rel. Amount		Ethylparabene	ok
	Rel. Amount		Propylparabene	ok
	Peak Width (0%)		Methylparabene	ok
	Peak Width (0%)		Ethylparabene	ok
	Peak Width (5%)		Propylparabene	ok
	Peak Width (5%)		Methylparabene	ok

เอกสารไม่ควบคุม



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 Calibration	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



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



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
Peak Table	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
Peak Table	W	Propylparabene	ok
	W	Methylparabene	ok
	W	Ethylparabene	ok
	F(X)	Propylparabene	ok
	F(X)	Methylparabene	ok
	F(X)	Ethylparabene	ok

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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

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Smp: Parabenes



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

Test Result: **Failed**

Signature 8-Dec-21

Reviewer's Signature // Date

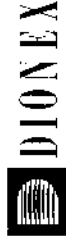


Signature 8-Dec-21

Operator's Signature // Date

เอกสารไม่ควบคุม

Smp: Parabenes



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
	Area	Methylparabene	ok
EXT290NM	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
	Noise (1.9-2.4 min)		ok
	Noise (1.9-2.4 min)		ok
Smooth Data: UV_VIS_1_MA_005_001 UV_VIS_1_OL_051_001 EXT290NM_SG_005_010	Noise (1.9-2.4 min)		ok
	Noise (1.9-2.4 min)		ok
	Noise (1.9-2.4 min)		ok

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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

Simon 8-Dec-21

Reviewer's Signature // Date



K. Khamrarporn 8-Dec-21

Operator's Signature // Date

เอกสารไม่ควบคุม



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

Simon 8-Dec-21

Reviewer's Signature // Date



K. Khamrarporn 8-Dec-21

Operator's Signature // Date

เอกสารไม่ควบคุม



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

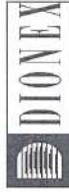
Variable Category	Report Variable	Status
Fraction Report	Fract. No.	ok
	Fract. Starttime *)	ok
	Fract. Endtime *)	ok
	No. of Tubes	ok
	Position	ok
	Peak Name	ok
Tube Report	No. of Peaks	ok
	Position	ok
	Tube Starttime *)	ok
	Tube Endtime *)	ok
	Max. Tube Volume	ok
	Peak Name	ok
	No. of Peaks	ok
	Fract.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



Test Result: Passed

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

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



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
Chromleon	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 *Sam* Qualification Executor *Kannaporn* Date *8-Dec-21*

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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

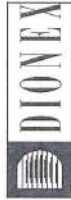
Additional Information:

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



Customer Signature *Sam* Qualification Executor *Kannaporn* Date *8-Dec-21*

เอกสารไม่ควบคุม



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 / Archechemia	Next Qualification:	Jun-2022

