

ภาคผนวก ญ  
ใบรายงานผลการวิเคราะห์

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## คุณภาพอากาศ

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## ANALYSIS REPORT

**CUSTOMER NAME** : ECO ORIENT RESOURCES (THAILAND) LTD.  
**ADDRESS** : 555 RASA TOWER II, 12TH FLOOR, UNIT 1203 PHAHOLYOTHIN ROAD CHATUCHAK CHATUCHAK BANGKOK 10900  
**CONTACT INFORMATION** : TEL : 0 2937 1124-9 e-mail : anucha@ecothai.net  
**SAMPLING SOURCE** : WBNE-C-A3 : BAN KUT TA BONG (UTM WGS 84 ZONE 47P 734939E 1731847N)  
**SAMPLE TYPE** : AMBIENT  
**SAMPLING DATE** : \*, \*\*  
**SAMPLING TIME** : \*, \*\*  
**SAMPLING BY** : MR. SURIYAN NITHICHERDCHOOWONG  
**ANALYZED BY** : MISS JETJANIN TUMSA-AT

**RECEIVED DATE** : SEPTEMBER 23, 2021  
**ANALYTICAL DATE** : SEPTEMBER 23-28, 2021  
**REPORT NO.** : 2021-U70746  
**WORK NO.** : 2021-006160  
**ANALYSIS NO.** : T21AR824-0001 - T21AR824-0002

PARAMETER	UNIT	METHOD OF ANALYSIS	RESULT		REGULATORY STANDARD
			WBNE-C-A3 : BAN KUT TA BONG		
			* T21AR824-0001	** T21AR824-0002	
TOTAL SUSPENDED PARTICULATE	mg/m³	GRAVIMETRIC (HIGH VOLUME METHOD)	0.023	0.022	≤ 0.33
PARTICULATE MATTER (≤ 10 µm)	mg/m³	GRAVIMETRIC (HIGH VOLUME METHOD)	0.013	0.012	≤ 0.12
SAMPLE CONDITION			COMPLETE	COMPLETE	

### REMARK

RESULT : REFERENCE CONDITION IS 25 DEGREE CELSIUS AT 1 ATMOSPHERE.  
TSP : US EPA, CODE OF FEDERAL REGULATION SEARCH RESULTS, 40 CFR-CHAPTER I PART 50, APPENDIX B.  
PM10 : US EPA, CODE OF FEDERAL REGULATION SEARCH RESULTS, 40 CFR-CHAPTER I PART 50, APPENDIX J.  
REGULATORY STANDARD : AMBIENT AIR QUALITY STANDARDS, NOTIFICATION OF THE NATIONAL ENVIRONMENT BOARD NO.24, B.E.2547 (2004).  
\* : SAMPLING FROM 08:30 HOUR ON SEPTEMBER 19, 2021 TO 08:30 HOUR ON SEPTEMBER 20, 2021.  
\*\* : SAMPLING FROM 08:30 HOUR ON SEPTEMBER 20, 2021 TO 08:30 HOUR ON SEPTEMBER 21, 2021.

*Piyapat S.*  
(MRS PIYAPAT SUTTAMANUTWONG)  
LABORATORY SUPERVISOR

OCTOBER 4, 2021



## ANALYSIS REPORT

**CUSTOMER NAME** : ECO ORIENT RESOURCES (THAILAND) LTD.  
**ADDRESS** : 555 RASA TOWER II, 12TH FLOOR, UNIT 1203 PHAHOLYOTHIN ROAD CHATUCHAK CHATUCHAK BANGKOK 10900  
**CONTACT INFORMATION** : TEL : 0 2937 1124-9 e-mail : anucha@ecothai.net  
**SAMPLING SOURCE** : WBNE-C-A3 : BAN KUT TA BONG (UTM WGS 84 ZONE 47P 734939E 1731847N)  
**SAMPLE TYPE** : AMBIENT  
**SAMPLING DATE** : \*  
**SAMPLING TIME** : \*  
**SAMPLING BY** : MR. SURIYAN NITHICHERDCHOOWONG  
**ANALYZED BY** : MISS JETJANIN TUMSA-AT

**RECEIVED DATE** : SEPTEMBER 23, 2021  
**ANALYTICAL DATE** : SEPTEMBER 23-28, 2021  
**REPORT NO.** : 2021-U70747  
**WORK NO.** : 2021-006160  
**ANALYSIS NO.** : T21AR824-0003

PARAMETER	UNIT	METHOD OF ANALYSIS	RESULT	REGULATORY STANDARD
			WBNE-C-A3 : BAN KUT TA BONG T21AR824-0003	
TOTAL SUSPENDED PARTICULATE	mg/m³	GRAVIMETRIC (HIGH VOLUME METHOD)	0.018	≤ 0.33
PARTICULATE MATTER (≤ 10 µm)	mg/m³	GRAVIMETRIC (HIGH VOLUME METHOD)	0.007	≤ 0.12
SAMPLE CONDITION			COMPLETE	

### REMARK

RESULT : REFERENCE CONDITION IS 25 DEGREE CELSIUS AT 1 ATMOSPHERE.  
TSP : US EPA, CODE OF FEDERAL REGULATION SEARCH RESULTS, 40 CFR-CHAPTER I PART 50, APPENDIX B.  
PM10 : US EPA, CODE OF FEDERAL REGULATION SEARCH RESULTS, 40 CFR-CHAPTER I PART 50, APPENDIX J.  
REGULATORY STANDARD : AMBIENT AIR QUALITY STANDARDS, NOTIFICATION OF THE NATIONAL ENVIRONMENT BOARD NO.24, B.E.2547 (2004).  
\* : SAMPLING FROM 08:30 HOUR ON SEPTEMBER 21, 2021 TO 08:30 HOUR ON SEPTEMBER 22, 2021.

*Piyapat S.*  
(MRS PIYAPAT SUTTAMANUTWONG)  
LABORATORY SUPERVISOR

OCTOBER 4, 2021





## ANALYSIS REPORT

**CUSTOMER NAME** : ECO ORIENT RESOURCES (THAILAND) LTD.  
**ADDRESS** : 555 RASA TOWER II, 12TH FLOOR, UNIT 1203 PHAHOLYOTHIN ROAD CHATUCHAK BANGKOK 10900  
**CONTACT INFORMATION** : TEL : 0 2937 1124-9 e-mail : anucha@ecohtai.net  
**MEASURING PLACE** : WBNE-C-A3 : BAN KUT TA BONG (UTM WGS 84 ZONE 47P 734939E 1731847N)  
**MEASURING TYPE** : AMBIENT (AIR) **RECEIVED DATE** : SEPTEMBER 19-22, 2021  
**MEASURING DATE** : SEPTEMBER 19-22, 2021 **ANALYTICAL DATE** : SEPTEMBER 19-22, 2021  
**MEASURING TIME** : \* **REPORT NO.** : 2021-U73292  
**MEASURING METHOD** : WIND SPEED & WIND DIRECTION EQUIPMENT **WORK NO.** : 2021-006160  
**MEASURED BY** : MR SURİYAN NITHICHERDCHOOWONG **ANALYSIS NO.** : T21AR824-0001 - T21AR824-0003

TIME *	RESULT (m/s)					
	WBNE-C-A3 : BAN KUT TA BONG (UTM WGS 84 ZONE 47P 734939E 1731847N)					
	SEPTEMBER 19 - 20, 2021		SEPTEMBER 20 - 21, 2021		SEPTEMBER 21 - 22, 2021	
	T21AR824-0001		T21AR824-0002		T21AR824-0003	
	WIND SPEED	WIND DIRECTION	WIND SPEED	WIND DIRECTION	WIND SPEED	WIND DIRECTION
08:00-09:00 HOUR	2.1	W	1.1	WSW	3.2	W
09:00-10:00 HOUR	1.6	SW	1.0	WNW	2.6	WSW
10:00-11:00 HOUR	2.0	W	1.0	WNW	2.8	SSW
11:00-12:00 HOUR	2.0	SW	0.9	SW	2.6	SSW
12:00-13:00 HOUR	1.7	WSW	1.7	SSW	2.6	SW
13:00-14:00 HOUR	2.2	WSW	1.4	WSW	2.6	SW
14:00-15:00 HOUR	1.8	WNW	1.8	WSW	2.9	S
15:00-16:00 HOUR	1.9	SW	2.2	S	3.0	WSW
16:00-17:00 HOUR	2.3	SW	2.7	SW	2.8	SW
17:00-18:00 HOUR	1.6	SW	2.4	S	2.8	WNW
18:00-19:00 HOUR	1.7	SW	2.3	S	2.9	NW
19:00-20:00 HOUR	2.3	SSW	2.6	S	3.5	NW
20:00-21:00 HOUR	2.3	SSW	2.3	SSE	3.4	WNW
21:00-22:00 HOUR	1.6	S	2.3	SSE	2.2	WNW
22:00-23:00 HOUR	1.7	S	2.9	SSE	2.7	SW
23:00-00:00 HOUR	1.1	S	3.5	SSW	1.9	SSW
00:00-01:00 HOUR	0.9	SSW	3.5	SSW	1.4	SSW
01:00-02:00 HOUR	0.7	SSW	2.8	SW	1.5	SW
02:00-03:00 HOUR	0.8	S	3.3	WSW	2.1	SSW
03:00-04:00 HOUR	1.1	S	3.7	SW	1.5	SSW
04:00-05:00 HOUR	1.1	S	3.2	SW	2.1	SSW
05:00-06:00 HOUR	1.2	SSW	2.7	W	3.1	SW
06:00-07:00 HOUR	1.0	SSW	2.5	W	2.2	WSW
07:00-08:00 HOUR	1.2	SW	2.7	WNW	2.7	WSW

(MR SILA BANJONGJAIKUK)  
LABORATORY SUPERVISOR

OCTOBER 7, 2021



## ANALYSIS REPORT

**CUSTOMER NAME** : ECO ORIENT RESOURCES (THAILAND) LTD.  
**ADDRESS** : 555 RASA TOWER II, 12TH FLOOR, UNIT 1203 PHAHOLYOTHIN ROAD CHATUCHAK BANGKOK 10900  
**CONTACT INFORMATION** : TEL : 0 2937 1124-9 e-mail : anucha@ecohtai.net  
**MEASURING PLACE** : WBNE-C-A3 : BAN KUT TA BONG (UTM WGS 84 ZONE 47P 734939E 1731847N)  
**MEASURING TYPE** : AMBIENT (AIR) **RECEIVED DATE** : SEPTEMBER 19-22, 2021  
**MEASURING DATE** : SEPTEMBER 19-22, 2021 **ANALYTICAL DATE** : SEPTEMBER 19-22, 2021  
**MEASURING TIME** : \* **REPORT NO.** : 2021-U73289  
**MEASURING METHOD** : CHEMILUMINESCENCE **WORK NO.** : 2021-006160  
**MEASURED BY** : MR SURİYAN NITHICHERDCHOOWONG **ANALYSIS NO.** : T21AR824-0001 - T21AR824-0003

TIME *	RESULT (ppm)		
	NITROGEN DIOXIDE		
	WBNE-C-A3 : BAN KUT TA BONG (UTM WGS 84 ZONE 47P 734939E 1731847N)		
	SEPTEMBER 19 - 20, 2021	SEPTEMBER 20 - 21, 2021	SEPTEMBER 21 - 22, 2021
	T21AR824-0001	T21AR824-0002	T21AR824-0003
08:00-09:00 HOUR	0.0145	0.0099	0.0121
09:00-10:00 HOUR	0.0117	0.0090	0.0108
10:00-11:00 HOUR	0.0143	0.0073	0.0110
11:00-12:00 HOUR	0.0106	0.0126	0.0108
12:00-13:00 HOUR	0.0100	0.0126	0.0110
13:00-14:00 HOUR	0.0110	0.0130	0.0090
14:00-15:00 HOUR	0.0090	0.0145	0.0063
15:00-16:00 HOUR	0.0063	0.0126	0.0080
16:00-17:00 HOUR	0.0080	0.0126	0.0077
17:00-18:00 HOUR	0.0063	0.0115	0.0109
18:00-19:00 HOUR	0.0063	0.0110	0.0108
19:00-20:00 HOUR	0.0077	0.0099	0.0121
20:00-21:00 HOUR	0.0063	0.0095	0.0136
21:00-22:00 HOUR	0.0067	0.0080	0.0099
22:00-23:00 HOUR	0.0054	0.0099	0.0110
23:00-00:00 HOUR	0.0054	0.0099	0.0097
00:00-01:00 HOUR	0.0058	0.0075	0.0060
01:00-02:00 HOUR	0.0070	0.0080	0.0072
02:00-03:00 HOUR	0.0070	0.0072	0.0099
03:00-04:00 HOUR	0.0079	0.0072	0.0057
04:00-05:00 HOUR	0.0099	0.0090	0.0066
05:00-06:00 HOUR	0.0099	0.0088	0.0070
06:00-07:00 HOUR	0.0091	0.0106	0.0075
07:00-08:00 HOUR	0.0090	0.0110	0.0090

(MR SILA BANJONGJAIKUK)  
LABORATORY SUPERVISOR

OCTOBER 7, 2021





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**ADDRESS** : 555 RASA TOWER II, 12TH FLOOR, UNIT 1203 PHAHOLYOTHIN ROAD CHATUCHAK BANGKOK 10900  
**CONTACT INFORMATION** : TEL : 0 2937 1124-9 e-mail : anucha@ecoohai.net  
**MEASURING PLACE** : WBNE-C-A3 : BAN KUT TA BONG (UTM WGS 84 ZONE 47P 734939E 1731847N)  
**MEASURING TYPE** : AMBIENT (AIR) **RECEIVED DATE** : SEPTEMBER 19-22, 2021  
**MEASURING DATE** : SEPTEMBER 19-22, 2021 **ANALYTICAL DATE** : SEPTEMBER 19-22, 2021  
**MEASURING TIME** : \* **REPORT NO.** : 2021-U73290  
**MEASURING METHOD** : UV FLUORESCENCE **WORK NO.** : 2021-006160  
**MEASURED BY** : MR SURIYAN NITHICHERDCHOOWONG **ANALYSIS NO.** : T21AR824-0001 - T21AR824-0003

TIME *	RESULT (ppm)		
	SULPHUR DIOXIDE		
	WBNE-C-A3 : BAN KUT TA BONG (UTM WGS 84 ZONE 47P 734939E 1731847N)		
	SEPTEMBER 19 - 20, 2021 T21AR824-0001	SEPTEMBER 20 - 21, 2021 T21AR824-0002	SEPTEMBER 21 - 22, 2021 T21AR824-0003
08:00-09:00 HOUR	0.0018	0.0015	0.0016
09:00-10:00 HOUR	0.0017	0.0015	0.0017
10:00-11:00 HOUR	0.0017	0.0015	0.0018
11:00-12:00 HOUR	0.0019	0.0015	0.0018
12:00-13:00 HOUR	0.0020	0.0013	0.0017
13:00-14:00 HOUR	0.0020	0.0011	0.0017
14:00-15:00 HOUR	0.0020	0.0009	0.0019
15:00-16:00 HOUR	0.0020	0.0009	0.0019
16:00-17:00 HOUR	0.0021	0.0009	0.0020
17:00-18:00 HOUR	0.0022	0.0008	0.0020
18:00-19:00 HOUR	0.0022	0.0008	0.0020
19:00-20:00 HOUR	0.0020	0.0009	0.0021
20:00-21:00 HOUR	0.0017	0.0010	0.0019
21:00-22:00 HOUR	0.0014	0.0010	0.0021
22:00-23:00 HOUR	0.0014	0.0010	0.0020
23:00-00:00 HOUR	0.0013	0.0012	0.0020
00:00-01:00 HOUR	0.0012	0.0013	0.0019
01:00-02:00 HOUR	0.0011	0.0015	0.0018
02:00-03:00 HOUR	0.0011	0.0017	0.0018
03:00-04:00 HOUR	0.0013	0.0019	0.0015
04:00-05:00 HOUR	0.0015	0.0020	0.0012
05:00-06:00 HOUR	0.0018	0.0020	0.0011
06:00-07:00 HOUR	0.0018	0.0018	0.0010
07:00-08:00 HOUR	0.0017	0.0018	0.0010
AVERAGE 24 HOUR	0.0017	0.0013	0.0017

*Sila Banjongjairuk*

(MR SILA BANJONGJAIKUK)  
LABORATORY SUPERVISOR

OCTOBER 7, 2021



### ANALYSIS REPORT

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**ADDRESS** : 555 RASA TOWER II, 12TH FLOOR, UNIT 1203 PHAHOLYOTHIN ROAD CHATUCHAK BANGKOK 10900  
**CONTACT INFORMATION** : TEL : 0 2937 1124-9 e-mail : anucha@ecoohai.net  
**MEASURING PLACE** : WBNE-C-A3 : BAN KUT TA BONG (UTM WGS 84 ZONE 47P 734939E 1731847N)  
**MEASURING TYPE** : AMBIENT (AIR) **RECEIVED DATE** : SEPTEMBER 19-22, 2021  
**MEASURING DATE** : SEPTEMBER 19-22, 2021 **ANALYTICAL DATE** : SEPTEMBER 19-22, 2021  
**MEASURING TIME** : \* **REPORT NO.** : 2021-U73288  
**MEASURING METHOD** : NON-DISPERSIVE INFRARED DETECTION **WORK NO.** : 2021-006160  
**MEASURED BY** : MR SURIYAN NITHICHERDCHOOWONG **ANALYSIS NO.** : T21AR824-0001-T21AR824-0003

TIME*	RESULT		
	CARBON MONOXIDE		
	WBNE-C-A3 : BAN KUT TA BONG (UTM WGS 84 ZONE 47P 734939E 1731847N)		
	SEPTEMBER 19-20, 2021 T21AR824-0001	SEPTEMBER 20-21, 2021 T21AR824-0002	SEPTEMBER 21-22, 2021 T21AR824-0003
08:00-16:00 HOUR	1.08	0.97	1.60
16:00-00:00 HOUR	1.38	1.44	1.57
00:00-08:00 HOUR	1.30	1.42	1.52
UNIT	ppm		

*Sila Banjongjairuk*

(MR SILA BANJONGJAIKUK)  
LABORATORY SUPERVISOR

OCTOBER 4, 2021


## ANALYSIS REPORT

**CUSTOMER NAME** : ECO ORIENT RESOURCES (THAILAND) LTD.  
**ADDRESS** : 555 RASA TOWER II, 12TH FLOOR, UNIT 1203 PHAHOLYOTHIN ROAD CHATUCHAK CHATUCHAK BANGKOK 10900  
**CONTACT INFORMATION** : TEL. 0 2937 1124-9 e-mail : anucha@eco-thai.net  
**SAMPLING SOURCE** : WBNE-C-A3 : BAN KUT TA BONG (UTM WGS 84 ZONE 47P 734939E 1731847N)  
**SAMPLE TYPE** : AMBIENT (AIR) **RECEIVED DATE** : SEPTEMBER 19-22, 2021  
**SAMPLING DATE** : \*, \*\*, \*\*\* **ANALYTICAL DATE** : SEPTEMBER 19-22, 2021  
**SAMPLING TIME** : \*, \*\*, \*\*\* **REPORT NO.** : 2021-U73291  
**SAMPLING METHOD** : <sup>1)</sup> **WORK NO.** : 2021-006160  
**SAMPLING BY** : MR SURIYAN NITHICHERDCHOOWONG **ANALYSIS NO.** : T21AR824-0001-T21AR824-0003  
**ANALYZED BY** : MR SURIYAN NITHICHERDCHOOWONG

PARAMETER	UNIT	METHOD OF ANALYSIS	RESULT		
			WBNE-C-A3 : BAN KUT TA BONG		
			(UTM WGS 84 ZONE 47P 734939E 1731847N)		
			*	**	***
			T21AR824-0001	T21AR824-0002	T21AR824-0003
TOTAL HYDROCARBONS	ppm	BAG SAMPLING, TOTAL HYDROCARBON ANALYZER (FID) METHOD <sup>1)</sup>	2.09	2.78	2.70
SAMPLE CONDITION			SAMPLING BAG		

### REMARK

- \* : SAMPLING FROM 08:00 HOUR ON SEPTEMBER 19, 2021 TO 08:00 HOUR ON SEPTEMBER 20, 2021  
\*\* : SAMPLING FROM 08:00 HOUR ON SEPTEMBER 20, 2021 TO 08:00 HOUR ON SEPTEMBER 21, 2021  
\*\*\* : SAMPLING FROM 08:00 HOUR ON SEPTEMBER 21, 2021 TO 08:00 HOUR ON SEPTEMBER 22, 2021

  
.....  
(MR SILA BANJONGJAIKAK)  
LABORATORY SUPERVISOR  
OCTOBER 4, 2021

- DO NOT COPY PARTIAL OF THIS ANALYSIS REPORT WITHOUT OFFICIAL APPROVAL.
- REPORTED ANALYSIS REFERS TO SUBMITTED SAMPLE ONLY.

# คุณภาพน้ำผิวดิน

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## ANALYSIS REPORT

**CUSTOMER NAME** : ECO ORIENT RESOURCES (THAILAND) LTD.  
**ADDRESS** : 555 RASA TOWER II, 12TH FLOOR, UNIT 1203 PHAHOLYOTHIN ROAD CHATUCHAK CHATUCHAK BANGKOK 10900  
**CONTACT INFORMATION** : TEL : 0 2937 1124-9 e-mail : anucha@ecothai.net  
**SAMPLING SOURCE** : WBNE-C-SW5 (UTM WGS 84 ZONE 47P 734609E 1731320N)  
**SAMPLE TYPE** : SURFACE WATER  
**SAMPLING DATE** : SEPTEMBER 9, 2021  
**SAMPLING TIME** : 13:00 HOUR  
**SAMPLING METHOD °** : GRAB, GRAB AND STERILE TECHNIQUE  
**SAMPLING BY °** : MR KRIDSANAPONG NAMTHIP  
**ANALYZED BY** : MISS CHOMTHANAN AHPATPAPHA

**RECEIVED DATE** : SEPTEMBER 10, 2021  
**ANALYTICAL DATE** : SEPTEMBER 10-16, 2021  
**REPORT NO.** : 2021-U68629  
**WORK NO.** : 2021-006160  
**ANALYSIS NO.** : T21AQ850-0001

PARAMETER	UNIT	METHOD OF ANALYSIS	RESULT	REGULATORY STANDARD	DETECTION LIMIT
			WBNE-C-SW5 T21AQ850-0001		
pH °	-	ELECTROMETRIC METHOD AT SITE (SM4500-H° B)	7.9 (31°C)	5.0-9.0	-
TEMPERATURE °	°C	THERMOMETER AT SITE (SM: 2550 B)	31	n°	-
ELECTRICAL CONDUCTIVITY °	µmhos/cm	ELECTRICAL CONDUCTIVITY METHOD AT SITE (SM: 2510 B)	199 (31°C)	-	0.1
FAT, OIL AND GREASE °	mg/L	SOXHLET EXTRACTION METHOD (SM: 5520 D)	ND	-	3
SALINITY °	ppt	ELECTRICAL CONDUCTIVITY METHOD AT SITE (SM: 2520 B)	0.1	-	0.1
TOTAL SUSPENDED SOLIDS °	mg/L	TOTAL SUSPENDED SOLIDS DRIED AT 103-105°C (SM: 2540 D)	ND	-	5.0
TOTAL DISSOLVED SOLIDS °	mg/L	TOTAL DISSOLVED SOLIDS DRIED AT 180°C (SM: 2540 C)	129	-	25
TOTAL PETROLEUM HYDROCARBONS °	mg/L	SOXHLET EXTRACTION METHOD (SM: 5520 D AND 5520 F)	ND	-	3
METALS					
IRON °	mg/L Fe	IN-HOUSE METHOD: UAE.TP.SW.01 (NITRIC ACID DIGESTION AND DIRECT AIR ACETYLENE FLAME METHOD); SM: 3030 E AND 3111 B	0.254	-	0.005
SELENIUM °	mg/L Se	HYDRIDE GENERATION AAS METHOD (SM: 3114 C)	ND	-	0.0005
TOTAL CHROMIUM °	mg/L Cr	IN-HOUSE METHOD: UAE.TP.SW.01 (NITRIC ACID DIGESTION AND DIRECT AIR ACETYLENE FLAME METHOD); SM: 3030 E AND 3111 B	ND	-	0.005
ARSENIC °	mg/L As	HYDRIDE GENERATION AAS METHOD (SM: 3114 C)	ND	≤ 0.01	0.0003
MERCURY °	mg/L Hg	IN-HOUSE METHOD: UAE.TP.HEM.002 (COLD VAPOUR ATOMIC ABSORPTION SPECTROMETRIC METHOD); SM: 3112 B	ND	≤ 0.002	0.0001
CADMIUM °	mg/L Cd	IN-HOUSE METHOD: UAE.TP.SW.01 (NITRIC ACID DIGESTION AND DIRECT AIR ACETYLENE FLAME METHOD); SM: 3030 E AND 3111 B	ND	≤ 0.005*, ≤ 0.05**	0.002
COPPER °	mg/L Cu	IN-HOUSE METHOD: UAE.TP.SW.01 (NITRIC ACID DIGESTION AND DIRECT AIR ACETYLENE FLAME METHOD); SM: 3030 E AND 3111 B	ND	≤ 0.1	0.002



PARAMETER	UNIT	METHOD OF ANALYSIS	RESULT	REGULATORY STANDARD	DETECTION LIMIT
			WBNE-C-SW5 T21AQ850-0001		
LEAD °	mg/L Pb	IN-HOUSE METHOD: UAE.TP.SW.01 (NITRIC ACID DIGESTION AND DIRECT AIR ACETYLENE FLAME METHOD); SM: 3030 E AND 3111 B	ND	≤ 0.05	0.003
MANGANESE °	mg/L Mn	IN-HOUSE METHOD: UAE.TP.SW.01 (NITRIC ACID DIGESTION AND DIRECT AIR ACETYLENE FLAME METHOD); SM: 3030 E AND 3111 B	0.043	≤ 1.0	0.002
NICKEL °	mg/L Ni	IN-HOUSE METHOD: UAE.TP.SW.01 (NITRIC ACID DIGESTION AND DIRECT AIR ACETYLENE FLAME METHOD); SM: 3030 E AND 3111 B	ND	≤ 0.1	0.005
ZINC °	mg/L Zn	IN-HOUSE METHOD: UAE.TP.SW.01 (NITRIC ACID DIGESTION AND DIRECT AIR ACETYLENE FLAME METHOD); SM: 3030 E AND 3111 B	ND	≤ 1.0	0.003
BARIUM °	mg/L Ba	NITRIC ACID-HYDROCHLORIC ACID DIGESTION AND INDUCTIVELY COUPLED PLASMA (ICP) METHOD (SM: 3030 F AND 3120 B)	0.070	-	0.003
MICROBIOLOGY					
FAECAL COLIFORM BACTERIA °	MPN/100 mL	MULTIPLE-TUBE FERMENTATION TECHNIQUE (SM: 9221 E)	4.5	≤ 4,000	1.8
VOLATILE ORGANIC COMPOUNDS					
BENZENE °	µg/L	PURGE AND TRAP GAS CHROMATOGRAPHIC/MASS SPECTROMETRIC METHOD (SM: 6200 B)	< 0.20	-	0.20
ETHYLBENZENE °	µg/L	PURGE AND TRAP GAS CHROMATOGRAPHIC/MASS SPECTROMETRIC METHOD (SM: 6200 B)	< 0.20	-	0.20
TOLUENE °	µg/L	PURGE AND TRAP GAS CHROMATOGRAPHIC/MASS SPECTROMETRIC METHOD (SM: 6200 B)	< 0.20	-	0.20

## ANALYSIS REPORT

**CUSTOMER NAME** : ECO ORIENT RESOURCES (THAILAND) LTD.  
**ADDRESS** : 555 RASA TOWER II, 12TH FLOOR, UNIT 1203 PHAHOLYOTHIN ROAD CHATUCHAK CHATUCHAK BANGKOK 10900  
**CONTACT INFORMATION** : TEL : 0 2937 1124-9 e-mail : anucha@ecothai.net  
**SAMPLING SOURCE** : WBNE-C-SW6 (UTM WGS 84 ZONE 47P 735618E 1731580N)  
**SAMPLE TYPE** : SURFACE WATER  
**SAMPLING DATE** : SEPTEMBER 9, 2021  
**SAMPLING TIME** : 12:30 HOUR  
**SAMPLING METHOD** : GRAB, GRAB AND STERILE TECHNIQUE  
**SAMPLING BY** : MR KRIDSANAPONG NAMTHIP  
**ANALYZED BY** : MISS CHOMTHANAN APHIPATPAPHA

**RECEIVED DATE** : SEPTEMBER 10, 2021  
**ANALYTICAL DATE** : SEPTEMBER 10-16, 2021  
**REPORT NO.** : 2021-U68630  
**WORK NO.** : 2021-006160  
**ANALYSIS NO.** : T21AQ850-0002

