

ภาคผนวก ญ
ใบรายงานผลการวิเคราะห์



คุณภาพอากาศ



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 PREEDA CHAIYAPOOMSAKUL
ANALYZED BY : MISS JETJARN TUMSA-AT

RECEIVED DATE : MARCH 3, 2022
ANALYTICAL DATE : MARCH 3-9, 2022
REPORT NO. : 2022-U017277
WORK NO. : 2022-001209
ANALYSIS NO. : T22AD982-0001 - T22AD982-0002

PARAMETER	UNIT	METHOD OF ANALYSIS	RESULT		REGULATORY STANDARD
			WBNE-C-A3 : BAN KUT TA BONG		
			* T23AD982-0001	** T23AD982-0002	
TOTAL SUSPENDED PARTICULATE	mg/m³	GRAVIMETRIC (HIGH VOLUME METHOD)	0.028	0.028	≤ 0.33
PARTICULATE MATTER (≤ 10 µm)	mg/m³	GRAVIMETRIC (HIGH VOLUME METHOD)	0.012	0.013	≤ 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 09:00 HOUR ON FEBRUARY 20, 2022 TO 09:00 HOUR ON FEBRUARY 21, 2022.
** : SAMPLING FROM 09:00 HOUR ON FEBRUARY 21, 2022 TO 09:00 HOUR ON FEBRUARY 22, 2022.

Piyapat S.
(MRS PIYAPAT SUTTAMANUTWONG)
LABORATORY SUPERVISOR

MARCH 14, 2022



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 PREEDA CHAIYAPOOMSAKUL
ANALYZED BY : MISS JETJARN TUMSA-AT

RECEIVED DATE : MARCH 3, 2022
ANALYTICAL DATE : MARCH 3-9, 2022
REPORT NO. : 2022-U017279
WORK NO. : 2022-001209
ANALYSIS NO. : T22AD982-0003

PARAMETER	UNIT	METHOD OF ANALYSIS	RESULT	REGULATORY STANDARD
			WBNE-C-A3 : BAN KUT TA BONG T22AD982-0003	
TOTAL SUSPENDED PARTICULATE	mg/m ³	GRAVIMETRIC (HIGH VOLUME METHOD)	0.040	≤ 0.33
PARTICULATE MATTER (≤ 10 µm)	mg/m ³	GRAVIMETRIC (HIGH VOLUME METHOD)	0.024	≤ 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 09:00 HOUR ON FEBRUARY 22, 2022 TO 09:00 HOUR ON FEBRUARY 23, 2022.

Piyapat S.
(MRS PIYAPAT SUTTAMANUTWONG)
LABORATORY SUPERVISOR


MARCH 14, 2022



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
MEASURING PLACE : WBNE-C-A3 : BAN KUT TA BONG (UTM WGS 84 ZONE 47P 734939E 1731847N)
MEASURING TYPE : AMBIENT (AIR) **RECEIVED DATE** : FEBRUARY 20-23, 2022
MEASURING DATE : FEBRUARY 20-23, 2022 **ANALYTICAL DATE** : FEBRUARY 20-23, 2022
MEASURING TIME : * **REPORT NO.** : 2022-U017980
MEASURING METHOD : NON-DISPERSIVE INFRARED DETECTION **WORK NO.** : 2022-001209
MEASURED BY : MR PREEDA CHAIYAPOOMSAKUL **ANALYSIS NO.** : T22AD982-0001-T22AD982-0003

TIME*	RESULT		
	CARBON MONOXIDE		
	WBNE-C-A3 : BAN KUT TA BONG (UTM WGS 84 ZONE 47P 734939E 1731847N)		
	FEBRUARY 20-21, 2022 T22AD982-0001	FEBRUARY 21-22, 2022 T22AD982-0002	FEBRUARY 22-23, 2022 T22AD982-0003
08:00-16:00 HOUR	0.99	1.09	1.40
16:00-00:00 HOUR	1.55	1.22	1.27
00:00-08:00 HOUR	1.28	1.44	1.53
UNIT	ppm		


(MR. SILA BANJONGJAIRUK)
LABORATORY SUPERVISOR
MARCH 11, 2022

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* REPORTED ANALYSIS REFERS TO SUBMITTED SAMPLE ONLY.

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
MEASURING PLACE : WBNE-C-A3 : BAN KUT TA BONG (UTM WGS 84 ZONE 47P 734939E 1731847N)
MEASURING TYPE : AMBIENT (AIR) **RECEIVED DATE** : FEBRUARY 20-23, 2022
MEASURING DATE : FEBRUARY 20-23, 2022 **ANALYTICAL DATE** : FEBRUARY 20-23, 2022
MEASURING TIME : * **REPORT NO.** : 2022-U017981
MEASURING METHOD : CHEMILUMINESCENCE **WORK NO.** : 2022-001209
MEASURED BY : MR. PREEDA CHAIYAPOOMSAKUL **ANALYSIS NO.** : T22AD982-0001 - T22AD982-0003

TIME *	RESULT (ppm)		
	NITROGEN DIOXIDE		
	WBNE-C-A3 : BAN KUT TA BONG (UTM WGS 84 ZONE 47P 734939E 1731847N)		
	FEBRUARY 20-21, 2022 T22AD982-0001	FEBRUARY 21-22, 2022 T22AD982-0002	FEBRUARY 22-23, 2022 T22AD982-0003
08:00-09:00 HOUR	0.0106	0.0093	0.0124
09:00-10:00 HOUR	0.0101	0.0091	0.0114
10:00-11:00 HOUR	0.0107	0.0094	0.0117
11:00-12:00 HOUR	0.0090	0.0068	0.0096
12:00-13:00 HOUR	0.0104	0.0084	0.0113
13:00-14:00 HOUR	0.0089	0.0089	0.0109
14:00-15:00 HOUR	0.0094	0.0097	0.0123
15:00-16:00 HOUR	0.0122	0.0130	0.0122
16:00-17:00 HOUR	0.0104	0.0106	0.0127
17:00-18:00 HOUR	0.0128	0.0136	0.0138
18:00-19:00 HOUR	0.0138	0.0119	0.0144
19:00-20:00 HOUR	0.0150	0.0119	0.0134
20:00-21:00 HOUR	0.0138	0.0136	0.0141
21:00-22:00 HOUR	0.0150	0.0111	0.0134
22:00-23:00 HOUR	0.0133	0.0102	0.0126
23:00-00:00 HOUR	0.0117	0.0104	0.0113
00:00-01:00 HOUR	0.0115	0.0105	0.0118
01:00-02:00 HOUR	0.0100	0.0089	0.0119
02:00-03:00 HOUR	0.0107	0.0105	0.0101
03:00-04:00 HOUR	0.0093	0.0121	0.0111
04:00-05:00 HOUR	0.0100	0.0141	0.0136
05:00-06:00 HOUR	0.0081	0.0113	0.0147
06:00-07:00 HOUR	0.0092	0.0130	0.0126
07:00-08:00 HOUR	0.0092	0.0123	0.0147


(MR. SILA BANJONGJAIRUK)
LABORATORY SUPERVISOR
MARCH 14, 2022

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ANALYSIS REPORT

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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
MEASURING PLACE : WBNE-C-A3 : BAN KUT TA BONG (UTM WGS 84 ZONE 47P 734939E 1731847N)
MEASURING TYPE : AMBIENT (AIR) **RECEIVED DATE** : FEBRUARY 20-23, 2022
MEASURING DATE : FEBRUARY 20-23, 2022 **ANALYTICAL DATE** : FEBRUARY 20-23, 2022
MEASURING TIME : * **REPORT NO.** : 2022-U017982
MEASURING METHOD : UV FLUORESCENCE **WORK NO.** : 2022-001209
MEASURED BY : MR. PREEDA CHAIYAPOOMSAKUL **ANALYSIS NO.** : T22AD982-0001 - T22AD982-0003

TIME *	RESULT (ppm)		
	SULPHUR DIOXIDE		
	WBNE-C-A3 : BAN KUT TA BONG (UTM WGS 84 ZONE 47P 734939E 1731847N)		
	FEBRUARY 20-21, 2022 T22AD982-0001	FEBRUARY 21-22, 2022 T22AD982-0002	FEBRUARY 22-23, 2022 T22AD982-0003
08:00-09:00 HOUR	0.0008	0.0022	0.0010
09:00-10:00 HOUR	0.0008	0.0015	0.0011
10:00-11:00 HOUR	0.0010	0.0015	0.0007
11:00-12:00 HOUR	0.0010	0.0010	0.0012
12:00-13:00 HOUR	0.0014	0.0011	0.0012
13:00-14:00 HOUR	0.0020	0.0009	0.0019
14:00-15:00 HOUR	0.0017	0.0009	0.0016
15:00-16:00 HOUR	0.0015	0.0009	0.0016
16:00-17:00 HOUR	0.0015	0.0009	0.0016
17:00-18:00 HOUR	0.0013	0.0011	0.0019
18:00-19:00 HOUR	0.0012	0.0014	0.0018
19:00-20:00 HOUR	0.0008	0.0012	0.0018
20:00-21:00 HOUR	0.0010	0.0017	0.0014
21:00-22:00 HOUR	0.0011	0.0024	0.0019
22:00-23:00 HOUR	0.0015	0.0019	0.0016
23:00-00:00 HOUR	0.0012	0.0020	0.0016
00:00-01:00 HOUR	0.0020	0.0020	0.0018
01:00-02:00 HOUR	0.0018	0.0017	0.0017
02:00-03:00 HOUR	0.0018	0.0023	0.0022
03:00-04:00 HOUR	0.0019	0.0021	0.0018
04:00-05:00 HOUR	0.0023	0.0020	0.0020
05:00-06:00 HOUR	0.0021	0.0023	0.0022
06:00-07:00 HOUR	0.0016	0.0020	0.0015
07:00-08:00 HOUR	0.0023	0.0017	0.0012
AVERAGE 24 HOUR	0.0015	0.0016	0.0016



(MR. SILA BANJONGJAIKAK)
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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 (AIR) **RECEIVED DATE** : FEBRUARY 20-23, 2022
SAMPLING DATE : *, **, *** **ANALYTICAL DATE** : FEBRUARY 20-23, 2022
SAMPLING TIME : *, **, *** **REPORT NO.** : 2022-U017983
SAMPLING METHOD : * **WORK NO.** : 2022-001209
SAMPLING BY : MR. PREEDA CHAIYAPOOMSAKUL **ANALYSIS NO.** : T22AD982-0001-T22AD982-0003
ANALYZED BY : MR. PREEDA CHAIYAPOOMSAKUL

PARAMETER	UNIT	METHOD OF ANALYSIS	RESULT		
			WBNE-C-A3 : BAN KUT TA BONG (UTM WGS 84 ZONE 47P 734939E 1731847N)		
			*	**	***
			T22AD982-0001	T22AD982-0002	T22AD982-0003
TOTAL HYDROCARBONS	ppm	BAG SAMPLING, TOTAL HYDROCARBON ANALYZER (FID) METHOD "	2.07	2.73	2.46
SAMPLE CONDITION			SAMPLING BAG		

REMARK

- * : SAMPLING FROM 08:00 HOUR ON FEBRUARY 20, 2022 TO 08:00 HOUR ON FEBRUARY 21, 2022
** : SAMPLING FROM 08:00 HOUR ON FEBRUARY 21, 2022 TO 08:00 HOUR ON FEBRUARY 22, 2022
*** : SAMPLING FROM 08:00 HOUR ON FEBRUARY 22, 2022 TO 08:00 HOUR ON FEBRUARY 23, 2022



(MR. SILA BANJONGJAIKAK)
LABORATORY SUPERVISOR

MARCH 11, 2022

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CONTACT INFORMATION : TEL : 0 2937 1124-9 e-mail : anucha@ecotha.net
MEASURING PLACE : WBNE-C-A3 : BAN KUT TA BONG (UTM WGS 84 ZONE 47P 734939E 1731847N)
MEASURING TYPE : AMBIENT (AJR) **RECEIVED DATE** : FEBRUARY 20-23, 2022
MEASURING DATE : FEBRUARY 20-23, 2022 **ANALYTICAL DATE** : FEBRUARY 20-23, 2022
MEASURING TIME : * **REPORT NO.** : 2022-0017984
MEASURING METHOD : WIND SPEED & WIND DIRECTION EQUIPMENT **WORK NO.** : 2022-001209
MEASURED BY : MR. PREEDA CHAIYAPOOMSAKUL **ANALYSIS NO.** : T22AD982-0001 - T22AD982-0003

TIME *	RESULT (m/s)					
	WBNE-C-A3 : BAN KUT TA BONG (UTM WGS 84 ZONE 47P 734939E 1731847N)					
	FEBRUARY 20-21, 2022 T22AD982-0001		FEBRUARY 21-22, 2022 T22AD982-0002		FEBRUARY 22-23, 2022 T22AD982-0003	
	WIND SPEED	WIND DIRECTION	WIND SPEED	WIND DIRECTION	WIND SPEED	WIND DIRECTION
08:00-09:00 HOUR	1.6	SSE	3.3	NE	1.8	N
09:00-10:00 HOUR	0.8	S	2.2	ENE	1.6	NE
10:00-11:00 HOUR	1.1	ENE	3.2	ENE	1.9	N
11:00-12:00 HOUR	1.4	NE	2.3	ENE	1.8	ENE
12:00-13:00 HOUR	0.7	NNE	3.0	ENE	1.7	E
13:00-14:00 HOUR	0.3	W	2.6	NE	1.4	ENE
14:00-15:00 HOUR	0.3	NE	3.2	NE	0.9	NE
15:00-16:00 HOUR	0.3	W	2.0	NE	0.4	N
16:00-17:00 HOUR	0.4	W	1.1	WSW	0.5	NW
17:00-18:00 HOUR	0.5	NW	1.5	W	0.9	SW
18:00-19:00 HOUR	0.3	NW	1.3	WSW	1.1	W
19:00-20:00 HOUR	0.8	ENE	1.5	WSW	1.3	W
20:00-21:00 HOUR	0.6	E	0.8	SE	2.1	W
21:00-22:00 HOUR	0.8	E	0.5	E	1.4	W
22:00-23:00 HOUR	1.2	E	0.3	WNW	1.1	WSW
23:00-00:00 HOUR	1.6	ENE	0.3	SW	0.8	WSW
00:00-01:00 HOUR	1.5	ENE	0.6	WSW	0.3	WSW
01:00-02:00 HOUR	1.3	NNE	1.1	SW	0.4	SE
02:00-03:00 HOUR	1.2	WNW	2.1	NW	1.0	WNW
03:00-04:00 HOUR	1.8	NE	1.8	NNE	0.6	NNE
04:00-05:00 HOUR	1.9	NE	1.8	NW	1.1	N
05:00-06:00 HOUR	2.1	ENE	1.6	NNE	1.6	NW
06:00-07:00 HOUR	2.6	NW	1.3	N	2.2	NNE
07:00-08:00 HOUR	2.2	NNW	1.3	SSW	1.3	ENE



(MR. SILA BANJONGJAIKUK)
LABORATORY SUPERVISOR

MARCH 14, 2022



คุณภาพน้ำผิวดิน



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 : FEBRUARY 22, 2022
SAMPLING TIME : 15:50 HOUR
SAMPLING METHOD ° : GRAB, GRAB AND STERILE TECHNIQUE
SAMPLING BY ° : MR KRIDSANAPONG NAMTHIP
ANALYZED BY : MISS PORNPIMOL WAENTHONG

RECEIVED DATE : FEBRUARY 24, 2022
ANALYTICAL DATE : FEBRUARY 24 - MARCH 14, 2022
REPORT NO. : 2022-U017822
WORK NO. : 2022-001209
ANALYSIS NO. : T22AD337-0001

PARAMETER	UNIT	METHOD OF ANALYSIS	RESULT	REGULATORY STANDARD	DETECTION LIMIT
			WBNE-C-SW5 T22AD337-0001		
pH °	-	ELECTROMETRIC METHOD AT SITE (SM4500-H° B)	8.0 (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)	175 (30°C)	-	0.1
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)	11.0	-	5.0
TOTAL DISSOLVED SOLIDS °	mg/L	TOTAL DISSOLVED SOLIDS DRIED AT 180 °C (SM 2540 C)	117	-	25
FAT, OIL AND GREASE °	mg/L	SOXHLET EXTRACTION METHOD (SM: 5520 D)	ND	-	3
TOTAL PETROLEUM HYDROCARBONS °	mg/L	SOXHLET EXTRACTION METHOD (SM: 5520 D AND 5520 F)	ND	-	3
METALS					
ARSENIC °	mg/L As	HYDRIDE GENERATION AAS METHOD (SM: 3114 C)	ND	≤ 0.01	0.0003
BARIUM °	mg/L Ba	NITRIC ACID-HYDROCHLORIC ACID DIGESTION AND INDUCTIVELY COUPLED PLASMA (ICP) METHOD (SM: 3030 F AND 3120 B)	0.095	-	0.003
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
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	0.715	-	0.005
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

PARAMETER	UNIT	METHOD OF ANALYSIS	RESULT	REGULATORY STANDARD	DETECTION LIMIT
			WBNE-C-SW5 T22AD337-0001		
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	0.031	≤ 1.0	0.002
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
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
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
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
MICROBIOLOGY					
FAECAL COLIFORM BACTERIA °	MPN/100 mL	MULTIPLE-TUBE FERMENTATION TECHNIQUE (SM 9221 E)	< 18	≤ 4,000	18
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



PARAMETER	UNIT	METHOD OF ANALYSIS	RESULT	REGULATORY STANDARD	DETECTION LIMIT
			WBNE-C-SW5 T22AD337-0001		
TOTAL XYLENES ^c	µg/L	PURGE AND TRAP GAS CHROMATOGRAPHIC/MASS SPECTROMETRIC METHOD (SM: 6200 B)	< 0.60	-	0.60
SAMPLE CONDITION WATER'S COLOUR/TURBID SEDIMENT			YELLOW/CLEAR YELLOW		

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

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

^c : 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, 23rd EDITION, 2017.

SM : STANDARD METHODS FOR THE EXAMINATION OF WATER AND WASTEWATER, APHA, AWWA, WEF, 23rd 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^d : NATURALLY BUT CHANGING NOT MORE THAN 3°C

≤ 0.005^a : WHEN WATER HARDNESS NOT MORE THAN 100 mg/L AS CaCO₃

≤ 0.05^a : WHEN WATER HARDNESS MORE THAN 100 mg/L AS CaCO₃

ND : NON-DETECTABLE

Benjawan V.

(MISS BENJAWAN VIREYOTHA)
LABORATORY SUPERVISOR

MARCH 17, 2022

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 735618E 1731580N)
SAMPLE TYPE : SURFACE WATER
SAMPLING DATE : FEBRUARY 22, 2022
SAMPLING TIME : 16:10 HOUR
SAMPLING METHOD^c : GRAB, GRAB AND STERILE TECHNIQUE
SAMPLING BY^c : MR. KRIDSANAPONG NAMTHIP
ANALYZED BY : MISS PORNPIMOL WAENTHONG

RECEIVED DATE : FEBRUARY 24, 2022
ANALYTICAL DATE : FEBRUARY 24 - MARCH 14, 2022
REPORT NO. : 2022-U017823
WORK NO. : 2022-001209
ANALYSIS NO. : T22AD337-0002

PARAMETER	UNIT	METHOD OF ANALYSIS	RESULT	REGULATORY STANDARD	DETECTION LIMIT
			WBNE-C-SW6 T22AD337-0002		
pH ^c	-	ELECTROMETRIC METHOD AT SITE (SM:4500-H ⁺ B)	8.5 (30°C)	5.0-9.0	-
TEMPERATURE ^c	°C	THERMOMETER AT SITE (SM: 2550 B)	30	n ^d	-
ELECTRICAL CONDUCTIVITY ^c	µmhos/cm	ELECTRICAL CONDUCTIVITY METHOD AT SITE (SM: 2510 B)	484 (30°C)	-	0.1
SALINITY ^c	ppt	ELECTRICAL CONDUCTIVITY METHOD AT SITE (SM: 2520 B)	0.2	-	0.1
TOTAL SUSPENDED SOLIDS ^a	mg/L	TOTAL SUSPENDED SOLIDS DRIED AT 103-105 °C (SM: 2540 D)	16.5	-	5.0
TOTAL DISSOLVED SOLIDS ^b	mg/L	TOTAL DISSOLVED SOLIDS DRIED AT 180 °C (SM: 2540 C)	419	-	25
FAT, OIL AND GREASE ^c	mg/L	SOXHLET EXTRACTION METHOD (SM: 5520 D)	ND	-	3
TOTAL PETROLEUM HYDROCARBONS ^c	mg/L	SOXHLET EXTRACTION METHOD (SM: 5520 D AND 5520 F)	ND	-	3
METALS					
ARSENIC ^c	mg/L As	HYDRIDE GENERATION AAS METHOD (SM: 3114 C)	0.0005	≤ 0.01	0.0003
BARIUM ^c	mg/L Ba	NITRIC ACID-HYDROCHLORIC ACID DIGESTION AND INDUCTIVELY COUPLED PLASMA (ICP) METHOD (SM: 3030 F AND 3120 B)	0.064	-	0.003
CADMIUM ^c	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 ^a , ≤ 0.05 ^a	0.002
COPPER ^c	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
IRON ^c	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	0.563	-	0.005
LEAD ^c	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



PARAMETER	UNIT	METHOD OF ANALYSIS	RESULT	REGULATORY STANDARD	DETECTION LIMIT
			WBNE-C-SW6 T22AD337-0002		
MANGANESE ^c	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	0.169	≤ 1.0	0.002
MERCURY ^b	mg/L Hg	IN-HOUSE METHOD: UAE.TP.HEM.002 (COLD VAPOUR ATOMIC ABSORPTION SPECTROMETRIC METHOD); SM: 3112 B	ND	≤ 0.002	0.0001
NICKEL ^c	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
SELENIUM ^c	mg/L Se	HYDRIDE GENERATION AAS METHOD (SM: 3114 C)	ND	-	0.0005
TOTAL CHROMIUM ^c	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
ZINC ^c	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
MICROBIOLOGY					
FAECAL COLIFORM BACTERIA ^b	MPN/100 mL	MULTIPLE-TUBE FERMENTATION TECHNIQUE (SM: 9221 E)	22	≤ 4,000	18
VOLATILE ORGANIC COMPOUNDS					
BENZENE ^c	µg/L	PURGE AND TRAP GAS CHROMATOGRAPHIC/MASS SPECTROMETRIC METHOD (SM: 6200 B)	< 0.20	-	0.20
ETHYLBENZENE ^c	µg/L	PURGE AND TRAP GAS CHROMATOGRAPHIC/MASS SPECTROMETRIC METHOD (SM: 6200 B)	< 0.20	-	0.20
TOLUENE ^c	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 T22AD337-0002		
TOTAL XYLENES ^c	µg/L	PURGE AND TRAP GAS CHROMATOGRAPHIC/MASS SPECTROMETRIC METHOD (SM: 6200 B)	< 0.60	-	0.60
SAMPLE CONDITION					
WATER'S COLOUR/TURBID			YELLOW/CLEAR		
SEDIMENT			YELLOW		

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

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

^c : 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, 23rd EDITION, 2017.

SM : STANDARD METHODS FOR THE EXAMINATION OF WATER AND WASTEWATER, APHA, AWWA, WEF, 23rd 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

n¹ : NATURALLY BUT CHANGING NOT MORE THAN 3°C

≤ 0.005^a : WHEN WATER HARDNESS NOT MORE THAN 100 mg/L AS CaCO₃

≤ 0.05^a : WHEN WATER HARDNESS MORE THAN 100 mg/L AS CaCO₃

ND : NON-DETECTABLE.