Test Results Summary

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



Customer Signature
Sinan

Qualification Executor
Kattana

Date
8-Dec-21

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



Customer Signature
Sinan

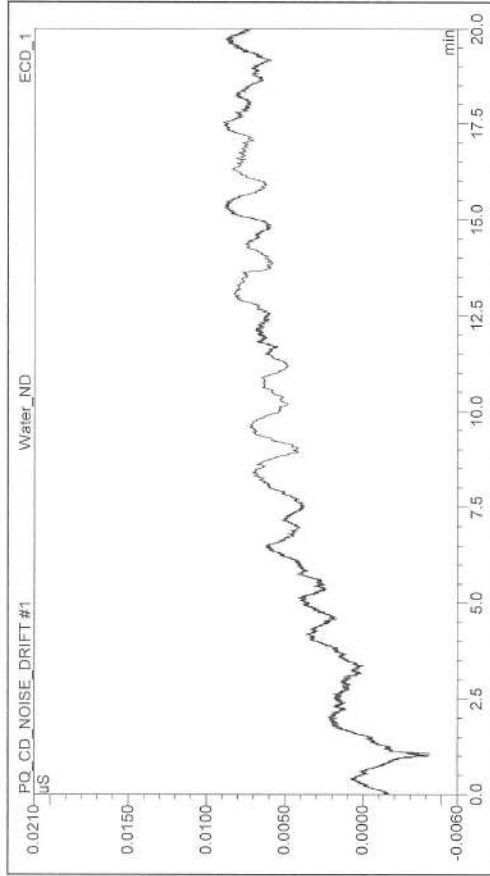
Qualification Executor
Kattana

Date
8-Dec-21

เอกสารไม่ควบคุม

เอกสารไม่ควบคุม

Chromatogram of Detector Noise and Drift



Customer Signature Suman Qualification Executor Kannarong Date 8-Dec-21

เอกสารไม่ควบคุม



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



Customer Signature Suman Qualification Executor Kannarong Date 8-Dec-21

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



Customer Signature Suran Qualification Executor Kannarong Date 8-Dec-21

เอกสารไม่ควบคุม



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

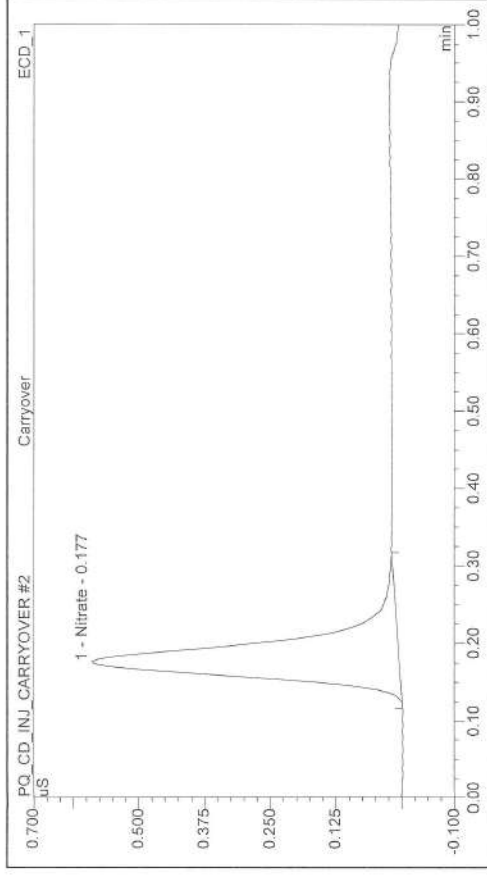
Test	Result
Injector Carry Over (Area %)	PASS



Customer Signature Suran Qualification Executor Kannarong Date 8-Dec-21

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Chromatogram for Carry Over test



Data for Carry Over test

Name	Ret.Time (detected) min	Area uS*min
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

Customer Signature: *Siraporn* Qualification Executor: *K. Channarong* Date: 8-Dec-21

เอกสารไม่ควบคุม



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

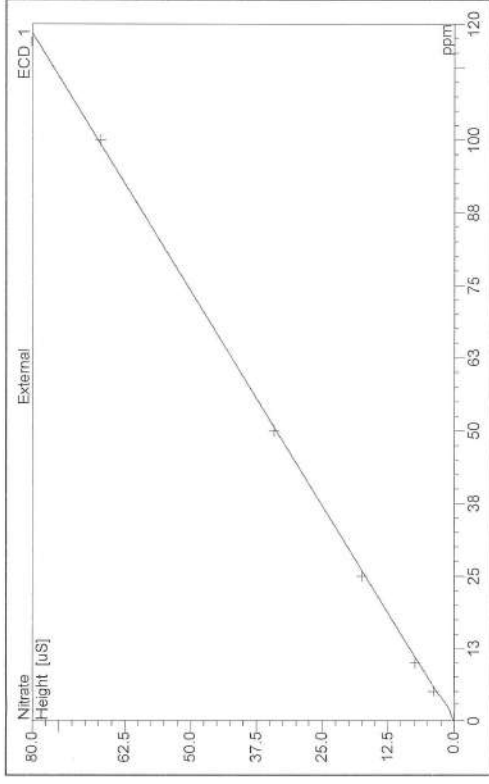
Customer Signature: *Siraporn* Qualification Executor: *K. Channarong* Date: 8-Dec-21

เอกสารไม่ควบคุม

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

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

Customer Signature: Siam Qualification Executor: K. Khamkhae Date: 8-Dec-21

Certificate of Completion

This certifies that

Channarong Khiao-Un

Has successfully completed

eLearn: RPG IC-Specific Qualification Service Training

Issued electronically and
approved by:

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

Valid for 3 years from:
Nov/19/2021

K. Khamrarporn
8-Dec-21

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.

