

ภาคผนวก ง

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 Hydrogen Sulphide Mercury TVOCs	Apex Instruments, USA.	XC-572-V 1701018	Envi Equipment Service Co., Ltd.	E21-0610	27 Jul 21	26 Jul 22	-
2	Flue gas Analyzer	Sulphur Dioxide Oxide of Nitrogen as Nitrogen Dioxide Carbon Monoxide	Testo	Testo 350 60899698	Entech Industrial Sulation Co., Ltd.	G 640293	12 May 21	11 May 22	-
3	Gas Detector	TVOCs	RAE Systems, Inc.	Mini-RAE 3000 592-925267	Executive Trading Limited	RA 108/21	28 Jun 21	27 Jun 22	-

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Ambient									
1	Orifice Transfer Standard Calibrator	Total Suspended Particulate (TSP) Particulate Matter < 10 µm (PM ₁₀)	Tisch Environmental, Inc.	TE-5025A 3383	Tisch Environmental, Inc.	27072020	27 Jul 20	26 Jul 22	-
2	U-Tube Manometer	Total Suspended Particulate (TSP) Particulate Matter < 10 µm (PM ₁₀)	Dwyer	1221-36-W/M -	Technology Promotion Association (Thailand-Japan)	22P803	12 Mar 22	11 Mar 23	-
3	Mass Flow Meter	Benzene	Alicat Scientific, Inc.	MB-5SCCM-D/5M 57730	Miracle International Technology Co., Ltd.	AD2110-274-0001	1 Nov 21	31 Oct 22	-
4	Aneroid Barometer	Total Suspended Particulate (TSP) Particulate Matter < 10 µm (PM ₁₀) Benzene	Barigo, Germany	-	Technology Promotion Association (Thailand-Japan)	21P2500	21 Jul 21	20 Jul 22	-
5	Dial Thermo-Hygrometer	Total Suspended Particulate (TSP) Particulate Matter < 10 µm (PM ₁₀) Benzene	Barigo, Germany	-	Technology Promotion Association (Thailand-Japan)	22H768	5 Apr 22	4 Apr 23	-
6	Nitrogen Dioxide Analyzer	Nitrogen Dioxide	Thermo	42C 42C-0508011076	UAE Consultant Co., Ltd.	2110/2021	21 Oct 21	20 Oct 22	-
7	Nitrogen Dioxide Analyzer	Nitrogen Dioxide	Thermo Environmental Instrument	42C 42C-76412-383	UAE Consultant Co., Ltd.	21102021	21 Oct 21	20 Oct 22	-
8	Nitrogen Dioxide Analyzer	Nitrogen Dioxide	Thermo Scientific	42i 1180540062	UAE Consultant Co., Ltd.	19072021	19 Jul 21	18 Jul 22	-
9	Nitrogen Dioxide Analyzer	Nitrogen Dioxide	Thermo Scientific	42i 1182920008	UAE Consultant Co., Ltd.	09072021	9 Jul 21	8 Jul 22	-

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Ambient									
10	Nitrogen Dioxide Analyzer	Nitrogen Dioxide	Thermo Scientific	42i 1191503038	UAE Consultant Co.,Ltd.	04112021	4 Nov 21	3 Nov 22	-
11	Standard Gases (Mixture)	Nitrogen Dioxide	Airgas	CC159599 2015PSIG	Airgas an Air Liquide company	E04NI99E15A01QC	30 Jul 19	30 Jul 22	-
12	Sulphur Dioxide Analyzer	Sulphur Dioxide	Thermo Scientific	43i 1200906876	UAE Consultant Co.,Ltd.	07122021	7 Dec 21	6 Dec 22	-
13	Sulphur Dioxide Analyzer	Sulphur Dioxide	Thermo Scientific	43i 1201778112	UAE Consultant Co.,Ltd.	14062021	14 Jun 21	13 Jun 22	-
14	Sulphur Dioxide Analyzer	Sulphur Dioxide	Thermo Scientific	43i 1201778116	UAE Consultant Co.,Ltd.	09062021	9 Jun 21	8 Jun 22	-
15	Sulphur Dioxide Analyzer	Sulphur Dioxide	Thermo Scientific	43i 1182920012	UAE Consultant Co.,Ltd.	09112021	22 Nov 21	21 Nov 22	-
16	Sulphur Dioxide Analyzer	Sulphur Dioxide	Thermo Scientific	43i 1182920013	UAE Consultant Co.,Ltd.	09112021	22 Nov 21	21 Nov 22	-
17	Standard Gases (Mixture)	Sulphur Dioxide	Airgas	CC159599 2015PSIG	Airgas an Air Liquide company	E04NI99E15A01QC	30 Jul 19	30 Jul 22	-
18	Carbon Monoxide Analyzer	Carbon Monoxide	Thermo	48i 1200906880	UAE Consultant Co.,Ltd.	30112021	30 Nov 21	29 Nov 22	-
19	Carbon Monoxide Analyzer	Carbon Monoxide	Thermo	48i 1201497730	UAE Consultant Co.,Ltd.	30112021	30 Nov 21	29 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									
20	Carbon Monoxide Analyzer	Carbon Monoxide	Thermo	48i 1201497732	UAE Consultant Co.,Ltd.	30112021	30 Nov 21	29 Nov 22	-
21	Carbon Monoxide Analyzer	Carbon Monoxide	Thermo	48i 1201497733	UAE Consultant Co.,Ltd.	30112021	30 Nov 21	29 Nov 22	-
22	Carbon Monoxide Analyzer	Carbon Monoxide	Thermo	48i 1201778117	UAE Consultant Co.,Ltd.	21122021	21 Dec 21	20 Dec 22	-
23	Standard Gases (Mixture)	Carbon Monoxide	Airgas	CC159599 2015PSIG	Airgas an Air Liquide company	160-401526192-1	30 Jul 19	30 Jul 22	-
24	Wind Speed/Wind Direction	WS/WD	Met One Instruments	580 / X23725 034B / X21189	Met One Instrument, Inc.	274/21	20 May 21	19 May 22	-
25	Wind Speed/Wind Direction	WS/WD	Met One Instruments	580 / X10448 034B / X10353	Thai Meteorological Department	273/21	20 May 21	19 May 22	-
26	Wind Speed/Wind Direction	WS/WD	Met One Instruments	580 X20003	Thai Meteorological Department	272/21	20 May 21	19 May 22	-
27	Wind Speed/Wind Direction	WS/WD	LSI LASTEM	E-LOG305 19040406	Thai Meteorological Department	354/21	20 Jul 21	19 Jul 22	-
28	Wind Speed/Wind Direction	WS/WD	LSI LASTEM	E-LOG305 20040002	Thai Meteorological Department	275/21	20 May 21	19 May 22	-
29	Sound Level Calibrator (Acoustic Calibrator)	Calibrate Sound Level Meter	Larson Davis	CAL150 6307	Innovative Instrument Co.,Ltd.	21-ACT-191	28 May 21	27 May 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									
30	Sound Level Meter	L _{Aeq} 24 hrs	Larson Davis	LxT2	Innovative Instrument Co.,Ltd.	22-ACT-034	21 Jan 22	20 Jan 23	-
				0005394					
31	Sound Level Meter	L _{Aeq} 24 hrs	Larson Davis	LxT2	Innovative Instrument Co.,Ltd.	22-ACT-105	11 Feb 22	10 Feb 23	-
				0005396					
32	Sound Level Meter	L _{Aeq} 24 hrs	Larson Davis	LxT2	Innovative Instrument Co.,Ltd.	22-ACT-035	21 Jan 22	20 Jan 23	-
				0005398					
33	Sound Level Meter	L _{Aeq} 24 hrs	Larson Davis	LxT2	Innovative Instrument Co.,Ltd.	22-ACT-036	21 Jan 22	20 Jan 23	-
				0005400					
34	Sound Level Meter	L _{Aeq} 24 hrs	Larson Davis	LxT2	Innovative Instrument Co.,Ltd.	22-ACT-103	11 Feb 22	10 Feb 23	-
				0005402					
35	Sound Level Meter	L _{Aeq} 24 hrs	Larson Davis	LxT2	Innovative Instrument Co.,Ltd.	22-ACT-101	11 Feb 22	10 Feb 23	-
				0005405					

List of Instruments Certification for Water Quality Analysis

No.	Instrument/Equipment	Parameter	Manufacturer	Model/Serial No.	Calibrator	Certification No.	Date of Calibration	Due date of Calibration	Remark
Water									
1	pH Meter	pH	Horiba	LAQUA-PH210 HA0C0025	Technology Promotion Association (Thailand-Japan)	21CH788	16 Jun 21	15 Jun 22	-
2	Conductivity Meter	Conductivity	YSI	Pro30 18K100974	Technology Promotion Association (Thailand-Japan)	21CH1021	17 Aug 21	16 Aug 22	-
3	DO Meter	DO	YSI	Pro 20i 18H110457	Technology Promotion Association (Thailand-Japan)	21TW158	29 Jul 21	28 Jul 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									
1	Air Flow Meter	Calibrate personal pump	TSI,Inc	4146 41461813030	Innovative Instrument Co.,Ltd.	21-AFM-073	23 Jul 21	22 Jul 22	-
2	Flow Meter	Calibrate personal pump	TSI,Inc	4146 41461922007	Innovative Instrument Co.,Ltd.	21-AFM-052	8 Jun 21	7 Jun 22	-
3	Aneroid Barometer	Respirable Dust Hydrogen Sulphide Benzene Methanol Toluene Xylene Hexane	Barigo, Germany	-	Technology Promotion Association (Thailand-Japan)	21P1156	31 Mar 21	30 Mar 22	-
4	Dial Thermo-Hygrometer	Respirable Dust Hydrogen Sulphide Benzene Methanol Toluene Xylene Hexane	Barigo, Germany	-	Technology Promotion Association (Thailand-Japan)	22H768	5 Apr 22	4 Apr 23	-
5	Noise Dosimeter	Noise Dosimeter	Svantek	SV 104 91923	Innovative Instrument Co.,Ltd.	22-ACT-114	17 Feb 22	16 Feb 23	-
6	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 Air & Noise Quality Analysis

No.	Instrument/Equipment	Parameter	Manufacturer	Model/Serial No.	Calibrator	Certification No.	Date of Calibration	Due date of Calibration	Remark
Workplace									
7	Noise Dosimeter	Noise Dosimeter	Svantek	SV 104IS 67627	Innovative Instrument Co.,Ltd.	21-ACT-361	20 Sep 21	19 Sep 22	-
8	Sound Level Meter	$L_{Aeq\ 8\ hours}$, L_{Amax}	Rion, Japan	NL-42 00609500	Sithiporn Associates Co., Ltd.	ACL22072	25 Jan 22	24 Jan 23	-
9	Digital Light Meter	Light	Extech Instrument, Taiwan	407026 A 016905	Innovative Instrument Co.,Ltd.	21-LXM-154	12 Sep 21	11 Sep 22	-

รายการใบรับรองสอบเทียบ/ทวนสอบ เครื่องมือหลักประจำห้องปฏิบัติการวิเคราะห์ สำหรับวิเคราะห์คุณภาพสิ่งแวดล้อม

No.	Instrument/Equipment	Parameter	Manufacturer	Model/Serial No.	Calibrator	Certification No.	Date of Calibration	Due date of Calibration*	Remark
เครื่องมือหลักประจำห้องปฏิบัติการวิเคราะห์คุณภาพอากาศ									
1	Analytical Balance (Readability 0.1 mg)	ฝุ่นละอองรวม (TSP) ฝุ่นละอองขนาดไม่เกิน 10 (PM-10)	Mettler-Toledo	AB204-S / 1128312528	National Food Institute, Ministry of Industry, Thailand	TH2058-097-040722- ACC-TH	7 Apr 22	6 Apr 23	
2	Analytical Balance (Readability 0.1 mg)		Mettler-Toledo	AB204-S/FACT / B108115858	National Food Institute, Ministry of Industry, Thailand	2102572-001-01	26 Apr 21	25 Apr 22	-
3	Gas Chromatrography - Mass Spectrometer (GC-MS)	เบนซีน สารอินทรีย์ระเหยง่าย (VOCs)	Agilent Technologies	System ID: US81839509 7890 G3440A / CN10821123 5975 G3172A / US81839509	Agilent Technologies (Thailand) Co.,Ltd.	Certificate of System Qualification GSMS-OQ	25 Feb 21	24 Feb 22	-
4	UV-VIS Spectrophotometer	NOX as NO2 H2S	Agilent Technologies	Cary60 G6860A / MY15410009	DQE Services Co.,Ltd.	SP21-015	29 May 21	28 May 22	-
5	UV-VIS Spectrophotometer		Hitachi	U-1900 / 2021-064	DQE Services Co.,Ltd.	SP21-008	25 Jan 21	24 Jan 22	-
6	Atomic Absorption Spectrometer (AAS)	Hg	Agilent Technologies	System ID:G8432A AA240FS / MY13160001	Thailand Institute of Scientific and Technological Research (TISTR).	MTC.ACL. No. 335/64	4 Feb 21	3 Feb 22	-
เครื่องมือหลักประจำห้องปฏิบัติการวิเคราะห์คุณภาพอากาศ และน้ำ									
5	pH Meter	พีเอช, อุณหภูมิ	Hanna Instrument	HI2020-02 / C0051107	National Food Institute, Ministry of Industry, Thailand	2103272-001-02	14 Jun 21	13 Jun 22	-
6	pH Meter		Mettler-Toledo	Seven Easy S20 / 123052512	National Food Institute, Ministry of Industry, Thailand	2101930-001-01	17 Mar 21	16 Mar 22	-
7	Conductivity Meter	ค่าการนำไฟฟ้า	SI Analytics	Lab955 / 16300356	SPC Calibration Center Co.,Ltd.	C24210091	29 Mar 21	28 Mar 22	-
8	Analytical Balance (Repeatability 0.01 mg)	สารแขวนลอย ,ทีดีเอส	Mettler-Toledo	AX105DR / 1122100406	National Food Institute, Ministry of Industry, Thailand	2200708-001-01	24 Nov 21	23 Nov 22	
9	Hot Air Oven		Memmert	UF55 / B216.1666	Technology Promotion Association (Thailand-Japan)	21TM1876	29 Oct 21	28 Oct 22	
10	Analytical Balance (Repeatability 0.1 mg)	น้ำมันและไขมัน, ปิโตรเลียมไฮโดรคาร์บอน	Mettler-Toledo	AB-204S/FACT / 1129361010	National Food Institute, Ministry of Industry, Thailand	2103270-001-01	11 Jun 21	10 Jun 22	
11	COD Reactor (Heating Block)	ซีโอดี	Hanna	HI839800-02 / 4500052101	Hanna Instruments (Thailand) Ltd.	HIT-2219-0480	9 May 22	8 May 23	

รายการใบรับรองสอบเทียบ/ทวนสอบ เครื่องมือหลักประจำห้องปฏิบัติการวิเคราะห์ สำหรับวิเคราะห์คุณภาพสิ่งแวดล้อม

No.	Instrument/Equipment	Parameter	Manufacturer	Model/Serial No.	Calibrator	Certification No.	Date of Calibration	Due date of Calibration*	Remark
เครื่องมือหลักประจำห้องปฏิบัติการวิเคราะห์คุณภาพอากาศ และน้ำ									
12	BOD Incubator	บีโอดี	Arco	UC4-1320 / (UAE.LAB.015/2561)	Technology Promotion Association (Thailand-Japan)	21TM366	23 Feb 21	22 Feb 22	-
13	BOD Incubator		Arco	UR-1320 / (UAE.LAB.018/2551)	Technology Promotion Association (Thailand-Japan)	21TM811	21 Apr 21	20 Apr 22	-
14	Incubator (Cooled Incubator)	โคลิฟอร์มแบคทีเรีย	Memmert	IPP 260 / V616.0066	Technology Promotion Association (Thailand-Japan)	21TM1874	28 Oct 21	27 Oct 22	-
15	Incubator (Cooled Incubator)		Memmert	IPP 260 / V615.0187	Technology Promotion Association (Thailand-Japan)	21TM706	21 Apr 21	20 Apr 22	-
16	Water Bath		Memmert	WNE 14 / L416.0612	Technology Promotion Association (Thailand-Japan)	22TM334	17 Feb 22	16 Feb 23	-
17	Water Bath		Memmert	WNE 14 / L414.1407	Technology Promotion Association (Thailand-Japan)	21TM708	21 Apr 21	20 Apr 22	-
18	Analytical Balance		Mettler-Toledo	MS603S / B0070110311	National Food Institute, Ministry of Industry, Thailand	22058-096-040722-ACC-T	7 Apr 22	6 Apr 23	
19	Auto Clave		ALP	CL-40L / 802664	Technology Promotion Association (Thailand-Japan)	22TM89	17 Feb 22	16 Feb 23	-
20	Atomic Absorption Spectrometer (AAS)	ปรอท	Agilent Technologies	System ID:G8432A AA240FS / MY13160001	Thailand Institute of Scientific and Technological Research (TISTR).	MTC.ACL. No. 486/65	7 Mar 22	6 Mar 23	-
21	Atomic Fluoresence Spectrometer (AFS)	ปรอทรวม (น้ำทะเล)	Analytik Jena	mercur DUO plus / K170A0153	Analytik Jena FarEast Thailand Ltd.	Maintenance Protocol C04-006	4 Apr 22	3 Apr 23	-
22	Fluorescence Spectrometer	ปิโตรเลียมไฮโดรคาร์บอน (น้ำทะเล)	Perkin Elmer	LS 55 / 81440	Perkin Elmer Ltd.	FLR1001-2021	18 Feb 22	17 Feb 23	-
23	Turbidity Meter	ความขุ่น	Oakton	T100IR / 1120501017	Technology Promotion Association (Thailand-Japan)	21CH1017	17 Aug 21	16 Aug 22	-
24	Digestor Unit	Total Kjeldahl Nitrogen (TKN)	FOSS TECATOR	2520auto / 91794469	Sithiporn Associates Co.,Ltd.	2202361-001-01	4 Apr 22	3 Apr 23	-
25	Distillation Unit (Kjeldahl Method)		FOSS TECATOR	KT200 / 91790524	Sithiporn Associates Co.,Ltd.	5874	30 Nov 21	29 Nov 22	-

Due Date of Calibration* : Based on the annual calibration plan. At least 1 time per year.

รายการใบรับรองสอบเทียบ/ทวนสอบ เครื่องมือหลักประจำห้องปฏิบัติการวิเคราะห์ สำหรับวิเคราะห์คุณภาพสิ่งแวดล้อม

No.	Instrument/Equipment	Parameter	Manufacturer	Model/Serial No.	Calibrator	Certification No.	Date of Calibration	Due date of Calibration*	Remark
เครื่องมือหลักประจำห้องปฏิบัติการวิเคราะห์คุณภาพน้ำ									
1	pH Meter	ค่าความเป็นกรด-ด่าง, อุณหภูมิ	Hanna Instrument	HI2020-02 / C0051107	National Food Institute, Ministry of Industry, Thailand	2103272-001-02	14 Jun 21	13 Jun 22	-
2	pH Meter		Mettler-Toledo	Seven Easy S20 / 123052512	National Food Institute, Ministry of Industry, Thailand	2101930-001-01	17 Mar 21	16 Mar 22	-
3	Analytical Balance (Repeatability 0.01 mg)	ปริมาณสารแขวนลอย	Mettler-Toledo	AX105DR / 1122100406	National Food Institute, Ministry of Industry, Thailand	2200708-001-01	24 Nov 21	23 Nov 22	-
4	Hot Air Oven		Memmert	UF55 / B216.1666	Technology Promotion Association (Thailand-Japan)	21TM1876	29 Oct 21	28 Oct 22	-
5	Analytical Balance (Repeatability 0.1 mg)	ไขมันและน้ำมัน	Mettler-Toledo	AB-204S/FACT / 1129361010	National Food Institute, Ministry of Industry, Thailand	2100857-001-01	11 Jun 21	10 Jun 22	-

Due Date of Calibration* : Based on the annual calibration plan. At least 1 time per year.

THAI METEOROLOGICAL DEPARTMENT


4353 Sukhumvit, Bangna, Bangkok, 10260 Tel. 081-454-2804,0-2399-0469

The Result of Calibration

20 May, 2021
Certification No. 27321
Page : 2 of 2

Standard	HOOK GAGE NO. 1425				TESTED ANEMOMETER	
	Pressure inches	Vacuum inches	Pressure hPa	Velocity m/sec	Correction m/sec	Correction m/sec
Ultrasonic Anemometer						
1.00	-	-	-	1.0	0.00	0.00
3.02	-	-	-	3.0	0.02	0.02
5.00	-	-	-	5.0	0.00	0.00
7.00	-	-	-	7.0	0.00	0.00
9.02	-	-	-	9.0	0.02	0.02
11.01	-	-	-	11.0	0.01	0.01
13.01	-	-	-	13.0	0.01	0.01
15.01	-	-	-	15.0	0.01	0.01
17.02	-	-	-	17.0	0.02	0.02
20.02	-	-	-	20.0	0.02	0.02

Wind Alot Plotting Board.	
US DEPARTMENT OF COMMERCE WEATHER BUREAU	
WIND DIRECTION	TESTED WIND DIRECTION
0	0
90	90
180	180
270	270

Calibrated by: 
Mr. Watchapol Subwat
Mechanical Engineer

Calibration & Test Section
Meteorological Instruments Bureau
4353 Sukhumvit, Bangna, Bangkok, 10260
Tel. 081-454-2804,0-2399-0469

เอกสารนี้ควบคุมคุณ
เอกสารนี้ควบคุมคุณ

THAI METEOROLOGICAL DEPARTMENT

4353 Sukhumvit, Bangna, Bangkok, 10260 Tel. 081-454-2804,0-2399-0469


Calibration Certificate

Issued by : Calibration & Test Section : Meteorological Instruments Bureau
Date of Issue : 20 May, 2021
Certification No. 27321
Page : 1 of 2

Object : Weather Station
Manufacturer : Met One Instruments
Model No. : Data Logger 580 Wind Sensor 034B
Mfg Code : Data Logger X20003 Wind Sensor X21187
Customer : United Analyst and Engineering Consultant Co.,Ltd.
81 Soi Udomsuk 41, Sukhumvit Road,
Bangchak, Prakanong, Bangkok 10260.

Calibration Condition : Temperature 25.1 °C Barometric Pressure 1009.6 hPa

NATIONAL STANDARD WIND TUNNEL : Thermal Anemometer 642 SN 91503
: HOOK GAGE NO 1425 : Wind Alot Plotting Board
N.I.S.T. Test Reference Number 731/241480
Model DA-650-3TV (sensor TR-90AH)
Serial Number 110730029 (sensor 120629586)
JAPAN QUALITY ASSURANCE ORGANIZATION

Calibrated by: 
Mr. Watchapol Subwat
Mechanical Engineer

Calibration & Test Section
Meteorological Instruments Bureau
4353 Sukhumvit, Bangna, Bangkok, 10260
Tel. 081-454-2804,0-2399-0469

เอกสารนี้ควบคุมคุณ
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Certificate of Calibration

Calibration Certification Information
Cal. Date: July 27, 2020
Operator: Jim Tisch
Calibration Model #: TE-5025A
Rootsmeier S/N: 438320
Calibrator S/N: 3383
Ta: 298 °K
Pa: 749.3 mm Hg

Run	Vol. Init (m3)	Vol. Final (m3)	ΔVol. (m3)	ΔTime (min)	ΔP (mm Hg)	ΔH (in H2O)
1	1	2	1	1.4020	3.2	2.00
2	3	4	1	1.0000	6.3	4.00
3	5	6	1	0.8920	7.8	5.00
4	7	8	1	0.8430	8.7	5.50
5	9	10	1	0.7010	12.7	8.00

Data Tabulation

Vstd (m3)	Qstd (x-axis)	$\sqrt{\frac{\Delta H}{Pa} \times \frac{Pa}{\Delta H}}$ (y-axis)	Va (x-axis)	Qa (x-axis)	$\sqrt{\frac{\Delta H}{Ta} \times \frac{Ta}{\Delta H}}$ (y-axis)
0.9817	0.7002	1.4042	0.9957	0.7102	0.8919
0.9776	0.9776	1.9859	0.9916	0.9916	1.2613
0.9757	1.0938	2.2203	0.9896	1.1094	1.4101
0.9745	1.1560	2.3266	0.9884	1.1725	1.4790
0.9692	1.3826	2.8084	0.9831	1.4024	1.7837
QSTD	m= 2.04953		QA	m= 1.28363	
	b= -0.02762			b= -0.01754	
	r= 0.99985			r= 0.99985	

Calculations

Vstd= ΔVol/(Pa-ΔP)/Pstd(Tstd/Ta)	Va= ΔVol/(Pa-ΔP)/Pa
Qstd= Vstd/ΔTime	Qa= Va/ΔTime

For subsequent flow rate calculations:

Qstd= $1/m \left(\sqrt{\frac{\Delta H}{Pa} \times \frac{Pa}{\Delta H}} \right) \left(\frac{Tstd}{Ta} \right)^{1/4}$	Qa= $1/m \left(\sqrt{\frac{\Delta H}{Ta} \times \frac{Ta}{\Delta H}} \right) \left(\frac{Tstd}{Ta} \right)^{1/4}$
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Standard Conditions

Tstd	298.15 °K
Pstd	760 mm Hg
Key	
ΔH: calibrator manometer reading (in H2O)	
ΔP: footometer 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 1988 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

Tisch Environmental, Inc.
145 South Miami Avenue
Village of Cleves, OH 45002

www.tisch-env.com
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THAI METEOROLOGICAL DEPARTMENT

4353 Sukhumvit, Bangna, Bangkok, 10260 Tel. 081-454-2804,0-2399-0469


Calibration Certificate

Issued by : Calibration & Test Section : Meteorological Instruments Bureau
Date of Issue : 20 May, 2021
Certification No. 27321
Page : 1 of 2

Object : Weather Station
Manufacturer : Met One Instruments
Model No. : Data Logger 580 Wind Sensor 034B
Mfg Code : Data Logger X10448 Wind Sensor X10353
Customer : United Analyst and Engineering Consultant Co.,Ltd.
81 Soi Udomsuk 41, Sukhumvit Road,
Bangchak, Prakanong, Bangkok 10260.

Calibration Condition : Temperature 25.1 °C Barometric Pressure 1009.6 hPa

NATIONAL STANDARD WIND TUNNEL : Thermal Anemometer 642 SN 91503
: HOOK GAGE NO 1425 : Wind Alot Plotting Board
N.I.S.T. Test Reference Number 731/241480
Model DA-650-3TV (sensor TR-90AH)
Serial Number 110730029 (sensor 120629586)
JAPAN QUALITY ASSURANCE ORGANIZATION

Calibrated by: 
Mr. Watchapol Subwat
Mechanical Engineer

Calibration & Test Section
Meteorological Instruments Bureau
4353 Sukhumvit, Bangna, Bangkok, 10260
Tel. 081-454-2804,0-2399-0469

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THAI METEOROLOGICAL DEPARTMENT


4353 Sukhumvit, Bangna, Bangkok 10260 Tel. 081-454-2804, 0-2399-0469

The Result of Calibration

20 July, 2021 Model DVAKS21 SN : 19020214
Certification No. 354221
Page : 2 of 7

Standard	HOOK GAGE NO. 1425			TESTED ANEMOMETER	
	Pressure inches	Vacuum inches	Pressure hPa	Velocity m/sec	Correction m/sec
Ultrasonic Anemometer					
msec					
1.00	-	-	-	0.9	0.10
3.02	-	-	-	2.7	0.32
5.00	-	-	-	4.9	0.10
7.04	-	-	-	6.7	0.34
9.02	-	-	-	8.9	0.12
11.02	-	-	-	10.7	0.32
13.01	-	-	-	13.0	0.01
15.01	-	-	-	14.7	0.31
17.02	-	-	-	17.0	0.02
20.02	-	-	-	19.7	0.32

Wind Adlt Plotting Board.	
US DEPARTMENT OF COMMERCE WEATHER BUREAU	
WIND DIRECTION	TESTED WIND DIRECTION
0	0
90	90
180	180
270	

Calibrated by : 
Mr. Watchapol Suwat
Mechanical Engineer



THAI METEOROLOGICAL DEPARTMENT

4353 Sukhumvit, Bangna, Bangkok 10260 Tel. 081-454-2804, 0-2399-0469

Calibration Certificate

Issued by : Calibration & Test Section : Meteorological Instruments Bureau
Date of Issue : 20 May, 2021
Certification No. 275721
Page : 1 of 2

Object : Wind speed and wind direction
Manufacturer : LSI
Type : Data Logger E-LOG 305 wind speed and wind direction DNA 021
Serial No. : Data Logger 20040002 wind speed and wind direction 20040102
ID No. : No.2/20
Customer : United Analyst and Engineering Consultant Co.,Ltd.
81 Soi Udomsuk 41, Sukhumvit Road,
Bangchak, Prakanong, Bangkok 10260.

Calibration Condition : Temperature 25.1 °C Barometric Pressure 1009.1 hPa

NATIONAL STANDARD WIND TUNNEL :
: Thermal Anemometer 642 SN 91563
: HOOK GAGE NO 1425 Plot Tube Theodor Friedrichs Type 0800.0000 serial 9023
N.I.S.T. Test Reference Number 7317241460
: Ultrasonic Anemometer Model DA-650-3TV (sensor TR-90AH)
Serial Number 110730029 (sensor 120626586)
JAPAN QUALITY ASSURANCE ORGANIZATION

Calibrated by : 
Mr. Watchapol Suwat
Mechanical Engineer



THAI METEOROLOGICAL DEPARTMENT

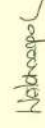
4353 Sukhumvit, Bangna, Bangkok 10260 Tel. 081-454-2804, 0-2399-0469

The Result of Calibration

20 May, 2021
Certification No. 272721
Page : 2 of 2

Standard	HOOK GAGE NO. 1425			TESTED ANEMOMETER	
	Pressure inches	Vacuum inches	Pressure hPa	Velocity m/sec	Correction m/sec
Ultrasonic Anemometer					
msec					
1.00	-	-	-	0.9	0.10
3.02	-	-	-	2.9	0.12
5.00	-	-	-	4.9	0.10
7.00	-	-	-	7.2	-0.20
9.02	-	-	-	9.2	-0.18
11.01	-	-	-	11.1	-0.09
13.01	-	-	-	13.1	-0.09
15.01	-	-	-	15.1	-0.09
17.02	-	-	-	17.0	0.02
20.02	-	-	-	20.0	0.02

Wind Adlt Plotting Board.	
US DEPARTMENT OF COMMERCE WEATHER BUREAU	
WIND DIRECTION	TESTED WIND DIRECTION
0	0
90	91
180	180
270	

Calibrated by : 
Mr. Watchapol Suwat
Mechanical Engineer



THAI METEOROLOGICAL DEPARTMENT

4353 Sukhumvit, Bangna, Bangkok 10260 Tel. 081-454-2804, 0-2399-0469

Calibration Certificate

Issued by : Calibration & Test Section : Meteorological Instruments Bureau
Date of Issue : 20 July, 2021
Certification No. 354221
Page : 1 of 7

Object : เครื่องวัดความเร็วลมและทิศทาง
Manufacturer : LSI
Type : Data Logger E-LOG 305 wind speed and wind direction DNA 827
Thermogrometers DMA875 Barometer DCA 801
Mfg Code : Data Logger 19040406 wind speed and wind direction 19020214
Thermogrometers 19050007 Barometer 19040190
Customer : United Analyst and Engineering Consultant Co.,Ltd.
81 Soi Udomsuk 41, Sukhumvit Road,
Bangchak, Prakanong, Bangkok 10260.
Calibration Condition : Temperature 25.1 °C Barometric Pressure 1007.8 hPa

NATIONAL STANDARD WIND TUNNEL : Thermal Anemometer 642 SN 91563
: HOOK GAGE NO 1425 : Wind Adlt Plotting Board
N.I.S.T. Test Reference Number 7317241460
: Ultrasonic Anemometer Model DA-650-3TV (sensor TR-90AH)
Serial Number 110730029 (sensor 120626586)
JAPAN QUALITY ASSURANCE ORGANIZATION
STANDARD THERMOMETER : Theodor Friedrich : Dry No.839094 Wet No. 838904
: Testo, testo 845 Serial No. 02940057 : Thermochielder No.918802

STANDARD BAROMETER : Digital Barometer Vaisala Type PTB3302 No. 19120015
Calibrated by : 
Mr. Watchapol Suwat
Mechanical Engineer



Certificate No	: 22-ACT-034
Request No	: Req-2022-0092

7. Long Term Stability

UCL Setting	Measured	UNCERTAINTY	Acceptance
FAST/A (37±19)	UUC		Limit
STD Setting	(dB)	(± dB)	(± dB)
Initial	114.0		
Final	114.0		
Deviated	0.0	0.1	0.3

5. Level linearity on the reference level range

TLC Setting		Anticipated REF (dB)	Deviation		UNCERTAINTY (\pm dB)	Acceptance Limit (\pm dB)
FAST / A / 375-139	S10 dB		LUC (dB)	EHR (dB)		
	139 dB	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	0.3	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	69.0	0.0		1.1
	64.00	64	63.9	-0.1		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		0.8
	44.00	44	44.1	0.1		1.1
	39.00	39	39.3	0.3		1.1
	35.00	38	35.3	0.3		1.1
	31.00	37	37.5	0.5		1.1

The results related only to the item calibrated. This certificate shall not be reproduced except in full, without written approval of the laboratory.