PARAMETER	UNIT	METHOD OF ANALYSIS	RESULT	REGULATORY STANDARD	DETECTION LIMIT
			WBNE-C-SW6 T21AQ850-0002		
pH <sup>c</sup>	-	ELECTROMETRIC METHOD AT SITE (SM:4500-H <sup>+</sup> B)	7.6 (30°C)	5.0-9.0	-
TEMPERATURE <sup>c</sup>	°C	THERMOMETER AT SITE (SM: 2550 B)	30	n <sup>i</sup>	-
ELECTRICAL CONDUCTIVITY <sup>c</sup>	µmhos/cm	ELECTRICAL CONDUCTIVITY METHOD AT SITE (SM: 2510 B)	262 (30°C)	-	0.1
FAT, OIL AND GREASE <sup>c</sup>	mg/L	SOXHLET EXTRACTION METHOD (SM: 5520 D)	ND	-	3
SALINITY <sup>c</sup>	ppt	ELECTRICAL CONDUCTIVITY METHOD AT SITE (SM: 2520 B)	0.2	-	0.1
TOTAL SUSPENDED SOLIDS <sup>a</sup>	mg/L	TOTAL SUSPENDED SOLIDS DRIED AT 103-105°C (SM: 2540 D)	10.7	-	5.0
TOTAL DISSOLVED SOLIDS <sup>b</sup>	mg/L	TOTAL DISSOLVED SOLIDS DRIED AT 180 °C (SM: 2540 C)	167	-	25
TOTAL PETROLEUM HYDROCARBONS <sup>c</sup>	mg/L	SOXHLET EXTRACTION METHOD (SM: 5520 D AND 5520 F)	ND	-	3
METALS					
IRON <sup>c</sup>	mg/L Fe	IN-HOUSE METHOD: UAE.TP.SW.01 (NITRIC ACID DIGESTION AND DIRECT AIR ACETYLENE FLAME METHOD); SM: 3030 E AND 3111 B	1.20	-	0.005
SELENIUM <sup>c</sup>	mg/L Se	HYDRIDE GENERATION AAS METHOD (SM: 3114 C)	ND	-	0.0005
TOTAL CHROMIUM <sup>c</sup>	mg/L Cr	IN-HOUSE METHOD: UAE.TP.SW.01 (NITRIC ACID DIGESTION AND DIRECT AIR ACETYLENE FLAME METHOD); SM: 3030 E AND 3111 B	ND	-	0.005
ARSENIC <sup>c</sup>	mg/L As	HYDRIDE GENERATION AAS METHOD (SM: 3114 C)	0.0006	≤ 0.01	0.0003
MERCURY <sup>b</sup>	mg/L Hg	IN-HOUSE METHOD: UAE.TP.HEM.002 (COLD VAPOUR ATOMIC ABSORPTION SPECTROMETRIC METHOD); SM: 3112 B	ND	≤ 0.002	0.0001
CADMIUM <sup>c</sup>	mg/L Cd	IN-HOUSE METHOD: UAE.TP.SW.01 (NITRIC ACID DIGESTION AND DIRECT AIR ACETYLENE FLAME METHOD); SM: 3030 E AND 3111 B	ND	≤ 0.005*, ≤ 0.05**	0.002
COPPER <sup>c</sup>	mg/L Cu	IN-HOUSE METHOD: UAE.TP.SW.01 (NITRIC ACID DIGESTION AND DIRECT AIR ACETYLENE FLAME METHOD); SM: 3030 E AND 3111 B	ND	≤ 0.1	0.002

*Bhuchonk p.*

(MR BHUCHONK PANICHLERTUMPI)  
LABORATORY SUPERVISOR

SEPTEMBER 27, 2021





PARAMETER	UNIT	METHOD OF ANALYSIS	RESULT	REGULATORY STANDARD	DETECTION LIMIT
			WBNE-C-SW6 T21AQ850-0002		
LEAD <sup>c</sup>	mg/L Pb	IN-HOUSE METHOD: UAE.TP.SW.01 (NITRIC ACID DIGESTION AND DIRECT AIR ACETYLENE FLAME METHOD); SM: 3030 E AND 3111 B	ND	≤ 0.05	0.003
MANGANESE <sup>c</sup>	mg/L Mn	IN-HOUSE METHOD: UAE.TP.SW.01 (NITRIC ACID DIGESTION AND DIRECT AIR ACETYLENE FLAME METHOD); SM: 3030 E AND 3111 B	0.051	≤ 1.0	0.002
NICKEL <sup>c</sup>	mg/L Ni	IN-HOUSE METHOD: UAE.TP.SW.01 (NITRIC ACID DIGESTION AND DIRECT AIR ACETYLENE FLAME METHOD); SM: 3030 E AND 3111 B	ND	≤ 0.1	0.005
ZINC <sup>c</sup>	mg/L Zn	IN-HOUSE METHOD: UAE.TP.SW.01 (NITRIC ACID DIGESTION AND DIRECT AIR ACETYLENE FLAME METHOD); SM: 3030 E AND 3111 B	ND	≤ 1.0	0.003
BARIUM <sup>c</sup>	mg/L Ba	NITRIC ACID-HYDROCHLORIC ACID DIGESTION AND INDUCTIVELY COUPLED PLASMA (ICP) METHOD (SM: 3030 F AND 3120 B)	0.049	-	0.003
MICROBIOLOGY					
FAECAL COLIFORM BACTERIA <sup>b</sup>	MPN/100 mL	MULTIPLE-TUBE FERMENTATION TECHNIQUE (SM: 9221 E)	130	≤ 4,000	1.8
VOLATILE ORGANIC COMPOUNDS					
BENZENE <sup>c</sup>	µg/L	PURGE AND TRAP GAS CHROMATOGRAPHIC/MASS SPECTROMETRIC METHOD (SM: 6200 B)	< 0.20	-	0.20
ETHYLBENZENE <sup>c</sup>	µg/L	PURGE AND TRAP GAS CHROMATOGRAPHIC/MASS SPECTROMETRIC METHOD (SM: 6200 B)	< 0.20	-	0.20
TOLUENE <sup>c</sup>	µg/L	PURGE AND TRAP GAS CHROMATOGRAPHIC/MASS SPECTROMETRIC METHOD (SM: 6200 B)	< 0.20	-	0.20

PARAMETER	UNIT	METHOD OF ANALYSIS	RESULT	REGULATORY STANDARD	DETECTION LIMIT
			WBNE-C-SW6 T21AQ850-0002		
TOTAL XYLENES <sup>c</sup>	µg/L	PURGE AND TRAP GAS CHROMATOGRAPHIC/MASS SPECTROMETRIC METHOD (SM: 6200 B)	< 0.60	-	0.60
SAMPLE CONDITION					
WATER'S COLOUR/TURBID			YELLOW/TURBID		
SEDIMENT			BROWN		

<sup>a</sup> : ISO/IEC 17025 ACCREDITED BY THAI INDUSTRIAL STANDARDS INSTITUTE (TISI)

<sup>b</sup> : ISO/IEC 17025 ACCREDITED BY DEPARTMENT OF SCIENCE SERVICE (DSS)

<sup>c</sup> : VERIFIED BY OWN LABORATORY QUALITY SYSTEM, BUT STILL NOT ACCREDITED

IN-HOUSE : BASED ON STANDARD METHODS FOR THE EXAMINATION OF WATER AND WASTEWATER, APHA, AWWA, WEF, 23<sup>RD</sup> EDITION, 2017.

SM : STANDARD METHODS FOR THE EXAMINATION OF WATER AND WASTEWATER, APHA, AWWA, WEF, 23<sup>RD</sup> EDITION, 2017.

REGULATORY STANDARD : SURFACE WATER QUALITY STANDARDS CLASS 3, NOTIFICATION OF THE NATIONAL ENVIRONMENT BOARD, NO.8, B.E. 2537 ISSUED UNDER THE ENHANCEMENT AND CONSERVATION OF NATIONAL ENVIRONMENTAL QUALITY ACT, B.E. 2535, PUBLISHED IN THE ROYAL GOVERNMENT GAZETTE, VOL. 111, PART 16, DATED FEBRUARY 24, B.E. 2537 (1994).

CLASS 3 : MEDIUM CLEAN FRESH SURFACE WATER RESOURCES USED FOR  
(1) CONSUMPTION, BUT PASSING THROUGH ON ORDINARY TREATMENT PROCESS BEFORE USING  
(2) AGRICULTURE

n<sup>1</sup> : NATURALLY BUT CHANGING NOT MORE THAN 3°C

≤ 0.005\* : WHEN WATER HARDNESS NOT MORE THAN 100 mg/L AS CaCO<sub>3</sub>

≤ 0.05\*\* : WHEN WATER HARDNESS MORE THAN 100 mg/L AS CaCO<sub>3</sub>

ND : NON-DETECTABLE.



(MR BHUCHONK PANICHLERTUMPI)  
LABORATORY SUPERVISOR

SEPTEMBER 27, 2021



## ANALYSIS REPORT

**CUSTOMER NAME** : ECO ORIENT RESOURCES (THAILAND) LTD.  
**ADDRESS** : 555 RASA TOWER II, 12TH FLOOR, UNIT 1203 PHAHOLYOTHIN ROAD CHATUCHAK CHATUCHAK BANGKOK 10900  
**CONTACT INFORMATION** : TEL : 0 2937 1124-9 e-mail : anucha@ecoohai.net  
**SAMPLING SOURCE** : WBNE-C-SW7 (UTM WGS 84 ZONE 47P 733621E 1728215N)  
**SAMPLE TYPE** : SURFACE WATER  
**SAMPLING DATE** : SEPTEMBER 9, 2021  
**SAMPLING TIME** : 13:50 HOUR  
**SAMPLING METHOD °** : GRAB, GRAB AND STERILE TECHNIQUE  
**SAMPLING BY °** : MR KRIDSANAPONG NAMTHIP  
**ANALYZED BY** : MISS CHOMTHANAN APHIPATPAPHA

**RECEIVED DATE** : SEPTEMBER 10, 2021  
**ANALYTICAL DATE** : SEPTEMBER 10-16, 2021  
**REPORT NO.** : 2021-U68631  
**WORK NO.** : 2021-006160  
**ANALYSIS NO.** : T21AQ850-0003

PARAMETER	UNIT	METHOD OF ANALYSIS	RESULT	REGULATORY STANDARD	DETECTION LIMIT
			WBNE-C-SW7 T21AQ850-0003		
pH °	-	ELECTROMETRIC METHOD AT SITE (SM:4500-H° B)	7.1 (30°C)	5.0-9.0	-
TEMPERATURE °	°C	THERMOMETER AT SITE (SM: 2550 B)	30	n°	-
ELECTRICAL CONDUCTIVITY °	µmhos/cm	ELECTRICAL CONDUCTIVITY METHOD AT SITE (SM: 2510 B)	132 (30°C)	-	0.1
FAT, OIL AND GREASE °	mg/L	SOXHLET EXTRACTION METHOD (SM: 5520 D)	ND	-	3
SALINITY °	ppt	ELECTRICAL CONDUCTIVITY METHOD AT SITE (SM: 2520 B)	0.1	-	0.1
TOTAL SUSPENDED SOLIDS °	mg/L	TOTAL SUSPENDED SOLIDS DRIED AT 103-105°C (SM: 2540 D)	5.7	-	5.0
TOTAL DISSOLVED SOLIDS °	mg/L	TOTAL DISSOLVED SOLIDS DRIED AT 180 °C (SM: 2540 C)	127	-	25
TOTAL PETROLEUM HYDROCARBONS °	mg/L	SOXHLET EXTRACTION METHOD (SM: 5520 D AND 5520 F)	ND	-	3
<b>METALS</b>					
IRON °	mg/L Fe	IN-HOUSE METHOD: UAE.TP.SW.01 (NITRIC ACID DIGESTION AND DIRECT AIR ACETYLENE FLAME METHOD); SM: 3030 E AND 3111 B	2.43	-	0.005
SELENIUM °	mg/L Se	HYDRIDE GENERATION AAS METHOD (SM: 3114 C)	ND	-	0.0005
TOTAL CHROMIUM °	mg/L Cr	IN-HOUSE METHOD: UAE.TP.SW.01 (NITRIC ACID DIGESTION AND DIRECT AIR ACETYLENE FLAME METHOD); SM: 3030 E AND 3111 B	ND	-	0.005
ARSENIC °	mg/L As	HYDRIDE GENERATION AAS METHOD (SM: 3114 C)	0.0004	≤ 0.01	0.0003
MERCURY °	mg/L Hg	IN-HOUSE METHOD: UAE.TP.HEM.002 (COLD VAPOUR ATOMIC ABSORPTION SPECTROMETRIC METHOD); SM: 3112 B	ND	≤ 0.002	0.0001
CADMIUM °	mg/L Cd	IN-HOUSE METHOD: UAE.TP.SW.01 (NITRIC ACID DIGESTION AND DIRECT AIR ACETYLENE FLAME METHOD); SM: 3030 E AND 3111 B	ND	≤0.005*, ≤ 0.05**	0.002
COPPER °	mg/L Cu	IN-HOUSE METHOD: UAE.TP.SW.01 (NITRIC ACID DIGESTION AND DIRECT AIR ACETYLENE FLAME METHOD); SM: 3030 E AND 3111 B	ND	≤ 0.1	0.002

PARAMETER	UNIT	METHOD OF ANALYSIS	RESULT	REGULATORY STANDARD	DETECTION LIMIT
			WBNE-C-SW7 T21AQ850-0003		
LEAD °	mg/L Pb	IN-HOUSE METHOD: UAE.TP.SW.01 (NITRIC ACID DIGESTION AND DIRECT AIR ACETYLENE FLAME METHOD); SM: 3030 E AND 3111 B	ND	≤ 0.05	0.003
MANGANESE °	mg/L Mn	IN-HOUSE METHOD: UAE.TP.SW.01 (NITRIC ACID DIGESTION AND DIRECT AIR ACETYLENE FLAME METHOD); SM: 3030 E AND 3111 B	0.027	≤ 1.0	0.002
NICKEL °	mg/L Ni	IN-HOUSE METHOD: UAE.TP.SW.01 (NITRIC ACID DIGESTION AND DIRECT AIR ACETYLENE FLAME METHOD); SM: 3030 E AND 3111 B	ND	≤ 0.1	0.005
ZINC °	mg/L Zn	IN-HOUSE METHOD: UAE.TP.SW.01 (NITRIC ACID DIGESTION AND DIRECT AIR ACETYLENE FLAME METHOD); SM: 3030 E AND 3111 B	ND	≤ 1.0	0.003
BARIUM °	mg/L Ba	NITRIC ACID-HYDROCHLORIC ACID DIGESTION AND INDUCTIVELY COUPLED PLASMA (ICP) METHOD (SM: 3030 F AND 3120 B)	0.029	-	0.003
<b>MICROBIOLOGY</b>					
FAECAL COLIFORM BACTERIA °	MPN/100 mL	MULTIPLE-TUBE FERMENTATION TECHNIQUE (SM: 9221 E)	70	≤ 4,000	1.8
<b>VOLATILE ORGANIC COMPOUNDS</b>					
BENZENE °	µg/L	PURGE AND TRAP GAS CHROMATOGRAPHIC/MASS SPECTROMETRIC METHOD (SM: 6200 B)	< 0.20	-	0.20
ETHYLBENZENE °	µg/L	PURGE AND TRAP GAS CHROMATOGRAPHIC/MASS SPECTROMETRIC METHOD (SM: 6200 B)	< 0.20	-	0.20
TOLUENE °	µg/L	PURGE AND TRAP GAS CHROMATOGRAPHIC/MASS SPECTROMETRIC METHOD (SM: 6200 B)	< 0.20	-	0.20



PARAMETER	UNIT	METHOD OF ANALYSIS	RESULT	REGULATORY STANDARD	DETECTION LIMIT
			WBNE-C-SW7 T21AQ850-0003		
TOTAL XYLENES <sup>c</sup>	µg/L	PURGE AND TRAP GAS CHROMATOGRAPHIC/MASS SPECTROMETRIC METHOD (SM: 6200 B)	< 0.60	-	0.60
<b>SAMPLE CONDITION</b>					
WATER'S COLOUR/TURBID			YELLOW/TURBID		
SEDIMENT			BROWN		

<sup>a</sup> : ISO/IEC 17025 ACCREDITED BY THAI INDUSTRIAL STANDARDS INSTITUTE (TISI)

<sup>b</sup> : ISO/IEC 17025 ACCREDITED BY DEPARTMENT OF SCIENCE SERVICE (DSS)

<sup>c</sup> : VERIFIED BY OWN LABORATORY QUALITY SYSTEM, BUT STILL NOT ACCREDITED

IN-HOUSE : BASED ON STANDARD METHODS FOR THE EXAMINATION OF WATER AND WASTEWATER, APHA, AWWA, WEF, 23 <sup>rd</sup> EDITION, 2017.

SM : STANDARD METHODS FOR THE EXAMINATION OF WATER AND WASTEWATER, APHA, AWWA, WEF, 23 <sup>rd</sup> EDITION, 2017.

REGULATORY STANDARD : SURFACE WATER QUALITY STANDARDS CLASS 3, NOTIFICATION OF THE NATIONAL ENVIRONMENT BOARD, NO.8,  
B.E. 2537 ISSUED UNDER THE ENHANCEMENT AND CONSERVATION OF NATIONAL ENVIRONMENTAL QUALITY  
ACT, B.E. 2535, PUBLISHED IN THE ROYAL GOVERNMENT GAZETTE, VOL. 111, PART 16, DATED FEBRUARY 24,  
B.E. 2537 (1994).

CLASS 3 : MEDIUM CLEAN FRESH SURFACE WATER RESOURCES USED FOR  
(1) CONSUMPTION, BUT PASSING THROUGH ON ORDINARY TREATMENT PROCESS BEFORE USING  
(2) AGRICULTURE

n' : NATURALLY BUT CHANGING NOT MORE THAN 3°C

≤ 0.005\* : WHEN WATER HARDNESS NOT MORE THAN 100 mg/L AS CaCO<sub>3</sub>

≤ 0.05\*\* : WHEN WATER HARDNESS MORE THAN 100 mg/L AS CaCO<sub>3</sub>

ND : NON-DETECTABLE

*Bhuchonk p.*

(MR BHUCHONK PANICHLERTUMPI)  
LABORATORY SUPERVISOR

SEPTEMBER 27, 2021

# คุณภาพน้ำใต้ดิน

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## ANALYSIS REPORT

**CUSTOMER NAME** : ECO ORIENT RESOURCES (THAILAND) LTD.  
**ADDRESS** : 555 RASA TOWER II, 12TH FLOOR, UNIT 1203 PHAHOLYOTHIN ROAD CHATUCHAK CHATUCHAK BANGKOK 10900  
**CONTACT INFORMATION** : TEL : 0 2937 1124-9 e-mail : anucha@ecothai.net  
**SAMPLING SOURCE** : MWWBNE-C (UP GRADIENT) (UTM WGS 84 ZONE 47P 734458E 1731297N)  
**SAMPLE TYPE** : GROUNDWATER  
**SAMPLING DATE** : SEPTEMBER 9, 2021  
**SAMPLING TIME** : 11:55 HOUR  
**SAMPLING METHOD °** : SUBMERSIBLE PUMP  
**SAMPLING BY °** : MR KRIDSANAPONG NAMTHIP  
**ANALYZED BY** : MISS CHOTIKA KIATTIKUL

**RECEIVED DATE** : SEPTEMBER 10, 2021  
**ANALYTICAL DATE** : SEPTEMBER 10-18, 2021  
**REPORT NO.** : 2021-U68867  
**WORK NO.** : 2021-006160  
**ANALYSIS NO.** : T21AQ851-0003

PARAMETER	UNIT	METHOD OF ANALYSIS	RESULT	REGULATORY STANDARD	DETECTION LIMIT
			MWWBNE-C (UP GRADIENT) T21AQ851-0003		
pH °	-	ELECTROMETRIC METHOD AT SITE (SM:4500-H° B)	8.0 (29°C)	-	-
TEMPERATURE °	°C	THERMOMETER AT SITE (SM: 2550 B)	29	-	-
ELECTRICAL CONDUCTIVITY °	µmhos/cm	ELECTRICAL CONDUCTIVITY METHOD AT SITE (SM: 2510 B)	482 (29°C)	-	0.1
SALINITY °	ppt	ELECTRICAL CONDUCTIVITY METHOD AT SITE (SM: 2520 B)	0.3	-	0.1
TOTAL SUSPENDED SOLIDS °	mg/L	TOTAL SUSPENDED SOLIDS DRIED AT 103-105°C (SM: 2540 D)	ND	-	5.0
TOTAL DISSOLVED SOLIDS °	mg/L	TOTAL DISSOLVED SOLIDS DRIED AT 180 °C (SM: 2540 C)	308	-	25
FAT, OIL AND GREASE °	mg/L	LIQUID-LIQUID, PARTITION-GRAVIMETRIC METHOD (SM: 5520 B)	ND	-	3
TOTAL PETROLEUM HYDROCARBONS °	mg/L	SOXHLET EXTRACTION METHOD (SM: 5520 D AND 5520 F)	ND	-	3
<b>METALS</b>					
IRON °	mg/L Fe	IN-HOUSE METHOD: UAE.TP.GW.01 (NITRIC ACID DIGESTION AND DIRECT AIR ACETYLENE FLAME METHOD); SM: 3030 E AND 3111 B	< LOQ	-	0.005
TOTAL CHROMIUM °	mg/L Cr	IN-HOUSE METHOD: UAE.TP.GW.01 (NITRIC ACID DIGESTION AND DIRECT AIR ACETYLENE FLAME METHOD); SM: 3030 E AND 3111 B	ND	-	0.005
ARSENIC °	mg/L As	HYDRIDE GENERATION AAS METHOD (SM: 3114 C)	ND	≤ 0.01	0.0003
SELENIUM °	mg/L Se	HYDRIDE GENERATION AAS METHOD (SM: 3114 C)	ND	≤ 0.01	0.0005
BARIUM °	mg/L Ba	NITRIC ACID-HYDROCHLORIC ACID DIGESTION AND INDUCTIVELY COUPLED PLASMA (ICP) METHOD (SM: 3030 F AND 3120 B)	0.011	-	0.003
MERCURY °	mg/L Hg	IN-HOUSE METHOD: UAE.TP.HEM.002 (COLD VAPOUR ATOMIC ABSORPTION SPECTROMETRIC METHOD); SM: 3112 B	ND	≤ 0.001	0.0001
CADMIUM °	mg/L Cd	IN-HOUSE METHOD: UAE.TP.GW.01 (NITRIC ACID DIGESTION AND DIRECT AIR ACETYLENE FLAME METHOD); SM: 3030 E AND 3111 B	ND	≤ 0.003	0.002



PARAMETER	UNIT	METHOD OF ANALYSIS	RESULT	REGULATORY STANDARD	DETECTION LIMIT
			MWWBNE-C (UP GRADIENT) T21AQ851-0003		
COPPER °	mg/L Cu	IN-HOUSE METHOD: UAE.TP.GW.01 (NITRIC ACID DIGESTION AND DIRECT AIR ACETYLENE FLAME METHOD); SM: 3030 E AND 3111 B	ND	≤ 1.0	0.002
LEAD °	mg/L Pb	IN-HOUSE METHOD: UAE.TP.GW.01 (NITRIC ACID DIGESTION AND DIRECT AIR ACETYLENE FLAME METHOD); SM: 3030 E AND 3111 B	< LOQ	≤ 0.01	0.003
MANGANESE °	mg/L Mn	IN-HOUSE METHOD: UAE.TP.GW.01 (NITRIC ACID DIGESTION AND DIRECT AIR ACETYLENE FLAME METHOD); SM: 3030 E AND 3111 B	ND	≤ 0.5	0.002
NICKEL °	mg/L Ni	IN-HOUSE METHOD: UAE.TP.GW.01 (NITRIC ACID DIGESTION AND DIRECT AIR ACETYLENE FLAME METHOD); SM: 3030 E AND 3111 B	ND	≤ 0.02	0.005
ZINC °	mg/L Zn	IN-HOUSE METHOD: UAE.TP.GW.01 (NITRIC ACID DIGESTION AND DIRECT AIR ACETYLENE FLAME METHOD); SM: 3030 E AND 3111 B	ND	≤ 5.0	0.003
<b>VOLATILE ORGANIC COMPOUNDS</b>					
BENZENE °	µg/L	PURGE AND TRAP GAS CHROMATOGRAPHIC/MASS SPECTROMETRIC METHOD (SM: 6200 B)	< 0.20	≤ 5	0.20
ETHYLBENZENE °	µg/L	PURGE AND TRAP GAS CHROMATOGRAPHIC/MASS SPECTROMETRIC METHOD (SM: 6200 B)	< 0.20	≤ 700	0.20
TOLUENE °	µg/L	PURGE AND TRAP GAS CHROMATOGRAPHIC/MASS SPECTROMETRIC METHOD (SM: 6200 B)	< 0.20	≤ 1,000	0.20
TOTAL XYLENES °	µg/L	PURGE AND TRAP GAS CHROMATOGRAPHIC/MASS SPECTROMETRIC METHOD (SM: 6200 B)	< 0.60	≤ 10,000	0.60
<b>SAMPLE CONDITION</b> WATER'S COLOUR/TURBID SEDIMENT			COLOURLESS/CLEAR -		

° : ISO/IEC 17025 ACCREDITED BY THAI INDUSTRIAL STANDARDS INSTITUTE (TISI)

° : ISO/IEC 17025 ACCREDITED BY DEPARTMENT OF SCIENCE SERVICE (DSS)

° : VERIFIED BY OWN LABORATORY QUALITY SYSTEM, BUT STILL NOT ACCREDITED

IN-HOUSE : BASED ON STANDARD METHODS FOR THE EXAMINATION OF WATER AND WASTEWATER, APHA, AWWA, WEF, 23<sup>RD</sup> EDITION, 2017.

SM : STANDARD METHODS FOR THE EXAMINATION OF WATER AND WASTEWATER, APHA, AWWA, WEF, 23<sup>RD</sup> EDITION, 2017.

REGULATORY STANDARD : GROUNDWATER QUALITY STANDARDS, NOTIFICATION OF THE NATIONAL ENVIRONMENT BOARD NO.20 (B.E. 2543) ISSUED UNDER THE ENHANCEMENT AND CONSERVATION OF NATIONAL ENVIRONMENTAL QUALITY ACT B.E. 2535.

ND : NON-DETECTABLE.

< LOQ : < LEVEL OF QUANTITATION (IRON ≥ 0.005 AND < 0.050 mg/L, LEAD ≥ 0.003 AND < 0.100 mg/L).