Certificate of Analysis

Better Separations Through
Better Chemistry

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.



Dionex Nitrate Standard

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

K. Khamrarporn

8-Dec-21

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

thermoscientific.com/dionex

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เอกสารไม่ควบคุม

Calibration Certificate

Certificate No.: 2202097-001-01
Client name: UNITED ANALYST AND ENGINEERING CONSULTANT CO.,LTD.
Address: 3 Sol Udomsuk 41, Sukhumvit Road,
Bangchack, Prakhnong, Bangkok 10260

Page 1 of 5

Equipment: pH Meter
Manufacturer: HANNA INSTRUMENTS
Model: HI 2211
Serial No.: 08165345
ID No.: UAE.WAT.004/2556
Order No.: 2202097
Operation No.: 2202097-001
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.

Calibration Report

Certificate No.: 2202097-001-01
Equipment: pH Meter
Manufacturer: HANNA INSTRUMENTS
Serial No.: 08165345
ID No.: UAE.WAT.004/2556
Resolution: 0.01 pH ; 0.1µV mV
Model: HI 2211
Type: Bench top

Page 2 of 5

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)

Instruments	Serial / ID No.	Manufacturer	Certificate No.	Due Date
2.1 DC Voltage Calibrator	2709007	Fluke	SCL-21F-0667	24 June 2022
2.2 Digital Thermometer	2709007	Fluke	CC-640599-01	30 October 2022
2.3 Thermo-Hygro Meter	80A-61-BTH 00558	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
3.2 Instruments No.2.2 through
3.3 Instruments No.2.3 through
3.4 Certified Reference Material No. 2.4 to 2.6 traceable to
3.5 Certified Reference Material No. 2.7 traceable to
NSC-TIS-17025 Laboratory Accreditation of Calibration No.0075
NSC-TIS-17025 Laboratory Accreditation of Calibration No.0061
NSC-TIS-17025 Laboratory Accreditation of Calibration No.0292
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
BIM ReN HI-7 LoN 30.04.2020; BIM ReN HI-9 LoN 28.05.2020; BIM ReN HI-3 LoN 30.04.2020; BIM ReN HI-10 LoN 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.

Calibration Report

Certificate No.: 2202097-001-01
Equipment: Digital Thermometer with RTD (pH Meter)
Resolution: 0.1 °C
Model: HI 2211
Serial No.: 08165345
ID No.: UAE.WAT.004/2556
Manufacturer: HANNA INSTRUMENTS
Date of Calibration: 16 March 2022

Page 5 of 5

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 SN : N/A

Dimension of probe : Diameter 3.5 mm., Length 100 mm.,

Sheath material : Stainless Steel

UUC* Reading (°C)	Standard Temperature (°C)	Correction Value (°C)	Uncertainty ± (°C)
15.0	15.001	0.0	0.099
25.0	25.002	0.0	0.099
35.0	35.002	0.0	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 *****

Calibration Certificate

Certificate No.: 2201793-001-01
Client name: UNITED ANALYST AND ENGINEERING CONSULTANT CO.,LTD.
Address: 3 Soi Udomek 41, Sukhumvit Road,
 Bangchack, Prakanong, Bangkok 10260

Page 1 of 5

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
Date of Issue: 1 March 2022
Approved by 
 (Mr.Nittapong Niyomchart)
 Specialist, Division of Calibration Laboratory
 Responsible for the Technical Management Team

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.

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 0851/84	03-Jun-22	TISTR
Platinum Resistance Thermometer (PRT)	5627A	877332			

Support Equipment : - Low Temperature Bath (ISOCAL-6), Model: Europa-6 Plus Basic, SN: 3415922

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 : ☒ Without adjustment ☐ After adjustment


 1 March 2022

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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 SIN : 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


 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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TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES
53/4/4 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG BANGKOK 10250
TEL. 0-2717-3000-27 FAX. 0-2719-9484



NSC-TISI-TIS17025
CALIBRATION 9008

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 : $(26 \pm 10) ^\circ\text{C}$
Relative Humidity : $(50 \pm 30) \%$

Calibrated by : Kunchit Promprat

Approved by :  Approved Signatory

() Ponthippa 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.