Certificate No	22-ACT-034
Request No	Req-2022-0092

9. Level linearity including the level range control

2. Level intensity (including the level range) Control	UIC Setting		Measured		UNCERTAINTY (\pm dB)	Acceptance Limit (\pm dB)
	FAST/A	REF	UIC	ERR (dB)		
UIC Range						
37-139		62.8	43.0	0.2	0.3	1.1
		114	114.5	0.0		1.1

10. Tone burst response

UUC Setting	UUC Time Response	STD Threshold (ms)	Anticipated		Measured		UNCERTAINTY (\pm DB)	Acceptance Limit (\pm DB)
			Ref (dB)	(dB)	UUC (dB)	ERR (dB)		
Fast		200	135.0	135.0	0.0		1	+1.0, -2.5
		2	118.0	117.7	-0.3			+1.5, -5.0
		0.25	109.0	108.8	-0.2			1
Slow		200	128.6	128.5	-0.1	0.3		1
		2	109.0	108.9	-0.1			+1.0, -5.0
		200	129.9	129.0	0.0			1
SUL		2	109.0	108.1	-0.1			+1.0, -2.5
		0.25	100.0	100.0	0.0			+1.5, -5.0

11. Peak C Sound level

ULC Setting	Anticipated		Measured		UNCERTAINTY (± dB)	Acceptance Limit (± dB)
	REF (dB)	STD (dB)	UUC (dB)	ERR (dB)		
FAST / C / 95-142	137.4	136.8	-0.60		3.0	2.0
Complete cycle	136.4	136.1	-0.30		0.2	2.0
Positive half cycle	136.4	136.2	-0.20			2.0
Negative half cycle						

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The results related only to the item collected. The certificate shall not be reproduced except in full, without written approval of the copyright owner.

Certificate No	: 22-ACT-035
Request No	: Req-2022-00

7. Long Term Stability

UUC Setting	Measured		UNCERTAINTY (\pm dB)	Acceptance Limit (\pm dB)
	FAST A / 17x39	UUC (dB)		
STD Setting	Initial	114.0		
	Final	114.0		
Deviated		6.0	0.1	0.2

8. Level linearity on the reference level range

[illegible]

The results related only to the item calibrated. The certificate should not be reproduced except in full, without written approval from the publisher.

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Certificate No	22-ACT-033
Request No	Req-2022-609

9. Level linearity including the level range control

UUC Setting	STD		Measured		UNCERTAINTY (\pm dB)	Acceptance Limit
	REF (dB)	REF (dB)	UUC (dB)	ERR (dB)		
FAST/A						
UUC Range						
37-139	114	43.3	43.4	0.2	0.3	1.1
			114.0	0.0		1.1

10. Tone burst response

UUC Setting		STD Toneburst (ms)	Anticipated		Measured		UNCERTAINTY (\pm dB)	Acceptance Limit (\pm dB)
A / 37.139 UUC Time Required			Ref (dB)	UUC (dB)	ERR (dB)	UUC (dB)		
Fast		200	135.0	135.0	0.0		1	+1.0, -2.5
		2	118.0	117.9	-0.1			+1.5, -5.0
		0.25	109.0	108.7	-0.3			1
Slow		200	128.6	128.5	-0.1		0.3	1
		2	109.0	108.9	-0.1			+1.0, -5.0
		200	129.0	129.0	0.0		1	+1.0, -2.5
SEL		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

Anticipated	Measured		UNCERTAINTY (\pm dB)	Acceptance Limit (\pm dB)
	REF (dB)	UUC (dB)		
UUC Setting				
FAST (C/705-142)				
STD Setting				
Complete cycle	137.4	136.8	-0.60	3.0
Positive half cycle	136.4	136.1	-0.30	2.0
Negative half cycle	136.4	136.1	-0.30	2.0

The results related only to the firm cultural. The certificate shall not be separated except in full, without written approval of the issuing authority. **เอกสารไม่ควรถูก**

เอกสารไม่ควบคุม

The results related only to the items highlighted. The certificate shall not be reproduced except in full, without written approval from the issuing authority.

เอกสารไม่ควบคุม

Certificate No	: 22-ACT-035
Request No	: Req-2022-009

1. Indication at the calibration check frequency

UUC Setting	Nominal Level	Before Adjust		Adjust		UNCERTAINTY (± 400)	Acceptance Limit (± 400)
		UUC (dB)	ERR (dB)	UUC (dB)	ERR (dB)		
FAST / A7-139							
Calibrator Setting							
1000 Hz / 114.00 dB	113.88	114.0	+0.15	113.9	0.05	(± 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

Measured	Uncertainty
UUC Setting	
FAST / 37.139	
UUC Weighting	
A	28.1
	(\pm dB)
	0.10

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

	UUC Setting	Measured (dB)	UNCERTAINTY (\pm dB)
	FAST / 374.39		
UUC Weighting	A	27.9	0.10
	C	27.3	0.10
	Z	31.9	0.10

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

U/LC Setting	Deviation from various Frequency				UNCERTAINTY ($\pm 4\text{dB}$)	Aspiration Limit ($\pm 4\text{dB}$)
	Weighting Respire curve			Z		
	A	C	dB			
FAST / 35-139			dB	dB		
STD Setting	0.6	0.0	0.0	0.0	2.0	
123 Hz						
10000 Hz	0.0	0.0	0.0	0.0	0.60	1.0
40000 Hz	0.4	0.3	0.3		0.60	3.0
80000 Hz	-0.1	-0.2	-0.1		0.70	5.0

The results related only to the items exhibited. The coefficients shall not be interpreted except in full, without written approval of the publisher.

Certificate No	22-ACT-035
Request No	Req-2022-009

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

ULC Setting	Deviation from various Frequency Weighting Response curve				UNCERTAINTY (\pm dB)	Acceptance (\pm dB)
	FAST / 37419	STD Setting	A (dB)	Z (dB)		
FAST / 37419	63 Hz	-0.2	-0.1	-0.1		2.0
	125 Hz	-0.1	0.0	-0.1		1.5
	250 Hz	-0.1	0.0	-0.1		1.5
	500 Hz	-0.1	0.0	-0.1	0.2	1.5
	1000 Hz	0.0	0.0	0.0		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	-0.1	-0.1	-0.1		-5, -INF.

5. Frequency and time weightings at 1kHz

UUC Setting	STD REF	Measured		UNCERTAINTY (\pm dB)	Acceptance Limit (\pm dB)
		UUC (dB)	ERR (dB)		
FAST / 37.139		114.60	0.0		0.2
A		114.60	0.0	0.2	0.2
C		114.60	0.0		0.2
Z		114.60	0.0		0.2

The results related only to the items highlighted. The certificate shall not be reproduced except in full, without written approval from the issuing authority.

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Environment : Ambient temperature : (23 ± 2) °C
Relative humidity : (50 ± 15) % RH

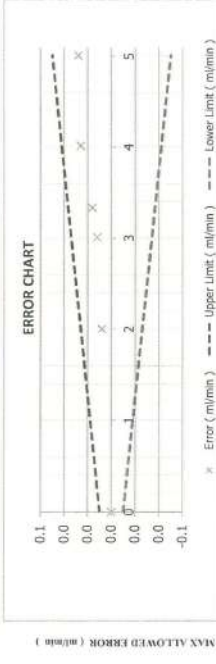
Capacity Range : 5 ml/min
Calibration Media : Air

Type : Mass Flowmeter

Unit Under Calibration Reference Condition :				
Temperature (°C)	Pressure (kPa)	UUC Reading (ml/min)	STD Reading (ml/min)	Error (ml/min)
23.88	100.87	0	0 *	0
23.81	100.96	2.002	1.994 *	0.008
23.78	101.03	3.010	2.998	0.012
23.73	101.07	3.333	3.317	0.016
23.70	101.14	4.013	3.987	0.026
23.68	101.26	5.009	4.981	0.028

Error = Unit Under Calibration - Standard

Marked * are not included in the NSC-ONSC accreditation schedule for our laboratory.



FLOWRATE (ml/min)

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Note : The actual flow rate is determined by the equation :

Q : Q = Flow rate
P : P = Absolute pressure
T : T = Absolute temperature
Subscript "Meas" = Measurement condition
Subscript "Ref" = Reference condition

$$Q_{true} = Q_{ref} \times \frac{P_{ref}}{P_{true}} \times \frac{T_{true}}{T_{ref}}$$

Traceability of Certificate :

The International System of Units (SI) through

NIMT Calibration Certificate No. MW-0003-20 for Mass Flow Calibrator (20 SCCM) Serial No. G500971 G20, Due 22-Jan-22

End of Certificate

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Result of calibration:- Without adjustment
Function:- Pressure Measurement
Increasing Pressure

Range: 0 inH₂O to 36 inH₂O
Scale Interval: 0.1 inH₂O (The Fifth Estimate)

UUC Indication			
Applied Pressure (inH ₂ O)	High-port side (inH ₂ O)	Low-port side (inH ₂ O)	ΔP (inH ₂ O)
0.00	0.00	0.00	0.00
2.00	1.00	-0.90	1.90
4.00	2.00	-1.90	3.90
6.00	3.00	-2.90	5.90
8.00	4.00	-3.94	7.94
10.00	5.00	-4.94	9.94
12.00	6.00	-5.94	11.94
14.00	7.02	-6.94	13.96
16.00	8.02	-7.94	15.96
18.00	9.04	-8.90	18.00
20.00	10.04	-9.90	20.00
22.00	11.08	-10.90	22.02
24.00	12.08	-11.90	24.02
26.00	13.08	-12.90	26.06
28.00	14.08	-13.90	28.06
30.00	15.10	-14.90	30.08
32.00	16.10	-15.90	32.08
34.00	17.08	-16.86	34.08
35.50	17.86	-18.00	35.86

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 %.

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MIRACLE INTERNATIONAL TECHNOLOGY CO.,LTD
214 Bangwaek Rd. Bangkai Bangkok 10160
Tel: 0-2865-4647-8 Fax: 0-2865-4649 http://www.mit.in.th



CALIBRATION CERTIFICATE

Certificate No.: AD2110-274-0001

Date Issued : 02-Nov-21

Customer

: United Analyst and Engineering Consultant Co.,Ltd.
81 Soi Udomsuk 41, Sukhumvit Road, Bangchak, Phrakhanong, Bangkok 10260

Equipment

: Mass Flow Meter

Manufacturer

: Alicat Scientific

Model

: MB-SSCCM-D

Serial No.

: 57730

ID No./Tag No.

: UAE.EMA2.169/2553

Date Received

: 22-Oct-21

Date Calibrated

: 01-Nov-21

Calibrated by

: Mr. Sonjet Onbua

Calibration Method or Calibration Procedure Used

In-house method : CP-34 by comparison against mass flow calibrator.

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

Result of Calibration

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

This certificate may not be reproduced other than in full except with the prior written approval of the Miracle International Technology Company Limited.

Approved by :

K. Nuthany

(Mr. Nuthapong Krudum)



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MULTI-POINT GAS TEST REPORT

Test Date : July 19, 2021

Equipment : Gas Analyzer (NO_x) Model : 42i
Manufacturer : Thermo Scientific Serial Number : 1180540062

Standard Gas Concentration

Sulphur Dioxide (SO ₂)	44.75	Thermo Scientific
Nitric Oxide (NO)	45.35	146i
Methane (CH ₄)	-	1180540071
Carbon Monoxide (CO)	1007	
Cylinder No. :	CC195959	
Expiration Date :	Jul 30, 2022	

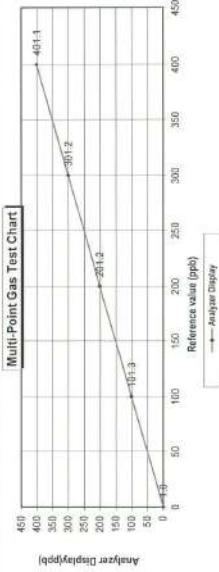
Dilutor Detail

PPM	
Manufacturer :	Thermo Scientific
Model :	146i
Serial Number :	1180540071

Multi-point gas test data

Reference Value (ppb)	Analyzer Display (ppb)	Difference Error	Percent Error	% Error
Zero	0.0	1.00	1.00	1.00
Level 1	100.0	101.3	1.30	1.28
Level 2	200.0	201.2	1.20	0.60
Level 3	400.0	391.2	1.20	0.40
Level 4	800.0	801.1	1.10	0.27
Level 5	1600.0	1601.1	1.10	0.27

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



Calculate by
Srinichai Y.
19 July 2021

Approve by
P. Kach u.
19 July 2021

MULTI-POINT GAS TEST REPORT

Test Date : July 9, 2021

Equipment : Gas Analyzer (NO_x) Model : 42i
Manufacturer : Thermo Scientific Serial Number : 1182920008

Standard Gas Concentration

Sulphur Dioxide (SO ₂)	44.75	Thermo Scientific
Nitric Oxide (NO)	45.35	146i
Methane (CH ₄)	-	1180540071
Carbon Monoxide (CO)	1007	
Cylinder No. :	CC195959	
Expiration Date :	Jul 30, 2022	

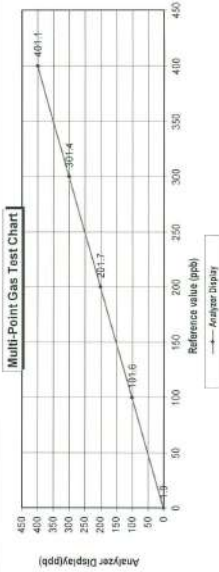
Dilutor Detail

PPM	
Manufacturer :	Thermo Scientific
Model :	146i
Serial Number :	1180540071

Multi-point gas test data

Reference Value (ppb)	Analyzer Display (ppb)	Difference Error	Percent Error	% Error
Zero	0.0	1.9	1.90	1.90
Level 1	100.0	101.6	1.60	1.57
Level 2	200.0	201.7	1.70	0.84
Level 3	400.0	391.4	1.40	0.46
Level 4	800.0	801.1	1.10	0.27
Level 5	1600.0	1601.1	1.10	0.27

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



Calculate by
Srinichai Y.
9 July 2021

Approve by
P. Kach u.
10 July 2021

MULTI-POINT GAS TEST REPORT

Test Date : Oct 21, 2021

Equipment : Gas Analyzer (NO_x) Model : 42C
Manufacturer : Thermo Electron Corporation Serial Number : 42C-0508011076

Standard Gas Concentration

Sulphur Dioxide (SO ₂)	45.75	Thermo Scientific
Nitric Oxide (NO)	45.35	146i
Methane (CH ₄)	-	1180540071
Carbon Monoxide (CO)	1007	
Cylinder No. :	CC195959	
Expiration Date :	Jul 30, 2022	

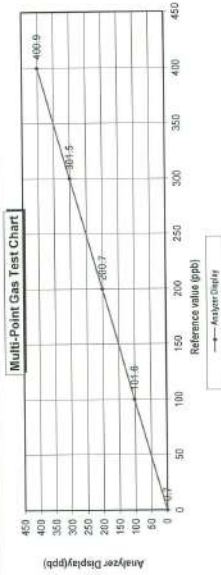
Dilutor Detail

PPM	
Manufacturer :	Thermo Scientific
Model :	146i
Serial Number :	1180540071

Multi-point gas test data

Reference Value (ppb)	Analyzer Display (ppb)	Difference Error	Percent Error	% Error
Zero	0.0	0.70	0.70	0.70
Level 1	100.0	101.6	1.60	1.57
Level 2	200.0	200.9	0.90	0.35
Level 3	400.0	391.5	1.50	0.50
Level 4	800.0	801.5	1.50	0.22
Level 5	1600.0	1601.9	1.90	0.67

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



Calculate by
Srinichai Y.
21 Oct 2021

Approve by
P. Kach u.
21 Oct 2021

MULTI-POINT GAS TEST REPORT

Test Date : Oct 21, 2021

Equipment : Gas Analyzer (NO_x) Model : 42C
Manufacturer : Thermo Environmental Instruments Serial Number : 42C-76412-383

Standard Gas Concentration

Sulphur Dioxide (SO ₂)	44.75	Thermo Scientific
Nitric Oxide (NO)	45.35	146i
Methane (CH ₄)	-	1180540071
Carbon Monoxide (CO)	1007	
Cylinder No. :	CC195959	
Expiration Date :	Jul 30, 2022	

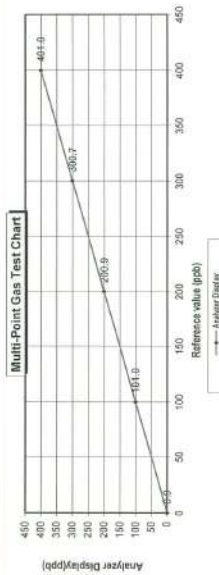
Dilutor Detail

PPM	
Manufacturer :	Thermo Scientific
Model :	146i
Serial Number :	1180540071

Multi-point gas test data

Reference Value (ppb)	Analyzer Display (ppb)	Difference Error	Percent Error	% Error
Zero	0.0	0.90	0.90	0.90
Level 1	100.0	101.0	1.00	0.99
Level 2	200.0	200.9	0.90	0.45
Level 3	400.0	390.7	0.90	0.23
Level 4	800.0	801.0	1.00	0.25
Level 5	1600.0	1601.9	1.90	0.56

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



Calculate by
Srinichai Y.
21 Oct 2021

Approve by
P. Kach u.
21 Oct 2021

MULTI-POINT GAS TEST REPORT

Test Date : Dec 7, 2021

Equipment : Gas Analyzer (SO₂)
Manufacturer : Thermo Scientific Model : 431
Serial Number : 1200956876

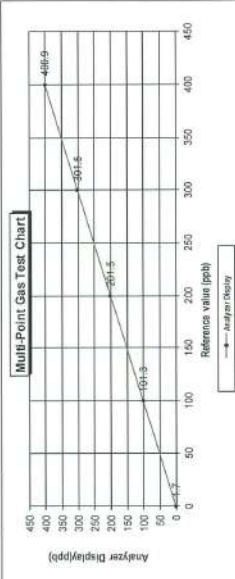
Standard Gas Concentration

Sulphur Dioxide (SO₂) 44.75 PPM
Nitric Oxide (NO) 45.35 PPM
Methane (CH₄) - PPM
Carbon Monoxide (CO) 1007 PPM
Cylinder No.: CCI59599
Expiration Date: Jul 30, 2022

Multi-point gas test data

Reference Value (ppb)	Analyzer Display (ppb)	Difference Error	Percent Error	% Error
Zero	0.0	1.70	1.70	1.70
Level 1	20.00%	101.3	1.30	1.28
Level 2	40.00%	201.5	1.50	0.74
Level 3	60.00%	301.5	1.50	0.50
Level 4	80.00%	400.9	0.90	0.22
Level 5	100.0%	500.0	0.00	0.00

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



Calculate by
Shirachai Y.

Approve by
Shirachai Y.
14 Dec 2021

MULTI-POINT GAS TEST REPORT

Test Date : June 14, 2021

Equipment : Gas Analyzer (SO₂)
Manufacturer : Thermo Scientific Model : 431
Serial Number : 1201778112

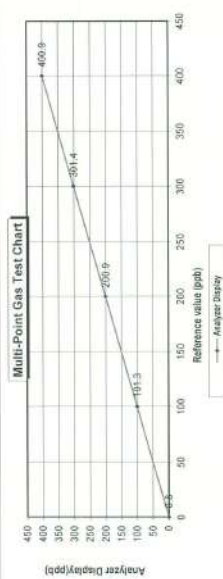
Standard Gas Concentration

Sulphur Dioxide (SO₂) 44.75 PPM
Nitric Oxide (NO) 45.35 PPM
Methane (CH₄) - PPM
Carbon Monoxide (CO) 1007 PPM
Cylinder No.: CCI59599
Expiration Date: Jul 30, 2022

Multi-point gas test data

Reference Value (ppb)	Analyzer Display (ppb)	Difference Error	Percent Error	% Error
Zero	0.0	0.80	0.80	0.80
Level 1	20.00%	101.3	1.30	1.28
Level 2	40.00%	200.9	0.90	0.45
Level 3	60.00%	301.4	1.40	0.46
Level 4	80.00%	400.9	0.90	0.22
Level 5	100.0%	500.0	0.00	0.00

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



Calculate by
Shirachai Y.

Approve by
Shirachai Y.
14 June 2021

MULTI-POINT GAS TEST REPORT

Test Date : Nov 4, 2021

Equipment : Gas Analyzer (NO₂)
Manufacturer : Thermo Scientific Model : 421
Serial Number : 1191503038

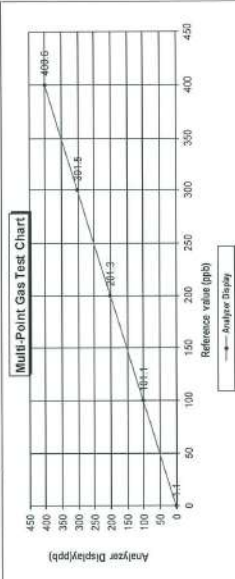
Standard Gas Concentration

Sulphur Dioxide (SO₂) 44.75 PPM
Nitric Oxide (NO) 45.35 PPM
Methane (CH₄) - PPM
Carbon Monoxide (CO) 1007 PPM
Cylinder No.: CCI59599
Expiration Date: Jul 30, 2022

Multi-point gas test data

Reference Value (ppb)	Analyzer Display (ppb)	Difference Error	Percent Error	% Error
Zero	0.0	1.10	1.10	1.10
Level 1	20.00%	101.1	1.10	1.09
Level 2	40.00%	201.3	1.30	0.65
Level 3	60.00%	301.5	1.50	0.50
Level 4	80.00%	400.6	0.60	0.15
Level 5	100.0%	500.0	0.00	0.00

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



Calculate by
Shirachai Y.

Approve by
Shirachai Y.
14 Nov 2021

CERTIFICATE OF ANALYSIS
Grade of Product: EPA Protocol

Part Number: EQN109E15A010C
Cylinder Number: CC119599
Laboratory: 124 - Plumsteadville - PA
PGVP Number: A12019
Gas Code: CO,NO,NO₂,SO₂,BALN
Reference Number: 180-401526-192-1
Cylinder Volume: 2015 PSIG
Valve Outlet: 660
Certification Date: Jul 30, 2019
Expiration Date: Jul 30, 2022

Certification performed in accordance with EPA Method 8000 for the determination of Nitrogen Oxides. This cylinder has a label analytical uncertainty of $\pm 0.5\%$ for Nitrogen Oxides. This label analytical uncertainty is based on a 95% confidence level. There are no significant impurities which affect the use of the calibration mixture. All concentrations are in a 100% Nitrogen balance gas.
Do Not Use This Cylinder Below 100 psig, i.e. 0.7 megapascals

Component	Requested Concentration	Actual Concentration	Method	Total Relative Uncertainty	Assay Dates
NO _x	48.00 PPM	44.75 PPM	G1	$\pm 0.8\%$ NIST Traceable	07/23/2019, 07/30/2019
NITRIC OXIDE	45.00 PPM	44.75 PPM	G1	$\pm 0.8\%$ NIST Traceable	07/23/2019, 07/30/2019
SULFUR DIOXIDE	45.00 PPM	45.35 PPM	G1	$\pm 1\%$ NIST Traceable	07/23/2019, 07/30/2019
CARBON MONOXIDE	1000 PPM	1007 PPM	G1	$\pm 0.4\%$ NIST Traceable	07/23/2019
NITROGEN	Balance	Balance			
Type	Lot ID	Cylinder No	Concentration	Uncertainty	Expiration Date
NTM	18000121	KAL004215	248.3 PPM NITRIC OXIDE/NITROGEN	$\pm 0.4\%$	Nov 08, 2023
NTM	092411	KAL004307	59.03 PPM NITRIC OXIDE/NITROGEN	$\pm 0.80\%$	Mar 12, 2024
NTM	092411	KAL004307	250.0 PPM NITRIC OXIDE/NITROGEN	$\pm 0.80\%$	Mar 12, 2024
NTM	092411	KAL004307-40X	40.03 PPM NITRIC OXIDE/NITROGEN	$\pm 0.80\%$	Mar 12, 2024
NTM	014136	KAL004307	40.03 PPM SULFUR DIOXIDE/NITROGEN	$\pm 1.0\%$	Jun 20, 2022
NTM	072205	KAL004370	970.0 PPM CARBON MONOXIDE/NITROGEN	$\pm 0.4\%$	May 14, 2021
Instrument/Make/Model	Analytical Principle	Last Multipoint Calibration			
CO MAS FTR 00020062	FTR	Jul 15, 2019			
NO MAS FTR 00020062	FTR	Jul 15, 2019			
NO MAS FTR 00020062	FTR	Jul 22, 2019			
SO ₂ MAS FTR 00020062	FTR	Jul 22, 2019			

Triad Data Available Upon Request

NOTES: PPM = 1/10⁶ CM3

PPM = 1000270

GROSS WEIGHT: 28.6 KG

NET WEIGHT: 4.1 KG

Triad Data Available Upon Request

NOTES: PPM = 1/10⁶ CM3

PPM = 1000270

GROSS WEIGHT: 28.6 KG

NET WEIGHT: 4.1 KG

Triad Data Available Upon Request

NOTES: PPM = 1/10⁶ CM3

PPM = 1000270

GROSS WEIGHT: 28.6 KG

NET WEIGHT: 4.1 KG

Triad Data Available Upon Request

NOTES: PPM = 1/10⁶ CM3

PPM = 1000270

GROSS WEIGHT: 28.6 KG

NET WEIGHT: 4.1 KG

Triad Data Available Upon Request

NOTES: PPM = 1/10⁶ CM3

PPM = 1000270

GROSS WEIGHT: 28.6 KG

NET WEIGHT: 4.1 KG

Triad Data Available Upon Request

NOTES: PPM = 1/10⁶ CM3

PPM = 1000270

GROSS WEIGHT: 28.6 KG

NET WEIGHT: 4.1 KG

Triad Data Available Upon Request

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PPM = 1000270

GROSS WEIGHT: 28.6 KG

NET WEIGHT: 4.1 KG

Triad Data Available Upon Request

NOTES: PPM = 1/10⁶ CM3

PPM = 1000270

GROSS WEIGHT: 28.6 KG

NET WEIGHT: 4.1 KG

Triad Data Available Upon Request

NOTES: PPM = 1/10⁶ CM3

PPM = 1000270

GROSS WEIGHT: 28.6 KG

NET WEIGHT: 4.1 KG

Triad Data Available Upon Request

NOTES: PPM = 1/10⁶ CM3

PPM = 1000270

GROSS WEIGHT: 28.6 KG

NET WEIGHT: 4.1 KG

Triad Data Available Upon Request

NOTES: PPM = 1/10⁶ CM3

PPM = 1000270

GROSS WEIGHT: 28.6 KG

NET WEIGHT: 4.1 KG

Triad Data Available Upon Request

NOTES: PPM = 1/10⁶ CM3

PPM = 1000270

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NET WEIGHT: 4.1 KG

Triad Data Available Upon Request

NOTES: PPM = 1/10⁶ CM3

PPM = 1000270

GROSS WEIGHT: 28.6 KG

NET WEIGHT: 4.1 KG

Triad Data Available Upon Request

NOTES: PPM = 1/10⁶ CM3

PPM = 1000270

GROSS WEIGHT: 28.6 KG

NET WEIGHT: 4.1 KG

Triad Data Available Upon Request

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NET WEIGHT: 4.1 KG

Triad Data Available Upon Request

NOTES: PPM = 1/10⁶ CM3

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NET WEIGHT: 4.1 KG

Triad Data Available Upon Request

NOTES: PPM = 1/10⁶ CM3

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GROSS WEIGHT: 28.6 KG

NET WEIGHT: 4.1 KG

Triad Data Available Upon Request

NOTES: PPM = 1/10⁶ CM3

PPM = 1000270

GROSS WEIGHT: 28.6 KG

NET WEIGHT: 4.1 KG

Triad Data Available Upon Request

NOTES: PPM = 1/10⁶ CM3

PPM = 1000270

GROSS WEIGHT: 28.6 KG

NET WEIGHT: 4.1 KG

Triad Data Available Upon Request

NOTES: PPM = 1/10⁶ CM3

PPM = 1000270

GROSS WEIGHT: 28.6 KG

NET WEIGHT: 4.1 KG

Triad Data Available Upon Request

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GROSS WEIGHT: 28.6 KG

NET WEIGHT: 4.1 KG

Triad Data Available Upon Request

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PPM = 1000270

GROSS WEIGHT: 28.6 KG

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Triad Data Available Upon Request

NOTES: PPM = 1/10⁶ CM3

PPM = 1000270

GROSS WEIGHT: 28.6 KG

NET WEIGHT: 4.1 KG

Triad Data Available Upon Request

NOTES: PPM = 1/10⁶ CM3

PPM = 1000270

GROSS WEIGHT: 28.6 KG

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Triad Data Available Upon Request

NOTES: PPM = 1/10⁶ CM3

PPM = 1000270

GROSS WEIGHT: 28.6 KG

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Triad Data Available Upon Request

NOTES: PPM = 1/10⁶ CM3

PPM = 1000270

GROSS WEIGHT: 28.6 KG

NET WEIGHT: 4.1 KG

Triad Data Available Upon Request

NOTES: PPM = 1/10⁶ CM3

PPM = 1000270

GROSS WEIGHT: 28.6 KG

NET WEIGHT: 4.1 KG

Triad Data Available Upon Request

NOTES: PPM = 1/10⁶ CM3

PPM = 1000270

GROSS WEIGHT: 28.6 KG

NET WEIGHT: 4.1 KG

Triad Data Available Upon Request

NOTES: PPM = 1/10⁶ CM3

PPM = 1000270

GROSS WEIGHT: 28.6 KG

NET WEIGHT:

MULTI-POINT GAS TEST REPORT

Test Date : Nov 22, 2021

Test Date : June 9, 2021

Equipment :	Gas Analyzer (SO ₂)	Model :	431
Manufacturer :	Thermo SCIENTIFIC	Serial Number :	1182920013

Equipment :	Gas Analyzer (SO ₂)	Model :	431
Manufacturer :	Thermo SCIENTIFIC	Serial Number :	1201778116

Standard Gas Concentration

Sulphur Dioxide (SO ₂)	44.75	ppm	Manufacturer :
Nitric Oxide (NO)	45.35	ppm	Model :
Methane (CH ₄)	-	ppm	Serial Number :

Thermo Scientific
146i
1180540071

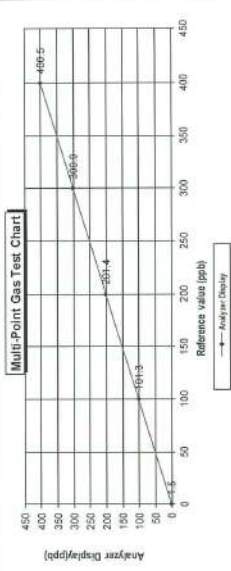
Carbon Monoxide (CO)	1007
Cylinder No. :	CC159599
Expiration Date :	Jul 30, 2022

Expiration Date : Jul 30, 2022

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	1.50	1.50	1.50
Level 2	25.00%	100.0	1.30	1.28	1.28
Level 3	45.00%	200.0	1.40	0.70	0.70
Level 4	65.00%	300.0	0.90	0.30	0.30
Level 5	85.00%	400.0	0.50	0.12	0.12
Remark : Measuring Range			Average Difference (%)		0.78
500.0 ppb					

:Acceptable Limit $\pm 5\%$ 

Calculate by

Calculate by
S. H. H. 7.
22, 11, 14

Page 1 of 1

เอกสารไม่ควบคุม

Airgas.
an Air Liquide company

Airgas Specialty Gases
Airgas USA, LLC
6141 Easton Road
Bldg 1
Plumsteadville, PA 19049
Airgas.com

CERTIFICATE OF ANALYSIS

Grade of Product: EPA Protocol

Part Number:	E04N199E15A07QC	Reference Number:	160-401526192
Cylinder Number:	CC1165959	Cylinder Volume:	144.4 CF
Laboratory:	124 - Plumsteadville - PA	Cylinder Pressure:	2015 PSIG
PG/V Number:	A12019	Valve Outlet:	660
Gas Code:	CO,N ₂ ,NOX,S ₀₂ ,BALN	Certification Date:	Jul 30, 2019

Expiration Date: Jul 30, 2022

Certification performed in accordance with EPA Analytical Method for Assess and Certification of Geospatial Calibration Standards (May 2017) document EPA-821-R-17-006. This certification was performed by a certified analyst (JLH) who has completed the required training and proficiency testing. The analysis was performed using EPA Method 8000-B, 2017, using the assay procedure described in the method. The results are reported as follows: There were no significant impurities which affected the data of this calibration mixture. All concentrations are uncertainly as stated below with a confidence level of 95%. There are no significant impurities which affected the data of this calibration mixture. All concentrations are uncertainly as stated below with a confidence level of 95%.

For information, the following values were obtained from the analysis:

Recovery: 100%

Precision: 100%

On Model Line This Collector below 400 min. is 0.7 megawatts.