(MISS BENDAWAN VIRIYOTHAJ)
LABORATORY SUPERVISOR

MARCH 17, 2022

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-SW7 (UTM WGS 84 ZONE 47P 733621E 1728215N)
SAMPLE TYPE : SURFACE WATER
SAMPLING DATE : FEBRUARY 22, 2022
SAMPLING TIME : 16:35 HOUR
SAMPLING METHOD : GRAB, GRAB AND STERILE TECHNIQUE
SAMPLING BY : MR KRIDSANAPONG NAMTHIP
ANALYZED BY : MISS PORNPIPOL WAENTHONG

RECEIVED DATE : FEBRUARY 24, 2022
ANALYTICAL DATE : FEBRUARY 24 - MARCH 14, 2022
REPORT NO. : 2022-U017824
WORK NO. : 2022-001209
ANALYSIS NO. : T22AD337-0003

PARAMETER	UNIT	METHOD OF ANALYSIS	RESULT	REGULATORY STANDARD	DETECTION LIMIT
			WBNE-C-SW7 T22AD337-0003		
pH ^o	-	ELECTROMETRIC METHOD AT SITE (SM4500-H ⁺ B)	7.1 (28°C)	5.0-9.0	-
TEMPERATURE ^o	°C	THERMOMETER AT SITE (SM 2550 B)	26	n ^l	-
ELECTRICAL CONDUCTIVITY ^o	µmhos/cm	ELECTRICAL CONDUCTIVITY METHOD AT SITE (SM 2510 B)	300 (28°C)	-	0.1
SALINITY ^o	ppt	ELECTRICAL CONDUCTIVITY METHOD AT SITE (SM 2520 B)	0.1	-	0.1
TOTAL SUSPENDED SOLIDS ^a	mg/L	TOTAL SUSPENDED SOLIDS DRIED AT 103-105 °C (SM 2540 D)	9.9	-	5.0
TOTAL DISSOLVED SOLIDS ^b	mg/L	TOTAL DISSOLVED SOLIDS DRIED AT 180 °C (SM 2540 C)	210	-	25
FAT, OIL AND GREASE ^c	mg/L	SOXHLET EXTRACTION METHOD (SM: 5520 D)	ND	-	3
TOTAL PETROLEUM HYDROCARBONS ^c	mg/L	SOXHLET EXTRACTION METHOD (SM: 5520 D AND 5520 F)	ND	-	3
METALS					
ARSENIC ^o	mg/L As	HYDRIDE GENERATION AAS METHOD (SM: 3114 C)	0.0016	≤ 0.01	0.0003
BARIUM ^o	mg/L Ba	NITRIC ACID-HYDROCHLORIC ACID DIGESTION AND INDUCTIVELY COUPLED PLASMA (ICP) METHOD (SM: 3030 F AND 3120 B)	0.046	-	0.003
CADMIUM ^o	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 ^o	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
IRON ^o	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	3.15	-	0.005
LEAD ^o	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

PARAMETER	UNIT	METHOD OF ANALYSIS	RESULT	REGULATORY STANDARD	DETECTION LIMIT
			WBNE-C-SW7 T22AD337-0003		
MANGANESE ^o	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	1.10	≤ 1.0	0.002
MERCURY ^b	mg/L Hg	IN-HOUSE METHOD: UAE.TP.HEM.002 (COLD VAPOUR ATOMIC ABSORPTION SPECTROMETRIC METHOD); SM: 3112 B	ND	≤ 0.002	0.0001
NICKEL ^o	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
SELENIUM ^o	mg/L Se	HYDRIDE GENERATION AAS METHOD (SM: 3114 C)	ND	-	0.0005
TOTAL CHROMIUM ^c	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
ZINC ^o	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
MICROBIOLOGY					
Faecal COLIFORM BACTERIA ^b	MPN/100 mL	MULTIPLE-TUBE FERMENTATION TECHNIQUE (SM: 9221 E)	33	≤ 4,000	1.8
VOLATILE ORGANIC COMPOUNDS					
BENZENE ^o	µg/L	PURGE AND TRAP GAS CHROMATOGRAPHY/MASS SPECTROMETRIC METHOD (SM: 6200 B)	< 0.20	-	0.20
ETHYLBENZENE ^o	µg/L	PURGE AND TRAP GAS CHROMATOGRAPHY/MASS SPECTROMETRIC METHOD (SM: 6200 B)	< 0.20	-	0.20
TOLUENE ^o	µg/L	PURGE AND TRAP GAS CHROMATOGRAPHY/MASS SPECTROMETRIC METHOD (SM: 6200 B)	< 0.20	-	0.20



PARAMETER	UNIT	METHOD OF ANALYSIS	RESULT	REGULATORY STANDARD	DETECTION LIMIT
			WBNE-C-SW7 T22AD337-0003		
TOTAL XYLENES ^a	µg/L	PURGE AND TRAP GAS CHROMATOGRAPHIC/MASS SPECTROMETRIC METHOD (SM: 6200 B)	< 0.60	-	0.60
SAMPLE CONDITION					
WATER'S COLOUR/TURBID SEDIMENT			YELLOW/CLEAR BROWN		

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

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

^c : 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, 23RD EDITION, 2017.

SM : STANDARD METHODS FOR THE EXAMINATION OF WATER AND WASTEWATER, APHA, AWWA, WEF, 23RD 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

if : NATURALLY BUT CHANGING NOT MORE THAN 3°C

≤ 0.005[°] : WHEN WATER HARDNESS NOT MORE THAN 100 mg/L AS CaCO₃

≤ 0.05[°] : WHEN WATER HARDNESS MORE THAN 100 mg/L AS CaCO₃

ND : NON-DETECTABLE



(MISS BENJAWAN VIRIYOTHAI)
LABORATORY SUPERVISOR

MARCH 17, 2022

คุณภาพน้ำใต้ดิน



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 : FEBRUARY 24, 2022
SAMPLING TIME : 10:30 HOUR
SAMPLING METHOD ° : SUBMERSIBLE PUMP
SAMPLING BY ° : MR KRIDSANAPONG NAMTHIP
ANALYZED BY : MISS NADNAPA KAMOLBOON

RECEIVED DATE : FEBRUARY 25, 2022
ANALYTICAL DATE : FEBRUARY 25 - MARCH 14, 2022
REPORT NO. : 2022-U019158
WORK NO. : 2022-001209
ANALYSIS NO. : T22AD446-0001

PARAMETER	UNIT	METHOD OF ANALYSIS	RESULT MWWBNE-C (UP GRADIENT) T22AD446-0001	REGULATORY STANDARD	DETECTION LIMIT
pH °	-	ELECTROMETRIC METHOD AT SITE (SM4500-H+ B)	7.8 (27°C)	-	-
TEMPERATURE °	°C	THERMOMETER AT SITE (SM 2550 B)	27	-	-
ELECTRICAL CONDUCTIVITY °	µmhos/cm	ELECTRICAL CONDUCTIVITY METHOD AT SITE (SM: 2510 B)	427 (27°C)	-	0.1
SALINITY °	ppt	ELECTRICAL CONDUCTIVITY METHOD AT SITE (SM: 2520 B)	0.2	-	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)	305	-	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
METALS					
ARSENIC °	mg/L As	HYDRIDE GENERATION AAS METHOD (SM: 3114 C)	ND	≤ 0.01	0.0003
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
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
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
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	0.084	-	0.005
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

PARAMETER	UNIT	METHOD OF ANALYSIS	RESULT MWWBNE-C (UP GRADIENT) T22AD446-0001	REGULATORY STANDARD	DETECTION LIMIT
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	< LOQ	≤ 0.5	0.002
MERCURY °	mg/L Hg	IN-HOUSE METHOD: UAE.TP.HBM.002 (COLD VAPOUR ATOMIC ABSORPTION SPECTROMETRIC METHOD); SM: 3112 B	ND	≤ 0.001	0.0001
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
SELENIUM °	mg/L Se	HYDRIDE GENERATION AAS METHOD (SM: 3114 C)	ND	≤ 0.01	0.0005
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
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	< LOQ	≤ 5.0	0.003
VOLATILE ORGANIC COMPOUNDS					
BENZENE °	µg/L	PURGE AND TRAP GAS CHROMATOGRAPHIC/MASS SPECTROMETRIC METHOD (SM: 6200 B)	< 0.20	≤ 5	0.20
ETHYL BENZENE °	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
			MWWBNE-C (UP GRADIENT) T22AD446-0001		
TOTAL XYLENES ^c	µg/L	PURGE AND TRAP GAS CHROMATOGRAPHIC/MASS SPECTROMETRIC METHOD (SM: 8200 B)	< 0.60	≤ 10,000	0.60
SAMPLE CONDITION WATER'S COLOUR/TURBID SEDIMENT			COLOURLESS/CLEAR BROWN		

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

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

^c : 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 rd EDITION, 2017.

SM : STANDARD METHODS FOR THE EXAMINATION OF WATER AND WASTEWATER, APHA, AWWA, WEF, 23 rd 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, MANGANESE ≥ 0.002 AND < 0.025 mg/L, ZINC ≥ 0.003 AND < 0.025 mg/L).

Benjawan V.

(MISS BENJAWAN VIRIYOTHAI)
LABORATORY SUPERVISOR

MARCH 17, 2022

ANALYSIS REPORT

CUSTOMER NAME	: ECO ORIENT RESOURCES (THAILAND) LTD.	RECEIVED DATE	: FEBRUARY 25, 2022
ADDRESS	: 555 RASA TOWER II, 12TH FLOOR, UNIT 1203 PHAHOLYOTHIN ROAD CHATUCHAK CHATUCHAK BANGKOK 10900	ANALYTICAL DATE	: FEBRUARY 25 - MARCH 14, 2022
CONTACT INFORMATION	: TEL : 0 2937 1124-9 e-mail : anucha@ecoohai.net	REPORT NO.	: 2022-U019161
SAMPLING SOURCE	: MWWBNE-C (DOWN GRADIENT) (UTM WGS 84 ZONE 47P 734583E 1731113N)	WORK NO.	: 2022-001209
SAMPLE TYPE	: GROUNDWATER	ANALYSIS NO.	: T22AD446-0002
SAMPLING DATE	: FEBRUARY 24, 2022		
SAMPLING TIME	: 10:15 HOUR		
SAMPLING METHOD ^c	: SUBMERSIBLE PUMP		
SAMPLING BY ^c	: MR KRIDSANAPONG NAMTHEP		
ANALYZED BY	: MISS NADNAPA KAMOLBOON		

PARAMETER	UNIT	METHOD OF ANALYSIS	RESULT	REGULATORY STANDARD	DETECTION LIMIT
			MWWBNE-C (DOWN GRADIENT) T22AD446-0002		
pH ^c	-	ELECTROMETRIC METHOD AT SITE (SM:4500-H ⁺ B)	7.5 (28°C)	-	-
TEMPERATURE ^c	°C	THERMOMETER AT SITE (SM: 2550 B)	28	-	-
ELECTRICAL CONDUCTIVITY ^c	µmhos/cm	ELECTRICAL CONDUCTIVITY METHOD AT SITE (SM: 2510 B)	654 (28°C)	-	0.1
SALINITY ^c	ppt	ELECTRICAL CONDUCTIVITY METHOD AT SITE (SM: 2520 B)	0.3	-	0.1
TOTAL SUSPENDED SOLIDS ^c	mg/L	TOTAL SUSPENDED SOLIDS DRIED AT 103-105 °C (SM: 2540 D)	ND	-	5.0
TOTAL DISSOLVED SOLIDS ^b	mg/L	TOTAL DISSOLVED SOLIDS DRIED AT 180 °C (SM: 2540 C)	396	-	25
TOTAL PETROLEUM HYDROCARBONS ^c	mg/L	SOXHLET EXTRACTION METHOD (SM: 5520 D AND 5520 F)	ND	-	3
FAT, OIL AND GREASE ^c	mg/L	LIQUID-LIQUID, PARTITION-GRAVIMETRIC METHOD (SM: 5520 B)	ND	-	3
METALS					
ARSENIC ^c	mg/L As	HYDRIDE GENERATION AAS METHOD (SM: 3114 C)	0.0003	≤ 0.01	0.0003
BARIUM ^c	mg/L Ba	NITRIC ACID-HYDROCHLORIC ACID DIGESTION AND INDUCTIVELY COUPLED PLASMA (ICP) METHOD (SM: 3030 F AND 3120 B)	0.010	-	0.063
CADMIUM ^c	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	0.062
COPPER ^c	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	0.062
IRON ^c	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	0.141	-	0.005
LEAD ^c	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



PARAMETER	UNIT	METHOD OF ANALYSIS	RESULT	REGULATORY STANDARD	DETECTION LIMIT
			MWWBNE-C (DOWN GRADIENT) T22AD446-0002		
MANGANESE ^a	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	0.028	≤ 0.5	0.002
MERCURY ^b	mg/L Hg	IN-HOUSE METHOD: UAE.TP.HEM.002 (COLD VAPOUR ATOMIC ABSORPTION SPECTROMETRIC METHOD); SM: 3112 B	ND	≤ 0.001	0.0001
NICKEL ^c	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
SELENIUM ^c	mg/L Se	HYDRIDE GENERATION AAS METHOD (SM: 3114 C)	ND	≤ 0.01	0.0005
TOTAL CHROMIUM ^c	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
ZINC ^d	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
VOLATILE ORGANIC COMPOUNDS					
BENZENE ^c	µg/L	PURGE AND TRAP GAS CHROMATOGRAPHIC/MASS SPECTROMETRIC METHOD (SM: 6200 B)	< 0.20	≤ 5	0.20
ETHYLBENZENE ^c	µg/L	PURGE AND TRAP GAS CHROMATOGRAPHIC/MASS SPECTROMETRIC METHOD (SM: 6200 B)	< 0.20	≤ 700	0.20
TOLUENE ^c	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
			MWWBNE-C (DOWN GRADIENT) T22AD446-0002		
TOTAL XYLENES ^c	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 BROWN		

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

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

^c : 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, 23RD EDITION, 2017.

SM : STANDARD METHODS FOR THE EXAMINATION OF WATER AND WASTEWATER, APHA, AWWA, WEF, 23RD 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 VIRIYOTHAJ)
LABORATORY SUPERVISOR

MARCH 17, 2022

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-GW6 (UTM WGS 84 ZONE 47P 735384E 1731798N)
SAMPLE TYPE : GROUNDWATER
SAMPLING DATE : FEBRUARY 24, 2022
SAMPLING TIME : 11:00 HOUR
SAMPLING METHOD ° : SUBMERSIBLE PUMP
SAMPLING BY ° : MR KRIDSANAPONG NAMTHIP
ANALYZED BY : MISS NADNAPA KAMOLBOON

RECEIVED DATE : FEBRUARY 25, 2022
ANALYTICAL DATE : FEBRUARY 25 - MARCH 14, 2022
REPORT NO. : 2022-U019180
WORK NO. : 2022-001209
ANALYSIS NO. : T22AD445-0001

PARAMETER	UNIT	METHOD OF ANALYSIS	RESULT	REGULATORY STANDARD	DETECTION LIMIT
			WBNE-C-GW6 T22AD445-0001		
pH °	-	ELECTROMETRIC METHOD AT SITE (SM:4500-H° B)	7.1 (30°C)	-	-
TEMPERATURE °	°C	THERMOMETER AT SITE (SM: 2550 B)	30	-	-
ELECTRICAL CONDUCTIVITY °	µmhos/cm	ELECTRICAL CONDUCTIVITY METHOD AT SITE (SM: 2510 B)	754 (30°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)	35.2	-	5.0
TOTAL DISSOLVED SOLIDS °	mg/L	TOTAL DISSOLVED SOLIDS DRIED AT 180 °C (SM: 2540 C)	490	-	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
METALS					
ARSENIC °	mg/L As	HYDRIDE GENERATION AAS METHOD (SM: 3114 C)	0.0008	≤ 0.01	0.0003
BARIUM °	mg/L Ba	NITRIC ACID-HYDROCHLORIC ACID DIGESTION AND INDUCTIVELY COUPLED PLASMA (ICP) METHOD (SM: 3030 F AND 3120 B)	0.015	-	0.003
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
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	0.034	≤ 1.0	0.002
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	12.5	-	0.005
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

PARAMETER	UNIT	METHOD OF ANALYSIS	RESULT	REGULATORY STANDARD	DETECTION LIMIT
			WBNE-C-GW6 T22AD445-0001		
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	0.266	≤ 0.5	0.002
MERCURY °	mg/L Hg	IN-HOUSE METHOD: UAE.TP.HBM.002 (COLD VAPOUR ATOMIC ABSORPTION SPECTROMETRIC METHOD); SM: 3112 B	ND	≤ 0.001	0.0001
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
SELENIUM °	mg/L Se	HYDRIDE GENERATION AAS METHOD (SM: 3114 C)	ND	≤ 0.01	0.0005
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
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	2.40	≤ 5.0	0.003
VOLATILE ORGANIC COMPOUNDS					
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
			WBNE-C-GW6 T22AD445-0001		
TOTAL XYLENES ^a	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		

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

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

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

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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).

Benjawan V.

(MISS BENJAWAN VIRIYOTHAI)
LABORATORY SUPERVISOR

MARCH 16, 2022

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-GW7 (UTM WGS 84 ZONE 47P 734949E 1727784N)
SAMPLE TYPE	: GROUNDWATER
SAMPLING DATE	: FEBRUARY 24, 2022
SAMPLING TIME	: 11:30 HOUR
SAMPLING METHOD ^a	: SUBMERSIBLE PUMP
SAMPLING BY ^a	: MR. KRIDSANAPONG NAMTHIP
ANALYZED BY	: MISS NADNAPA KAMOLBOON
RECEIVED DATE	: FEBRUARY 25, 2022
ANALYTICAL DATE	: FEBRUARY 25 - MARCH 14, 2022
REPORT NO.	: 2022-U019181
WORK NO.	: 2022-001209
ANALYSIS NO.	: T22AD445-0002

PARAMETER	UNIT	METHOD OF ANALYSIS	RESULT	REGULATORY STANDARD	DETECTION LIMIT
			WBNE-C-GW7 T22AD445-0002		
pH ^c	-	ELECTROMETRIC METHOD AT SITE (SM:4500-H ⁺ B)	6.2 (26°C)	-	-
TEMPERATURE ^c	°C	THERMOMETER AT SITE (SM: 2550 B)	26	-	-
ELECTRICAL CONDUCTIVITY ^c	µmhos/cm	ELECTRICAL CONDUCTIVITY METHOD AT SITE (SM: 2510 B)	286 (26°C)	-	0.1
SALINITY ^c	ppt	ELECTRICAL CONDUCTIVITY METHOD AT SITE (SM: 2520 B)	0.1	-	0.1
TOTAL SUSPENDED SOLIDS ^c	mg/L	TOTAL SUSPENDED SOLIDS DRIED AT 103-105 °C (SM: 2540 D)	ND	-	5.0
TOTAL DISSOLVED SOLIDS ^b	mg/L	TOTAL DISSOLVED SOLIDS DRIED AT 180 °C (SM: 2540 C)	217	-	25
FAT, OIL AND GREASE ^c	mg/L	LIQUID-LIQUID, PARTITION-GRAVIMETRIC METHOD (SM: 5520 B)	ND	-	3
TOTAL PETROLEUM HYDROCARBONS ^c	mg/L	SOXHLET EXTRACTION METHOD (SM: 5520 D AND 5520 F)	ND	-	3
METALS					
ARSENIC ^c	mg/L As	HYDRIDE GENERATION AAS METHOD (SM: 3114 C)	ND	≤ 0.01	0.0003
BARIIUM ^c	mg/L Ba	NITRIC ACID-HYDROCHLORIC ACID DIGESTION AND INDUCTIVELY COUPLED PLASMA (ICP) METHOD (SM: 3030 F AND 3120 B)	0.031	-	0.003
CADMIUM ^c	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
COPPER ^c	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	< LOQ	≤ 1.0	0.002
IRON ^c	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	0.125	-	0.005
LEAD ^c	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



PARAMETER	UNIT	METHOD OF ANALYSIS	RESULT	REGULATORY STANDARD	DETECTION LIMIT
			WBNE-C-GW7 T22AD445-0002		
MANGANESE ^a	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	0.075	≤ 0.5	0.002
MERCURY ^b	mg/L Hg	IN-HOUSE METHOD: UAE/TP.HEM.002 (COLD VAPOUR ATOMIC ABSORPTION SPECTROMETRIC METHOD); SM: 3112 B	ND	≤ 0.001	0.0001
NICKEL ^c	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
SELENIUM ^c	mg/L Se	HYDRIDE GENERATION AAS METHOD (SM: 3114 C)	ND	≤ 0.01	0.0005
TOTAL CHROMIUM ^c	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
ZINC ^c	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 ^c	µg/L	PURGE AND TRAP GAS CHROMATOGRAPHIC/MASS SPECTROMETRIC METHOD (SM: 6200 B)	< 0.20	≤ 5	0.20
ETHYLBENZENE ^c	µg/L	PURGE AND TRAP GAS CHROMATOGRAPHIC/MASS SPECTROMETRIC METHOD (SM: 6200 B)	< 0.20	≤ 700	0.20
TOLUENE ^c	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
			WBNE-C-GW7 T22AD445-0002		
TOTAL XYLENES ^a	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 BROWN		

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

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ND : NON-DETECTABLE.

< LOQ : < LEVEL OF QUANTITATION (COPPER ≥ 0.002 AND < 0.025 mg/L, ZINC ≥ 0.003 AND < 0.025 mg/L).

Benjawan V.

(MISS BENJAWAN VIRIYOTHAI)
LABORATORY SUPERVISOR

MARCH 16, 2022

ภาคผนวก ฏ
เอกสารสอบเทียบเครื่องมือ



List of Instruments Certification for Air & Noise Quality Analysis

No.	Instrument/Equipment	Parameter	Manufacturer	Model/Serial No.	Calibrator	Certification No.	Date of Calibration	Due date of Calibration	Remark
Ambient									
1	Orifice Transfer Standard Calibrator	Total Suspended Particulate (TSP) Particulate Matter < 10 µm (PM ₁₀)	Andersen Instruments, Inc	G25A 11MX	Tisch Environmental, Inc.	28062022	28 Jun 22	27 Jun 24	-
2	U-Tube Manometer	Total Suspended Particulate (TSP) Particulate Matter < 10 µm (PM ₁₀)	Dwyer	1221-36-W/M -	Technology Promotion Association (Thailand-Japan)	22P802	12 Mar 22	11 Mar 23	-
3	Aneroid Barometer	Total Suspended Particulate (TSP) Particulate Matter < 10 µm (PM ₁₀)	Barigo, Germany	-	Technology Promotion Association (Thailand-Japan)	21P2499	21 Jul 21	20 Jul 22	-
4	Dial Thermo-Hygrometer	Total Suspended Particulate (TSP) Particulate Matter < 10 µm (PM ₁₀)	Barigo, Germany	-	Technology Promotion Association (Thailand-Japan)	22H771	5 Apr 22	4 Apr 23	-
5	Nitrogen Dioxide Analyzer	Nitrogen Dioxide	Thermo Scientific	42i 1200636463	UAE Consultant Co.,Ltd.	10112021	10 Nov 21	9 Nov 22	-
6	Standard Gases (Mixture)	Nitrogen Dioxide	Airgas	EB0143262 2015PSIG	Airgas an Air Liquide company	E04NI99E15A01D3	21 Jun 21	21 Jun 24	-
7	Sulphur Dioxide Analyzer	Sulphur Dioxide	Thermo Scientific	43i 1201778114	UAE Consultant Co.,Ltd.	09062021	9 Jun 21	8 Jun 22	-
8	Standard Gases (Mixture)	Sulphur Dioxide	Airgas	EB0143262 2015PSIG	Airgas an Air Liquide company	E04NI99E15A01D3	21 Jun 21	21 Jun 24	-
9	Carbon Monoxide Analyzer	Carbon Monoxide	Thermo	48i CM08140004	UAE Consultant Co.,Ltd.	14102021	14 Oct 21	13 Oct 22	-
10	Standard Gases (Mixture)	Sulphur Dioxide	Airgas	EB0143262 2015PSIG	Airgas an Air Liquide company	E04NI99E15A01D3	21 Jun 21	21 Jun 24	-
11	Total Hydrocarbons Analyzer	Total Hydrocarbons	HORIBA	APHA-370 VV2FY3R3	UAE Consultant Co.,Ltd.	07072021	7 Jul 21	6 Jul 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 20100019	Thai Meteorological Department	205/21	12 Apr 21	11 Apr 22	-

List of Instruments Certification for Water Quality Analysis

No.	Instrument/Equipment	Parameter	Manufacturer	Model/Serial No.	Calibrator	Certification No.	Date of Calibration	Due date of Calibration	Remark
Water									
1	pH Meter	pH	YSI	pH100A JC03354	Technology Promotion Association (Thailand-Japan)	22CH60	13 Jan 22	12 Jan 23	-
2	Conductivity Meter	Conductivity	YSI	Pro30 18C105225	Technology Promotion Association (Thailand-Japan)	21CH1470	21 Oct 21	20 Oct 22	-