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A 0038099



Equipment : BOD Incubator
Condition As-Received : Used Item
Reference : 2202-0446OC-1

Cert. No.: 22TM90
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	MY44035217	21LM30	23 Dec 2022

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

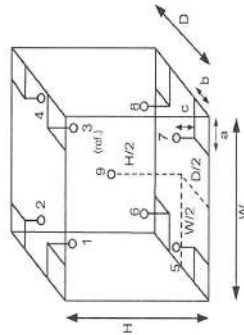
3. This certification is traceable to the International System of Unit.

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



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

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

เอกสารไม่ควบคุม

เอกสารไม่ควบคุม
A 1096042



Equipment : BOD Incubator
Condition As-Received : Used Item
Reference : 2202-0446OC-1
Result of Calibration :- (*) Without Adjustment
Function of UUC* : Temperature Source
Fresh air setting : Not Available

Cert. No.: 22TM90
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
20.0	19.5	19.4	0.30	0.58	1.0	0.55	2
Measured Temperature (°C)							
Position							
1	2	3	4	5	6	7	8
20.154	20.013	20.356	19.939	19.834	19.761	19.817	19.824
				9 (ref.)			
					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 %.

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เอกสารไม่ควบคุม
a 1096041



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES
53/44 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG BANGKOK 10250
TEL. 0-2717-3000-27 FAX. 0-2719-9484



MSC18-15151025
CALIBRATION 0005

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 :  Approved Signatory

() Ponthippa Tameyakul
() Malee Butkruea
() Suwit Imjai

Issue Date : 18 April 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
A 0040246



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

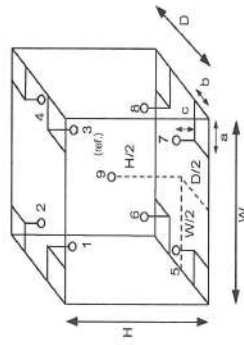
1. Reference standard instrument:-
Instrument Model Serial No. Cert. No. Due Date
1) Data Acquisition 34970A MY41021843 22LM4 10 Jan 2023
2. This certificate is valid only to the item calibrated on date and place of calibration.
3. This certification is traceable to the International System of Unit.

Result of Calibration :-

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



Probe Installation Details :

a = 10 cm
b = 10 cm
c = 10 cm
D = 0.62 m
W = 1.2 m
H = 1.2 m
Capacity = 0.89 m³

Dimension of Chamber :

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



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
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
20.0	20.0	20.0	0.50	0.44	1.1	0.64	2

Measured Temperature (°C)								
Position								
Calibration Point (°C)	1	2	3	4	5	6	7	8
20.0	20.080	20.056	19.866	19.826	19.655	19.656	19.819	19.979
								9 (ref.)
								19.699

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

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

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

UUC* : Unit Under Calibration

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

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

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a 1104314



เอกสารไม่ควบคุม

a 1104313

2008 ๒๕๕๑ กรุงเทพมหานคร ๓๕ ถนนสุขุมวิท แขวงบางนา เขตคลองเตย กรุงเทพมหานคร 10700, Thailand
Tel: +66(0) 2422 8945 Fax: +66(0) 2422 8945

Calibration Report

Certificate No.: 2203120-001-01
Equipment: Electronic Balance
Manufacturer: METTLER TOLEDO
Model: AB204-S/FACT
Resolution: 0.0001 g
Serial No.: 1129351010
ID No.: UAE.WAS.002/2552
Capacity: 220 g

Date of Calibration: 1 June 2022
Page 3 of 3

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 -----


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 :  **Approved by :** 
 (Mr.Tanawat Rittidach) (Ms. Chonthicha Sangngern)
 Technical Manager 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.

REPORT OF CALIBRATION

Certificate No. : SP22-016

Page 2 of 5

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
Absorbance Standard set	25760	95935	22 October 2023
Absorbance 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.