*Benjawan V.*

(MISS BENJAWAN VIRIYOTHAI)  
LABORATORY SUPERVISOR

SEPTEMBER 27, 2021

## ANALYSIS REPORT

**CUSTOMER NAME** : ECO ORIENT RESOURCES (THAILAND) LTD.  
**ADDRESS** : 555 RASA TOWER II, 12TH FLOOR, UNIT 1203 PHAHOLYOTHIN ROAD CHATUCHAK CHATUCHAK BANGKOK 10900  
**CONTACT INFORMATION** : TEL : 0 2937 1124-9 e-mail : anucha@ecothal.net  
**SAMPLING SOURCE** : MWWBNE-C (DOWN GRADIENT) (UTM WGS 84 ZONE 47P 734583E 1731113N)  
**SAMPLE TYPE** : GROUNDWATER  
**SAMPLING DATE** : SEPTEMBER 9, 2021  
**SAMPLING TIME** : 11:20 HOUR  
**SAMPLING METHOD** : SUBMERSIBLE PUMP  
**SAMPLING BY** : MR KRIDSANAPONG NAMTHIP  
**ANALYZED BY** : MISS CHOTIKA KIATTIKUL

PARAMETER	UNIT	METHOD OF ANALYSIS	RESULT	REGULATORY STANDARD	DETECTION LIMIT
			MWWBNE-C (DOWN GRADIENT) T21AQ851-0004		
pH °	-	ELECTROMETRIC METHOD AT SITE (SM:4500-H° B)	7.7 (29°C)	-	-
TEMPERATURE °	°C	THERMOMETER AT SITE (SM: 2550 B)	29	-	-
ELECTRICAL CONDUCTIVITY °	µmhos/cm	ELECTRICAL CONDUCTIVITY METHOD AT SITE (SM: 2510 B)	654 (29°C)	-	0.1
SALINITY °	ppt	ELECTRICAL CONDUCTIVITY METHOD AT SITE (SM: 2520 B)	0.4	-	0.1
TOTAL SUSPENDED SOLIDS °	mg/L	TOTAL SUSPENDED SOLIDS DRIED AT 103-105°C (SM: 2540 D)	ND	-	5.0
TOTAL DISSOLVED SOLIDS °	mg/L	TOTAL DISSOLVED SOLIDS DRIED AT 180 °C (SM: 2540 C)	418	-	25
FAT, OIL AND GREASE °	mg/L	LIQUID-LIQUID, PARTITION-GRAVIMETRIC METHOD (SM: 5520 B)	ND	-	3
TOTAL PETROLEUM HYDROCARBONS °	mg/L	SOXHLET EXTRACTION METHOD (SM: 5520 D AND 5520 F)	ND	-	3
<b>METALS</b>					
IRON °	mg/L Fe	IN-HOUSE METHOD: UAE.TP.GW.01 (NITRIC ACID DIGESTION AND DIRECT AIR ACETYLENE FLAME METHOD); SM: 3030 E AND 3111 B	0.082	-	0.005
TOTAL CHROMIUM °	mg/L Cr	IN-HOUSE METHOD: UAE.TP.GW.01 (NITRIC ACID DIGESTION AND DIRECT AIR ACETYLENE FLAME METHOD); SM: 3030 E AND 3111 B	ND	-	0.005
ARSENIC °	mg/L As	HYDRIDE GENERATION AAS METHOD (SM: 3114 C)	0.0004	≤ 0.01	0.0003
SELENIUM °	mg/L Se	HYDRIDE GENERATION AAS METHOD (SM: 3114 C)	ND	≤ 0.01	0.0005
BARIUM °	mg/L Ba	NITRIC ACID-HYDROCHLORIC ACID DIGESTION AND INDUCTIVELY COUPLED PLASMA (ICP) METHOD (SM: 3030 F AND 3120 B)	0.006	-	0.003
MERCURY °	mg/L Hg	IN-HOUSE METHOD: UAE.TP.HEM.002 (COLD VAPOUR ATOMIC ABSORPTION SPECTROMETRIC METHOD); SM: 3112 B	ND	≤ 0.001	0.0001
CADMIUM °	mg/L Cd	IN-HOUSE METHOD: UAE.TP.GW.01 (NITRIC ACID DIGESTION AND DIRECT AIR ACETYLENE FLAME METHOD); SM: 3030 E AND 3111 B	ND	≤ 0.003	0.002



PARAMETER	UNIT	METHOD OF ANALYSIS	RESULT	REGULATORY STANDARD	DETECTION LIMIT
			MWWBNE-C (DOWN GRADIENT) T21AQ851-0004		
COPPER °	mg/L Cu	IN-HOUSE METHOD: UAE.TP.GW.01 (NITRIC ACID DIGESTION AND DIRECT AIR ACETYLENE FLAME METHOD); SM: 3030 E AND 3111 B	ND	≤ 1.0	0.002
LEAD °	mg/L Pb	IN-HOUSE METHOD: UAE.TP.GW.01 (NITRIC ACID DIGESTION AND DIRECT AIR ACETYLENE FLAME METHOD); SM: 3030 E AND 3111 B	ND	≤ 0.01	0.003
MANGANESE °	mg/L Mn	IN-HOUSE METHOD: UAE.TP.GW.01 (NITRIC ACID DIGESTION AND DIRECT AIR ACETYLENE FLAME METHOD); SM: 3030 E AND 3111 B	0.032	≤ 0.5	0.002
NICKEL °	mg/L Ni	IN-HOUSE METHOD: UAE.TP.GW.01 (NITRIC ACID DIGESTION AND DIRECT AIR ACETYLENE FLAME METHOD); SM: 3030 E AND 3111 B	ND	≤ 0.02	0.005
ZINC °	mg/L Zn	IN-HOUSE METHOD: UAE.TP.GW.01 (NITRIC ACID DIGESTION AND DIRECT AIR ACETYLENE FLAME METHOD); SM: 3030 E AND 3111 B	ND	≤ 5.0	0.003
<b>VOLATILE ORGANIC COMPOUNDS</b>					
BENZENE °	µg/L	PURGE AND TRAP GAS CHROMATOGRAPHIC/MASS SPECTROMETRIC METHOD (SM: 6200 B)	< 0.20	≤ 5	0.20
ETHYLBENZENE °	µg/L	PURGE AND TRAP GAS CHROMATOGRAPHIC/MASS SPECTROMETRIC METHOD (SM: 6200 B)	< 0.20	≤ 700	0.20
TOLUENE °	µg/L	PURGE AND TRAP GAS CHROMATOGRAPHIC/MASS SPECTROMETRIC METHOD (SM: 6200 B)	< 0.20	≤ 1,000	0.20



PARAMETER	UNIT	METHOD OF ANALYSIS	RESULT	REGULATORY STANDARD	DETECTION LIMIT
			MW/WBNE-C (DOWN GRADIENT) T21AQ851-0004		
TOTAL XYLENES <sup>a</sup>	µg/L	PURGE AND TRAP GAS CHROMATOGRAPHIC/MASS SPECTROMETRIC METHOD (SM: 6200 B)	< 0.60	≤ 10,000	0.60
SAMPLE CONDITION WATER'S COLOUR/TURBID SEDIMENT			COLOURLESS/CLEAR -		

<sup>a</sup> : ISO/IEC 17025 ACCREDITED BY THAI INDUSTRIAL STANDARDS INSTITUTE (TISI)

<sup>b</sup> : ISO/IEC 17025 ACCREDITED BY DEPARTMENT OF SCIENCE SERVICE (DSS)

<sup>c</sup> : VERIFIED BY OWN LABORATORY QUALITY SYSTEM, BUT STILL NOT ACCREDITED

IN-HOUSE : BASED ON STANDARD METHODS FOR THE EXAMINATION OF WATER AND WASTEWATER, APHA, AWWA, WEF, 23<sup>rd</sup> EDITION, 2017.

SM : STANDARD METHODS FOR THE EXAMINATION OF WATER AND WASTEWATER, APHA, AWWA, WEF, 23<sup>rd</sup> EDITION, 2017.

REGULATORY STANDARD : GROUNDWATER QUALITY STANDARDS, NOTIFICATION OF THE NATIONAL ENVIRONMENT BOARD NO.20 (B.E. 2543) ISSUED UNDER THE ENHANCEMENT AND CONSERVATION OF NATIONAL ENVIRONMENTAL QUALITY ACT B.E. 2535.

ND : NON-DETECTABLE.

*Benjawan V.*

(MISS BENJAWAN VIRIYOTHAI)  
LABORATORY SUPERVISOR

SEPTEMBER 27, 2021

## ANALYSIS REPORT

CUSTOMER NAME	: ECO ORIENT RESOURCES (THAILAND) LTD.
ADDRESS	: 555 RASA TOWER II, 12TH FLOOR, UNIT 1203 PHAHOLYOTHIN ROAD CHATUCHAK CHATUCHAK BANGKOK 10900
CONTACT INFORMATION	: TEL : 0 2937 1124-9 e-mail : anucha@ecothai.net
SAMPLING SOURCE	: WBNE-C-GW6 (UTM WGS 84 ZONE 47P 735384E 1731798N)
SAMPLE TYPE	: GROUNDWATER
SAMPLING DATE	: SEPTEMBER 9, 2021
SAMPLING TIME	: 12:05 HOUR
SAMPLING METHOD <sup>c</sup>	: GRAB
SAMPLING BY <sup>c</sup>	: MR KRIDSANAPONG NAMTHIP
ANALYZED BY	: MISS CHOTIKA KIATTIKUL
RECEIVED DATE	: SEPTEMBER 10, 2021
ANALYTICAL DATE	: SEPTEMBER 10-18, 2021
REPORT NO.	: 2021-U68865
WORK NO.	: 2021-006160
ANALYSIS NO.	: T21AQ851-0001

PARAMETER	UNIT	METHOD OF ANALYSIS	RESULT	REGULATORY STANDARD	DETECTION LIMIT
			WBNE-C-GW6 T21AQ851-0001		
pH <sup>c</sup>	-	ELECTROMETRIC METHOD AT SITE (SM4500-H <sup>+</sup> B)	7.2 (32°C)	-	-
TEMPERATURE <sup>c</sup>	°C	THERMOMETER AT SITE (SM: 2550 B)	32	-	-
ELECTRICAL CONDUCTIVITY <sup>c</sup>	µmhos/cm	ELECTRICAL CONDUCTIVITY METHOD AT SITE (SM: 2510 B)	744 (32°C)	-	0.1
SALINITY <sup>c</sup>	ppt	ELECTRICAL CONDUCTIVITY METHOD AT SITE (SM: 2520 B)	0.5	-	0.1
TOTAL SUSPENDED SOLIDS <sup>a</sup>	mg/L	TOTAL SUSPENDED SOLIDS DRIED AT 103-105°C (SM: 2540 D)	19.3	-	5.0
TOTAL DISSOLVED SOLIDS <sup>b</sup>	mg/L	TOTAL DISSOLVED SOLIDS DRIED AT 180°C (SM: 2540 C)	514	-	25
FAT, OIL AND GREASE <sup>c</sup>	mg/L	LIQUID-LIQUID, PARTITION-GRAVIMETRIC METHOD (SM: 5520 B)	ND	-	3
TOTAL PETROLEUM HYDROCARBONS <sup>c</sup>	mg/L	SOXHLET EXTRACTION METHOD (SM: 5520 D AND 5520 F)	ND	-	3
METALS					
IRON <sup>c</sup>	mg/L Fe	IN-HOUSE METHOD: UAE.TP.GW.01 (NITRIC ACID DIGESTION AND DIRECT AIR ACETYLENE FLAME METHOD); SM: 3030 E AND 3111 B	7.58	-	0.005
TOTAL CHROMIUM <sup>c</sup>	mg/L Cr	IN-HOUSE METHOD: UAE.TP.GW.01 (NITRIC ACID DIGESTION AND DIRECT AIR ACETYLENE FLAME METHOD); SM: 3030 E AND 3111 B	ND	-	0.005
ARSENIC <sup>c</sup>	mg/L As	HYDRIDE GENERATION AAS METHOD (SM: 3114 C)	0.0011	≤ 0.01	0.0003
SELENIUM <sup>c</sup>	mg/L Se	HYDRIDE GENERATION AAS METHOD (SM: 3114 C)	ND	≤ 0.01	0.0005
BARIUM <sup>c</sup>	mg/L Ba	NITRIC ACID-HYDROCHLORIC ACID DIGESTION AND INDUCTIVELY COUPLED PLASMA (ICP) METHOD (SM: 3030 F AND 3120 B)	0.013	-	0.003
MERCURY <sup>b</sup>	mg/L Hg	IN-HOUSE METHOD: UAE.TP.HEM.002 (COLD VAPOUR ATOMIC ABSORPTION SPECTROMETRIC METHOD); SM: 3112 B	ND	≤ 0.001	0.0001
CADMIUM <sup>c</sup>	mg/L Cd	IN-HOUSE METHOD: UAE.TP.GW.01 (NITRIC ACID DIGESTION AND DIRECT AIR ACETYLENE FLAME METHOD); SM: 3030 E AND 3111 B	ND	≤ 0.003	0.002





PARAMETER	UNIT	METHOD OF ANALYSIS	RESULT	REGULATORY STANDARD	DETECTION LIMIT
			WBNE-C-GW6 T21AQ851-0001		
COPPER <sup>c</sup>	mg/L Cu	IN-HOUSE METHOD: UAE.TP.GW.01 (NITRIC ACID DIGESTION AND DIRECT AIR ACETYLENE FLAME METHOD); SM: 3030 E AND 3111 B	0.031	≤ 1.0	0.002
LEAD <sup>c</sup>	mg/L Pb	IN-HOUSE METHOD: UAE.TP.GW.01 (NITRIC ACID DIGESTION AND DIRECT AIR ACETYLENE FLAME METHOD); SM: 3030 E AND 3111 B	< LOQ	≤ 0.01	0.003
MANGANESE <sup>c</sup>	mg/L Mn	IN-HOUSE METHOD: UAE.TP.GW.01 (NITRIC ACID DIGESTION AND DIRECT AIR ACETYLENE FLAME METHOD); SM: 3030 E AND 3111 B	0.309	≤ 0.5	0.002
NICKEL <sup>c</sup>	mg/L Ni	IN-HOUSE METHOD: UAE.TP.GW.01 (NITRIC ACID DIGESTION AND DIRECT AIR ACETYLENE FLAME METHOD); SM: 3030 E AND 3111 B	< LOQ	≤ 0.02	0.005
ZINC <sup>c</sup>	mg/L Zn	IN-HOUSE METHOD: UAE.TP.GW.01 (NITRIC ACID DIGESTION AND DIRECT AIR ACETYLENE FLAME METHOD); SM: 3030 E AND 3111 B	2.68	≤ 5.0	0.003
VOLATILE ORGANIC COMPOUNDS					
BENZENE <sup>a</sup>	µg/L	PURGE AND TRAP GAS CHROMATOGRAPHIC/MASS SPECTROMETRIC METHOD (SM: 6200 B)	< 0.20	≤ 5	0.20
ETHYLBENZENE <sup>a</sup>	µg/L	PURGE AND TRAP GAS CHROMATOGRAPHIC/MASS SPECTROMETRIC METHOD (SM: 6200 B)	< 0.20	≤ 700	0.20
TOLUENE <sup>a</sup>	µg/L	PURGE AND TRAP GAS CHROMATOGRAPHIC/MASS SPECTROMETRIC METHOD (SM: 6200 B)	1.0	≤ 1,000	0.20
TOTAL XYLENES <sup>a</sup>	µg/L	PURGE AND TRAP GAS CHROMATOGRAPHIC/MASS SPECTROMETRIC METHOD (SM: 6200 B)	< 0.60	≤ 10,000	0.60
SAMPLE CONDITION WATER'S COLOUR/TURBID SEDIMENT			YELLOW/TURBID BROWN		

<sup>a</sup> : ISO/IEC 17025 ACCREDITED BY THAI INDUSTRIAL STANDARDS INSTITUTE (TISI)

<sup>b</sup> : ISO/IEC 17025 ACCREDITED BY DEPARTMENT OF SCIENCE SERVICE (DSS)

<sup>c</sup> : VERIFIED BY OWN LABORATORY QUALITY SYSTEM, BUT STILL NOT ACCREDITED

IN-HOUSE : BASED ON STANDARD METHODS FOR THE EXAMINATION OF WATER AND WASTEWATER, APHA, AWWA, WEF, 23<sup>RD</sup> EDITION, 2017.

SM : STANDARD METHODS FOR THE EXAMINATION OF WATER AND WASTEWATER, APHA, AWWA, WEF, 23<sup>RD</sup> EDITION, 2017.

REGULATORY STANDARD : GROUNDWATER QUALITY STANDARDS, NOTIFICATION OF THE NATIONAL ENVIRONMENT BOARD NO.20 (B.E. 2543)  
ISSUED UNDER THE ENHANCEMENT AND CONSERVATION OF NATIONAL ENVIRONMENTAL QUALITY ACT B.E. 2535.

ND : NON-DETECTABLE.

< LOQ : < LEVEL OF QUANTITATION (LEAD ≥ 0.003 AND < 0.100 mg/L, NICKEL ≥ 0.005 AND < 0.050 mg/L).

*Benjawan V.*

(MISS BENJAWAN VIRIYOTHAI)  
LABORATORY SUPERVISOR

SEPTEMBER 27, 2021

## ANALYSIS REPORT

**CUSTOMER NAME** : ECO ORIENT RESOURCES (THAILAND) LTD.  
**ADDRESS** : 555 RASA TOWER II, 12TH FLOOR, UNIT 1203 PHAHOLYOTHIN ROAD CHATUCHAK CHATUCHAK BANGKOK 10900  
**CONTACT INFORMATION** : TEL : 0 2937 1124-9 e-mail : anucha@ecothal.net  
**SAMPLING SOURCE** : WBNE-C-GW7 (UTM WGS 84 ZONE 47P 734949E 1727784N)  
**SAMPLE TYPE** : GROUNDWATER  
**SAMPLING DATE** : SEPTEMBER 9, 2021  
**SAMPLING TIME** : 14:10 HOUR  
**SAMPLING METHOD <sup>c</sup>** : GRAB  
**SAMPLING BY <sup>c</sup>** : MR KRIDSANAPONG NAMTHIP  
**ANALYZED BY** : MISS CHOTIKA KIATTIKUL  
**RECEIVED DATE** : SEPTEMBER 10, 2021  
**ANALYTICAL DATE** : SEPTEMBER 10-18, 2021  
**REPORT NO.** : 2021-U68866  
**WORK NO.** : 2021-006160  
**ANALYSIS NO.** : T21AQ851-0002

PARAMETER	UNIT	METHOD OF ANALYSIS	RESULT	REGULATORY STANDARD	DETECTION LIMIT
			WBNE-C-GW7 T21AQ851-0002		
pH <sup>c</sup>	-	ELECTROMETRIC METHOD AT SITE (SM:4500-H+ B)	6.1 (32°C)	-	-
TEMPERATURE <sup>c</sup>	°C	THERMOMETER AT SITE (SM: 2550 B)	32	-	-
ELECTRICAL CONDUCTIVITY <sup>c</sup>	µmhos/cm	ELECTRICAL CONDUCTIVITY METHOD AT SITE (SM: 2510 B)	324 (32°C)	-	0.1
SALINITY <sup>c</sup>	ppt	ELECTRICAL CONDUCTIVITY METHOD AT SITE (SM: 2520 B)	0.2	-	0.1
TOTAL SUSPENDED SOLIDS <sup>a</sup>	mg/L	TOTAL SUSPENDED SOLIDS DRIED AT 103-105°C (SM: 2540 D)	ND	-	5.0
TOTAL DISSOLVED SOLIDS <sup>b</sup>	mg/L	TOTAL DISSOLVED SOLIDS DRIED AT 180°C (SM: 2540 C)	633	-	25
FAT, OIL AND GREASE <sup>c</sup>	mg/L	LIQUID-LIQUID, PARTITION-GRAVIMETRIC METHOD (SM: 5520 B)	ND	-	3
TOTAL PETROLEUM HYDROCARBONS <sup>c</sup>	mg/L	SOXHLET EXTRACTION METHOD (SM: 5520 D AND 5520 F)	ND	-	3
METALS					
IRON <sup>c</sup>	mg/L Fe	IN-HOUSE METHOD: UAE.TP.GW.01 (NITRIC ACID DIGESTION AND DIRECT AIR ACETYLENE FLAME METHOD); SM: 3030 E AND 3111 B	< LOQ	-	0.005
TOTAL CHROMIUM <sup>c</sup>	mg/L Cr	IN-HOUSE METHOD: UAE.TP.GW.01 (NITRIC ACID DIGESTION AND DIRECT AIR ACETYLENE FLAME METHOD); SM: 3030 E AND 3111 B	ND	-	0.005
ARSENIC <sup>c</sup>	mg/L As	HYDRIDE GENERATION AAS METHOD (SM: 3114 C)	0.0003	≤ 0.01	0.0003
SELENIUM <sup>c</sup>	mg/L Se	HYDRIDE GENERATION AAS METHOD (SM: 3114 C)	ND	≤ 0.01	0.0005
BARIUM <sup>c</sup>	mg/L Ba	NITRIC ACID-HYDROCHLORIC ACID DIGESTION AND INDUCTIVELY COUPLED PLASMA (ICP) METHOD (SM: 3030 F AND 3120 B)	0.032	-	0.003
MERCURY <sup>b</sup>	mg/L Hg	IN-HOUSE METHOD: UAE.TP.HEM.002 (COLD VAPOUR ATOMIC ABSORPTION SPECTROMETRIC METHOD); SM: 3112 B	ND	≤ 0.001	0.0001
CADMIUM <sup>c</sup>	mg/L Cd	IN-HOUSE METHOD: UAE.TP.GW.01 (NITRIC ACID DIGESTION AND DIRECT AIR ACETYLENE FLAME METHOD); SM: 3030 E AND 3111 B	ND	≤ 0.003	0.002



PARAMETER	UNIT	METHOD OF ANALYSIS	RESULT	REGULATORY STANDARD	DETECTION LIMIT
			WBNE-C-GW7 T21AQ851-0002		
COPPER <sup>a</sup>	mg/L Cu	IN-HOUSE METHOD: UAE.TP.GW.01 (NITRIC ACID DIGESTION AND DIRECT AIR ACETYLENE FLAME METHOD); SM: 3030 E AND 3111 B	ND	≤ 1.0	0.002
LEAD <sup>a</sup>	mg/L Pb	IN-HOUSE METHOD: UAE.TP.GW.01 (NITRIC ACID DIGESTION AND DIRECT AIR ACETYLENE FLAME METHOD); SM: 3030 E AND 3111 B	ND	≤ 0.01	0.003
MANGANESE <sup>a</sup>	mg/L Mn	IN-HOUSE METHOD: UAE.TP.GW.01 (NITRIC ACID DIGESTION AND DIRECT AIR ACETYLENE FLAME METHOD); SM: 3030 E AND 3111 B	0.094	≤ 0.5	0.002
NICKEL <sup>a</sup>	mg/L Ni	IN-HOUSE METHOD: UAE.TP.GW.01 (NITRIC ACID DIGESTION AND DIRECT AIR ACETYLENE FLAME METHOD); SM: 3030 E AND 3111 B	ND	≤ 0.02	0.005
ZINC <sup>a</sup>	mg/L Zn	IN-HOUSE METHOD: UAE.TP.GW.01 (NITRIC ACID DIGESTION AND DIRECT AIR ACETYLENE FLAME METHOD); SM: 3030 E AND 3111 B	< LOQ	≤ 5.0	0.003
VOLATILE ORGANIC COMPOUNDS					
BENZENE <sup>a</sup>	µg/L	PURGE AND TRAP GAS CHROMATOGRAPHIC/MASS SPECTROMETRIC METHOD (SM: 6200 B)	< 0.20	≤ 5	0.20
ETHYLBENZENE <sup>a</sup>	µg/L	PURGE AND TRAP GAS CHROMATOGRAPHIC/MASS SPECTROMETRIC METHOD (SM: 6200 B)	< 0.20	≤ 700	0.20
TOLUENE <sup>a</sup>	µg/L	PURGE AND TRAP GAS CHROMATOGRAPHIC/MASS SPECTROMETRIC METHOD (SM: 6200 B)	< 0.20	≤ 1,000	0.20
TOTAL XYLENES <sup>a</sup>	µg/L	PURGE AND TRAP GAS CHROMATOGRAPHIC/MASS SPECTROMETRIC METHOD (SM: 6200 B)	< 0.60	≤ 10,000	0.60
SAMPLE CONDITION					
WATER'S COLOUR/TURBID			COLOURLESS/CLEAR		
SEDIMENT			-		

<sup>a</sup> : ISO/IEC 17025 ACCREDITED BY THAI INDUSTRIAL STANDARDS INSTITUTE (TISI)

<sup>b</sup> : ISO/IEC 17025 ACCREDITED BY DEPARTMENT OF SCIENCE SERVICE (DSS)

<sup>c</sup> : VERIFIED BY OWN LABORATORY QUALITY SYSTEM, BUT STILL NOT ACCREDITED

IN-HOUSE : BASED ON STANDARD METHODS FOR THE EXAMINATION OF WATER AND WASTEWATER, APHA, AWWA, WEF, 23<sup>RD</sup> EDITION, 2017.

SM : STANDARD METHODS FOR THE EXAMINATION OF WATER AND WASTEWATER, APHA, AWWA, WEF, 23<sup>RD</sup> EDITION, 2017.

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ND : NON-DETECTABLE

< LOQ : < LEVEL OF QUANTITATION (IRON ≥ 0.005 AND < 0.050 mg/L, ZINC ≥ 0.003 AND < 0.025 mg/L).

*Benjawan V.*

(MISS BENJAWAN VIRIYOTHAI)  
LABORATORY SUPERVISOR

SEPTEMBER 27, 2021

ภาคผนวก ฎ  
เอกสารสอบเทียบเครื่องมือ

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## 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
<b>Ambient</b>									
1	Orifice Transfer Standard Calibrator	Total Suspended Particulate (TSP) Particulate Matter < 10 µm (PM <sub>10</sub> )	Andersen Instruments, Inc.	G25A 1901	Tisch Environmental, Inc.	22062020	22 Jun 20	21 Jun 22	-
2	U-Tube Manometer	Total Suspended Particulate (TSP) Particulate Matter < 10 µm (PM <sub>10</sub> )	Dwyer	1221-36-W/M -	Technology Promotion Association (Thailand-Japan)	21P443	9 Feb 21	8 Feb 22	-
3	Aneroid Barometer	Total Suspended Particulate (TSP) Particulate Matter < 10 µm (PM <sub>10</sub> )	Barigo, Germany	-	Technology Promotion Association (Thailand-Japan)	21P435	8 Feb 21	7 Feb 22	-
4	Dial Thermo-Hygrometer	Total Suspended Particulate (TSP) Particulate Matter < 10 µm (PM <sub>10</sub> )	Barigo, Germany	-	Technology Promotion Association (Thailand-Japan)	21H804	8 Apr 21	7 Apr 22	-
5	Nitrogen Dioxide Analyzer	Nitrogen Dioxide	Thermo Environmental Instrument	42C 42C-58929-320	UAE Consultant Co., Ltd.	20012021	20 Jan 21	19 Jan 22	-
6	Standard Gases (Mixture)	Nitrogen Dioxide	Airgas	CC159599 2015PSIG	Airgas an Air Liquide company	E04NI99E15A01QC	30 Jul 19	30 Jul 22	-
7	Sulphur Dioxide Analyzer	Sulphur Dioxide	Thermo Scientific	43i 1182920016	UAE Consultant Co., Ltd.	08012021	8 Jan 21	7 Jan 22	-
8	Standard Gases (Mixture)	Sulphur Dioxide	Airgas	CC159599 2015PSIG	Airgas an Air Liquide company	E04NI99E15A01QC	30 Jul 19	30 Jul 22	-
9	Carbon Monoxide Analyzer	Carbon Monoxide	Thermo	48C 48CTL-65506-348	UAE Consultant Co., Ltd.	09022021	9 Feb 21	8 Feb 22	-
10	Standard Gases (Mixture)	Carbon Monoxide	Airgas	CC159599 2015PSIG	Airgas an Air Liquide company	160-401526192-1	30 Jul 19	30 Jul 22	-
11	Total Hydrocarbons Analyzer	Total Hydrocarbons	HORIBA	APHA-370 KWWV1R96	UAE Consultant Co., Ltd.	09062021	9 Jun 21	8 Jun 22	-
12	Standard Gas	Total Hydrocarbons	Linde	D824432	Linde	09042013	4 Aug 20	4 Aug 28	-
13	Wind Speed/Wind Direction	WS/WD	LSI LASTEM	E-LOG305 20070023	Thai Meteorological Department	185/21	5 Apr 21	4 Apr 22	-



# Certificate of Calibration

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

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

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

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

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

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

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

www.tisch-env.com  
TOLL FREE: (877)263-7610  
FAX: (513)467-9009

เอกสารไม่ควบคุม



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)  
CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES  
53/44 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG, BANGKOK 10250  
TEL. 0-2717-3000-24 FAX. 0-2719-9484

## Certificate of Calibration

Certificate No.: 21P443  
Page: 1 of 2

Equipment: U Tube Manometer  
Manufacturer: Dwyer  
Model: 1221-36-W/M  
Serial No.: -  
ID No.: UAE.EMA2.096/2555

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

Condition As-Received: Used Item  
Received Date: 01 February 2021  
Calibration Date: 09 February 2021

Reference: 2102-0083WSC  
Ambient Temperature: ( 23 ± 2 ) °C  
Relative Humidity: ( 50 ± 15 ) %  
Atmospheric Pressure: 1012 mbar  
Submitted by: United Analyst and Engineering Consultant Co.,Ltd.  
81 Soi Udomsuk 41, Sukhumvit Road, Bangkok, Phrakhanong, Bangkok 10260

Procedure used: The calibration was conducted by direct comparison method against Pressure Measuring Instruments Standard according to in-house calibration procedure CP-P04, using \* DKD-R 8-1; Calibration of Pressure Gauges, Edition 03/2014 \* as a guidelines.

### Condition of this result of calibration

1. Reference standards instruments:

Instrument	Model	Serial No.	Certificate No.	Due Date
1) Pressure Calibrator	PC109P	1189	MP-0113-20	14 Jul 2021

- This result of calibration was made on requested at the point specified by customer.
- Scale and conversion factor is 1 kPa = 4.0146293 inH2O
- This instrument was used clean air as pressure media.
- This instrument was installed in vertical orientation and center of connector was used as the reference level.
- The certificate is valid only to the item calibrated on date and place of calibration.
- This Certification is traceable to the International System of Unit maintained at:-  
-National Institute of Metrology Thailand (NIMT)

Calibrated by: Nopparat Phongam  
Issue Date: 11 February 2021

Approved Signatory: Attapol P.  
[ ] Phalinee Prabpaipai  
[ ] Sura Suwannasri  
[x] Attapol Panurach

เอกสารไม่ควบคุม  
B 0250405



Cert.No.: 21P443  
Page: 2 of 2

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

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

UUC Indication		ΔP (inH2O)	Error (inH2O)
Applied Pressure (inH2O)	High-port side (inH2O)		
0.00	0.00	0.00	0.00
2.00	1.02	-1.02	2.04
4.00	1.98	-1.98	3.96
6.00	2.98	-2.98	5.96
10.00	4.98	-4.98	9.96
12.00	6.00	-5.98	11.98
14.00	7.02	-6.98	14.00
16.00	8.02	-8.00	16.02
18.00	9.04	-9.00	18.04
20.00	10.04	-10.00	20.04
22.00	11.06	-11.00	22.06
24.00	12.06	-12.00	24.06
26.00	13.06	-13.00	26.06
28.00	14.06	-14.02	28.08
30.00	15.06	-15.02	30.08
32.00	16.06	-16.02	32.08
34.00	17.06	-17.02	34.08
35.80	17.98	-17.92	35.90

The uncertainty of measurement was ± 0.11 inH2O  
\* UUC = Unit Under Calibration

\* ΔP = High-port side - Low-port side

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

-o-o-

Attapol P.