Certificate of Calibration

Calibration Certification Information				
Cal. Date:	June 28, 2022	Rootmeter S/N:	438220	Ta: 297 °K
Operator:	Jin Tisch	Pa:	753.6	mm Hg
Calibration Model #:	G25A	Calibrator S/N:	11MX	

Run	Vol. Init (ml)	Vol. Final (ml)	ΔVol. (ml)	ΔTime (min)	ΔP (mm Hg)	ΔH (in H ₂ O)
1	1	2	1	1.3910	3.3	2.00
2	3	4	1	0.9890	6.4	4.00
3	5	6	1	0.8850	8.0	5.00
4	7	8	1	0.8430	9.0	5.50
5	9	10	1	0.8970	12.9	8.00

Data Tabulation						
Vol (ml)	Qstd (x-axis)	$\sqrt{\Delta H \left(\frac{P_a}{P_{std}} \right) \left(\frac{V_{std}}{V_a} \right)}$	Va (x-axis)	Qs (x-axis)	$\sqrt{\Delta H \left(\frac{T_a}{T_a} \right)}$	(y-axis)
0.9900	0.7122	1.4106	0.9956	0.7158	0.8878	
0.9865	0.9975	1.9949	0.9915	1.0025	1.2555	
0.9844	1.1129	2.2304	0.9894	1.1179	1.4037	
0.9831	1.1661	2.5991	0.9881	1.1721	1.4723	
0.9779	1.4030	2.8213	0.9829	1.4031	1.7754	
m=		2.04215	m=		1.27876	
b=		-0.04258	b=		-0.02680	
r=		1.00000	r=		1.00000	

Calculations			
Vstd	ΔVstd(Pa-ΔP)/Pstd(Tstd/Ta)	Va	ΔVstd(Pa-ΔP)/Pa
Qstd	Vstd/ΔTime	Qs	Va/ΔTime
For subsequent flow rate calculations:			
Qstd	$1/m \left(\sqrt{\Delta H \left(\frac{P_a}{P_{std}} \right) \left(\frac{V_{std}}{V_a} \right)} \right) b$		
Qs	$1/m \left(\sqrt{\Delta H \left(\frac{T_a}{T_a} \right)} \right) b$		

Standard Conditions	
Vstd	250.15 mL
Pstd	760 mm Hg
Key	
ΔH:	calibrator manometer reading (in H ₂ O)
ΔP:	barometer manometer reading (mm Hg)
Ta:	actual ambient 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

เอกสารไม่ควบคุม



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES
534/4 PATANAKARN ROAD 501 18, SUKHUMVIT, BANGKOK 10258
TEL: 0-2713-3000-34 FAX: 0-2718-9448

Certificate of Calibration

Certificate No.: 22P802
Page: 1 of 2

Equipment: U-Tube Manometer
Manufacturer: Dwyer
Model: 7221-30W/M
Serial No.:
ID No.: UAE/EMA2.031/2854

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: 03 March 2022
Calibration Date: 12 March 2022

Reference: 2253-0131W5C
Ambient Temperature: (23 ± 2) °C
Relative Humidity: (50 ± 10) %
Atmospheric Pressure: 1010 mbar
Submitted by: United Analyst and Engineering Consultant Co., Ltd.
81 Soi Udomakul 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 5-1: 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	PC10EP	1189	MP-0110-21	09 Aug 2022

- This result of calibration was made on requested at the point specified by customer.
- Scale and conversion factor is 1 kPa = 4.0146293 inHg
- This instrument was used clean air as pressure media
- This instrument was calibrated by applied pressure to high-port (+) side and low-port (-) side upon to atmospheric pressure
- This instrument was installed in vertical orientation and top of the pressure port 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: Suwit Assamarn
Issue Date: 14 March 2022

Approved Signatory: Attapei P.
[] Phakree Pratsapatt
[] Sun Suwanasri
[x] Attapei Panurach

เอกสารไม่ควบคุม

n 0282415



Cert.No.: 22P802
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 Film Estimate)

UUC Indication				
Applied Pressure (inH ₂ O)	High-port side (inH ₂ O)	Low-port side (inH ₂ O)	ΔP (inH ₂ O)	Error (inH ₂ O)
0.00	0.00	0.00	0.00	0.00
2.00	1.00	-0.92	1.92	-0.08
4.00	2.00	-1.92	3.92	-0.08
6.00	3.00	-2.92	5.92	-0.08
8.00	4.02	-3.92	7.94	-0.06
10.00	5.02	-4.94	9.96	-0.04
12.00	6.04	-5.94	11.98	-0.02
14.00	7.04	-6.94	13.98	-0.02
16.00	8.06	-7.94	16.00	0.00
18.00	9.06	-8.94	18.00	0.00
20.00	10.09	-9.96	20.04	0.04
22.00	11.08	-10.96	22.04	0.04
24.00	12.10	-11.96	24.06	0.06
26.00	13.10	-12.96	26.06	0.06
28.00	14.10	-13.98	28.08	0.08
30.00	15.10	-14.98	30.08	0.08
32.00	16.12	-15.98	32.10	0.10
34.00	17.12	-16.98	34.10	0.10
36.00	17.98	-17.86	35.84	0.14

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 %.

-00-

เอกสารไม่ควบคุม

n 109524



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES
534/4 PATANAKARN ROAD 501 18, SUKHUMVIT, BANGKOK 10258
TEL: 0-2713-3000-34 FAX: 0-2718-9448

Certificate of Calibration

Certificate No.: 21P2489
Page: 1 of 2

Equipment: Aneroid Barometer
Manufacturer: Barigo
Model:
Serial No.:
ID No.: UAE/ANY.122/2590

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: 20 July 2021
Calibration Date: 21 July 2021

Reference: 2107-0570W5C
Ambient Temperature: (23 ± 2) °C
Relative Humidity: (50 ± 10) %
Atmospheric Pressure: 1009 mbar
Submitted by: United Analyst and Engineering Consultant Co., Ltd.
81 Soi Udomakul 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-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	DRH42	1422505046	MP-0053-21	08 Apr 2022

- This instrument was installed in vertical orientation and center of the dial was used as the reference level.
- This result of calibration was made on requested at the point specified by customer.
- This instrument was used clean air as pressure media.
- This 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: Suwit Assamarn
Issue Date: 22 July 2021

Approved Signatory: Attapei P.
[] Phakree Pratsapatt
[] Sun Suwanasri
[x] Attapei Panurach

เอกสารไม่ควบคุม

n 0264462



Cert.No.: 21P2499
Page: 2 of 2

Result of calibration: Without adjustment
Function: Absolute Pressure Measurement

Range: 900 hPa to 1030 hPa
Scale Interval: 1 hPa (The FIM Estimate)

Increasing Pressure

Applied Pressure (hPa)	957.00	969.27	981.15	990.48	1000.99	1010.75	1020.58	1029.49
UUC* Indication (hPa)	960.0	970.0	980.0	990.0	1000.0	1010.0	1020.0	1030.0
Error (hPa)	2.34	0.73	-0.15	-0.48	-0.68	-0.75	-0.58	0.51

Decreasing Pressure

Applied Pressure (hPa)	1029.41	1020.69	1010.80	1000.75	990.59	980.39	969.41	957.79
UUC* Indication (hPa)	1030.0	1020.0	1010.0	1000.0	990.0	980.0	970.0	960.0
Error (hPa)	0.39	-0.69	-0.90	-0.78	-0.59	-0.30	-0.59	2.21

The uncertainty of measurement was ± 0.30 hPa

* UUC = Unit Under Calibration

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

-00-

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a 1062243



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
CORPORATE SERVICES & EQUIPMENT CALIBRATION AND TESTING SERVICES
534/4 PATTANAKARN ROAD SOI 18, SIAMLIANG, SIAMLIANG, BANGKOK 10250
TEL. 0-2717-009-24 FAX. 0-2719-9184



Certificate of Calibration

Certificate No.: 22H1771
Page: 1 of 2

Equipment: Dial Thermo-Hygrometer

Manufacturer: Barigo

Model: -

Serial No.: -

ID No.: UAE.ANV.0092548

Condition As-Received: Used Item

Received Date: 30 March 2022

Calibration Date: 01 April 2022

to 05 April 2023

Reference: 2503-1134WSC

Ambient Temperature: $(25 \pm 3) ^\circ\text{C}$

Relative Humidity: $(50 \pm 20) \%$

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

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

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

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

Condition of this result of calibration

1. Reference standards instruments:

Instrument	Model	Serial No.	Certificate No.	Due Date
1) Standard Chilled Mirror Hygrometer Sensor	Dew Prime II	31883	19714	17 Sep 2022
2) Standard Humidity/Temperature Meter	400	10200027	TH-0063-21	01 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 maintained at:-

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

-National Institute of Metrology Thailand (NIMT)

Calibrated by: Somchai Durneer

Issue Date: 08 April 2022

Approved Signatory:

[Signature]
[Signature]
[Signature]

เอกสารไม่ควบคุม
a 0285423



Cert. No.: 22H1771
Page: 2 of 2

Result of Calibration: Without Adjustment

Function:	Reference Temperature ($^{\circ}\text{C}$)	Standard Humidity (%R.H.)	UUC* Reading (%R.H.)	Error (%R.H.)	Uncertainty of Measurement (%R.H.)
	25.0	40.1	42	1.8	1.8
	25.0	60.0	61	1.0	1.8
	25.0	80.0	78	-2.0	2.0

Result of Calibration: Without Adjustment

Function:	Standard Temperature ($^{\circ}\text{C}$)	UUC* Reading ($^{\circ}\text{C}$)	Error ($^{\circ}\text{C}$)	Uncertainty of Measurement ($^{\circ}\text{C}$)
	20.02	20.0	-0.02	0.72
	29.98	30.0	0.02	0.72
	35.02	35.0	-0.02	0.72
	40.03	40.0	-0.03	0.72

UUC* : Unit Under Calibration

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

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เอกสารไม่ควบคุม
a 1104141



United Analyst and Engineering Consultant Co., Ltd.
3 Soi Udomsak 41, Sukhumvit Road, Bangkok, Phrakhanong, Bangkok 10260
Tel. 0 2763 2828 Fax 0 2763 2900 www.uaeconsultant.com E-mail: uae@uaeconsultant.com

MULTI-POINT GAS TEST REPORT

Test Date: Nov 10, 2021

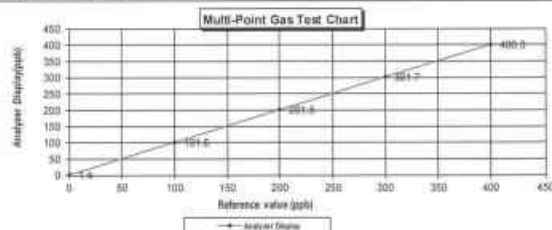
Equipment: Gas Analyzer (NO_x) Model: 421
Manufacturer: Thermo Scientific Serial Number: 1200536463

Standard Gas Concentration

Standard Gas Concentration	Value	Unit	Dilutor Detail
Sulphur Dioxide (SO ₂)	44.75	PPM	Manufacturer: Thermo Scientific
Nitric Oxide (NO)	45.35	PPM	Model: 146
Methane (CH ₄)	-	PPM	Serial Number: 1180540071
Carbon Monoxide (CO)	1007	PPM	
Cylinder No.:	CC199599		
Expiration Date:	Jul 30, 2022		

Multi-point gas test data

Reference Value (ppb)	Analyzer Display (ppb)	Difference Error	Percent Error	[% Error]
Level 1: Zero	0.0	1.4	1.40	1.40
Level 2: 20.00%	100.0	101.6	1.02	1.57
Level 3: 40.00%	200.0	201.5	1.50	0.74
Level 4: 60.00%	300.0	301.7	1.70	0.56
Level 5: 80.00%	400.0	400.5	0.13	0.12
Remark: Measuring Range	500.0 ppb		Average Difference (%)	0.88
Acceptable Limit	$\pm 5\%$			



Calculate by
[Signature]
10/11/21

Approve by
[Signature]
10/11/21

เอกสารไม่ควบคุม

CERTIFICATE OF ANALYSIS

Grade of Product: EPA Protocol

Part Number: ED4N199E15A0103 Reference Number: 122-402135187-1
Cylinder Number: EBD143262 Cylinder Volume: 144.4 CF
Laboratory: 124 - Durham (SAP) - NC Cylinder Pressure: 2015 PSIG
PGVP Number: B22021 Valve Outlet: 680
Gas Code: CO,NO,NOX,SO2,BALN Certification Date: Jun 21, 2021

Expiration Date: Jun 21, 2024

Certification performed in accordance with EPA Toxicology Protocol for Analytical Certification of Gas and Calibration Standards (May 2012) document EPA 800/1-12931, using the assay procedures listed. Analytical methodology does not require correction for analytical interference. This certificate has a total analytical uncertainty of stated below with a confidence level of 95%. There are no significant irregularities which affect the use of this calibration status. All concentrations are on a mole/mole basis unless otherwise noted.

Do Not Use This Certificate before 100 ppb, i.e. 5.7 mg/m³

Component	Requested Concentration	Actual Concentration	Protocol Method	Total Relative Uncertainty	Assay Date
NOX	40.00 PPM	45.36 PPM	G1	+/- 1.4% NIST Traceable	09/14/2021, 09/21/2021
NITRIC OXIDE	40.00 PPM	40.34 PPM	G1	+/- 1.4% NIST Traceable	09/14/2021, 09/21/2021
SULFUR DIOXIDE	40.00 PPM	44.83 PPM	G1	+/- 1.0% NIST Traceable	09/14/2021, 09/21/2021
CARBON MONOXIDE	1000 PPM	1064.4 PPM	G1	+/- 0.7% NIST Traceable	09/14/2021, 09/21/2021
NITROGEN	Balance				08/14/2021

Type	Lot ID	Cylinder No	Concentration	Uncertainty	Expiration Date
NTRM	20001120	CC706058	40.02 PPM NITRIC OXIDE/NITROGEN	+/- 1.0%	Feb 02, 2026
PRM	12398	D865025	3.91 PPM NITROGEN DIOXIDE/AIR	+/- 2.5%	Feb 20, 2030
GMS	401423930102	CC805581	4.348 PPM NITROGEN DIOXIDE/NITROGEN	+/- 2.1	Feb 18, 2023
NTRM	16011043	CC473277	40.02 PPM SULFUR DIOXIDE/NITROGEN	+/- 0.8%	Jun 17, 2022
NTRM	14020119	CC434277	980.9 PPM CARBON MONOXIDE/NITROGEN	+/- 0.6%	Nov 15, 2025

The SO2, PM10 or H2O noted above is only in reference to the GMS used in the assay and not part of the analysis.

Instrument/Make/Model	Analytical Principle	Last Multipoint Calibration
Nicolet 8700 AHR0601333 CO	FTIR	Jun 03, 2021
Nicolet 8700 AHR0601333 NO	FTIR	Jun 03, 2021
Nicolet 8700 AHR0601333 NO2	FTIR	Jun 03, 2021
Nicolet 8700 AHR0601333 SO2	FTIR	Jun 03, 2021

Triad Data Available Upon Request

NOTES: PO #5221002607
GROSS WT: 28.40kg
NET WT: 4.73kg



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

Approved for Release



MULTI-POINT GAS TEST REPORT

Test Date : June 9, 2021

Equipment : Gas Analyzer (SO₂) Model : 45
Manufacturer : Thermo SCIENTIFIC Serial Number : 1201776114

Standard Gas Concentration

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

Dilutor Detail

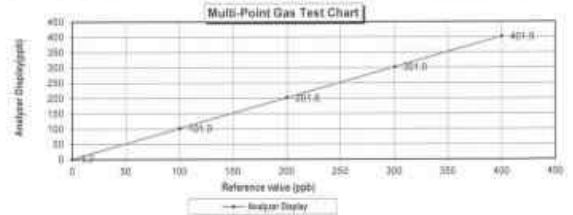
Manufacturer : Thermo SCIENTIFIC
Model : 1461
Serial Number : 1180540071

Multi-point gas test data

Level	Reference Value (ppb)	Analyzer Display (ppb)	Difference Error	Percent Error	[% Error]
Level 1	Zero	0.0	1.70	1.70	1.70
Level 2	20.00%	101.9	1.90	1.88	1.88
Level 3	40.00%	201.6	1.60	0.79	0.79
Level 4	60.00%	301.9	1.90	0.63	0.63
Level 5	80.00%	401.9	1.90	0.47	0.47

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

Average Difference (%) : 1.09



Calculate by
Srichan-y
9 June 2021

Approve by
Phum-h
9 June 2021

CERTIFICATE OF ANALYSIS

Grade of Product: EPA Protocol

Part Number: ED4N199E15A0103 Reference Number: 122-402135187-1
Cylinder Number: EBD143262 Cylinder Volume: 144.4 CF
Laboratory: 124 - Durham (SAP) - NC Cylinder Pressure: 2015 PSIG
PGVP Number: B22021 Valve Outlet: 680
Gas Code: CO,NO,NOX,SO2,BALN Certification Date: Jun 21, 2021

Expiration Date: Jun 21, 2024

Certification performed in accordance with EPA Toxicology Protocol for Analytical Certification of Gas and Calibration Standards (May 2012) document EPA 800/1-12931, using the assay procedures listed. Analytical methodology does not require correction for analytical interference. This certificate has a total analytical uncertainty of stated below with a confidence level of 95%. There are no significant irregularities which affect the use of this calibration status. All concentrations are on a mole/mole basis unless otherwise noted.

Do Not Use This Certificate before 100 ppb, i.e. 5.7 mg/m³

Component	Requested Concentration	Actual Concentration	Protocol Method	Total Relative Uncertainty	Assay Date
NOX	40.00 PPM	45.36 PPM	G1	+/- 1.4% NIST Traceable	09/14/2021, 09/21/2021
NITRIC OXIDE	40.00 PPM	40.34 PPM	G1	+/- 1.4% NIST Traceable	09/14/2021, 09/21/2021
SULFUR DIOXIDE	40.00 PPM	44.83 PPM	G1	+/- 1.0% NIST Traceable	09/14/2021, 09/21/2021
CARBON MONOXIDE	1000 PPM	1064.4 PPM	G1	+/- 0.7% NIST Traceable	09/14/2021, 09/21/2021
NITROGEN	Balance				08/14/2021

Type	Lot ID	Cylinder No	Concentration	Uncertainty	Expiration Date
NTRM	20001120	CC706058	40.02 PPM NITRIC OXIDE/NITROGEN	+/- 1.0%	Feb 02, 2026
PRM	12398	D865025	3.91 PPM NITROGEN DIOXIDE/AIR	+/- 2.5%	Feb 20, 2030
GMS	401423930102	CC805581	4.348 PPM NITROGEN DIOXIDE/NITROGEN	+/- 2.1	Feb 18, 2023
NTRM	16011043	CC473277	40.02 PPM SULFUR DIOXIDE/NITROGEN	+/- 0.8%	Jun 17, 2022
NTRM	14020119	CC434277	980.9 PPM CARBON MONOXIDE/NITROGEN	+/- 0.6%	Nov 15, 2025

The SO2, PM10 or H2O noted above is only in reference to the GMS used in the assay and not part of the analysis.

Instrument/Make/Model	Analytical Principle	Last Multipoint Calibration
Nicolet 8700 AHR0601333 CO	FTIR	Jun 03, 2021
Nicolet 8700 AHR0601333 NO	FTIR	Jun 03, 2021
Nicolet 8700 AHR0601333 NO2	FTIR	Jun 03, 2021
Nicolet 8700 AHR0601333 SO2	FTIR	Jun 03, 2021

Triad Data Available Upon Request

NOTES: PO #5221002607
GROSS WT: 28.40kg
NET WT: 4.73kg



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

Approved for Release



MULTI-POINT GAS TEST REPORT

Test Date : Oct 14, 2021

Equipment : Gas Analyzer (CO) Model : 480
Manufacturer : Thermo SCIENTIFIC Serial Number : CM68140004

Standard Gas Concentration

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

Dilutor Detail

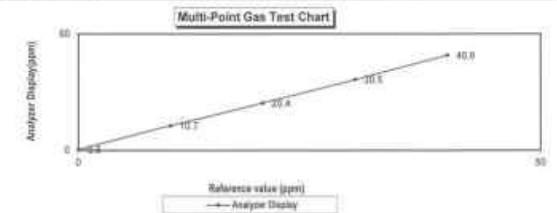
Manufacturer : Thermo SCIENTIFIC
Model : 1461
Serial Number : 1180540071

Multi-point gas test data

Level	Reference Value (ppm)	Analyzer Display (ppm)	Difference Error	Percent Error	[% Error]
Level 1	Zero	0.0	0.5	0.5	0.5
Level 2	20.00%	10.7	0.7	6.5	6.5
Level 3	40.00%	20.4	0.4	2.0	2.0
Level 4	60.00%	30.5	0.5	1.6	1.6
Level 5	80.00%	40.0	0.0	2.2	2.2

Remark : Measuring Range : 50.0 ppm
Acceptable Limit \pm 5%

Average Difference (%) : 2.57



Calculate by
Srichan-y
14 Oct 2021

Approve by
Phum-h
14 Oct 2021



Certificate of Calibration

Equipment : Conductivity Meter
Manufacturer : VSI
Model : Pro 30
Serial No. : 18C105225
ID No. : LAE.EPM.20812561 (ENV.507.04-51)
Condition As-Received : Used Item
Received Date : 19 October 2021
Calibration Date : 21 October 2021
Reference : 2110-0601W5C-1
Submitted by : United Analyst and Engineering Consultant Co., Ltd.
3 Sol Udomsak 41, Si-dumvit Road,
Bangkok, Phrakharang, Bangkok 10250
Ambient Temperature : 25 ± 2.5 °C
Relative Humidity : 52 ± 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 Larnagatrakul

Approved by :

✓ / Mako Dullavea
() Sathip Moongnui
() Warakorn Larnagatrakul

Issue Date : 29 October 2021

The Uncertainties are for a confidence probability of approximately 95%

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Approved by the user of the certificate: _____

เอกสารไม่ควบคุม
A 0033914



Condition of this result of calibration

1. Reference Standard Instrument

Instrument	Serial No.	ID No.	Certificate No.	Due date
1) Thermometer	1863378	134RC095	211877	17 Sep 2022
2) Ref. Sol Thermometer	3240078	60RC032	211153	14 Feb 2022

This certificate 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 B through CPA Chem Ltd., ANSI-ASQ National Accreditation Board, Accredited No. AR-1335

Conductivity Solution	Manufacturer	Lot No.	Exp. date
1413.0 µS/cm	CPA Chem	761021	02 Aug 2022
12.8806 mS/cm	CPA Chem	754057	28 Jun 2022

- Control Conductivity calibration solution temperature by Water bath (20 ± 0.1 °C)

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

Calibration results

Function : Conductivity Measurement

1*) After Adjustment at 1413.0 µS/cm

Conductivity Electrode Serial No.: 18C106559

Standard Conductivity Solution	Before Adjustment UUC* Reading	After Adjustment UUC* Reading	Uncertainty of Measurement (\pm)	Coverage factor k
1413.0 µS/cm 12.8806 mS/cm	1530 µS/cm 12.73 mS/cm	1413 µS/cm 12.85 mS/cm	± 1 µS/cm 0.062 mS/cm	2.50 2.50

Remark : - UUC* = Unit Under Calibration

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a 1079152



Calibration Results

Function : Temperature Measurement

(*) Without adjustment

This equipment was connected with Temperature Probe:

- Model : PRO 30 COND-1
- Serial No. : 18C105559

Dimension of probe:

- Length : 8 mm.
- Diameter : 2.5 mm.
- Immersion Depth : 80 mm.