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REPORT OF CALIBRATION

Certificate No. : SP22-016

Page 3 of 5

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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REPORT OF CALIBRATION

Certificate No. : SP22-016

Page 4 of 5

Photometric Accuracy :

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

REPORT OF CALIBRATION

Certificate No. : SP22-016

Page 5 of 5

Wavelength Accuracy :

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

Remark : - UUC = Unit Under Calibration

- N/A = Not Available

- 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

เอกสารไม่ควบคุม

- End of Certificate -

เอกสารไม่ควบคุม

CERTIFICATE OF CALIBRATION

Page 1 of 5

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 : 

Approved by : 

(Mr. Tanawut Rittidach)

(Ms. Chonhicha Sangngern)

Technical Manager

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.

REPORT OF CALIBRATION

Page 2 of 5

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
Absorbance Standard set	25760	95935	22 October 2023
Absorbance 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 Siam 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.

REPORT OF CALIBRATION

Certificate No. : SP22-007

Page 3 of 5

Calibration Results : Without adjustment

Photometric Accuracy :

Wavelength (nm.)	CRMs Values (Abs)	UUC Reading (Abs)	Correction (Abs)	Uncertainty (Abs)	Coverage factor <i>k</i>
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

REPORT OF CALIBRATION

Certificate No. : SP22-007

Page 4 of 5

Photometric Accuracy :

Wavelength (nm.)	CRMs Values (Abs)	UUC Reading (Abs)	Correction (Abs)	Uncertainty (Abs)	Coverage factor <i>k</i>
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

REPORT OF CALIBRATION

Certificate No. : SP22-007

Page 5 of 5

Wavelength Accuracy :

CRMs Values (nm.)	UUC Reading (nm.)	Correction (nm.)	Uncertainty (nm.)	Coverage factor <i>k</i>
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 Calibration

- N/A = Not Available

- 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 -

CERTIFICATE OF CALIBRATION

Certificate No. : SP22-008

Page 1 of 5

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

Address : 3 Soi Udomsuk 41, Sukhumvit Road, Bangehak, 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

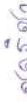
Calibration Date : 20 January 2022

Issue Date : 24 January 2022

Condition Instrument : Good

Calibrated by : 

Approved by :



(Mr. Tanawut Rititach)

(Ms. Chonhicha Sangngern)

Technical Manager

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.

REPORT OF CALIBRATION

Certificate No. : SP22-008

Page 2 of 5

Environment Condition : Ambient Temperature $25 \pm 5^{\circ}\text{C}$

Relative humidity $55 \pm 20\%$ RH

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

Certified Reference Materials :

Material	Serial No.	Certificate No.	Due date
Absorbance Standard set	25760	95935	22 October 2023
Absorbance 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.

REPORT OF CALIBRATION

Certificate No. : SP22-008

Page 3 of 5

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
440	2.1900	2.182	0.0080	0.0075	2.00
	0.0000	0.000	0.0000	0.0028	2.00
	0.5607	0.559	0.0017	0.0034	2.00
465	1.0247	1.023	0.0017	0.0035	2.00
	2.1229	2.116	0.0069	0.0079	2.00
	0.0000	0.000	0.0000	0.0028	2.00
546.1	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
590	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
635	1.9987	1.992	0.0067	0.0084	2.00
	0.0000	0.000	0.0000	0.0028	2.00
	0.5523	0.552	0.0003	0.0030	2.00
635	1.0809	1.080	0.0009	0.0030	2.00
	2.0391	2.031	0.0081	0.0079	2.00
	0.0000	0.000	0.0000	0.0028	2.00
635	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

REPORT OF CALIBRATION

Certificate No. : SP22-008

Page 4 of 5

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

REPORT OF CALIBRATION

Certificate No. : SP22-008

Page 5 of 5

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 Calibration

- N/A = Not Available

- 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 -

Calibration Certificate

Certificate No.: 2200708-001-01
Client name: UNITED ANALYST AND ENGINEERING CONSULTANT CO.,LTD.
Address: 3 Soi Udomsuk 41, Sukhumvit Road,
Bangchack, Prakhong, Bangkok 10260