เอกสารไม่ควบคุม  
a 1037942



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)  
CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES  
53/44 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG, BANGKOK 10250  
TEL. 0-2717-3000-24 FAX. 0-2719-9484

## Certificate of Calibration

Certificate No.: 21P443  
Page: 1 of 2

Equipment: U Tube Manometer  
Manufacturer: Dwyer  
Model: 1221-36-W/M  
Serial No.: -  
ID No.: UAE.EMA2.096/2555

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

Condition As-Received: Used Item  
Received Date: 01 February 2021  
Calibration Date: 09 February 2021

Reference: 2102-0083WSC  
Ambient Temperature: ( 23 ± 2 ) °C  
Relative Humidity: ( 50 ± 15 ) %  
Atmospheric Pressure: 1012 mbar  
Submitted by: United Analyst and Engineering Consultant Co.,Ltd.  
81 Soi Udomsuk 41, Sukhumvit Road, Bangkok, Phrakhanong, Bangkok 10260

Procedure used: The calibration was conducted by direct comparison method against Pressure Measuring Instruments Standard according to in-house calibration procedure CP-P04, using \* DKD-R 8-1; Calibration of Pressure Gauges, Edition 03/2014 \* as a guidelines.

### Condition of this result of calibration

1. Reference standards instruments:

Instrument	Model	Serial No.	Certificate No.	Due Date
1) Pressure Calibrator	PC109P	1189	MP-0113-20	14 Jul 2021

- This result of calibration was made on requested at the point specified by customer.
- Scale and conversion factor is 1 kPa = 4.0146293 inH2O
- This instrument was used clean air as pressure media.
- This instrument was installed in vertical orientation and center of connector was used as the reference level.
- The certificate is valid only to the item calibrated on date and place of calibration.
- This Certification is traceable to the International System of Unit maintained at:-  
-National Institute of Metrology Thailand (NIMT)

Calibrated by: Nopparat Phongam  
Issue Date: 11 February 2021

Approved Signatory: Attapol P.  
[ ] Phalinee Prabpaipai  
[ ] Sura Suwannasri  
[x] Attapol Panurach

เอกสารไม่ควบคุม  
B 0250405





Cert.No.: 21P443  
Page: 2 of 2

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

Range: 0 inH<sub>2</sub>O to 36 inH<sub>2</sub>O  
Scale Interval: 0.1 inH<sub>2</sub>O (The Fifth Estimate)

Applied Pressure (inH <sub>2</sub> O)	UUC Indication		$\Delta P$ (inH <sub>2</sub> O)	Error (inH <sub>2</sub> O)
	High-port side (inH <sub>2</sub> O)	Low-port side (inH <sub>2</sub> O)		
0.00	0.00	0.00	0.00	0.00
2.00	1.02	-1.02	2.04	0.04
4.00	1.98	-1.98	3.96	-0.04
6.00	2.98	-2.98	5.96	-0.04
10.00	4.98	-4.98	9.96	-0.04
12.00	6.00	-5.98	11.98	-0.02
14.00	7.02	-6.98	14.00	0.00
16.00	8.02	-8.00	16.02	0.02
18.00	9.04	-9.00	18.04	0.04
20.00	10.04	-10.00	20.04	0.04
22.00	11.06	-11.00	22.06	0.06
24.00	12.06	-12.00	24.06	0.06
26.00	13.06	-13.00	26.06	0.06
28.00	14.06	-14.02	28.06	0.06
30.00	15.06	-15.02	30.08	0.08
32.00	16.06	-16.02	32.08	0.08
34.00	17.06	-17.02	34.08	0.08
35.80	17.98	-17.92	35.90	0.10

The uncertainty of measurement was  $\pm 0.11$  inH<sub>2</sub>O

\* UUC = Unit Under Calibration

\*  $\Delta P$  = 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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Atapol P.

เอกสารไม่ควบคุม  
a 1037942



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)  
CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES  
5344 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG, BANGKOK 10250  
TEL. 0-2717-3000-24 FAX. 0-2719-9484



## Certificate of Calibration

Certificate No.: 21P435  
Page: 1 of 2

Equipment: Aneroid Barometer  
Manufacturer: Barigo  
Model: 111MS  
Serial No.: -  
ID No.: UAE.EMAZ.067/2552  
Condition As-Received: Used Item  
Received Date: 01 February 2021  
Calibration Date: 08 February 2021  
Reference: 2102-0083WSC  
Ambient Temperature:  $(23 \pm 2) ^\circ\text{C}$   
Relative Humidity:  $(50 \pm 15) \%$   
Atmospheric Pressure: 1012 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, Bangchak,  
Phrakhanong, 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 "DKD-R 6-1 : Calibration of Pressure  
Gauges, Edition 03/2014" as a guidelines.

### Condition of this result of calibration

1. Reference standards instruments:

Instrument	Model	Serial No.	Certificate No.	Due Date
1) Standard Barometer	DPI142	1422505046	MP-0053-20	05 Apr 2021
2. This instrument was installed in vertical orientation and center of the dial was used as the reference level.				
3. This result of calibration was made on requested at the point specified by customer.				
4. Scale and conversion factor is 1 kPa = 7.50062 mmHg				
5. This instrument was used clean air as pressure media.				
6. The certificate is valid only to the item calibrated on date and place of calibration.				
7. This Certificate is traceable to the International System of Unit maintained at:- -National Institute of Metrology Thailand (NIMT)				

Calibrated by: Nopparat Phangam  
Issue Date: 11 February 2021

Approved Signatory: Atapol P.  
[ ] Phalinee Prabpaipal  
[ ] Sura Suwannasri  
[x] Atapol Panurach

เอกสารไม่ควบคุม  
B 0250401



Cert.No.: 21P435  
Page: 2 of 2

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

Range: 720 mmHg to 780 mmHg  
Scale Interval: 1 mmHg (The Fifth Estimate)

Applied Pressure (mmHg)	719.48	730.76	741.39	752.01	763.14	774.96	786.96
UUC Indication (mmHg)	720.0	730.0	740.0	750.0	760.0	770.0	780.0
Error (mmHg)	0.52	-0.76	-1.39	-2.01	-3.14	-4.96	-6.96

Decreasing Pressure							
Applied Pressure (mmHg)	786.96	774.76	762.78	751.81	740.88	730.53	719.35
UUC Indication (mmHg)	780.0	770.0	760.0	750.0	740.0	730.0	720.0
Error (mmHg)	-6.96	-4.76	-2.78	-1.81	-0.88	-0.53	0.65

The uncertainty of measurement was  $\pm 0.24$  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 %.

-000-

Atapol P.

เอกสารไม่ควบคุม  
a 1037938



United Analyst and Engineering Consultant Co., Ltd.  
3 Soi Udomsuk 41, Sukhumvit Road, Bangchak, Phrakhanong, Bangkok 10260  
Tel. 0 2763 2828 Fax 0 2763 2800 www.uaeconsultant.com E-mail: use@uaeconsultant.com

## MULTI-POINT GAS TEST REPORT

Test Date: Jan 19, 2021

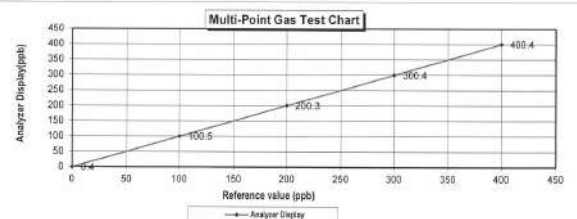
Equipment: Gas Analyzer (NO<sub>2</sub>) Model: 42C  
Manufacturer: Thermo Environmental Instruments Serial Number: 42C-58929-320

### Standard Gas Concentration

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

### Multi-point gas test data

Level	Reference Value (ppb)	Analyzer Display (ppb)	Difference Error	Percent Error	[% Error]
Level 1	Zero	0.0	0.40	0.40	0.40
Level 2	20.00%	100.5	0.50	0.50	0.50
Level 3	40.00%	200.3	0.30	0.15	0.15
Level 4	60.00%	300.4	0.40	0.13	0.13
Level 5	80.00%	400.4	0.40	0.10	0.10
Remark: Measuring Range 500.0 ppb			Average Difference (%)		
: Acceptable Limit $\pm 5\%$			0.26		



Calculate by  
Sirichan Samgou  
[Signature]

Approve by  
[Signature]  
[Signature]



### MULTI-POINT GAS TEST REPORT

Test Date : Jan 8, 2021

Equipment : Gas Analyzer (SO<sub>2</sub>) Model : 43i  
Manufacturer : Thermo SCIENTIFIC Serial Number : 1182920016

#### Standard Gas Concentration

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

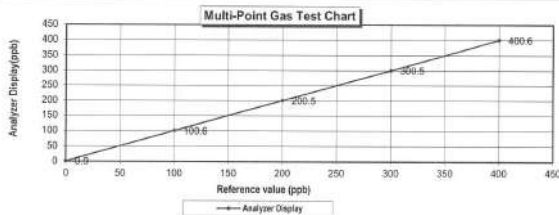
#### Dilutor Detail

Manufacturer : Thermo SCIENTIFIC  
Model : 146i  
Serial Number : 1180540071

#### Multi-point gas test data

Reference Value (ppb)	Analyzer Display (ppb)	Difference Error	Percent Error	[% Error]
Level 1 Zero	0.0	0.9	0.90	0.90
Level 2 20.00%	100.0	0.60	0.60	0.60
Level 3 40.00%	200.0	0.50	0.25	0.25
Level 4 60.00%	300.5	0.50	0.17	0.17
Level 5 80.00%	400.6	0.60	0.15	0.15

Remark : Measuring Range 500.0 ppb  
Acceptable Limit  $\pm 5\%$   
Average Difference (%) 0.41



Calculate by

Srichai y.  
8 Jan 2021

Approve by

8 Jan 2021

### MULTI-POINT GAS TEST REPORT

Test Date : Feb 08, 2021

Equipment : Gas Analyzer (CO) Model : 48C  
Manufacturer : Thermo Environmental Instruments Serial Number : 48CTL-65506-348

#### Standard Gas Concentration

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

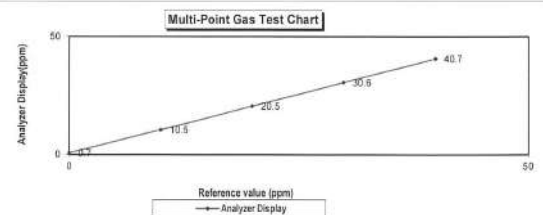
#### Dilutor Detail

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

#### Multi-point gas test data

Reference Value (ppm)	Analyzer Display (ppm)	Difference Error	Percent Error	[% Error]
Level 1 Zero	0.0	0.7	0.7	0.7
Level 2 20.00%	10.0	0.5	4.8	4.8
Level 3 40.00%	20.0	0.5	2.4	2.4
Level 4 60.00%	30.0	0.6	2.0	2.0
Level 5 80.00%	40.7	0.7	1.7	1.7

Remark : Measuring Range 50.0 ppm  
Acceptable Limit  $\pm 5\%$   
Average Difference (%) 2.32



Calculate by

Srichai y.  
9 Feb 2021

Approve by

9 Feb 2021



an Air Liquide company

## CERTIFICATE OF ANALYSIS

### Grade of Product: EPA Protocol

Part Number: E04N199E15A01QC Reference Number: 160-401526192-1  
Cylinder Number: CC159599 Cylinder Volume: 144.4 CF  
Laboratory: 124 - Plumsteadville - PA Cylinder Pressure: 2015 PSIG  
PGVP Number: A12019 Valve Outlet: 660  
Gas Code: CO, NO, NO<sub>2</sub>, SO<sub>2</sub>, BALN Certification Date: Jul 30, 2019  
Expiration Date: Jul 30, 2022

Airgas Specialty Gases  
Airgas USA, LLC  
6641 Easton Road  
Bldg 1  
Plumsteadville, PA 17349  
Airgas.com

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

ANALYTICAL RESULTS					
Component	Requested Concentration	Actual Concentration	Protocol Method	Total Relative Uncertainty	Assay Dates
NOX	45.00 PPM	44.76 PPM	G1	$\pm 0.5\%$ NIST Traceable	07/23/2019, 07/30/2019
NITRIC OXIDE	45.00 PPM	44.76 PPM	G1	$\pm 0.5\%$ 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				

CALIBRATION STANDARDS					
Type	Lot ID	Cylinder No	Concentration	Uncertainty	Expiration Date
NTRM	18060121	KAL004215	249.9 PPM NITRIC OXIDE/NITROGEN	$\pm 0.4\%$	Nov 08, 2023
NTRM	052411	KAL004307	50.03 PPM NITRIC OXIDE/NITROGEN	$\pm 0.80\%$	Mar 12, 2024
NTRM	18060121	KAL004215	250.0 PPM NO <sub>2</sub> /NITROGEN	$\pm 0.4\%$	Nov 08, 2023
NTRM	052411	KAL004307-NOX	50.03 PPM NO <sub>2</sub> /NITROGEN	$\pm 0.80\%$	Mar 12, 2024
NTRM	0141709	KAL003160	49.87 PPM SULFUR DIOXIDE/NITROGEN	$\pm 1.0\%$	Jun 20, 2022
NTRM	072508	KAL004570	870.0 PPM CARBON MONOXIDE/NITROGEN	$\pm 0.4\%$	May 14, 2021

ANALYTICAL EQUIPMENT		
Instrument/Make/Model	Analytical Principle	Last Multipoint Calibration
CO MKS FTIR 000928062	FTIR	Jul 15, 2019
NO MKS FTIR 000928062	FTIR	Jul 22, 2019
NO MKS FTIR 000928062	FTIR	Jul 22, 2019
SO <sub>2</sub> MKS FTIR 000928062	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



### MULTI-POINT GAS TEST REPORT

Test Date : June 9, 2021

Equipment : Hydrocarbon Analyzer Model : APHA-370  
Manufacturer : HORIBA Serial Number : KWWV1R96

#### Standard Gas Concentration

Sulphur Dioxide (SO<sub>2</sub>) - PPM Manufacturer :  
Nitric Oxide (NO) - PPM Model :  
Methane (CH<sub>4</sub>) 39.8 PPM Serial Number :  
Carbon Monoxide (CO) - PPM  
Cylinder No. : D624432  
Expiration Date : Aug 4, 2028

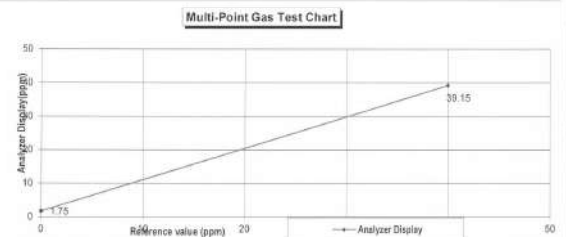
#### Dilutor Detail

Manufacturer :  
Model :  
Serial Number :

#### Multi-point gas test data

Reference Value (ppm)	Analyzer Display (ppm)	Difference Error	Percent Error	[% Error]
Level 1 Zero	0.00	1.75	1.75	1.75
Level 2 80.00%	40.00	39.15	-0.85	-2.17

Remark : Measuring Range 50.00 ppm  
Acceptable Limit  $\pm 5\%$   
Average Difference (%) 1.96



Calculate by

Srichai y.  
10 June 2021

Approve by

10 June 2021

Certificate Of Analysis  
Special Gases Mixture

Customer Details  
Name: United Analyst & Engineering Co., Ltd.  
Address: 350 Udomsuk 41, Sukhumvit Rd., Bang Chak, Khwaeng Phra Khanong, Bangkok 10260  
Customer Tag No.:

Certificate Details  
Number: 3384/20  
Date of Issue: 4-Aug-2020  
Expiry date: 4-Aug-2028  
Material Details: 90161442  
Material Code: 400400-AI-34  
Cylinder No.: 0824432  
Production Order: 6.60 M<sup>3</sup>  
Filling pressure: 137.0 bar  
Valve: CGA 590 BRASS  
Gas content: LINDE  
Cylinder Material: Aluminum  
Cylinder Size: 50.1

Laboratory Report  
Component: Methane in Air  
Normal Concentration: 40.0 ppm  
Analysis Result<sup>1</sup>: 39.8 ppm  
Uncertainty<sup>2</sup>: ± 1% relative  
Method of Analysis<sup>3</sup>: (6) I-PB-352  
Assay Date: 4-Aug-2020

Reference Standard used in Assay  
Reference Standard: Methane in Nitrogen  
Cylinder number: 25599596  
Concentration: 40.29 ± 0.39 ppm  
Expiry date: 01-01-2020

Analytical Instruments used in Assay  
Instrument/Make/Model: FTIR Spectrometers Nicolet 650  
Analytical Principle: FTIR-CH4  
Last Multipoint Calibration: 4-Aug-2020

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

Comments  
When rendering, please quote the material number.

Note:  
1. All results reported in this report are on analysis basis, unless otherwise specified. The Assay of this material has been performed in accordance with the EPA Testability Protocol EPA 400/9-12/2017 for the Assay and Certification of Gaseous Calibration Standards using gravimetric or volumetric methods. The reported expanded uncertainty is based on a standard uncertainty multiplied by a coverage factor k=2, providing a level of confidence of approximately 95%. The measurement of this material is traceable to the SI through the reference gas standard which is traceable to the National Standard of the US or other recognized national metrology institutes.  
2. The measurement of this material is traceable to the SI through the reference gas standard which is traceable to the National Standard of the US or other recognized national metrology institutes.  
3. (1) Gas Chromatography, (2) Gravimetric Oxygen Analysis, (3) Electrochemical Oxygen Analyzer, (4) Electrochemical Moisture Analyzer, (5) Total Hydrocarbon Analyzer, (6) Other (specified)

Page 1 of 1  
This report shall not be reproduced except in full.  
Sukanya Panyasorn  
Signature for and on behalf of Linde (Thailand) Co., Ltd.  
Linde (Thailand) Public Company Limited (มหาชน)  
197 New Bangkok Tower A, 215 New 14, Bangkok 10110, 10110, Bangkok  
Tel: (662) 235-4100 Fax: (662) 235-4101  
E-mail: info@linde.co.th  
Website: www.linde.co.th

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 : 5 April, 2021  
Certification No. : 185/21  
Page : 1 of 2

Object : Wind speed and wind direction  
Manufacturer : LSI  
Type : Data Logger E-LOG 305 wind speed and wind direction DNA 821  
Serial No. : Data Logger 20070023 wind speed and wind direction 20040188  
ID No. : No.17  
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 1013.0 hPa

NATIONAL STANDARD WIND TUNNEL :  
Thermal Anemometer 642 S/N 91563  
HOOK GAGE NO 1425 Pitot Tube Theodor Friedrichs Type 0800.0000 serial 9023  
N.I.S.T. Test Reference Number 731/241460  
Ultrasonic Anemometer Model DA-650-3TV (sensor TR-90AH)  
Serial Number 110730029 (sensor 120629566)

JAPAN QUALITY ASSURANCE ORGANIZATION  
Calibrated by : Watchapol Subwat  
Signed : Pissod Promsut  
Mechanical Engineer  
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. 185/21

5 April, 2021

Page : 2 of 3

Standard	HOOK GAGE NO. 1425			TESTED ANEMOMETER	
	Pressure	Vacuum	Pressure	Velocity	Correction
Ultrasonic Anemometer	m/sec	inches	inches	m/sec	m/sec
1.00	-	-	-	0.9	0.10
3.02	-	-	-	2.9	0.12
5.00	-	-	-	4.5	0.50
7.04	-	-	-	7.0	0.04
9.02	-	-	-	8.6	0.42
11.01	-	-	-	11.0	0.01
13.01	-	-	-	12.7	0.31
15.01	-	-	-	15.1	-0.09
17.02	-	-	-	16.6	0.42
20.02	-	-	-	20.0	0.02

Wind Aloft Plotting Board.	
U.S. DEPARTMENT OF COMMERCE WEATHER BUREAU	
WIND DIRECTION	TESTED WIND DIRECTION
0	0
90	90
180	180
270	270

Calibrated by : Watchapol Subwat  
Mechanical Engineer

Calibration & Test Section  
Meteorological Instruments Bureau  
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## 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
<b>Water</b>									
1	pH Meter	pH	Horiba	LAQUA-PH210 HA0D0082	Technology Promotion Association (Thailand-Japan)	21CH416	19 Mar 21	18 Mar 22	-
2	Conductivity Meter	Conductivity	YSI	Pro30 17B101802	Technology Promotion Association (Thailand-Japan)	21CH987	3 Aug 21	2 Aug 22	-





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



Cert.No.: 21CH416  
Page.: 1 of 3

## Certificate of Calibration

Equipment : pH Meter  
Manufacturer : Horiba  
Model : LAQUA-PH210  
Serial No. : HA0D0082  
ID No. : UAE.EFM.072/2564(EFM pH.05/64)  
Condition As-Received: New Item  
Received Date : 18 March 2021  
Calibration Date : 19 March 2021  
Reference : 2103-0840WSC-5  
Submitted by : United Analyst and Engineering Consultant Co., Ltd.  
3 Soi Udomsuk 41, Sukhumvit Road, Bangchak,  
Phrakhanong, Bangkok 10260  
Ambient Temperature : (25 ± 2.5) °C  
Relative Humidity : (50 ± 15) %  
Calibration Procedure : In-house method :  
- CP-CH5 by direct measurement with standard  
voltage calibrator and direct measurement with  
certified reference material (CRM)  
- CP-CH8 by comparison with standard thermometer

Calibrated by : Uthen Kankawi

Approved by :   
Approved Signatory

( / ) Malee Butkruea  
( ) Saithip Meangmai  
( ) Warakorn Lernagatrakul

Issue Date : 25 March 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

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### Condition of this calibration result

1. Reference Standard Instrument : -

Instrument	Serial No.	ID No.	Cert. No.	Due Date
1) Document Process Calibrator	46530031	130RC098	20E3666	14 Oct 2021
2) Ref. Standard Thermometer	2188080	130RC044	20I1389	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	706694	06 Sep 2022
pH 6.985	CPA chem	722285	19 Dec 2021
pH 10.012	CPA chem	722287	19 Dec 2021

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

### Calibration Results

Function : mV Measurement

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

Unit Under Calibration	Nominal Value	Standard Voltage Input	Actual Reading		Uncertainty of Measurement ( ±mV )	Coverage factor k
	pH	mV	mV	pH		
pH Meter S/N.: HA0D0082	4.00	177.48	177.4	4.01	0.058	2.00
	7.00	0.00	0.0	7.00	0.058	2.00
	7.00	0.00	0.0	7.00	0.058	2.00
	10.00	-177.48	-177.2	10.01	0.058	2.00

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Cert.No.: 21CH416  
Page.: 3 of 3

### Calibration Results

Function : pH Measurement

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

Unit Under Calibration	Standard pH Buffer Solution	Actual pH Reading	Actual mV Reading ( mV )	Uncertainty of pH measurement ( ± )	Coverage factor k
pH Electrode S/N.: 990F0193	4.008	4.01	175.6	0.0079	2.00
	6.985	6.99	3.5	0.011	2.00
	6.985	6.99	2.4	0.011	2.05
	10.012	10.01	-173.4	0.013	2.00

Function : Temperature Measurement

( \* ) Without adjustment

This equipment was connected with Temperature Probe;

- Model : 9652  
- Serial No. : 990F0193  
Dimension of probe;  
- Length : 90 mm.  
- Diameter : 16 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	25.006	25.0	-0.006	0.20	2.00
30.0	30.008	30.0	-0.008	0.20	2.00
35.0	35.003	35.0	-0.003	0.20	2.00

Remark : - UUC\* = Unit Under Calibration

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

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



Cert.No.: 21CH987  
Page.: 1 of 3

## Certificate of Calibration

Equipment : Conductivity Meter  
Manufacturer : YSI  
Model : Pro 30  
Serial No. : 17B101802  
ID No. : UAE.EFM.122/2560(ENV.SCT.02/60)  
Condition As-Received: Used Item  
Received Date : 27 July 2021  
Calibration Date : 03 August 2021  
Reference : 2107-0697WSC-1  
Submitted by : United Analyst and Engineering Consultant Co., Ltd.  
3 Soi Udomsuk 41, Sukhumvit Road, Bangchak,  
Phrakhanong, Bangkok 10260  
Ambient Temperature : (25 ± 2.5) °C  
Relative Humidity : (50 ± 15) %  
Calibration Procedure : In-house method :  
- CP-CH6 by direct measurement  
with certified reference material (CRM)  
- CP-CH8 by comparison with standard thermometer

Calibrated by : Warakorn Lernagatrakul

Approved by :   
Approved Signatory

( ) Malee Butkruea  
( / ) Saithip Meangmai  
( ) Warakorn Lernagatrakul

Issue Date : 10 August 2021

The Uncertainties are for a confidence probability of approximately 95%

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Cert.No.: 21CH987

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	2011119	15 Sep 2021
2) Ref. Std. Thermometer	4982054	110RC044	2011233	15 Oct 2021

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

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

## 2. Certified Reference Materials :-

- 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 $\mu\text{S/cm}$	CPA chem	754036	28 June 2022
12.8806 $\text{mS/cm}$	CPA chem	725924	12 Jan 2022

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

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

**Calibration results**

Function : Conductivity Measurement

(\*) After Adjustment at 1413.0  $\mu\text{S/cm}$ 

Conductivity Electrode Serial No.: 18L10008

Standard Conductivity Solution	Before Adjustment UUC* Reading	After Adjustment UUC* Reading	Uncertainty of Measurement ( $\pm$ )	Coverage factor k
1413.0 $\mu\text{S/cm}$	1125 $\mu\text{S/cm}$	1413 $\mu\text{S/cm}$	9.0 $\mu\text{S/cm}$	2.00
12.8806 $\text{mS/cm}$	10.02 $\text{mS/cm}$	12.45 $\text{mS/cm}$	0.082 $\text{mS/cm}$	2.00

Remark - UUC\* = Unit Under Calibration

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Cert.No.: 21CH987

Page.: 3 of 3

**Calibration Results**

Function : Temperature Measurement

(\*) Without adjustment

This equipment was connected with Temperature Probe;

- Model : PRO30 COND-T

- Serial No. 18L100008

Dimension of probe;

- Length : 8 mm.

- Diameter : 2 mm.

- Immersion Depth : 90 mm.