ANALYTICAL RESULTS					Assay Dates
Component	Requested Concentration	Actual Concentration	Protocol Method	Total Relative Uncertainty	
NOX	48.00 PPM	47.35 PPM	G1	+/- 0.8% NIST Traceable	07/23/2019, 07/26/2019
NITRIC OXIDE	48.00 PPM	47.35 PPM	G1	+/- 0.8% NIST Traceable	07/23/2019, 07/26/2019
NITROGEN	1000 PPM	45.75 PPM	G1	+/- 1% NIST Traceable	07/23/2019, 07/26/2019
CARBON MONOXIDE	1000 PPM	1007 PPM	G1	+/- 0.4% NIST Traceable	07/23/2019
CALIBRATION STANDARDS					
Type	Lot ID	Cylinder No	Uncertainty		Expiration Date
NITRM	18060121	KAL004215	248.3 PPM NITRIC OXIDE/NITROGEN	+/- 0.3%	Nov 08, 2023
NITRM	092411	KAL004307	55.03 PPM NITROGEN	+/- 0.8%	Nov 08, 2023
NITRM	0806121	55.03 PPM NITROGEN	55.03 PPM NITROGEN	+/- 0.4%	Nov 08, 2023
NITRM	0806121	49.67 PPM NOX	49.67 PPM SULFUR DIOXIDE/NITROGEN	+/- 0.80%	Mar 12, 2024
NITRM	0141759	KAL001570	49.67 PPM SULFUR DIOXIDE/NITROGEN	+/- 1.0%	Jun 20, 2021
NITRM	072508	KAL0014570	970.9 PPM CARBON MONOXIDE/NITROGEN	+/- 0.4%	May 14, 2021

ANALYTICAL EQUIPMENT

	Analytical Principle	Last Multipoint Calibration
--	----------------------	-----------------------------

Inst. diff. in time (sec) to Oct.	FTIR	Jul 19, 2019
CO MKS FTIR 000929062	FTIR	Jul 22, 2019
NO MKS FTIR 000929062	FTIR	Jul 22, 2019
NO MKS FTIR 000929062	FTIR	Jul 22, 2019
SO2 MKS FTIR 000929062	FTIR	Jul 22, 2019

Triad Data Available Upon Request

NOTES: RAN# 51319-CM03
PO# 5219002210
GROSS WEIGHT: 28.6 KG
NET WEIGHT: 4.1 KG

GROSS WEIGHT: 28.8
NET WEIGHT: 4.1 KG



Calculate by
Stichai V.
22.11.14

Approved by
22 Nov 2021

Signature on file
Approved for Release

Page 1 of 160-401526192-1

Page 1 of 1

เอกสารไม่ควบคุม

MULTI-POINT GAS TEST REPORT

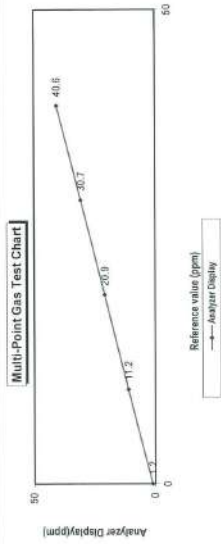
Test Date : Nov 30, 2021

Equipment : Gas Analyzer (CO)
Manufacturer : Thermo Scientific Model : 481
Serial Number : 1201497732

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

Multi-point gas test data

Reference Value (ppm)	Analyzer Display (ppm)	Difference Error	Percent Error	% Error]
Level 1 Zero	0.0	1.2	1.2	1.2
Level 2 20.00%	10.0	11.2	10.7	10.7
Level 3 40.00%	20.0	20.9	4.3	4.3
Level 4 60.00%	30.0	30.7	2.3	2.3
Level 5 80.00%	40.0	40.6	1.5	1.5
Remark : Measuring Range 50.0 ppm				
Acceptable Limit \pm 5%				
Average Difference (%) 4.00				



Calculate by
Srichai Y.
30.11.2021

Approve by
Adina N.
30. Nov. 2021

MULTI-POINT GAS TEST REPORT

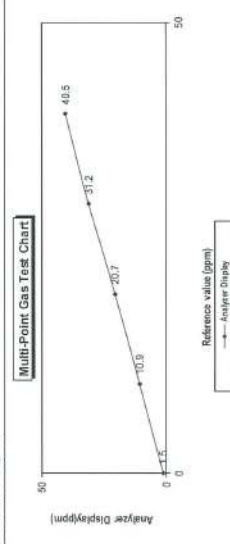
Test Date : Nov 30, 2021

Equipment : Gas Analyzer (CO)
Manufacturer : Thermo Scientific Model : 481
Serial Number : 1201497733

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

Multi-point gas test data

Reference Value (ppm)	Analyzer Display (ppm)	Difference Error	Percent Error	% Error]
Level 1 Zero	0.0	1.5	1.5	1.5
Level 2 20.00%	10.0	10.9	0.9	8.3
Level 3 40.00%	20.0	20.7	0.7	3.4
Level 4 60.00%	30.0	31.3	1.3	2.8
Level 5 80.00%	40.0	40.5	0.5	1.2
Remark : Measuring Range 50.0 ppm				
Acceptable Limit \pm 5%				
Average Difference (%) 3.64				



Calculate by
Srichai Y.
30.11.2021

Approve by
Adina N.
30. Nov. 2021

MULTI-POINT GAS TEST REPORT

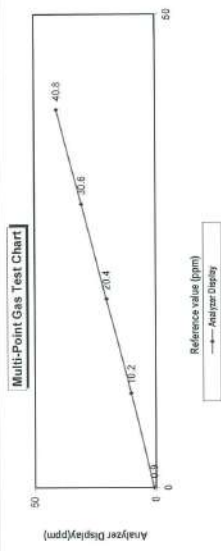
Test Date : Nov 30, 2021

Equipment : Gas Analyzer (CO)
Manufacturer : Thermo Scientific Model : 481
Serial Number : 1200906880

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

Multi-point gas test data

Reference Value (ppm)	Analyzer Display (ppm)	Difference Error	Percent Error	% Error]
Level 1 Zero	0.0	0.9	0.9	0.9
Level 2 20.00%	10.0	10.2	0.2	2.0
Level 3 40.00%	20.0	20.4	0.4	2.0
Level 4 60.00%	30.0	30.6	0.6	2.0
Level 5 80.00%	40.0	40.8	0.8	2.0
Remark : Measuring Range 50.0 ppm				
Acceptable Limit \pm 5%				
Average Difference (%) 1.75				



Calculate by
Srichai Y.
30.11.2021

Approve by
Adina N.
30. Nov. 2021

MULTI-POINT GAS TEST REPORT

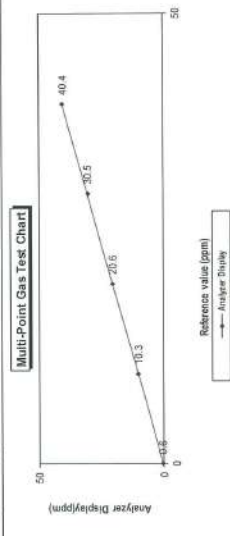
Test Date : Nov 30, 2021

Equipment : Gas Analyzer (CO)
Manufacturer : Thermo Scientific Model : 481
Serial Number : 1201497730

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

Multi-point gas test data

Reference Value (ppm)	Analyzer Display (ppm)	Difference Error	Percent Error	% Error]
Level 1 Zero	0.0	0.6	0.6	0.6
Level 2 20.00%	10.0	10.3	0.3	2.9
Level 3 40.00%	20.0	20.6	0.6	2.9
Level 4 60.00%	30.0	30.5	0.5	1.6
Level 5 80.00%	40.0	40.4	0.4	1.0
Remark : Measuring Range 50.0 ppm				
Acceptable Limit \pm 5%				
Average Difference (%) 1.81				



Calculate by
Srichai Y.
30.11.2021

Approve by
Adina N.
30. Nov. 2021



MULTI-POINT GAS TEST REPORT

Test Date : Dec 21, 2021

Equipment : Gas Analyzer (CO) Model : 481
Manufacturer : Thermo Scientific Serial Number : 1201778117

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.: CCI95959
Expiration Date : Jul 30, 2022

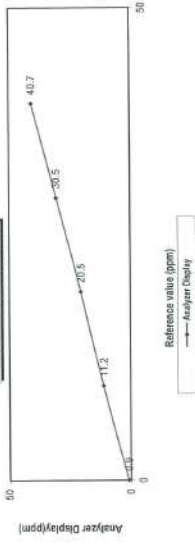
Multi-point gas test data

Level	Reference Value (ppm)	Analyzer Display (ppm)	Difference Error	Percent Error	% Error
Level 1	Zero	0.0	0.9	0.9	0.9
Level 2	20.00%	11.2	1.2	10.7	10.7
Level 3	40.00%	20.5	0.5	2.4	2.4
Level 4	60.00%	30.5	0.5	1.6	1.6
Level 5	80.00%	40.7	0.7	1.7	1.7

Remark : Measuring Range : 50.0 ppm

Acceptable Limit $\pm 5\%$

Multi-Point Gas Test Chart



Calculate by

Sirithana
29.12.21

Approve by
16/10/21
21/12/21

Page 1 of 1

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Airgas Specialty Gases
Airgas USA, LLC
644 Easton Road
Pharmachille, PA 15069
Airgas.com

CERTIFICATE OF ANALYSIS

Grade of Product: EPA Protocol

Part Number: EG4N98E15A010C
Cylinder Number: CC19599
Laboratory: 124 - Plumsteadville - PA
PGVP Number: A12019
Gas Code: CO,NO,NOX,SO2,BALN
Reference Number: 180-401526 192-1
Cylinder Volume: 24.4
Cylinder Pressure: 2015 PSIG
Valve Outlet: 660
Certification Date: Jul 30, 2019
Expiration Date: Jul 30, 2022

Certification performed in accordance with EPA Method 2100 and EPA Method 2107. This certificate is valid for the duration of the calibration. The cylinder has a label analytical uncertainty as stated below with a confidence level of 95%. There are no significant impurities which affect the use of the calibration mixture. All concentrations are on a dry basis. Do Not Use This Cylinder Below 100 psig, i.e. 0.7 megapascals.

ANALYTICAL RESULTS			
Component	Requested Concentration	Actual Concentration	Total Relative Uncertainty
NOX	48.00 PPM	44.75 PPM	$\pm 0.8\%$ NIST Traceable
NITRIC OXIDE	45.00 PPM	44.75 PPM	$\pm 0.8\%$ NIST Traceable
SULFUR DIOXIDE	45.00 PPM	45.35 PPM	$\pm 1\%$ NIST Traceable
CARBON MONOXIDE	1000 PPM	1007 PPM	$\pm 0.4\%$ NIST Traceable
NITROGEN	Balance	Balance	
CALIBRATION STANDARDS			
Type	Lot ID	Cylinder No	Expiration Date
NTM	18090121	KAL004215	Nov 08, 2023
NTM	092411	KAL004307	Mar 12, 2024
NTM	18090121	KAL004215	Nov 08, 2023
NTM	092411	KAL004307	Mar 12, 2024
NTM	014116	KAL004307	Jun 20, 2022
NTM	072205	KAL004370	May 14, 2021
ANALYTICAL EQUIPMENT			
Last Multipoint Calibration			
Instrument/Model	CO MAS FTR 00020962		
NO MAS FTR 00020962	FTIR		
NO MAS FTR 00020962	FTIR		
NO MAS FTR 00020962	FTIR		

Triad Data Available Upon Request

NOTES: 1. All concentrations are on a dry basis.
2. Gross weight: 28.6 KG
NET WEIGHT: 4.1 KG



Calibrated by:

Mr. Wachampol Subwat

Mechanical Engineer

Signatures on file

Approved for Release

Page 1 of 1 180-401526 192-1

เอกสารไม่ควบคุม

THAI METEOROLOGICAL DEPARTMENT

4353 Sukhumvit, Bangna, Bangkok 10260 Tel. 081-454-2804-0-2399-0169

Calibration Certificate

Issued by : Calibration & Test Section : Meteorological Instruments Bureau

Date of Issue : 20 May, 2021

Certification No. 274/21

Page : 1 of 2

Object : Weather Station

Manufacturer : Met One Instruments

Model No. : Data Logger 580 Wind Sensor 034B

Mfg Code : Data Logger X23725 Wind Sensor X21189

Customer : United Analyst and Engineering Consultant Co., Ltd.

81 Soi Udomsuk 41, Sukhumvit Road,

Bangchak, Prakanong, Bangkok 10260.

Calibration Condition : Temperature 25.1 °C Barometric Pressure 1009.2 hPa

NATIONAL STANDARD WIND TUNNEL : Thermal Anemometer 642 SIN 91563

HOOK GAGE NO 1425 : Wind Anemometer Plotting Board

N.I.S.T. Test Reference Number 731/24 1460

Model DA-950-3TV (Sensor TR-90AH)

Serial Number 110730029 (Sensor 120620586)

JAPAN QUALITY ASSURANCE ORGANIZATION

Calibrated by: Netrap
Mr. Wachampol Subwat
Mechanical Engineer

Authorized Signatory
for the Unit
Sub-Standard Instrument
เอกสารไม่ควบคุม

THAI METEOROLOGICAL DEPARTMENT

4353 Sukhumvit, Bangna, Bangkok 10260 Tel. 081-454-2804-0-2399-0469

The Result of Calibration

Certification No. 274/21

20 May, 2021

Page : 2 of 2

TESTED ANEMOMETER			
Standard	HOOK GAGE NO. 1425	TESTED ANEMOMETER	
Ultrasonic Anemometer	Pressure inches	Vacuum inches	Correction
1.00	-	-	0.00
3.02	-	-	0.02
5.00	-	-	0.00
7.00	-	-	0.00
9.02	-	-	0.02
11.01	-	-	0.01
13.01	-	-	0.01
15.01	-	-	-0.99
17.02	-	-	-0.98
20.02	-	-	-0.98

Wind Anemometer Plotting Board.	
US DEPARTMENT OF COMMERCE WEATHER BUREAU	
WIND DIRECTION	TESTED WIND DIRECTION
0	0
90	90
180	180
270	270

Calibrated by:

Mr. Wachampol Subwat

Mechanical Engineer

Signatures on file

Approved for Release

Page 1 of 1 180-401526 192-1

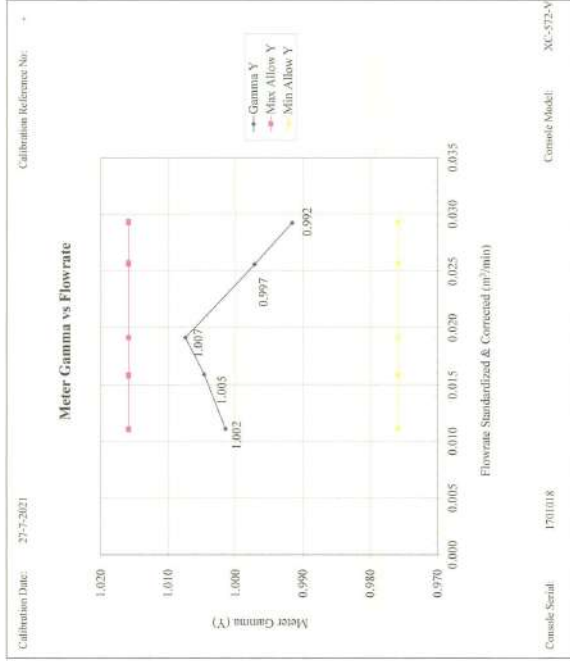
เอกสารไม่ควบคุม

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

Calibration Data									
Results									
Standardized Data					Dry Gas Meter				
Dry Gas Meter		Calibration Factor			Flowrate		Std & Corr		
(V _{std}) (Q _{std})	Calibration Meter	Value	Variation	(ΔY)	(Q _{std})	(ΔH _g)	Std	Corr	Variation
m ³ m ³ /min	m ³ m ³ /min	(V)	(ΔY)		mm H ₂ O	(ΔH _g)	m ³ /min	m ³ /min	(ΔH _g)
0.138 0.011	0.138 0.011	1.006	0.010	0.011	46.569	-0.802			
0.138 0.011	0.137 0.011	0.997	0.001	0.011	47.131	-0.241			
0.138 0.016	0.139 0.016	1.012	0.016	0.016	45.558	-1.815			
0.138 0.016	0.138 0.016	1.003	0.007	0.016	46.415	-0.937			
0.277 0.019	0.274 0.019	0.992	-0.004	0.019	48.824	1.451			
0.277 0.019	0.274 0.019	0.992	-0.004	0.019	48.711	1.338			
0.278 0.026	0.275 0.026	0.986	-0.009	0.026	48.099	0.726			
0.278 0.026	0.277 0.026	0.994	-0.002	0.026	47.563	0.190			
0.279 0.030	0.275 0.029	0.987	-0.009	0.029	47.698	0.326			
0.279 0.030	0.276 0.029	0.991	-0.005	0.029	47.157	-0.716			
					Y Average		DH@ Average		
					0.996		47.373		

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 $\pm 0.2\%$.
 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.

เอกสารไม่ควบคุม



เอกสารไม่ควบคุม

CERTIFICATE OF CALIBRATION

Customer	: United Analyst and Engineering Consultant Co., Ltd.
Address	: 81 Soi Udomsak 41, Sakhumvit Road, Bangchak, Phrakhanong, Bangkok 10260
Description of Equipment	: Console meter
Manufacturer	: Apex Instrument
Model Number	: XC-572-V
Serial Number	: 1701018
ID/Control No.	: -
Environment Conditions	: Temperature (25 \pm 2) °C
	: Humidity (50 \pm 15) % RH
Cal. Date	: 27/07/2021
Issue Date	: 27/07/2021

Calibration Method or Calibration Procedure Used

US EPA Method (United State Environmental Protection Agency)
 This certificate is traceable to national standard, which reflects 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. Sunya Sangnil
 Approved by : 
 (Mr. Mann Fushkhud)
 Technical Manager

เอกสารไม่ควบคุม

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

Meter Console Information				Calibration Conditions				Factors/Conversions			
Console Model Number	XC-572-V	Date	27/7/2021	Time	09:45 AM	Std Temp	295	K			
Console Serial Number	1701018	Calibration Reference No.	-			Std Press	760	mm Hg			
DGM Model Number	SK25EX	Barometric Pressure	761.00	mm Hg		K1	0.386				
DGM Serial Number	00002030	Calibration Meter Gamma	0.999			Console Leak Check	PASS				

Calibration Data											
Metering Console						Calibration Meter					
Run Time	DGM Orifice	Volume	Outlet Temp	Volume	Outlet Temp	Volume	Volume	Volume	Outlet Temp	Outlet Temp	Outlet Temp
Elapsed	DH	Initial	Final	Initial	Final	Initial	Final	Initial	Initial	Final	Final
(Q)	(P)	(V _{std})	(V _{std})	(V _{std})	(V _{std})	(V _{std})	(V _{std})	(V _{std})	(V _{std})	(V _{std})	(V _{std})
min	mm H ₂ O	m ³	m ³	m ³	m ³	m ³	m ³	m ³	m ³	m ³	m ³
12.40	13.0	1512.485	1512.625	27	27	11.01632	11.15746	26	26	26	26
8.75	26.0	1512.773	1512.913	27	27	11.30058	11.44278	26	26	26	26
8.75	26.0	1512.913	1513.053	28	28	11.44278	11.58366	26	26	26	26
14.33	40.0	1513.064	1513.344	28	28	11.70192	11.98092	25	25	25	25
14.32	40.0	1513.344	1513.624	29	29	11.98092	12.26092	25	25	25	25
10.72	70.0	1513.634	1513.914	29	29	12.26092	12.54328	24	24	24	24
10.73	70.0	1513.914	1514.194	29	29	12.54328	12.82364	24	24	24	24
9.42	90.0	1514.205	1514.485	30	30	12.82364	13.11482	24	24	24	24
9.40	90.0	1514.485	1514.765	30	30	13.11482	13.39496	24	24	24	24

เอกสารไม่ควบคุม

Certificate No.: G 640293
Date of issue : 12-May-21

Instrument description : 1. Flue gas Analyzer
Instrument model : 1. Tisto 350 New
Instrument serial no. : 60899698
ID no. or control no. : UAE-FPM 008/2560
Manufacturer : 1. TISTO AG
Probe description : 1. -
Probe model : 1. -
Probe serial : 1. -
Customer name : 1. UNITED ANALYST AND ENGINEERING CONSULTANT CO. LTD.
Customer address : 1. 81/501 UDONSUKHAI, SUKHUMVIT ROAD, BANGCHAK, PHRAKONG
BANGKOK 10260
Total pages of certificate : 2 Pages
Receiving no. : L-211143
Receiving date : 10-May-21
Parameter of calibration : 1. Gas Calibration (Oxygen 2.501, 10.00, 21.00 %vol, Carbon Monoxide 80.23, 301.4, 1000 ppm, Nitric Oxide 10.04, 150.2, 200.8 ppm, Sulphur Dioxide 50.28, 100.9, 600.0 ppm, Nitrogen Dioxide 10.20, 80.37, 200.8 ppm)
Condition of UUC : 1. All of the Measurement were carried out the stabilized laboratory
Ambient condition : 1. Temperature : 23 ± 0.5 °C
Humidity : 58 ± 1.5 %RH
Calibration place : 1. 171/21, Soi Ngumwongwan 47 Yeak 48, Toongsongkhong, Lakul, Bangkok 10210
Calibration procedure no. : 1. WF-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.

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

Date of calibration : 12-May-21

Kwanranchik
Mr. Kwanranchik Khairudinn
Calibration Technician

CP Wuttie
Mrs. Nongluck Wongpattine
Technical Manager

FPM-CL-09-C Rev.8

Page 1 of 2

Issued Date: 26/02/16

ENTECH INDUSTRIAL SOLUTION CO. LTD.

171/21, Soi Ngumwongwan 47 Yeak 48, Toongsongkhong, Lakul, Bangkok 10210 THAILAND. Tel. 0-2779-8888 Fax. 0-2779-8889 info@entech.co.th

เอกสารไม่ควบคุม

Certificate No.: G 640293

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) 80.23 ppm	2396/19	Linde	15-Jul-21
Carbon monoxide (CO) 301.4 ppm	2397/19	Linde	16-Jul-21
Carbon monoxide (CO) 1002 ppm	2424/19	Linde	17-Jul-21
Nitric Oxide (NO) 10.04 ppm	2448/19	Linde	17-Jul-21
Nitric Oxide (NO) 150.2 ppm	2309/19	Linde	09-Jul-21
Nitric Oxide (NO) 320.9 ppm	2433/19	Linde	16-Jul-21
Sulphur Dioxide (SO ₂) 50.28 ppm	2410/19	Linde	21-Jul-21
Sulphur Dioxide (SO ₂) 100.9 ppm	4940/20	Linde	16-Jul-21
Sulphur Dioxide (SO ₂) 600.0 ppm	2398/19	Linde	16-Jul-21
Nitrogen Dioxide (NO ₂) 10.20 ppm	2929/19	Linde	27-Aug-21
Nitrogen Dioxide (NO ₂) 80.37 ppm	2379/19	Linde	14-Jul-21
Nitrogen Dioxide (NO ₂) 200.8 ppm	2347/19	Linde	10-Jul-21

Measured room conditions

Temperature : 25.0 °C Humidity : 46.7 %RH Pressure : 1012.5 mbar

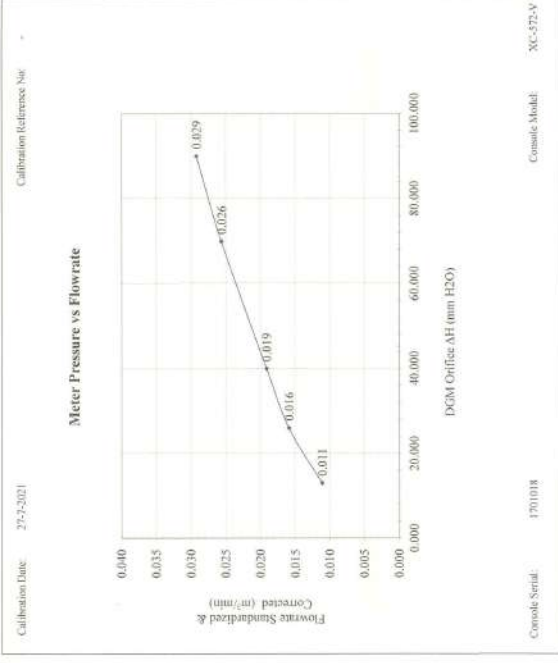
Calibration conditions

Gas Temperature : 23 °C Flow rate : 1,200 ml/min Gas pressure : 1021.6 mbar

Calibration results (without adjustment) (Table 2)

Parameter of Standard	Standard Values	Mean of UUC	Error	Uncertainty (±)
O ₂ (%vol)	2.501	2.45	-0.051	0.20
O ₂ (%vol)	10.00	9.89	-0.11	0.40
O ₂ (%vol)	21.00	21.13	0.13	0.80
CO (ppm)	80.23	81	0.77	2.8
CO (ppm)	301.4	300	-1.4	11
CO (ppm)	1002	999	-3	34
NO (ppm)	10.04	8.4	-2.04	3.0
NO (ppm)	150.2	150	-0.2	5.0
NO (ppm)	320.9	315	-5.9	10
SO ₂ (ppm)	50.28	50	-0.28	5.0
SO ₂ (ppm)	100.9	102	1.1	5.0
SO ₂ (ppm)	600.0	598	-2.0	14
NO ₂ (ppm)	10.20	11	1.10	1.5
NO ₂ (ppm)	80.37	82	1.73	5.0
NO ₂ (ppm)	200.8	202	1.6	5.0

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



THERMOCOUPLES SYSTEM CALIBRATION

Sampling System Equipment Information		Calibration Conditions	
Console Model Number	XC-572-V	Date	27/7/2021 12:00 PM
Console Serial Number	1701018	Calibration Reference No.	
DGM Model Number	SK25EX	Reference Thermometer	DIGICON
DGM Serial Number	00002030	Serial Number	183169105
Meter Box Model Number	JENCO 765 KF		
Meter Box Serial Number	JC 16103		

Results		Console Thermocouple Simulator	
Channel and test point	Meter Box Channel	Temperature Reading (°C)	
Stack	-18.0 25.0 38.0 93.0 149.0 260.0 371.0 482.0 593.0 816.0 1038.0	149.0 258.0 371.0 482.0 593.0 814.0 1036.0	
Aux	-17.0 24.0 37.0 93.0 149.0		
Probe	-17.0 24.0 37.0 93.0 149.0		
Filter	-17.0 24.0 37.0 93.0 149.0		
Oven	-17.0 24.0 37.0 93.0 149.0		
Exit	-16.0 24.0 38.0		

Stack Probe Filter
Tolerance Range
Absolute
Meter Exit
3.0 °C
3.0 °C
2.0 °C



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
CORPORATE SERVICES & EQUIPMENT CALIBRATION AND TESTING SERVICES
53/41 PATTANAKARN ROAD SOI 18, SUKHUMVIT, SUKHUMVIT BANGKOK 10250
TEL: 02-2717-3000/27 FAX: 02-2719-9484



Cert.No.: 21CH788
Page: 1 of 3

Certificate of Calibration

Equipment : pH Meter
Manufacturer : Horiba
Model : LAQUA-pH210
Serial No. : HA000025
ID No. : UAE.EFM.117/2563(ENV.pH.07/63)
Condition As-Received:
Received Date : 14 June 2021
Calibration Date : 16 June 2021
Submitted by : 2106-0458WSC-3
United Analyst and Engineering Consultant Co., Ltd.
3 Soi Udomsak 41, Sukhumvit Road,
Bangchak, Phraekhanong, 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 Lemgagtrakul
Approved by :
(/) Malee Buksuea
() Sathip Meangmal
() Warakorn Lemgagtrakul
Issue Date : 21 June 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.

เอกสารไม่ควบคุม
A 002445



บริษัท เอกเสควิฟ เทคคิง จำกัด (มหาชน)

48/194-5 หมู่ที่ 5 ซอย 19 ถนนประดิษฐ์มนูธรรม แขวงลาดพร้าว เขตคลองจั่น กรุงเทพมหานคร 10230
TEL (662) 515-0145-50 FAX (662) 515-0144 www.eulthai.com E-mail : info@eulthai.com

No. RA 10821

Certificate of Calibration

Customer : United Analyst and Engineering Consultant Co., Ltd.
Address : 81 Soi Udomsak 41, Sukhumvit Road, Bangchak, Prakanong, Bangkok, 10260.
Calibration location : Executive Trading Limited.
Address : 48/194-5 Soi Praditmanutham 19, Pradit Manutham Road, Latphrao, Bangkok 10230

Tools :

Instrument : Gas Detector
Product : RAE Systems
Model Name : MiniRAE3000
Serial Number : 592-925267
Environmental Condition :
Temperature : (25 ± 3) °C
Relative Humidity : (39 ± 15) %
Pressure : 760 mmHg

Date of Calibration : June 28, 2021

Due Date of Calibration : June 28, 2022

Calibration Method : This instrument has been calibrated using calibration gases. Test and calibration data is on file with Executive Trading Limited.

Reference Standard : Isobutylene Standard Gas 100 ppm; Lot number 1291364,
Exp Date: 04/01/25.

Test Result

Sensor Type	Reference Concentration	Before Cal.	After Cal.	Error Reading	Result
PID	0.0 ppm (Air Zero)	0.0 ppm	0.0 ppm	0.0 ppm	Pass
PID	100 ppm (Isobutylene)	105.8 ppm	100.0 ppm	0.0 ppm	Pass

Flow Rate of Pump : 490 cc/min.

Accuracy : ± 2 % at calibration point

Calibrated By :
(Mr. Surinthon Seinate)
Service Engineer

Approved By :
(Mr. Sutiwong Kongthongsang)
Service Engineer Manager

The results relate only to the items tested or calibrated.

Advertising the Report/Certificate and publicity of the results except in full are prohibited unless written permission is obtained from the company.

EXECUTIVE TRADING LIMITED 48/194-5 SOI PRADITMANUTHAM 19, PRADITMANUTHAM ROAD, LATPHRAO, BANGKOK 10230

เอกสารไม่ควบคุม



Honeywell Analytics - Singapore Office:
17 Changi Business Park Central 1
Singapore 486073
Cert Ref: 00017



Honeywell
THE POWER OF CONNECTED
Gas Detection

CERTIFICATE Of Attendance

It is hereby certified that

Mr Sutiwong Kongthongsang
(Executive Trading Limited)

has attended the

RAE Products & Maintenance Training Course

Conducted by

RAE Systems BY HONEYWELL

on 31st July to 2nd August 2018



Conducted by : Desmond Tan
Service Engineer/Technical Trainer
Date of Issue : 2nd August 2018
Valid for 2 years from date of issue

เอกสารไม่ควบคุม

เอกสารไม่ควบคุม



Cert.No.: 21CH1021
Page.: 1 of 3

Certificate of Calibration

Equipment : Conductivity Meter
Manufacturer : YSI
Model : Pro 30
Serial No. : 18K100974
ID No. : UAE EFM 070/2562 (ENV SCT 06/61)
Condition As-Received:
Received Date : 04 August 2021
Calibration Date : 17 August 2021
Reference : 2108-0109WSC-4
Submitted by : United Analyst and Engineering Consultant Co., Ltd.
3 Soi Udomsuk 41, Sukhumvit Road,
Bangchak, Phra Khanong, Bangkok 10260
(25 ± 2.5) °C
(50 ± 15) %
In-house method :
- CP-CH6 by direct measurement
with certified reference material (CRM)
- CP-CH6 by comparison with standard thermometer

Calibrated by : Warakorn Lerngagrakul

Approved by :
(/) Malee Bukruea
() Sathip Meangmal
() Warakorn Lerngagrakul

Approved Signatory

Issue Date : 23 August 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

เอกสารไม่ควบคุม 5

เอกสารไม่ควบคุม 5

เอกสารไม่ควบคุม 5



Cert.No.: 21CH1021
Page.: 2 of 3

Condition of this result of calibration

1. Reference Standard Instrument :

Instrument	Serial No.	ID No.	Certificate No.	Due date
1) Thermometer	1963878	130RC095	201119	15 Sep 2021
2) Ref. Std Thermometer	2188080	130RC044	2011389	19 Nov 2021

This certification is traceable to the International System of Unit maintained at:-

- Traceable to National Institute of Metrology (Thailand), NIMT

2. Certified Reference Materials :-

- Conductivity calibration solution: CPA chem Ltd. The measurement results are traceable to SI through CPA chem Ltd., ANSI-ASQ National Accreditation Board, Accredited No. AR-1835

Conductivity Solution	Manufacturer	Lot No.	Exp. date
1413.0 µS/cm	CPA Chem	754036	28 Jun 2022
12.8806 mS/cm	CPA Chem	725924	12 Jan 2022

- Control Conductivity calibration solution temperature by Water bath (25±0.1) °C
3. This certificate is valid only to the item calibrated on date and place of calibration.

Calibration results

Function : Conductivity Measurement

(*) After Adjustment at 1413.0 µS/cm

Conductivity Electrode Serial No.: 18L100008

Standard Conductivity Solution	Before Adjustment UUC* Reading	After Adjustment UUC* Reading	Uncertainty of Measurement (±)	Coverage factor k
1413.0 µS/cm	1183 µS/cm	1413 µS/cm	9.0 µS/cm	2.00
12.8806 mS/cm	10.79 mS/cm	12.77 mS/cm	0.082 mS/cm	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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เอกสารไม่ควบคุม 5

เอกสารไม่ควบคุม 5



Condition of this calibration result

1. Reference Standard Instrument : *

Instrument	Serial No.	ID No.	Cert. No.	Due Date
1) Document Process Calibrator	43160066	130RC092	21E1223/1	27 Apr 2022
2) Ref. Standard Thermometer	2188080	130RC044	2011389	19 Nov 2021

This certification is traceable to the International System of Unit maintained at:-

- Traceable to National Institute of Metrology (Thailand), NIMT

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

Buffer Solution	Manufacturer	Lot No.	Exp. date
pH 4.008	CPA chem	725926	13 Jan 2023
pH 6.985	CPA chem	725927	12 Jan 2022
pH 10.012	CPA chem	725928	12 Jan 2022

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

Calibration Results

Function : mV Measurement

Performing standard curve by Fluke at pH (4.7)(7.10)

Unit Under Calibration	Nominal Value	Standard Voltage Input		Actual Reading		Uncertainty of Measurement (±mV)	Coverage factor k
		pH	mV	mV	pH		
pH Meter SN.: HA0C0025	4.00	177.48	177.5	4.01	7.02	0.058	2.00
	7.00	0.00	0.0	7.02	0.058	0.058	2.00
	10.00	-177.48	-177.5	10.01	0.058	0.058	2.00

เอกสารไม่ควบคุม 5

เอกสารไม่ควบคุม 5



Cert.No.: 21CH788
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 (mV)	Actual pH Reading (mV)	Uncertainty of pH measurement (±)	Coverage factor k
pH Electrode S/N.: 980C0199	4.008	152.7	152.7	0.0079	2.00
	6.985	6.99	-21.3	0.0093	2.00
	10.012	6.99	-21.7	0.0093	2.00

Function : Temperature Measurement

(*) Without adjustment

This equipment was connected with Temperature Probe;

- Model : 9652

- Serial No. : 990C0199

- Dimension of probe;

- Length : 80 mm.

- Diameter : 15 mm.

- Immersion Depth : 80 mm.

Calibration Point (°C)	Standard Temperature (°C)	UUC* Reading (°C)	Error (°C)	Uncertainty of measurement (± °C)	Coverage factor k
25.0	25.003	25.0	-0.003	0.20	2.00
30.0	30.001	30.0	-0.001	0.20	2.00
35.0	35.005	35.0	-0.005	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 %.

เอกสารไม่ควบคุม 5

เอกสารไม่ควบคุม 5



Cert.No.: 21TW158
Page.: 2 of 2

Result : Dissolved Oxygen Meter Adjustment With Air 100 %

Dissolved Oxygen Probe No.: 18H110457

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



Cert.No.: 21CH1021
Page.: 3 of 3

Calibration Results

Function : Temperature Measurement

(*) Without adjustment
This equipment was connected with Temperature Probe;

- Model : PRO30 CON-T
- Serial No. : 18L100008

Dimension of probe;

- Length : 8 mm.
- Diameter : 2 mm.
- Immersion Depth : 90 mm.