Calibration Point (°C)	Standard Temperature (°C)	UUC* Reading (°C)	Error (°C)	Uncertainty of Measurement (\pm °C)	Coverage factor k
25.0	25.005	25.0	-0.005	0.20	2.50
30.0	30.004	30.0	-0.004	0.20	2.50
35.0	35.004	35.0	-0.004	0.20	2.50

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
a 1079152

โครงการผลิตปิโตรเลียมบนบก พื้นที่ผลิต WBNE และพื้นที่ผลิต STE แปลงสำรวจบนบกหมายเลข L44/43 อำเภอวิเชียรบุรี
และอำเภอศรีเทพ จังหวัดเพชรบูรณ์ ระหว่างเดือนมกราคม - มิถุนายน พ.ศ. 2565
บริษัท อีโค โอเรียนท์ รีซอสเซส (ประเทศไทย) จำกัด

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	22 Apr 21	21 Apr 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), โครเมียมเฮกซะวาเลนท์ (Cr6+)	Agilent Technologies	System ID:G8432A AA240FS / MY13160001	Thailand Institute of Scientific and Technological Research (TISTR).	MTC.ACL. No. 335/64	28 Jan 22	27 Jan 23	-
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	-

บริษัท ยูไนเต็ด แอนนาลิสต์ แอนด์ เอ็นจิเนียริ่ง คอนซัลแตนท์ จำกัด
ห้องปฏิบัติการวิเคราะห์มาตรฐาน ISO/IEC 17025

โครงการผลิตปิโตรเลียมบนบก พื้นที่ผลิต WBNE และพื้นที่ผลิต STE แปลงสำรวจบนบกหมายเลข L44/43 อำเภอวิเชียรบุรี
และอำเภอศรีเทพ จังหวัดเพชรบูรณ์ ระหว่างเดือนมกราคม - มิถุนายน พ.ศ. 2565
บริษัท อีโค โอเรียนท์ รีซอสเซส (ประเทศไทย) จำกัด

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	แบคทีเรียกลุ่มฟีคอลโคลิฟอร์ม (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	17 Feb 22	16 Feb 23	-
15	Water Bath		Memmert	WNE 14 / L416.0612	Technology Promotion Association (Thailand-Japan)	21TM423	17 Feb 22	16 Feb 23	-
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 / 808763	Technology Promotion Association (Thailand-Japan)	22TM681	27 May 22	26 May 23	-

Due Date of Calibration* : กำหนดตามแผนการสอบเทียบประจำปี อย่างน้อยปีละ 1 ครั้ง

Mettler-Toledo (Thailand) Ltd.
848/4 - 848/5 Lasalle Rd., Bangna Tai Sub-District
Bangna District, Bangkok 10260
+66 2723 0362
MT-TH.ServiceSupport@mt.com



Accuracy Calibration Certificate

Customer

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

Weighing Device

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

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

Procedure

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

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

The sensitivity/span of the weighing instrument was adjusted before calibration with a built-in weight.
In accordance with EURAMET cg-18 (11/2015), the test loads were selected to reflect the specific use of the weighing device or to accommodate specific calibration conditions.

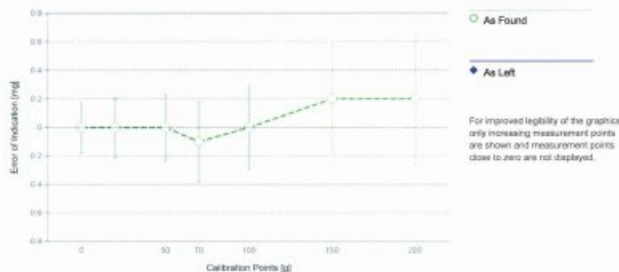
	Temperature	Humidity
As Found	Start: 22.5 °C End: 21.4 °C	Start: 56.1 % End: 63.2 %

As Found Calibration Date: 07-Apr-2022 Calibration: 
As Left Calibration Date: N/A
Issue Date: 08-Apr-2022 Approved Signatory: 
☒ Kessakorn Tassanachaisakul
☐ Sans Jitriyom
☐ Surachet Sukkate

เอกสารไม่ควบคุม

Error of Indication

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



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

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

Test Equipment

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

Weight Set 1: OIML E2

Weight Set No.: WS60 Date of Issue: 23-Feb-2022
Certificate Number: C208581631 Calibration Due Date: 14-Aug-2023

Thermo Hygrometer

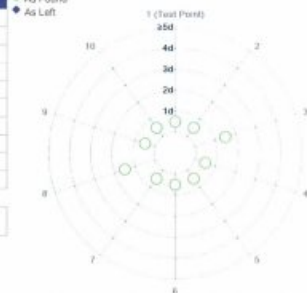
Equipment No.: IN161 Date of Issue: 14-Jun-2021
Certificate Number: 21H1220 Calibration Due Date: 01-Jun-2022

เอกสารไม่ควบคุม

Measurement Results

Repeatability

Test Load: 100 g	As Found	As Left
1	99.9999 g	N/A
2	100.0000 g	N/A
3	99.9998 g	N/A
4	100.0000 g	N/A
5	99.9999 g	N/A
6	100.0000 g	N/A
7	99.9999 g	N/A
8	100.0001 g	N/A
9	99.9999 g	N/A
10	100.0000 g	N/A
Standard Deviation	0.00008 g	N/A



The '1' in the graph represents the readability of the range/interval in which the test was performed.
The results of this graph are based upon the absolute values of the difference from the mean value.

Eccentricity

Test Load: 100 g	Position	As Found	As Left
1	100.0000 g	N/A	N/A
2	99.9998 g	N/A	N/A
3	99.9998 g	N/A	N/A
4	100.0001 g	N/A	N/A
5	100.0001 g	N/A	N/A
Maximum Deviation	0.0002 g	N/A	N/A



The '1' in the graph represents the readability of the range/interval in which the test was performed.

เอกสารไม่ควบคุม

Remarks

Equipment condition: Good
Next calibration according to customer's procedure
Calibration data not decide by calibration laboratory
Test weight by Filter pan: 1 g = 0.9999 g, 3 g = 3.0000 g, 5 g = 5.0000 g

End of Accredited Section

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

เอกสารไม่ควบคุม

Measurement Uncertainty of the Weighing Instrument in Use

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

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

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

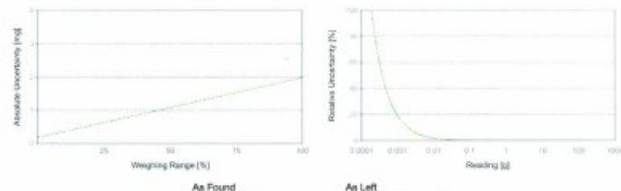
Linearization of Uncertainty Equation

Range	d	Max	As Found	As Left
1	0.0001 g	220 g	$U_1 = 0.19 \text{ mg} + 0.00817 \text{ mg/g} \cdot R$	N/A

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

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

Net Indication	As Found	As Left
0.0220 g	0.19 mg	0.86%
0.2200 g	0.19 mg	0.087%
2.2000 g	0.21 mg	0.0090%
22.0000 g	0.37 mg	0.0017%
220.0000 g	2.0 mg	0.00090%



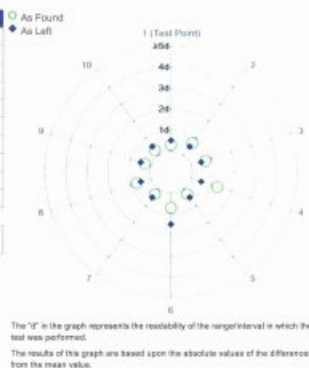
เอกสารไม่ควบคุม

Measurement Results

Repeatability

Test Load: 100 g

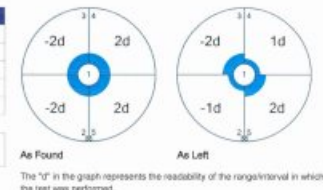
	As Found	As Left
1	100.0005 g	99.9999 g
2	100.0004 g	100.0000 g
3	100.0004 g	99.9999 g
4	100.0006 g	100.0000 g
5	100.0005 g	99.9999 g
6	100.0004 g	99.9998 g
7	100.0005 g	100.0000 g
8	100.0004 g	100.0000 g
9	100.0005 g	100.0000 g
10	100.0005 g	100.0000 g
Standard Deviation	0.00007 g	0.00007 g



Eccentricity

Test Load: 100 g

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



เอกสารไม่ควบคุม

Mettler-Toledo (Thailand) Ltd.
84/84 - 84/85 Leslie Rd., Bangna T-Sub-District
Bangna District, Bangkok 10260
+66 2723 0382
MT-TH.ServiceSupport@mt.com



Accuracy Calibration Certificate

Customer

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

Weighing Device

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

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

Procedure

Calibration Guideline: EURAMET cg-18 v. 4.0 (11/2015)
METTLER TOLEDO Work Instruction: CPM002/20

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

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

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

	Temperature	Humidity
As Found	Start: 22.6 °C End: 22.1 °C	Start: 56.6 % End: 51.9 %
As Left	Start: 22.3 °C End: 22.4 °C	Start: 48.2 % End: 55.8 %

As Found Calibration Date: 07-Apr-2022 Calibrator:
As Left Calibration Date: 07-Apr-2022
Issue Date: 08-Apr-2022
Approved Signatory:
☒ Krasorn Tassanasachakul
☐ Sam Jitvrom
☐ Surachet Sukkate

เอกสารไม่ควบคุม

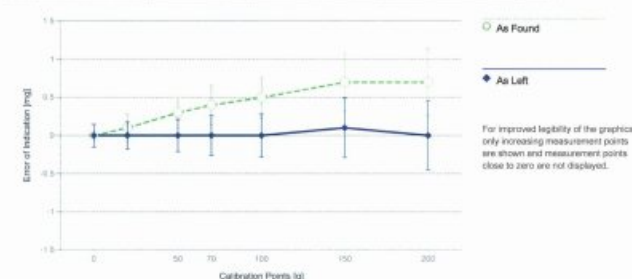
Error of Indication

As Found

	Reference Value	Indication	Error of Indication	Expanded Uncertainty	k
1	0.0000 g	0.0000 g	0.0000 g	0.15 mg	2
2	0.1000 g	0.1001 g	0.0001 g	0.16 mg	2
3	1.0000 g	0.9999 g	-0.0001 g	0.16 mg	2
4	5.0000 g	5.0000 g	0.0000 g	0.16 mg	2
5	10.0000 g	10.0001 g	0.0001 g	0.17 mg	2
6	20.0000 g	20.0001 g	0.0001 g	0.18 mg	2
7	50.0000 g	50.0003 g	0.0003 g	0.20 mg	2
8	70.0001 g	70.0005 g	0.0004 g	0.26 mg	2
9	100.0000 g	100.0005 g	0.0005 g	0.27 mg	2
10	150.0000 g	150.0007 g	0.0007 g	0.36 mg	2
11	200.0001 g	200.0008 g	0.0007 g	0.44 mg	2

As Left

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



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

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

เอกสารไม่ควบคุม

Test Equipment

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

Weight Set 1: OIML E2

Weight Set No.: W580 Date of Issue: 23-Feb-2022
Certificate Number: C20581631 Calibration Due Date: 14-Aug-2023

Thermo Hygrometer

Equipment No.: IN161 Date of Issue: 14-Jun-2021
Certificate Number: Z1H1220 Calibration Due Date: 01-Jun-2022

Remarks

FACT adjustment functionality activated
Value of the built-in weight adjusted
Equipment condition: Good
Next calibration according to customer's procedure
Calibration data not decide by calibration laboratory
Test weight by Fiker pan: 1 g = 1.0000 g, 3 g = 3.0000 g, 5 g = 5.0000 g

End of Accredited Section

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

Measurement Uncertainty of the Weighing Instrument in Use

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

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

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

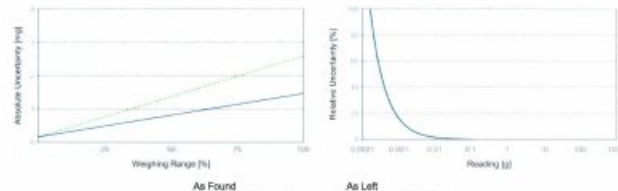
Linearization of Uncertainty Equation

Range	d	Max	As Found	As Left
1	0.0001 g	220 g	$U_1 = 0.16 \text{ mg} + 0.0111 \text{ mg/g} \cdot R$	$U_1 = 0.16 \text{ mg} + 0.00992 \text{ mg/g} \cdot R$

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

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

Net Indication	As Found	As Left
0.0220 g	0.16 mg	0.16 mg
0.2200 g	0.16 mg	0.16 mg
2.2000 g	0.18 mg	0.17 mg
22.0000 g	0.40 mg	0.29 mg
220.0000 g	2.6 mg	1.5 mg



บริษัท ไทยยูนิค จำกัด THAI UNIQUE CO., LTD.

80-82 ถนนประชาวิทย์ไทย แขวงบางขุนพรหม เขตพระนคร กรุงเทพฯ 10200
80-82 Prachathipatai Rd., Bangkhunphrom, Pranakorn, Bangkok 10200
Tel: 0-2629-0191-5, 0-2280-1787, Fax: 0-2280-1788, E-mail: thawan@thaiunique.com, Website: www.thaiunique.com

CERTIFICATE OF CALIBRATION GAS CHROMATOGRAPH MASS SPECTROMETER

Certificate No.: SV2205/20385

Customer: United Analyst and Engineering Consultant Co., Ltd.
Address: 3 Soi Udomsuk 41 Sukhumvit Rd. Bangchak
Phrakhanong Bangkok Thailand 10260

Instruments Model: MS Scion-SQ S/N GQS1203F021
GC 451-GC S/N BR1203M099
AUTO SAMPLER CP8400 S/N BR1203M331

Standard Reference Number: 393065201
Procedure Document Number: 394207000

System Test

PM perform and Diagnostic Test	<input checked="" type="checkbox"/> PASS	<input type="checkbox"/> FAIL
Air Water Check Test	<input checked="" type="checkbox"/> PASS	<input type="checkbox"/> FAIL
Tune Test EI	<input checked="" type="checkbox"/> PASS	<input type="checkbox"/> FAIL
Signal to Noise Test (EI) SCAN	<input checked="" type="checkbox"/> PASS	<input type="checkbox"/> FAIL
Injection EI Area Precision Test	<input checked="" type="checkbox"/> PASS	<input type="checkbox"/> FAIL
Injection EI RT Precision Test	<input checked="" type="checkbox"/> PASS	<input type="checkbox"/> FAIL
User Demonstration	<input checked="" type="checkbox"/> PASS	<input type="checkbox"/> FAIL

Engineer: Somchai Pohtongkam

Date: 19 May 2022

SCION™ Operational Qualification Protocol

For SCION Instrument

Name and Model:

Serial Number:

System ID Number:

Publication no. 394207000

Revision A

November 2011

Contact

Scion 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.

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



www.scion.com/support.html

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เอกสารไม่ควบคุม

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เอกสารไม่ควบคุม

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)	SOMCHAI POHTONGKAM
Title	ENGINEER
Signature	<i>Somchai P.</i>
Initials	SOMCHAI
Date	19 MAY 22

Name (Print)	
Title	
Signature	
Initials	
Date	

เอกสารไม่ควบคุม

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

เอกสารไม่ควบคุม


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)	CHANA CHANSRI
Title	ENGINEER
Signature	
Initials	
Date	19 MAY 2022

Name (Print)	
Title	
Signature	
Initials	
Date	

เอกสารไม่ควบคุม

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	

เอกสารไม่ควบคุม

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		Reviewer Initials		QA/QC Initials	
Date	19 MAY 22	Date		Date	

เอกสารไม่ควบคุม

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 Scion 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 Scion does not provide full qualification instructions for non-Scion manufactured accessories. Limited instructions may be supplied. If qualification of a non-Scion 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.

เอกสารไม่ควบคุม

- 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 initiated 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	<i>Sachet R</i>	Reviewer Initials		QA/QC Initials	
Date	19 MAY 02	Date		Date	

เอกสารไม่ควบคุม

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	<i>Sachet R</i>	Reviewer Initials		QA/QC Initials	
Date	19 MAY 02	Date		Date	

เอกสารไม่ควบคุม

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	<i>Sachet R</i>	Reviewer Initials		QA/QC Initials	
Date	19 MAY 02	Date		Date	

เอกสารไม่ควบคุม

4.6 Required Materials

The following stock solutions are required:

- 100 pg/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	Sachin P.	Reviewer Initials		QA/QC Initials	
Date	19 MAY 22	Date		Date	

เอกสารไม่ควบคุม

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	Sachin P.	Reviewer Initials		QA/QC Initials	
Date	19 MAY 22	Date		Date	

4.8 Specific Instructions for Documentation

The Reviewer designates specific documentation instructions as follows.

Permanent Ink Color	Blue
Preferred Date Format	19 MAY 22

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

Qualification Rep. Initials	Sachin P.	Reviewer Initials		QA/QC Initials	
Date	19 MAY 22	Date		Date	

เอกสารไม่ควบคุม

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	Sachin P.	Reviewer Initials		QA/QC Initials	
Date	19 MAY 22	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	Sachin P.	Reviewer Initials		QA/QC Initials	
Date	19 MAY 22	Date		Date	

เอกสารไม่ควบคุม

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	Sachin P.	Reviewer Initials		QA/QC Initials	
Date	19 MAY 22	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:
 - Scion notified that Part Number XXXXX and XXXX are missing.
 - Scion 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.

Qualification Rep. Initials	Sachin P.	Reviewer Initials		QA/QC Initials	
Date	19 MAY 22	Date		Date	

เอกสารไม่ควบคุม

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 P.M. Protocol

Qualification Rep. Initials	<u>Sudhavit P.</u>	Reviewer Initials		QA/QC Initials	
Date	<u>19 MAY 22</u>	Date		Date	

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

Qualification Rep. Initials	<u>Sudhavit P.</u>	Reviewer Initials		QA/QC Initials	
Date	<u>19 MAY 22</u>	Date		Date	

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

Qualification Rep. Initials	<u>Sudhavit P.</u>	Reviewer Initials		QA/QC Initials	
Date	<u>19 MAY 22</u>	Date		Date	

เอกสารไม่ควบคุม

5.2 System Description

5.2.1 SCION Description

Installation Date: <u>2015</u>	Principal Operator:	Phone Number:
Company Information		
Company: <u>United Analyst and Engineering</u>		
Installation Site: <u>LAB</u>		
Name:	Building:	
Address: <u>3 Soi Udomsuk 41</u>	Address/Location: <u>Sukhumvit Rd.</u>	
City, State: <u>Bangchak, Bangkok</u>	City, State: <u>Bangkok</u>	
Zip/Country: <u>Thailand</u>	Zip/Country: <u>10260</u>	
System Description		
SCION: <u>SQ</u>	Serial Number:	<u>GQS 1203F021</u>
Sales Order Number:	Sales Order Addendum Number:	
GC		
Module Type: <u>Scion 151</u>	Serial Number:	<u>BR1203M099</u>
AutoSampler		
Module Type: <u>dp 8400</u>	Serial Number:	<u>BR1203M331</u>
MS Workstation		
Version: <u>MSWS 8.2.1</u>	Serial Number:	<u>01106-6711-88Q-450C</u>
Computer Operating System		
Operating System: <u>Windows 7</u>	Version: <u>Pro</u>	Service Pack: <u>-</u>
Computer		
Make: <u>Dell</u>	Model: <u>optiplex</u>	Serial No.: <u>DNNYHSI</u>
Hard Drive: <u>1TB</u>		Size/RAM: <u>8GB</u>
Addendum Number(s): <u>2. System description</u>		

Qualification Rep. Initials	<u>Sudhavit P.</u>	Reviewer Initials		QA/QC Initials	
Date	<u>19 MAY 22</u>	Date		Date	

เอกสารไม่ควบคุม

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

Qualification Rep. Initials	<u>Sudhavit P.</u>	Reviewer Initials		QA/QC Initials	
Date	<u>19 MAY 22</u>	Date		Date	

เอกสารไม่ควบคุม

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 250lm X 0.25lm.

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>Sudhavit P.</u>	Reviewer Initials		QA/QC Initials	
Date	<u>19 MAY 22</u>	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 ≥500:1		✓		
PCI Full Scan‡	100 pg BZP	80-230	S/N ≥500:1	✓			
NCI Full Scan‡	200 fg OFN	200-300	S/N ≥1000:1	✓			

Qualification Rep. Initials	<u>Sudhavit P.</u>	Reviewer Initials		QA/QC Initials	
Date	<u>19 MAY 22</u>	Date		Date	

เอกสารไม่ควบคุม

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 ± 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

เอกสารไม่ควบคุม

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	3.670	70230
2	3.668	80953
3	3.669	78432
4	3.667	75823
5	3.668	79060
6	3.669	81491
7	3.670	81644
8	3.671	79531
9	3.670	79852
10	3.668	81366
% RSD	0.03	4.16

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

Addendum _____

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

เอกสารไม่ควบคุม

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 N/A

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

เอกสารไม่ควบคุม

5.6 Final Evaluation

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

Qualification Rep. Initials	<u>Sardam P.</u>	Reviewer Initials		QA/QC Initials	
Date	<u>19 MAY 22</u>	Date		Date	

เอกสารไม่ควบคุม

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 DPS400

Serial Number(s): GQS1203F021

Sales Order Number: _____

Company Name: United Analyst 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	

เอกสารไม่ควบคุม

6.2 Operational Qualification Protocol Assignment

This Operational Qualification Protocol document is used for:

Operational Qualification Protocol as final test at Scion	<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 Scion

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

Instrument(s): Scion 451 SQ with DPS400

Serial Number(s): GQS1203F021

Sales Order Number: _____

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

เอกสารไม่ควบคุม

Scion Certified Engineer

Name (Print)	<u>SOMCHAI POHTONGKAM</u>
Title	<u>ENGINEER</u>
Signature	<u>Somchai P.</u>
Initials	<u>SOMCHAI</u>
Date	

6.4 Remarks

เอกสารไม่ควบคุม

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.

เอกสารไม่ควบคุม

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	
-----------------------	--

This area is intentionally left blank.

เอกสารไม่ควบคุม

	
<h1>Certificate</h1>	
It is hereby certified that	
Mr.Somchai Pohtongkam	
Has successfully completed the Service & Application Training for	
Scion Chromatography Products	
Training Contents were:	
Hardware Operation, Software operation, Data analysis and Installation, & Troubleshooting of Model:	
SCION GC, GCMS SQ, GCMS TQ	
At Techcomp Singapore	
By Mr. Michael Mei (Service Manager)	
On 11 th –15 th July 2016	
 Hans van den Heuvel Commercial Director Scion Instruments	
Date: 19 July 2016	Cert. No.: TSG-SCIONGC-15011602

เอกสารไม่ควบคุม

Addendum Procedure: P.M. Protocol Page Number: 1

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
-----------------------	-----

This area is intentionally left blank.

เอกสารไม่ควบคุม

Qualification Rep. Initials		Reviewer Initials		QA/QC Initials	
Date	19 MAY 22	Date		Date	

เอกสารไม่ควบคุม



PREVENTIVE MAINTENANCE PROTOCOL
FOR GAS CHROMATOGRAPH MASS SPECTROMETER

Model & Serial Number: SQ S/N G3S19203F021
Customer : United Analyst and Engineering Consultant Co., Ltd.
Date: 10 MAY 2022

GC System

- ☒ Clean all system
- ☒ Check circuit board connector and cable
- ☒ Check column oven heater feed - through, fan motor, mount and bearings
- ☒ Check all LED's and readout display
- ☒ Check operation of all heated zones
- ☒ Check flow rates, filters and gases
- ☒ Verify flow controller operation

MS System

- ☒ Check fan motor MS
- ☒ Check circuit board connector and cable
- ☒ Run electronic Diagnostics
- ☒ Check Gas Clean Filter
- ☒ Check for leak system
- ☒ Check turbo pump (system status)
- ☒ Check vacuum oil
- ☒ Check temperature zone
- ☒ Check air/water (mass 18:19; 28)
- ☒ Check HMN
- ☒ Clean Trap (Saturn,MS200, 4000 Series) or Ion source (1200L, 500, SQ,TQ Series)
- ☒ Check Electron multiplier (If close to 2,000 Volts, Change the multiplier)
- ☒ Check Cal Gas (FC-43)
- ☒ Sensitivity (EI Scan Mode S/N Ratio with for OFN)
- ☒ Check %RSD of Area (EI Scan Mode , for OFN)
- ☒ Check %RSD of RT (EI Scan Mode , for OFN)

SIGN :

Engineer :

Sarun P.
Sarun P. Pattanasakorn

Customer :

(.....)