Calibration Point ( $^{\circ}\text{C}$ )	Standard Temperature ( $^{\circ}\text{C}$ )	UUC* Reading ( $^{\circ}\text{C}$ )	Error ( $^{\circ}\text{C}$ )	Uncertainty of Measurement ( $\pm$ $^{\circ}\text{C}$ )	Coverage factor k
25.0	25.002	24.8	-0.202	0.20	2.00
30.0	30.005	29.8	-0.205	0.20	2.00
35.0	35.006	34.8	-0.206	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

ใบรับรองสอบเทียบเครื่องมือประจำห้องปฏิบัติการ สำหรับตรวจวัดคุณภาพสิ่งแวดล้อม

No.	Instrument/Equipment	Parameter	Manufacturer	Model/Serial No.	Calibrator	Certification No.	Date of Calibration	Due date of Calibration*	Remark
เครื่องมือประจำห้องปฏิบัติการวิเคราะห์ สำหรับวิเคราะห์คุณภาพอากาศในบรรยากาศโดยทั่วไป									
1	Analytical Balance (Readability 0.1 mg)	ฝุ่นละอองรวม (TSP) ฝุ่นละอองขนาดไม่เกิน 10 ไมครอน	Mettler-Toledo	AB204-S / 1128312528	National Food Institute, Ministry of Industry, Thailand	2200704-001-01	24 Nov 21	23 Nov 22	-
2	Analytical Balance (Readability 0.1 mg)	(PM-10)	Mettler-Toledo	AB204-S/FACT / B108115858	National Food Institute, Ministry of Industry, Thailand	2102572-001-01	26 Apr 21	25 Apr 22	-
เครื่องมือประจำห้องปฏิบัติการวิเคราะห์ สำหรับวิเคราะห์คุณภาพน้ำ									
3	Gas Chromatography - Mass Spectrometer (GC-MS)	สารกลุ่ม BTEX เบนซีน (Benzene), โทลูอิน (Toluene), เอทิลเบนซีน (Ethylbenzene), ไซลีนทั้งหมด (Total Xylene)	Bruker Scion	451-GC / BR1201M099 Scion-SQ / GQS1203F021 CP8400 / BR1203M331	World Tech Enterprise Co.,Ltd.	Certificate of Calibration  PM/OQ	6 Jan 21	5 Jan 22	-
4	Inductively Coupled Plasma- Optical Emission (ICP-OES)	กลุ่มโลหะหนัก : ตะกั่ว (Pb), นิกเกิล (Ni), แบเรียม (Ba), ปรอททั้งหมด (Total Hg), ซีลีเนียม (Se),	Agilent Technologies	System ID:G8015A G8015AA / MY18030001	Agilent Technologies (Thailand) Co.,Ltd.	Preventive Maintenance Checklist	9 Dec 21	8 Dec 22	-
5	Atomic Absorption Spectrometer (AAS)	ทองแดง (Cu),แมงกานีส (Mn),สังกะสี (Zn), เหล็ก (Fe), สารหนู (As), แคดเมียม (Cd), โครเมียมทั้งหมด (Total Cr)	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	-
6	Conductivity Meter	การนำไฟฟ้า(EC) ความเค็ม (Salinity)	SI Analytics	Lab955 / 16300356	SPC Calibration Center Co.,Ltd.	C24210091	29 Mar 21	28 Mar 22	-
7	pH Meter	ค่าความเป็นกรด-ด่าง (pH) อุณหภูมิ (Temperature)	Mettler-Toledo	Seven Easy S20 / 1231155210	National Food Institute, Ministry of Industry, Thailand	2103189-002-01	14 Jun 21	13 Jun 22	-
8	pH Meter		Hanna Instrument	HI2211 / 8165345	National Food Institute, Ministry of Industry, Thailand	2102015-001-01	17 Mar 21	16 Mar 22	-

ใบรับรองสอบเทียบเครื่องมือประจำห้องปฏิบัติการ สำหรับตรวจวัดคุณภาพสิ่งแวดล้อม

No.	Instrument/Equipment	Parameter	Manufacturer	Model/Serial No.	Calibrator	Certification No.	Date of Calibration	Due date of Calibration*	Remark
เครื่องมือประจำห้องปฏิบัติการวิเคราะห์ สำหรับวิเคราะห์คุณภาพน้ำผิวดิน และน้ำใต้ดิน									
9	Analytical Balance (Readability 0.1 mg)	ปิโตรเลียมไฮโดรคาร์บอนทั้งหมด (TPH), น้ำมันและไขมัน (Oil & Grease)	Mettler-Toledo	AB-204S/FACT / 1129361010	National Food Institute, Ministry of Industry, Thailand	2103270-001-01	11 Jun 21	10 Jun 22	-
10	Analytical Balance (Readability 0.01 mg)	ของแข็งแขวนลอย (Total Suspended Solids : TSS)	Mettler-Toledo	AX105DR / 1122100406	National Food Institute, Ministry of Industry, Thailand	2200708-001-01	24 Nov 21	23 Nov 22	-
11	Hot Air Oven	ของแข็งละลายน้ำทั้งหมด (Total Dissolved Solids : TDS)	Memmert	UF55 / B216.1666	Technology Promotion Association (Thailand-Japan)	21TM1876	29 Oct 21	28 Oct 22	-
12	Incubator	แบคทีเรียกลุ่มฟิคอลโคลิฟอร์ม (Fecal Coliform Bacteria)	Memmert	IPP 260 / V615.0187	Technology Promotion Association (Thailand-Japan)	21TM706	21 Apr 21	20 Apr 22	-
13	Incubator		Memmert	IPP 260 / V616.0066	Technology Promotion Association (Thailand-Japan)	21TM1874	28 Oct 21	27 Oct 22	-
14	Water Bath		Memmert	WNE 14 / L416.0606	Technology Promotion Association (Thailand-Japan)	21TM422	22 Feb 21	21 Feb 22	-
15	Water Bath		Memmert	WNE 14 / L416.0612	Technology Promotion Association (Thailand-Japan)	21TM423	23 Feb 21	22 Feb 22	-
16	Analytical Balance		Mettler-Toledo	MS603S / B0070110311	National Food Institute, Ministry of Industry, Thailand	2200705-001-01	24 Nov 21	23 Nov 22	-
17	Auto Clave		ALP	CL-40L / 802664	Technology Promotion Association (Thailand-Japan)	21TM425	23 Feb 21	22 Feb 22	-

Due Date of Calibration\* : กำหนดตามแผนการสอบเทียบประจำปี อย่างน้อยปีละ 1 ครั้ง

## Calibration Certificate

**Certificate No.:** 2102572-001-01  
**Client name:** UNITED ANALYST AND ENGINEERING CONSULTANT CO., LTD.  
**Address:** 3 Soi Udomsuk 41, Sukhumvit Road,  
Bangchack, Prakanong, Bangkok 10260

Page 1 of 5

**Equipment:** Electronic Balance

**Manufacturer:** METTLER TOLEDO

**Model:** AB204-S/FACT

**Serial No.:** B108115858

**ID No.:** UAE.AIR.016/2555


**Order No.:** 2102572

**Operation No.:** 2102572-001

**Date of Receipt:** 26 April 2021

**Date of Calibration:** 26 April 2021

**Calibrated by** Mr. Manas Somsak  
Expert

**Approved by**   
(Mr. Pheraphat Tuanjit)  
Manager, Division of Calibration Laboratory  
Responsible for the Technical Management Team

**Date of Issue:** 29 April 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 reproduced in any other than in full, except with the prior written approval of the National Food Institute.

F-CS-009 Revision: 00 Date: 14-12-61

เอกสารไม่ควบคุม

## Calibration Report

**Certificate No.:** 2102572-001-01  
**Equipment:** Electronic Balance  
**Model:** AB204-S/FACT  
**Serial No.:** B108115858  
**Capacity:** 220 g  
**Manufacturer:** METTLER TOLEDO  
**Resolution:** 0.0001 g  
**ID No.:** UAE.AIR.016/2555

Page 2 of 5

**Date of Calibration:** 26 April 2021  
**Environment Condition:** Ambient Temperature: 22.0 ± 0.2 °C Relative Humidity: 48 ± 2 %

**Place of Calibration:** Balance Room (306), UNITED ANALYST AND ENGINEERING CONSULTANT CO., LTD.

**Condition of Equipment:** Good Condition

**Condition of This Results of Calibration:**

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

2. Reference Standards:

Reference Standard	Model	Serial No.	Calibrated By	Certificate No.	Due Date
Standard Weight Class E2	1-500mg	15880	TCS	M20111955	28 November 2021
Standard Weight Class E2	1-500g	15862	TCS	M20111965	28 November 2021
Instrument	Model	Serial No.	Calibrated By	Certificate No.	Due Date
Thermo-Hygro Meter	PONPE 490	NFLBTH 004/18	Quality Reborn	QR21-0300	15 February 2022

3. This certification is traceable to SI UNIT

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

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

**Calibration Results:**




1. Repeatability of Reading:

Nominal Value (g)	Standard Deviation of Reading (g)
100	0.000030
200	0.000042

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
(g)	(g)	(g)
50.0001	50.0001	50.0001
50.0002	50.0002	50.0002
50.0002	50.0002	50.0001
(Maximum Difference)		
0.0001		

F-CS-012 Revision: 00 Date: 14-12-61

เอกสารไม่ควบคุม

## Calibration Report

**Certificate No.:** 2102572-001-01  
**Equipment:** Electronic Balance  
**Model:** AB204-S/FACT  
**Serial No.:** B108115858  
**Capacity:** 220 g  
**Manufacturer:** METTLER TOLEDO  
**Resolution:** 0.0001 g  
**ID No.:** UAE.AIR.016/2555

Page 3 of 5

**Date of Calibration:** 26 April 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	0.00000	0.0000	0.0000	0.000082	2.00
0.1	0.10000	0.1000	0.0000	0.000082	2.00
0.5	0.49999	0.5000	0.0000	0.000083	2.00
1	0.99999	1.0000	0.0000	0.000086	2.00
2	1.99999	2.0000	0.0000	0.000084	2.00
5	4.99998	5.0000	0.0000	0.000084	2.00
10	10.00003	10.0000	0.0000	0.00011	2.00
15	15.00001	15.0000	0.0000	0.00012	2.00
20	20.00004	20.0000	0.0000	0.00013	2.00
30	30.00005	30.0001	0.0000	0.00013	2.00
40	40.00000	40.0001	-0.0001	0.00014	2.00
50	49.99999	50.0002	-0.0002	0.00015	2.00
70	70.00003	70.0002	-0.0002	0.00019	2.00
100	99.99997	100.0003	-0.0003	0.00020	2.00
150	149.99997	150.0004	-0.0004	0.00027	2.00
200	199.99999	200.0005	-0.0005	0.00043	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-CS-012 Revision: 00 Date: 14-12-61

เอกสารไม่ควบคุม

## Calibration Report

**Certificate No.:** 2102572-001-01  
**Equipment:** Electronic Balance  
**Model:** AB204-S/FACT  
**Serial No.:** B108115858  
**Capacity:** 220 g  
**Manufacturer:** METTLER TOLEDO  
**Resolution:** 0.0001 g  
**ID No.:** UAE.AIR.016/2555

Page 4 of 5

**Date of Calibration:** 26 April 2021  
**Environment Condition:** Ambient Temperature: 22.0 ± 0.2 °C Relative Humidity: 48 ± 2 %

**Place of Calibration:** Balance Room (306), UNITED ANALYST AND ENGINEERING CONSULTANT CO., LTD.

**Condition of Equipment:** Good Condition

**Condition of This Results of Calibration:**

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

2. Reference Standards:

Reference Standard	Model	Serial No.	Calibrated By	Certificate No.	Due Date
Standard Weight Class E2	1-500mg	15880	TCS	M20111955	28 November 2021
Standard Weight Class E2	1-500g	15862	TCS	M20111965	28 November 2021
Instrument	Model	Serial No.	Calibrated By	Certificate No.	Due Date
Thermo-Hygro Meter	PONPE 490	NFLBTH 004/18	Quality Reborn	QR21-0300	15 February 2022

3. This certification is traceable to SI UNIT

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

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

**Calibration Results:**

(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	2	3
(g)	(g)	(g)
5.0000	5.0002	5.0001
5.0001	5.0001	5.0001
5.0000	5.0000	5.0000
(Maximum Difference)		
0.0002		

F-CS-012 Revision: 00 Date: 14-12-61

เอกสารไม่ควบคุม



## Calibration Report

**Certificate No.:** 2102572-001-01  
**Equipment:** Electronic Balance  
**Model:** AB204-S/FACT  
**Serial No.:** 8108115858  
**Capacity:** 220 g  
**Manufacturer:** METTLER TOLEDO  
**Resolution:** 0.0001 g  
**ID No.:** UAE.AIR.016/2555

**Date of Calibration:** 25 April 2021 **Page 5 of 5**

**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	0.0000	0.0000	0.0000	0.000082	2.00
0.01	0.01000	0.01000	0.00000	0.000082	2.00
0.05	0.05000	0.05000	0.00000	0.000082	2.00
0.1	0.10000	0.10000	0.00000	0.000082	2.00
0.5	0.49999	0.50000	0.00001	0.000083	2.00
1	0.99999	1.00000	0.00001	0.000086	2.00
2	1.99999	2.00000	0.00001	0.000084	2.00
3	2.99998	3.00000	0.00002	0.000087	2.00
4	3.99999	4.00000	0.00001	0.000085	2.00
5	4.99998	5.00000	0.00002	0.000084	2.00
10	10.00003	10.00000	0.00003	0.00011	2.00
15	15.00001	15.00000	0.00001	0.00012	2.00
20	20.00004	20.00000	0.00004	0.00013	2.00

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

----- End -----

เอกสารไม่ควบคุม

F-CS-012 Revision: 00 Date: 14-12-61

## Calibration Certificate

**Certificate No.:** 2200704-001-01  
**Client name:** UNITED ANALYST AND ENGINEERING CONSULTANT CO.,LTD.  
**Address:** 3 Soi Udomsuk 41, Sukhumvit Road, Bangchack, Prakhonong, Bangkok 10260

**Page 1 of 5**

**Equipment:** Electronic Balance

**Manufacturer:** Mettler Toledo

**Model:** AB204-S

**Serial No.:** 1128312528

**ID No.:** UAE.AIR.019/2550


**Order No.:** 2200704

**Operation No.:** 2200704-001

**Date of Receipt:** 24 November 2021

**Date of Calibration:** 24 November 2021

**Calibrated by** Mr.Worapob Sooktong  
Scientist

**Approved by**   
(Mr. Phraphat Tuanjit)  
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 reproduced other than in full except with the prior written approval of the National Food Institute.

เอกสารไม่ควบคุม

F-CS-009 Revision: 00 Date: 14-12-61

## Calibration Report

**Certificate No.:** 2200704-001-01  
**Equipment:** Electronic Balance  
**Model:** AB204-S  
**Serial No.:** 1128312528  
**Capacity:** 200 g  
**Manufacturer:** Mettler Toledo  
**Resolution:** 0.0001 g  
**ID No.:** UAE.AIR.019/2550

**Date of Calibration:** 24 November 2021 **Page 2 of 5**

**Environment Condition:** Ambient Temperature: 21.5 ± 0.5 °C Relative Humidity: 43 ± 2.5 %

**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 N-MA-001 In-house Method based on UKAS Lab 14 : 2019

2. Reference Standards:

Reference Standard	Model	Serial No.	Calibrated By	Certificate No.	Due Date
Standard Weight Class E2	1-500mg	8308068554	TCS	M21019975	12 January 2022
Standard Weight Class E2	1-500g	8308068128	TCS	M21019985	13 January 2022
Instrument	Model	Serial No.	Calibrated By	Certificate No.	Due Date
Thermo Hygro Meter	11A1	888.44.8TH 003/35	Quality Reborn	QR21-0297	15 February 2022

3. This certification is traceable to SI UNIT

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

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

**Calibration Results:**

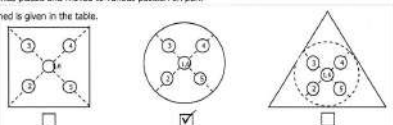
**1. Repeatability of Reading:**

Nominal Value (g)	Standard Deviation of Reading (g)
10	0.00000
20	0.00000

**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)
49.9999	49.9999	49.9999	49.9999	49.9999	49.9999	0.0000

เอกสารไม่ควบคุม

F-CS-012 Revision: 00 Date: 14-12-61

## Calibration Report

**Certificate No.:** 2200704-001-01  
**Equipment:** Electronic Balance  
**Model:** AB204-S  
**Serial No.:** 1128312528  
**Capacity:** 200 g  
**Manufacturer:** Mettler Toledo  
**Resolution:** 0.0001 g  
**ID No.:** UAE.AIR.019/2550

**Date of Calibration:** 24 November 2021 **Page 3 of 5**

**Calibration Results:** (Continued)

**Calibration Range:** 0-20 g

**Calibration Adjustment:** Internal Calibration

**3. Departure from Nominal Value:** (Test Weight by filter pan)

Nominal Value (g)	Standard Value (g)	Average Reading (g)	Correction (g)	Uncertainty (= g)	Coverage Factor k
Unloaded	0.00000	0.00000	0.00000	0.000082	2.00
0.01	0.01000	0.01000	0.00000	0.000082	2.00
0.05	0.05000	0.05000	0.00000	0.000082	2.00
0.1	0.10000	0.10000	0.00000	0.000082	2.00
0.5	0.50000	0.50000	0.00000	0.000083	2.00
1	1.00001	1.00000	0.00001	0.000083	2.00
2	2.00001	2.00000	0.00001	0.000083	2.00
3	3.00001	3.00000	0.00001	0.000084	2.00
4	4.00001	4.00000	0.00001	0.000085	2.00
5	5.00000	4.99999	0.00001	0.000084	2.00
10	9.99998	9.99999	0.00001	0.000087	2.00
15	14.99998	14.99999	0.00001	0.000089	2.00
20	19.99992	19.99999	0.00001	0.000089	2.00

เอกสารไม่ควบคุม

F-CS-012 Revision: 00 Date: 14-12-61

## Calibration Report

**Certificate No.:** 2200704-001-01  
**Equipment:** Electronic Balance  
**Model:** AB204-S  
**Serial No.:** 1126312528  
**Capacity:** 200 g  
**Manufacturer:** Mettler Toledo  
**Resolution:** 0.0001 g  
**ID No.:** UAE.AIR.019/2550

**Date of Calibration:** 24 November 2021 **Page 4 of 5**

**Environment Condition:** Ambient Temperature: 21.5 ± 0.5 °C Relative Humidity: 43 ± 2.5 %

**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 W-MA-001 In-House Method based on UKAS Lab 14 : 2019

2. Reference Standards:

Reference Standard	Model	Serial No.	Calibrated By	Certificate No.	Due Date
Standard Weight Class E2	1-500mg	830806554	TCS	M21010575	12 January 2022
Standard Weight Class E2	1-500g	8308066128	TCS	M21010885	13 January 2022
Instrument	Model	Serial No.	Calibrated By	Certificate No.	Due Date
Thermo-Hygro Meter	11A1	asv.jkl.8TH.003/55	Quality Reborn	QR21-0297	15 February 2022

3. This certification is traceable to SI UNIT

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

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

**Calibration Results:**

1. Repeatability of Reading:

Nominal Value (g)	Standard Deviation of Reading (g)
100	0.00000
200	0.00000

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.

loading obtained is given in the table.

☐

☒

☐

1	2	3	4	5	6	(Maximum Difference)
(g)	(g)	(g)	(g)	(g)	(g)	(g)
49.9999	49.9999	49.9999	49.9999	49.9999	49.9999	0.0000

F-CS-012 Revision: 00 Date: 14-12-61

เอกสารไม่ควบคุม

## Calibration Report

**Certificate No.:** 2200704-001-01  
**Equipment:** Electronic Balance  
**Model:** AB204-S  
**Serial No.:** 1126312528  
**Capacity:** 200 g  
**Manufacturer:** Mettler Toledo  
**Resolution:** 0.0001 g  
**ID No.:** UAE.AIR.019/2550

**Date of Calibration:** 24 November 2021 **Page 5 of 5**

**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
Unload	0.00000	0.0000	0.0000	0.000082	2.00
0.1	0.10000	0.1000	0.0000	0.000082	2.00
0.5	0.50000	0.5000	0.0000	0.000083	2.00
1	1.00001	1.0000	0.0000	0.000083	2.00
5	5.00000	4.9999	0.0001	0.000084	2.00
10	9.99998	9.9999	0.0001	0.000087	2.00
20	19.99999	19.9999	0.0001	0.000089	2.00
50	49.99990	49.9999	0.0000	0.000112	2.00
70	69.99988	69.9999	0.0000	0.000114	2.00
100	100.00000	99.9999	0.0001	0.000117	2.00
120	119.99999	119.9999	0.0001	0.000119	2.00
150	149.99990	149.9999	0.0000	0.000122	2.00
200	200.00009	199.9999	0.0002	0.000129	2.00

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

----- End -----

F-CS-012 Revision: 00 Date: 14-12-61

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## Certificate of calibration OQ For Bruker Scion 451 SQ

**Product ID :** Scion 451-SQ with CP8400

**Model Number :** 451-GC S/N : BR1201M099  
 Scion-SQ S/N : GQS1203F021  
 CP8400 S/N : BR1203M331

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

**Address :** 3 Soi Udomsuk41, Sukumvit Rd ,Bangchak  
 Prakanong , Bangkok , Thailand 10260

**Date of Qualified :** January 6 , 2021  
**Next Due date :** January 6 , 2022

This certifies for products which was performed in acceptable criteria specifications.

PM perform and Diagnostic test PASSED  
 Tune Test EI PASSED  
 Air Water Check Test PASSED  
 Signal to Noise Test (EI) SCAN PASSED  
 Injection EI Precision Test PASSED  
 User Demonstration PASSED

Provided by :

World Tech Enterprise Co.,Ltd.  
 1168/72 Lumpini Tower, 25/F  
 Rama IV Road , Kwaeng Thungmahamek,  
 Khet Sathon, Bangkok , Thailand  
 10120

Certified by   
 Chitchayut Lertawasadrakul

Certified Customer Service Engineer

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SCION™

## Operational Qualification Protocol

For Bruker SCION

Instrument Name and Model: Scion 451 SQ with CP8400

Serial Number: BR1201M099, GQS1203F021, BR1203M331

System ID Number:

Publication no. 394207000

Revision A

November 2011



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## Contact

Bruker Customer Service and Support uses a Customer Relationship Management (CRM) system. The interaction with this system offers the Customer immediate benefits including the contact center or help desk.

Bruker worldwide service & support offices can be found from Bruker website:



[www.bruker.com/support.html](http://www.bruker.com/support.html)

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## 1.0 Revision History

This qualification protocol is updated as necessary, which includes the event of any regulatory changes to Title 21 of the Code of Federal Regulations (21 CFR) Parts 210 and 211 (if applicable), any software or hardware changes, or updates that may impact on regulatory compliance.

Issue Number	Date	Comments



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## 2.0 Qualification Representative and Reviewer Details

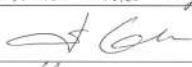
### 2.1 Qualification Representative Details

Each person responsible for executing any part of this Protocol must complete the table below, providing a sample of their signature and initials, and recording the date the Qualification was performed.

Qualification representatives are nominated to execute and verify the completeness of the test protocol and correctness of all entries.

All testing must be performed in accordance with procedures outlined in this manual. The representative must be trained and qualified to perform the procedures outlined in this document.

A copy of their appropriate qualifications is to be inserted into "Qualification Representative Details" on page 30.

Name (Print)	Chitchayut Lertkongsadatsakul
Title	Customer Service Engineer
Signature	
Initials	CL
Date	6 Jan 2021

Name (Print)	
Title	
Signature	
Initials	
Date	



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### 2.2 Reviewer Details

Each representative responsible for reviewing any part of this protocol must record their details in the following tables, providing a sample of their signature and initials, and recording the date the qualification was performed.

An employee or designee of the company operating the instrument must review these qualification procedures. All calculations and data will be checked by the reviewer. Data review must be performed in accordance with the qualification guidelines "Qualification Guidelines and GMP Documentation" on page 10 and in compliance with current Good Manufacturing Practice (cGMP) as specified by 21 CFR Parts 210 and 211.

Documentation supporting training in the area of data review and cGMP must be carefully maintained and reviewed by the instrument owner.

Reviewer representatives are responsible for reviewing the completeness of the qualification protocol and accuracy of all entries.

Name (Print)	
Title	
Signature	
Initials	
Date	

Name (Print)	
Title	
Signature	
Initials	
Date	



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### 2.3 Quality Assurance/Control Details

As Quality Assurance/Control (QA/QC), who is empowered to approve instrument compliance documents, I approve the procedures in the SCION Operational Qualification Protocol, which I may have amended, I accept the qualification of the Qualification Representative, and I will review and initial the results.

Name (Print)	
Title	
Signature	
Initials	
Date	

Name (Print)	
Title	
Signature	
Initials	
Date	



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### 3.0 Customer Responsibilities

The customer shall ensure that the Preventive Maintenance (PM) or Installation Qualification (IQ) up to point 9.11 is completed. A customer representative should be available at all times during the Operational Qualification Protocol.

**Note** The Operational Qualification Protocol test procedure should be performed after significant repairs, and at least once a year.

Qualification Rep. Initials	CL	Reviewer Initials		QA/QC Initials	
Date	6 Jan 2021	Date		Date	



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## 4.0 Qualification Guidelines and GMP Documentation

### 4.1 Qualification Summary

At the end of qualification execution, all tables and data entry fields must be completed and all test results, where specified, must be printed and attached to the protocol.

The Qualification Representative and the Reviewer must sign (signature or initials) and date each page that has a signature field. This represents agreement and acceptance of all data and information on the signed page.

**Note** Bruker does not provide instructions for full Qualification of the personal computer (PC) used to operate the SCION. If further qualification of the PC is required the end-user must contact the PC manufacturer.

**Note** Bruker does not provide full qualification instructions for non-Bruker manufactured accessories. Limited instructions may be supplied. If qualification of a non-Bruker accessory is required, the end user must contact the accessory manufacturer.

### 4.2 Qualification Guidelines

The following are general guidelines for performing the qualification tests in accordance with cGMP for the Manufacturing, Processing, Packaging, or Holding of Drugs per 21CFR Parts 210 and 211. Additional local requirements may also apply.

- Read the guidelines before starting the qualification.
- Perform all tests exactly as written.
- Use a pen with permanent blue or black ink unless otherwise specified by company policy.
- Neatly strike out any incorrect words or numbers, made while writing comments or recording results, information or data within this Protocol, with a single line. The word(s) crossed out must remain legible. Write the correction as close as possible to the original entry. Write a brief description of the error. For example, write 'Transcription error' or 'Re-written for clarity'. Initial and date the change.
- Entering initials where a signature is requested, and vice versa is permitted. The exception to this is in 2.0: Qualification Representative and Reviewer Details on page 6, where examples of each person's signature and initials are required.
- Use the date format dd Mon yyyy (e.g. 08 Mar 2011) unless otherwise specified by company policy.



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### 4.4 Exception Reports

An exception to the protocol occurs when the observed result differs from the acceptance criteria or expected result.

All exceptions to the protocol must be documented in the Exception Report. The Exception Report includes a detailed description of the exception and resolution by the Qualification Representative.

Each Exception Report shall be issued with a unique identification number in the form ERID-XX-X. This number is generated by the page number on which the exception occurred followed by a sequential number indicating each exception found on the page.

For example, if an exception occurs on page 34, the Exception Report shall be identified as 'ERID-34-1'. If another exception occurs on page 34, the second report shall be identified as 'ERID-34-2'. This identification number should be recorded in the 'Pass / Fail / N/A' field after each test.

Each Exception Report must be signed by the Qualification Representative and the Reviewer as evidence of approval.

The Exception Report is inserted in the appropriately named appendix and numbered as per Section 4.3 of this protocol.

Qualification Rep. Initials		Reviewer Initials	QA/QC Initials
Date	6 Jun 2021	Date	Date



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- Complete all tables and data fields to comply with this protocol. Blank fields are not permitted. For items that are not applicable, draw a line through the field, and write 'N/A' (Not Applicable). If entire tables or sections of tables are not applicable, strike a line either through the entire table or the specific area and enter 'N/A'. Complete the signature fields on the page.
- Write 'Pass', 'Fail' or 'N/A' as applicable to the test requirement or outcome.
- Ensure that results and/or specific documents are printed and attached to the specified appendix.
- The Qualification Representative and Reviewer must both sign (signature or initials) and date the signature fields on each page. This represents agreement and acceptance of all data and information on the page.

### 4.3 Page Numbering of Appendices

Each page that is inserted after the appendix is numbered with the letter of the appendix and a sequential number. The appendix page number must be initialed and dated by both the Qualification Representative and the Reviewer.

For example, pages inserted after Appendix C are numbered

C-1, C-2, C-3...etc, along with the initials and date.

If the reverse of each appendix page is left blank, it should be marked 'N/A' and signed and dated.

When the IQ is complete the total number of pages inserted after each appendix is written on the front page of the respective appendix sheet.

Qualification Rep. Initials		Reviewer Initials	QA/QC Initials
Date	6 Jun 2021	Date	Date



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### 4.5 Reference Documents

The following documents are relevant to this Qualification:

- Installation Qualification Protocol
- Completed service report from Preventative Maintenance (PM) schedule

Qualification Rep. Initials		Reviewer Initials	QA/QC Initials
Date	6 Jun 2021	Date	Date



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## 4.6 Required Materials

The following stock solutions are required:

- 100 fg/μL OFN 394204200
- 1 pg/μL OFN 393065201
- 100 pg/μL OFN 393110101
- 10 pg/μL BZP 93065301
- 100 pg/μL BZP 394206200

The above solutions will be used to prepare the following working solutions which will be required to execute this OQ:

**Note** Refer to Appendix 1 for the preparation of the standard solutions.

Qualification Rep. Initials	U	Reviewer Initials	QA/QC Initials
Date	6 Jun 2021	Date	Date



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## 4.7 General Guidelines

The following are general cGMP guidelines.

- Perform each procedure exactly as written.
- Fill in each item on the form or mark it Not Applicable (N/A).
- If an item is marked N/A, initial it and date it.
- The Reviewer reviews and initials all entries recorded by the Qualification Representative.
- Keep all raw data. The Qualification Representative and the Reviewer will initial it, and date it.
- Do not destroy raw data.
- Attach raw data from an instrument, such as the SCION, as an Addendum using the instructions in the following Addendums section.
- If several instruments are qualified simultaneously, reference shared information, such as standard preparation and chemical information, to the document containing the original information by its model and instrument identification number.
- Label all reference standards as required by local regulations.
- Record the time each reference standard was opened.
- Use reference standards within 24 hours of preparation.

Qualification Rep. Initials	U	Reviewer Initials	QA/QC Initials
Date	6 Jun 2021	Date	Date

## 4.8 Specific Instructions for Documentation

The Reviewer designates specific documentation instructions as follows.

Permanent Ink Color	Blue
Preferred Date Format	date month year

If more instructions are required: Use an addendum sheet, write the addendum number, and a brief description.