Calibration Point (°C)	Standard Temperature (°C)	UUC* Reading (°C)	Error (°C)	Uncertainty of Measurement (± °C)	Coverage factor k
25.0	25.006	24.9	-0.106	0.20	2.00
30.0	30.004	29.9	-0.104	0.20	2.00
35.0	35.003	34.8	-0.203	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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เอกสารไม่ควบคุม



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
CORPORATE SERVICES 3 : EQUIPMENT CALIBRATION AND TESTING SERVICES
5344 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG BANGKOK 10250
TEL. 0-2717-3000-27 FAX. 0-2719-4484



Cert. No.: 21TM1366
Page.: 1 of 2

Certificate of Calibration

Equipment : DO Meter With Sensor
Manufacturer : YSI
Model : Pro 20i
Serial No. : 18H110457
ID No. : UAE.EFM.202/2561 (ENV.D0.06/61)
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 : 2 August 2021
Calibrated Date : 2 August 2021
Ambient Temperature : (26 ± 10) °C
Relative Humidity : (50 ± 30) %
AC Line Voltage : (220 ± 22) V

Calibrated by : Preesha Hahib

Approved by : 
Approved Signatory

() Pornthippa Tameyakul
() Malee Bulkrua
(✓) Suwit Imjai

Issue Date : 10 August 2021

The Uncertainties are for a confidence probability of approximately 95 %

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TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
CORPORATE SERVICES 3 : EQUIPMENT CALIBRATION AND TESTING SERVICES
5344 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG BANGKOK 10250
TEL. 0-2717-3000 FAX. 0-2719-4484

Certificate of Testing

Equipment : DO Meter
Manufacturer : YSI
Model : Pro 20i
Serial No. : 18H110457
ID No. : UAE.EFM.202/2561 (ENV.D0.06/61)
Received Date : 27 July 2021
Test Date : 30 July 2021
Reference : 2107-0695WSC-3
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 : Walatak Sirthean

Approved by : 
Approved Signatory

() Malee Bulkrua
(✓) Sathip Meangmal
() Warakorn Leringtrakul

Issue Date : 4 August 2021

เอกสารไม่ควบคุม

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

Result of Calibration :

Flow Setting		UUC Flow Reading		Correction Flow		Uncertainty	
LPM	LPM	LPM	LPM	LPM	LPM	LPM	LPM
0.02	0.01919	0.022	-0.00287	0.00045			
0.05	0.05084	0.053	-0.00216	0.00093			
0.10	0.1047	0.102	0.0027	0.0019			
0.20	0.2043	0.197	0.0065	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	2.066	1.989	0.077	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-APM-01 Rev.02 Issue date 01/07/19

เอกสารไม่ควบคุม

Certificate of Calibration

Customer : UNITED ANALYST AND ENGINEERING CONSULTANT
Name : CO.,LTD.
Address : 81 Soi Udomsak 41, Sukhumvit Road, Bangkok, Prakanong, Bangkok 10260

Certificate No : 21-AFM-082
Request No : Req-2021-1322

Unit Under Calibration Details

Measurement Item : Mass flow meter
Manufacturer : TSI
Model : 4146
Serial Number : 41461922007
ID : UAE-EPM-233-2662
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	Seamlyne	21 April 2022
Air Flow Meter	Gilibrator 3 High Flow	18501012012	Seamlyne	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. Nopadol Lungsart
Service Calibration Engineer

Approved By :

Mr. Pait Mahasom
Calibration Engineer Supervisor
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-APM-01 Rev.02 Issue date 01/07/19

เอกสารไม่ควบคุม



Equipment : DO Meter With Sensor
Condition As-Received : Used Item
Reference : 2107-0695WSC-4
Page.: 2 of 2

Procedure Used : -

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

The temperature scale used was based on ITS-90.

Condition of this result of calibration

1. Reference standard instrument:-

Instrument : Digital Thermometer Model : 1502A Serial No. : A52847 Cert. No. : 201246 Due Date : 14 Oct 2021

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

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

Result of Calibration : (*) Without Adjustment

Function : Temperature measurement.

This instrument was connected with temperature sensor, S/N: 18H100722

Calibration Point (°C)	Immersion Depth (mm)	Standard Temperature (°C)	UUC* Reading (°C)	Error (°C)	Uncertainty (± °C)	Coverage Factor k
25.0	100	25.005	25.0	-0.005	0.16	2.00
30.0	100	30.009	30.0	-0.009	0.16	2.00
35.0	100	35.003	35.0	-0.003	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

Certificate of Calibration

Customer : UNITED ANALYST AND ENGINEERING CONSULTANT CO.,LTD.
Name :
Address : 81 Soi Udomsak 41, Sukhumvit Road, Bangkok, Prakanong, Bangkok 10260

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

Unit Under Calibration Details

Measurement Item : Air flow meter
Manufacturer : TSI
Model : 4146
Serial Number : 41461813630
ID : UAE-EPM 1022641
Location of Calibration : LAB 4 AIR VELOCITY METER

Calibration Environment and Details

Temperature : 23 °C ± 3 °C
Humidity : 55 %RH ± 20 %RH
Barometric Pressure : 1013 hPa ± 10 hPa
Received Date : 22 June 2021
Calibration Date : 23 July 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 Low Flow	18501010006	Seamlyne	21 May 2022
Air Flow Meter	Gilibrator 3 Standard Flow	19031011003	Seamlyne	20 May 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. Nopadol Lungsart
Service Calibration Engineer

Approved By :

Mr. Pait Mahasom
Calibration Engineer Supervisor
23 July 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-APM-01 Rev.02 Issue date 01/07/19

เอกสารไม่ควบคุม



Cert.No.: 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 min Estimate)

Increasing Pressure	714.29	725.74	737.41	748.82	761.02	773.03
Applied Pressure (mmHg)	720.0	730.0	740.0	750.0	760.0	770.0
UUC* Indication (mmHg)	5.71	4.26	2.59	1.16	-1.02	-3.03
Error (mmHg)						

Decreasing Pressure	772.94	760.65	748.21	737.18	726.53	714.45
Applied Pressure (mmHg)	770.0	760.0	750.0	740.0	730.0	720.0
UUC* Indication (mmHg)	-2.94	-0.65	-1.79	-2.82	-4.47	-5.56
Error (mmHg)						

The uncertainty of measurement is ± 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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เอกการไม่ควบคุม
Attestation
B 1046546

Certificate No.: 21-AN-052
Request No.: Req-2021-522

Flow Setting		STD Flow Reading		UUC Flow Reading		Correction Plus		Uncertainty	
LPM	LPM	LPM	LPM	LPM	LPM	LPM	LPM	LPM	LPM
0.02		0.02085		0.019		0.00105		0.00065	
0.05		0.05086		0.047		0.00306		0.00092	
0.1		0.1013		0.098		0.0033		0.0019	
0.2		0.2006		0.198		0.0026		0.0011	
0.5		0.5005		0.503		-0.0025		0.008	
1.0		1.002		0.996		0.004		0.013	
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

เอกการไม่ควบคุม

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



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
CORPORATE SERVICES & EQUIPMENT CALIBRATION AND TESTING SERVICES
3344 PATTANAKARN ROAD SOI 18 SUANLUANG, SUANLUANG, BANGKOK 10250
TEL: 0-2717-5006-24 FAX: 0-2716-9484



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
CORPORATE SERVICES & EQUIPMENT CALIBRATION AND TESTING SERVICES
3344 PATTANAKARN ROAD SOI 18 SUANLUANG, SUANLUANG, BANGKOK 10250
TEL: 0-2717-5006-24 FAX: 0-2716-9484

Certificate of Calibration

Certificate No.: 22H768
Page: 1 of 2

Equipment: Dial Thermo-Hygrometer
Manufacturer: Barigo
Model: -
Serial No.: -
ID No.: UAE-ANV/130/2550
Condition As-Received: Used Item
Received Date: 30 March 2022
Calibration Date: 01 April 2022
Reference: 2203-1124WSC
Ambient Temperature: (25 \pm 3) °C
Relative Humidity: (50 \pm 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, Prakhlang, 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	1020327	TH-0063-21	01 Jul 2022

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

3. The certificate 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 Dumvor
Issue Date: 08 April 2022

Approved Signatory: [Signature]
[Signature]
[Signature]
[Signature]

เอกการไม่ควบคุม
B 0285420

Certificate of Calibration

Certificate No.: 21P1156
Page: 1 of 2

Equipment: Aneroid Barometer
Manufacturer: Barigo
Model: 111MS
Serial No.: -
ID No.: UAE-EMA2/060/2552
Condition As-Received: Used Item
Received Date: 29 March 2021
Calibration Date: 31 March 2021
Reference: 2103-118WSC
Ambient Temperature: (23 \pm 2) °C
Relative Humidity: (50 \pm 15) %
Atmospheric Pressure: 1007 mbar

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, Prakhlang, Bangkok 10260

Procedure used: The calibration was conducted by direct comparison method against Pressure Measuring Instruments Standard according to in-house calibration procedure CP-P10, using "DKQ-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-0053-20	05 Apr 2021

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

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

-National Institute of Metrology Thailand (NIMT)

Calibrated by: Sukman Khinaw
Issue Date: 31 March 2021

Approved Signatory: [Signature]
[Signature]
[Signature]
[Signature]

เอกการไม่ควบคุม
B 0256510

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

1. Absolute acoustical sensitivity

UUC Setting	Time				Exposure Measurement		Tolerances	
	Ref	UUC	Ref	UUC	Error	Limit	UUC	Limit
FAST / A 55:140 Calibrator Setting	(s)	(s)	(Pa·h)	(Pa·h)	(%)	(%)	(%)	(%)
1000 Hz 114 dB	120.00	120	3.23	3.20	-0.93	3.0	-21	-26

Note : Absolute sensitivity was established by the use of Sound Calibrator Brand SYANTEK, Model SY SA, SN: 50079

2. Frequency weightings

UUC Setting	Deviation from various Frequency Weighting				Tolerances	
	UNCERTAINTY				Limit	
	A	C	(dB)	(± dB)	(± dB)	
FAST / 55:140 STD Setting	(dB)	(dB)	(dB)	(dB)	(dB)	
125 Hz	-0.3	-0.3	0.40	2.0	2.0	
250 Hz	-0.1	-0.2	0.40	1.5	1.5	
500 Hz	-0.2	-0.3	0.40	1.5	1.5	
1000 Hz	0.0	0.0	0.40	-	-	
2000 Hz	0.0	0.0	0.40	2.0	2.0	
4000 Hz	1.2	1.2	0.40	3.0	3.0	
8000 Hz	-1.4	-1.3	0.40	3.0	3.0	

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the Calibration Laboratory.

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Page: 241

เอกสารไม่ควบคุม

a 1104144

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

3. Linearity of response to steady signals

UUC Setting	FAST / A High				Tolerances	
	UNCERTAINTY				Limit	
	Ref	UUC	Ref	UUC	Error	Limit
1000 Hz	(dB)	(dB)	(Pa·h)	(Pa·h)	(%)	(%)
8000 Hz	(dB)	(dB)	(Pa·h)	(Pa·h)	(%)	(%)
63 Hz	(dB)	(dB)	(Pa·h)	(Pa·h)	(%)	(%)
Tolerances Limit	(dB)	(dB)	(Pa·h)	(Pa·h)	(%)	(%)
UNCERTAINTY	(dB)	(dB)	(Pa·h)	(Pa·h)	(%)	(%)

b. Sound exposure meter linearity of error

UUC Setting	Time				Exposure Measurement		Tolerances	
	UNCERTAINTY				Limit		Limit	
	Ref	UUC	Ref	UUC	Error	Limit	UUC	Limit
FAST / A 55:140 Calibrator Setting	(s)	(s)	(Pa·h)	(Pa·h)	(%)	(%)	(%)	(%)
1000 Hz 110 dB	27	27	0.30	0.30	0.00	0.00	0.00	0.00
1000 Hz 110 dB	45	45	0.50	0.51	-2.00	-2.00	-2.00	-2.00
1000 Hz 110 dB	90	90	1.00	1.01	-1.00	-1.00	-1.00	-1.00
1000 Hz 110 dB	180	180	2.00	2.02	-1.00	-1.00	-1.00	-1.00
1000 Hz 120 dB	36	36	4.00	3.94	-1.50	-1.50	-1.50	-1.50
1000 Hz 120 dB	72	72	8.00	7.87	-1.63	-1.63	-1.63	-1.63
1000 Hz 120 dB	90	90	10.00	9.90	-1.00	-1.00	-1.00	-1.00
1000 Hz 120 dB	180	180	20.00	19.76	-1.20	-1.20	-1.20	-1.20
1000 Hz 120 dB	360	360	40.00	39.42	-1.45	-1.45	-1.45	-1.45
1000 Hz 120 dB	720	720	80.00	78.66	-1.68	-1.68	-1.68	-1.68

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the Calibration Laboratory.

เอกสารไม่ควบคุม

Page: 241

เอกสารไม่ควบคุม

a 1104144

Certificate of Calibration

Customer : UNITED ANALYST AND ENGINEERING CONSULTANT CO., LTD.
Name : 81 Soi Udomsak 41, Sukhumvit Road, Bangchak, Prakan, Bangkok 10260
Address : 81 Soi Udomsak 41, Sukhumvit Road, Bangchak, Prakan, Bangkok 10260
Request No : Req-2022-0331

Unit Under Calibration Details
Measurement item : Noise dosimeter
Manufacturer : SYANTEK
Model : SV104
Serial Number : 91923
ID :
Recall : 0.1 dB
Calibration Environment and Details
Temperature : 23.1 °C ± 1 °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 (P-NIM-01) based on IEC 61251:2017
Location of Calibration : Lab Acoustic

Instrument	Brand	Model	SN	Due calibration	Traceability
Multi-frequency Calibrator	Quest	Quest-cal	188272	14 June 2022	TSR
Standard Microphone	GRAE	40AN	188273	15 September 2022	GRAS
Sine Generator	Sonatek	Sonatek	131	18 October 2022	WK Electric
Tuner	EXTRECH	-	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. Nopphon Laungat
Calibration Officer

Approved By :
Mr. Pait Muthavorn
Calibration Engineer Supervisor
Issue Date : 17 February 2022

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the Calibration Laboratory.

เอกสารไม่ควบคุม

Certificate No	21-ACT-261
Request No	Req-2021-1241

1. Absolute acoustical sensitivity

UUC Setting	Time		Exposure Measurement		UNCERTAINTY (%)	Tolerance Limit (%)
	Ref	UUC	Ref	Error		
	(s)	(s)	($\mu\text{g}/\text{h}$)	(%)		
FAS / A / (0)-0						
Callaniser-String						
1000 Hz / 114 dB	120.06	120	3.23	3.20	-0.93	3.0
						-21, +26

Note: Absolute sensitivity was established by the use of Sound Calibrator Brand SV 33A, SN. 58079

2. Frequency weightings

UUC Setting	Deviation from various			UNCERTAINTY (\pm dB)	Tolerance Limit (\pm dB)
	Frequency Weighting				
	A	C	(dB)		
FAST 60-140					
STD Setting	(dB)	(dB)	(dB)		
+63 Hz	-1.0	-1.0	0.40	2.0	
125 Hz	-0.4	-0.3	0.40	1.5	
250 Hz	-0.1	-0.1	0.40	1.5	
500 Hz	-0.1	0.0	0.40	1.5	
1000 Hz	0.0	0.0	0.40	-	
2000 Hz	0.0	0.1	0.40	2.0	
4000 Hz	-0.8	-0.8	0.40	3.0	
8000 Hz	-2.1	-2.1	0.40	5.0	

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Certificate No	:	21-ACT-361
Request No	:	Req-2021-1241

3. Linearity of response to steady signals

3. Linearity of response to steady signals

ULC Setting		PAST / A High									
1000 Hz	Ref	(dB)	62.0	86.0	90.0	100.0	110.0	114.0	120.0	130.0	140.0
	Level A	(dB)	69.6	80.3	90.2	100.1	110.0	114.0	120.0	130.0	140.0
	Error	(dB)	7.6	0.3	0.2	0.2	0.0	0.6	0.0	0.0	0.0
8000 Hz	Ref	(dB)									
	Level A	(dB)	86.9	98.9	108.9	112.9	118.9	126.9	138.9		
	Error	(dB)				0.2	0.0	0.6	0.0	-0.1	-0.1
63 Hz	Ref	(dB)									
	Level A	(dB)						87.2	93.8	102.8	113.8
	Error	(dB)						87.6	93.8	100.0	113.0
Tolerances Limit		(dB)						0.0	0.0	0.0	0.0
UNCERTAINTY		(±dB)	1.0								
			0.37								

b. Sound exposure meter linearity of error

UUC Setting		Time		Exposure Measurement			UNCERTAINTY	Tolerance Limit
		Ref	UUC	Ref	UUC	Error	(%)	(%)
FAST / A / 00-140	Calibrate/Setting		(s)		($\mu\text{W h}$)	(%)		
	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	0.99	-1.00	4.3	
	1000 Hz 110 dB	180	180	2.00	1.98	-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		
	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			

The results related only to the item affirmed. The certificate shall not be reproduced except in full, without written approval of the issuing authority.

เอกสารนี้มีความลับ

เอกสารนี้เป็นเอกสารลับของกองทัพอากาศ
ห้ามเผยแพร่โดยไม่ได้รับอนุญาต

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 (Pa h)	Tolerances Limit
	Ref	UUC	Ref	UUC		
FAST / A 255-40	(s)	(s)	(Pa h)	(Pa h)	(Pa h)	(Pa h)
Callister-String						
4000 II-97. dB	2346	2346	0.00	0.99	-0.01	-0.29 to -0.41

b. Sound exposure meter response for series of toneburst impulses

UUC Sealing	Time		Exposure Measurement			UNCERTAINTY (%)	Tolerances Limit
	Ref (s)	UUC (s)	Ref (Pa·h)	UUC (Pa·h)	Error (%)		
FAST / A: 35-40 Calibration Sealing							
Sheet 1 ms, 95 d3	23466	23466	1.00	0.99	-1.00	-21 ± +26	-21 ± +41
Sheet 1 ms, 100 d3	900	900	1.00	1.00	0.00	-21 ± +26	-21 ± +41
Sheet 1 ms, 105 d3	943	943	1.00	1.00	0.00	-21 ± +26	-21 ± +41

5. Response to unipolar pulse

UUC Setting	Time UUC	Exposure Measurement		UNCERTAINTY (%)	Tolerance Limit (%)
		UUC (Pa h)	Different (%)		
FAST / A / 55-140	(a)				
Calibrator Setting					
Continuous Recycle +			10.66		
Continuous Recycle -	7		10.66	2.4	-21 + +26

* Indicates non accredited

End of Certificate

The results related only to the dam calibration. The certificate shall not be reproduced except in full, without written approval of the issuing authority.

Certificate of Calibration

Customer	UNITED ANALYST AND ENGINEERING CONSULTANT CO.,LTD.	Certificate No : 21-ACT-361
Name	81 Soi Udomsak 41, Sakharavit Road, Bangnahe, Prachinburi, Bangkok 10260	Footwall No : Rep-2021-1241
Address		

Unit Under Calibration Details

Measurement Item	: Noise dosimeter
Manufacturer	: SVANTEK
Model	: SV 0415
Serial Number	: 67027
ID	: GAEFPM104-2561
Resolution	: 0.1 dB
Microphone Class	: 2
Microphone Model	: SV 2715
Microphone SN	: 68647
Preamplifier Model	-
Preamplifier SN	-
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	: 10 September 2021
Calibrated Date	: 20 September 2021

Calibration Procedure

Location of Calibration : Lab Acoustic				
Reference Standard				
Instrument	Brand	Model	S/N	Date calibration
Multi-frequency Calibrator	Qnet	Qnet-cal	188272	14 June 2022
Standard Microphone	GRAS	40AN	188273	29 October 2021
Sine Generator	Swanflac	Swanflac	131	20 September 2021
Timer	EXTRECH	-	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 : me

me
Mr. Noppadon Luangart
Calibration Officer

Approved By :

Approval By : Mr. Paat Mathayom
Calibration Engineer Supervisor
Issue Date : 20 September 2021

The results in table only in the item affirmed. The certificate shall not be reproduced except in full, without written approval of the Department of Education, Ltd.

เอกสารแนบควบคุม

The results related only to the item collected. The certificate shall not be reproduced except in full, without written approval of the publisher. 0000 01 007 19

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 :

Instrument	Model	Serial No.	Cert. No.	Due Date
Waveform Generator	33210A	MY48017076	EF-0012-21	10-Feb-22
Waveform Generator	33511B	MY52302742	EF-0011-21	10-Feb-22
Digital Multimeter	33461A	MY53220104	EEL-BP_050264	10-Feb-22
Digital Multimeter	33461A	MY53220076	EEL-BP_030264	08-Feb-22
Digital Multimeter	34461A	MY60024273	1-15180725251-1	15-Sep-22
Programmable Attenuator	MAT-1070	62100114	1500-0774E	08-Mar-22
Condenser Microphone	4180	2977900	AA-1008-21	05-Feb-22
Measuring Amplifier	NA-42KA1	34560495	AA-3003-21	16-Feb-22

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

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

4. Response to short duration
a. Response for sinusoidal signals - reference level

UUC Setting	Time	Ref (Pa _{rms})	UUC (Pa _{rms})	Error (Pa _{rms})	UNCERTAINTY (Pa _{rms})	Tolerances Limit (%)
FAST / A / 60-140						
Calibrator Setting						
4000 Hz 95 dB	2446	2946	1.00	0.99	-0.01	0.01

b. Sound exposure meter response for series of toneburst impulses

UUC Setting	Time	Ref (Pa _{rms})	UUC (Pa _{rms})	Error (Pa _{rms})	UNCERTAINTY (Pa _{rms})	Tolerances Limit (%)
FAST / A / 60-140						
Calibrator Setting						
Burst 1 ms, 95 dB	2846	2846	1.00	0.99	-1.00	-21 to +26
Burst 1 ms, 100 dB	900	900	1.00	0.99	-1.00	-21 to +41
Burst 1 ms, 106 dB	143	143	1.00	0.99	-1.00	-21 to +41

5. Response to unipolar pulse

UUC Setting	Time	Ref (Pa _{rms})	UUC (Pa _{rms})	Different (%)	UNCERTAINTY (%)	Tolerances Limit (%)
FAST / A / 60-140						
Calibrator Setting						
Continuous Rectangle 1			10.61			
Continuous Rectangle 2	7		10.61	0.00	2.4	-21 to +26

End of Certificate

The results indicated only to the item calibrated. This certificate shall not be reproduced except in full, without written approval of the Laboratory.
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Calibration Certificate

Equipment : SOUND LEVEL METER
Manufacturer : RION
Model : NI-42 Microphone UC-52 / Preamplifier NH-24
Serial No.: 00609500 / 189689 / 01126
ID No.:

Condition As Found : GOOD

Customer : UNITED ANALYST AND ENGINEERING CONSULTANT (UAE)
81 SOI UDOMSIK 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 : Nithakorn 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.

Continuation of Calibration Certificate

Cert. No. : ACL22072
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	132.9	-0.1	± 1.1
132.0	131.9	-0.1	± 1.1
131.0	131.0	0.0	± 1.1
129.0	129.0	0.0	± 1.1
124.0	124.0	0.0	± 1.1
119.0	119.0	0.0	± 1.1
114.0	114.0	0.0	± 1.1
109.0	109.0	0.0	± 1.1
104.0	104.0	0.0	± 1.1
99.0	99.0	0.0	± 1.1
94.0	94.0	0.0	± 1.1
89.0	89.0	0.0	± 1.1
84.0	84.0	0.0	± 1.1
79.0	79.0	0.0	± 1.1
74.0	74.0	0.0	± 1.1
69.0	69.0	0.0	± 1.1
64.0	64.0	0.0	± 1.1
59.0	59.0	0.0	± 1.1
54.0	54.0	0.0	± 1.1
49.0	49.0	0.0	± 1.1
44.0	44.0	0.0	± 1.1
39.0	39.0	0.0	± 1.1
34.0	34.1	0.1	± 1.1
30.0	30.1	0.1	± 1.1
29.0	29.1	0.1	± 1.1
28.0	28.2	0.2	± 1.1
27.0	27.2	0.2	± 1.1
26.0	26.3	0.3	± 1.1
25.0	25.3	0.3	± 1.1

QF-TS12-04-04-020664

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Continuation of Calibration Certificate

Cert. No. : ACL22072
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, T _b (ms)	Cycle	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Fast	0.25	1	108.0	107.9	-0.1	1.5 ; -5.0
	2	8	117.0	117.0	0.0	1.0 ; -2.5
Slow	200	800	134.0	134.0	0.0	±1.0
	2	8	108.0	108.0	0.0	1.5 ; -5.0
SEL	0.25	1	99.0	98.9	-0.1	1.5 ; -5.0
	2	8	108.0	108.0	0.0	1.0 ; -2.5
	200	800	128.0	128.0	0.0	±1.0

10. Peak C sound level

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

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

QF-TS12-04-04-020664

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Continuation of Calibration Certificate

Cert. No. : ACL22072
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)
17.6

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

Frequency Weighting	Measured value (dB)
A - weight	14.4
C - weight	20.5
Flat	26.5

3. Acoustical signal tests of frequency weightings

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

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

QF-TS12-04-04-020664

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T. Petch-

Continuation of Calibration Certificate

Cert. No. : ACL22072
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
63	0.0	-0.1	-0.1
125	0.0	0.0	0.0
250	0.0	0.0	-0.1
500	0.0	0.0	-0.1
1000	0.0	0.0	0.0
2000	0.0	0.0	0.0
4000	0.0	0.0	0.0
8000	0.0	0.1	0.1
			Acceptance Limits
			±2.0
			±1.5
			±1.5
			±1.0
			±2.0
			±3.0
			±5.0

5. Frequency and time weightings at 1 kHz

5.1 Frequency weightings at 1 kHz

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

5.2 Time weighting at 1 kHz

Frequency Weighting	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Fast	94.0	0.0	-
Slow	94.0	0.0	±0.1
1eq	94.0	0.0	±0.1

6. Long - term stability

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

QF-TS12-04-04-020664

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T. Petch-

Calibration Note
UUC Adjustment : Zero adjustment before use.

Certificate No : 21-LXM-154
Request No : Req-2021-1418
Page : 2/2

Result of Calibration :

UUC Range (Hz)	Standard (Hz)	UUC Reading (Hz)	Correction (Hz)	Uncertainty (± Hz)
2000	0	0	0	0.5%
	50	49	1	
	100	99	1	
	200	199	1	
	300	299	1	
	400	398	2	
	600	601	-1	
	800	799	1	
	1000	1001	-3	
	1200	1206	-6	
20000	1400	1402	-2	2.3 % of Reading
	1600	1597	3	
	1800	1793	7	
	2000	1987	13	
	3000	2980	20	
	4000	3970	30	
	5000	4970	30	

End of Certificate

Calibrated By :  Mr. Noppakorn Lamsang

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11. Overload indication

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

12. High level stability

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

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

End of Calibration Certificate

QF-TS12-04-04-020664

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T. Petch-

INNOVATIVE INSTRUMENT CALIBRATION LAB
INNOVATIVE INSTRUMENT CO., LTD. HEAD OFFICE
7139 MOO 13, SOI SINTINAKORN 11 TAMBON BANG KAEU,
AMPHOE BANG PHU SAMUT PRAKAN PROVINCE 10640 THAILAND
TEL: 06052116-5806-1 FAX: 06052116-7140



Certificate of Calibration

Customer : UNITED ANALYST AND ENGINEERING CONSULTANT CO.,LTD.
Name : 81 Soi Uthornak 41, Sukhumvit Road, Banglank, Pratuang,
Address : Bangkok 10260

Certificate No : 21-LXM-154
Request No : Req-2021-1418
Page : 1/2

Unit Under Calibration Details

Instrument Name : Digital Lux Meter
Manufacturer : EXTECH
Model : 407026
Serial Number : A016905
Resolution : 1 lx
ID Number : UAE.EFM.018.2559

Range Calibration : 2000 , 20000 lx
Instrument Status : Used

Calibration Environment and Details

Temperature : 25 °C ± 2 °C
Humidity : 60 %RH ± 20 %RH
Received Date : 29 October, 2021
Calibrated Date : 12 November, 2021

Calibration Procedure : The measurement was done in accordance with CP-LXM-01

Reference Standard : Photometer and Illuminance Sensor, Serial No.: 306652, 306922, which was calibrated on 26 October 2021,
Certificate No.: TP-1026-21

Traceability : This Certificate is traceable to International System of Unit (SI) Unit through National Institute of
Metrology (Thailand)

Note

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

Approved By :

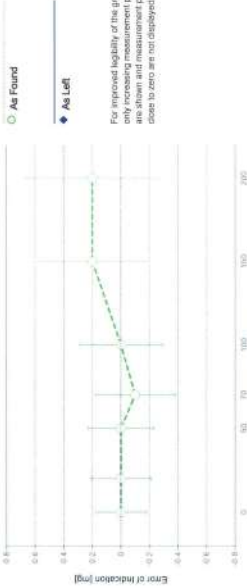
Mr. Paet Mahasom
Calibration Engineer Supervisor
12 November, 2021

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ISO 9001:2015 & ISO 17025:2017

Error of Indication

As Found	Reference Value	Indication	Error of Indication	Expanded Uncertainty	k
1	0.0000 g	0.0000 g	0.0000 g	0.16 mg	2
2	0.0000 g	0.1000 g	0.0000 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	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	150.0000 g	0.0000 g	0.43 mg	2
11	200.0001 g	200.0000 g	0.0000 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 cp-18. The value of the measurement 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.: W560
Certificate Number: C203581631
Date of Issue: 23-Feb-2022
Calibration Due Date: 14-Aug-2023

Thermo Hygrometer

Equipment No.: IN161
Certificate Number: 21H1220
Date of Issue: 14-Jun-2021
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 Filler 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.

Mettler-Toledo (Thailand) Ltd.

84164 - 84055 Lasilae Rd., Bangnae 1a Sub-District

Bangna District, Bangkok 10260

+66 2723 0352

MT-TH.ServiceSupport@mt.com

Accuracy Calibration Certificate

Customer

Company: United Analyst and Engineering Consultant Co., Ltd.
Address: 3 Soi Udon Suk 41, Sathurwiri Rd., Bang Chak
City: Phra Prachin
Zip / Postal: 10260
State / Province: Bangkok
Order Number:
Contact: Suwit Chotirok

Weighing Device

Manufacturer: Mettler Toledo
Model: AB204-S
Serial No.: 1128312528
Building: N/A
Floor: 2
Room: Balance Room 2 (018)
Instrument Type: Asset Number: UAE-AUR-F192500
Terminal Model: N/A
Terminal Serial No.: N/A
Terminal Asset No.: N/A

Range	Max. Capacity	Repeatability (g)
1	220 g	0.0001 g

Procedure

Calibration Guideline:

EURAMET cp-18 v.4.0 (11/2015)

METTLER TOLEDO Work Instruction:

CPFA002020

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 cp-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	Start: 22.5 °C	End: 21.4 °C	Start: 56.1 %	End: 63.2 %
Temperature	Humidity			

As Found Calibration Date: 07-Apr-2022

As Left Calibration Date: N/A

Issue Date: 08-Apr-2022

Approved Signatory: Srinet Chumchan

Signature: Katsakorn Tassanachatsakul

Signature: Sant Jinyong

Signature: Surasak Subsom

Remarks

Equipment condition: Good

Next calibration according to customer's procedure

Calibration data not decide by calibration laboratory

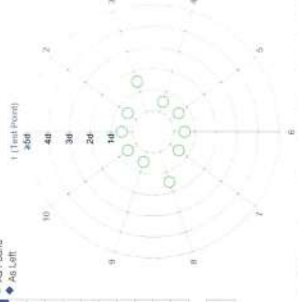
*Test weight by Filler pan: 1 g = 0.9999 g, 3 g = 3.0000 g, 5 g = 5.0000 g

End of Accredited Section

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

Test Load: 100 g

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



Certificate of System Qualification

GC-OQ + GCMS-OQ

System ID:	CN10821123
Organization Name:	UAE Consultant Co., Ltd.
Organization Location:	3 Soi Udomsuk 41, Sukhumvit Rd., Bangkok, Prakanong, Bangkok 10260
Date:	February 25, 2021 1:07:31 PM
EOP Name:	AgilentRecommended, AgilentRecommended
EOP Revision:	GC 02.51, GCMS 02.51
Overall Qualification Status:	Pass

System Inspection and Basic Safety and Operation

Name:	7890
Setpoint Status:	Pass

Overall System Inspection and Basic Safety and Operation Test Status

Pass

Inlet Pressure Accuracy

Name:	7890
Front:	SSL
Setpoint Status:	Pass
Inlet Pressure:	25.0 psi
Accuracy:	25.2 psi
Agilent Recommended:	0.2 psi

Overall Inlet Pressure Accuracy Test Status

Pass

GC Oven Temperature Accuracy

Name:	7890
-------	------

Date:	February 25, 2021 1:07:31 PM
System ID:	CN10821123

Page 1 / 14

เอกสารไม่ควบคุม

Setpoint Status:	Pass
Zone:	Oven
Temperature:	230.0
Accuracy:	231.6 °C
Agilent Recommended:	1.6 °C

Setpoint Status:	Pass
Zone:	Oven
Temperature:	100.0
Accuracy:	101.4 °C
Agilent Recommended:	1.4 °C

Overall GC Oven Temperature Accuracy Test Status

Pass

GC Oven Temperature Stability

Name:	7890
Setpoint Status:	Pass
Temperature:	100.0
Stability:	101.4 °C
Agilent Recommended:	0.0 °C

Overall GC Oven Temperature Stability Test Status

Pass

Log Amp

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

Date:	February 25, 2021 1:07:31 PM
System ID:	CN10821123

Page 2 / 14

เอกสารไม่ควบคุม

Calibration Report

Certificate No.:	2102572-001-01
Equipment:	Electronic Balance
Model:	A2004-SFACT
Serial No.:	810815868
Capacity:	220 g
Manufacturer:	METTLER TOLEDO
Resolution:	0.0001 g
ID No.:	UAE.AIR.016/2555

Date of Calibration: 26 Jan 2021

Environment Condition: Ambient Temperature: 22.0 ± 0.2 °C Relative Humidity: 48 ± 2 %

Place of Calibration: Balance Room (30), UNITED ANALYST AND ENGINEERING CONSULTANT CO., LTD.