Page 1 of 4

Equipment: Electronic Balance

Manufacturer: METTLER TOLEDO

Model: AX 105 DR

Serial No.: 1122100406

ID No.: UAE.WAO.004/2546

Order No.: 2200708

Operation No.: 2200708-001

Date of Receipt: 24 November 2021

Date of Calibration: 24 November 2021

Calibrated by Mr.Worapob Sooktong
Scientist

Approved by (Mr.Pheraphat Tuanjit)
Manager, Division of Calibration Laboratory

Date of Issue: 30 November 2021

Responsible for the Technical Management Team

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.

Calibration Report

Certificate No.: 2200708-001-01
Equipment: Electronic Balance
Manufacturer: METTLER TOLEDO
Model: AX 105 DR
Resolution: 0.00001 g/ 0.0001 g
ID No.: UAE.WAO.004/2546
Serial No.: 1122100406
Capacity: 110 g

Page 2 of 4

Date of Calibration: 24 November 2021

Environment Condition: Ambient Temperature: 22.0 ± 0.5 °C Relative Humidity: 39 ± 1 %

Place of Calibration: 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	15880	TCS	M20111955	28 November 2021
Standard Weight Class E2	1-500g	15882	TCS	M20111965	28 November 2021
Instrument	Model	Serial No.	Calibrated By	Certificate No.	Due Date
Thermo-Hygro Meter	11A1	88888888	Quality Reborn	QR21-0297	15 February 2022

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)
15	0.000057
30	0.000064
50	0.000053
100	0.000048

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)
50.0000	50.0000	49.9999	50.0000	49.9999	49.9999	0.0001

Calibration Report

Certificate No.: 2200708-001-01
Equipment: Electronic Balance
Manufacturer: METTLER TOLEDO
Resolution: 0.00001 g/ 0.0001 g
ID No.: UAE.WAO.004/2546
Model: AX 105 DR
Serial No.: 1122100406
Capacity: 110 g

Date of Calibration: 24 November 2021 Page 3 of 4

Calibration Results: (Continued)

Calibration Range: 0-100 g

Calibration Adjustment: Internal Calibration

3. Departure from Nominal Value: (Range: 0 - 30 g ; Resolution: 0.00001 g)

Nominal Value (g)	Standard Value (g)	Average Reading (g)	Correction (g)	Uncertainty (± g)	Coverage Factor k
Unload	0.00000	0.00000	0.00000	0.0000089	2.00
0.01	0.009998	0.01000	0.00000	0.000011	2.00
0.02	0.019997	0.02000	0.00000	0.000012	2.00
0.05	0.050001	0.05000	0.00000	0.000011	2.00
0.1	0.100002	0.10000	0.00000	0.000012	2.00
0.2	0.200004	0.20000	0.00000	0.000013	2.00
0.5	0.499994	0.50000	-0.00001	0.000014	2.00
1	0.999986	1.00000	-0.00001	0.000026	2.00
2	1.999989	1.99998	0.00001	0.000019	2.00
5	4.999979	4.99998	0.00000	0.000022	2.00
10	10.000026	9.99994	0.00009	0.000074	2.00
20	20.000037	19.99991	0.00013	0.000099	2.00
30	30.000063	30.00000	0.00006	0.00013	2.00

Calibration Report

Certificate No.: 2200708-001-01
Equipment: Electronic Balance
Manufacturer: METTLER TOLEDO
Resolution: 0.00001 g/ 0.0001 g
ID No.: UAE.WAO.004/2546
Model: AX 105 DR
Serial No.: 1122100406
Capacity: 110 g

Date of Calibration: 24 November 2021 Page 4 of 4

Calibration Results: (Continued)