Qualification Rep. Initials	U	Reviewer Initials	QA/QC Initials
Date	6 Jun 2021	Date	Date



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## 4.9 Documentation Corrections

**Note** All original entries must remain legible after corrections are made.

1. Draw a line through the incorrect information.
2. Write the correction as close as possible to the original entry, or enter a footnote.
3. Write a brief description of the error. For example, write "transcription error," "rewritten for clarity," or "correcting wrong entry".
4. Initial and date the change.

Qualification Rep. Initials	U	Reviewer Initials	QA/QC Initials
Date	6 Jun 2021	Date	Date

## 4.10 Marking Procedures Not Applicable

Some sections may not be relevant for the qualification. To indicate that a procedure or part of a form is unnecessary and that it was not forgotten or inadvertently overlooked:

1. Draw a line through the portion that is not applicable. Write the letters N/A (for not applicable), your initials, and the date near the diagonal line.
2. If a procedural step is unnecessary, select N/A if it is indicated, or write a comment in an Addendum. The Qualification Representative and the Reviewer enter their initials and the date near the line.

**Note** The Qualification Representative and Reviewer must sign and date all forms, even when part or all of the form is marked N/A.

Qualification Rep. Initials	U	Reviewer Initials	QA/QC Initials
Date	6 Jun 2021	Date	Date



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## 4.11 Addendums

The following are reasons to complete an addendum sheet:

- A deviation needs documentation.
- Additional information or data needs to be recorded.
- Insufficient space to include the correction on the sheet where the error was made.

Qualification Rep. Initials	U	Reviewer Initials	QA/QC Initials
Date	6 Jun 2021	Date	Date

## 4.12 Addendum Example

The following is an example of using an addendum sheet to document a deviation.

If some of the items on the sales order were not present, you could do the following:

1. Use an addendum sheet.
2. Write Instrument Delivery on the Procedure line.
3. Write the addendum page number followed by a letter. For example: page 12A, where 12 is the page and A represents the first addendum on that page.
4. Write the plan to obtain the missing items, which may be the following:
  - Bruker notified that Part Number XXXXX and XXXX are missing.
  - Bruker replied that the parts are in stock and will be sent overnight.
  - While waiting for the parts to arrive, I will continue to set up the instrument.
5. Review the plan with the Reviewer and make the necessary modifications.
6. Document the arrival of the parts and write that this addendum is resolved. Attach a copy of delivery documents and create addendum pages as required.

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## 5.0 Operational Qualification

This chapter contains the tests to be completed to perform an Operational Qualification for the SCION.

### 5.1 OQ Preparation

The following must be done before starting the OQ:

1. Preventative Maintenance must have been completed and signed off by the Qualification Representative, Reviewer, and QA/QC person, and attach a copy of the service report and add an addendum number.

Addendum 18A - 18T

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Date	6 Jan 2021	Date	Date

2. OQ must have been completed and signed off by the Qualification Representative, Reviewer, and QA/QC person.

Qualification Rep. Initials	U	Reviewer Initials	QA/QC Initials
Date	6 Jan 2021	Date	Date

3. The QA/QC person must review, approve, append (if necessary), and sign the Pre-execution Approval.

Qualification Rep. Initials	U	Reviewer Initials	QA/QC Initials
Date	6 Jan 2021	Date	Date



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4. The Qualification Representative and the Reviewer must sign and date the Pre-execution Approval.

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Date	6 Jan 2021	Date	Date



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## 5.2 System Description

### 5.2.1 SCION Description

Installation Date:	Principal Operator:	Phone Number:
<b>Company Information</b>		
Company: United Analyst and Engineering Limited		
Name:	Building:	
Address: 391 Udonrakon Sukhumvit Rd. Bangkok		
City, State:	City, State:	
Zip/Country:	Zip/Country:	
<b>System Description</b>		
SCION SQ	Serial Number:	6QS1203F021
Sales Order Number:	Sales Order Addendum Number:	
<b>GC</b>		
Module Type: GC-451	Serial Number:	BR1201M099
<b>AutoSampler</b>		
Module Type: CP-8400	Serial Number:	BR1203M331
<b>Bruker MS Workstation</b>		
Version: 8.2.1 RC33	Serial Number:	01106-b311-BB0-450C
<b>Computer Operating System</b>		
Operating System: Windows 7	Version: Professional	Serial No.: Service Pack: 1
<b>Computer</b>		
Make: Dell	Model: Optiplex 790	Serial No.: DNNYHS1
Hard Drive 1TB Size / RAM: 4GB		
Addendum Number(s):	18-C - 18-G	
Qualification Rep. Initials	Reviewer Initials	QA/QC Initials
Date	Date	Date



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## 5.3 Data Sheet Specifications

Run these tests after the instrument has pumped down and is leak free. Use the factory methods. Follow the Installation Procedure; complete this section and the appropriate line of the OQ Summary. Print out the methods and results and attach as addendums. Use the factory test column Br-5ms 15m X 250im X 0.25im.

Table 5-1 TQ Specification

Mode	Concentration	Scan Range	Result †	N/A	Pass	Fail	Addendum
EI Full Scan	1 pg OFN	50-300	S/N ≥500:1	✓			
EI MRM	100 fg OFN	272-222	S/N ≥5000:1	✓			
PCI Full Scan†	10 pg BZP	80-230	S/N ≥50:1	✓			
NCI Full Scan†	1 pg OFN	200-300	S/N ≥4000:1	✓			

† The Signal-to-Noise ratio S/N values are based on RMS noise figure.

‡ CI tests use methane gas as reagent gas.

For any tests that did not pass, complete an Addendum for each, write the Addendum number and a brief description.

Qualification Rep. Initials	U	Reviewer Initials	QA/QC Initials
Date	6 Jan 2021	Date	Date

Table 5-2 SQ Specification

Mode	Concentration	Scan Range	Result †	N/A	Pass	Fail	Addendum
EI Full Scan	1 pg OFN	50-300	S/N ≥600:1		✓		18A - 18I
PCI Full Scan†	100 pg BZP	80-230	S/N ≥600:1	✓			
NCI Full Scan†	200 fg OFN	200-300	S/N ≥1000:1	✓			

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## 5.4 EI Precision Test TQ

The following precision tests are for systems with autosamplers only. The test solution is 1 pg/μL OFN test mix part number 393065201.

The following is the required precision for 10 consecutive injections:

Injection	Retention Time	Peak Area
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		
% RSD		

As an alternative, a % RSD summary report from MSWS can be added as an addendum.

Addendum N/A

	N/A	Pass	Fail	Addendum
Observed Mass is between 271.6 m/z to 272.4 m/z, which is $\pm 0.4$ of the expected m/z.	✓			
Retention Time $\leq 1\%$ Relative Standard Deviation (RSD).	✓			
Peak Area $\leq 10\%$ Relative Standard Deviation (RSD).	✓			

To complete this section use the factory MRM method on the system CD. Print a copy of the method and add as an addendum.

Addendum N/A



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If the hardware is not the same as the factory method, then note this in the addendum and how the hardware available has been configured to compensate. The most common variation here is the sampler, where the Combi Pal has been used instead of the 8400. This will have no impact on results and can be tracked and recorded in the addendum.

## 5.5 EI Precision Test SQ

The following precision tests are for systems with autosamplers only. The test solution is 1 pg/μL OFN test mix part number 393065201.

The following is the required precision for 10 consecutive injections:

Injection	Retention Time	Peak Area
1	3.815	6201
2	3.816	5550
3	3.816	6208
4	3.817	5200
5	3.815	5539
6	3.818	5924
7	3.816	6071
8	3.817	4559
9	3.817	5414
10	3.817	5424
% RSD	0.0220%	9.1441%

As an alternative, a % RSD summary report from MSWS can be added as an addendum.

Addendum 23A-23AB

	N/A	Pass	Fail	Addendum
Observed Mass is between 271.6 m/z to 272.4 m/z, which is $\pm 0.4$ of the expected m/z.		✓		23A-23AB
Retention Time $\leq 1\%$ Relative Standard Deviation (RSD).		✓		23A-23AB
Peak Area $\leq 10\%$ Relative Standard Deviation (RSD).		✓		23A-23AB



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To complete this section use the factory Scan method on the system CD. Print a copy of the method and add as an addendum.

Addendum 23A-23AB

If the hardware is not the same as the factory method, then note this in the addendum and how the hardware available has been configured to compensate. The most common variation here is the sampler, where the Combi Pal has been used instead of the 8400. This will have no impact on results and can be tracked and recorded in the addendum.

Addendum N/A



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## 5.6 Final Evaluation

	N/A	Pass	Fail	Addendum
Is the equipment in normal operation condition?		✓		
Have all of the OQ requirements been completed?		✓		

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Date	<u>6 Jan 2021</u>	Date		Date	



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## 6.0 Protocol Approval

### 6.1 Protocol Acceptance / Approval by Customer

I agree that the procedures and information referenced in this document are applicable.

Instrument(s): Scion 451 SQ with CP8400

Serial Number(s): BR1201M049, QA51203F021, BR1203M331

Sales Order Number: \_\_\_\_\_

Company Name: United Analyte and Engineering Consultant Co., Ltd.

I agree that the Operational Qualification Protocol has been satisfactorily completed.	<input checked="" type="checkbox"/>
I confirm that the Operational Qualification Protocol has not been completed, because of these failed (non-passed) items	<input type="checkbox"/>

#### Authorized Customer Representative

Name (Print)	
Title	
Signature	
Initials	
Date	



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#### Bruker Certified Engineer

Name (Print)	<u>Chutawat Lertwongsatitkul</u>
Title	<u>Customer Service Engineer</u>
Signature	<u>[Signature]</u>
Initials	<u>CL</u>
Date	<u>16 Jan 2021</u>

### 6.4 Remarks




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## 6.2 Operational Qualification Protocol Assignment

This Operational Qualification Protocol document is used for:

Operational Qualification Protocol as final test at Bruker	<input type="checkbox"/>
Operational Qualification Protocol after Installation Qualification	<input type="checkbox"/>
Operational Qualification Protocol after Preventive Maintenance and OQ completion.	<input checked="" type="checkbox"/>

### 6.3 Protocol Acceptance / Protocol Approval by Bruker

I agree that the procedures and information referenced in this document are applicable.

Instrument(s): Scion 451 SQ with CP8400

Serial Number(s): BR1201M049, QA51203F021, BR1203M331

Sales Order Number: \_\_\_\_\_

Company Name: United Analyte and Engineering Consultant Co., Ltd.

3 soi Udomak 41, Sukhumvit Rd, Bangkok,  
Parkview, Bangkok Thailand 10260



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## Appendices

Each page that is inserted after the appendix is numbered with the letter of the appendix and a sequential number. The appendix page number must be initialed and dated by both the Qualification Representative and the Reviewer.

For example, pages inserted after Appendix C are numbered C-1, C-2, C-3...etc along with the initials and date.

If the reverse of each appendix page is left blank it should be marked NA and signed and dated.

When the OQ is complete the total number of pages inserted after each appendix is written on the front page of the respective appendix sheet.



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## A.1 Qualification Representative Details

The Qualification Representative is to insert a copy of their appropriate qualification(s) after this page.

No. of Pages Inserted	13
-----------------------	----

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Addendum Procedure: QA Preparation Page Number: 18

Qualification Rep. Initials	<u>le</u>	Reviewer Initials	QA/QC Initials
Date	<u>6 Jun 2021</u>	Date	Date



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## B.1 Exceptions

Each Exception Report shall be issued with a unique identification number in the form of ERID-XX-X. This number is generated by the page number on which the exception occurred followed by a sequential number indicating each exception found on the page.

For example, If an exception occurs on page 34, it shall be identified as Exception Report 'ERID-34-1'. If another exception occurs on page 34, the second exception shall be identified as 'ERID-34-2'. This identification number should be recorded in the pass/fail field after each test.

Insert Exception Reports (if any) after this page.

No. of Pages Inserted	N/A
-----------------------	-----

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Addendum Procedure: SA Specification Page Number: 21

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Date	<u>6 Jun 2021</u>	Date	Date



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Addendum Procedure: EI Precision Test SA Page Number: 23 Ex

Qualification Rep. Initials	<u>Cl</u>	Reviewer Initials		QA/QC Initials	
Date	<u>6 Jan 2021</u>	Date		Date	



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Addendum Procedure: EI Precision Test SA Page Number: 23

Qualification Rep. Initials	<u>Cl</u>	Reviewer Initials		QA/QC Initials	
Date	<u>6 Jan 2021</u>	Date		Date	



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## Operational Qualification Protocol Certification

for

SCION

with the serial number

BR1201M049, G651203F021, BR1203M331

has successfully completed all criteria for hardware Operational Qualification Protocol

as detailed in this document.

## Bruker Certified Engineer

Chitchayut Lertwongdetrakul [Signature] 6 Jan 2021  
Name (please print) Signature Date

## Authorized Customer Representative

\_\_\_\_\_  
Name / Function (please print) Signature Date

## Customer Address

United Analyst and Engineering Consultant Co., Ltd  
3 soi Udomsak 41, Sukhumvit Rd. Bangkok. Prakanay  
Bangkok Thailand 10260



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Agilent Technologies

Agilent 5110 and 5100 ICP-OES  
Preventive Maintenance Checklist

Agilent Preventive Maintenance provides factory recommended service for your analytical systems to assure reliable operation and the accuracy of your results. Delivered by highly-trained and certified service engineers using genuine Agilent parts and supplies, Agilent Preventive Maintenance provides everything you need to reduce unplanned downtime and keep your systems operating at their peak.

For more information about Agilent Technologies services please visit our web site using the following URL <http://www.agilent.com/en-us/services/analytical-instrument-services>

## Customer Information

- Customers should provide all necessary operating supplies upon request of the engineer.
- For customers using HF applications, the instrument should be returned to its standard sample introduction system.
- A customer representative should be available to the engineer while performing the preventive maintenance procedures.
- Any parts, not included in the Parts Lists section of this document, are not part of the recommended Preventive Maintenance service, nor are they included in the price of this service.
- If a system requires the use of additional or special procedures and/or parts for the instrument service, then these must be ordered separately and charged as a repair, which may incur additional

## Service Engineer's Responsibilities

- Only complete/printout pages that relate to the system being serviced.
- Complete empty fields with the relevant information.
- Complete the relevant checkboxes in the checklist using a "X" or tick mark "✓" in the checkbox.
- Complete Not Applicable check boxes to indicate services not delivered, as needed.
- Complete the PM service in the order of the tasks listed.
- Complete the Service Review section together with the customer.

เอกสารไม่ควบคุม

## Agilent 5110 and 5100 ICP-OES Preventive Maintenance Checklist

### System Information

Instrument system name and ID	ICP-OES 5110 VDV
Instrument system site and location	UAE Consultant
List system component product numbers	List the serial numbers of each component
1. 01015A	1. MY 190 5000 1
2.	2.
3.	3.
4.	4.
5.	5.
6.	6.
7.	7.
8.	8.
9.	9.
10.	10.

ICP-OES Configuration table	Circle the type or write in the type if other
Nebulizer Type	SeaSpray   OneNeb   other
Spray Chamber	Cyclonic Single Pass   Cyclonic Double Pass   other
Torch	Radial   Dual View   other
Injector Diameter	2.4mm   1.8mm   1.4mm   0.8mm   other
Injector Material	Quartz   Ceramic   other

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## Agilent 5110 and 5100 ICP-OES Preventive Maintenance Checklist

### General Preparation

- ☒ Discuss any specific questions or issues with the customer prior to starting.
- ☒ Review the instrument logbook.
- ☒ Perform general external inspection of system for cleanliness.
- ☒ Check for proper installation of safety-related parts, assemblies, sensors etc.
- ☒ Check for required firmware/software updates and verify with customers if they would like it installed.
- ☐ For HF application systems, if standard sample introduction system was not installed, ask the customer to install it. *N/A*
- ☒ Run Instrument Performance test and record results in Instrument Performance Test Results Table - Pre PM.

### Inspect and clean the system

- ☒ Look for any obvious external damage or problems.
- ☒ Inspect water cooling hoses, gas lines and power cord for excessive wear or damage.
- ☒ Perform a general internal inspection of the system for excessive dust accumulation, clean if necessary.
- ☒ Inspect sample introduction components and record any required maintenance in the Service Engineer Comments and notify the customer as the required actions required.
- ☒ Record the instrument operating conditions in the ICP-OES Status Results Table.
- ☒ Replace the polychromator purge filter.
- ☒ Replace the radial pre-optics window
- ☒ Replace the axial pre-optics window for SVDV and VDV instruments.
- ☒ Check exhaust flow for the correct positive extraction at the exhaust duct to insure they meet minimum specifications.
- ☒ Replace air inlet dust filter.
- ☐ Replace high capacity air inlet dust filter element if installed. *N/A*
- ☒ Remove and clean instrument water inlet filter.

### Agilent Water Recirculator

- ☐ Section NOT Applicable
- ☒ Drain cooling fluid and remove any particles from the chiller reservoir
- ☒ Remove, clean, and reinstall water inlet metal mesh filter if present.
- ☒ Re fill with Polyclear Plus cooling fluid.
- ☒ Clean the cooling system Air filter and the condenser.

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## Agilent 5110 and 5100 ICP-OES Preventive Maintenance Checklist

### SPS 3 Auto Sampler

- ☒ Section NOT Applicable
- ☐ Power cycle the autosampler and verify successful initialization.
- ☐ Inspect X and Z axis belts for wear. Replace is necessary.
- ☐ Clean X and Z axis slide shafts.
- ☐ Using customer's racks and the Agilent software move the sample probe to the 4 outermost corners and rinse port, ensure that the probe is approximately centered in the vial.

### SPS 4 Auto Sampler

- ☒ Section NOT Applicable
- ☐ Clean the spill tray, rack location mat, end frames and chassis with a damp soft cloth and diluted mild detergent.
- ☐ Clean the auto sampler cover panels, if cover kit is installed, with domestic window cleaner
- ☐ Check the X-axis and Z-axis drive belts for cracks, splits, damaged teeth, excessive fraying, color changes or degradation from fumes.
- ☐ Check the X-axis, Theta-axis and Z-axis FFC cables for cracks, incorrect positioning, damaged edges or damaged connectors.
- ☐ Pump Tubing Replacement. Replace peristaltic pump tubing. Replace all tubing that goes from the rinse station to the pump and from the pump to the waste/rinse bottles

### AVS 4, 6, 7

- ☒ Section NOT Applicable
- ☐ Replace valve rotor seal
- ☐ Check fittings for signs of leaks
- ☐ Check tubing including autosampler tubing for kinks or excessive wear
- ☐ Check high flow pump for signs of leaks

### Instrument Adjustment

- ☒ Check position of Zn peak, adjust if required.
- ☒ Check Argon Ratio, adjust to specified value if required.
- ☒ Perform Detector Calibration.
- ☒ Perform Instrument Calibration.
- ☒ Run Instrument Performance Test and record results in Instrument Performance Test Results Table - Post PM.
- ☒ For systems using ICP Expert version 7.3 and above run the following Instrument tests and record the result in the Instrument Test Results Table
  - ☒ Subsystem Communications Test
  - ☒ Air Flow

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## Agilent 5110 and 5100 ICP-OES Preventive Maintenance Checklist

- ☒ Water Flow
- ☒ Gas Flows
- ☒ RF Generator
- ☒ Camera Test
- ☒ Optics Test
- ☒ Nebulizer Test

### Instrument Performance Test Results Table

Note: These measurements do not form part of any specification and are for reference only.

	Pre PM Sensitivity Check		Post PM Sensitivity Check	
	Radial	Axial *	Radial	Axial*
Zn 213.857 nm SRBR	4.012.7	7.954.1	4.191.8	3.921.7
Mn 257.610 nm SRBR	11415.1	30.916.7	11991.6	34460.9
Al 396.152 nm SBR	7.7	15.7	8.7	13.5
K 766.491 nm SBR	9.3	31.9	9.7	44.4

\* Axial result is not applicable for G8016AA, G8012AA Radial View instruments.

### Instrument Test Results Table

Note: The Instrument Test results are for systems using ICP Expert version 7.3 and above only.

Instrument Test	Result
Subsystem Communications Test	Pass
Air Flow	Pass
Water Flow	Pass
Gas Flows	Pass
RF Generator	Pass
Camera Test	Pass
Optics Test	Pass
Nebulizer test	Pass

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**Agilent 5110 and 5100 ICP-OES  
Preventive Maintenance Checklist**
**ICP-OES Status Results Table**

Note: These measurements do not form part of any specification and are for reference only.

Measurement	Standby Mode	Plasma On
Mains Voltage	115.713 VAC	194.510 VAC
Mains Current	0.114 A	2.143 A
Instrument Temperature	23.4 °C	23.5 °C
RF Air Flow (sensor speed)	14.0 Hz	14.0 Hz
Plasma Exhaust Temperature	No measurement	65.0 °C
Water Flow Oscillator	No measurement	1.03 L/min
Water Flow Detector	0.00 L/min	1.37 L/min
Water Inlet Temperature	19.1 °C	19.1 °C
Polychromator Temperature	35.0 °C	35.0 °C
CCD Temperature	24.9 °C	-14.7 °C
Thermal Stabilizer	35.0 °C	35.0 °C
Argon Supply Pressure	614.15 kPa	614.51 kPa
Purge Gas Supply Pressure*1	141.34 kPa	65.17 kPa
Option Gas Supply Pressure*1	— kPa	— kPa
Nebulizer Flow	No measurement	0.90 L/min
Nebulizer Back Pressure	No measurement	162.45 kPa
Plasma Gas Flow	No measurement	15.00 L/min
Auxiliary Gas Flow	No measurement	1.70 L/min
RF Power	No measurement	1201.1 W
RF Supply Current	No measurement	8.133 A
RF Supply Voltage	No measurement	194.510 V

\*1 If option installed

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**Agilent 5110 and 5100 ICP-OES  
Preventive Maintenance Checklist**
**ICP-OES Parts List Table**

Part description	Part Number	Product /Model # where used	Quantity Consumed
Axial Pre-Optic Window	G8010-68014	G8010A, G8011A, G8014A/G8015A	1
Radial Pre-Optic Window	G8010-68015	All	1
Polyclear Plus Cooling Fluid	G3292-80012	Agilent Water Recirculator	—
Purge Gas Filter	G8010-60136	All	1
Air inlet filter	G8000-68002	All	1
High Capacity Air Filter	G8010-60189	Optional	—
Rotor seal for 6-7 port valve for AVS6/7	G8494-00002	G8494A/G8495	—
Rotor seal for 4 port valve for AVS4	G8493-00002	G8493A	—
Rinse solution to rinse station 2.5mm id x 1m	G8410-80123	SPS 4	—
Barb connector 2.5mm-1.5mm ID	G8410-80124	SPS 4	—
PVC waste tubing, 8mm od x 5mm id, 2m	G8410-80122	SPS 4	—
<b>Additional Parts may be required from engineers stock:</b>			
X axis drive belt	5410047500	SPS 3	—
Z axis drive belt	5410047400	SPS 3	—
Peristaltic pump tubing, PVC SolvaFlex, 3 bridged,	3710049000	SPS 4	—

**Restore system**

For IIF applications, ask the customer to reinstall their sample introduction system.

Leave system in an idle state: on and purging.

Guidance: If the PM service is performed prior to a qualification service, then use the qualification procedure as a guide for final instrument set up and checkout.

**Service Review**

- ☒ Affix the PM sticker to the system or instrument logbook based on the customer's request.
- ☒ Complete the Service Engineer Comments section below if there are additional comments.

Issued: 4 March 2021, Revision: A.01

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Pre PM

**Agilent 5110 and 5100 ICP-OES  
Preventive Maintenance Checklist**

- ☒ Review the service and any test results with the customer.
- ☒ If the Instrument firmware was updated, record the details of the change in the Service Engineer's Comments box below or if necessary, in the customer's IQ records.

**Service Engineer Comments (optional)**

If there are any specific points you wish to note as part of performing the installation or other items of interest for the customer, please write in this box.

**Other Important Customer Web Links**

How to get information on your product:

- ☐ Literature Library - <http://www.agilent.com/en-us/products/icp-oes/icp-oes-systems/5110-icp-oes#literature>
- ☐ Need to know more? - <http://www.agilent.com/crosslab/university/>
- ☐ Need technical support, FAQs? - <http://www.agilent.com/en-us/support/landing/icp-oes>
- ☐ Need supplies? - [www.agilent.com/chem/supplies](http://www.agilent.com/chem/supplies)

**Service Completion**

Service request number 6004337217 Date service completed 09/12/21

Agilent signature Nukoon L. Customer signature Aphorn Onkang

Document part number: G8014-90075

Issued: 4 March 2021, Revision: A.01

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Agilent Technologies

เอกสารไม่ควบคุม

**Report Summary**

Instrument Model	Agilent 5100/5110 VDV ICP-OES
Instrument ID	G8011A/G8015A
Instrument Serial Number	MY18030001
Software Version	7.3.1.9507
Firmware Version	3442
Tested By	Nukoon L.
Test Completed On	12/9/2021 9:14:59 AM

**Result Summary**

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

เอกสารไม่ควบคุม

Resolution Test			Pass
Element Wavelength	Specification	Width	
N (174.213 nm)	≤ 9.40	7.27	
As (188.980 nm)	≤ 8.20	6.23	
C (193.027 nm)	≤ 11.50	8.26	
Mo (202.032 nm)	≤ 8.20	6.42	
Cr (206.158 nm)	≤ 13.40	9.27	
Zn (213.857 nm)	≤ 8.70	6.77	
Pb (220.353 nm)	≤ 9.50	7.12	
Co (228.615 nm)	≤ 17.20	11.88	
Ba (230.424 nm)	≤ 9.40	7.36	
Mn (257.610 nm)	≤ 13.30	9.52	
Mn (260.568 nm)	≤ 20.30	14.30	
Cr (267.716 nm)	≤ 11.00	7.99	
Cu (324.754 nm)	≤ 25.00	19.08	
Cu (327.395 nm)	≤ 14.20	11.32	
Sr (338.071 nm)	≤ 33.50	24.39	
Ba (455.403 nm)	≤ 44.00	33.86	
Sr (460.733 nm)	≤ 36.00	17.38	
Ba (493.408 nm)	≤ 36.00	25.53	
Ba (614.171 nm)	≤ 42.00	24.99	
Ar (675.283 nm)	≤ 74.00	59.49	
K (766.491 nm)	≤ 80.00	65.27	

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เอกสารไม่ควบคุม

Sensitivity Test						Pass
Radial						
Element Wavelength	Specification	Method	Ratio	Standard	Blank	
As (188.980 nm)	≥ 46.0	SRBR	167.2	1131.3	42.4	
Se (196.026 nm)	≥ 41.0	SRBR	119.1	1177.1	84.2	
Zn (213.857 nm)	≥ 1421.0	SRBR	4082.3	49908.2	148.6	
Pb (220.353 nm)	≥ 46.0	SRBR	191.1	2682.8	172.6	
Mn (257.610 nm)	≥ 3518.0	SRBR	11415.2	265002.2	536.8	
Al (396.152 nm)	≥ 3.4	SBR	7.8	49838.0	5676.5	
Ba (493.408 nm)	≥ 34.0	SBR	116.1	1999041.4	17066.5	
K (766.491 nm)	≥ 1.8	SBR	5.3	101078.4	16104.6	
Axial						
Element Wavelength	Specification	Method	Ratio	Standard	Blank	
As (188.980 nm)	≥ 208.0	SRBR	252.9	3214.2	147.0	
Se (196.026 nm)	≥ 159.0	SRBR	216.2	3639.7	272.2	
Zn (206.200 nm)	≥ 234.0	SRBR	1203.3	14046.1	133.7	
Zn (213.857 nm)	≥ 1743.0	SRBR	7856.1	171323.1	472.9	
Cd (214.439 nm)	≥ 4227.0	SRBR	7054.9	129539.3	335.4	
Pb (220.353 nm)	≥ 320.0	SRBR	531.7	13218.2	566.2	
Mn (257.610 nm)	≥ 10625.0	SRBR	30884.7	1314844.0	1807.4	
Cr (267.716 nm)	≥ 1048.0	SRBR	4442.1	174420.3	1515.1	
Cu (324.754 nm)	≥ 19.0	SBR	50.7	374603.6	7249.0	
Al (396.152 nm)	≥ 6.0	SBR	15.7	279915.3	16790.4	
Ba (493.408 nm)	≥ 60.0	SBR	209.7	10899956.6	51728.3	
K (766.491 nm)	≥ 24.0	SBR	38.9	1983197.5	49746.6	