Condition of Equipment: Good Condition

Condition of This Results of Calibration:

- Calibration Method: NFI Method M-194-001 In-house Method Based on JIS S 4014 Calibration of Weighing Machines : 2006
- Reference Standard: Model Serial No. Calibrated By Certificate No. Due Date
Standard Weight Class E2 1-502mg 15860 TCS M20115955 28 November 2021
Standard Weight Class E2 1-500g 15862 TCS M20115965 28 November 2021
Instrument Model Serial No. Calibrated By Certificate No. Due Date
Thermo-Hygro Meter PCWFE 430 METTEI RN418 Quality Record QP21-5000 15 February 2022
- This certificate is traceable to SI UNIT
- This certificate is issued only for the instrument we calibrated.
- This result of calibration was found accurate as shown on date and place of calibration only.

Calibration Results: (Calibration with filter pan)

1. Repeatability of Reading:

Nominal Value (g)	Standard Deviation of Reading (g)
10	0.0000
20	0.0000

2. Off-Center Error:

A mass of 5 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)
5.0000	5.0002	5.0001	5.0001	5.0000	5.0002	0.0002

FC-012 Revision: 00 Date: 14-12-61

เอกสารไม่ควบคุม

Calibration Report

Certificate No.:	2102572-001-01
Equipment:	Electronic Balance
Model:	A2004-SFACT
Serial No.:	810815868
Capacity:	220 g
Manufacturer:	METTLER TOLEDO
Resolution:	0.0001 g
ID No.:	UAE.AIR.016/2555

Date of Calibration: 26 Jan 2021

Calibration Results: (Continued)

Calibration Range: 0 - 200 g

Calibration Adjustment: Internal Calibration

3. Departure from Nominal Value: (Calibration with filter pan)

Nominal Value (g)	Standard Value (g)	Average Reading (g)	Correction (g)	Uncertainty (± g)	Coverage Factor k
Unloaded	0.00000	0.0000	0.0000	0.000002	2.00
0.01	0.01000	0.0100	0.0000	0.000002	2.00
0.05	0.05000	0.0500	0.0000	0.000002	2.00
0.1	0.10000	0.1000	0.0000	0.000002	2.00
0.5	0.49999	0.5000	0.0000	0.000003	2.00
1	0.99999	1.0000	0.0000	0.000006	2.00
2	1.99999	2.0000	0.0000	0.000004	2.00
3	2.99998	3.0000	0.0000	0.000007	2.00
4	3.99999	4.0000	0.0000	0.000005	2.00
5	4.99998	5.0000	0.0000	0.000004	2.00
10	10.00003	10.0000	0.0000	0.000011	2.00
15	15.00001	15.0000	0.0000	0.000012	2.00
20	20.00004	20.0000	0.0000	0.000013	2.00

Date:	February 25, 2021 1:07:31 PM
System ID:	CN10821123

Page 2 / 14

เอกสารไม่ควบคุม

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 %.

FC-012 Revision: 00 Date: 14-12-61

----- End -----

เอกสารไม่ควบคุม

Instrument Details

Purpose

This section describes the as found system configuration.

Details

System	System ID	CN10821123
Manufacturer	Manufacturer	Agilent Technologies
Name	7890	
Flow Data Input	Manual Data	
Temperature Data Input	Manual Data or Other Data Logging	
Tested Combination1		
Injection Technique	Manual Injection	
Inlet	Front	
Detector	External	
LTM Included?	No	
Sampler 1		
Manufacturer	Agilent Technologies	
Type	Manual Injection	
Usage	Sample Injection	
Syringe Volume (µL)	10	
Manifrance 1		
Manufacturer	Agilent Technologies	
Name	7890	
Model Number	G3440A	
Serial Number	CN10821123	
Firmware Revision	A.01.06	
Oven Type	Standard	

Date: February 25, 2021 1:07:31 PM
System ID: CN10821123

เอกสารไม่ควบคุม

เอกสารไม่ควบคุม

Inlet 1	Manufacturer	Agilent Technologies
Name	7890	
Type	SSL	
Location	Front	
Carrier Gas	Helium	
Control Type	Electronic Pressure Control (EPC)	
Purged Inlet	Yes	

Inlet 2	Manufacturer	Agilent Technologies
Name	7890	
Type	SSL	
Location	Back	
Carrier Gas	Helium	
Control Type	Electronic Pressure Control (EPC)	
Purged Inlet	Yes	

Detector 1	Manufacturer	Agilent Technologies
Name	Mass Spectrometer	
Type	Mass Spectrometer	
Location	External	

Mass Spectrometer 1	Manufacturer	Agilent Technologies
Type	SQ	
Name	5975C Inert XL with TAD	
Serial Number	USB1539509	
Firmware Revision	5.02.04	
High Vacuum System	Turbo Pump	
Scouting Run Standard	OFN Std	

Date: February 25, 2021 1:07:31 PM
System ID: CN10821123

เอกสารไม่ควบคุม

Overall Log Amp Test Status

Pass

RIPA

Tested Combination1	Front	SSL	/	External	SQ
Name:	5975C Inert XL with TAD				
Setpoint Status:	Pass				
Amc:	1050	m/z	Diff After Five Minutes:		
Agilent Recommended:	>=	-100	and	<=	100
		29	mV		516
					1100
					mV

Overall RIPA Test Status

Pass

Tune EI

Tested Combination1	Front	SSL	/	External	SQ
Name:	5975C Inert XL with TAD				
Setpoint Status:	Pass				
Filament:	1				
Setpoint Status:	Pass				
Filament:	2				
Overall Tune EI Test Status	<div>Pass</div>				
Signal to Noise EI					
Tested Combination1	Front	SSL	/	External	SQ
Name:	5975C Inert XL with TAD				

Date: February 25, 2021 1:07:31 PM
System ID: CN10821123

Source:	EI - Inert	Filament:	1
Setpoint Status:	Pass		
Signal to Noise:	376		
Agilent Recommended:	>=	320	
Source:	EI - Inert	Filament:	2
Setpoint Status:	Pass		
Signal to Noise:	570		
Agilent Recommended:	>=	320	

Overall Signal to Noise EI Test Status

Pass

Date: February 25, 2021 1:07:31 PM
System ID: CN10821123

เอกสารไม่ควบคุม

System id: CHN0811123
Print Date: February 26, 2021 1:07:34 PM

User Name: suparak.nimsongtham
Hostname: SCG7921277

UAE_HWOQ Transaction log :

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
February 25, 2021 10:54:42 AM	Audit	Session Created	Session	None
February 25, 2021 10:54:42 AM	Start	Configuration	Session	None
February 25, 2021 10:54:42 AM	Audit	Enrollment	Licensing	User is HelpEngineer and does not require an unlock code
February 25, 2021 10:57:29 AM	Audit	Exp-loaded	Session	EDP details for primary technique [3d]

Page 116

Date: February 25, 2021 1:07:31 PM
System ID: CN10321123

Page 9 / 14

เอกสารไม่ควบคุม

Date: February 25, 2021 1:07:31 PM
System ID: CN10821123

Page 7 / 14

เอกสารไม่ควบคุม

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User Name: supasak.nimsongtham
 Hostname: SCG70212Y7
 UAE_HWOQ Transaction log :

System Id: CN10821123
Print Date: February 25, 2021 1:07:34 PM

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
February 25, 2021 10:58:05 AM	Start Execution		Signal to Noise BI - Liquid Injection, Front SBL, S2 - Plasmant 1, L = 1-320	None
February 25, 2021 11:00:45 AM	Start Execution		Signal to Noise BI - Liquid Injection, Front SBL, S2 - Plasmant 1, L = 1-320	None
February 25, 2021 11:00:52 AM	Start Execution		System Inspection and Basic Safety and Operation - 7890 - Qualitative Test - No septums associated	None
February 25, 2021 11:01:08 AM	End Execution		System Inspection and Basic Safety and Operation - 7890 - Qualitative Test - No septums associated	Run Count : 1
February 25, 2021 11:01:22 AM	Start Execution		Initial Pressure Accuracy - Front SBL - Pressure Controlled Inlet - S, 2.0 PSI - L, 1-1.2 PSI	None
February 25, 2021 11:02:43 AM	End Execution		Initial Pressure Accuracy - Front SBL - Pressure Controlled Inlet - S, 2.0 PSI - L, 1-1.2 PSI	Run Count : 1
February 25, 2021 11:02:46 AM	Start Execution		GC Oven Temperature Accuracy - 1960 - Temperature Check - S, 220°C - L, 1-1.0 AND $\pm 1.0\%$ report in K	None
February 25, 2021 11:03:31 AM	Start Execution		GC Oven Temperature Accuracy - 1960 - Temperature Check - S, 220°C - L, 1-1.0 AND $\pm 1.0\%$ report in K	Manual Data Entry
February 25, 2021 11:03:32 AM	End Execution		GC Oven Temperature Accuracy - 1960 - Temperature Check - S, 220°C - L, 1-1.0 AND $\pm 1.0\%$ report in K	Run Count : 1

Page 2 / 6

Date: February 25, 2021 1:07:31 PM
System ID: CN10821123

February 25, 2013
CN10821123

Page 10 / 14

เอกสารไม่ควบคุม

Date: February 25, 2021 1:07:31 PM
System ID: CN10821123

February 25,
CN10821123

Page 8 / 14

เอกสารไม่ควบคุม

User Name: supasak.jimsongtham Hostname: SC0782177		System ID: CN10821123 Print Date: February 25, 2021 1:07:34 PM	
UAE_HWOOD Transaction log :			
Time	Transaction State	Activity Performed	Optional Information
February 25, 2021 12:31:33	End	Execution	Run Count : 1
TAD SQ - Source: EI - Inert Flammet 2 (Qualitative - No separate associated)			
February 25, 2021 12:32:22	Start	Execution	None
Signal to Noise EI - Liquid Injection, Front SSL, SQ - Source: EI - Inert using Flammet 1 - L vs 320			
February 25, 2021 12:33:07	Start	Execution	None
Signal to Noise EI - Liquid Injection, Front SSL, SQ - Source: EI - Inert using Flammet 1 - L vs 320			
February 25, 2021 12:33:59	Audit	Data	Data File Path : E:\PMO\2021\TESTS\N02L DATA\MS
February 25, 2021 12:34:09	End	Execution	Run Count : 1
Signal to Noise EI - Liquid Injection, Front SSL, SQ - Source: EI - Inert using Flammet 1 - L vs 320			
February 25, 2021 12:34:10	Start	Execution	None
Signal to Noise EI - Liquid Injection, Front SSL, SQ - Source: EI - Inert using Flammet 2 - L vs 320			
February 25, 2021 12:35:41	Audit	Data	Data File Path : E:\PMO\2021\TESTS\N02L DATA\MS
February 25, 2021 12:36:14	Audit	Data	Data File Path : E:\PMO\2021\TESTS\N02L DATA\MS

เอกสารไม่ควบคุม

User Name: supasak.jimsongtham Hostname: SC0782177		System ID: CN10821123 Print Date: February 25, 2021 1:07:34 PM	
UAE_HWOOD Transaction log :			
Time	Transaction State	Activity Performed	Optional Information
February 25, 2021 11:33:33	Start	Execution	None
GC Oven Temperature Accuracy: -196K - Temperature : Oven - S: 100.0°C - L vs -1.0 AND <= 1.0 % support in K			
February 25, 2021 11:33:43	Start	Execution	None
GC Oven Temperature Accuracy: -196K - Temperature : Oven - S: 100.0°C - L vs -1.0 AND <= 1.0 % support in K			
February 25, 2021 11:34:03	Audit	Data	Manual Data Entry
GC Oven Temperature Accuracy: -196K - Temperature : Oven - S: 100.0°C - L vs -1.0 AND <= 1.0 % support in K			
February 25, 2021 11:34:05	End	Execution	Run Count : 1
GC Oven Temperature Accuracy: -196K - Temperature : Oven - S: 100.0°C - L vs -1.0 AND <= 1.0 % support in K			
February 25, 2021 11:34:07	Start	Execution	None
GC Oven Temperature Stability -196K - Temperature, Oven - S: 100.0°C - L vs 0.0°C			
February 25, 2021 11:35:19	Audit	Data	Manual Data Entry
GC Oven Temperature Stability -196K - Temperature, Oven - S: 100.0°C - L vs 0.0°C			
February 25, 2021 11:35:20	End	Execution	Run Count : 1
GC Oven Temperature Stability -196K - Temperature, Oven - S: 100.0°C - L vs 0.0°C			
February 25, 2021 11:35:24	Start	Execution	None
Liq Amp - 9975C Inert XL with TAD SQ - Source: EI - Inert			
February 25, 2021 11:35:07	End	Execution	Run Count : 1
Liq Amp - 9975C Inert XL with TAD SQ - Source: EI - Inert			
February 25, 2021 11:35:34	Start	Execution	None
9979A - 9975C Inert XL with TAD SQ - Source: EI - Inert			

เอกสารไม่ควบคุม

User Name: supasak.jimsongtham Hostname: SC0782177		System ID: CN10821123 Print Date: February 25, 2021 1:07:34 PM	
UAE_HWOOD Transaction log :			
Time	Transaction State	Activity Performed	Optional Information
February 25, 2021 12:56:21	Start	Execution	Signal to Noise EI - Liquid Injection, Front SSL, SQ - Source: EI - Inert using Flammet 2 - L vs 320
February 25, 2021 12:56:27	Start	Execution	Signal to Noise EI - Liquid Injection, Front SSL, SQ - Source: EI - Inert using Flammet 2 - L vs 320
February 25, 2021 12:57:17	Audit	Data	Data File Path : E:\PMO\2021\TESTS\N02L DATA\MS
February 25, 2021 12:57:25	End	Execution	Run Count : 1
February 25, 2021 12:57:29	End	Qualification	OQ
February 25, 2021 12:57:29	Start	Reporting	None
February 25, 2021 1:08:34	Audit	Reporting	Report Generated : Certificate
February 25, 2021 1:08:34	Audit	Reporting	Report Generated : Certificate

เอกสารไม่ควบคุม

User Name: supasak.jimsongtham Hostname: SC0782177		System ID: CN10821123 Print Date: February 25, 2021 1:07:34 PM	
UAE_HWOOD Transaction log :			
Time	Transaction State	Activity Performed	Optional Information
February 25, 2021 11:09:08	Start	Execution	Time EI - 9975C Inert XL with TAD SQ - Source: EI - Inert Flammet 1 (Qualitative - No separate associated)
February 25, 2021 11:39:09	Start	Execution	9979A - 9975C Inert XL with TAD SQ - Source: EI - Inert
February 25, 2021 11:39:20	Audit	AutoClosed	Session
February 25, 2021 12:48:44	Audit	AutoRestarted	Session
February 25, 2021 12:49:19	Audit	SessionResumed	Session
February 25, 2021 12:49:19	Start	Qualification	OQ
February 25, 2021 12:49:19	Start	Execution	9979A - 9975C Inert XL with TAD SQ - Source: EI - Inert
February 25, 2021 12:49:19	Start	Execution	9979A - 9975C Inert XL with TAD SQ - Source: EI - Inert
February 25, 2021 12:50:16	Start	Execution	Time EI - 9975C Inert XL with TAD SQ - Source: EI - Inert Flammet 1 (Qualitative - No separate associated)
February 25, 2021 12:50:51	End	Execution	Run Count : 1
February 25, 2021 12:50:51	End	Execution	Time EI - 9975C Inert XL with TAD SQ - Source: EI - Inert Flammet 2 (Qualitative - No separate associated)

เอกสารไม่ควบคุม

REPORT OF CALIBRATION

Certificate No. : SP21-015

Page 4 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	0.0042	2.00
	0.5791	0.5767	0.0024	0.0042	2.00
	1.0488	1.0444	0.0044	0.0042	2.00
440	2.1914	2.1841	0.0073	0.0092	2.00
	0.0000	0.0001	-0.0001	0.0042	2.00
	0.5618	0.5609	0.0009	0.0042	2.00
465	1.0260	1.0244	0.0016	0.0042	2.00
	2.1259	2.1192	0.0067	0.0091	2.00
	0.0000	0.0000	0.0000	0.0042	2.00
546.1	0.5240	0.5212	0.0028	0.0042	2.00
	0.9639	0.9632	0.0007	0.0042	2.00
	1.9788	1.9717	0.0071	0.0091	2.00
590	0.0000	-0.0001	0.0001	0.0042	2.00
	0.5194	0.5184	0.0010	0.0042	2.00
	0.9991	0.9991	0.0000	0.0042	2.00
635	1.9970	1.9911	0.0059	0.0093	2.00
	0.0000	0.0000	0.0000	0.0042	2.00
	0.5523	0.5517	0.0006	0.0042	2.00
635	1.0810	1.0802	0.0008	0.0042	2.00
	2.0369	2.0293	0.0076	0.0092	2.00
	0.0000	-0.0001	0.0001	0.0042	2.00
635	0.5596	0.5593	0.0003	0.0042	2.00
	1.0513	1.0505	0.0008	0.0042	2.00
	1.9268	1.9217	0.0051	0.0092	2.00

PM-510-02 RB3 11/03/20

เอกสารไม่ควบคุม

REPORT OF CALIBRATION

Certificate No. : SP21-015

Page 5 of 5

Photometric Accuracy :

Wavelength (nm.)	CRMs Values (Abs)	UUC Reading (Abs)	Correction (Abs)	Uncertainty (Abs)	Coverage factor k
235	0.0000	0.0001	-0.0001	0.0075	2.00
	0.7498	0.7438	0.0060	0.0075	2.00
257	0.0000	0.0000	0.0000	0.0075	2.00
	0.8712	0.8647	0.0065	0.0075	2.00
313	0.0000	0.0000	0.0000	0.0075	2.00
	0.2920	0.2900	0.0020	0.0075	2.00
350	0.0000	0.0000	0.0000	0.0075	2.00
	0.6459	0.6428	0.0031	0.0075	2.00

Remark : - UUC = Unit Under Calibration

--N/A = Not Available

--The result expanded uncertainty of measurement (U) is stated at the standard uncertainty of measurement multiplied by the coverage factor k,
which for a normal distribution corresponds to a coverage probability of approximately 95%.

- End of Certificate -

PM-510-02 RB3 11/03/20

เอกสารไม่ควบคุม

REPORT OF CALIBRATION

Certificate No. : SP21-015

Page 2 of 5

Environment Condition : Ambient Temperature 25 ± 5 °C

Relative humidity 50 ± 15 %RH

Calibration method : 1h-house method CP-01 Calibration of UV-Vis Spectrophotometer Based on ASTM E275-08

Certified Reference Materials :

Material	Serial No.	Certificate No.	Due date
Absorbance Standard set	25760	80102	11/7/2021
Absorbance Standard set	25757	80105	11/7/2021
Wavelength Standard set	25806	80103	11/7/2021
Wavelength Standard set	25758	80104	11/7/2021

Traceability : This certification is traceable to the International System of Unit maintained at National Institute -

of Standards and Technology (NIST) through Sharma 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.

PM-510-02 RB3 11/03/20

เอกสารไม่ควบคุม

REPORT OF CALIBRATION

Certificate No. : SP21-015

Page 3 of 5

Wavelength Accuracy :

CRMs Values (nm.)	UUC Reading (nm.)	Correction (nm.)	Uncertainty (nm.)	Coverage factor k
241.72	242.0	-0.28	0.19	2.00
279.45	279.5	-0.05	0.19	2.00
287.81	287.9	-0.09	0.19	2.00
334.06	333.8	0.26	0.19	2.00
360.93	360.5	0.43	0.19	2.00
418.59	418.2	0.39	0.19	2.00
445.94	445.6	0.34	0.19	2.00
453.66	453.3	0.36	0.19	2.00
460.02	459.8	0.22	0.19	2.00
536.59	536.7	-0.11	0.19	2.00
637.98	638.4	-0.42	0.19	2.00
431.38	430.9	0.48	0.19	2.00
472.50	472.5	0.00	0.19	2.00
513.47	513.4	0.07	0.19	2.00
528.88	529.2	-0.32	0.19	2.00
573.17	573.5	-0.33	0.19	2.00
585.35	584.8	0.55	0.20	2.00
684.40	684.9	-0.50	0.19	2.00
740.72	740.4	0.32	0.19	2.00
748.55	749.0	-0.45	0.19	2.00
807.03	807.1	-0.07	0.19	2.00
879.28	879.4	-0.12	0.19	2.00

PM-510-02 RB3 11/03/20

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DOE Services

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

Page 3 of 5

REPORT OF CALIBRATION

Certificate No.: SP21-008

Wavelength Accuracy :

CRM Values (nm.)	UVC Reading (nm.)	Correction (nm.)	Uncertainty (nm.)	Coverage factor k
241.34	240.8	0.74	0.19	2.00
279.40	278.6	0.80	0.19	2.00
288.70	287.6	1.10	0.19	2.00
334.22	333.6	0.62	0.19	2.00
361.26	360.6	0.66	0.19	2.00
418.48	418.0	0.48	0.19	2.00
446.70	445.8	0.90	0.19	2.00
453.20	452.8	0.40	0.19	2.00
460.06	459.6	0.46	0.19	2.00
536.90	536.2	0.70	0.19	2.00
637.94	637.4	0.54	0.19	2.00
440.74	440.2	0.54	0.19	2.00
472.22	471.8	0.42	0.19	2.00
513.70	513.0	0.70	0.19	2.00
528.72	528.2	0.52	0.19	2.00
574.60	574.0	0.60	0.19	2.00
585.48	584.8	0.68	0.19	2.00
684.63	684.0	0.63	0.19	2.00
740.27	739.8	0.47	0.19	2.00
748.28	747.8	0.48	0.19	2.00
807.16	806.6	0.56	0.19	2.00
879.70	879.0	0.70	0.19	2.00

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Page 4 of 5

REPORT OF CALIBRATION

Certificate No.: SP21-008

Calibration Results : Without adjustment

Photometric Accuracy :

Wavelength (nm.)	CRM Values (Abs)	UVC Reading (Abs)	Correction (Abs)	Uncertainty (Abs)	Coverage factor k
420	0.0000	0.000	0.0000	0.0042	2.00
	0.5791	0.577	0.0021	0.0042	2.00
	1.0488	1.045	0.0038	0.0042	2.00
	2.1914	2.183	0.0084	0.0092	2.00
440	0.0000	0.000	0.0000	0.0042	2.00
	0.5618	0.560	0.0018	0.0042	2.00
	1.0260	1.025	0.0010	0.0042	2.00
	2.1259	2.122	0.0039	0.0091	2.00
465	0.0000	0.000	0.0000	0.0042	2.00
	0.5240	0.522	0.0020	0.0042	2.00
	0.9639	0.965	-0.0011	0.0042	2.00
	1.9788	1.978	0.0008	0.0092	2.00
546.1	0.0000	0.000	0.0000	0.0042	2.00
	0.5194	0.519	0.0004	0.0042	2.00
	0.9991	1.001	-0.0019	0.0042	2.00
	1.9970	1.998	-0.0010	0.0092	2.00
590	0.0000	0.000	0.0000	0.0042	2.00
	0.5523	0.553	-0.0007	0.0042	2.00
	1.0810	1.082	-0.0010	0.0042	2.00
	2.0369	2.035	0.0019	0.0092	2.00
635	0.0000	0.000	0.0000	0.0042	2.00
	0.5596	0.561	-0.0014	0.0042	2.00
	1.0513	1.052	-0.0007	0.0042	2.00
	1.9268	1.925	0.0018	0.0092	2.00

PM-510-02-003 11/03/2019

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Page 1 of 5

CERTIFICATE OF CALIBRATION

Certificate No.: SP21-008

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

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

Location of calibration: Laboratory 315

Equipment: Spectrophotometer

Manufacturer: Hitachi

Model: U-1900

Serial No.: 2021-064

ID No.: UAE.WAS.006/2552

Received Date :25 January 2564

Calibration Date : 25 January 2564

Issue Date : 26 January 2564

Condition of Instrument : Used

Calibrated by: ปัทมา Approved by: Ant S.
(Miss Chonticha Sangngern) (Miss Chonticha 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 DOE Services Co., Ltd.

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Page 2 of 5

REPORT OF CALIBRATION

Certificate No.: SP21-008

Environment Condition : Ambient Temperature 25 ± 5 °C
Relative humidity 50 ± 15 %RH

Calibration method : In-house method CP-01 Calibration of UV-Vis Spectrophotometer Based on ASTM E275-08

Certified Reference Materials :

Material	Serial No.	Certificate No.	Due date
Absorbance Standard set	25760	80102	7/11/2021
Absorbance Standard set	25757	80105	7/11/2021
Wavelength Standard set	25806	80103	7/11/2021
Wavelength Standard set	25758	80104	7/11/2021

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

Spectral Band Width of UVC : 4.0 nm.
Scan Speed of UVC : 200 nm./min
Scan Interval of UVC : 0.1 nm.
Resolution of UVC: Photometric 0.001 Abs.
Wavelength 0.1 nm.

PM-510-02-003 11/03/2019

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PM-510-02-003 11/03/2019

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Request No. 25-64 / 0247

1 / 5

CALIBRATION DATA

MTC. ACL No. 335 / 64

1. Noise Level in term of standard deviation

Element	Cd	Cr	Cu	Fe	Pb	Mn	Ni	Zn
Absorbance	0.0009	-0.0003	-0.0004	-0.0011	-0.0001	-0.0003	-0.0002	0.0019
	0.0002	-0.0016	0.0003	0.0011	-0.0010	-0.0004	-0.0016	0.0006
	-0.0002	-0.0006	0.0001	-0.0007	-0.0006	-0.0003	-0.0014	0.0019
	0.0002	-0.0012	0.0002	-0.0010	-0.0013	-0.0010	-0.0017	0.0015
	0.0009	-0.0025	-0.0002	-0.0008	-0.0002	-0.0016	-0.0010	0.0011
	0.0001	-0.0023	0.0005	-0.0013	0.0000	-0.0001	-0.0005	0.0009
	0.0010	-0.0005	-0.0001	0.0003	-0.0005	-0.0014	0.0006	0.0015
	0.0007	0.0000	0.0002	-0.0009	-0.0003	-0.0010	-0.0016	0.0011
	0.0005	-0.0006	-0.0004	-0.0009	0.0000	-0.0006	-0.0012	0.0011
	0.0007	-0.0013	-0.0003	-0.0005	-0.0007	-0.0001	-0.0003	0.0016
Standard Deviation	0.0009	-0.0015	-0.0009	-0.0012	0.0002	-0.0006	-0.0015	0.0010
	0.0014	0.0006	-0.0001	-0.0006	-0.0014	-0.0013	-0.0013	0.0005
	0.0002	0.0001	0.0003	-0.0003	-0.0006	-0.0013	-0.0006	0.0001
	0.0003	-0.0008	-0.0007	-0.0015	-0.0008	-0.0006	-0.0007	0.0011
	0.0008	-0.0011	0.0001	-0.0002	-0.0002	-0.0014	-0.0001	0.0002
	0.0000	-0.0006	-0.0005	-0.0018	-0.0001	-0.0011	-0.0013	0.0007
	0.0001	0.0007	-0.0004	-0.0016	-0.0001	-0.0011	-0.0018	0.0013
	-0.0002	-0.0013	0.0000	-0.0008	-0.0008	-0.0005	-0.0007	0.0016
	0.0006	0.0003	0.0002	-0.0002	0.0000	-0.0013	-0.0011	0.0007
	0.0004	0.0004	0.0005	-0.0025	0.0001	-0.0014	-0.0014	0.0012

Continue 2 / 5

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Request No. 25-64 / 0247

2 / 5

MTC. ACL No. 335 / 64

2. Precision

Element	Conc. (mg/l)	Absorbance										Ave. Abs.	SD
Cd	0.02	0.0075	0.0069	0.0072	0.0069	0.0073	0.0075	0.0074	0.0083	0.0081	0.007	0.0005	6.19
	0.30	0.0944	0.0947	0.0949	0.0936	0.0947	0.0942	0.0950	0.0938	0.0942	0.0945	0.0005	0.48
	0.70	0.2154	0.2157	0.2156	0.2157	0.2158	0.2157	0.2163	0.2167	0.2162	0.216	0.0004	0.18
Cr	0.10	0.0070	0.0079	0.0076	0.0084	0.0079	0.0082	0.0092	0.0094	0.0089	0.0086	0.0008	9.35
	0.30	0.0202	0.0226	0.0206	0.0207	0.0222	0.0209	0.0223	0.0215	0.0221	0.0222	0.0009	4.00
	0.70	0.0439	0.0453	0.0455	0.0425	0.0438	0.0449	0.0441	0.0452	0.0447	0.0452	0.0009	2.10
Cu	0.05	0.0071	0.0081	0.0074	0.0070	0.0065	0.0072	0.0077	0.0073	0.0067	0.0005	6.45	
	0.30	0.0411	0.0411	0.0424	0.0420	0.0419	0.0409	0.0413	0.0414	0.0419	0.0411	0.0005	1.21
	0.70	0.0909	0.0899	0.0905	0.0906	0.0904	0.0897	0.0905	0.0899	0.0904	0.0900	0.0004	0.41
Fe	0.10	0.0077	0.0078	0.0080	0.0071	0.0074	0.0086	0.0076	0.0081	0.0085	0.0088	0.0005	6.89
	0.50	0.0409	0.0405	0.0410	0.0406	0.0410	0.0404	0.0408	0.0404	0.0400	0.0400	0.0004	0.92
	1.00	0.0797	0.0795	0.0805	0.0789	0.0791	0.0813	0.0795	0.0806	0.0806	0.0794	0.0008	0.98
Pb	0.20	0.0082	0.0086	0.0102	0.0086	0.0087	0.0091	0.0086	0.0089	0.0083	0.0088	0.0009	6.34
	0.70	0.0327	0.0314	0.0312	0.0325	0.0331	0.0312	0.0321	0.0322	0.0320	0.0317	0.0006	2.01
	1.50	0.0673	0.0674	0.0677	0.0686	0.0673	0.0663	0.0672	0.0673	0.0675	0.067	0.0006	0.84
Mn	0.05	0.0095	0.0102	0.0100	0.0096	0.0105	0.0100	0.0102	0.0101	0.0096	0.0100	0.0003	3.17
	0.30	0.0626	0.0626	0.0622	0.0621	0.0625	0.0628	0.0618	0.0626	0.0620	0.0626	0.0007	1.08
	0.70	0.1397	0.1404	0.1415	0.1407	0.1404	0.1388	0.1424	0.1412	0.1408	0.1399	0.0010	0.71
Ni	0.10	0.0088	0.0087	0.0093	0.0090	0.0086	0.0082	0.0088	0.0089	0.0084	0.0096	0.0004	4.62
	0.50	0.0455	0.0445	0.0460	0.0469	0.0457	0.0471	0.0462	0.0466	0.0468	0.0464	0.0005	2.08
	1.00	0.0865	0.0878	0.0858	0.0872	0.0858	0.0862	0.0846	0.0867	0.0863	0.0865	0.0006	1.00
Zn	0.05	0.0323	0.0328	0.0331	0.0326	0.0338	0.0325	0.0340	0.0331	0.0340	0.0327	0.0006	1.91
	0.30	0.1735	0.1734	0.1743	0.1734	0.1731	0.1734	0.1719	0.1731	0.1724	0.1740	0.0007	0.40
	0.70	0.3552	0.3551	0.3564	0.3530	0.3560	0.3564	0.3571	0.3559	0.3586	0.3559	0.0015	0.42

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DOE Services Co.,Ltd.

DOE Services



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REPORT OF CALIBRATION

Certificate No. SP21-008

Page 5 of 5

Photometric Accuracy :

Wavelength (nm.)	CRMs Values (Abs)	UUC Reading (Abs)	Correction (Abs)	Uncertainty (Abs)	Coverage factor k
235	0.0000	0.0000	0.0000	0.0076	2.00
	0.7498	0.745	0.0048	0.0076	2.00
257	0.0000	0.0000	0.0000	0.0076	2.00
	0.8712	0.864	0.0072	0.0076	2.00
313	0.0000	0.0000	0.0000	0.0076	2.00
	0.2920	0.290	0.0020	0.0076	2.00
350	0.0000	0.0000	0.0000	0.0076	2.00
	0.6459	0.632	0.0139	0.0076	2.00

Remark : - UUC = Unit Under Calibration

-NA - 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%

- End of Certificate -

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PM-019-02 800 11002019

เอกสารไม่ควบคุม

Request No. 25-64 / 0247

MTC. ACL No. 335 / 64

CALIBRATION CERTIFICATE

NOMENCLATURE : 1. Atomic Absorption Spectrophotometer "Agilent Technologies" Model AA240FS

Serial No. MY13160001

2. Working standard solution "Merck", "PerkinElmer Pure"

Cadmium Lot No. 24-155C0Y1, Chromium Lot No. 24-112CRA71, Copper Lot No. 24-154CUY1, Iron Lot No.HC90432981,
Lead Lot No. 24-162P8Y1, Manganese Lot No. 24-146MNY1, Nickel Lot No. 24-187NW1, Zinc Lot No. 24-173ZNY1

SUBMITTED BY : United Analyst and Engineering Consultant Co., Ltd.