Version information

About 451-GC Details

Software Version: 5.09

Hostname: GC_123 (IP 10.190.65.10)
Mac Address: 00:e0:4b:34:f5:0d

Software Version: 4.05

GC_Application: 27267
LUI_Application: 0

Ok

Version information

About 451-GC Details

Hardware:
Mainboard: 14
Mainboard SerialNr: 200048
Option Board: 0
Option Board SerialNr: 0

Firmware:
I/O Controller: 2.2
I/O Extender: 1.3
Option Board Controller: 0.0

Ok

เอกสารไม่ควบคุม

เอกสารไม่ควบคุม

Version information

About 451-GC Details

Injector EFCs:
Software Version
Front: 1.35
Middle: 1.35
Rear: 0.0
Serial number
Front: 26254
Middle: 26256
Rear: -1

Ok

Version information

About 451-GC Details

Auxiliary EFCs:
Software Version
Front: 0.0
Middle: 0.0
Rear: 0.0
Serial number
Front: 0
Middle: 0
Rear: 0

Ok

Version information

About 451-GC Details

Autosampler:
CP84xMBus: 2.0
CP84xTS1: 1.0
CP84xTS6: 1.20
CP84xTray: 1.20
CP84xTower: 1.20
CP84xSyringe: 1.21
CP84xPlunger: 1.20

GC Application build info:

Ok

เอกสารไม่ควบคุม

เอกสารไม่ควบคุม

Version information

About 451-GC Details

CP84xxTray: 1.20
 CP84xxTower: 1.20
 CP84xxSyringe: 1.21
 CP84xxPlunger: 1.20

GC Application build info:
 User: autobuilder
 IP address: 10.190.65.195
 Mac address: 00:26:b9:86:6a:c4
 Timestamp: 19-09-2011 18:25

Ok

451-GC Setup

Column Oven Zone: Temp Limit 250.0 C, No Coolant
 Zone 1 Front S/S/L: Temp Limit 250.0 C, No Coolant
 Zone 2 Mid PTV: Temp Limit 325.0 C, LN2 Coolant
 Zone 3 Not Configured
 Zone 4 Not Configured
 Zone 5 Not Configured
 Zone 6 Not Configured
 Valve 01 is Unused
 Valve 02 is Unused
 Valve 03 is Unused
 Valve 04 is Unused
 Valve 05 is Unused
 Valve 06 is Unused
 Valve 07 is Unused
 Valves 08-15 not installed, require option board

Front S/S/L Injector is associated with zone 1
 Mid PTV Injector is associated with zone 2
 Front Injector EFC Type 21 Outlet: Vacuum, Units: psi, Spillless Vent: 20 ml/min, Gas Saver: 20 ml/min after 0.00 min, Backflush Disabled
 Mid Injector EFC Type 21 Outlet: Air, Units: psi, Spillless Vent: 20 ml/min, Gas Saver: 20 ml/min after 0.00 min, Backflush Disabled

Front Column (Type WOOT) is Configured with L=3000 cm, D=250 microns, He Carrier Gas
 DBS24
 Mid Column (Type WOOT) is Configured with L=3000 cm, D=250 microns, He Carrier Gas
 BP-500
 Rear Column not Configured

8400 Autosampler connected to SID-2 is Configured with 10 ul Syringe, Inj Ports in Both Positions
 Nothing connected to SID-1

8400 Dual Mode Setup Prev OK

เอกสารไม่ควบคุม

MSWS 8.2.1 for TQ MS

BRUKER
 Daltonics
 MS Workstation

System Control Version 8.2.1

Copyright ? 2016, Bruker Service Code: MSWS-01106

Enabled Module Drivers:
 Bruker GC-MS
 43x-GC
 Bruker CTC PAL-xt

Installation History:
 MS Workstation
 S/N: 01106-6711-880-450C
 Installed by Bruker
 Organization: Microsoft
 Installation date: 14/8/2563 9:27

Validate Installed Files Close

เอกสารไม่ควบคุม

SCION Operational Qualification Protocol

Addendum Procedure: 2. System description Page Number: 5

SCION Operational Qualification Protocol

Addendum Procedure: 3. Test Result Page Number: 30

Qualification Rep. Initials	<i>Sachin P.</i>	Reviewer Initials		QA/QC Initials	
Date	19 MAY 22	Date		Date	

Qualification Rep. Initials	<i>Sachin P.</i>	Reviewer Initials		QA/QC Initials	
Date	19 MAY 22	Date		Date	

เอกสารไม่ควบคุม

เอกสารไม่ควบคุม

SCION MS system hardware test
Test date 5-18-2022

Main module test
Passed -> Power supply test
Passed -> Main user analog out test

CIDV module test

5-18-2022
vent valve can only be tested when vented:
pressure sensor and pneumatics not tested in single quad system:
Passed -> cidv module test

onv module test

5-18-2022
Passed -> onv module test

CIG Tests only performed on a CI system
EI module test

8-28-2022
Passed -> EI High voltage DC rail test
Passed -> EI Lens 1 test
Passed -> Lens 2 test
Passed -> Repeller test
Passed -> Electron energy test
Passed -> EI Source test

CI Tests only performed on a CI system
Det module test

5-18-2022

Detector module test
Passed -> Power supply test
Passed -> HV Power supply Type test
Passed -> HV Power supply Revision test
Passed -> Detector accelerator test
Passed -> Detector baseline dac test
Passed -> Detector Noise test
Passed -> Detector multiplier dac test:
Passed -> Detector module test
QB module test

5-18-2022

Passed -> QB module test

QI module test

5-18-2022

Passed -> QI module test

เอกสารไม่ควบคุม

เอกสารไม่ควบคุม

Main module test

5-18-2022
Passed -> LED Test
Passed -> Speaker Test
Passed -> Power supply test
Passed -> Main user analog out test
Passed -> Main module test

CIDV module test

5-18-2022
Passed -> CIDV Power supply test
Passed -> Turb0 control test
vent valve can only be tested when vented
pressure sensor and pneumatics not tested in single quad system
Passed -> cidv module test

เอกสารไม่ควบคุม

เอกสารไม่ควบคุม

env module test
5-18-2022
Passed -> Power supply test
Passed -> temp sensor test
Passed -> Valve current test
Passed -> env fan test
Passed -> heater current test
Passed -> env module test

EI module test
5-18-2022
Passed -> EI Power supply test
Passed -> EI High voltage DC rail test
Passed -> EI Lens 1 test
Passed -> Lens 2 test
Passed -> Repeller test
Passed -> Electron energy test
Passed -> AMP test
Passed -> EI Filament test
Check maximum heater current and heater wattage
Max Heater Current = 1.27 Wattage = 29.65
Source heater wattage measures OK
Passed -> EI Heater test
Passed -> EI Source test

เอกสารไม่ควบคุม

เอกสารไม่ควบคุม

Dut module test
5-18-2022
Passed -> Power supply test
Passed -> HV Power supply fyon test
Passed -> HV Power supply Revision test
Passed -> Detector accelerator test
Passed -> Detector baseline dac test
Passed -> Detector Noise test
Passed -> Detector multiplier dac test
Passed -> Detector module test

Q0 module test
5-18-2022
Passed -> Power supply test
Passed -> Q0 high voltage DC rail test
Passed -> Q0 DAC test
Passed -> Quad offset test
Passed -> RF detector test
Passed -> RF modulator test
Passed -> RF current test
Passed -> heater current test
Passed -> Q0 module test

เอกสารไม่ควบคุม

เอกสารไม่ควบคุม

Sample ID:	cfm1pg	Operator:	TU
Instrument ID:	Brucker GC/MS #1	Last Calibration:	26/11/2557 15:55
Measurement Type:	Area	Calibration Type:	External Standard
Acquisition Date:	19/5/2565 12:23	Data File:	...022\oq\cfm1pg008.xmls
Calculation Date:	19/5/2565 12:28	Method:	...ds\pm2017fs_plv.mth
Sample Type:	Analysis		
Inj. Sample Notes:	None		

Compound Information

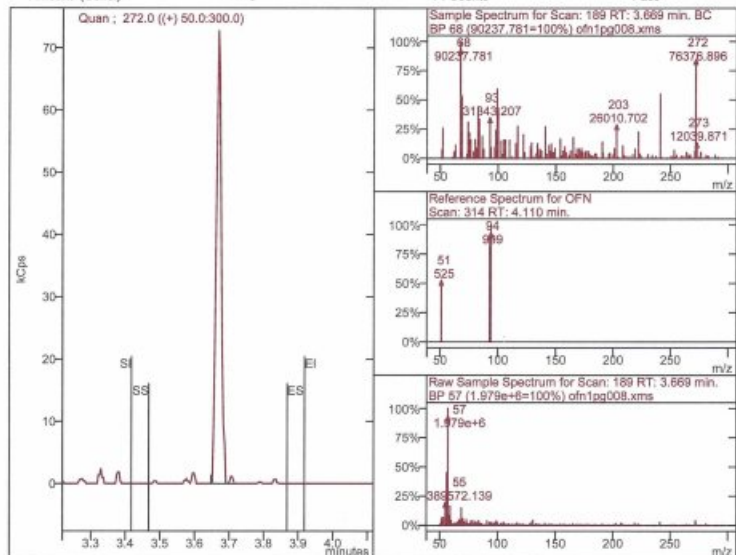
Peak Name:	OFN	Compound Number: 1	CAS Number: None	Identified
Result Index:	1			

Identification

Parameter	Specification	Actual	Status
Search Type	Highest		
Retention Time	3.668 +/- 0.200	3.670 min.	Pass
Match Result		N/A	

Integration and Quantitation

Parameter	Specification	Actual	Status
Quan Ions	272.0		
Calibration Equation	Average		
Area	>=10	74230	Pass
Height		72761	
Amount (Conc.)	>= 0	74 Counts	Pass



เอกสารไม่ควบคุม

Sample ID:	cfm1pg	Operator:	TU
Instrument ID:	Brucker GC/MS #1	Last Calibration:	26/11/2557 15:55
Measurement Type:	Area	Calibration Type:	External Standard
Acquisition Date:	19/5/2565 12:36	Data File:	...022\oq\cfm1pg009.xmls
Calculation Date:	19/5/2565 12:41	Method:	...ds\pm2017fs_plv.mth
Sample Type:	Analysis		
Inj. Sample Notes:	None		

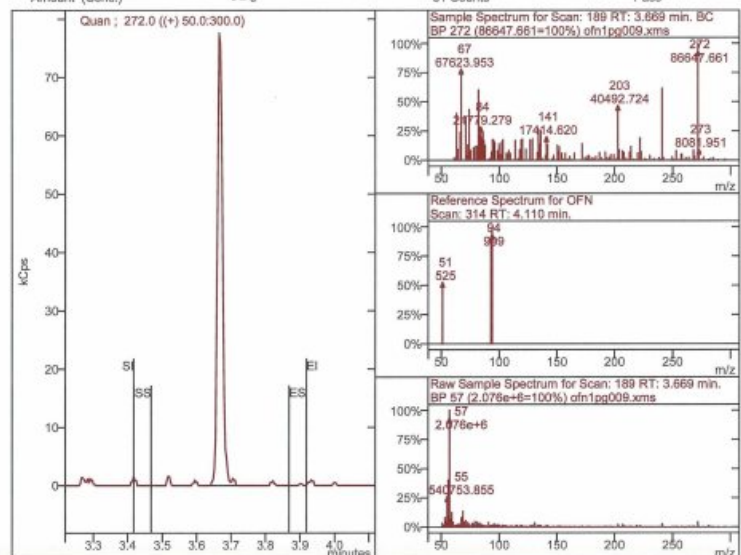
Compound Information

Peak Name:	OFN	Compound Number: 1	CAS Number: None	Identified
Result Index:	1			

Parameter	Specification	Actual	Status
Search Type	Highest		
Retention Time	3.668 +/- 0.200	3.668 min.	Pass
Match Result		N/A	

Integration and Quantitation

Parameter	Specification	Actual	Status
Quan Ions	272.0		
Calibration Equation	Average		
Area	>=10	80953	Pass
Height		76589	
Amount (Conc.)	>= 0	81 Counts	Pass



เอกสารไม่ควบคุม

Sample ID:	cfm1pg	Operator:	TU
Instrument ID:	Brucker GC/MS #1	Last Calibration:	26/11/2557 15:55
Measurement Type:	Area	Calibration Type:	External Standard
Acquisition Date:	19/5/2565 12:49	Data File:	...022\oq\cfm1pg010.xmls
Calculation Date:	19/5/2565 12:55	Method:	...ds\pm2017fs_plv.mth
Sample Type:	Analysis		
Inj. Sample Notes:	None		

Compound Information

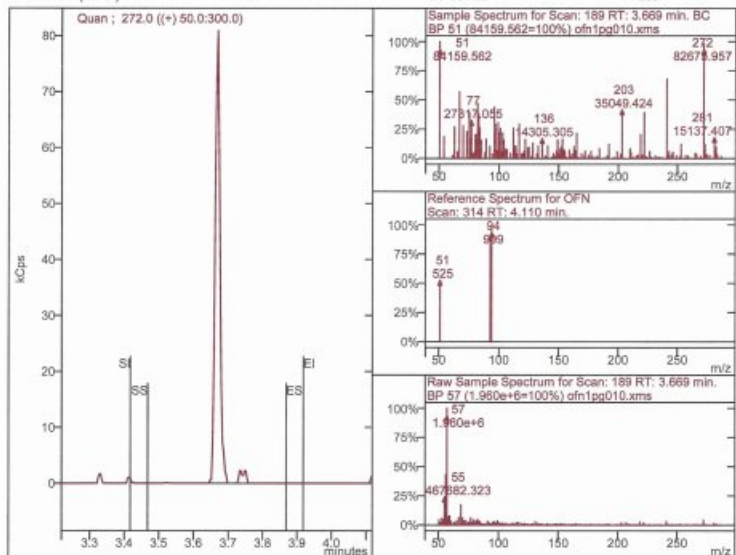
Peak Name:	OFN	Compound Number: 1	CAS Number: None	Identified
Result Index:	1			

Identification

Parameter	Specification	Actual	Status
Search Type	Highest		
Retention Time	3.668 +/- 0.200	3.669 min.	Pass
Match Result		N/A	

Integration and Quantitation

Parameter	Specification	Actual	Status
Quan Ions	272.0		
Calibration Equation	Average		
Area	>=10	78832	Pass
Height		80862	
Amount (Conc.)	>= 0	79 Counts	Pass



เอกสารไม่ควบคุม

Sample ID:	cfm1pg	Operator:	TU
Instrument ID:	Brucker GC/MS #1	Last Calibration:	26/11/2557 15:55
Measurement Type:	Area	Calibration Type:	External Standard
Acquisition Date:	19/5/2565 13:03	Data File:	...022\oq\cfm1pg011.xmls
Calculation Date:	19/5/2565 13:08	Method:	...ds\pm2017fs_plv.mth
Sample Type:	Analysis		
Inj. Sample Notes:	None		

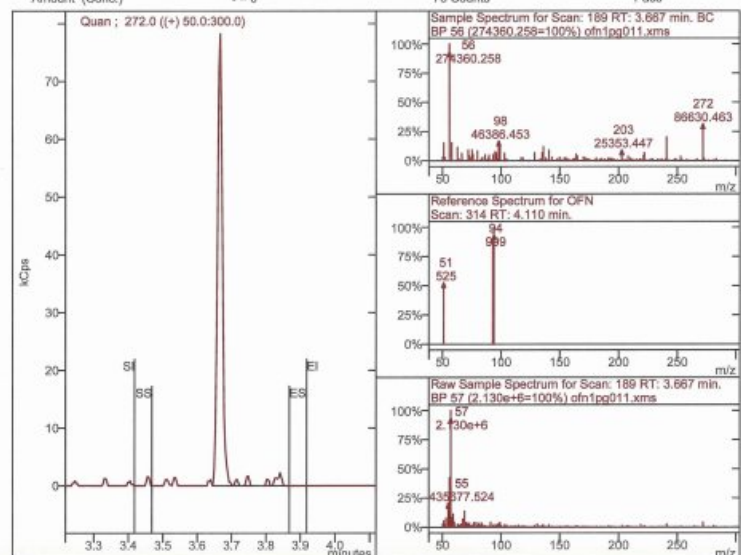
Compound Information

Peak Name:	OFN	Compound Number: 1	CAS Number: None	Identified
Result Index:	1			

Parameter	Specification	Actual	Status
Search Type	Highest		
Retention Time	3.668 +/- 0.200	3.667 min.	Pass
Match Result		N/A	

Integration and Quantitation

Parameter	Specification	Actual	Status
Quan Ions	272.0		
Calibration Equation	Average		
Area	>=10	75823	Pass
Height		78279	
Amount (Conc.)	>= 0	76 Counts	Pass



เอกสารไม่ควบคุม

Sample ID:	ofn1pg	Operator:	TU
Instrument ID:	Brucker GC/MS #1	Last Calibration:	26/11/2557 15:55
Measurement Type:	Area	Calibration Type:	External Standard
Acquisition Date:	19/5/2565 13:16	Data File:	...022\oq\ofn1pg012.xmls
Calculation Date:	19/5/2565 13:21	Method:	...ds\pm2017\fs_ptv.mth
Sample Type:	Analysis		
Inj. Sample Notes:	None		

Compound Information

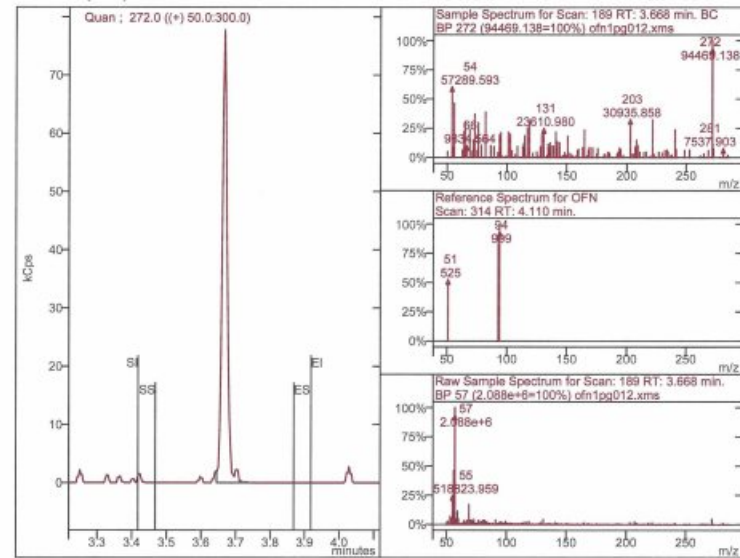
Peak Name:	OFN	Compound Number:	1	CAS Number:	None	Identified
Result Index:	1					

Identification

Parameter	Specification	Actual	Status
Search Type	Highest		
Retention Time	3.668 +/- 0.200	3.668 min.	Pass
Match Result		N/A	

Integration and Quantitation

Parameter	Specification	Actual	Status
Quant Ions	272.0		
Calibration Equation	Average		
Area	>=10	79060	Pass
Height		77781	
Amount (Conc.)	>= 0	79 Counts	Pass



เอกสารไม่ควบคุม

Sample ID:	ofn1pg	Operator:	TU
Instrument ID:	Brucker GC/MS #1	Last Calibration:	26/11/2557 15:55
Measurement Type:	Area	Calibration Type:	External Standard
Acquisition Date:	19/5/2565 13:29	Data File:	...022\oq\ofn1pg013.xmls
Calculation Date:	19/5/2565 13:34	Method:	...ds\pm2017\fs_ptv.mth
Sample Type:	Analysis		
Inj. Sample Notes:	None		

Compound Information

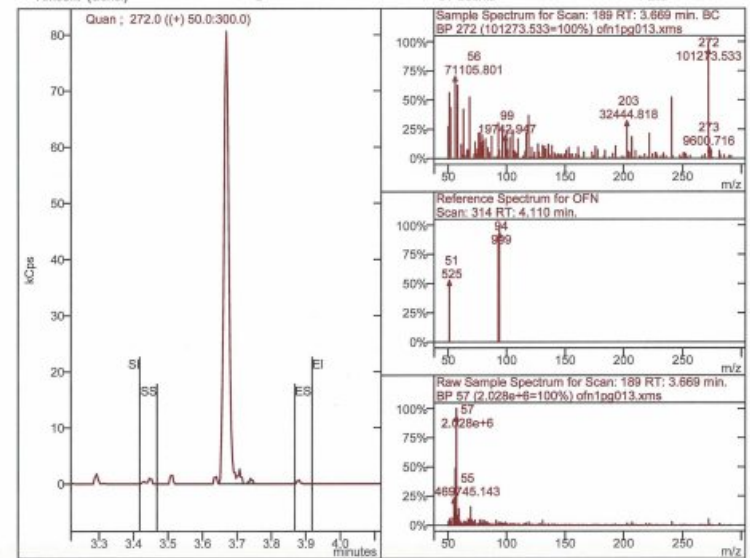
Peak Name:	OFN	Compound Number:	1	CAS Number:	None	Identified
Result Index:	1					

Identification

Parameter	Specification	Actual	Status
Search Type	Highest		
Retention Time	3.668 +/- 0.200	3.669 min.	Pass
Match Result		N/A	

Integration and Quantitation

Parameter	Specification	Actual	Status
Quant Ions	272.0		
Calibration Equation	Average		
Area	>=10	81481	Pass
Height		80643	
Amount (Conc.)	>= 0	81 Counts	Pass



เอกสารไม่ควบคุม

Sample ID:	ofn1pg	Operator:	TU
Instrument ID:	Brucker GC/MS #1	Last Calibration:	26/11/2557 15:55
Measurement Type:	Area	Calibration Type:	External Standard
Acquisition Date:	19/5/2565 13:56	Data File:	...022\oq\ofn1pg014.xmls
Calculation Date:	19/5/2565 14:06	Method:	...ds\pm2017\fs_ptv.mth
Sample Type:	Analysis		
Inj. Sample Notes:	None		

Compound Information

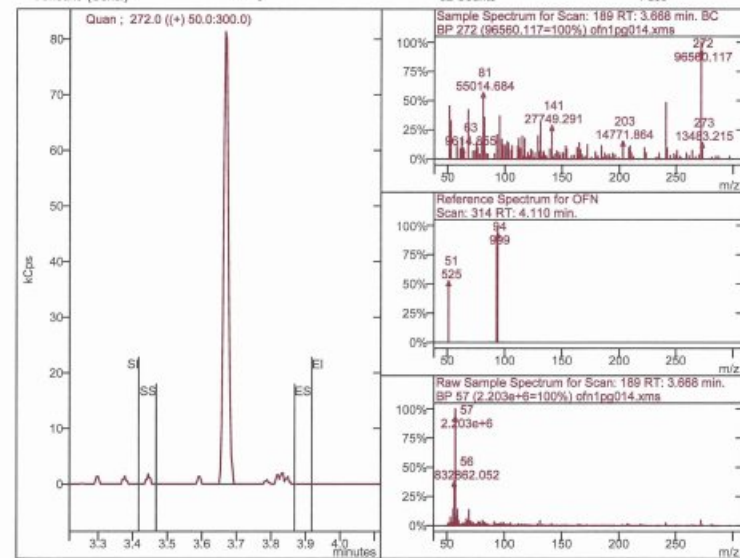
Peak Name:	OFN	Compound Number:	1	CAS Number:	None	Identified
Result Index:	1					

Identification

Parameter	Specification	Actual	Status
Search Type	Highest		
Retention Time	3.668 +/- 0.200	3.670 min.	Pass
Match Result		N/A	

Integration and Quantitation

Parameter	Specification	Actual	Status
Quant Ions	272.0		
Calibration Equation	Average		
Area	>=10	81684	Pass
Height		81381	
Amount (Conc.)	>= 0	82 Counts	Pass



เอกสารไม่ควบคุม

Sample ID:	ofn1pg	Operator:	TU
Instrument ID:	Brucker GC/MS #1	Last Calibration:	26/11/2557 15:55
Measurement Type:	Area	Calibration Type:	External Standard
Acquisition Date:	19/5/2565 14:09	Data File:	...022\oq\ofn1pg015.xmls
Calculation Date:	19/5/2565 14:14	Method:	...ds\pm2017\fs_ptv.mth
Sample Type:	Analysis		
Inj. Sample Notes:	None		

Compound Information

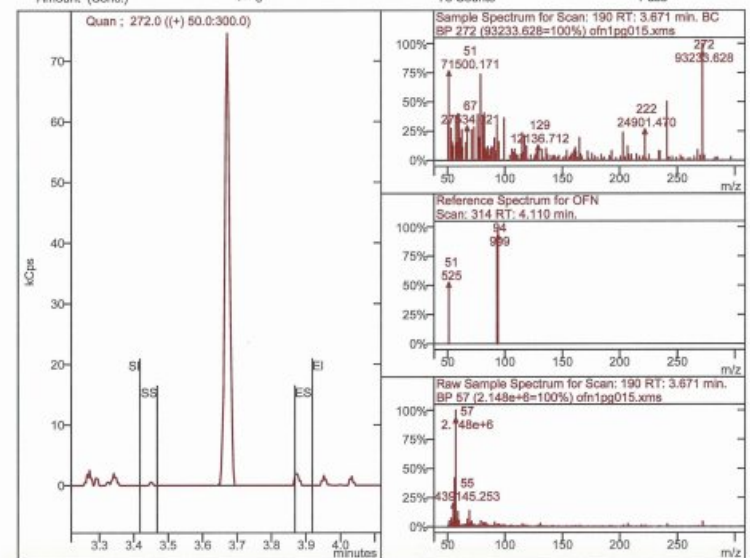
Peak Name:	OFN	Compound Number:	1	CAS Number:	None	Identified
Result Index:	1					