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เอกสารไม่ควบคุม

Post PM

Precision Test			Pass
Radial			
Element Wavelength	Specification	Measured Value % RSD	
As (188.980 nm)	≤ 2.60	0.81	
Se (196.026 nm)	≤ 2.60	1.21	
Zn (213.857 nm)	≤ 1.50	0.39	
Pb (220.353 nm)	≤ 2.60	0.41	
Mn (257.610 nm)	≤ 1.50	0.46	
Al (396.152 nm)	≤ 1.50	0.41	
Ba (493.408 nm)	≤ 1.50	0.51	
K (766.491 nm)	≤ 1.50	0.36	
Axial			
Element Wavelength	Specification	Measured Value % RSD	
As (188.980 nm)	≤ 1.50	0.51	
Se (196.026 nm)	≤ 1.50	0.73	
Zn (206.200 nm)	≤ 1.50	0.30	
Zn (213.857 nm)	≤ 1.50	0.37	
Cd (214.439 nm)	≤ 1.50	0.36	
Pb (220.353 nm)	≤ 1.50	0.28	
Mn (257.610 nm)	≤ 1.50	0.63	
Cr (267.716 nm)	≤ 1.50	0.30	
Cu (324.754 nm)	≤ 1.50	0.54	
Al (396.152 nm)	≤ 1.50	0.45	
Ba (493.408 nm)	≤ 1.50	0.64	
K (766.491 nm)	≤ 1.50	0.56	

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เอกสารไม่ควบคุม

Report Summary	
Instrument Model	Agilent 5100/5110 VDV ICP-OES
Instrument ID	G8011A/G8015A
Instrument Serial Number	MY18030001
Software Version	7.3.1.9507
Firmware Version	3442
Tested By	Nukoon L.
Test Completed On	12/9/2021 12:55:49 PM
Result Summary	
Subsystem Communications Test	Skipped
Air Flow Test	Skipped
Water Flow Test	Skipped
Gas Flows Test	Skipped
RF Generator Test	Skipped
Camera Test	Skipped
Optics Test	Pass
Advanced Valve System Test	Skipped
Resolution Test	Pass
Sensitivity Test	Pass
Precision Test	Pass
Optics Test	
	Pass
Intensity	Radial 5296135 Axial 5755042
Wavelength	737.212 737.212

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เอกสารไม่ควบคุม

Resolution Test			Pass
Element Wavelength	Specification	Width	
N (174.213 nm)	≤ 9.40	7.22	
As (188.980 nm)	≤ 8.20	6.15	
C (193.027 nm)	≤ 11.50	8.22	
Mo (202.032 nm)	≤ 8.20	6.33	
Cr (206.158 nm)	≤ 13.40	9.21	
Zn (213.857 nm)	≤ 8.70	6.87	
Pb (220.353 nm)	≤ 9.50	7.02	
Co (228.615 nm)	≤ 17.20	11.81	
Ba (230.424 nm)	≤ 9.40	7.46	
Mn (257.610 nm)	≤ 13.30	9.49	
Mn (260.568 nm)	≤ 20.30	14.19	
Cr (267.716 nm)	≤ 11.00	7.90	
Cu (324.754 nm)	≤ 25.00	18.92	
Cu (327.395 nm)	≤ 14.20	11.32	
Sr (338.071 nm)	≤ 33.50	24.29	
Ba (455.403 nm)	≤ 44.00	33.68	
Sr (460.733 nm)	≤ 36.00	17.64	
Ba (493.408 nm)	≤ 36.00	25.56	
Ba (614.171 nm)	≤ 42.00	24.75	
Ar (675.283 nm)	≤ 74.00	59.18	
K (766.491 nm)	≤ 80.00	65.19	

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เอกสารไม่ควบคุม

Sensitivity Test						Pass
Radial						
Element Wavelength	Specification	Method	Ratio	Standard	Blank	
As (188.980 nm)	≥ 46.0	SRBR	154.8	1242.3	58.5	
Se (196.026 nm)	≥ 41.0	SRBR	117.4	1259.6	97.9	
Zn (213.857 nm)	≥ 1421.0	SRBR	4192.8	52402.6	155.3	
Pb (220.353 nm)	≥ 46.0	SRBR	196.4	2814.2	179.9	
Mn (257.610 nm)	≥ 3518.0	SRBR	11993.6	281210.1	547.6	
Al (396.152 nm)	≥ 3.4	SBR	8.7	55103.6	5662.9	
Ba (493.408 nm)	≥ 34.0	SBR	125.4	2152916.9	17032.2	
K (766.491 nm)	≥ 1.8	SBR	5.7	107906.7	16079.8	
Axial						
Element Wavelength	Specification	Method	Ratio	Standard	Blank	
As (188.980 nm)	≥ 208.0	SRBR	297.5	4054.8	170.4	
Se (196.026 nm)	≥ 159.0	SRBR	260.2	4794.9	298.5	
Zn (206.200 nm)	≥ 234.0	SRBR	1305.9	16162.3	150.3	
Zn (213.857 nm)	≥ 1743.0	SRBR	8920.7	200915.6	504.7	
Cd (214.439 nm)	≥ 4227.0	SRBR	7958.3	149327.5	350.4	
Pb (220.353 nm)	≥ 320.0	SRBR	606.7	15244.5	584.0	
Mn (257.610 nm)	≥ 10625.0	SRBR	34460.9	1493092.8	1872.5	
Cr (267.716 nm)	≥ 1048.0	SRBR	5018.6	198000.6	1532.6	
Cu (324.754 nm)	≥ 19.0	SBR	57.5	423683.7	7248.6	
Al (396.152 nm)	≥ 6.0	SBR	18.5	320004.9	16441.4	
Ba (493.408 nm)	≥ 60.0	SBR	233.3	11882915.4	50714.5	
K (766.491 nm)	≥ 24.0	SBR	44.6	2218974.4	48657.9	

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เอกสารไม่ควบคุม

Precision Test			Pass
Radial			
Element Wavelength	Specification	Measured Value % RSD	
As (188.980 nm)	≤ 2.60	1.38	
Se (196.026 nm)	≤ 2.60	0.91	
Zn (213.857 nm)	≤ 1.50	0.38	
Pb (220.353 nm)	≤ 2.60	0.44	
Mn (257.610 nm)	≤ 1.50	0.43	
Al (396.152 nm)	≤ 1.50	0.38	
Ba (493.408 nm)	≤ 1.50	0.66	
K (766.491 nm)	≤ 1.50	0.36	
Axial			
Element Wavelength	Specification	Measured Value % RSD	
As (188.980 nm)	≤ 1.50	0.61	
Se (196.026 nm)	≤ 1.50	0.52	
Zn (206.200 nm)	≤ 1.50	0.36	
Zn (213.857 nm)	≤ 1.50	0.33	
Cd (214.439 nm)	≤ 1.50	0.41	
Pb (220.353 nm)	≤ 1.50	0.36	
Mn (257.610 nm)	≤ 1.50	0.74	
Cr (267.716 nm)	≤ 1.50	0.25	
Cu (324.754 nm)	≤ 1.50	0.71	
Al (396.152 nm)	≤ 1.50	0.44	
Ba (493.408 nm)	≤ 1.50	0.73	
K (766.491 nm)	≤ 1.50	0.97	

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เอกสารไม่ควบคุม

Report Summary		
Instrument Model	Agilent 5100/5110 VDV ICP-OES	
Instrument ID	G8011A/G8015A	
Instrument Serial Number	MY18030001	
Software Version	7.3.1.9507	
Firmware Version	3442	
Tested By	Nukoon L.	
Test Completed On	12/9/2021 1:34:10 PM	
Result Summary		
Subsystem Communications Test		Pass
Air Flow Test		Pass
Water Flow Test		Pass
Gas Flows Test		Pass
RF Generator Test		Pass
Camera Test		Pass
Optics Test		Skipped
Advanced Valve System Test		Skipped
Resolution Test		Skipped
Sensitivity Test		Skipped
Precision Test		Skipped
Subsystem Communications Test		
Pass		
Air Flow Test		
Pass		
30% Air Flow (relative speed)	75% Air Flow (relative speed)	
15.00	19.00	
Water Flow Test		
Pass		
RF Water Flow(L/min)	Camera Water Flow (L/min)	Water Inlet Temperature (°C)
1.98	1.36	17.16

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เอกสารไม่ควบคุม



Gas Flows Test			Pass		
Nebulizer Target Flow	Actual Flow	Back Pressure	Auxiliary Target Flow	Actual Flow	Back Pressure
0.70	0.70	203.80	2.00	1.99	108.66
Makeup Target Flow	Actual Flow	Back Pressure	Plasma Target Flow	Actual Flow	Back Pressure
2.00	2.00	113.89	18.00	17.93	24.24
RF Generator Test			Pass		
RF Power Supply Test		Passed			
RF Power Supply (V)		141.475			
RF Oscillator Test		Passed			
RF Oscillator Frequency (MHz)		25.874			
Work Coil Current (A)		45.931			
RF Power Supply Current (A)		2.000			
Camera Test			Pass		
	Integration Time (ms)	Standard Deviation	Status		
Electronic Offset Test	1000	5.261	Passed		
Dark Current Test	6000	0.734	Passed		
Array Test	5	0.024	Passed		
Linearity Test		0.118	Passed		

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เอกสารไม่ควบคุม



Request No. 25-64 / 0247 1 / 5 MTC. ACL. No. 335 / 64

#### CALIBRATION DATA

##### 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	-0.001	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
	0.0009	-0.0015	-0.0009	-0.0012	0.0002	-0.0006	-0.0015	0.0010
	0.0014	0.0006	-0.001	-0.0006	-0.0014	-0.0012	-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	0.0005	-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
Average Absorbance	0.000	-0.001	0.000	-0.001	0.000	-0.001	-0.001	0.001
Standard Deviation	0.0004	0.0009	0.0005	0.0008	0.0005	0.0005	0.0006	0.0005

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INDUSTRIAL METROLOGY AND TESTING SERVICE CENTRE

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FM.BLMTC.002 Rev.3

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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	%RSD
Cd	0.02	0.0075	0.0072	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	0.094	0.0005	0.48
	0.70	0.2154	0.2157	0.2156	0.2157	0.2158	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	0.0076	0.008	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	0.022	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	0.045	0.0009	2.10
Cu	0.05	0.0071	0.0081	0.0074	0.0070	0.0070	0.0065	0.0072	0.0077	0.0073	0.0067	0.007	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	0.041	0.0005	1.21
	0.70	0.0909	0.0899	0.0905	0.0906	0.0904	0.0897	0.0905	0.0902	0.0899	0.0904	0.090	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	0.008	0.0005	6.89
	0.50	0.0409	0.0405	0.0410	0.0406	0.0410	0.0408	0.0408	0.0404	0.0400	0.0400	0.041	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	0.080	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	0.009	0.0006	6.34
	0.70	0.0327	0.0314	0.0312	0.0325	0.0331	0.0312	0.0321	0.0322	0.0320	0.0317	0.032	0.0006	2.01
	1.50	0.0673	0.0674	0.0677	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	0.010	0.0003	3.17
	0.30	0.0626	0.0626	0.0622	0.0621	0.0605	0.0628	0.0618	0.0626	0.0620	0.0626	0.062	0.0007	1.08
	0.70	0.1397	0.1404	0.1415	0.1407	0.1404	0.1388	0.1428	0.1412	0.1408	0.1399	0.141	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	0.009	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	0.046	0.0010	2.08
	1.00	0.0865	0.0878	0.0858	0.0872	0.0858	0.0862	0.0846	0.0867	0.0863	0.0865	0.086	0.0009	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	0.033	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	0.173	0.0007	0.40
	0.70	0.3552	0.3551	0.3564	0.3530	0.3560	0.3564	0.3577	0.3559	0.3586	0.3559	0.356	0.0015	0.42

Continue 3 / 5

INDUSTRIAL METROLOGY AND TESTING SERVICE CENTRE

The results relate only to the items tested or calibrated.  
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FM.BLMTC.002 Rev.3

Head Office  
35 Mu 3 Tambon Khlong Ha, Amphoe Khlong Luang,  
Changwat Pathumthani 12120, Thailand  
Tel. (66) 0 2577 9000  
Fax. (66) 0 2577 9009  
E-mail : numpai@tistr.or.th Website:www.tistr.or.th

Office/Laboratory  
Sol 1/C, Bangsoo Industrial Estate, Sukhumvit Road,  
Amphoe Muang, Changwat Samutprakan 10280, Thailand  
Tel. (66) 0 2323 1672-80 ext. 115, 116  
Fax. (66) 0 2323 9165  
E-mail : mtg@tistr.or.th

Office  
196 Phahonyothin Road, Chatuchak, Bangkok 10900,  
Thailand  
Tel. (66) 0 2579 1121-30 ext. 5219, 5225, 5217  
Fax. (66) 0 2578 8530  
E-mail : mtg@tistr.or.th

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Request No. 25-64 / 0247

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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

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Fax. (66) 0 2323 9165  
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E-mail : sutha@tistr.or.th

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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. Suthongkum*  
(Mr. Danai Srithongkum)

Approved by *(Mrs. Thippaya Junvee Fortune)*  
(Mrs. Thippaya Junvee Fortune)

Sr Director of Analytical Chemistry Laboratory  
Calibration date : 4 February 2021

INDUSTRIAL METROLOGY AND TESTING SERVICE CENTRE

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Fax. (66) 0 2323 9165  
E-mail : mtg@tistr.or.th

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Thailand  
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Fax. (66) 0 2579 9009  
E-mail : sutha@tistr.or.th

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Request No. 25-64 / 0247

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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

INDUSTRIAL METROLOGY AND TESTING SERVICE CENTRE

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

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Amphoe Muang, Changwat Samutprakan 10280, Thailand  
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Fax. (66) 0 2579 9009  
E-mail : sutha@tistr.or.th

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SPC Calibration Center

SERT  
Part of DKSH Group



## Certificate of Calibration

Equipment: CONDUCTIVITY METER  
Model: Lab955  
Serial No. (or ID.): 16300356  
Manufacturer: SI Analytics  
Electrode Serial No.: 16070067  
Condition: In Condition  
Certificate No.: C24210091  
Issued Date: 29 March 2021  
Job No.: KSPR2104894  
Page: 1 of 2  
Model: LF413T Brand: SI Analytics

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

Calibration By: Mr. Imron Ama  
Calibration Date: 29 March 2021  
The Method used: In house method, SPCC-WI-48, 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 Radiometer Analytical Co., Ltd. Certificate No. 1561, 1515, 1377

*Imron Ama*  
(Mr. Imron Ama)

Person in charge

*SERT*  
บริษัท เอสพีซี อาร์ที จำกัด  
SPC RT Co., Ltd.

*(Mr. Dumrong Boonsopon)*  
(Mr. Dumrong Boonsopon)

Authorized signatory

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

บริษัท เอสพีซี อาร์ที จำกัด  
SPC RT Co., Ltd.  
เลขที่ 0003 1194 โซ่ Wachirathamsathit 57 ถนนสุขุมวิท 101/1 แขวงบางนาเหนือ เขตวัฒนา กรุงเทพมหานคร 10260  
โทร 0 2153 4323 โทร 3305-3398 โทร 0 2153 4424 E-mail: info@spcrt.com Website: www.spcrt.com

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SPCC-FM-C24-08: 23 Nov 2020



**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

บริษัท เอสพี ซีอียู จำกัด  
SPC PT CO., LTD.  
เลขที่ 00023 194 ซอยสุขุมวิท 41 แขวงคลองเตย เขตคลองเตย กรุงเทพมหานคร 10250  
โทร 02-265-4333 Fax 02-265-4334 E-mail info@spccal.com Website www.spccal.com

เอกสารไม่ควบคุม  
SPCC-FM-C24-06: 23 Nov 2020



National Food Institute, Ministry of Industry, Thailand

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Tel : +66 (0) 2462 0500 Fax : +66 (0) 2462 0543 Website : www.nfi.go.th E-mail : cal@nfi.go.th



**Calibration Certificate**

**Certificate No.:** 2103189-002-01  
**Client name:** UNITED ANALYST AND ENGINEERING CONSULTANT CO.,LTD.  
**Address:** 3 Soi Udomsuk 41, Sukhumvit Road, Bangchack, Prakhonong, Bangkok 10280

Page 1 of 5

**Equipment:** pH Meter  
**Manufacturer:** METTLER TOLEDO  
**Model:** SevenEasy pH  
**Serial No.:** 1231155210  
**ID No.:** UAE.WAT.010/2553  
**Order No.:** 2103189  
**Operation No.:** 2103189-002  
**Date of Receipt:** 9 June 2021  
**Date of Calibration:** 14 June 2021

**Calibrated by** Mr.Manas Somsak Expert  
**Approved by** ( Mr.Pharaphat Tuanjit )  
Manager, Division of Calibration Laboratory  
Responsible for the Technical Management Team  
**Date of Issue:** 15 June 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 reproduced other than in full, except with the prior written approval of the National Food Institute.

F-CS-009 Revision: 00 Date: 14-12-61

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National Food Institute, Ministry of Industry, Thailand

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Tel : +66 (0) 2462 0500 Fax : +66 (0) 2462 0543 Website : www.nfi.go.th E-mail : cal@nfi.go.th



**Calibration Report**

**Certificate No.:** 2103189-002-01  
**Equipment:** pH Meter  
**Resolution:** 0.01 pH ; 1 mV  
**Manufacturer:** METTLER TOLEDO  
**Model:** SevenEasy pH  
**Serial No.:** 1231155210  
**Type:** Bench top  
**ID No.:** UAE.WAT.010/2553  
**Date of Calibration:** 14 June 2021  
**Location:** Chemical Calibration Laboratory, National Food Institute  
**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-CO-002 based on direct measurement by using standard voltage calibrator and certified reference material (CRM)  
2. Reference Standards / Certified Reference Material

Page 2 of 5

Instruments	Serial / ID No.	Manufacturer	Certificate No.	Due Date
2.1 DC Voltage Calibrator	2709007	Fuke	SCJ-30F-0862	17 June 2021
2.2 Digital Thermometer	2709007	Fuke	CC 630609-01	30 October 2021
2.3 Thermo-Hygro Meter	NFI.BTH40317	PONPE	QR20-1578	21 September 2021

Certified Reference Material	Lot No.	Manufacturer	Ref N	Expiry Date
2.4 pH buffer 4.008 (Primary pH buffer Solution)	710048	CPAchem	PH216.L5	2 October 2022
2.5 pH buffer 6.865 (Primary pH buffer Solution)	710049	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 NSO-TISI-TIS 17025 Laboratory Accreditation of Calibration No.0075  
3.2 Instruments No.2.2 through NSO-TISI-TIS 17025 Laboratory Accreditation of Calibration No.0061  
3.3 Instruments No.2.3 through NSO-TISI-TIS 17025 Laboratory Accreditation of Calibration No.0262  
3.4 Certified Reference Material No. 2.4 to 2.6 traceable to Primary measurement method- Hamed cell using calibrated thermometer, barometer, and nanovoltmeter. The Standard Solution preparation and certified by CPAchem Ltd is accredited to ISO 17034 and ISO/IEC 17025  
3.5 Certified Reference Material No. 2.7 traceable to BIM RefN H-7 LoN 30.04.2020; BIM RefN H-8 LoN 28.05.2020; BIM RefN H-8 LoN 30.04.2020; BIM RefN H-10 LoN 28.05.2020. The Standard Solution preparation and certified by CPAchem Ltd is accredited to ISO 17034 and ISO/IEC 17025  
4. This certificate was certified only for the instrument we calibrated.  
5. This result of calibration was found accurate as shown on date and place of calibration only.

F-CS-012 Revision: 00 Date: 14-12-61

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**Calibration Report**

**Certificate No.:** 2103189-002-01  
**Equipment:** pH Meter  
**Resolution:** 0.01 pH ; 1 mV  
**Manufacturer:** METTLER TOLEDO  
**Model:** SevenEasy pH  
**Serial No.:** 1231155210  
**Type:** Bench top  
**ID No.:** UAE.WAT.010/2553  
**Date of Calibration:** 14 June 2021  
**Calibration Results:**  
1. Calibration of pH Meter ( Manual Temperature Compensation at 25 °C )

Page 3 of 5

Nominal pH	DC Voltage Standard (mV)	Average Indicator Reading		Uncertainty (±mV)	Coverage Factor (k)
		mV	pH		
0.00	414.118	414	0.08	0.58	2.00
2.00	295.811	296	2.00	0.58	2.00
4.00	177.461	178	4.00	0.58	2.00
6.00	59.160	59	6.00	0.58	2.00
7.00	0.000	0	7.00	0.58	2.00
8.00	-59.158	-59	8.00	0.58	2.00
10.00	-177.461	-177	10.00	0.58	2.00
12.00	-295.812	-296	12.00	0.58	2.00
14.00	-414.118	-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  
**Model:** InLab Solids  
**Serial No.:** 115582  
**ID No.:** N/A  
**Performance of Electrode system** (Three-Point Calibration at pH4, pH7 and pH10)

Certified Value @25 °C (pH)	Average Indicator Reading		Relative Slope (%)	Uncertainty (± pH)	Coverage Factor (k)
	pH	mV			
4.008	4.01	165	99.9	0.0071	2.00
6.866	6.87	16		0.0075	2.00
6.866	6.87	16	99.9	0.0075	2.00
10.008	10.01	-166		0.0093	2.00
9.985	9.99	9	-	0.0093	2.00

F-CS-012 Revision: 00 Date: 14-12-61

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## Calibration Report

Certificate No.: 2103189-002-01  
Equipment: Digital Thermometer with RTD (pH Meter)  
Resolution: 0.1 °C Model: SevenEasy pH  
Serial No.: 1231155210 ID No.: UAE.WAT.010/2553  
Manufacturer: METTLER TOLEDO  
Date of Calibration: 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:

- Calibration Method :
  - In house method: W-TE-025 by comparison with standard thermometer.
  - The Calibration is determined by comparing with a known temperature from a standard resistance thermometer.
  - The temperature scale in use at this laboratory is the International Temperature scale of 1990 (ITS-90).

### 2. Reference Standard Instrument:

Instrument	Model	Serial No.	Certificate No.	Due Date	Through
HANDHELD THERMOMETER	1521	A85997	TE 640028-01	12-Dec-21	NATIONAL FOOD INSTITUTE
Platinum Resistance Thermometer (PRT)	380	009201			

Support Equipment : Low Temperature Bath (SOCAL-6), Model: Europa-8 Plus Basic, S/N: 341592/2

- 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 ☐ After adjustment
- Result of Calibration: ☒ X ☐ Without adjustment ☐ After adjustment

F-CS-012 Revision: 00 Date: 14-12-61

เอกสารไม่ควบคุม

## Calibration Report

Certificate No.: 2103189-002-01  
Equipment: Digital Thermometer with RTD (pH Meter)  
Resolution: 0.1 °C Model: SevenEasy pH  
Serial No.: 1231155210 ID No.: UAE.WAT.010/2553  
Manufacturer: METTLER TOLEDO  
Date of Calibration: 14 June 2021 Page 5 of 5

Calibration point: 15.0, 25.0 and 35.0 °C

### Calibration result:

- The probe was immersed in liquid bath or dry bath to a minimum depth of 25 mm.
- Description of probe, model: iLab Solids S/N: 115862
- Dimension of probe : Diameter 6 mm, Length 25 mm.
- Sheath material : Glass

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
35.1	34.999	-0.1	0.13

### 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 %.

F-CS-012 Revision: 00 Date: 14-12-61

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## Calibration Certificate

Certificate No.: 2102015-001-01  
Client name: UNITED ANALYST AND ENGINEERING CONSULTANT CO.,LTD.  
Address: 3 Soi Udomsuk 41, Sukhumvit Road, Bangchack, Prakanong, Bangkok 10260

Page 1 of 5

Equipment: pH Meter

Manufacturer: HANNA INSTRUMENTS

Model: HI 2211

Serial No.: 08165345

ID No.: UAE.WAT.004/2556

Order No.: 2102015

Operation No.: 2102015-001

Date of Receipt: 16 March 2021

Date of Calibration: 17 March 2021

Calibrated by Mr.Manas Somsak Expert Approved by (Mr.Pheraphat Tuanjit) Manager, Division of Calibration Laboratory Responsible for the Technical Management Team  
Date of Issue: 19 March 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 reproduced other than in full except with the prior written approval of the National Food Institute.

F-CS-009 Revision: 00 Date: 14-12-61

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## Calibration Report

Certificate No.: 2102015-001-01  
Equipment: pH Meter  
Resolution: 0.01 pH ± 0.1 mV  
Manufacturer: HANNA INSTRUMENTS Model: HI 2211  
Serial No.: 08165345 Type: Bench top  
ID No.: UAE.WAT.004/2556

Date of Calibration: 17 March 2021 Page 2 of 5

Location: Chemical Calibration Laboratory, National Food Institute  
Environment Condition: Ambient Temperature: ( 23.3 ± 1.5 ) °C Relative Humidity: ( 53.5 ± 5 ) %  
Condition of Equipment: Good Condition

### Condition of this Results of Calibration

- Calibration Method: In house method : W-CC-002 based on direct measurement by using standard voltage calibrator and certified reference material (CRM)
- Reference Standards / Certified Reference Material
 

Instruments	Serial / ID No.	Manufacturer	Certificate No.	Due Date
2.1 DC Voltage Calibrator	2709007	Fuke	SCV-20F-0682	17 June 2021
2.2 Digital Thermometer	2709007	Fuke	CC 630609-01	30 October 2021
2.3 Thermo-Hygro Meter	NPLBTH-003/17	PONPE	QR20-1578	21 September 2021

Certified Reference Material	Lot No.	Manufacturer	Ref N	Expiry Date
2.4 pH buffer 4.008 (Primary pH buffer Solution)	710048	CPAchem	PH216.L5	2 October 2022
2.5 pH buffer 6.865 (Primary pH buffer Solution)	710049	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
- This certificate is traceable to The International System of Unit (SI Unit)
  - Instruments No.2.1 through NSC-TISI-TIS 17025 Laboratory Accreditation of Calibration No.0075
  - Instruments No.2.2 through NSC-TISI-TIS 17025 Laboratory Accreditation of Calibration No.0061
  - Instruments No.2.3 through NSC-TISI-TIS 17025 Laboratory Accreditation of Calibration No.0292
  - Certified Reference Material No. 2.4 to 2.6 traceable to Primary measurement method- Homed cell using calibrated thermometer, barometer, and manometer. The standard solution preparation and certified by CPAchem Ltd is accredited to ISO 17034 and ISO/IEC 17025
  - Certified Reference Material No. 2.7 traceable to BSM ReN Hi-7 Lot# 30 04.2020; BSM ReN Hi-9 Lot# 28.05.2020; BSM ReN Hi-8 Lot# 30.04.2020; BSM ReN Hi-10 Lot# 28.05.2020. The Standard Solution preparation and certified by CPAchem Ltd is accredited to ISO 17034 and ISO/IEC 17025
- 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.

F-CS-012 Revision: 00 Date: 14-12-61

เอกสารไม่ควบคุม

## Calibration Report

Certificate No.: 2102015-001-01  
Equipment: pH Meter  
Resolution: 0.01 pH ; 0.1 mV  
Manufacturer: HANNA INSTRUMENTS Model: HI2211  
Serial No.: 08165345 Type: Bench top  
ID No.: UAE.WAT.004/2556

Date of Calibration: 17 March 2021 Page 3 of 5

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

Nominal pH	DC Voltage Standard (mV)	Average Indicator Reading		Uncertainty (mV)	Coverage Factor (k)
		mV	pH		
9.00	414.118	414	9.00	0.58	2.00
2.00	295.811	295.7	2.00	0.063	2.00
4.00	177.461	177.5	4.00	0.063	2.00
6.00	59.160	59.2	6.00	0.063	2.00
7.00	9.000	9.1	7.00	0.063	2.00
8.00	-59.158	-59.1	8.00	0.063	2.00
10.00	-177.461	-177.3	10.00	0.063	2.00
12.00	-295.812	-295.6	12.00	0.063	2.00
14.00	-414.118	-414	14.00	0.58	2.00

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

Equipment: pH Electrode Type: Combined Electrode  
Manufacturer: HANNA INSTRUMENTS Model: HI 1131  
Serial No.: 05912F2V ID No.: N/A

Performance of Electrode system (Three-Point Calibration at pH4, pH7 and pH10)

Certified Value @25 °C (pH)	Average Indicator Reading		Relative Slope (%)	Uncertainty (± pH)	Coverage Factor (k)
	pH	mV			
4.008	4.01	165.0	95.8	0.0071	2.00
6.866	6.87	2.9		0.0075	2.00
6.866	6.87	2.9	94.5	0.0075	2.00
10.008	10.01	-172.7		0.0093	2.00
6.865	6.99	-4.0		0.0093	2.00

F-CS-012 Revision: 00 Date: 14-12-61

เอกสารไม่ควบคุม

## Calibration Report

Certificate No.: 2102015-001-01  
Equipment: Digital Thermometer with RTD (pH Meter)  
Resolution: 0.1 °C Model: HI 2211  
Serial No.: 08165345 ID No.: UAE.WAT.004/2556  
Manufacturer: HANNA INSTRUMENTS

Date of Calibration: 17 March 2021 Page 4 of 5

Location: Chemical Calibration Laboratory, National Food Institute  
Environment Condition: Ambient Temperature 23 °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 1990 (ITS-90).

2. Reference Standard Instrument :

Instrument	Model	Serial No.	Certificate No.	Due Date	Through
HANDHELD THERMOMETER	1523	2118154	PSL-T 76783	04-Jun-21	TISTR
Platinum Resistance Thermometer (PRT)	5627A	877332			

Support Equipment : - Low Temperature Bath (ISOCAL-6), Model: Europa-6 Plus Basic, SN: 341592/2

3. This certificate is traceable to International System of Units (SI Units).
4. This certificate was certified only for the instrument we calibrated.
5. This result of calibration was found accurate as shown on date and place of calibration only.