3. Soi Ubonsuk41, Sukhumvit Road, Bangchak, Prakanong, Bangkok 10260

CALIBRATION PROCEDURE : 1. Performance Verification of Atomic Absorption Spectrophotometer

(MI-500-02-30)

2. Estimation Uncertainty of Measurement In Analytical Chemistry (QH-513)

REFERENCE MATERIAL : Traceable to NIST "Agilent Technologies", "AccuStandard"

Cadmium Lot No. 0099663190, Chromium Lot No. 0101187438, Copper Lot No. 0101965286, Iron Lot No. 2146025090,
Lead Lot No. 0104659412, Manganese Lot No. 0106301916, Nickel Lot No. 0984273115, Zinc Lot No. 2160355689

CALIBRATION RANGE : 0.020,0.10,0.30,0.50,0.70 mg/l at 228.8 nm.Cd, 0.10,0.20,0.30,0.50,0.70 mg/l at 357.9 nm.Cr,
0.05,0.10,0.30,0.50,0.70 mg/l at 324.7 nm.Cu, 0.10,0.30,0.50,0.70,1.00 mg/l at 248.3 nm.Fe, 0.20,0.50,0.70,1.00,1.50 mg/l
at 217.0 nm.Pb, 0.05,0.10,0.30,0.50,0.70 mg/l at 279.5 nm.Mn, 0.10,0.30,0.50,0.70,1.00 mg/l at 232.0 nm.Ni,
0.05,0.10,0.30,0.50,0.70 mg/l at 213.9 nm.Zn

AMBIENT CONDITIONS : Temperature 19.9 °C Relative humidity 46 %

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

Calibrated by  (Mr. Danai Sirithongum)

Approved by  (Mrs. Thippaya Junwee Fortune)
Director of Analytical Chemistry Laboratory
Ref. 2025264011500187001
Calibration Date : 4 February 2021

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Request No. 25-64 / 0247

5 / 5

MTC. ACL. No. 335 / 64

3.7 Reading on wavelength- Nickel (Ni) at 232.0 nm.

Element	Standard Value of RM (mg/L)	Reading (mg/L)	Error of Measurement (mg/L)	Error of Measurement (%)	Uncertainty (mg/L)
Ni	0.1003	0.099	-0.001	1.30	± 0.010
	0.5015	0.525	0.024	4.69	± 0.025
	1.0030	0.987	-0.016	1.60	± 0.045

3.8 Reading on wavelength- Zinc (Zn) at 213.9 nm.

Element	Standard Value of RM (mg/L)	Reading (mg/L)	Error of Measurement (mg/L)	Error of Measurement (%)	Uncertainty (mg/L)
Zn	0.050	0.046	-0.004	8.00	± 0.011
	0.300	0.322	0.022	7.33	± 0.021
	0.700	0.681	-0.019	2.71	± 0.042

Remark : The reported uncertainty is an expanded uncertainty calculated using a coverage factor of 2 (k = 2) which gives a level of confidence of approximately 95%

Calibrated by *Dr. Saithongkum*
(Mr. Danai Srithongkum)

Approved by *Mrs. Thippaya Junwee Fortune*
(Mrs. Thippaya Junwee Fortune)
Director of Analytical Chemistry Laboratory
Calibration date : 4 February 2021

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Calibration Certificate

Substitute for Certificate No.: 2103272-001-01
Certificate No.: 2103272-001-02
Client name: UNITED ANALYST AND ENGINEERING CONSULTANT CO.,LTD.
Address: 3 Soi Udomsuk 41, Sukhumvit Road, Bangkok, Prakhong, Bangkok 10240

Page 1 of 5

Equipment:	pH Meter
Manufacturer:	HANNA INSTRUMENTS
Model:	H2020-02
Serial No.:	C0051107
ID No.:	UAE WAO 05/2587
Order No.:	2103272
Operation No.:	2103272-001
Date of Receipt:	11 June 2021
Date of Calibration:	14 June 2021

Calibrated by Mr.Mriss Somak Expert
Approved by *Mr. Phiraphat Tuanjit*
(Mr. Phiraphat Tuanjit)
Manager, Division of Calibration Laboratory
Responsible for the Technical Management Team
Date of issue: 2 July 2021

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

This Certificate is issued in accordance with the conditions of accreditation granted by the Thai Laboratory Accreditation Scheme which has assessed the National Food Institute as a competent laboratory for the calibration of pH meters. The certificate may not be reproduced other than in full, except with the prior written approval of the National Food Institute.

F-05-011, Revision: 01 Date: 14-12-51

เอกสารไม่ควบคุม



Request No. 25-64 / 0247

3 / 5

MTC. ACL. No. 335 / 64

3. Accuracy

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

Element	Standard Value of RM (mg/L)	Reading (mg/L)	Error of Measurement (mg/L)	Error of Measurement (%)	Uncertainty (mg/L)
Cd	0.020	0.019	-0.001	5.00	± 0.005
	0.300	0.302	0.002	0.67	± 0.006
	0.700	0.698	-0.002	0.29	± 0.012

3.2 Reading on wavelength- Chromium (Cr) at 357.9 nm.

Element	Standard Value of RM (mg/L)	Reading (mg/L)	Error of Measurement (mg/L)	Error of Measurement (%)	Uncertainty (mg/L)
Cr	0.100	0.106	0.006	6.00	± 0.015
	0.300	0.308	0.008	2.67	± 0.019
	0.700	0.657	-0.043	6.14	± 0.032

3.3 Reading on wavelength- Copper (Cu) at 324.7 nm.

Element	Standard Value of RM (mg/L)	Reading (mg/L)	Error of Measurement (mg/L)	Error of Measurement (%)	Uncertainty (mg/L)
Cu	0.04955	0.050	0.000	0.91	± 0.004
	0.29730	0.316	0.019	6.29	± 0.009
	0.69370	0.696	0.002	0.33	± 0.018

Continue 4 / 5

INDUSTRIAL METROLOGY AND TESTING SERVICE CENTRE

Advertising the Report/Certificate and publicity of the results except in full are prohibited unless written permission is obtained from the governor of TSIR.

Head Office

35 Mu 3 Tambon Khlong Luang, Amphoe Khlong Luang, Chongwatthani 12120, Thailand
Tel. (66) 0 2577 9000
Fax. (66) 0 2577 9009
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เอกสารไม่ควบคุม



Request No. 25-64 / 0247

4 / 5

MTC. ACL. No. 335 / 64

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

Element	Standard Value of RM (mg/L)	Reading (mg/L)	Error of Measurement (mg/L)	Error of Measurement (%)	Uncertainty (mg/L)
Fe	0.100	0.091	-0.009	9.00	± 0.012
	0.500	0.485	-0.015	3.00	± 0.015
	1.000	0.960	-0.040	4.00	± 0.060

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

Element	Standard Value of RM (mg/L)	Reading (mg/L)	Error of Measurement (mg/L)	Error of Measurement (%)	Uncertainty (mg/L)
Pb	0.1988	0.205	0.006	3.12	± 0.013
	0.6958	0.703	0.007	1.03	± 0.018
	1.4910	1.463	-0.028	1.88	± 0.033

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

Element	Standard Value of RM (mg/L)	Reading (mg/L)	Error of Measurement (mg/L)	Error of Measurement (%)	Uncertainty (mg/L)
Mn	0.04955	0.049	-0.001	1.11	± 0.005
	0.29730	0.307	0.0097	3.26	± 0.007
	0.69370	0.694	0.0003	0.04	± 0.013

Continue 5 / 5

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Office

196 Phrayothai Road, Chabuck, Bangkok 10900, Thailand
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E-mail : turnpaeng@nfi.go.th

F-05-011, Revision: 01 Date: 14-12-51

เอกสารไม่ควบคุม

Calibration Report

Certificate No.: 2103272-201-02
Equipment: Digital Thermometer with RTD (pH Meter)
Resolution: 0.1 °C Model: SevenEasy pH
Serial No.: C0051107 ID No.: UAE WAO.0052557
Manufacturer: HANNA INSTRUMENTS
Date of Calibration: 14 June 2021

Page 4 of 5

Location: Chemical Calibration Laboratory, National Food Institute
Environment Condition: Ambient Temperature: 24 °C ± 1 °C
Relative Humidity: 54 % ± 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 1980 (ITS-90).

2. Reference Standard Instrument:

Instrument	Model	Serial No.	Certificate No.	Due Date	Through
HAUTHELD THERMOMETER	1521	A85907	TE 840028-01	12-Dec-21	NATIONAL FOOD INSTITUTE
Platinum Resistance Thermometer (PRT)	385	509201			
Support Equipment:	- Low Temperature Bath (ISOCAL 6), Model: Europa-4 Plus Basic, S/N: 3411922				

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



FCS-012 Revision: 00 Date: 14-12-61

เอกสารไม่ควบคุม

Calibration Report

Certificate No.: 2103272-001-02
Equipment: pH Meter
Resolution: 0.01 pH : 0.1 mV
Manufacturer: HANNA INSTRUMENTS
Model: HQ202-02
Serial No.: C0051107 ID No.: UAE WAO.0052557
Type: Bench top
Date of Calibration: 14 June 2021

Page 2 of 5

Location: Chemical Calibration Laboratory, National Food Institute
Environment Condition: Ambient Temperature: (23.7 ± 1.5) °C
Relative Humidity: (53.5 ± 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 calculator and certified reference material (CRM)

2. Reference Standards / Certified Reference Material

Instruments	Serial ID No.	Manufacturer	Certificate No.	Expiry Date
2.1 DC Voltage Calculator	270007	Fuke	SCL-207-0992	17 June 2021
2.2 Digital Thermometer	270007	Fuke	CC-030609-01	30 October 2021
2.3 Thermo-Hygro Meter	NF1817H03D17	PONPE	G03C-1576	21 September 2021

Certified Reference Material	Lot No.	Manufacturer	Ref/L	Expiry Date
2.4 pH buffer 4.00 (Primary pH buffer Solution)	710048	CPAchem	PH416.L5	2 October 2022
2.5 pH buffer 6.86 (Primary pH buffer Solution)	710049	CPAchem	PH417.L5	2 October 2022
2.6 pH buffer 9.01 (Primary pH buffer Solution)	710050	CPAchem	PH426.L5	2 October 2021
2.7 pH buffer 7.20 (Standard pH buffer Solution)	710051	CPAchem	PH107.L5	2 October 2021

3. This certificate is traceable to the International System of Units (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

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.

FCS-012 Revision: 00 Date: 14-12-61

 เอกสารไม่ควบคุม

Calibration Report

Certificate No.: 2103272-201-02
Equipment: Digital Thermometer with RTD (pH Meter)
Resolution: 0.1 °C Model: SevenEasy pH
Serial No.: C0051107 ID No.: UAE WAO.0052557
Manufacturer: HANNA INSTRUMENTS
Date of Calibration: 14 June 2021

Page 5 of 5

15.5, 25.0 and 35.0 °C**

- The probe was immersed in liquid bath or dry bath to a minimum depth of 100 mm.

- Description of probe, model : H11310 S/N : 078743

Dimension of probe : Diameter : 4 mm, Length : 118 mm.

Sheath material : Business Steel

UUC* Reading (°C)	Standard Temperature (°C)	Correction Value (°C)	Uncertainty ± (°C)
15.1	15.001	-0.1	0.13
25.1	24.999	-0.1	0.13
35.2	34.999	-0.2	0.13

Remark: Edited Model from scope to HQ200-02.

NSIR

-UUC* Unit Under Calibration

- NFI Laboratory is not accredited ISO/IEC 17025 for calibration. In the scope marked with **

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

FCS-012 Revision: 00 Date: 14-12-61

 เอกสารไม่ควบคุม

Calibration Report

Certificate No.: 2103272-001-02
Equipment: pH Meter
Resolution: 0.01 pH : 0.1 mV
Manufacturer: HANNA INSTRUMENTS
Model: HQ202-02
Serial No.: C0051107 ID No.: UAE WAO.0052557
Type: Bench top
Date of Calibration: 14 June 2021

Page 3 of 5

1. Calibration of pH Meter
(Manual Temperature Compensation at 25 °C)

Nominal pH	DC Voltage Standard (mV)	Average Indicator Reading		Uncertainty (mV)	Coverage Factor (k)
		mV	pH		
0.00	414.118	415.7	0.00	0.063	2.00
2.00	295.811	297.3	2.00	0.063	2.00
4.00	177.483	179.0	4.00	0.063	2.00
6.00	99.140	60.7	6.00	0.063	2.00
7.00	0.000	1.5	7.00	0.063	2.00
8.00	-89.158	-87.7	8.00	0.063	2.00
10.00	-177.481	-176.0	10.00	0.063	2.00
12.00	-265.812	-264.4	12.00	0.063	2.00
14.00	-354.115	-353.4	14.00	0.063	2.00

2. Calibration of pH Meter with Electrode (Manual Temperature Compensation at 25 °C)

Equipment:	pH Electrode	Type:	Combined Electrode
Manufacturer:	HANNA INSTRUMENTS	Model:	H11310
Serial No.:	078743	ID No.	N/A
Performance of Electrode system (Three-Point Calibration at pH4, pH7 and pH10)			

FCS-012 Revision: 00 Date: 14-12-61

 เอกสารไม่ควบคุม

Calibration Results:

Before Adjustment

Standard Conductivity Solution	Unit Under Calibration Reading	Correction	Coverage Factor (k)	Uncertainty (±)
24.97 µS/cm	26.7 µS/cm	-1.73 µS/cm	2.00	0.52 µS/cm
1408.3 µS/cm	1439 µS/cm	-30.7 µS/cm	2.00	7.8 µS/cm
111.31 mS/cm	112.4 mS/cm	-1.09 mS/cm	2.00	0.58 mS/cm

After Adjustment : at 1408.3 µS/cm

Standard Conductivity Solution	Unit Under Calibration Reading	Correction	Coverage Factor (k)	Uncertainty (±)
24.97 µS/cm	25.8 µS/cm	-0.83 µS/cm	2.00	0.52 µS/cm
1408.3 µS/cm	1410 µS/cm	-1.7 µS/cm	2.00	7.8 µS/cm
111.31 mS/cm	110.1 mS/cm	1.21 mS/cm	2.00	0.58 mS/cm

The End of Certificate

วันที่: ๒๕ มิถุนายน ๒๕๖๕

Report Version: 1.21.0.268
Report Number: 150003
From: Number 150003
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เอกสารไม่ควบคุม

SPCC-FN-C24-06: 23 Nov 2020

Calibration Certificate ID
TH0058-03F-040722-ACC-THMettler-Toledo (Thailand) Ltd.
846/4 - 846/5 Laksale Rd., Bangna Tai Sub-District
Bangna District, Bangkok 10260
+66 2723 0352
MT-TH.ServiceSupport@mt.com

METTLER TOLEDO



Accuracy Calibration Certificate

Customer	United Analyst and Engineering Consultant Co., Ltd. 3 Soi Udorn Suk 41, Sukhumvit Rd., Bang Chak
Company:	
Address:	
City:	Bangkok
Zip / Postal:	10260
State / Province:	Bangkok
Order Number:	



Weighing Device

Manufacturer:	Mettler Toledo	Instrument Type:	Weighting Instrument
Model:	AB204-S	Asset Number:	UAE-AR-F192300
Serial No.:	118317228	Terminal Model:	N/A
Building:	N/A	Terminal Serial No.:	N/A
Floor:	2	Terminal Asset No.:	N/A
Room:	Balance Room 2 (008)		
Range	Max. Capacity	Repeatability (g)	0.001 g
1	220 g		

Procedure

Calibration Guideline:	EURAMET cp-18 v. 4.3 (11/2015)
METTLER TOLEDO Work Instruction:	CPW0022/26
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 cp-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	Start: 22.5 °C	End: 21.4 °C	Start: 56.1 %	End: 63.2 %
Temperature	Humidity			

As Found Calibration Date:	07-Apr-2022	Calibrator:	
As Left Calibration Date:	N/A		
Issue Date:	08-Apr-2022	Approved Signatory:	Sirwet Chomchan

☒ Kasasorn Tassanachaisakul
☐ Sirint Jinyong
☐ Surasak Suda

เอกสารไม่ควบคุม

Calibration Report

Certificate No.:
Equipment:2101003-001-61
Digital Thermometer with RTD (pH Meter)
Resolution: 0.1 °C
Model: SevenEasy pHSerial No.: 123052512
Manufacturer: METTLER TOLEDO
Date of Calibration: 17 March 2021
ID No.: UAE WAS 0032503

Page 5 of 5

Calibration point:
Calibration result:15.0, 25.0 and 35.0 °C
- The probe was immersed in liquid bath or dry bath to a minimum depth of 100 mm.

Description of probe, model: SN: -

Dimension of probe: Diameter 3.0 mm, Length 120 mm.
Sheath material: Stainless Steel

UUC* Reading (°C)	Standard Temperature (°C)	Correction Value (°C)	Uncertainty ± (°C)
15.2	15.003	-0.2	0.099
25.2	25.003	-0.2	0.099
35.2	35.007	-0.2	0.099

Note

- UUC* Unit Under Calibration

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

***** End *****

F-GS-412 Revision: 00 Date: 14-12-81

เอกสารไม่ควบคุม

SPC Calibration Center

SART
Part of DKSH Group

Certificate of Calibration

Equipment:	CONDUCTIVITY METER	Certificate No.:	C24210081
Model:	Lab695	Issued Date:	29 March 2021
Serial No. (or ID.):	16300356	Job No.:	KSPPR2104894
Manufacturer:	SI Analytics	Page:	1 of 2
Electrode Serial No.	16070067	Model:	LF413T
Condition:	In Condition	Brand:	SI Analytics

Customer: United Analyst and Engineering Consultant Company Limited

3 Soi Udorn Suk 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 Wachthramsahit 57, Sukhumvit 101/1 Rd.,
Bangchak, Prakanong, Bangkok 10260 ThailandCalibration By: Mr. Imron Ama
Calibration Date: 29 March 2021The Method used: In house method, SPCC-WH-49, base on ASTM D 1125-14 and D 5391-14
Traceability: This certificate is traceable to the CRM maintained by DAKKS/DKD calibration laboratory through Radometer Analytical Co., Ltd. Certificate No. 1561, 1515, 1377SART
บริษัท เอสอาร์ที จำกัด
SPC RT Co., Ltd.(Mr. Dumrong Boonsopon)
Authorized signatoryThis certificate is issued in 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.

วันที่: ๒๕ มิถุนายน ๒๕๖๕

Report Version: 1.21.0.268
Report Number: 150003
From: Number 150003
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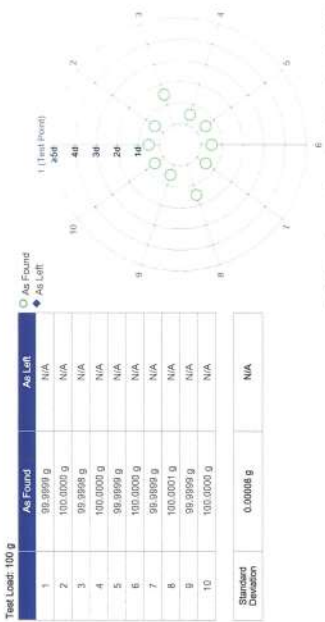
Remarks

Equipment condition: Good
Next calibration according to customer's procedure
Calibration data not decide by calibration laboratory
Test weight by Filler 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 Results
Repeatability



The 'd' in the graph represents the readability of the range interval in which the last value is placed.
The results of this graph are based upon the absolute values of the differences from the mean value.

Eccentricity



The 'd' in the graph represents the readability of the range interval in which the last value is placed.

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Measurement Uncertainty of the Weighing Instrument in Use

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

Temperature coefficient for the evaluation of the measurement uncertainty in use: $3.0 \cdot 10^{-4} / K$
Temperature range on site for the calculation of the measurement uncertainty in use: 3 K.

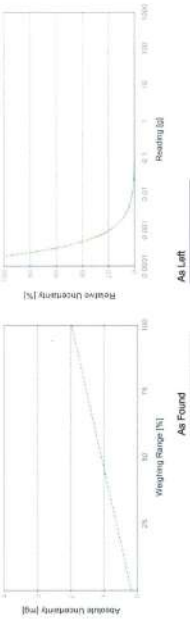
Linearization of Uncertainty Equation

Range	d	Max	As Found	As Left
1	0.0001 g	220 g	$U_1 = 0.19 \text{ mg} + 0.0817 \text{ mg/g} \cdot R$	N/A

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

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

Net Indication	As Found	As Left
0.0220 g	0.19 mg	0.89%
0.2200 g	0.19 mg	0.087%
2.2000 g	0.21 mg	0.0095%
22.0000 g	0.37 mg	0.0017%
220.0000 g	2.0 mg	0.00090%



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Error of Indication

As Found	Reference Value	Indication	Error of Indication	Expanded Uncertainty	k
1	0.0000 g	0.0000 g	0.0000 g	0.16 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	150.0000 g	0.0000 g	0.40 mg	2
11	200.0001 g	200.0000 g	0.0000 g	0.46 mg	2



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

The uncertainty stated is the expanded uncertainty at calibration obtained by multiplying the standard combined uncertainty by the coverage factor k – which can be larger than 2 according to EURAMET-cp-18. The value of the measured less 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.: W580
Certificate Number: C208581631
Date of Issue: 23-Feb-2022
Calibration Due Date: 14-Aug-2023

Thermo Hygrometer

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

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เอกสารไม่ควบคุม



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

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

Calibration Point (°C)	UUC* Setting (°C)	UUC* Reading (°C)	Temperature stability (± °C)	Temperature uniformity (°C)	Overall Variation (°C)	Uncertainty (± °C)	Coverage Factor k
104.0	104.0	104.0	0.11	0.52	0.72	0.42	2
140.0	140.0	140.0	0.25	1.1	1.4	1.1	2
180.0	180.0	180.0	0.18	0.87	1.2	1.1	2

Calibration Point (°C)	Measured Temperature (°C)				
	1	2	3	4	5
104.0	103.852	103.978	104.382	104.323	103.776
140.0	140.309	140.730	140.426	140.270	139.531
180.0	180.598	180.339	180.755	180.619	179.716
					179.829
					180.204
					139.885
					139.750
					103.907
					104.196
					104.312
					140.015
					139.666
					179.716
					179.829
					180.204
					139.885
					139.750
					103.907
					104.196
					104.312
					140.015
					139.666
					179.716
					179.829
					180.204
					139.885
					139.750
					103.907
					104.196
					104.312
					140.015
					139.666
					179.716
					179.829
					180.204
					139.885
					139.750
					103.907
					104.196
					104.312
					140.015
					139.666
					179.716
					179.829
					180.204
					139.885
					139.750
					103.907
					104.196
					104.312
					140.015
					139.666
					179.716
					179.829
					180.204
					139.885
					139.750
					103.907
					104.196
					104.312
					140.015
					139.666
					179.716
					179.829
					180.204
					139.885
					139.750
					103.907
					104.196
					104.312
					140.015
					139.666
					179.716
					179.829
					180.204
					139.885
					139.750
					103.907
					104.196
					104.312
					140.015
					139.666
					179.716
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					139.750
					103.907
					104.196
					104.312
					140.015
					139.666
					179.716
					179.829
					180.204
					139.885
					139.750
					103.907
					104.196

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



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES
3344 JANTANAKARN RD. 501/14, SUKUMVIT, SUKUMVIT BANGKOK 10260
TEL. 0-2717-3000-27 FAX. 0-2719-9485



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES
3344 JANTANAKARN RD. 501/14, SUKUMVIT, SUKUMVIT BANGKOK 10260
TEL. 0-2717-3000-27 FAX. 0-2719-9485

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.0272559

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

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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.

เอกสารไม่ควบคุม



National Food Institute, Ministry of Industry, Thailand
82008 Soi 38, Anan Asoyong Road, Bang Yi Khan Subdistrict, Bang Phai District, Bangkok 10710, Thailand
Tel. +66 (0) 2622 8508 Fax +66 (0) 2622 8545 Website : www.nfi.or.th E-mail : cal@nfi.or.th

Calibration Certificate

Certificate No.: 2103270-001-01
Client name: UNITED ANALYST AND ENGINEERING CONSULTANT CO.,LTD.
Address: 3 Soi Udomsuk 41, Sukhumvit Road,
Bangchak, Phrakhanong, Bangkok 10260

Equipment: Electronic Balance

Manufacturer: Mettler Toledo

Model: AB204-S/FACT

Serial No.: 1129361010

ID No.: UAE.WAS.002/2552

Order No.: 2103270

Operation No.: 2103270-001

Date of Receipt: 11 June 2021

Date of Calibration: 11 June 2021

Calibrated by Mr.Yoshin Charoensuk
Scientist
Approved by (Mr.Praphat Tuajit)
Manager, Division of Calibration Laboratory

Date of Issue: 15 June 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 Association Scheme which has assessed the measurement capability of the laboratory and its capability to meet national standards and to the units of measurement realized at the corresponding national standards laboratory. This certificate may not be re-used or other than in full, except with the prior written approval of the National Food Institute.

FC-509 Revision: 00 Date: 14-12-61

เอกสารไม่ควบคุม



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 1) Data Acquisition Model 34570A Serial No. MY44057817 Cert. No. 21LM10 Due Date 20 Jul 2022

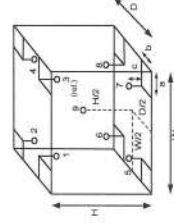
2. This certificate is valid only to the item calibrated on date and place of calibration.

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

Result of Calibration : (*) Without Adjustment

Function of UUC* : Temperature Source

Fresh air setting : Close



Probe Installation Details :

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

Dimension of Chamber :

Environment during calibration	
Beginning	Finished
Temp. (°C)	28
REL.Humid. (%)	56
AC Supply (Volt)	230

Ref. Std. ID No.: @ Calibration Point	
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 15RTD2/16
7	21-15TC-07 15RTD2/17
8	21-15TC-08 15RTD2/18
9 (ref.)	21-15TC-09 15RTD2/19

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เอกสารไม่ควบคุม

Certificate No. : HIT-2219-0480

Page : 1 of 2

CERTIFICATE OF CALIBRATION

Equipment : COD Test Tube Heater
Meter Model : HI839800-02
Serial No. : 04500052101
Tube Heater : 25 Vial Capacity
Accuracy : $\pm 2^{\circ}\text{C}$
Temperature Range : -10°C to 160°C
Ambient Temperature : $(25 \pm 2)^{\circ}\text{C}$
Relative Humidity : $(50 \pm 15)\%$ RH
Manufacturer : Hanna Instruments
Made in : Romania
Condition As-Received : RE220588
Used Product
Customer name : United Analyst and Engineering Consultant Co., Ltd.
3 Soi Udomsuk 41, Sukhumvit Rd., Bangchak,
Prakhong, Bangkok 10260

Received date : 29 April 2022
Calibrate date : 9 May 2022
Issue date : 10 May 2022
Calibrated Location : Hanna Instruments (Thailand) Ltd.
Calibration Procedure : This calibrator was conducted by using in-house: calibration procedure
CP-04 by using certified reference material

Calibrated by : *Phat.* Approved by : *Phat.*
Mr. Pichit Pethong
Calibration Engineer
Mr. Anan Suwanaisakul
Authorized Signatory



This certificate was certified only for the instrument we calibrated.
This result of calibration was found accurate on date and place of calibration only.

** This certificate may not be reproduced other than in full, except with the prior written **
approval of the head of Hanna Instrument (Thailand).

เอกสารไม่ควบคุม

Certificate No. : HIT-2219-0480

Page : 2 of 2

Condition of this calibration result

Reference Standard Instruments:

Instruments	Model	Serial No.	Certificate No.	Traceable
Data Acquisition Switch Unit	34970A	US37038858	WK2106-154-1	WK Electric Co., Ltd.

Calibration Result:

Measurement Temperature Source Accuracy for COD Reactor

Capacity (Vial)	Nominal Value ($^{\circ}\text{C}$)	Average Value ($^{\circ}\text{C}$)	\pm Uncertainty ($^{\circ}\text{C}$)	\pm Tolerance of UUC ($^{\circ}\text{C}$)	Acceptance Criteria
25 Vial	150.0	150.2	0.55	2	Pass

Figure: Shows the location of the temperature source.

(1A)	(2A)	(3A)	(4A)	(5A)
149.82 $^{\circ}\text{C}$	149.36 $^{\circ}\text{C}$	149.92 $^{\circ}\text{C}$	149.43 $^{\circ}\text{C}$	149.83 $^{\circ}\text{C}$
(1B)	(2B)	(3B)	(4B)	(5B)
150.45 $^{\circ}\text{C}$	150.66 $^{\circ}\text{C}$	150.37 $^{\circ}\text{C}$	149.66 $^{\circ}\text{C}$	150.01 $^{\circ}\text{C}$
(1C)	(2C)	(3C)	(4C)	(5C)
150.78 $^{\circ}\text{C}$	151.30 $^{\circ}\text{C}$	151.33 $^{\circ}\text{C}$	149.57 $^{\circ}\text{C}$	150.52 $^{\circ}\text{C}$
(1D)	(2D)	(3D)	(4D)	(5D)
151.12 $^{\circ}\text{C}$	151.59 $^{\circ}\text{C}$	150.80 $^{\circ}\text{C}$	149.62 $^{\circ}\text{C}$	149.81 $^{\circ}\text{C}$
(1E)	(2E)	(3E)	(4E)	(5E)
150.69 $^{\circ}\text{C}$	149.58 $^{\circ}\text{C}$	149.60 $^{\circ}\text{C}$	149.24 $^{\circ}\text{C}$	149.93 $^{\circ}\text{C}$

Remark: The Acceptance criteria is the error value plus or minus the Measurement Uncertainty, and then Not More than the Tolerance value of UUC, therefore concluded that pass.

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

** End of certificate **

เอกสารไม่ควบคุม

Calibration Report

Certificate No. : 2103270-001-01
Equipment: Electronic Balance

Manufacturer: Mettler Toledo
Resolution: 0.0001 g
ID No.: UAE WAS.002/2552

Page 2 of 3

Date of Calibration: 11 June 2021

Environment Condition: Ambient Temperature: $21.1 \pm 0.4^{\circ}\text{C}$ Relative Humidity: $48 \pm 4\%$

Place of Calibration: Laboratory, united analyst and engineering consultant co. ltd.

Condition of Equipment: Good Condition

Condition of This Results of Calibration:

1. Calibration Method: NFI Method WMA-001. In-House Method Based on UKAS LAB 14 Calibration of Weighing Machines : 2006

2. Reference Standard:

Reference Standard Model Serial No. Calibrated By Certificate No. Due Date

Standard Weight Class E2 Jmg to 200g B95562572 TCS HQ204045 29 April 2022

Instrument Model Serial No. Calibrated By Certificate No. Due Date

Thermo-Hygro Heater POUMPE 490 NF3JFH 004/18 Quality Reborn QR21-0300 15 February 2022

3. This certification is traceable to SI UNIT

4. This certificate is certified only for the instrument we calibrated.

5. This result of calibration was found accurate as shown on date and place of calibration only.

Calibration Results:

1. Repeatability of Reading:

Nominal Value (g)	Standard Deviation of Reading (g)
100	0.00067
200	0.00057

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	2	3	4	5	6	(Maximum Difference)
(g)	(g)	(g)	(g)	(g)	(g)	(g)	(g)
50.0000	49.9999	49.9999	50.0000	50.0000	50.0000	50.0000	0.0001

FCS-012 Revision: 00 Date: 14-12-61

เอกสารไม่ควบคุม

Calibration Report

Certificate No. : 2103270-001-01
Equipment: Electronic Balance

Manufacturer: Mettler Toledo
Resolution: 0.0001 g
ID No.: UAE WAS.002/2552

Date of Calibration: 11 June 2021

Environment Condition: Ambient Temperature: $21.1 \pm 0.4^{\circ}\text{C}$ Relative Humidity: $48 \pm 4\%$

Place of Calibration: Laboratory, united analyst and engineering consultant co. ltd.

Condition of Equipment: Good Condition

Condition of This Results of Calibration:

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2. Reference Standard:

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Standard Weight Class E2 Jmg to 200g B95562572 TCS HQ204045 29 April 2022

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Calibration Results:

1. Repeatability of Reading:

A mass of 50 g was placed and moved to various position on pan.

The balance reading obtained is given in the table.

	1	2	3	4	5	6	(Maximum Difference)
(g)	(g)	(g)	(g)	(g)	(g)	(g)	(g)
50.0000	49.9999	49.9999	50.0000	50.0000	50.0000	50.0000	0.0001

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 %.

FCS-012 Revision: 00 Date: 14-12-61

***** End *****

เอกสารไม่ควบคุม



Certificate of Calibration

Cert. No.: 21TM1874
Page.: 1 of 3

Equipment: Incubator
Manufacturer: Memmert
Model: IPP 260
Serial No.: V616.0066
ID No.: UAE MIC.0322559
Submitted by: United Analyst and Engineering Consultant Co.,Ltd.
3 Soi Udomsak 41, Sukhumvit Road,
Bangchak, Phraekhanong,
Bangkok 10260
Location: Microbiology Laboratory (302)
Received Order: 28 October 2021
Calibration Date: 28 - 29 October 2021
Ambient Temperature: (26 ± 10) °C
Relative Humidity: (50 ± 30) %
Calibrated by: Kunchit Promprat
Approved by:
() Ponthippa Tamayakul
() Mailee Burkuea
() Suwit Imjai
Approved Signatory

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 & Equipment Calibration and Testing Services.

เอกสารไม่ควบคุม



Equipment: Incubator
Condition As-Received: Used Item
Reference: 2110-0680C-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).

The temperature scale used was based on ITS-90.

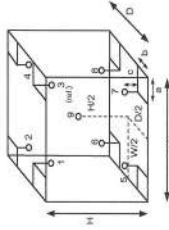
Condition of this result of calibration

1. Reference standard instrument:-
Instrument **Model** **Serial No.** **Cert. No.** **Due Date**
1) Data Acquisition 34970A MY44067817 21LM10 20 Jul 2022
2. This certificate is valid only to the item calibrated on date and place of calibration.
3. This certification is traceable to the International System of Unit.

Result of Calibration :- (*) Without Adjustment

Function of UUC* : Temperature Source

Fresh air setting : Not Available



Probe Installation Details :
a = 5.0 cm
b = 5.0 cm
c = 5.0 cm
Dimension of Chamber :
D = 0.50 m
W = 0.64 m
H = 0.80 m
Capacity = 0.26 m³

Environment during calibration		
	Beginning	Finished
Temp. (°C)	22	22
REL.Humid. (%)	59	60
AC Supply (Volt)	226	226

Position :	Ref. Std. ID No.:
1	15RTD2/11
2	15RTD2/12
3	15RTD2/13
4	15RTD2/14
5	15RTD2/15
6	15RTD2/20
7	15RTD2/17
8	15RTD2/16
9 (ref.)	15RTD2/19

เอกสารไม่ควบคุม



Equipment: BOD Incubator
Condition As-Received: Used Item
Reference: 2104-0024OC-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 **Serial No.** **Cert. No.** **Traceable** **Due Date**
1) Data Acquisition MY57013711 20LM7 NIST, NIMT 18 May 2021
2. This certification is traceable to the SI unit.
3. This certificate is valid only to the item calibrated on date and place of calibration.