Identification

Parameter	Specification	Actual	Status
Search Type	Highest		
Retention Time	3.668 +/- 0.200	3.671 min.	Pass
Match Result		N/A	

Integration and Quantitation

Parameter	Specification	Actual	Status
Quant Ions	272.0		
Calibration Equation	Average		
Area	>=10	72531	Pass
Height		74597	
Amount (Conc.)	>= 0	73 Counts	Pass



เอกสารไม่ควบคุม

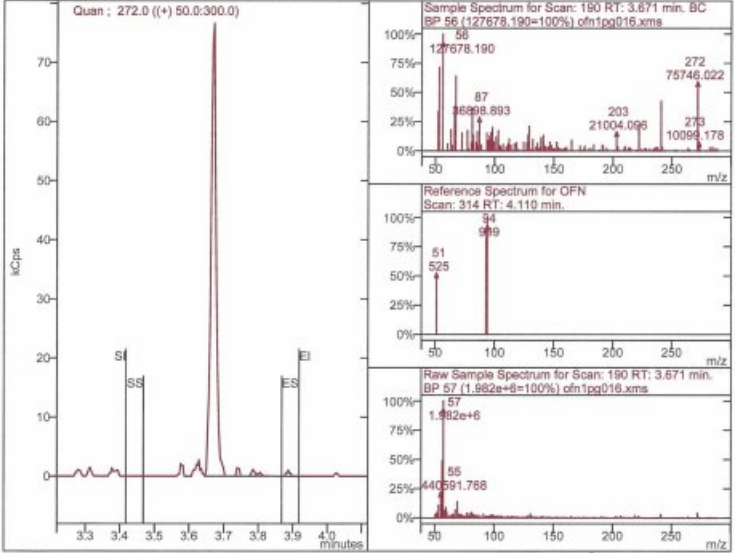
Sample ID:	ofn1pg	Operator:	TU
Instrument ID:	Brucker GC/MS #1	Last Calibration:	26/11/2557 15:55
Measurement Type:	Area	Calibration Type:	External Standard
Acquisition Date:	19/5/2565 14:22	Data File:	...022\ofn1pg016.xmls
Calculation Date:	19/5/2565 14:27	Method:	...ds\pm2017\fs_ptv.mth
Sample Type:	Analysis		
Inj. Sample Notes:	None		

Compound Information

Peak Name:	OFN	Compound Number:	1	CAS Number:	None	Identified	
Result Index:	1						
Parameter	Specification	Actual	Status				
Search Type	Highest						
Retention Time	3.668 +/- 0.200	3.670 min.	Pass				
Match Result		N/A					

Integration and Quantitation

Parameter	Specification	Actual	Status				
Quan Ions	272.0						
Calibration Equation	Average						
Area	>=10	79852	Pass				
Height		76648					
Amount (Conc.)	>= 0	80 Counts	Pass				



เอกสารไม่ควบคุม

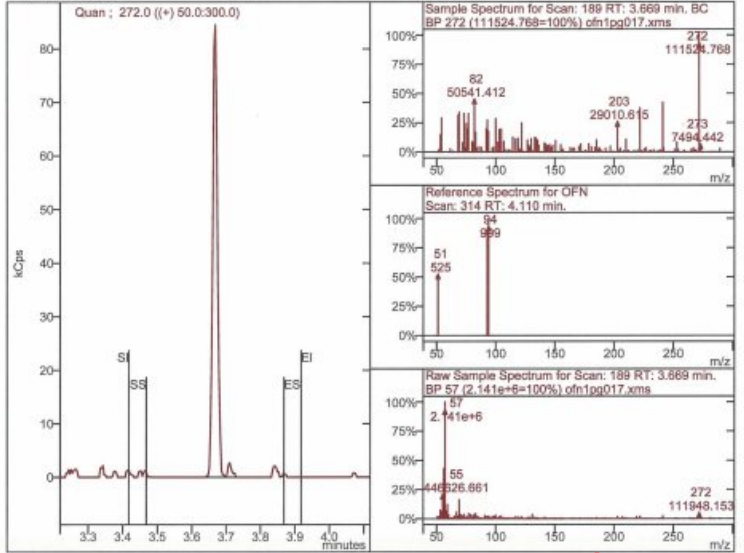
Sample ID:	ofn1pg	Operator:	TU
Instrument ID:	Brucker GC/MS #1	Last Calibration:	26/11/2557 15:55
Measurement Type:	Area	Calibration Type:	External Standard
Acquisition Date:	19/5/2565 14:37	Data File:	...022\ofn1pg017.xmls
Calculation Date:	19/5/2565 14:42	Method:	...ds\pm2017\fs_ptv.mth
Sample Type:	Analysis		
Inj. Sample Notes:	None		

Compound Information

Peak Name:	OFN	Compound Number:	1	CAS Number:	None	Identified	
Result Index:	1						
Parameter	Specification	Actual	Status				
Search Type	Highest						
Retention Time	3.668 +/- 0.200	3.668 min.	Pass				
Match Result		N/A					

Integration and Quantitation

Parameter	Specification	Actual	Status				
Quan Ions	272.0						
Calibration Equation	Average						
Area	>=10	81366	Pass				
Height		84532					
Amount (Conc.)	>= 0	81 Counts	Pass				

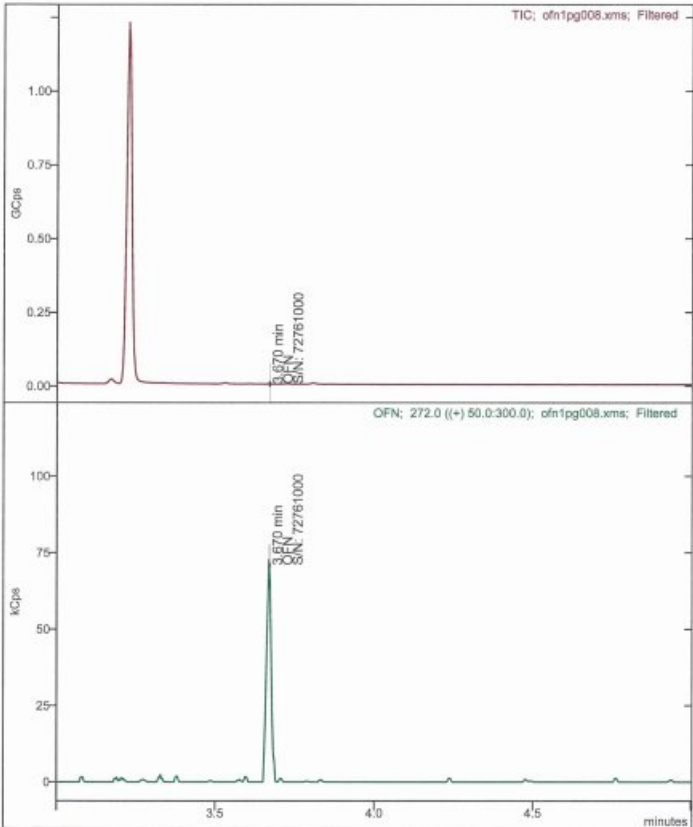


เอกสารไม่ควบคุม

Chromatogram Plots

File: e:\tu\pm2022\ofn1pg008.xmls
Sample: ofn1pg
Scan Range: 1 - 565 Time Range: 3.00 - 5.00 min.

Operator: TU
Date: 19/5/2565 12:23

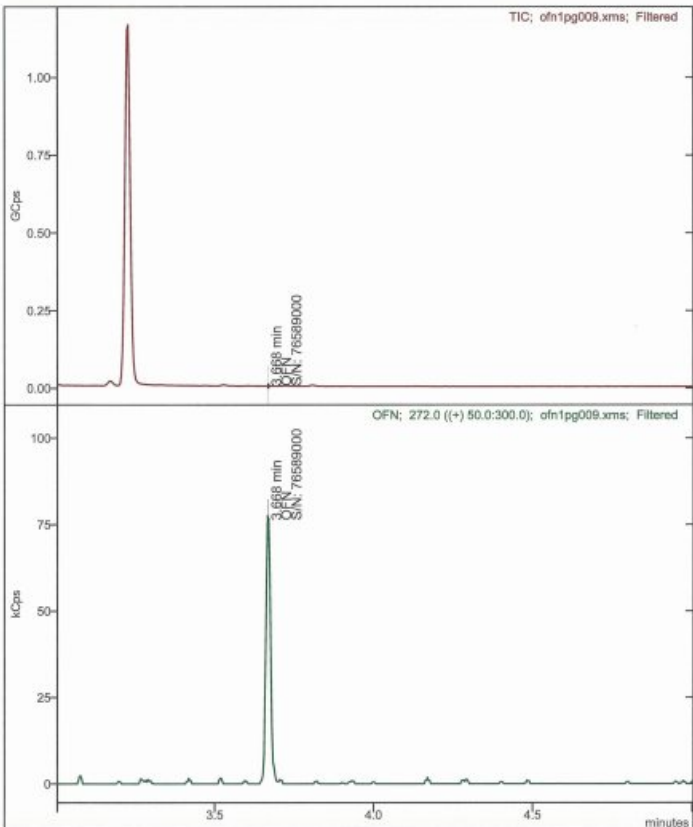


เอกสารไม่ควบคุม

Chromatogram Plots

File: e:\tu\pm2022\ofn1pg009.xmls
Sample: ofn1pg
Scan Range: 1 - 564 Time Range: 3.00 - 5.00 min.

Operator: TU
Date: 19/5/2565 12:36



เอกสารไม่ควบคุม

Chromatogram Plots

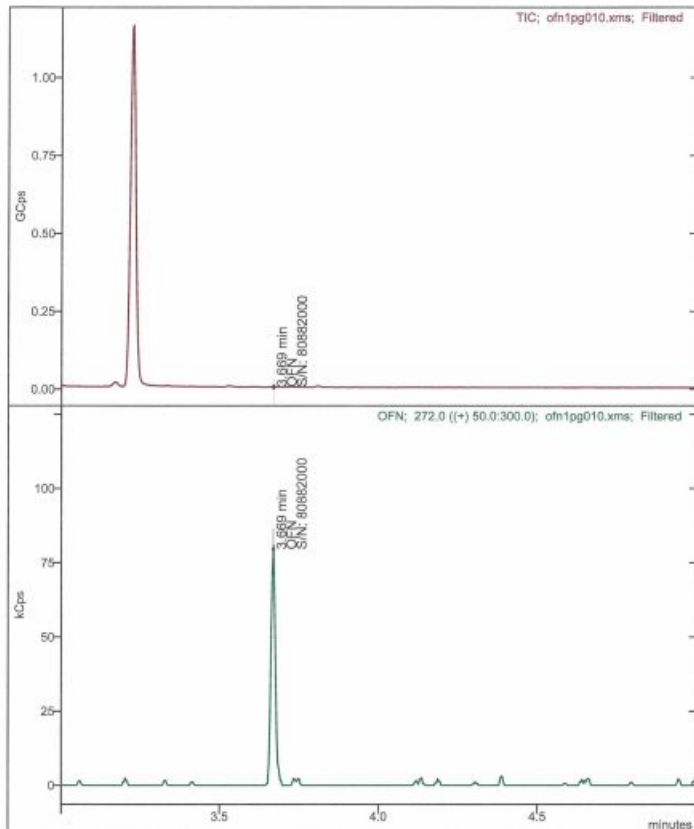
File: e:\tu\pm2022\oq\ofn1pg010.xms

Sample: ofn1pg

Scan Range: 1 - 566 Time Range: 3.00 - 5.00 min.

Operator: TU

Date: 19/5/2565 12:49



เอกสารไม่ควบคุม

Chromatogram Plots

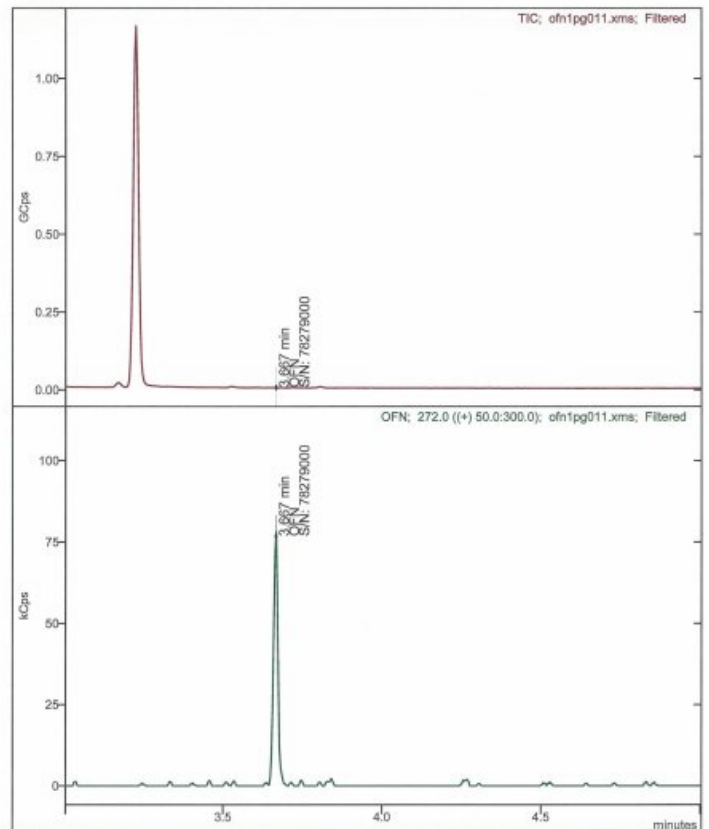
File: e:\tu\pm2022\oq\ofn1pg011.xms

Sample: ofn1pg

Scan Range: 1 - 566 Time Range: 3.00 - 5.00 min.

Operator: TU

Date: 19/5/2565 13:03



เอกสารไม่ควบคุม

Chromatogram Plots

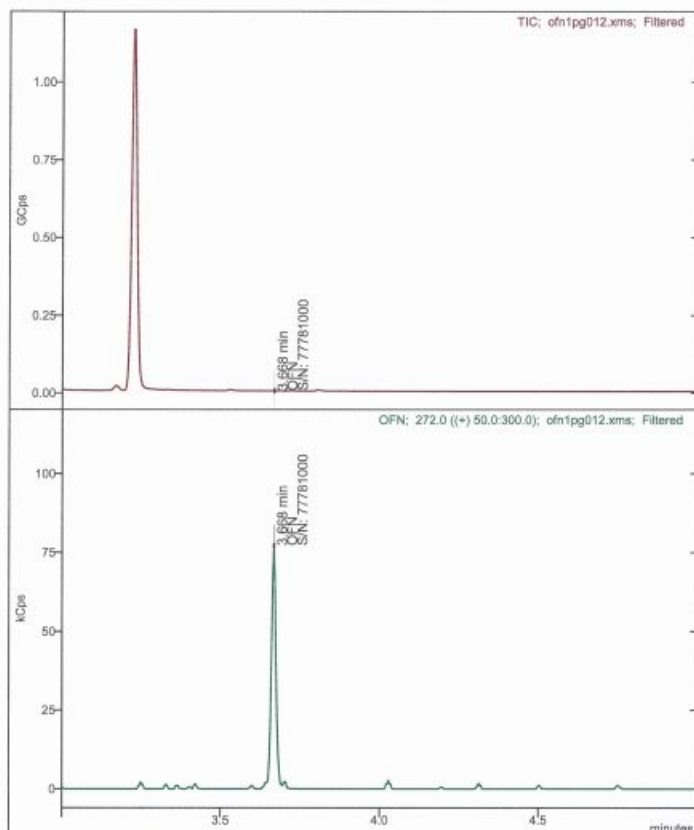
File: e:\tu\pm2022\oq\ofn1pg012.xms

Sample: ofn1pg

Scan Range: 1 - 566 Time Range: 3.00 - 5.00 min.

Operator: TU

Date: 19/5/2565 13:16



เอกสารไม่ควบคุม

Chromatogram Plots

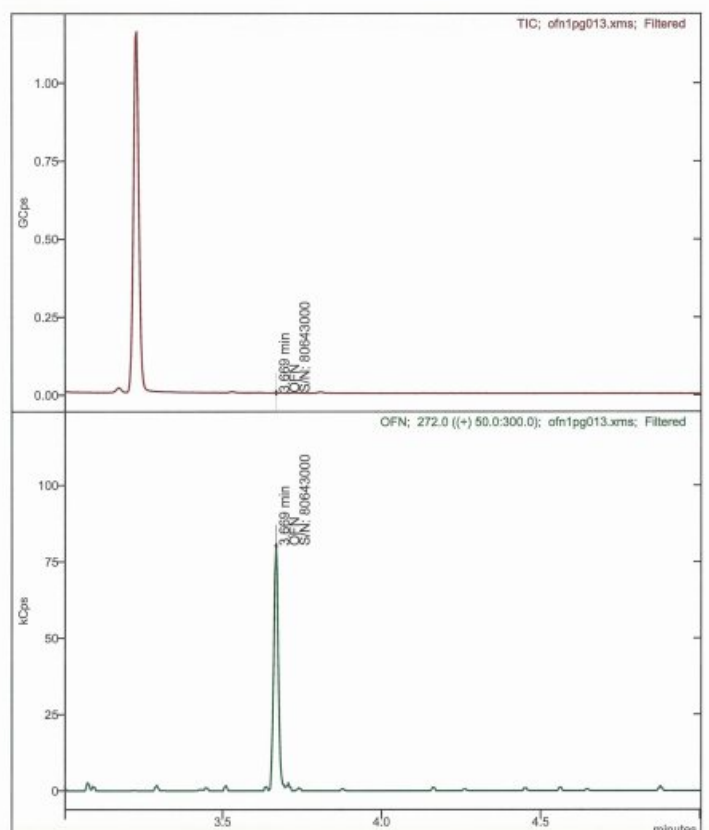
File: e:\tu\pm2022\oq\ofn1pg013.xms

Sample: ofn1pg

Scan Range: 1 - 566 Time Range: 3.00 - 5.00 min.

Operator: TU

Date: 19/5/2565 13:29



เอกสารไม่ควบคุม

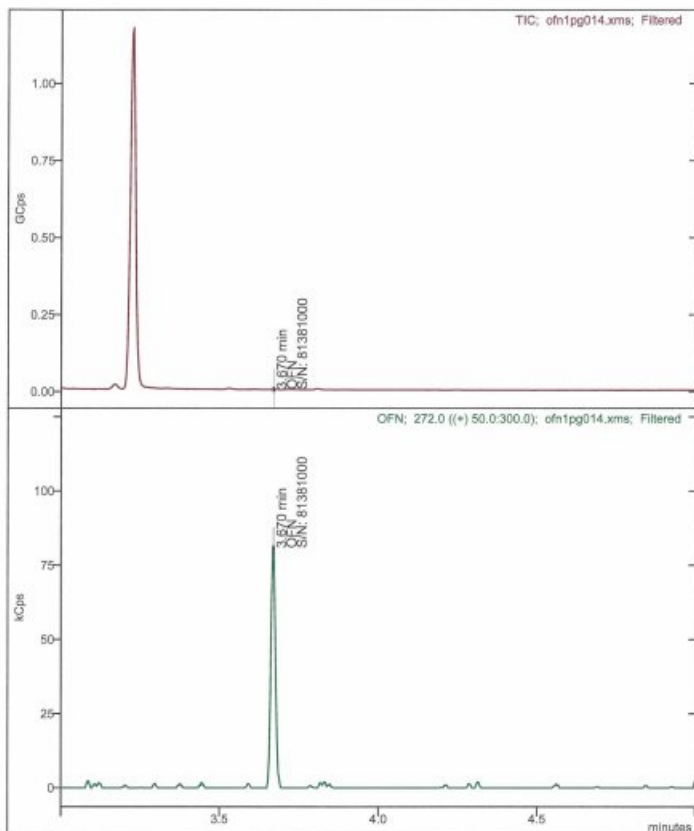
Print Date: 19 May 2022 14:33:09

Chromatogram Plots

File: e:\tu\pm2022\oq\ofn1pg014.xms
Sample: ofn1pg

Operator: TU
Date: 19/5/2565 13:56

Scan Range: 1 - 565 Time Range: 3.00 - 5.00 min.



เอกสารไม่ควบคุม

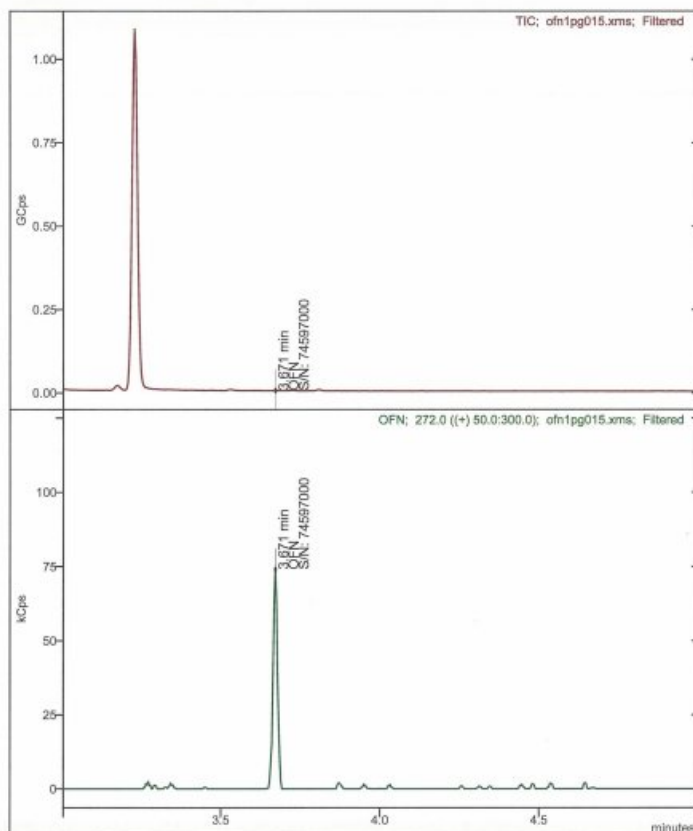
Print Date: 19 May 2022 14:33:38

Chromatogram Plots

File: e:\tu\pm2022\oq\ofn1pg015.xms
Sample: ofn1pg

Operator: TU
Date: 19/5/2565 14:09

Scan Range: 1 - 565 Time Range: 3.00 - 5.00 min.



เอกสารไม่ควบคุม

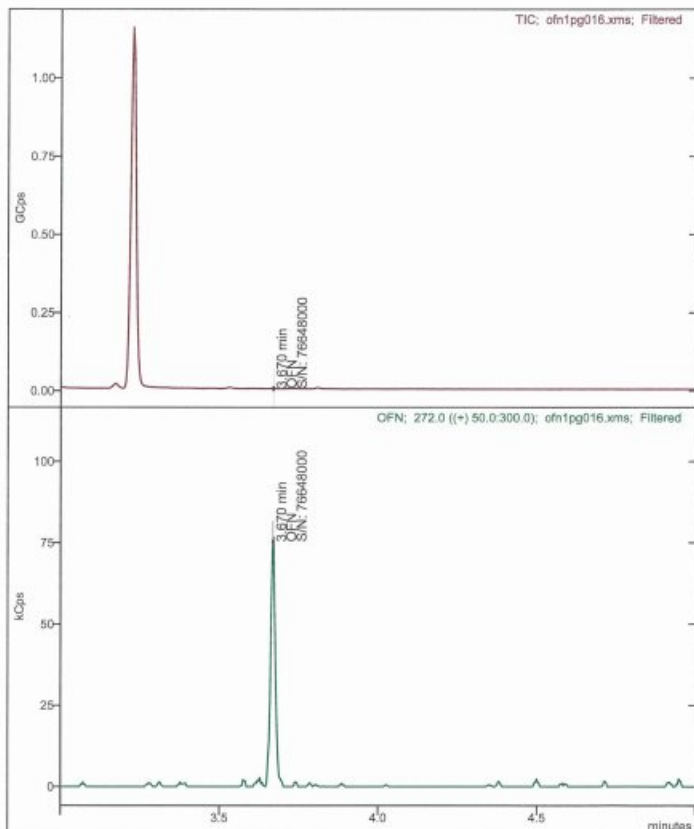
Print Date: 19 May 2022 14:34:33

Chromatogram Plots

File: e:\tu\pm2022\oq\ofn1pg016.xms
Sample: ofn1pg

Operator: TU
Date: 19/5/2565 14:22

Scan Range: 1 - 566 Time Range: 3.00 - 5.00 min.