6. Condition of Calibrated item : Good  
7. Result of Calibration : ☒ Without adjustment ☐ After adjustment

F-CS-012 Revision: 00 Date: 14-12-61

เอกสารไม่ควบคุม

## Calibration Report

Certificate No.: 2102015-001-01  
Equipment: Digital Thermometer with RTD (pH Meter)  
Resolution: 0.1 °C Model: HI 2211  
Serial No.: 08165345 ID No.: UAE.WAT.004/2556  
Manufacturer: HANNA INSTRUMENTS

Date of Calibration: 17 March 2021 Page 5 of 5

Calibration point: 15.0, 25.0 and 35.0 °C

Calibration result:

- The probe was immersed in liquid bath or dry bath to a minimum depth of 100 mm.
- Description of probe, model : S/N :  
Dimension of probe : Diameter 3.8 mm, Length 100 mm.  
Sheath material : Stainless Steel

UUC* Reading (°C)	Standard Temperature (°C)	Correction Value (°C)	Uncertainty ± (°C)
14.9	15.003	0.1	0.099
25.0	25.003	0.0	0.099
35.0	35.007	0.0	0.099

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

F-CS-012 Revision: 00 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, Prakhong, 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.Yothin Charoensuk  
Scientist

Approved by (Mr.Pheraphat Tuanjit)  
Manager, Division of Calibration Laboratory  
Responsible for the Technical Management Team

Date of Issue: 15 June 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 reproduced other than in full except with the prior written approval of the National Food Institute.

F-CS-009 Revision: 00 Date: 14-12-61

เอกสารไม่ควบคุม

## Calibration Report

Certificate No.: 2103270-001-01  
 Equipment: Electronic Balance  
 Model: AB204-S/FACT  
 Serial No.: 1129361010  
 Capacity: 220 g  
 Manufacturer: Mettler Toledo  
 Resolution: 0.0001 g  
 ID No.: UAE.WAS.002/2552

Date of Calibration: 11 June 2021 Page 2 of 3

Environment Condition: Ambient Temperature: 23.3 ± 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: NFI Method W-MA-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 1mg to 200g 8505567572 TCS M20040405 20 April 2022

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

Thermo-Hygro Meter POWE 490 NFI.BTH 004/18 Quality Reborn QR21-0300 15 February 2022

3. This certification is traceable to SI UNIT

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

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

Calibration Results:

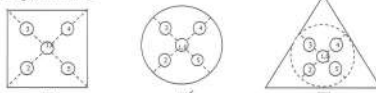
1. Repeatability of Reading:

Nominal Value ( g )	Standard Deviation of Reading ( g )
100	0.000067
200	0.000057

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 )
50.0000	49.9999	49.9999	50.0000	50.0000	50.0000	0.0001

F-CS-012 Revision: 00 Date: 14-12-61

เอกสารไม่ควบคุม

## Calibration Report

Certificate No.: 2103270-001-01  
 Equipment: Electronic Balance  
 Model: AB204-S/FACT  
 Serial No.: 1129361010  
 Capacity: 220 g  
 Manufacturer: Mettler Toledo  
 Resolution: 0.0001 g  
 ID No.: UAE.WAS.002/2552

Date of Calibration: 11 June 2021 Page 3 of 3

Calibration Results: (Continued)

Calibration Range: 0-200 g

Calibration Adjustment: Internal Calibration

3. Departure from Nominal Value:

Nominal Value ( g )	Standard Value ( g )	Average Reading ( g )	Correction ( g )	Uncertainty ( g )	Coverage Factor K
Unloaded	0.00000	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	5.00002	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-CS-012 Revision: 00 Date: 14-12-61

เอกสารไม่ควบคุม

## Calibration Certificate

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

Page 1 of 4

Equipment: Electronic Balance

Manufacturer: METTLER TOLEDO

Model: AX 105 DR

Serial No.: 1122100406

ID No.: UAE.WAO.004/2546

Order No.: 2200708

Operation No.: 2200708-001

Date of Receipt: 24 November 2021

Date of Calibration: 24 November 2021

Calibrated by Mr.Worapob Sooktong  
 Scientist

Approved by (Mr.Pheraphat Tuanjit)  
 Manager, Division of Calibration Laboratory  
 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 reproduced other than in full except with the prior written approval of the National Food Institute.

F-CS-009 Revision: 00 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: 0.00001 g/ 0.0001 g  
 ID No.: UAE.WAO.004/2546

Date of Calibration: 24 November 2021 Page 2 of 4

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

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

Condition of Equipment: Good Condition

Condition of This Results of Calibration:

1. Calibration Method: NFI Method W-MA-001 In-House Method based on UKAS Lab 14 : 2019

2. Reference Standards:

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

Standard Weight Class E2 1-500mg 15880 TCS M20111955 28 November 2021

Standard Weight Class E2 1-500g 15882 TCS M20111965 28 November 2021

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

Thermo-Hygro Meter 11A1 aaw.a.h. BTH 003/55 Quality Reborn QR21-0297 15 February 2022

3. This certification is traceable to SI UNIT

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

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

Calibration Results:

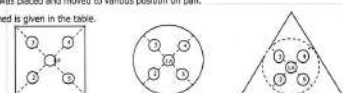
1. Repeatability of Reading:

Nominal Value ( g )	Standard Deviation of Reading ( g )
15	0.000057
30	0.0000084
50	0.000053
100	0.000048

2. Off-Center Error:

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

The balance reading obtained is given in the table.



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

F-CS-012 Revision: 00 Date: 14-12-61

เอกสารไม่ควบคุม

## Calibration Report

**Certificate No.:** 2200708-001-01  
**Equipment:** Electronic Balance  
**Model:** AK 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 **Page 3 of 4**

**Calibration Results:** (Continued)  
**Calibration Range:** 0-100 g  
**Calibration Adjustment:** Internal Calibration

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

Nominal Value ( g )	Standard Value ( g )	Average Reading ( g )	Correction ( g )	Uncertainty ( # g )	Coverage Factor #
Unread	0.00000	0.00000	0.00000	0.0000089	2.00
0.01	0.009998	0.01000	0.00000	0.000011	2.00
0.02	0.019997	0.02000	0.00000	0.000012	2.00
0.05	0.050001	0.05000	0.00000	0.000011	2.00
0.1	0.100002	0.10000	0.00000	0.000012	2.00
0.2	0.200004	0.20000	0.00000	0.000013	2.00
0.5	0.499994	0.50000	-0.00001	0.000014	2.00
1	0.999986	1.00000	-0.00001	0.000026	2.00
2	1.999989	1.99998	0.00001	0.000019	2.00
5	4.999979	4.99998	0.00000	0.000022	2.00
10	10.000026	9.99994	0.00009	0.000074	2.00
20	20.000017	19.99991	0.00010	0.000099	2.00
30	30.000063	30.00000	0.00006	0.00013	2.00

F-CS-012 Revision: 00 Date: 14-12-61

เอกสารไม่ควบคุม

## Calibration Report

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

**Date of Calibration:** 24 November 2021 **Page 4 of 4**

**Calibration Results:** (Continued)  
**Calibration Range:** 0-100 g  
**Calibration Adjustment:** Internal Calibration

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

Nominal Value ( g )	Standard Value ( g )	Average Reading ( g )	Correction ( g )	Uncertainty ( # g )	Coverage Factor #
40	40.00000	39.9999	0.00001	0.00014	2.00
45	44.99998	44.9999	0.00001	0.00015	2.00
50	49.99999	49.9999	0.00001	0.00016	2.00
55	54.99997	54.9998	0.00002	0.00016	2.00
60	59.99992	59.9999	0.00001	0.00018	2.00
65	64.99990	64.9999	0.00001	0.00018	2.00
70	70.00003	69.9999	0.00001	0.00019	2.00
75	75.00001	74.9999	0.00001	0.00020	2.00
80	80.00005	79.9998	0.00003	0.00021	2.00
85	85.00003	84.9998	0.00002	0.00022	2.00
90	89.99999	89.9998	0.00002	0.00021	2.00
100	99.99997	99.9998	0.00002	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 %.

F-CS-012 Revision: 00 Date: 14-12-61

เอกสารไม่ควบคุม



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



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

## Certificate of Calibration

**Equipment:** Hot Air Oven  
**Manufacturer:** Memmert  
**Model:** UF 55  
**Serial No.:** B216.1666  
**ID No.:** UAE.WAO.027/2559  
**Submitted by:** United Analyst and Engineering Consultant Co., Ltd.  
 3 Soi Udomsuk 41, Sukhumvit Road,  
 Bangchak, Phrakhanong,  
 Bangkok 10260  
**Location:** Lab Floor 2  
**Received Order:** 29 October 2021  
**Calibration Date:** 29 October 2021  
**Ambient Temperature:** (26 ± 10) °C  
**Relative Humidity:** (50 ± 30) %  
**Calibrated by:** Kunchit Promrat  
**Approved by:**   
 Approved Signatory  
 ( ) Pornthippa Tameyakul  
 ( ) Mailee 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.

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**Equipment:** Hot Air Oven  
**Condition As-Received:** Used Item  
**Reference:** 2110-0701QC-1  
**Procedure Used:**

**Cert. No.:** 21TM1876  
**Page.:** 2 of 3

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

The temperature scale used was based on ITS-90.

### Condition of this result of calibration

1. Reference standard instrument:-

Instrument	Model	Serial No.	Cert. No.	Due Date
1) Data Acquisition	34970A	MY44067817	21LM10	20 Jul 2022

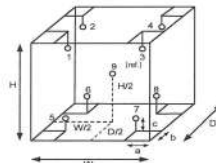
2. This certificate is valid only to the item calibrated on date and place of calibration.

3. This 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  
 b = 5.0 cm  
 c = 5.0 cm  
**Dimension of Chamber:**  
 D = 0.33 m  
 W = 0.40 m  
 H = 0.40 m  
 Capacity = 0.053 m³

Environment during calibration		
	Beginning	Finished
Temp. (°C)	28	28
REL Humid. (%)	56	55
AG Supply (Volt)	230	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	15RTD2/20
7	21-15TC-07	15RTD2/17
8	21-15TC-08	15RTD2/18
9 (ref.)	21-15TC-09	15RTD2/19

เอกสารไม่ควบคุม





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

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

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)								
	Position								
	1	2	3	4	5	6	7	8	9 (ref.)
104.0	103.852	103.978	104.382	104.323	103.776	104.015	104.312	104.196	103.907
140.0	140.309	140.730	140.426	140.270	139.531	139.666	140.067	139.895	139.750
180.0	180.598	180.339	180.755	180.619	179.716	179.829	180.204	180.365	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



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)  
 CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES  
 53/4 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG BANGKOK 10250  
 TEL. 0-2717-3000-37 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.  
 3 Soi Udomsuk 41, Sukhumvit Road,  
 Bangkok, Phrakhanong,  
 Bangkok 10260  
 Location : 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 :   
 Approved Signatory

( ) Pornthippa Tameyaskul  
 ( ✓ ) Malee Butkruea  
 ( ) Suwit Imjai

Issue Date : 5 May 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 0027609



Equipment : Incubator  
 Condition As-Received : Used Item  
 Reference : 2104-0019OC-1  
 Procedure Used :-

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

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	MY44060450	21LM4	NIMT	06 Mar 2022

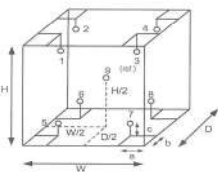
2. This certification is traceable to the SI unit.  
 3. This certificate is valid only to the item calibrated on date and place of calibration.

Remark : NIMT : National Institute of Metrology Thailand.

Result of Calibration :- ( \* ) Without Adjustment

Function of UUC\* : Temperature Source

Fresh air setting : Close



Probe Installation Details :  
 a = 10 cm  
 b = 10 cm  
 c = 10 cm  
 Dimension of Chamber :  
 D = 0.50 m  
 W = 0.64 m  
 H = 0.80 m  
 Capacity = 0.26 m<sup>3</sup>

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

-o0o-

เอกสารไม่ควบคุม

a 1052708



Equipment : Incubator  
 Condition As-Received : Used Item  
 Reference : 2104-0019OC-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 k
35.0	35.0	35.0	0.11	0.36	0.55	0.30	2

Calibration Point (°C)	Measured Temperature (°C)								
	Position								
	1	2	3	4	5	6	7	8	9 (ref.)
35.0	34.946	35.035	35.120	35.087	34.989	35.121	34.745	35.004	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 %.

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เอกสารไม่ควบคุม

a 1052707



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

## Certificate of Calibration

**Equipment :** Incubator  
**Manufacturer :** Memmert  
**Model :** IPP 260  
**Serial No. :** V616.0066  
**ID No. :** UAE.MIC.032/2559  
**Submitted by :** United Analyst and Engineering Consultant Co., Ltd.  
3 Soi Udomsuk 41, Sukhumvit Road,  
Bangchak, Phrakhanong,  
Bangkok 10260  
**Location :** Microbiology Laboratory (302)  
**Received Order :** 28 October 2021  
**Calibration Date :** 28 - 29 October 2021  
**Ambient Temperature :** ( 26 ± 10 ) °C  
**Relative Humidity :** ( 50 ± 30 ) %  
**Calibrated by :** Kunchit Promprat  
**Approved by :**   
( ) Pornthippa Tameyakul  
( / ) Malee Butkruea  
( ) Suwit Imjai  
**Issue Date :** 4 November 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



**Equipment :** Incubator  
**Condition As-Received :** Used Item  
**Reference :** 2110-0698OC-1  
**Procedure Used :-**

Cert. No.: 21TM1874  
Page.: 2 of 3

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

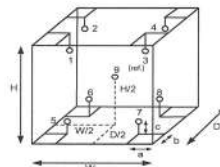
2. This certificate is valid only to the item calibrated on date and place of calibration.

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 :

Dimension of Chamber :		
a = 5.0 cm	D = 0.50 m	
b = 5.0 cm	W = 0.64 m	
c = 5.0 cm	H = 0.80 m	
	Capacity = 0.26 m <sup>3</sup>	

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	15RTD2/18
9 (ref.)	15RTD2/19

เอกสารไม่ควบคุม



**Equipment :** Incubator  
**Condition As-Received :** Used Item  
**Reference :** 2110-0698OC-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 k
25.0	25.0	24.5	0.053	0.25	0.42	0.30	2
35.0	35.0	35.0	0.029	0.43	0.75	0.30	2

Calibration Point ( °C )	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	24.786
35.0	35.340	35.384	35.336	35.307	34.680	35.120	34.813	34.996	35.088

**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



Cert. No.: 21TM422  
Page.: 1 of 3

## Certificate of Calibration

**Equipment :** Water Bath  
**Manufacturer :** Memmert  
**Model :** WNE 14  
**Serial No. :** L416.0606  
**ID No. :** UAE.MIC.002/2560  
**Submitted by :** United Analyst and Engineering Consultant Co., Ltd.  
3 Soi Udomsuk 41, Sukhumvit Road,  
Bangchak, Phrakhanong,  
Bangkok 10260  
**Location :** Microbiology Laboratory  
**Received Order :** 22 February 2021  
**Calibration Date :** 22 February 2021  
**Ambient Temperature :** ( 26 ± 10 ) °C  
**Relative Humidity :** ( 50 ± 30 ) %  
**Calibrated by :** Man Pattanapongpaiboon  
**Approved by :**   
( ) Pornthippa Tameyakul  
( / ) Malee Butkruea  
( ) Suwit Imjai  
**Issue Date :** 3 March 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



Equipment : Water Bath  
 Condition As-Received : Used Item  
 Reference : 2102-0751OC-3  
 Procedure Used :-

Cert. No.: 21TM422  
 Page.: 2 of 3

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

The temperature scale used was based on ITS-90.

#### Condition of this result of calibration

1. Reference standard instrument:-

Instrument	Serial No.	Cert. No.	Traceable	Due Date
1) Data Acquisition	MY44036292	20LM5	NIST, NIMT	10 Apr 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.

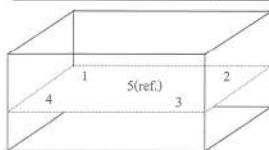
**Remark :** NIST : National Institute of Standards and Technology, The United State of America.

NIMT : National Institute of Metrology Thailand.

**Result of Calibration :-** ( \* ) Without Adjustment

**Function of UUC\* :** Temperature Source

	Environmental		AC Voltage Supply
	( °C )	( %R.H. )	( Volt )
Beginning of Calibration	24	54	219
Finished of Calibration	24	58	221



Front

Position :	Ref. Std. ID No.
1	70RC148
2	70RC149
3	70RC150
4	70RC151
5(ref.)	70RC152

เอกสารไม่ควบคุม

๑ 1๐4๓๐21



Equipment : Water Bath  
 Condition As-Received : Used Item  
 Reference : 2102-0751OC-3  
 Result of Calibration :- ( \* ) Without Adjustment  
 Function of UUC\* : Temperature Source

Cert. No.: 21TM422  
 Page.: 3 of 3

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	44.462	44.465	44.510	44.496	44.460

Calibration point ( °C )	Uniformity ( °C )	Stability ( ± °C )	Uncertainty ( ± °C )	Coverage Factor k
44.5	0.097	0.046	0.15	2

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

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

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

**UUC\* :** Unit Under Calibration

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

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

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เอกสารไม่ควบคุม

๑ 1๐4๓๐2๐



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)  
 CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES  
 534/4 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG BANGKOK 10250  
 TEL. 0-2717-3000-37 FAX. 0-2719-9484



Cert. No.: 21TM423  
 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, Phrakhanong,  
 Bangkok 10260  
**Location :** Microbiology Laboratory  
**Received Order :** 22 February 2021  
**Calibration Date :** 23 February 2021  
**Ambient Temperature :** ( 26 ± 10 ) °C  
**Relative Humidity :** ( 50 ± 30 ) %  
**Calibrated by :** Man Pattanasongpaiboon

**Approved by :**   
 Approved Signatory

( ) Pormthippa Tameyakul  
 ( ✓ ) Maiee Butkruea  
 ( ) Suwit Imjai

**Issue Date :** 3 March 2021

The Uncertainties are for a confidence probability of approximately 95%

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เอกสารไม่ควบคุม

A 002538



Equipment : Water Bath  
 Condition As-Received : Used Item  
 Reference : 2102-0751OC-4  
 Procedure Used :-

Cert. No.: 21TM423  
 Page.: 2 of 3

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

The temperature scale used was based on ITS-90.

#### Condition of this result of calibration

1. Reference standard instrument:-

Instrument	Serial No.	Cert. No.	Traceable	Due Date
1) Data Acquisition	MY44036292	20LM5	NIST, NIMT	10 Apr 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.

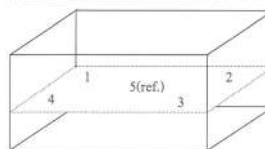
**Remark :** NIST : National Institute of Standards and Technology, The United State of America.

NIMT : National Institute of Metrology Thailand.

**Result of Calibration :-** ( \* ) Without Adjustment

**Function of UUC\* :** Temperature Source

	Environmental		AC Voltage Supply
	( °C )	( %R.H. )	( Volt )
Beginning of Calibration	24	56	220
Finished of Calibration	24	59	221



Front

Position :	Ref. Std. ID No.
1	70RC148
2	70RC149
3	70RC150
4	70RC151
5(ref.)	70RC152

เอกสารไม่ควบคุม

A 0025329



Equipment : Water Bath  
 Condition As-Received : Used Item  
 Reference : 2102-07510C-4  
 Result of Calibration :- ( \* ) Without Adjustment  
 Function of UUC\* : Temperature Source

Cert. No.: 21TM423  
 Page.: 3 of 3

Calibration point ( °C )	UUC* Setting ( °C )	UUC* Reading ( °C )	Average* Standard Reading ( °C )				
			Position				
			1	2	3	4	5 (ref.)
44.5	44.5	44.5	44.531	44.474	44.492	44.514	44.537

Calibration point ( °C )	Uniformity ( °C )	Stability ( ± °C )	Uncertainty ( ± °C )	Coverage Factor k
44.5	0.12	0.044	0.15	2

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

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

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

UUC\* : Unit Under Calibration

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

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

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เอกสารไม่ควบคุม  
 1043928



National Food Institute, Ministry of Industry, Thailand

2008 Soi 35, Anun Arun Road, Bang Yi Khan Subdistrict, Bang Phai District, Bangkok 10700, Thailand  
 Tel : +66 (0) 24-22 8688 Fax : +66 (0) 24-22 8558 Website : www.nfi.or.th E-mail : cal@nfi.or.th



## Calibration Certificate

Certificate No.: 2200705-001-01  
 Client name: UNITED ANALYST AND ENGINEERING CONSULTANT CO.,LTD.  
 Address: 3 Soi Udomsuk 41, Sukhumvit Road,  
 Bangchack, Prakanong, Bangkok 10260

Page 1 of 3

Equipment: Electronic Balance

Manufacturer: METTLER TOLEDO

Model: MS6035/01

Serial No.: B007010311

ID No.: UAE.MIC.008/2553

Order No.: 2200705

Operation No.: 2200705-001

Date of Receipt: 24 November 2021

Date of Calibration: 24 November 2021

Calibrated by Mr.Jumpon Pimsri  
 Scientist

Approved by   
 (Mr.Pheraphat Tuanjit)  
 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 reproduced other than in full except with the prior written approval of the National Food Institute.

F-CS-009 Revision: 00 Date: 14-12-61

เอกสารไม่ควบคุม



National Food Institute, Ministry of Industry, Thailand

2008 Soi 35, Anun Arun Road, Bang Yi Khan Subdistrict, Bang Phai District, Bangkok 10700, Thailand  
 Tel : +66 (0) 24-22 8688 Fax : +66 (0) 24-22 8558 Website : www.nfi.or.th E-mail : cal@nfi.or.th



## Calibration Report

Certificate No.: 2200705-001-01

Equipment: Electronic Balance  
 Model: MS6035/01  
 Serial No.: B007010311  
 Capacity: 620 g g  
 Manufacturer: METTLER TOLEDO  
 Resolution: 0.001 g  
 ID No.: UAE.MIC.008/2553

Date of Calibration: 24 November 2021 Page 2 of 3

Environment Condition: Ambient Temperature: 24.1 ± 0.6 °C Relative Humidity: 48 ± 2.5 %

Place of Calibration: 306 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-9A-001 In-House Method based on UKAS Lab 14 : 2019

2. Reference Standards:

Reference Standard	Model	Serial No.	Calibrated By	Certificate No.	Due Date
Standard Weight Class E2	1-500mg	B308068554	TCS	M21010575	12 January 2022
Standard Weight Class E2	1-500g	B308068128	TCS	M21010585	13 January 2022
Instrument	Model	Serial No.	Calibrated By	Certificate No.	Due Date
Thermo-Hygro Meter	PONPE 490	NFLBTH 001/17	Quality Reborn	QR21-0299	15 February 2022

3. This certification is traceable to SI UNIT

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

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

Calibration Results:

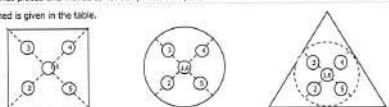
1. Repeatability of Reading:

Nominal Value ( g )	Standard Deviation of Reading ( g )
300	0.00052
600	0.00063

2. Off-Center Error:

A mass of 200 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 )
200.001	200.000	200.002	200.001	200.000	200.002	0.002

เอกสารไม่ควบคุม

F-CS-012 Revision: 00 Date: 14-12-61



National Food Institute, Ministry of Industry, Thailand

2008 Soi 35, Anun Arun Road, Bang Yi Khan Subdistrict, Bang Phai District, Bangkok 10700, Thailand  
 Tel : +66 (0) 24-22 8688 Fax : +66 (0) 24-22 8558 Website : www.nfi.or.th E-mail : cal@nfi.or.th



## Calibration Report

Certificate No.: 2200705-001-01

Equipment: Electronic Balance  
 Model: MS6035/01  
 Serial No.: B007010311  
 Capacity: 620 g g  
 Manufacturer: METTLER TOLEDO  
 Resolution: 0.001 g  
 ID No.: UAE.MIC.008/2553

Date of Calibration: 24 November 2021 Page 3 of 3

Calibration Results: (Continued)

Calibration Range: 0-600 g

Calibration Adjustment: Internal Calibration

3. Departure from Nominal Value:

Nominal value ( g )	Standard Value ( g )	Average Reading ( g )	Correction ( g )	Uncertainty ( ± g )	Coverage Factor k
Unload	0.0000	0.000	0.000	0.00088	2.00
0.1	0.1000	0.099	0.001	0.00088	2.00
0.5	0.5000	0.500	0.000	0.00088	2.00
1	1.0000	1.000	0.000	0.00088	2.00
5	5.0000	5.000	0.000	0.00088	2.00
10	10.0000	10.000	0.000	0.00088	2.00
20	20.0000	20.000	0.000	0.00089	2.00
50	49.9999	50.001	-0.001	0.00089	2.00
70	69.9999	70.000	0.000	0.00089	2.00
100	100.0000	100.000	0.000	0.00090	2.00
150	149.9999	150.000	0.000	0.00091	2.00
200	200.0001	199.999	0.001	0.00093	2.00
300	300.0001	300.000	0.000	0.00097	2.00
400	400.0000	400.001	-0.001	0.0011	2.00
500	499.9999	500.001	-0.001	0.0012	2.00
600	599.9999	600.000	0.000	0.0013	2.00

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

----- End -----

F-CS-012 Revision: 00 Date: 14-12-61

เอกสารไม่ควบคุม



Cert. No.: 21TM425  
Page.: 1 of 3

## Certificate of Calibration

**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,  
Bangkok, Phrakhanong,  
Bangkok 10260  
**Location :** Air Analysis Unit  
**Received Order :** 22 February 2021  
**Calibration Date :** 23 February 2021  
**Ambient Temperature :** ( 26 ± 10 ) °C  
**Relative Humidity :** ( 50 ± 30 ) %  
**Calibrated by :** Man Pattansongpaiboon  
**Approved by :**   
( ) Pornthipha Tameyakul  
(✓) Malee Butkruea  
( ) Suwit Imjai

**Issue Date :** 3 March 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 0025135



**Equipment :** Autoclave  
**Condition As-Received :** Used Item  
**Reference :** 2102-0751OC-1  
**Procedure Used :-**

Cert. No.: 21TM425  
Page.: 2 of 3

Calibration were conducted using in-house calibration procedure CP-OT03 according to direct measurement method with Data Acquisition which connected with Thermocouple Type T.  
The temperature scale used was based on ITS-90.

### Condition of this result of calibration

1. Reference standard instrument:-

Instrument	Serial No.	Cert. No.	Traceable	Due Date
1.) Data Acquisition	MY49023932	20LM6	NIST, NIMT	20 Apr 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.

4. This result of calibration covers laboratory autoclaves for the sterilization of goods and material which could be infected with organisms categorized as Hazard Group 1, 2 and 3\*\*

(\*\* = Categorization of pathogens according to hazard and categories of containment, second edition, 1990 )  
It does not cover autoclaves for use with material infect with organisms in Hazard Group 4, for which complete containment and sterilization of infected condensate is considered to be essential.

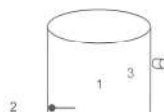
This result of calibration does not apply to sterilizers or disinfectors used for medical, dental, pharmaceutical or veterinary purposes which are directly concerned with patient care, or those used for fabrics subjected to sterilization which are required to be dry at the end of cycle.

**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



	Environmental		
	( °C )	( %R.H. )	( Volt )
Beginning of Calibration	26	61	222
Finished of Calibration	26	63	223

Position	Description	Ref. Std. Thermocouple
1 =	Center of chamber	19-16TC-08
2 =	Temperature sensor	19-16TC-09
3 =	Exhaust port	19-16TC-10

เอกสารไม่ควบคุม

a 1043935



**Equipment :** Autoclave  
**Condition As-Received :** Used Item  
**Reference :** 2102-0751OC-1

Cert. No.: 21TM425  
Page.: 3 of 3

**Result of Calibration :-** ( \* ) Without Adjustment

**Operating parameter Set :** Temperature = 116 °C  
Sterilization period = 15 minutes

UUC* Setting ( °C )	UUC* Reading ( °C )	Position	Average* Standard Reading ( °C )	Stability ( ± °C )	Pressure Reading ( MPa )	Uncertainty ( ± °C )	Coverage Factor k
116	116	1	117.021	0.23	0.08	0.92	2
		2	117.111				
		3	117.212				

**Operating parameter Set :** Temperature = 122 °C  
Sterilization period = 15 minutes

UUC* Setting ( °C )	UUC* Reading ( °C )	Position	Average* Standard Reading ( °C )	Stability ( ± °C )	Pressure Reading ( MPa )	Uncertainty ( ± °C )	Coverage Factor k
122	122	1	122.817	0.15	0.12	1.10	2
		2	122.914				
		3	122.978				

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

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

**UUC\* :** Unit Under Calibration

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

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

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