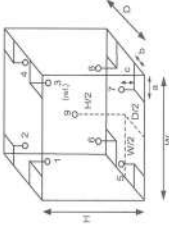
Remark : NIST : National Institute of Standards and Technology, The United State of America.

NIMT : National Institute of Metrology Thailand.

Result of Calibration :- (*) Without Adjustment

Function of UUC* : Temperature Source

Fresh air setting : Not Available



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

Environment during calibration		
	Beginning	Finished
Temp. (°C)	27	28
REL.Humid. (%)	47	51
AC Supply (Volt)	221	222

Position :	Ref. Std.ID No.:
1	18RTD-2/1
2	18RTD-2/2
3	18RTD-2/3
4	18RTD-2/4
5	18RTD-2/5
6	18RTD-2/6
7	18RTD-2/7
8	18RTD-2/8
9 (ref.)	18RTD-2/9

เอกสารไม่ควบคุม

เอกสารไม่ควบคุม

a 1052721



Equipment: BOD Incubator
Condition As-Received: Used Item
Reference: 2104-0024OC-3

Result of Calibration :- (*) Without Adjustment

Function of UUC* : Temperature Source

Calibration Point (°C)	UUC* Setting (°C)	Temperature stability (± °C)	Temperature uniformity (°C)	Overall Variation (°C)	Uncertainty (± °C)	Coverage Factor k
20.0	20.0	0.15	0.47	0.86	0.31	2

Measured Temperature (°C)								
Calibration Point (°C)	1	2	3	4	5	6	7	8
20.0	20.368	20.509	20.115	20.023	19.826	19.955	20.135	20.269
	9 (ref.)							
	20.101							

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

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

Temperature stability : 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

เอกสารไม่ควบคุม

a 1052720



Equipment : Incubator
Condition As-Received : Used Item
Reference : 2104-00190C-1
Procedure Used : 2104-00190C-1

Cert. No.: 21TM706
Page.: 2 of 3

Calibration was conducted using calibration procedure CP-QT02 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 : MY4400Q450
Serial No. : 21LM4
Cert. No. : 21LM4
Traceable : NIMT
Due Date : 09 Mar 2022

2. This certificate is traceable to the SI unit.

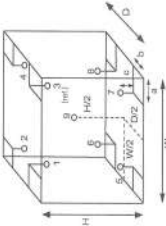
3. This certificate is valid only to the item calibrated on date and place of calibration.

Remark : NIMT : National Institute of Metrology Thailand.

Result of Calibration :- (*) Without Adjustment

Function of UUC* : Temperature Source

Fresh air setting : Close



Probe Installation Details :

Dimension of Chamber :
a = 10 cm D = 0.50 m
b = 10 cm W = 0.64 m
c = 10 cm H = 0.80 m
Capacity = 0.26 m³

Environment during calibration		
Temp. (°C)	Beginning	Finished
REL.Humid. (%)	24	23
AC Supply (Volt)	60	63
	223	224

Position :	Ref. Std. ID No. :
1	19-14RTD-01
2	19-14RTD-02
3	19-14RTD-03
4	19-14RTD-04
5	19-14RTD-05
6	19-14RTD-06
7	21-14RTD-07
8	19-14RTD-08
9 (ref.)	19-14RTD-09

เอกสารไม่ควบคุม

a 1052708



Equipment : Incubator
Condition As-Received : Used Item
Reference : 2104-00190C-1
Result of Calibration :- (*) Without Adjustment
Function of UUC* : Temperature Source

Cert. No.: 21TM706
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
35.0	35.0	35.0	0.11	0.36	0.55	0.30	2
Measured Temperature (°C)							
Position							
1	2	3	4	5	6	7	8
34.946	35.035	35.120	35.087	34.989	35.121	34.745	35.004
35.0	35.0	35.0	35.0	35.0	35.0	35.0	35.0
9 (ref.)							
34.994							

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 %.

-o-o-

Approved by :
() Ponthippa Tamayakul
(✓) Malee Bulkruea
() Suwit Injai

Approved Signatory

Signature

Issue Date : 5 May 2021

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

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

เอกสารไม่ควบคุม

a 1052707



Equipment : Incubator
Condition As-Received : Used Item
Reference : 2110-06980C-1
Result of Calibration :- (*) Without Adjustment
Function of UUC* : Temperature Source
Fresh air setting : Not Available

Cert. No.: 21TM1874
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
35.0	35.0	35.0	0.053	0.25	0.42	0.30	2
35.0	35.0	35.0	0.029	0.43	0.75	0.30	2

Measured Temperature (°C)								
Position								
1	2	3	4	5	6	7	8	9 (ref.)
25.0	25.007	24.986	24.943	24.894	24.653	24.806	24.672	24.694
35.0	35.340	35.384	35.336	35.307	34.690	35.120	34.813	34.996
35.0	35.340	35.384	35.336	35.307	34.690	35.120	34.813	34.996

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 %.

-o-o-

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เอกสารไม่ควบคุม



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
CORPORATE SERVICES & EQUIPMENT CALIBRATION AND TESTING SERVICES
534/4 PATTANAKARN ROAD SUKHUMVIT 14, SUKHUMVIT, BANGKOK 10250
TEL: 0-2711-3000-27 FAX: 0-2719-9484



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
CORPORATE SERVICES & EQUIPMENT CALIBRATION AND TESTING SERVICES
534/4 PATTANAKARN ROAD SUKHUMVIT 14, SUKHUMVIT, BANGKOK 10250
TEL: 0-2711-3000-27 FAX: 0-2719-9484

Cert. No.: 21TM706
Page.: 1 of 3

Certificate of Calibration

Equipment : Incubator
Manufacturer : Memmert
Model : IPP260
Serial No. : V615.0187

ID No. : UAE MIC.003/2559

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

Location : 3 Soi Udomsuk 41, Sukhumvit Road,

Bangkok, Phrakhanong,

Microbiology Laboratory

Received Order : 21 April 2021

Calibration Date : 21 April 2021

Ambient Temperature : (26 ± 10) °C

Relative Humidity : (50 ± 30) %

Calibrated by : Kritsada Chaitrong

Approved by :
() Ponthippa Tamayakul
(✓) Malee Bulkruea
() Suwit Injai

Approved Signatory

Signature

Issue Date : 5 May 2021

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

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

เอกสารไม่ควบคุม

a 1052707



Cert. No.: 22TM334
Page: 3 of 3
Equipment: Water Bath
Condition As-Received: Used Item
Reference: 2202-0444OC-4
Result of Calibration: () Without Adjustment
Function of UUC*: Temperature Source

Calibration point (°C)	UUC* Setting (°C)	UUC* Reading (°C)	Average* Standard Reading (°C)				
			1	2	3	4	5 (ref.)
44.5	44.5	44.5	44.572	44.514	44.507	44.530	44.565

Calibration point (°C)	Uniformity (°C)	Stability (± °C)	Uncertainty (± °C)	Coverage Factor k	
				k	k
44.5	0.10	0.042	0.15	2	2

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

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

Stability*: One-half of the greatest maximum difference of measured temperature at any one probe.

UUC*: Unit Under Calibration

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

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

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WUW

เอกสารไม่ควบคุม

a 1096054



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
CORPORATE SERVICES & EQUIPMENT CALIBRATION AND TESTING SERVICES
534/4 PATTANAKARN ROAD 501 18, SUKHUMVIT, SUKHUMVIT BANGKOK 10250
TEL. 0-2715-3000-27 FAX. 0-2719-9484



Cert. No.: 21TM708
Page: 1 of 3

Certificate of Calibration

Equipment: Water Bath
Manufacturer: Memmert
Model: WNE 14
Serial No.: L414.1407
ID No.: UAE.MIC.006/2558
Submitted by: United Analyst and Engineering Consultant Co., Ltd.
3 Soi Udomsuk 41, Sukhumvit Road,
Bangchak, Phraekhanong,
Bangkok 10260
Microbiology Laboratory
Location: 21 April 2021
Received Order: 21 April 2021
Calibration Date: 21 April 2021
Ambient Temperature: (26 ± 10) °C
Relative Humidity: (50 ± 30) %
Calibrated by: Kritasda Chaltrong

Approved by: Approved Signatory

() Ponthippa Tameyakul
() Malee Burkrua
() Suwit Imjai

Issue Date: 5 May 2021

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 0627612



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
CORPORATE SERVICES & EQUIPMENT CALIBRATION AND TESTING SERVICES
534/4 PATTANAKARN ROAD 501 18, SUKHUMVIT, SUKHUMVIT BANGKOK 10250
TEL. 0-2715-3000-27 FAX. 0-2719-9484



Cert. No.: 22TM334
Page: 1 of 3

Certificate of Calibration

Equipment: Water Bath
Manufacturer: Memmert
Model: WNE 14
Serial No.: L416.0612
ID No.: UAE.MIC.003/2560
Submitted by: United Analyst and Engineering Consultant Co., Ltd.
3 Soi Udomsuk 41, Sukhumvit Road,
Bangchak, Phraekhanong,
Bangkok 10260
Microbiology Laboratory
Location: 17 February 2022
Received Order: 17 February 2022
Calibration Date: 17 February 2022
Ambient Temperature: (26 ± 10) °C
Relative Humidity: (50 ± 30) %
Calibrated by: Suwit Imjai

Approved by: Approved Signatory

() Ponthippa Tameyakul
() Malee Burkrua

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 0038095



Cert. No.: 22TM334
Page: 2 of 3
Equipment: Water Bath
Condition As-Received: Used Item
Reference: 2202-0444OC-4

Procedure Used :-

Calibration were conducted using in-house calibration procedure CP-OT04 according to direct measurement method with Data Acquisition which connected with Industrial Platinum Resistance Thermometer (PRT).

The temperature scale used was based on ITS-90.

Condition of this result of calibration

1. Reference standard instrument:-

Instrument Model Serial No. Cert. No. Due Date

1) Data Acquisition 34970A MY44067817 21LM10 20 Jul 2022

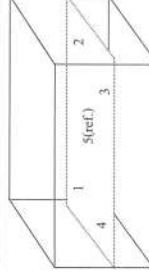
2. This certificate is valid only to the item calibrated on date and place of calibration.

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

Result of Calibration: () Without Adjustment

Function of UUC*: Temperature Source

Beginning of Calibration Finished of Calibration	Environmental		AC Voltage Supply	
	(°C)	(%R.H.)	(V)	(Vol)
	21	65	229	
	22	57	230	



Front

Position:	Ref. Std. ID No.:
1	70RC143
2	70RC144
3	70RC145
4	70RC146
5(ref.)	70RC147

WUW

เอกสารไม่ควบคุม

a 1096055

Mettler-Toledo (Thailand) Ltd.
84/04 - 84/05 Lasilai Rd., Bangna Tri Sub-District
Bangna District, Bangkok 10260
+66 2723 1332
MT.TH.ServiceSupport@mt.com



Accuracy Calibration Certificate

Customer

Company: United Analysts and Engineering Consultant Co., Ltd.
Address: 3 Soi Udom Suk 41, Sukhumvit Rd., Bang Chak
City: Phra Prachin
Zip / Postal: 10260
State / Province: Bangkok
Order Number: 00000000000000000000

Contact: Suwit Chotachok

Weighing Device

Manufacturer: Mettler Toledo
Model: ME6038L01
Serial No.: 8507111311
Building: 2
Floor: 2
Room: Balance Room (206)

Range	Max. Capacity	Repeatability (g)
1	620 g	0.001 g

Weighing Instrument
UAE-MC-009/2553
N/A
N/A

Procedure

Calibration Guideline: EURAMET (p-18 v. 4.3) (11/2015)
METTLER TOLEDO Work Instruction: CPW002226
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 (p-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	Start: 22.8 °C	End: 23.0 °C	Start: 49.5 %	End: 58.3 %
Temperature	Humidity			

As Found Calibration Date: 07-Apr-2022
As Left Calibration Date: N/A
Issue Date: 08-Apr-2022

Sriwit Chotachok

Approved Signatory:

☒ Katsakorn Tassachaisakul
☐ Santi Jinyong
☐ Surasart Subokan

Measurement Results

Repeatability

Test Load: 200 g	As Found	As Left
1	200.001 g	N/A
2	200.001 g	N/A
3	200.001 g	N/A
4	200.001 g	N/A
5	200.001 g	N/A
6	200.000 g	N/A
7	200.001 g	N/A
8	200.001 g	N/A
9	200.000 g	N/A
10	200.001 g	N/A
Standard Deviation	0.0004 g	N/A

Eccentricity

Test Load: 200 g	As Found	As Left
1	200.001 g	N/A
2	200.001 g	N/A
3	200.002 g	N/A
4	200.002 g	N/A
5	200.000 g	N/A
Maximum Deviation	0.001 g	N/A

This "e" in the graph represents the repeatability of the range/interval in which the test was performed.

Equipment : Water Bath
Condition As-Received : Used Item
Reference : 2104-00190C-4
Procedure Used :-

Calibration were conducted using in-house calibration procedure CP-OT04 according to direct measurement method with Data Acquisition which connected with Industrial Platinum Resistance Thermometer (I PRT).

The temperature scale used was based on ITS-90.

Condition of this result of calibration

1. Reference standard Instrument:-

Instrument : MY44060450
Serial No. : 21LM4
Cert. No. : 21LM4
Traceable : NIMT
Due Date : 06 Mar 2022

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

Remark : NIMT : National Institute of Metrology Thailand.

Result of Calibration :- (*) Without Adjustment

Function of UUC* : Temperature Source

Beginning of Calibration	Environmental		AC Voltage Supply (Volt)
	(°C)	(%R.H.)	
23	24	60	223
Finished of Calibration	23	65	224



Front

Position :	Ref. Std. SIN.:
	1
1	4803988-001
2	4803988-002
3	4803988-003
4	4803988-004
5(ref.)	4803988-005

Equipment :

Water Bath

Cert. No.: 21TM708

Condition As-Received : Used Item

Page.: 3 of 3

Reference : 2104-00190C-4

Result of Calibration :- (*) Without Adjustment

Function of UUC* : Temperature Source

Calibration point (°C)	UUC* Setting (°C)	UUC* Reading (°C)	Average* Standard Reading (°C)			
			Position			
			1	2	3	4
44.5	44.5	44.5	44.524	44.507	44.501	44.518
Calibration point (°C)	Uniformity (°C)	Stability (± °C)	Uncertainty (± °C)	Coverage Factor k	2	
44.5	0.052	0.035	0.16			

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

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

Stability : One-half of the greatest maximum difference of measured temperature at any one probe.

UUC* : Unit Under Calibration

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

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

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Measurement Uncertainty of the Weighing Instrument in Use

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

Temperature coefficient for the evaluation of the measurement uncertainty in use: $3.0 \cdot 10^{-6} / ^\circ\text{C}$
Temperature range on site for the evaluation of the measurement uncertainty in use: 3°C

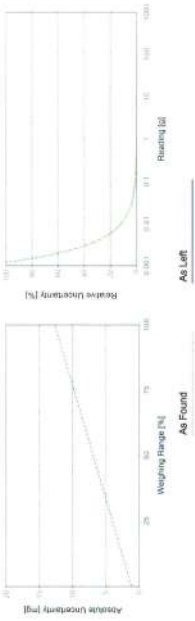
Uncertainty of Uncertainty Equation

Range	d	Max	As Found	As Left
1	0.001 g	620 g	$U_1 = 1.2 \text{ mg} + 0.0166 \text{ mg/g} \cdot R$	N/A

To optimize the stability of the indication, besides of the zero load only increasing measurement points with a last 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
0.002 g	1.2 mg	N/A
0.020 g	1.2 mg	N/A
0.200 g	1.3 mg	N/A
2.000 g	2.4 mg	N/A
20.000 g	13 mg	N/A



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Error of Indication

As Found	Reference Value	Indication	Error of Indication	Expanded Uncertainty	k
1	0.000 g	0.000 g	0.000 g	1.0 mg	2
2	0.500 g	0.500 g	0.000 g	1.2 mg	2
3	1.000 g	1.000 g	0.000 g	1.2 mg	2
4	50.000 g	50.000 g	0.000 g	1.2 mg	2
5	100.000 g	100.000 g	0.000 g	1.3 mg	2
6	150.000 g	150.000 g	0.000 g	1.5 mg	2
7	200.000 g	200.000 g	0.001 g	1.6 mg	2
8	300.000 g	300.000 g	0.000 g	2.0 mg	2
9	400.000 g	400.000 g	0.000 g	2.5 mg	2
10	500.000 g	500.000 g	0.001 g	2.9 mg	2
11	600.000 g	600.000 g	0.000 g	3.4 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 up-18. The value of the measurand lies within the assigned range of values with a probability of approximately 95%.

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

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Measurement Uncertainty of the Weighing Instrument in Use

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

Temperature coefficient for the evaluation of the measurement uncertainty in use: $3.0 \cdot 10^{-6} / ^\circ\text{C}$
Temperature range on site for the evaluation of the measurement uncertainty in use: 3°C

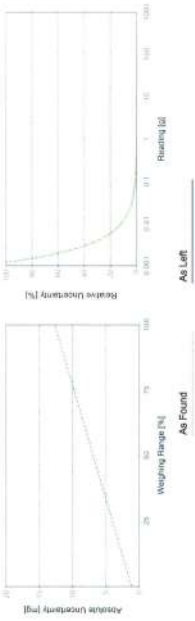
Uncertainty of Uncertainty Equation

Range	d	Max	As Found	As Left
1	0.001 g	620 g	$U_1 = 1.2 \text{ mg} + 0.0166 \text{ mg/g} \cdot R$	N/A

To optimize the stability of the indication, besides of the zero load only increasing measurement points with a last 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
0.002 g	1.2 mg	N/A
0.020 g	1.2 mg	N/A
0.200 g	1.3 mg	N/A
2.000 g	2.4 mg	N/A
20.000 g	13 mg	N/A



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Error of Indication

As Found	Reference Value	Indication	Error of Indication	Expanded Uncertainty	k
1	0.000 g	0.000 g	0.000 g	1.0 mg	2
2	0.500 g	0.500 g	0.000 g	1.2 mg	2
3	1.000 g	1.000 g	0.000 g	1.2 mg	2
4	50.000 g	50.000 g	0.000 g	1.2 mg	2
5	100.000 g	100.000 g	0.000 g	1.3 mg	2
6	150.000 g	150.000 g	0.000 g	1.5 mg	2
7	200.000 g	200.000 g	0.001 g	1.6 mg	2
8	300.000 g	300.000 g	0.000 g	2.0 mg	2
9	400.000 g	400.000 g	0.000 g	2.5 mg	2
10	500.000 g	500.000 g	0.001 g	2.9 mg	2
11	600.000 g	600.000 g	0.000 g	3.4 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 up-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.

เอกสารไม่ควบคุม



TECHNOLOGY PROMOTION ASSOCIATION (THAI AND JAPAN)
CORPORATE SERVICES & EQUIPMENT CALIBRATION AND TESTING SERVICES
3344 PATTANAKARN ROAD, SUKHUMVIT 11, SUKHUMVIT, BANGKOK 10250



TEL: 0-2717-3900-37 FAX: 0-2719-9444

Certificate of Calibration

Cert. No.: 22TM89
Page.: 1 of 3

Equipment :	Autoclave
Manufacturer :	ALP
Model :	CL-40L
Serial No. :	802664
ID No. :	UAE.MIC.014/2550
Submitted by :	United Analyst and Engineering Consultant Co., Ltd. 3 Soi Udomsuk 41, Sukhumvit Road, Bangchak, Phrakhanong, Bangkok 10260
Location :	Air Analysis Unit
Received Order :	17 February 2022
Calibration Date :	17 February 2022
Ambient Temperature :	$(26 \pm 10) ^\circ\text{C}$
Relative Humidity :	$(50 \pm 30) \%$
Calibrated by :	Kunchit Prompratt

Approved by : Approved Signatory

() Ponthippa Tameyakul
() Milice Bulkruea
() Suwit Injai

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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Request No. 25-65 / 0398

MTC. ACL.No. 486 / 65

CALIBRATION CERTIFICATE

NOMENCLATURE : 1. Atomic Absorption Spectrophotometer "Agilent Technologies"

Model AA240FS, Serial No. MY13160001

2. Working standard solution "Inorganic Ventures"

Multi Analyte Custom Grade Solution, Lot No. P2-MEB675610

SUBMITTED BY : United Analyst and Engineering Consultant Co., Ltd.

3. Soi Udomsakdi, Sukhumvit Road, Bangchak Prakanong, Bangkok 10260

CALIBRATION PROCEDURE : 1. Performance Verification of Atomic Absorption Spectrophotometer

(WI-500-02-30)

2. Estimation Uncertainty of Measurement in Analytical Chemistry (QIP-513)

REFERENCE MATERIAL : Traceable to NIST "Agilent Technologies", "Carlo Erba"

Cadmium Lot No. 0108047046, Chromium Lot No. 0106315418, Copper Lot No. 0107480530, Iron Lot No. 0104697566,

Lead Lot No. 0104659473, Manganese Lot No. T109228A, Nickel Lot No. 0100978044, Zinc Lot No. 0100792297

CALIBRATION RANGE: 0.020,0.10,0.30,0.50,0.70 mg/L at 228.8 nm Cd, 0.10,0.20,0.30,0.50,0.70 mg/L at 357.9 nm Cr,

0.05,0.10,0.30,0.50,0.70 mg/L at 324.7 nm Cu, 0.10,0.30,0.50,0.70,1.00 mg/L at 248.3 nm Fe, 0.20,0.50,0.70,1.00,1.50 mg/L

at 217.0 nm Pb, 0.05,0.10,0.30,0.50,0.70 mg/L at 279.5 nm Mn, 0.10,0.30,0.50,0.70,1.00 mg/L at 232.0 nm Ni,

0.05,0.10,0.30,0.50,0.70 mg/L at 213.9 nm Zn

AMBIENT CONDITIONS : Temperature 22 °C Relative humidity 60 %

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

Calibrated by 
(Mr. Danai Sritrongkum)

Approved by 
Director of Analytical Chemistry Laboratory
Ref. 202565020400522001

Calibration Date : 3 February 2022

Advertising the Report/Certificate and publicity of the results except in full are prohibited unless written permission is obtained from the governor of TISTR.

Head Office
39 Mu. 3 Tambon Khlong Ha, Amphoe Khlong Luang,
Changwat Pathumthani 12120, Thailand
Tel. (66) 0 2517 9000
Fax. (66) 0 2517 9009
Email : tistr@tistr.or.th Website:www.tistr.or.th

Office
195 Phrakongthit Road, Chatuchak, Bangkok 10900,
Thailand
Tel. (66) 0 2323 1672-80 ext. 115, 116
Fax. (66) 0 2323 9165
Email : tistr@tistr.or.th

FMB.LMTC.002 Rev.4

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เอกสารไม่ควบคุม

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Request No. 25-65 / 0398

MTC. ACL. No. 486 / 65

CALIBRATION DATA

1. Noise Level in term of standard deviation

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

Continue 2 / 5

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FMB.LMTC.002 Rev.4

เอกสารไม่ควบคุม

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๑ 1๐๑๕๐๓๑



TISTR

Request No. 25-65 / 0398 4 / 5 MTC. ACL. No. 486 / 65

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

Element	Standard Value of RM (mg/l)	Reading (mg/l)	Error of Measurement (mg/l)	Error of Measurement (%)	Uncertainty (mg/l)
Fe	0.1003	0.106	0.006	5.68	± 0.008
	0.3015	0.322	0.021	4.09	± 0.017
	1.0030	0.993	-0.010	1.00	± 0.032

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

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

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

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

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Amphoe Muang, Changwat Samutprakan 10260, Thailand
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2565

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E-mail : mtc@tistr.or.th



TISTR

Request No. 25-65 / 0398

5 / 5 MTC. ACL. No. 486 / 65

3.7 Reading on wavelength- Nickel (Ni) at 232.0 nm.

Element	Standard Value of RM (mg/l)	Reading (mg/l)	Error of Measurement (mg/l)	Error of Measurement (%)	Uncertainty (mg/l)
Ni	0.099	0.102	0.003	3.03	± 0.007
	0.495	0.489	-0.006	1.21	± 0.010
	0.990	0.975	-0.015	1.52	± 0.020

3.8 Reading on wavelength- Zinc (Zn) at 213.9 nm.

Element	Standard Value of RM (mg/l)	Reading (mg/l)	Error of Measurement (mg/l)	Error of Measurement (%)	Uncertainty (mg/l)
Zn	0.050	0.050	0.000	0.00	± 0.012
	0.300	0.307	0.007	2.33	± 0.011
	0.700	0.660	-0.040	5.71	± 0.015

Remark : The reported uncertainty is an expanded uncertainty calculated using a coverage factor of 2 (k = 2) which gives a level of confidence of approximately 95%

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

Approved by.....
Director of Analytical Chemistry Laboratory
Calibration date : 3 February 2022

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TISTR

2 / 5

Request No. 25-65 / 0398

MTC. ACL. No. 486 / 65

2. Precision

Element	Conc. (mg/l)	Absorbance			Ave. Abs.	SD	%RSD
		0.02	0.0074	0.0062	0.0070	0.0065	0.0069
Cd	0.30	0.952	0.959	0.951	0.952	0.0948	0.0956
	0.70	0.2213	0.2180	0.2203	0.2204	0.0211	0.2196
	0.10	0.0596	0.0598	0.0597	0.0102	0.0097	0.0103
Cr	0.30	0.0309	0.0302	0.0300	0.0316	0.0299	0.0309
	0.70	0.0659	0.0667	0.0664	0.0648	0.0662	0.0658
	0.05	0.0080	0.0075	0.0078	0.0075	0.0081	0.0075
Cu	0.30	0.0417	0.0419	0.0412	0.0424	0.0420	0.0403
	0.70	0.0969	0.0965	0.0972	0.0961	0.0958	0.0961
	0.10	0.0090	0.0105	0.0078	0.0099	0.0091	0.0093
Fe	0.50	0.0462	0.0470	0.0464	0.0467	0.0462	0.0467
	1.00	0.0867	0.0886	0.0910	0.0892	0.0897	0.0873
	0.20	0.0091	0.0095	0.0088	0.0087	0.0094	0.0090
Pb	0.70	0.0322	0.0321	0.0324	0.0318	0.0335	0.0326
	1.50	0.0533	0.0463	0.0663	0.0644	0.0632	0.0671
	0.05	0.0092	0.0092	0.0097	0.0087	0.0085	0.0079
Mn	0.30	0.0616	0.0630	0.0632	0.0633	0.0634	0.0628
	0.70	0.1396	0.1366	0.1386	0.1377	0.1386	0.1396
	0.10	0.0102	0.0092	0.0097	0.0104	0.0091	0.0105
Ni	0.50	0.0488	0.0489	0.0489	0.0495	0.0490	0.0481
	1.00	0.0976	0.0979	0.0975	0.0992	0.0977	0.0973
	0.05	0.0340	0.0349	0.0340	0.0352	0.0337	0.0351
Zn	0.30	0.1669	0.1655	0.1628	0.1642	0.1637	0.1659
	0.70	0.3456	0.3467	0.3445	0.3430	0.3422	0.3464

Continue 3 / 5

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FM.B.MTC.002 Rev.4

2565

เอกสารไม่ควบคุม

E-mail : mtc@tistr.or.th

Maintenance works basic unit

- tightness visual check inside the Mercur
- visual check if gold-traps are broken
- visual check if spectrometer is contaminated
- visual check of the fluorescence cell
- visual check of the absorption cell, incl. window reactor cleaning
- check pump-hose, if necessary change it
- check swivel drive (SEV)
- test Bubble-Sensor
- check gas flows
- check volume flows, reagents
- recording stray light values
- measurement with 30 ng/l

Maintenance works Autosampler

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

Maintenance Protocol

Atomic Fluorescence Spectrometer
mercur DUO /
mercur DUO plus

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เอกสารไม่ควบคุม

Device parameter	nominal value	actual value
visual check general tightness inside the Mercur	o.k.:	changed:
visual check Goldtraps	o.k.:	changed:
visual check spectrometer		
	Fluorescence cell	o.k.:
	Absorption cell, incl. window lens	o.k.:
	Swivel drive (SEV)	o.k.:
check pump hoses		o.k.:
check hoses and hose connectors		o.k.:
check and clean reactor		o.k.:
check drying hose output Gas-liquid-separator		o.k.:
check bubble-sensor		o.k.:
Check gasflow		not o.k.:
	Valve 1	10 Nl/h
	Valve 2	50 Nl/h
	Valve 3	5 Nl/h
	Valve 4	10 Nl/h
Check liquidflow		
	Acid	2.5ml/min ± 1 ml
	Red-agent	2.5ml/min ± 1 ml
	Sample	10ml/min ± 2 ml
Adventitious light - values	(V)	from file
	100	0
	200	0
	300	0
	350	0
	400	1
	450	4
	500	9
	550	19
	575	27
	600	38

เอกสารไม่ควบคุม

Serial-No.: K170A0153 Customer-No.:
Date: 4/02/2022 Carried out by: M. Srichai Fok-on.

Maintenance with following Operational Qualification (OQ)
(requires a separate OQ protocol)

Company	บริษัท อีทีเค จำกัด (มหาชน) เลขที่ 102/60 ถนนสุขุมวิท กรุงเทพฯ
User	Mr. Srichai Fok-on.
Department	Lab
Street	3 ซอยทองหล่อ 41 ถนนสุขุมวิท แขวงคลองเตย เขตคลองเตย กรุงเทพฯ
Zip Code, City	กรุงเทพมหานคร 10260
Country	Thailand
Phone	
Fax	
E-mail	

เอกสารไม่ควบคุม

QC parameters

[illegible]

Calibration standards

No	Name	State	Pos	Conc./ ng/L	Ints	SD	RSD/%
1	Cal-Zero	(-)	##	0.000	H: 0.000344 A: 0.004747	0.000040 9.290	11.85
2	Cal-Std1	(-)	##	30.000	H: 0.002913 A: 0.03433	0.000069 0.000916	2.371 2.670

เอกสารไม่ควบคุม

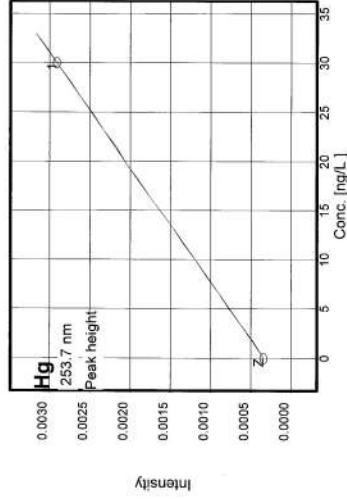
Mercur

4/02/2022 17:59 Page 3/4

Calibration function	1	4/02/2022 17:59	Calibration (Peak height)
----------------------	---	-----------------	---------------------------

```
Ints=k1+k2*conc
k1=0.000344      k2=0.000086
Recal factor:
```

Slope sc0	0.00009 Ints/(ng/L) 1.00000 ng/L	R2-adjusted	1.0000
Lower limit	0 ng/L	Upper limit	33.0 ng/L
Detection limit	---	Defect limit	---



Measurements and events (sorted by time)

Hg ID	Without Enrichment / FBR / 30 µg/L PM ₄₋₁₀	Ints	SD	RSD/%	Int. type	Time
Cal-Zero	Conc.	0.000342			PkH	17.49
		0.000304				17.50
		0.000385				17.51
Cal-Std1	0ng/L	0.000344	0.00040750	11.85	PkH	17.56
		0.002923				17.57
		0.002840				17.57
		0.002977				17.58
Calibration	30.00ng/L	0.002913	0.00069060	2.371		17.58
	Calibration function: 01					17.59

Mercur

เอกสารไม่ควบคุม

Mercur

Report file: C:\WinAAS\TMP\2022\Result\Pro_012
Program version: 4.7.9.0 Printed on:

Operator:
Laboratory:
Code:

Remarks:

Method parameters

Method	Without Enrichment / FBR / 30 µg/L_PM_4-02-22
Created on	4/02/2022 Time 17:45

Parameters Mercury Technique: Hg fluorescence

[illegible]

Mercur

เอกสารไม่ควบคุม

เอกสารไม่ควบคุม

Place, Date (DD/MM/YYYY)

4/02/2022

Place, Date (DD/MM/YYYY)

4/02/2028

M/S. Sanchai Fale-On.
Signature Technician

Signature Customer

QC parameters

QC type	Conc. check	QC check samp. 1	QC check samp. 2
Conc.	---	---	---
Error limit	---	---	---
Rep. measurement	off	Error limit	flag + continue
QC std.1 no.	1(30.000 µg/L)	Reaction	1(30.000 µg/L)
QC std.1 limit	± 50.00%	QC std.2 no.	± 50.00%
QC std. act.	flag + continue	QC std.2 limit	flag + continue
Expect. blank abs.	0.0100± 0.0100	Reaction	off
QC precision	off	Reaction	Off
		QC Recal factor	Off

Calibration settings

Calib. meth	Standard calib.	Calibr. unit	µg/L
No. standards	1	Conversion fac.	1000
Type of standards	---	Standard prep.	Premixed
		Blank correct.	---
Output unit	µg/L	Recalib. std. no.	---
Calib. stat.	Mean	Conversion fac.	1000
		Meas. cycles	3
Stock sol. 1	---	Blind cycles	1
Stock sol. 3	---	Stock sol. 2	---
Type of cal. curve	linear	Stock sol. 4	---
Weighted cal.	off	Intercept	Zero
Check of cal. curve	no outlier test	Grubbs stat.	off

Sample statistics

Stat. mode	off	Meas. cycles	1
Confid. level	95.4 %	Blind cycles	1
Grubbs stat.	---		

Calibration standards

No	Name	State	Pos	Conc./ µg/L	Ints	SD	RSD/%
1	Cal-Zero	(-)	##	0.000	H: 0.001423 A: 0.004275	0.00027 1.946 0.00307 7.188	
2	Cal-Std1	(-)	##	30.000	H: 0.01046 A: 0.03042	0.00097 9.445 0.002821 9.273	

Hg

เอกสารไม่ควบคุม

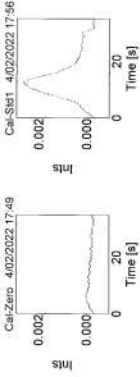
Mercur

Mercur

เอกสารไม่ควบคุม

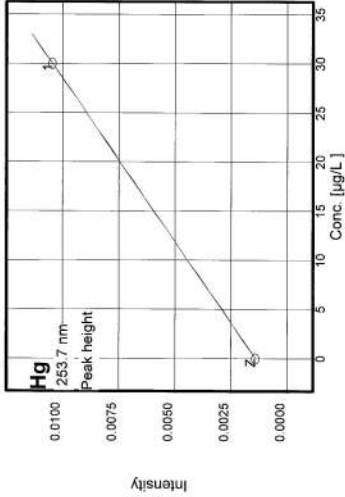
Peak plots

Hg



Calibration function 1 4/02/2022 17:31 Calibration (Peak height)

Ints=k1+k2*conc		k1=0.001423		k2=0.000301		Recal. factor: ---	
Slope	0.00030 Ints/(µg/L)	R2-adjusted	1.0000				
sc0	1.00000 µg/L	Upper limit	33.0 µg/L				
Lower limit	0 µg/L	Deter. limit	---				
Detection limit	---						



Calibration standards

No	Name	State	Pos	Conc / µg/L	Ints	SD	RSD/%
1	Cal-Zero	(-)	##	0.000	H: 0.001423 A: 0.004275	0.000027 0.000307	1.946 7.188
2	Cal-Std1	(-)	##	30.000	H: 0.01136 A: 0.03294	0.000036 0.000360	0.325 1.094
Calibration function 2 4/02/2022 17:39 Calibration (Peak height)							
Ints=k1+k2*conc				k1=0.001423 k2=0.000331			
Slope		0.00033 Ints/(µg/L)		R2-adjusted		Recal. factor: ---	
sc0		1.00000 µg/L		Upper limit		1.0000	
Lower limit		0 µg/L		Deter. limit		33.0 µg/L	
Detection limit		---				---	

Hg

เอกสารไม่ควบคุม

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Mercur

Report file:	C:\WinAAS\TMP\2022\Result\Po_011		
Program version:	4.7.9.0	Printed on:	4/02/2022 17:40
		Recording started on	4/02/2022 17:15 GMT+7.0
Operator:			
Laboratory:			
Code:			
Remarks:			

Method parameters

Method	With Enrichment / FBR / 30 µg/L_PM_4-02-22		
Created on	4/02/2022	Time	14:54
Program	---		

Hg

Parameters Mercur Technique: Hg fluorescence

Line	253.7 nm		
Lamp type	Hg-LP		
Integr. mode	Peak height	Integr. time	20 s
PMT	444 V	Peak smoothing	12/5
AZ time	5 s		
Delay	0 s		

Working mode	Err. w/o reload.	System cleaning	Off
FBR technique	on	Wash time acid	10 s
Pump speed	3	Soaking time	20 s
Sample load time	10 s	Gas load time	5 NL/h
Reaction time	10 s		
Delay	5 s		
	0 s		
Purge time1	20 s		
Purge time2	15 s	Gas wash time2	15 NL/h
Purge time3	10 s	Gas wash time3	15 NL/h
Heat-time coll.1	20 s	Cool. time coll.1	50 s

Mercur

Report file: C:\WinAAS\TMP\2022\ResultPro_009
Program version: 4.7.9.0 Printed on: 4/02/2022 16:09
Operator: Recording started on 4/02/2022 15:55 GMT+7.0
Laboratory:
Code:
Remarks:

Method parameters

Method Without enrichment / FBR 100 ng/L PM_5-6 Abs cell
Created on 6/08/2021 Time 11:41
Program

Hg

Parameters Mercur Technique: Hg absorption

Line	253.7 nm
Lamp type	Hg-LP
Integr. mode	Peak height
PMT	242 V
AZ time	5 s
Delay	0 s

Working mode	W/o enrich.
FBR technique	off
Pump speed	4
Sample load time	8 s
Reaction time	12 s
Waiting time AZ	15 s
Purge time 1	51 s

QC parameters

QC type	Conc. check
QC check samp. 1	---
Conc.	---
Error limit	---
Rep. measurement	flag + continue
QC std.1 no.	QC std.2 no.
QC std.1 limit	1(100.00 ng/L)
QC std. act.	± 50.00%
Expect. blank abs.	flag + continue
QC precision	0.0100± 0.0100
	off
	Reaction
	Reaction
	QC Recal.factor
	Off

เอกสารไม่ควบคุม

Mercur

Calibration settings

Calib. meth	Standard calib.
No. standards	1
Type of standards	---
	ng/L
	Conversion fac.
	Standard prep.
	Blank correct.