Calibration Range: 0-100 g

Calibration Adjustment: Internal Calibration

3. Departure from Nominal Value: (Range: 31 - 100 g ; Resolution: 0.0001 g)

Nominal Value (g)	Standard Value (g)	Average Reading (g)	Correction (g)	Uncertainty (± g)	Coverage Factor k
40	40.00000	39.99999	0.00001	0.00014	2.00
45	44.99998	44.99999	0.00001	0.00015	2.00
50	49.99999	49.99999	0.00001	0.00016	2.00
55	54.99997	54.99998	0.00002	0.00016	2.00
60	60.00002	59.99999	0.00001	0.00018	2.00
65	65.00000	64.99999	0.00001	0.00018	2.00
70	70.00003	69.99999	0.00001	0.00019	2.00
75	75.00001	74.99999	0.00001	0.00020	2.00
80	80.00005	79.99998	0.00003	0.00021	2.00
85	85.00003	84.99998	0.00002	0.00022	2.00
90	89.99999	89.99998	0.00002	0.00021	2.00
100	99.99997	99.99998	0.00002	0.00020	2.00



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES
534/4 PAITANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG BANGKOK 10250
TEL. 0-2717-3000-27 FAX. 0-2719-0484



JIAE-JIRA
MTC-TB17035
CALIBRATION 0008

Cert. No.: 21TM1876
Page.: 1 of 3

Certificate of Calibration

Equipment : Hot Air Oven
Manufacturer : Memmert
Model : UF 55
Serial No. : B216.1666
ID No. : UAE.WAO.027/2559

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 : 29 October 2021
Calibration Date : 29 October 2021
Ambient Temperature : (26 ± 10) °C
Relative Humidity : (50 ± 30) %

Calibrated by : Kunchit Promprat

Approved by : 
Approved Signatory

() Ponthippa Tameyakul
() Malee Butkruea
() Suwit Imjai

Issue Date : 4 November 2021

The Uncertainties are for a confidence probability of approximately 95%

This certificate may not be reproduced other than in full, except with the prior written

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



Equipment : Hot Air Oven
Condition As-Received : Used Item
Reference : 2110-0701OC-1
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 MY44067817 21LM10 20 Jul 2022

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

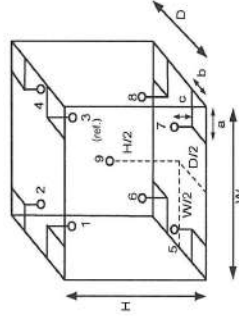
3. This certificate is traceable to the International System of Unit.

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)	230 230



Probe Installation Details :

Dimension of Chamber :
a = 5.0 cm D = 0.33 m
b = 5.0 cm W = 0.40 m
c = 5.0 cm H = 0.40 m
Capacity = 0.053 m³

Ref. Std. ID No.: @	
Position :	(140, 180) °C (104) °C
1	21-15TC-01 15RTD2/11
2	21-15TC-02 15RTD2/12
3	21-15TC-03 15RTD2/13
4	21-15TC-04 15RTD2/14
5	21-15TC-05 15RTD2/15
6	21-15TC-06 15RTD2/20
7	21-15TC-07 15RTD2/17
8	21-15TC-08 15RTD2/18
9 (ref.)	21-15TC-09 15RTD2/19

malu

เอกสารไม่ควบคุม

เอกสารไม่ควบคุม



Certificate of Calibration

Equipment: Hot Air Oven
Condition As-Received: Used Item
Reference: 2110-0701OC-1
Result of Calibration :- (*) Without Adjustment
Function of UUC* : Temperature Source
Fresh air setting : Close

Cert. No.: 21TM1876
Page.: 3 of 3

Equipment: CONDUCTIVITY METER
Model: Lab955
Serial No. (or ID.): 16300356
Manufacturer: SI Analytics
Electrode Serial No. 16070067
Condition: In Condition
Certificate No.: C24220084
Issued Date: 22 March 2022
Job No.: KSPR2203267
Page: 1 of 2
Model : LF413T
Brand : SI Analytics

Customer: United Analyst and Engineering Consultant Company Limited
3 Soi Udomsuk 41 Sukhumvit Road,
Bangkok, 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 Wachirathamthit 57, Sukhumvit 101/1 Rd.,
Bangchak, Prakanong, Bangkok 10260 Thailand

Calibration By: Mr. Wasan Nuchnahee
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

Person in charge
(Mr. Wasan Nuchnahee)

Authorized signatory
(Mr. Dumrong Boonsopon)

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.