เอกสารไม่ควบคุม

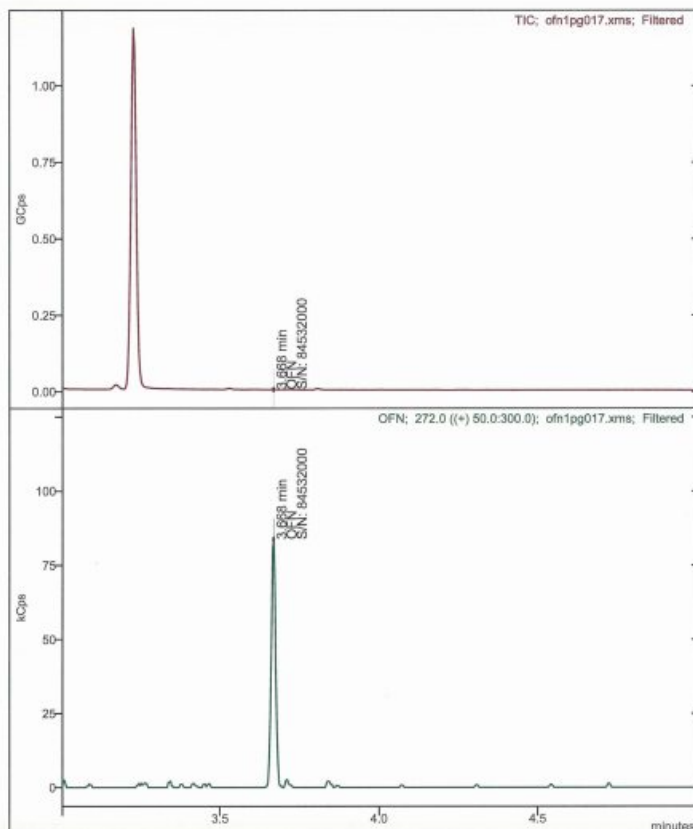
Print Date: 19 May 2022 14:49:01

Chromatogram Plots

File: e:\tu\pm2022\oq\ofn1pg017.xms
Sample: ofn1pg

Operator: TU
Date: 19/5/2565 14:37

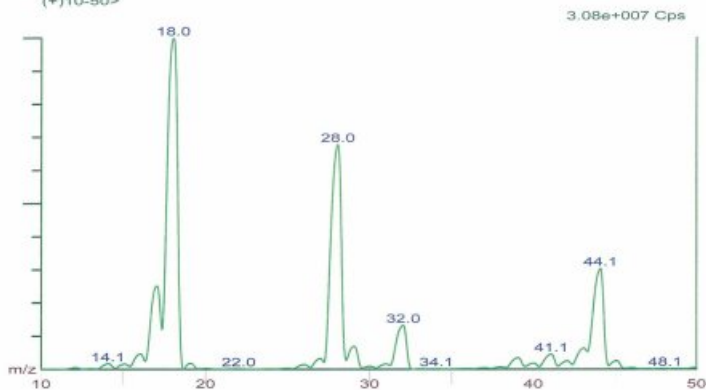
Scan Range: 1 - 565 Time Range: 3.00 - 5.00 min.



เอกสารไม่ควบคุม

scan 267853 (15 scans) (Speroteged)
Notes:EI, EDR On (1)
Compounds:OFN
(+)10-50>

Date:19 MAY 22 9:17 AM



28 absolute size (cps)

- Normal < 9.0e7
- Measured 2.12e7

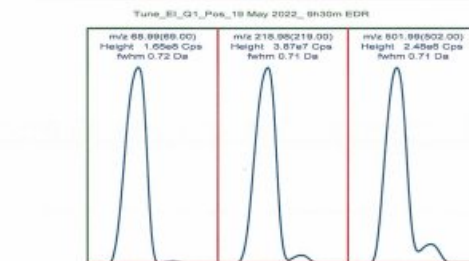
28/32 Ratio

- Normal <2.8:1 or >4.2:1
- Measured 5.3:1

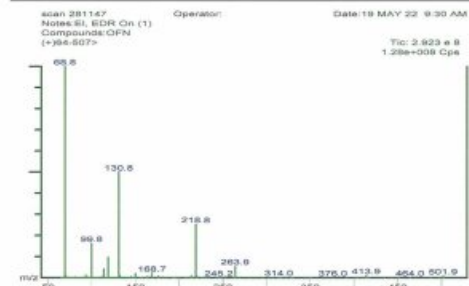
28/18 Ratio

- Normal <2.0:1
- Measured 0.7:1

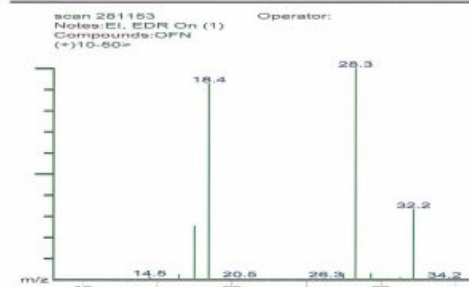
เอกสารไม่ควบคุม



Instrument: SCION SQ
Location:
Operator:
Date/Time: 19 May 2022 9:30:53



EI
Temperature 250C
Filament 2
Emission 40uA
Electron Energy 69eV
Q0 Helium On
Transferline 250C
Detector Max 1.78kV
Repeller Max 23V



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SCION Operational Qualification Protocol

Addendum Procedure: A. Certificate Page Number: _____

SCION Operational Qualification Protocol

Operational Qualification Protocol Certification

for

SCION

with the serial number

GQS1203F21

has successfully completed all criteria for hardware Operational Qualification Protocol
as detailed in this document.

Scion Certified Engineer

SOMCHAI POHTONSKAM
Name (please print)

Somchai P. 19 MAY 22
Signature Date

Authorized Customer Representative

Name / Function (please print)

Signature

Date

Customer Address

United Analyst and Engineering Consultant Co., Ltd.

Qualification Rep. Initials	<u>Somchai P.</u>	Reviewer Initials		QA/QC Initials	
Date	<u>19 MAY 22</u>	Date		Date	

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เอกสารไม่ควบคุม

**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.

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**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. 83815A	1. MY 19030001
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. *NA*
- Run Instrument Performance test and record results in Instrument Performance Test Results Table - Pre PM.

Inspect and clean the system

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

Agilent Water Recirculator

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

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**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	4092.3	7956.1	4191.9	3929.7
Mn 257.610 nm SRBR	11415.1	30394.7	11493.6	34460.9
Al 396.152 nm SBR	7.3	15.7	8.7	13.5
K 766.491 nm SBR	5.3	11.9	5.7	44.6

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

Instrument Test Results Table

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

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

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**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	225.767 VAC	199.510 VAC
Mains Current	0.119 A	3.233 A
Instrument Temperature	23.4 °C	23.5 °C
RF Air Flow (sensor speed)	18.0 Hz	19.0 Hz
Plasma Exhaust Temperature	No measurement	65.0 °C
Water Flow Oscillator	No measurement	1.03 L/min
Water Flow Detector	0.80 L/min	1.33 L/min
Water Inlet Temperature	19.1 °C	12.8 °C
Polychromator Temperature	35.0 °C	35.0 °C
CCD Temperature	26.9 °C	-38.7 °C
Thermal Stabilizer	35.0 °C	35.0 °C
Argon Supply Pressure	614.15 kPa	629.92 kPa
Purge Gas Supply Pressure*1	64.34 kPa	65.63 kPa
Option Gas Supply Pressure*1	— kPa	— kPa
Nebulizer Flow	No measurement	0.30 L/min
Nebulizer Back Pressure	No measurement	305.85 kPa
Plasma Gas Flow	No measurement	15.00 L/min
Auxiliary Gas Flow	No measurement	1.10 L/min
RF Power	No measurement	1201.1 W
RF Supply Current	No measurement	3.133 A
RF Supply Voltage	No measurement	194.518 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	—
Additional Parts may be required from engineers stock:			
X axis drive belt	5410047500	SPS 3	—
Z axis drive belt	5410047400	SPS 3	—
Peristaltic pump tubing, PVC SolvaFlex, 3 bridged.	3710049000	SPS 4	—

Restore system

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

Leave system in an idle state: on and purging.

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

Service Review

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

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

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

Service Engineer Comments (optional)

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

Other Important Customer Web Links

How to get information on your product:

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

Service Completion

Service request number 6004392117 Date service completed 09/12/21

Agilent signature Nelson L. Customer signature Aphorn Onkong

Document part number: G8014-90075

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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 9:14:59 AM

Result Summary

Subsystem Communications Test	Skipped
Air Flow Test	Skipped
Water Flow Test	Skipped
Gas Flow 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

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Resolution Test

Pass

Element Wavelength	Specification	Width
N (174.213 nm)	≤ 9.40	7.27
As (188.980 nm)	≤ 8.20	8.23
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)	≤ 8.50	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 (514.171 nm)	≤ 42.00	24.99
Ar (675.283 nm)	≤ 74.00	59.49
K (766.491 nm)	≤ 80.00	65.27

เอกสารไม่ควบคุม

Sensitivity Test

Pass

Radial					
Element Wavelength	Specification	Method	Ratio	Standard	Blank
As (188.980 nm)	≥ 45.0	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)	≥ 45.0	SRBR	191.1	2682.8	172.6
Mn (257.610 nm)	≥ 3618.0	SRBR	11415.2	285002.2	536.8
Al (396.152 nm)	≥ 3.4	SBR	7.8	46838.0	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)	≥ 206.0	SRBR	252.9	3214.2	147.0
Se (196.026 nm)	≥ 159.0	SRBR	216.2	3839.7	272.2
Zn (206.200 nm)	≥ 234.0	SRBR	1203.3	14046.1	133.7
Zn (213.857 nm)	≥ 1743.0	SRBR	7856.1	171323.1	472.9
Cd (214.439 nm)	≥ 4227.0	SRBR	7054.9	129639.3	335.4
Pb (220.353 nm)	≥ 320.0	SRBR	531.7	13218.2	566.2
Mn (257.610 nm)	≥ 10825.0	SRBR	30884.7	1314644.0	1807.4
Cr (267.716 nm)	≥ 1048.0	SRBR	4442.1	174420.3	1515.1
Cu (324.754 nm)	≥ 19.0	SBR	50.7	374803.8	7249.0
Al (396.152 nm)	≥ 6.0	SBR	15.7	279915.3	16790.4
Ba (493.408 nm)	≥ 60.0	SBR	209.7	10899856.6	51728.3
K (766.491 nm)	≥ 24.0	SBR	38.9	1963197.5	49746.8

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Precision Test

Pass

Radial		
Element Wavelength	Specification	Measured Value % RSD
As (188.980 nm)	≤ 2.60	0.81
Se (196.026 nm)	≤ 2.60	1.21
Zn (213.857 nm)	≤ 1.50	0.39
Pb (220.353 nm)	≤ 2.60	0.41
Mn (257.610 nm)	≤ 1.50	0.45
Al (396.152 nm)	≤ 1.50	0.41
Ba (493.408 nm)	≤ 1.50	0.51
K (766.491 nm)	≤ 1.50	0.36
Axial		
Element Wavelength	Specification	Measured Value % RSD
As (188.980 nm)	≤ 1.50	0.51
Se (196.026 nm)	≤ 1.50	0.73
Zn (206.200 nm)	≤ 1.50	0.30
Zn (213.857 nm)	≤ 1.50	0.37
Cd (214.439 nm)	≤ 1.50	0.36
Pb (220.353 nm)	≤ 1.50	0.28
Mn (257.610 nm)	≤ 1.50	0.63
Cr (267.716 nm)	≤ 1.50	0.30
Cu (324.754 nm)	≤ 1.50	0.54
Al (396.152 nm)	≤ 1.50	0.45
Ba (493.408 nm)	≤ 1.50	0.64
K (766.491 nm)	≤ 1.50	0.96

เอกสารไม่ควบคุม

Report Summary

Instrument Model	Agilent 5100/5110 VDV ICP-OES
Instrument ID	G8011A/G8015A
Instrument Serial Number	MY18030001
Software Version	7.3.1.6507
Firmware Version	3442
Tested By	Nukoon L.
Test Completed On	12/9/2021 12:55:49 PM

Result Summary

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

Optics Test

Pass

	Radial	Axial
Intensity	5296135	5755042
Wavelength	737.212	737.212

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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 (206.168 nm)	≤ 13.40	9.21
Zn (213.857 nm)	≤ 6.70	6.87
Pb (220.353 nm)	≤ 9.50	7.02
Co (228.815 nm)	≤ 17.20	11.81
Ba (230.424 nm)	≤ 9.40	7.46
Mn (257.610 nm)	≤ 13.30	8.49
Mn (260.568 nm)	≤ 20.30	14.19
Cr (267.716 nm)	≤ 11.00	7.90
Cu (324.754 nm)	≤ 25.00	18.62
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

เอกสารไม่ควบคุม

Sensitivity Test

Pass

Radial	Element Wavelength	Specification	Method	Ratio	Standard	Blank
	As (188.580 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	5692.9
	Ba (493.408 nm)	≥ 34.0	SBR	125.4	2152916.9	17032.2
	K (766.491 nm)	≥ 1.8	SBR	5.7	107906.7	16079.6

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

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

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	
30% Air Flow (relative speed)	75% Air Flow (relative speed)
15.00	19.00

Water Flow Test		
RF Water Flow (L/min)	Camera Water Flow (L/min)	Water Inlet Temperature (°C)
1.08	1.38	17.18

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Gas Flows Test					
Nebulizer Target Flow	Actual Flow	Back Pressure	Auxiliary Target Flow	Actual Flow	Back Pressure
0.70	0.70	203.80	2.00	1.99	108.68
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	
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			
	Integration Time (ms)	Standard Deviation	Status
Electronic Offset Test	1000	5.281	Passed
Dark Current Test	9000	0.734	Passed
Array Test	5	0.024	Passed
Linearity Test		0.118	Passed

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Agilent 55 240 280 Series Atomic Absorption Spectroscopy Systems

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. This checklist will be completed at the end of the service and provided to you as a record of the installation.

Note: While non-current production AA instrument and/or accessory models are not covered specifically in this document it can be used as a basic reference.

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

Introduction

Customer Information

- Customers should provide all necessary operating supplies upon request of the engineer.
- 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 extra or special procedures and/or parts for the maintenance service, then these must be ordered separately and charged as a repair, which may incur additional costs.

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Instrument Preventive Maintenance Checklist

Important Customer Web Links

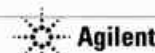
- For more information about Agilent Technologies services, please visit our website using the following URL: <http://www.agilent.com/en-us/products/crosslab-instrument-services/service-repair>
- To access Agilent University, visit <http://www.agilent.com/crosslab/university/> to learn about training options, which include online, classroom and onsite delivery. A training specialist can work directly with you to help determine your best options.
- A useful Agilent Resource Center web page is available, which includes short videos on maintenance, quick lists of consumables for new instruments, and other valuable information. Check out the Resource Page here: <https://www.agilent.com/en-us/agilentresources>
- Need technical support, FAQs, supplies? – visit our Support Home page at <http://www.agilent.com/search/support>
- Get answers, Share insights, Build connections: Join the Agilent Community at <https://community.agilent.com/welcome>

Service Engineer's Responsibilities

- Contact the customer and ensure that all necessary supplies are available before the preventive maintenance visit.
 - Confirm the ability of the instrument to deliver continued safe operation as established via the Agilent AA safe operation flow chart. (Refer directly to the AA 55/240/280 Preventive Maintenance Scope of Work to make this decision.)
 - Only select those pages that relate to the system or module being serviced.
 - Complete empty fields with the relevant information.
 - Complete the relevant checkboxes in the checklist using either a "X" or tick mark "✓".
 - Check "Section not applicable" check boxes to indicate services/tasks not delivered, as appropriate.
 - Complete the Preventive Maintenance service in the order of the tasks listed.
 - Complete the Service Review section together with the customer.
 - Complete the fields for page numbers at the foot of each selected page.
 - Complete the total number of pages field in the Service Completion section.
 - Ask the customer to sign the Service Completion section including the customer's and your signature.
- This information is subject to change without notice.

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Instrument Maintenance

System Information

- ☐ Check this box if an instrument configuration report is attached instead of completing the table.

Instrument System Name and ID	240FS AAS
Instrument System Site and Location	United Analyst and Engineering Consultant

List System Component Product Numbers	List the Serial Numbers of each Component
1. G 2432 A	MY 13160001
2.	
3.	
4.	
5.	
6.	
7.	
8.	
9.	

Preparation, Safe operation and Initial performance checks

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- ☐ Agilent AA safe operation flow chart inspections (to determine if the PM can be performed)

NOTE: If by following the flow chart the instrument is deemed to be unsafe for continued use you MUST NOT continue PM work. Inform the customer immediately of the Agilent recommendation that use of the instrument be discontinued.

- ☒ Discuss any specific issues with the customer before starting.
- ☐ For HF application systems, if standard sample introduction system was not installed, ask the customer to install it. **WIR**
- ☒ Review the instrument logbook for recorded problems and comments.
- ☒ Save instrument control settings before starting the procedure.
- ☒ Perform a general inspection of the system for cleanliness.
- ☒ Check for proper installation of parts, assemblies, sensors etc.
- ☒ Check system for required installation of components, settings as defined by current Service Notes
- ☒ Check for required firmware updates and verify with customers if they would like them installed.
- ☒ Use SVD to perform a Full Wavelength Scan for Cu HCL - "As found test_1"
- ☒ Perform a Basic Cu ABS test - "As found test_2"
- ☒ Print the Details page or screen captures of the test results and attach to the end of this checklist.

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Preventive Maintenance Procedures

FLAME SYSTEM section

- ☐ Section not applicable

Electronic components

- ☒ Review and confirm instrument configuration data in SVD
- ☒ Confirm power supply voltages using the **SVD Power Supply diagnostic**.
- ☒ For Dual Beam instruments - Confirm RBC frequency using the **SVD RBC frequency diagnostic**.

Mechanical components

- ☒ Check the burner adjuster controls for complete and free movement. If the burner adjuster needs lubrication, use Molykote 321 or mineral-based molybdenum disulphide grease.
- ☒ Run SVD tests to exercise all motor drives over the full range of their travel:
 - ☒ Monochromator drive
 - ☒ Slit drive
 - ☒ Lamp selector
 - ☐ ABA **WIR**

Optics components

- ☒ Check that external optical surfaces are clean - Clean or replace as required.
- ☒ Use SVD and perform **Mono Wavelength Correction**.
- ☒ Use SVD and perform **Slit Calibration**.
- ☒ Use SVD and perform **Grating Squareness Diagnostic**.
- ☒ Use SVD and perform **Zero Order Offset/Mono Correction**.
- ☒ Use SVD and perform **Wavelength Repeatability**.
- ☒ Physically inspect selected HC lamps (customer to supply per their choice) and measure the % Gain for each lamp. Advise customer if lamps are showing emission degradation due to age.
- ☒ Check that the signal energy of the D2 and HC lamps track properly. Advise customer if their D2 lamp is showing emission degradation due to age.

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Sample Introduction and Atomization

- ☒ Inspect the burner interlock plate to ensure that the interlock pin is secure and correct for the burner type.
- ☒ Clean the burner slot with a clean white card.
- ☒ Check the uniformity of the slot width.
- ☒ Clean the burner if required.
- ☒ Change the burner o-ring.
- ☒ Clean the nebulizer, spray chamber and liquid trap.
- ☒ Change all o-rings and seals in the nebulizer, nebulizer block and spray chamber.
- ☒ Check that the pressure relief bung releases readily.
- ☒ Change o-rings on the fuel and oxidant delivery bars.
- ☒ Leave the liquid trap EMPTY and verify the flame will not ignite in this state.
- ☒ Refill liquid trap and check that overflow drains freely into the drain/waste tube.
- ☒ Check the drain/waste tube for good drainage. It should not have tight bends, kinks or loops and the lower end must be above the liquid level in the waste vessel
- ☒ Check and clean the igniter electrode

Gas handling components and safety interlocks

- ☒ Pressure test for leaks
- ☒ Leak test gasbox internal components and connections
- ☒ Check safety interlock status and operation using the **SVD interlock monitoring diagnostic**.

Analytical performance for Flame systems

- ☒ Ignite a flame.
- ☒ Check that you can adjust the nebulizer uptake rate from 4 to 6.5 mL per minute.
- ☒ Optimize the instrument ready to perform Cu sensitivity test.
- ☒ Create a manual method to perform a Basic Cu ABS test - "Final Performance Testing"
- ☒ Run a PM completed sensitivity test for a 5 ppm copper sample and record the results in the AA PM Performance test results and measurements table.

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FURNACE SYSTEM section

☒ Section not applicable

Electronic components

- ☐ Review and confirm instrument configuration data in SVD
- ☐ Confirm power supply voltages using the **SVD Power Supply diagnostic**.

Mechanical components

- ☐ Run SVD tests to exercise all motor drives over the full range of their travel.
 - ☐ Monochromator drive
 - ☐ Slit drive
 - ☐ Lamp selector

Optics components

- ☐ Check that external optical surfaces are clean – Clean or replace as required.
- ☐ Use SVD and perform **Mono Wavelength Correction**.
- ☐ Use SVD and perform **Slit Calibration**.
- ☐ Use SVD and perform **Grating Squariness Diagnostic**.
- ☐ Use SVD and perform **Zero Order Offset/Mono Correction**.
- ☐ Use SVD and perform **Wavelength Repeatability**.
- ☐ Physically inspect selected HC lamps (customer to supply per their choice) and measure the % Gain for each lamp. Advise customer if lamps are showing emission degradation due to age.

Gas handling, water system and workhead component checks

- ☐ Inspect the GTA workhead gas hoses and connections for leaks.
- ☐ Pressure test for gas leaks.
- ☐ If the cooler system is accessible (stand-alone) check for correct operation and coolant/water level – this includes any temperature and pressure settings plus filter cleaning (air flow and water).
- ☐ Inspect the GTA workhead water hoses and connections for leaks.
- ☐ Check all graphite components and replace if necessary.

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- ☐ Tube
- ☐ Electrodes
- ☐ Shroud

- ☐ Check and clean the end windows on the workhead.
- ☐ Check safety interlock operation.

Analytical performance for Furnace systems

- ☐ Optimize the instrument ready to perform Cu sensitivity test.
- ☐ Run the sensitivity test for a 25 ppb copper sample and record the results in the results table.

PSD autosampler accessory for Furnace systems

- ☐ Section NOT Applicable
- ☐ Check condition of the PSD capillary – replace if necessary
- ☐ Check condition and operation of PSD syringe – ensure it does not have air locks and bubbles.
- ☐ Change PSD rinse bottle o-ring.
- ☐ Check and clean the rinse vessel.
- ☐ Check the drain tube for good drainage. It should not have tight bends, kinks or loops and the lower end must be above the liquid level in the waste vessel.
- ☐ Ensure that the waste vessel is suitable for use with the furnace system.

Sample introduction pump system (SIPS) accessory

- ☐ Section NOT Applicable
- ☐ Re-torque screws securing the hubs, presser arms and pump rotors.
- ☐ Adjust each roller so that it rotates freely.
- ☐ Wipe clean the pump rotor rollers and pump bands with a dry clean cloth.
- ☐ Ensure that the presser arms and the surfaces near the pump are free from dirt and spills.
- ☐ Remove the pump module rear cover and check for the incursion of liquids and any signs of corrosion.
- ☐ Re-torque the nuts that fasten the motor mounting plates to the chassis.
- ☐ Check clips securing the diluents holder and replace if necessary.
- ☐ Disconnect, clean T-piece, and reassemble the tubing using the following steps:

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- ☐ Remove the T-piece by disconnecting the pump tubes, the pump bands and all other tubing.
- ☐ Place the T-piece in an ultrasonic bath containing strong detergent 1-5% Decon 30 or similar, for approximately 5-10 minutes.
- ☐ Wash the T-piece under a tap with a strong flow of water.
- ☐ Rinse with distilled water through all of the inlets in the reverse direction to normal sample flow.
- ☐ Reassemble.