	Recalib. std. no.
	Conversion fac.
	Meas. cycles
	Blind cycles
	Stock sol. 2
	Stock sol. 4
	Intercept
	Grubbs stat.
	calculated
	off
	no outlier test

Sample statistics

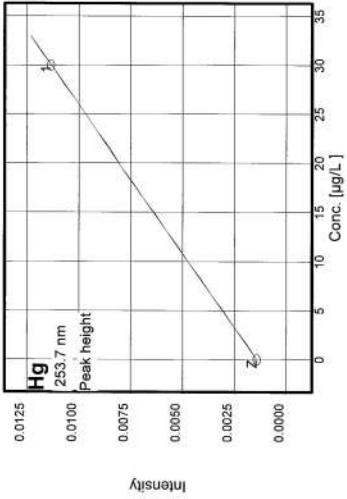
Stat. mode	Mean
Confid. level	95.4 %
Grubbs stat.	---

Calibration standards

No	Name	State	Pos	Conc./ ng/L	Abs	SD	RSD/%
1	Cal-Zero	(-)	##	0.00	H: 0.000265 A: 0.003730	0.000062 0.003049	23.66 81.74
2	Cal-Std1	(-)	##	100.00	H: 0.003620 A: 0.054076	0.000138 0.003871	3.821 6.789
Calibration function 1 4/02/2022 16:08 Calibration (Peak height)							
Abs=k1+k2*conc				Recal. factor: ---			
k1=0.000266 k2=0.000034							
Slope	0.00003 Abs/(ng/L)	R2-adjusted	1.0000				
sc0	1.00000 ng/L	Charact. conc.	129.953 (ng/L)/1%				
Lower limit	0 ng/L	Upper limit	110. ng/L				
Detection limit	---	Deter. limit	---				

เอกสารไม่ควบคุม

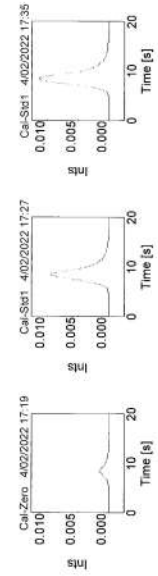
Mercur



Measurements and events (sorted by time)

Hg	W/o Enrichment / FBR / 30 µg/L PM_4-02-22	4/02/2022	17:15
ID	Ints	BG	SD
Cal-Zero	0.001398		PxH
	0.001453		17:19
	0.001419		17:21
			17:23
Cal-Std1	0.001423	0.000027690	1.946
	0.009317		PxH
	0.01103		17:27
	0.01103		17:29
			17:31
Calibration	30.00µg/L	0.01046	0.0009877
	Calibration function: 01		9.445
Cal-Std1		0.01140	PxH
		0.01133	17:35
		0.01135	17:37
			17:39
Calibration	30.00µg/L	0.01136	0.000036960
	Calibration function: 02		0.325
			17:39

Peak plots



เอกสารไม่ควบคุม

Mercur

เอกสารไม่ควบคุม

Mercur

Procedure Checklist

Use (✓) to check off those steps in the checklist that have been completed.

1. General:
- ☐

Review the instrument performance with the customer and document any recent problems.
- ☐

Perform general inspection of system for cleanliness.

2. Optical checks and Clean:

☐

Lamp Alignment/Intensity

☐

Sample Compartment and Windows

☐

Mirror and Grating Alignment

☐

Filler Wheel

☐

Cell Holder Alignment

3. Mechanical:

☐

Physical Inspection – Please write any comments in the additional comments section.

☐

Grating Drive Mechanism.

☐

Slit Drive Mechanism.

☐

Sample Holder

4. Test:
- ☐

Emission Wavelength Accuracy:

Emission Wavelength Accuracy	Actual Value (nm)	Validation Criteria	
		Accuracy Limit +/- (nm)	
Target Peak # 1	253.7	253.8	± 1.0 nm
Target Peak # 2	507.3	507.2	± 1.0 nm
Target Peak # 3	626.0	625.6	± 1.0 nm

เอกสารไม่ควบคุม

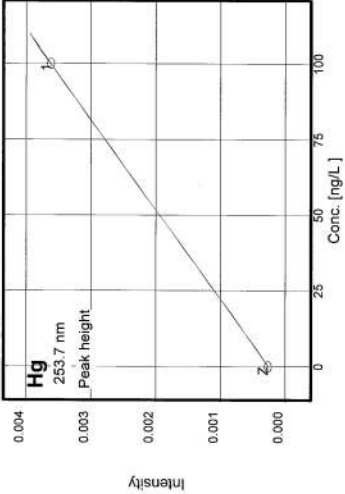
Component List

Component	Specific Model	Serial #	Software Version	Configuration Notes
	L555	81440	4.00.03	
	-	-	-	-
	-	-	-	-

Parts Lists

Test standard Used				
Part Number (if applicable)		Description		
C 520-7440		Standard Fluorescence Intensity Filter		
B050 7805		Sealed Water Cell		
Additional Tools Required for PM				
Part Number (if applicable)		Description	Quantity	Serial #
				Calibration Due Date (MM/YY)

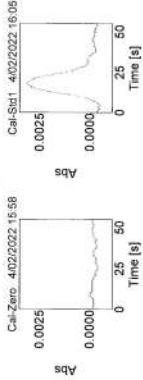
เอกสารไม่ควบคุม



Measurements and events (sorted by time)

Hg	ID	Without enrichment / FBR	100 ng/L PM_5-6 Abs cell	4/02/2022	Int. type	Time
Cal-Zero	Conc.				PtH	15:58
	Abs	0.000329				16:00
	SD	0.000264				16:02
Cal-Std1	0ng/L	0.000265	0.000062901	23.66	PtH	16:02
		0.003486				16:05
		0.003613				16:06
Calibration	100.ng/L	0.003763				16:08
		0.003620	0.00013837	3.821		16:08
	Calibration function:	01				16:08

Peak plots



Mercur

เอกสารไม่ควบคุม

LS 45/50B/55 - Preventive Maintenance report

Company Name:	United analyst and Engineering Consultant Co.,Ltd.
Address:	3 Soi Udomsuk 41, Sukumvit Road, Phrakhanong, Bangkok 10260
User Name :	K. Primpun
WO Number:	WO-01624974
Telephone Number :	02-763-2828
Certificate Number :	FLR1001-2021
Customer Support Engineer :	Tanongsak
P.M. Number	1 of 1
PM Performed: (DD-MMM-YYYY)	18-Feb-2022
Next PM Due Date: (DD-MMM-YYYY)	18-Feb-2023

Scope

The purpose of this PM is to ensure the continued functionality of the PerkinElmer Fluorescence Spectrophotometer by inspecting and replacing any worn or damaged parts. This service should only be performed by a trained representative of PerkinElmer.

General Instructions:

The customer must provide the engineer operational data to demonstrate recent instrument performance prior to starting the PM. Always check with the customer before making any changes that may affect the customer's analysis should be signed by an authorized PerkinElmer and customer representative and left with the customer. Update the PM sticker and instrument logbook as required.

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เอกสารไม่ควบคุม

Additional Comments

Additional Comments Regarding the PM	
Reference intensity low	

☐ Excitation Wavelength Accuracy.

Excitation Wavelength Accuracy		Actual Value	Validation Criteria
Target Peak (nm)		(nm)	Accuracy Limit +/- (nm)
Target Peak # 1	253.7	254.2	± 1.0 nm
Target Peak # 2	365.0	365.0	± 1.0 nm
Target Peak # 3	507.3	507.4	± 1.0 nm

☐ Emission Slit calibration.

Emission Slit		Actual Value	Validation Criteria
Target Value (nm)		(nm)	Accuracy Limit +/- (nm)
Target Peak # 1	2.5	2.52	± 0.5 nm
Target Peak # 2	5.0	5.11	± 0.5 nm
Target Peak # 3	10.0	10.23	+ 1.0 / - 0.5 nm

☐ Excitation Wavelength Repeatability.

Emission Slit		Actual Value	Validation Criteria
Target Value (nm)		(nm)	Accuracy Limit +/- (nm)
Target Peak # 1	2.5	2.45	± 0.5 nm
Target Peak # 2	5.0	4.67	± 0.5 nm
Target Peak # 3	10.0	10.21	+ 1.0 / - 0.5 nm

เอกสารไม่ควบคุม

เอกสารไม่ควบคุม



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

53/4 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG BANGKOK 10250
TEL. 0-2717-3000-24 FAX. 0-2719-9484

Cert.No.: 21CH1017
Page.: 1 of 2

Certificate of Calibration

Equipment :	Turbidity Meter
Manufacturer :	Oakton
Model :	T1100R
Serial No. :	1120501017
ID. No. :	UAE.WAT.056/2563
Condition As-Received:	Used Item
Received Date :	09 August 2021
Calibration Date :	17 August 2021
Reference :	2108-0201WSC-1
Submitted by :	United Analyst and Engineering Consultant Co.,Ltd. 3 Soi Udomsuk 41, Sukhumvit Road, Bangkok. Phrakhanong, Bangkok 10260

Ambient Temperature : (25 ± 2.5) °C
Relative Humidity : (50 ± 20) %
Calibration Procedure : In - house method : CP-CH11
based on direct measurement by
using Formazin standard solution

Calibrated by : Walalak Sirinhean
Approved by :
Approved Signatory

() Malee Bulkrusa
() Sathip Meangmai
() Warakorn Lemgagrakul

Issue Date : 23 August 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 Calibration and Testing Equipment Services.

เอกสารไม่ควบคุม

เอกสารไม่ควบคุม

Calibration Certificate

Certificate No.: 2101930-001-01
Client name: UNITED ANALYST AND ENGINEERING CONSULTANT CO.,LTD.
Address: 3 Soi Udomsak 41, Sukhumvit Road,
Bangchack, Prakanong, Bangkok 10260

Page 1 of 5

Equipment: pH Meter
Manufacturer: METTLER TOLEDO
Model: SevenEasy pH
Serial No.: 123052312
ID No.: UAE.WAS.0032553
Order No.: 2101930
Operation No.: 2101930-001
Date of Receipt: 10 March 2021
Date of Calibration: 17 March 2021

Calibrated by Mr.Manas Somsak
Expert
Date of Issue: 19 March 2021
Approved by (Mr.Pieraphat Tuantit)
Manager, 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.

FCS-009 Revision: 00 Date: 14-12-61

เอกสารไม่ควบคุม

Calibration Report

Certificate No.: 2101930-001-01
Equipment: pH Meter
Resolution: 0.01 pH ± 1 mV
Model: SevenEasy pH
Type: Bench top
Serial No.: 123052312
ID No.: UAE.WAS.0032553
Date of Calibration: 17 March 2021
Location: Chemical Calibration Laboratory, National Food Institute
Environment Condition: Ambient Temperature: (23.3 ± 1.5) °C Relative Humidity: (93.5 ± 5) %
Condition of Equipment: Good Condition

Condition of this Result of Calibration
1. Calibration Method
In house method (NCS-C-002) based on direct measurement by using standard voltage calibrator and certified reference material (CRM)

Instrument	Serial / ID No.	Manufacturer	Certificate No.	Date
2.1 DC Voltage Calibrator	2795007	Fluke	SCL-25F-662	17 June 2021
2.2 Digital Thermometer	2795007	Fluke	CG 630009-01	30 October 2021
2.3 Thermo-Hygro Meter	NFIETH033V17	PONPE	QK00-1578	21 September 2021
Certified Reference Material	Lot No.	Manufacturer	Serial	Expiry Date
2.4 pH Buffer 4.00 (Primary pH buffer Solution)	710146	CPAchem	PH216.L5	2 October 2022
2.5 pH Buffer 6.86 (Primary pH buffer Solution)	710146	CPAchem	PH217.L5	2 October 2022
2.6 pH Buffer 10.01 (Primary pH buffer Solution)	710050	CPAchem	PH220.L5	2 October 2021
2.7 pH Buffer 7.00 (Standard pH buffer Solution)	710051	CPAchem	PH107.L5	2 October 2021

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-TS1-T15 17025 Laboratory Accreditation of Calibration No.00719
NSC-TS1-T15 17025 Laboratory Accreditation of Calibration No.0081
NSC-TS1-T15 17025 Laboratory Accreditation of Calibration No.0292
Primary measurement method: Handred out using calibrated reference material and certified reference material. Solution preparation and certified by CPAchem Ltd is accredited to ISO 17024 and ISO/IEC 17025
BM RefH H4-T Lot# 30.04.2020, BM RefH H4-S Lot# 26.05.2020, BM RefH H4-L Lot# 30.04.2020, BM RefH H4-10 Lot# 26.06.2020. The reference material is traceable to the SI unit of pH. CPAchem Ltd is accredited to ISO 17024 and ISO/IEC 17025

4. This certificate was certified only for the instrument we calibrated.
5. The result of calibration was found accurate as shown on date and place of calibration only.

FCS-012 Revision: 00 Date: 14-12-61

เอกสารไม่ควบคุม

Calibration Report

Certificate No.: 2103272-001-02
Equipment: Digital Thermometer with RTD (pH Meter)
Resolution: 0.1 °C Model: SevenEasy pH
Serial No.: C0051107 ID No.: UAE.WAO.0050557
Manufacturer: HANNA INSTRUMENTS
Date of Calibration: 14 June 2021

Page 4 of 5

Location: Chemical Calibration Laboratory, National Food Institute
Environment Condition: Ambient Temperature: 24 °C ± 1 °C
Relative Humidity: 54 % ± 2 %

Condition of this results of Calibration:

1. Calibration Method :
- In house method WTE-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
HAUTHELD THERMOMETER	1521	A85907	TE 640028-01	12-Dec-21	NATIONAL FOOD INSTITUTE
Platinum Resistance Thermometer (PRT)	385	S00201			
Support Equipment :	- Low Temperature Bath (ISOCAL 6), Model Europa-4 Plus Basic, S/N: 3418922				

3. This certificate is traceable to International System of Unit (SI Units).
4. This certificate is 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

FCS-012 Revision: 00 Date: 14-12-61

เอกสารไม่ควบคุม

Calibration Report

Certificate No.: 2103272-001-02
Equipment: Digital Thermometer with RTD (pH Meter)
Resolution: 0.1 °C Model: SevenEasy pH
Serial No.: C0051107 ID No.: UAE.WAO.0050557
Manufacturer: HANNA INSTRUMENTS
Date of Calibration: 14 June 2021

Page 5 of 5

Calibration point: 15.5, 20.0 and 30.0 °C**

Calibration result:

- The probe was immersed in liquid bath or dry bath to a minimum depth of 100 mm.
Dimension of probe: Diameter 4 mm, Length 118 mm

UUC* Reading (°C)	Standard Temperature (°C)	Correction Value (°C)	Uncertainty ± (°C)
15.1	15.001	-0.1	0.13
20.1	20.000	-0.1	0.13
30.2	30.000	-0.2	0.13

Remark: Edited Model from edge to H2000-02.
NSM

- UUC* Unit Under Calibration
- NFI Laboratory is not accredited ISO/IEC 17025 for calibration. In the scope marked with **
The report uncertainty of measurement was based on standard uncertainty multiplied by coverage factor k= 2, providing a level of confidence of approximately 95 %.

FCS-012 Revision: 00 Date: 14-12-61

เอกสารไม่ควบคุม

Calibration Report

Certificate No.: 2101930-001-01
Equipment: Digital Thermometer with RTD (pH Meter)
Resolution: 0.1 °C
Model: SevenEasy pH
Serial No.: 123052512
ID No.: UAE WAS.0032553
Manufacturer: METTLER TOLEDO
Date of Calibration: 17 March 2021

Page 6 of 6

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: SN: -

Dimension of probe: Diameter 3.0 mm, Length 120 mm.
Sheath material: Stainless Steel

UUC* Reading	Standard Temperature (°C)	Correction Value (°C)	Uncertainty ± (°C)
15.2	15.003	-0.2	0.099
25.2	25.003	-0.2	0.099
35.2	35.007	-0.2	0.099

Note: - UUC* Unit Under Calibration
The report uncertainty of measurement was based on standard uncertainty multiplied by coverage factor k=2, providing a level of confidence of approximately 95 %.

FCS-012 Revision: 00 Date: 14-12-01

เอกสาร ไม้ควบคุม

Calibration Report

Certificate No.: 2101930-001-01
Equipment: pH Meter
Resolution: 0.01 pH ; 1 mV
Model: SevenEasy pH
Serial No.: 123052512
ID No.: UAE WAS.0032553
Manufacturer: METTLER TOLEDO
Type: Bench top
Date of Calibration: 17 March 2021

Page 2 of 5

(Manual Temperature Compensation at 25 °C)

Nominal pH	DC Voltage Standard	Average Indicator Reading		Uncertainty (mV)	Coverage Factor (k)
		mV	pH		
0.00	-414.115	-414	0.00	0.58	2.00
2.00	295.111	296	2.00	0.58	2.00
4.00	177.651	178	4.00	0.58	2.00
6.00	59.180	59	6.00	0.58	2.00
7.00	0.000	0	7.00	0.58	2.00
8.00	-59.155	-59	8.00	0.58	2.00
10.00	-177.651	-177	10.00	0.58	2.00
12.00	-295.612	-296	12.00	0.58	2.00
14.00	-414.115	-414	14.00	0.58	2.00

2. Calibration of pH Meter with Electrode (Manual Temperature Compensation at 25 °C)

Equipment: pH Electrode
Manufacturer: METTLER TOLEDO
Serial No.: 9453943
ID No.: N/A
Type: Combined Electrode
Model: InLab Solids

(Three-Point Calibration of pH4, pH7 and pH10)

Certified Value @25 °C (pH)	Average Indicator Reading		Relative Slope (%)	Uncertainty (± pH)	Coverage Factor (k)
	pH	mV			
4.008	4.01	166	97.5	0.0071	2.00
6.865	6.87	21	98.0	0.0075	2.00
8.655	8.67	21	98.0	0.0075	2.00
10.008	10.01	-161		0.0093	2.00
6.665	6.69	14		0.0093	2.00

FCS-012 Revision: 00 Date: 14-12-01

เอกสาร ไม้ควบคุม

Calibration Certificate

Certificate No.: 2200708-001-01
Client name: UNITED ANALYST AND ENGINEERING CONSULTANT CO.,LTD.
Address: 3 Soi Udomsuk 41, Sukhumvit Road, Bangkok, Prakhonong, 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.Worapong Soekstong
Scientist
Approved by (Mr.Pheraphat Tanijit)
Manager, Division of Calibration Laboratory
Responsible for the Technical Management Team
Date of Issue: 30 November 2021

The uncertainties are for a confidence probability of approximately 95%
This Certificate is issued in accordance with the conditions of accreditation granted by the Thai Laboratory Accreditation Scheme which has assessed the measurement capability of the laboratory and its traceability to recognized national standards and to the units of measurement realized at the corresponding national standards laboratory. This certificate may not be requested other than in full except with the prior written approval of the National Food Institute.

FCS-009 Revision: 00 Date: 14-12-01

เอกสาร ไม้ควบคุม

Calibration Report

Certificate No.: 2101930-001-01
Equipment: Digital Thermometer with RTD (pH Meter)
Resolution: 0.1 °C
Model: SevenEasy pH
Serial No.: 123052512
ID No.: UAE WAS.0032553
Manufacturer: METTLER TOLEDO
Date of Calibration: 17 March 2021

Page 4 of 6

Location: Chemical Calibration Laboratory, National Food Institute
Environment Conditions: Ambient Temperature 23 °C ± 1 °C
Relative Humidity 54 % ± 2 %

Condition of this results of Calibration:

- Calibration Method:
 - In-house method: WTE-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).
- Reference Standard Instrument:
 - Low Temperature Bath (BOCAL-6), Model Europe-6 Plus Basic, S/N: 3419922

Instrument	Model	Serial No.	Certificate No.	Due Date	Through
HANDHELD THERMOMETER Platinum Resistance Thermometer (PRT)	5523 5627A	2115154 877332	PSL-7 787603	04-Jun-21	TSTR

Support Equipment: - Low Temperature Bath (BOCAL-6), Model Europe-6 Plus Basic, S/N: 3419922

- This certificate is traceable to International System of Units (SI Units).
- This certificate was certified only for the instrument we calibrated.
- This result of calibration was found accurate as shown on date and place of calibration only.
- Condition of Calibrated item:

Good ☒ Without adjustment ☐
- Result of Calibration:

Good ☒ After adjustment ☐

FCS-012 Revision: 00 Date: 14-12-01

เอกสาร ไม้ควบคุม

Calibration Report

Certificate No.: 2200708-001-01

Equipment: Electronic Balance

Model: AX 105 DR

Serial No.: 1122100406

Capacity: 110 g

Manufacturer: METTLER TOLEDO

Resolution: 0.0001 g/0.0001 g

ID No.: UAE.WAO.004/2546

Date of Calibration: 24 November 2021

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	39.9999	0.0001	0.00014	2.00
45	44.99999	44.9999	0.0001	0.00015	2.00
50	49.99999	49.9999	0.0001	0.00016	2.00
55	54.99997	54.9998	0.0002	0.00016	2.00
60	60.00002	59.9999	0.0001	0.00018	2.00
65	65.00000	64.9999	0.0001	0.00018	2.00
70	70.00003	69.9999	0.0001	0.00019	2.00
75	75.00001	74.9999	0.0001	0.00020	2.00
80	80.00005	79.9998	0.0003	0.00021	2.00
85	85.00003	84.9998	0.0002	0.00022	2.00
90	89.99999	89.9998	0.0002	0.00021	2.00
100	99.99997	99.9998	0.0002	0.00020	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 %.

FCS-012 Revision: 01 Date: 14-12-61

เอกสารไม่ควบคุม

----- End -----

Certificate of Calibration

Cert. No.: 21TM1876

Page.. 1 of 3

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 Promrat

Approved by:

() Ponnhipha Tameyakul

() Malee Bulkruea

() 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.

เอกสารไม่ควบคุม

Calibration Report

Certificate No.: 2200708-001-01

Equipment: Electronic Balance

Model: AX 105 DR

Serial No.: 1122100406

Capacity: 110 g

Manufacturer: METTLER TOLEDO

Resolution: 0.0001 g/0.0001 g

ID No.: UAE.WAO.004/2546

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-HA-001 In-House Method based on UMAS Lab 14: 2019

2. Reference Standards:

Standard Weight Class E2 1-500mg 15880 TC5 M20111955

Standard Weight Class E2 1-500g 15882 TC5 M20111965

Instrument Model Serial No. Calibrated By Due Date

Thermo-Hygro Meter 11A1 serial:01 BTH 003155 Quality Room Q821-0297

3. This certificate is traceable to SI UNIT

4. This certificate is certified only for the instrument we calibrated.

5. The 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)
25	0.000057
30	0.000084
50	0.000033
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	49.9999	49.9999	50.0000	49.9999	49.9999	0.0001

FCS-012 Revision: 01 Date: 14-12-61

เอกสารไม่ควบคุม

Calibration Report

Certificate No.: 2200708-001-01

Equipment: Electronic Balance

Model: AX 105 DR

Serial No.: 1122100406

Capacity: 110 g

Manufacturer: METTLER TOLEDO

Resolution: 0.0001 g/0.0001 g

ID No.: UAE.WAO.004/2546

Date of Calibration: 24 November 2021

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
Unread	0.000000	0.00000	0.00000	0.0000099	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	0.500006	0.50000	-0.00001	0.000014	2.00
1	0.999995	1.00000	-0.00001	0.000025	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

FCS-012 Revision: 01 Date: 14-12-61

เอกสารไม่ควบคุม

Calibration Certificate

Certificate No.: 2103270-001-01
Client name: UNITED ANALYST AND ENGINEERING CONSULTANT CO.,LTD.
Address: 3 Soi Udomsuk 41, Sukhumvit Road,
Bangchack, Prakhonng, Bangkok 10250

Page 1 of 3

Equipment: Electronic Balance

Manufacturer: Mettler Toledo

Model: AB204-S/FACT

Serial No.: 1129361010

ID No.: UAE.WAS.002/2552

Order No.: 2103270

Operation No.: 2103270-001

Date of Receipt: 11 June 2021

Date of Calibration: 11 June 2021

Calibrated by Mr.Yoshin Charoensuk
Approved by 
Manager, Division of Calibration Laboratory

Date of Issue: 15 June 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 capability to meet national standards and to the units of measurement realized at the corresponding national standards laboratory. This certificate may not be regarded as other than in full except with the prior written approval of the National Food Institute.

FC-509 Revision: 00 Date: 14-12-61

เอกสารไม่ควบคุม

Calibration Report

Certificate No.: 2103270-001-01
Equipment: Electronic Balance

Manufacturer: Mettler Toledo

Resolution: 0.0001 g

ID No.: UAE.WAS.002/2552

Capacity: 220 g

Date of Calibration: 11 June 2021

Environment Condition: Ambient Temperature: 21.1 ± 0.4 °C Relative Humidity: 48 ± 4 %

Place of Calibration: Laboratory, United analyst and engineering consultant co.,ltd

Condition of Equipment: Good Condition

Condition of This Results of Calibration:

1. Calibration Method: NIST Method W-84-001 In-House Method Based on UKAS LAB 14 Calibration of Weighing Machines : 2006

2. Reference Standards:

Reference Standard **Model** **Serial No.** **Calibrated By** **Certificate No.** **Due Date**

Standard Weight Class E2 **Model** **Serial No.** **Calibrated By** **Certificate No.** **Due Date**

Thermo-Hydro Meter **Model** **Serial No.** **Calibrated By** **Certificate No.** **Due Date**

3. This certification is traceable to SI UNIT

4. This certificate was certified only for the instrument was calibrated.

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

Calibration Results:

1. Repeatability of Reading:

Nominal Value (g)	Standard Deviation of Reading (g)
100	0.00067
200	0.00057

2. Off-Center Error:

A mass of 50 g was placed and moved to various position on pans.
The balance reading obtained is given in the table.

	1	2	3	4	5	6	(Maximum Difference)
(g)	(g)	(g)	(g)	(g)	(g)	(g)	(g)
50.0000	49.9999	49.9999	50.0000	50.0000	50.0000	50.0000	0.0001

FC-502 Revision: 00 Date: 14-12-61

เอกสารไม่ควบคุม



Equipment: Hot Air Oven
Condition As-Received: Used Item
Reference: 2110-0701-OC-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 MY4067817 21LM10 20 Jul 2022

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

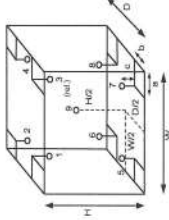
3. This certification is traceable to the International System of Unit.

Result of Calibration :- (*) Without Adjustment

Function of UUC: Temperature Source

Fresh air setting: Close

Environment during calibration	
Beginning	Finished
Temp. (°C)	28
REL.Humid. (%)	56
AC Supply (Volt)	230
	230



Probe Installation Details :

Dimension of Chamber :
D = 0.33 m
W = 0.40 m
H = 0.40 m
Capacity = 0.053 m³

Ref. Std. ID No.: @ Calibration Point	
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

เอกสารไม่ควบคุม

เอกสารไม่ควบคุม



Equipment: Hot Air Oven
Condition As-Received: Used Item
Reference: 2110-0701-OC-1

Result of Calibration :- (*) Without Adjustment

Function of UUC: Temperature Source

Fresh air setting: Close

Calibration Point (°C)	UUC* Setting (°C)	UUC* Reading (°C)	Temperature stability (± °C)	Temperature uniformity (°C)	Overall Variation (°C)	Uncertainty (± °C)	Coverage Factor k
104.0	104.0	104.0	0.11	0.52	0.72	0.42	2
140.0	140.0	140.0	0.25	1.1	1.4	1.1	2
180.0	180.0	180.0	0.18	0.87	1.2	1.1	2

Measured Temperature (°C)	
Position	9 (ref.)
1	104.015
2	104.323
3	103.776
4	104.015
5	104.312
6	104.196
7	103.907
8	140.270
9	139.531
10	140.730
11	140.426
12	139.666
13	140.067
14	139.895
15	139.750
16	180.598
17	180.339
18	180.755
19	180.619
20	179.716
21	179.829
22	180.204
23	180.365
24	179.975

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

เอกสารไม่ควบคุม

Calibration Report

Certificate No.: **2103270-001-01**
Equipment: **Electronic Balance**

Manufacturer: **Nettech Toledo**
Resolution: **0.0001 g**
ID No.: **UAE.WAS.002/2552**

Model: **AED04-S/FACT**
Serial No.: **1129361010**
Capacity: **200 g**

Date of Calibration: **11 June 2021**

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
Unloaded	0.0000	0.0000	0.0000	0.000092	2.00
0.01	0.01000	0.0100	0.0000	0.000092	2.00
0.05	0.05000	0.0500	0.0000	0.000092	2.00
0.1	0.10001	0.1000	0.0000	0.000093	2.00
0.2	0.20001	0.2001	-0.0001	0.000093	2.00
0.5	0.50001	0.5000	0.0000	0.000093	2.00
1	1.00001	1.0000	0.0000	0.000093	2.00
2	2.00002	2.0001	-0.0001	0.000093	2.00
5	5.00003	4.9999	0.0001	0.000094	2.00
10	10.00001	9.9999	0.0001	0.000096	2.00
20	20.00003	20.0000	0.0000	0.00010	2.00
50	50.00004	50.0000	0.0000	0.00012	2.00
70	70.00007	70.0000	0.0001	0.00014	2.00
100	100.00009	100.0000	0.0001	0.00016	2.00
150	150.00013	150.0000	0.0001	0.00021	2.00
200	200.00016	200.0001	0.0001	0.00028	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 %.

F-C5-012 Revision: 00 Date: 14-12-61

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