Calibration Results:

Before Adjustment

Standard	Unit Under Calibration	Reading	Correction	Coverage Factor	Uncertainty (±)
Conductivity Solution					
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	Unit Under Calibration	Reading	Correction	Coverage Factor	Uncertainty (±)
Conductivity Solution					
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

ใบตรวจสอบสภาพเครื่องวัดสิ่งแวดล้อม

เลขที่ใบงาน: KSPR2203267

หมายเลขเครื่อง: 16300356

ชนิดเครื่องมือ: CONDUCTIVITY METER

รุ่น: Lab955

ตรวจสอบ (รับ)	รายการตรวจเช็ค	ตรวจสอบ (ส่ง)		หมายเหตุ
		22 Mar 2022	22 Mar 2022	
ปกติ	ไม่ปกติ	ปกติ	ไม่ปกติ	
<i>General</i>				
<input checked="" type="checkbox"/>	1. ความสมบูรณ์เครื่อง	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	2. ความสะอาด (ช้องใส่ตัวอย่าง, ภายใน-นอกเครื่อง)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	3. สวิตช์ ปิด - เปิด เครื่อง (On-Off Switch)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	4. ปุ่มกด (Keypad)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	5. หน้าจอ (Display, Screen Contrast)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<i>Spectrophotometer</i>				
<input type="checkbox"/>	6. แรงดันไฟฟ้า (Battery Backup) ≥ 2.5 VDC	<input type="checkbox"/>	<input type="checkbox"/>	
<input type="checkbox"/>	7. ตัวหมุนเลือกความยาวคลื่น (Wavelength Control)	<input type="checkbox"/>	<input type="checkbox"/>	
<input type="checkbox"/>	8. ความยาวคลื่น (Wavelength Check)	<input type="checkbox"/>	<input type="checkbox"/>	
<input type="checkbox"/>	9. แหล่งกำเนิดแสง (UV $< 3,000$ hour)	<input type="checkbox"/>	<input type="checkbox"/>	
<input type="checkbox"/>	10. แหล่งกำเนิดแสง (Visible $< 5,000$ hour)	<input type="checkbox"/>	<input type="checkbox"/>	
<input type="checkbox"/>	11. ช้องวัดหลายตัวอย่าง (Carousel Module)	<input type="checkbox"/>	<input type="checkbox"/>	
<i>pH Meter and Conductivity Meter</i>				
<input checked="" type="checkbox"/>	12. อิเล็กโทรด (Electrode and Connection Cable)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input type="checkbox"/>	13. ระดับสารละลายใน Electrode (Level KCl)	<input type="checkbox"/>	<input type="checkbox"/>	
<input type="checkbox"/>	14. ฝาปิดกันปลาย Electrode (Dust Protection Hood)	<input type="checkbox"/>	<input type="checkbox"/>	
<input type="checkbox"/>	15. ขาจับอิเล็กโทรด (Stand)	<input type="checkbox"/>	<input type="checkbox"/>	
<i>Turbidimeter</i>				
<input type="checkbox"/>	16. ค่าความขุ่นที่ต่ำสุด (No Sample)	<input type="checkbox"/>	<input type="checkbox"/>	
<input type="checkbox"/>	17. ระดับการส่องสว่างของแสง (≥ 2.5 ไม่นเกิน 3.0)	<input type="checkbox"/>	<input type="checkbox"/>	
<i>Automatic titrator</i>				
<input type="checkbox"/>	18. สภาพ Piston Burettes	<input type="checkbox"/>	<input type="checkbox"/>	
<input type="checkbox"/>	19. Function Rinsing and Dosing	<input type="checkbox"/>	<input type="checkbox"/>	
<input type="checkbox"/>	20. ระบบท่อสายยางและอุปกรณ์ประกอบ	<input type="checkbox"/>	<input type="checkbox"/>	

ข้อแนะนำ : Electrode วัดอุณหภูมิได้ 24.9 °C โดย Control Waterbath ที่ 25.0 $\pm 0.1^{\circ}\text{C}$

Mr. Wasan Nuchnabee

Service Engineer