Sample preparation system (SPS 4) accessory

☒ Section NOT Applicable

The Agilent SPS 4 autosampler is designed to need minimal maintenance.

The following maintenance requirements are suggested to maintain the performance of the autosampler.

- ☐ Cleaning the spill tray, rack location mat, end frames and chassis accessories with a damp soft cloth and diluted mild detergent.
- ☐ Cleaning the autosampler cover panels with domestic window cleaner.
- ☐ Checking 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 edge or damaged connectors.

NOTE: The autosampler requires no extra lubrication throughout its lifetime.

For further details refer to the SPS 4 service manual G8410-90050.

Sample preparation system (SPS 3) accessory

☒ Section NOT Applicable

- ☐ Check the x-axis and z-axis timing belts – Replace if there are any cracks, splits or color deterioration and belt tension.
- ☐ Check belt tensions - adjust if required
- ☐ Check the lubrication pad for single x-axis shaft. If pad is dry or customer has observed any vibration or erratic movements of the x-axis carriage, add 1 mL of Dow Corning 200 8 Fluid, 200 CS into the well.
- ☐ Check the auto-sampler ability to find tube positions - Calibrate if required.
- ☐ Clean the exterior surfaces of the accessory with soft lint free cloth. This cloth can be dampened with warm water or a mild detergent. Do not use organic solvents or abrasive cleaning agents.

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Vapor generation accessory VGA (hydride generator)

- ☐ Section NOT Applicable
- ☒ Inspect VGA gas supply hose.
- ☒ Inspect/replace VGA pump tubing.
- ☒ Check low gas pressure interlock setting – adjust if required.
- ☒ Check precision orifice gas flow setting – adjust if required.
- ☒ Check gas regulator pressure to 46 psi (325 kPa) – adjust if required.
- ☐ Clean the exterior surfaces of the accessory with soft lint free cloth. This cloth can be dampened with warm water or a mild detergent. Do not use organic solvents or abrasive cleaning agents. **N/A**

UltraAA lamp accessory (external)

- ☒ Section NOT Applicable
- ☐ Check the condition of the power cable.
- ☐ Clean the exterior surfaces of the accessory with soft lint free cloth. This cloth can be dampened with warm water or a mild detergent. Do not use organic solvents or abrasive cleaning agents.

Restore System

- ☐ If you have altered the customer's instrumentation during the course of PM, restore to the original status to allow the customer to conduct their normal activities (e.g., reload the customer's method.)

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.

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Signature Page

Service Review

- ☒ Attach available reports/printouts of all tests to this documentation.
- ☒ Record the Preventive Maintenance service activity in the customer's records/logbook.
- ☒ Update/reset instrument maintenance counters as appropriate.
- ☒ Affix the PM sticker to the system or instrument logbook based on the customer's request.
- ☒ Complete the Service Engineer Comments section if there are additional comments.
- ☒ Review this service, parts replaced, and test results obtained with the customer.
- ☒ If the instrument firmware was updated, record the details of the change in the Service Engineer's Comments box or if necessary, in the customer's IQ records.

Test Results

Test Description	Expected Test Result	Actual Test Result
Flame optics PMT Gain test		
For copper at 324.8 nm, 4 mA, 0.5 nm slit width	< 55 %	42 %
Flame performance test with 5 ppm copper sample		
Air /acetylene, mixing paddle removed	Abs value > 0.5	0.5963
Air /acetylene, mixing paddle installed, 10 replicates	%RSD < 1.0	0.4
Deuterium furnace optics PMT Gain test		
For copper at 324.8 nm, 4 mA, 0.5 nm slit width	< 55 %	
Deuterium furnace performance test with 25 ppb copper sample (324.8 nm)		
Precision %RSD	≤ 4.0 %	-
Abs value	≥ 0.15	-
Zeeman furnace analytical performance: 25 ppb copper sample (327.4 nm)		
Precision %RSD	≤ 4.0 %	-
Abs value	≥ 0.10	-
MSR%	≥ 70 %	-

As VQA-77 test Abs.

0.2 Abs

0.2156 Abs

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AA consumable and parts list table

Part Description	Part Number	Product/Model # where used	PM supplied or Consumable	Instrument-Type
Test Solution - Cu 5ppm solution	6610030100	50 55 140 240 280	PM supplied	Common
Test Solution - Blank solution	5190-7001	50 55 140 240 280	PM supplied	Common
Copper, 1000 ug/ml, 100ml	5190-8279	50 55 140 240 280	*	Common
Kit, Mix 7 O-rings, aqueous, complete set	9910093400	50 55 140 240 280	PM supplied	Flame
Organic Kit	9910093500	50 55 140 240 280	PM supplied	Flame
Wire Nebulizer Cleaning	9910024700	50 55 140 240 280	consumable	Flame
Tubing-Capillary Std Nebs	9910024800	50 55 140 240 280	consumable	Flame
Capillary Tube Hvac Neb (3) (organics only)	9910044000	50 55 140 240 280	consumable	Flame
Glass impact beads (5/pk)	9910025700	50 55 140 240 280	consumable	Flame
Teflon impact beads (5/pk) (organics only)	9910053300	50 55 140 240 280	consumable	Flame
Burner cleaning strip (100/pk)	9910053900	50 55 140 240 280	consumable	Flame
Window UV silica - round (right side)	2010082600	50 55 140 240 280	PM supplied	Common
Window UV silica - rectangular (left side)	2010082500	50 55 140 240 280	PM supplied	Common
Pad adhesive window (round)	4910012700	50 55 140 240 280	PM supplied	Common
Pad adhesive window (rectangular)	4910012800	50 55 140 240 280	PM supplied	Common
Electrode kit (1 pr) (D2)	6310003400	GTA120	PM supplied	Furnace
Shroud (D2)	6310003100	GTA120	PM supplied	Furnace
Zeeman electrode kit (1 pr)	6310003500	GTA120	PM supplied	Furnace
Zeeman shroud	6310003600	GTA120	PM supplied	Furnace
O-ring, PSD rinse bottle	6910025900	PSD120	PM supplied	Furnace

* For engineers who only service AA instruments 5190-8279 can be used as a cheaper alternative for 6610030100.

Items classified as PM supplied in the above table are included in the standard PM

Those classified as consumable should be provided by the customer or charged to the customer if supplied by the Agilent service engineer.

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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.

Service Completion

Service request number 6004901032

Date service completed 28 Jan 2022

Agilent signature Kanyakorn S.

Customer signature Chomthanan A.

Total number of pages in this document 13

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SVD Results Report



Report ID#	Diagnostic Start Time: 28/01/2022 8:48:57 AM	Diagnostic End Time: 28/01/2022 9:51:04 AM
Customer: UAE	Service Engineer: Kanyakorn S.	
Address:	Contact Details: 026376363#1	

Instrument Configuration

Configuration:

Serial Number: MY13180001	Turret Type: Automatic
Instrument Model: Varian AA140/240/280	Number Of Lamps: 4
Flame Instrument: True	Mono Type: Automatic
Furnace Instrument: True	Gasbox Type: Y Gas Box
Zeeman Present: False	Auto Burner Adjuster: False
Internal Zeeman: False	Mains Frequency: 50
Internal UltraAA: False	Firmware Version: 2.11
Optics Type: Double Beam	Photomultiplier Type: Normal(900nm)
D2 BG Correction Fitted: True	PWB Version: 45
Boot Block Version: 1.09	

EEPROM Data:

Instrument Run Hours: 48966.584	D2 Run Hours: 38036.500
Zero Wavelength Offset: 30.071	D2 Serial Number: not set !
Mono Correction: 0.755	D2 Install Date: 01/01/1970
Flame Hours: 23619.165	D2 Original Intensity: 1.000
	D2 Last Intensity: 475.000

Frequency:

Averaging Period: 30.0	
Datapoint Count: 20	
Upper Limit: 51.00	Highest Measured Frequency: 50.00
Average Frequency: 50.00	
Lower Limit: 49.00	Lowest Measured Frequency: 50.00

Result: Passed

Report Generated At: 28/01/2022 9:52:26 AM

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SVD Results Report

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Power Supply:

Averaging Period: 30.0
Datapoint Count: 20

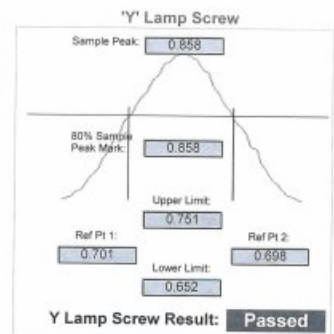
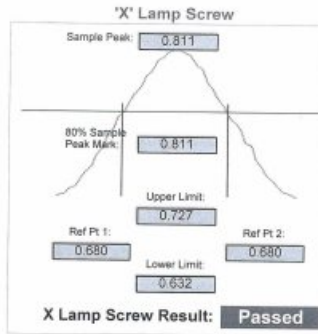
	Lower Limit (V)	Actual (V)	Upper Limit (V)	Result:
12.00 V Rail	10.80	12.20	13.20	Passed
-12.00 V Rail	-13.20	-11.90	-10.80	Passed
5.00 V Rail	4.50	5.01	5.50	Passed
310.00 V Rail	279.00	320.00	341.00	Passed

Optics

Beam Balance:

Lamp Type: Copper
Lamp Socket Used: 3

Peak Selected: 324.80
Lamp Alignment: Performed



Grating Squareness:

Lamp Element(s): Copper
Lamp Turret Position: 3
Lamp Current(mA): 4.00
Slit Width(nm): 0.5
1st Order Wavelength(nm): 324.80
Lamp Alignment: Performed

	Lower Limit (nm)	Actual (nm)	Upper Limit (nm)	Result:
Zero Order	-0.10	0.00	0.10	Passed
First Order	324.45	324.75	325.15	Passed
Second Order	649.23	649.52	649.97	Passed

Wavelength Repeatability:

Lamp Used: Copper
Peak Used(nm): 324.750
Connected to Socket: 3
Lamp Current(mA): 4
Slit Width(nm): 0.2
Slit Height: Normal
Lamp Alignment: Performed

Lower Limit(nm)	324.763	324.883	Upper Limit(nm)
(Approach from Zero Order)		(Approach from end)	
Sample 1:	324.823	Sample 2:	324.823
Sample 3:	324.823	Sample 4:	324.819
Sample 5:	324.819	Sample 6:	324.819
Sample 7:	324.819	Sample 8:	324.819
Sample 9:	324.819	Sample 10:	324.819

Mean: 324.821
Standard Deviation: 0.002

Result: Passed

Mechanical

Wavelength Drive:

Passed

Slit Drive:

Passed

Turret Drive:

Passed

Auto Burner Adjuster Drive:

Untested

Miscellaneous

Signal Processing Linearity:

Calculate Mode: New Calc Mode

	Lower Limit	Actual	Upper Limit	Result:
S0	114	280	297	Passed
S1	156	164	191	Passed
S2	271	295	332	Passed
S3	474	505	579	Passed
S4	825	913	1008	Passed
S5	1435	1519	1754	Passed
S6	2498	2753	3053	Passed
S7	4347	4724	5313	Passed

Interlocks:

Burner Fitted: Working	Flame Detect: Working
N2O Burner Fitted: Untested	GCU Active: Working
Flame Shield Closed: Working	Oxidant Pressure: Working
Gas Control Fitted: Untested	Oxidant Changeover: Untested
Pressure Release Bung Fitted: Working	Ignition: Working
Liquid Trap Fitted: Working	

Auto Lamp Recognition:

Lamp 1: 12 - Chromium (Cr) Lamp 5: Not Supported
 Lamp 2: Uncoded Lamp/Not Connected Lamp 6: Not Supported
 Lamp 3: 14 - Copper (Cu) Lamp 7: Not Supported
 Lamp 4: 87 - Silver/Cadmium/Lead/Zinc(UltrAA) (Ag/C Lamp 8: Not Supported

Result: **Passed**

GTA Temperature Monitoring:

Not Performed

Notes:

Signatures:

Chonthanan A. 28 Jan 2022 Kanyakorn S. 28 Jan 2022
 UAE Date Kanyakorn S. Date

Sequential by time report

28/01/2022 11:03 AM
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SpectrAA

Analyst
 Date Started: 28/01/2022 9:56 AM GMT, 28/01/2022 2:56 AM
 Worksheet: RM 28-01-2022 01-Sensitivity test
 Comment:
 Methods: Cu
 Computer name: HBM-212
 Serial Number: MY 13180001

Method: Cu (Flame)

Sample ID	Exp. Abs	%RSD	Mean Abs			
Cu 5 ppm	0.500	0.4	0.5004			
Readings						
0.5042	0.5002	0.4979	0.5006	0.5021	0.4980	
0.5019	0.5004	0.4958	0.4958	0.5012	0.4972	

Report Generated At: 28/01/2022 9:52:26 AM

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SVD Report Report SVD
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Sequential by time report

28/01/2022 12:22 PM
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SpectrAA

Analyst
 Date Started: 28/01/2022 11:04 AM GMT, 28/01/2022 4:04 AM
 Worksheet: As Hydride
 Comment:
 Methods: As
 Computer name: HBM-212
 Serial Number: MY 13180001

Method: As (Vapor)

Sample ID	Exp. Abs	%RSD	Mean Abs			
As 10 ppm	0.22	1.1	0.2158			
Readings						
0.2188	0.2171	0.2190	0.2145	0.2125	0.2122	28/01/2022

SPC Calibration Center

SERT
Part of DKSH Group

Certificate of Calibration

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

Customer: United Analyst and Engineering Consultant Company Limited
 3 Soi Udomsuk 41 Sukhumvit Road,
 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.,
 Bangkok, Prakanong, Bangkok 10260 Thailand

Calibration By: Mr. Imron Ama
 Calibration Date: 29 March 2021
 The Method used: In house method, SPCC-WI-49, base on ASTM D 1125-14 and D 5391-14
 Traceability: This certificate is traceable to the 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 เอสอาร์ที 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.

เอกสารไม่ควบคุม

เอกสารไม่ควบคุม

บริษัท เอสอาร์ที จำกัด
 SPC RT CO., LTD.
 เลขที่ 00003 1194 ซอย Wachirathamsathit 57 แขวงคลองเตย เขตวัฒนา กรุงเทพมหานคร 10260
 โทรศัพท์ 02-000-1194 โทรสาร 02-000-1194 โทรสาร 02-000-1194 โทรสาร 02-000-1194 โทรสาร 02-000-1194
 โทร 0 2000 4333 โทร 0 2000 4334 โทร 0 2000 4335 E-mail: info.spc@spc-rt.com Website: www.spc-rt.com

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

SPC RT 00, LTD.
ถนนรัชดาภิเษก 194 ซอยรัชดาภิเษก 57 แขวงจตุจักร เขตจตุจักร กรุงเทพมหานคร 10000
โทร 02-265 4333 Fax 02-265 4338 E-mail: info@spcgroup.com Website: www.spcgroup.com

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



National Food Institute, Ministry of Industry, Thailand

2008 Soi 36, Anuram Road, Bang Yi Khan Subdistrict, Bang Phai District, Bangkok 10700, Thailand
Tel : +66 (0) 2-622 8668 Fax : +66 (0) 2-622 8558 Website : www.nfi.go.th E-mail : cal@nfi.go.th



Calibration Certificate

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

Page 1 of 5

Equipment: pH Meter
Manufacturer: METTLER TOLEDO
Model: SevenEasy pH
Serial No.: 1231155210
ID No.: UAE.WAT.010/2553
Order No.: 2201793
Operation No.: 2201793-001
Date of Receipt: 21 February 2022
Date of Calibration: 1 March 2022

Calibrated by Mr.Pheraphat Tuanjit Scientist
Approved by P. Jangphairat (Mr.Nuttapol Niyomchart) Specialist, Division of Calibration Laboratory
Date of Issue: 1 March 2022
Responsible for the Technical Management Team

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

This Certificate is issued in accordance with the conditions of accreditation granted by the Thai Laboratory Accreditation Scheme which has assessed the measurement capability of the laboratory and its capability to recognize 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 36, Anuram Road, Bang Yi Khan Subdistrict, Bang Phai District, Bangkok 10700, Thailand
Tel : +66 (0) 2-622 8668 Fax : +66 (0) 2-622 8558 Website : www.nfi.go.th E-mail : cal@nfi.go.th



Calibration Report

Certificate No.: 2201793-001-01
Equipment: pH Meter
Resolution: 0.01 pH ; 1 mV
Manufacturer: METTLER TOLEDO
Model: SevenEasy pH
Serial No.: 1231155210
Type: Bench top
ID No.: UAE.WAT.010/2553
Date of Calibration: 1 March 2022
Location: Chemical Calibration Laboratory, NATIONAL FOOD INSTITUTE
Environment Condition: Ambient Temperature: (23.5 ± 1.5) °C Relative Humidity: (53 ± 5) %
Condition of Equipment: Good Condition
Condition of this Results of Calibration
1. Calibration Method: In house method ; W-CO-002 based on direct measurement by using standard voltage calibrator and certified reference material (CRM).
2. Reference Standards / Certified Reference Material

Instruments	Serial / ID No.	Manufacturer	Certificate No.	Due Date
2.1 DC Voltage Calibrator	2706007	Puke	SC-21P-0687	24 June 2022
2.2 Digital Thermometer	2706007	Puke	CC-44C596-01	30 October 2022
2.3 Thermo-Hygro Meter	NFL05418	PONPE	GR22-0195	27 January 2023

Certified Reference Material	Lot No.	Manufacturer	Ref N	Expiry Date
2.4 pH buffer 4.008 (Primary pH buffer Solution)	741339	CPAchem	PH216 L5	19 April 2023
2.5 pH buffer 6.865 (Primary pH buffer Solution)	741340	CPAchem	PH217 L5	19 April 2023
2.6 pH buffer 10.01 (Primary pH buffer Solution)	741342	CPAchem	PH220 L5	19 April 2022
2.7 pH buffer 7.00 (Standard pH buffer Solution)	732606	CPAchem	PH107 L5	16 March 2022

3. This certification is traceable to The International System of Unit (SI Unit)
3.1 Instruments No.2.1 through NSC-TIS-TIS 17025 Laboratory Accreditation of Calibration No.0075
3.2 Instruments No.2.2 through NSC-TIS-TIS 17025 Laboratory Accreditation of Calibration No.0061
3.3 Instruments No.2.3 through NSC-TIS-TIS 17025 Laboratory Accreditation of Calibration No.0292
3.4 Certified Reference Material No. 2.4 to 2.6 traceable to Primary measurement method- Hammett call using calibrated thermometer, barometer, and nanocoulometer. 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 BM RefN H-7 LotN 30.04.2020; BM RefN H-8 LotN 28.05.2020; BM RefN H-8 LotN 30.04.2020; BM RefN H-10 LotN 28.05.2020. The Standard Solution preparation and certified by CPAchem Ltd is accredited to ISO 17034 and ISO/IEC 17025
4. This certificate was certified only for the instrument we calibrated.
5. This result of calibration was found accurate as shown on date and place of calibration only.

P. Jangphairat
1 March 2022

เอกสารไม่ควบคุม

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



National Food Institute, Ministry of Industry, Thailand

2008 Soi 36, Anuram Road, Bang Yi Khan Subdistrict, Bang Phai District, Bangkok 10700, Thailand
Tel : +66 (0) 2-622 8668 Fax : +66 (0) 2-622 8558 Website : www.nfi.go.th E-mail : cal@nfi.go.th



Calibration Report

Certificate No.: 2201793-001-01
Equipment: pH Meter
Resolution: 0.01 pH ; 1 mV
Manufacturer: METTLER TOLEDO
Model: SevenEasy pH
Serial No.: 1231155210
Type: Bench top
ID No.: UAE.WAT.010/2553
Date of Calibration: 1 March 2022
Calibration Results:
1. Calibration of pH Meter (Manual Temperature Compensation at 25 °C)

Nominal pH	DC Voltage Standard (mV)	Average Indicator Reading	Uncertainty (mV)	Coverage Factor (k)
0.00	414.117	414	0.00	0.58
2.00	295.911	296	0.00	0.58
4.00	177.462	178	0.00	0.58
6.00	59.159	59	0.00	0.58
7.00	-0.001	0	0.00	0.58
8.00	-59.159	-59	0.00	0.58
10.00	-177.463	-177	0.00	0.58
12.00	-295.912	-296	0.00	0.58
14.00	-414.119	-414	0.00	0.58

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

Equipment:	pH Electrode	Type:	Combined Electrode
Manufacturer:	METTLER TOLEDO	Model:	InLabSolve
Serial No.:	1156882	ID No.	N/A

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

Certified Value @25 °C (pH)	Average Indicator Reading	Relative Slope (%)	Uncertainty (± pH)	Coverage Factor (k)
4.008	4.00	180	96.25	0.0076
6.865	6.88	16	-	0.0079
10.012	10.01	-162	96.13	0.0094
6.865	7.00	9	-	0.0097

P. Jangphairat
1 March 2022

เอกสารไม่ควบคุม

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

Calibration Report

Certificate No.: 2201793-001-01
Equipment: Digital Thermometer with RTD (pH Meter)
Resolution: 0.1 °C Model: SevenEasy pH
Serial No.: 1231156210 ID No.: UAE.WAT.0102553
Manufacturer: METTLER TOLEDO
Date of Calibration: 1 March 2022 Page 4 of 5

Location: Chemical Calibration Laboratory, NATIONAL FOOD INSTITUTE
Environment Condition: Ambient Temperature 24 °C ± 1 °C
Relative Humidity 55 % ± 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	1523	2118154	PSL-T 0851/64	03-Jun-22	TISTR
Platinum Resistance Thermometer (PRT)	5627A	877332			

Support Equipment : - Low Temperature Bath (ISOCAL-5), Model: Europa-5 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.

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.: 2201793-001-01
Equipment: Digital Thermometer with RTD (pH Meter)
Resolution: 0.1 °C Model: SevenEasy pH
Serial No.: 1231156210 ID No.: UAE.WAT.0102553
Manufacturer: METTLER TOLEDO
Date of Calibration: 1 March 2022 Page 5 of 5

Calibration point: 15.0, 25.0 and 35.0 °C
Calibration result:

- The probe was immersed in liquid bath or dry bath to a minimum depth of 100 mm.
- Description of probe, model : N/A SN : N/A
- Dimension of probe : Diameter 4 mm., Length 100 mm.,
- Sheath material : Stainless Steel

UUC* Reading (°C)	Standard Temperature (°C)	Correction Value (°C)	Uncertainty ± (°C)
15.1	15.006	-0.1	0.009
25.1	25.004	-0.1	0.009
35.1	35.003	-0.1	0.009

Note

- UUC* : Unit Under Calibration

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

----- End -----

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

เอกสารไม่ควบคุม

Calibration Certificate

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

Page 1 of 5

Equipment: pH Meter
Manufacturer: HANNA INSTRUMENTS
Model: HI 2211
Serial No.: 08165345
ID No.: UAE.WAT.0042556

Order No.: 2202097
Operation No.: 2202097-001
Date of Receipt: 11 March 2022
Date of Calibration: 16 March 2022

Calibrated by Mr.Manas Somsak Specialist Approved by (Mr.Pheraphat Tuanjit) Manager, Division of Calibration Laboratory
Date of Issue: 21 March 2022 Responsible for the Technical Management Team

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

This Certificate is issued in accordance with the conditions of accreditation granted by the Thai Laboratory Accreditation Scheme which has assessed the measurement capability of the laboratory and its traceability to recognized national standards and to the units of measurement related 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.: 2202097-001-01
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.0042556

Date of Calibration: 16 March 2022 Page 2 of 5

Location: Chemical Calibration Laboratory, National Food Institute
Environment Condition: Ambient Temperature: (23.0 ± 1.5) °C Relative Humidity: (49.5 ± 5) %
Condition of Equipment: Good Condition

Condition of this Results of Calibration

- Calibration Method : In house method : W-CC-052 based on direct measurement by using standard voltage calibrator and certified reference material (CRM)

2. Reference Standards / Certified Reference Material

Instrument	Serial / ID No.	Manufacturer	Certificate No.	Due Date
2.1 DC Voltage Calibrator	2709007	Fuke	SCL-21F-0987	24 June 2022
2.2 Digital Thermometer	2709007	Fuke	CC-640599-01	30 October 2022
2.3 Thermo-Hygro Meter	ans.41.BTH.00558	PONPE	QR21-2787	15 November 2022

Certified Reference Material	Lot No.	Manufacturer	Ref N	Expiry Date
2.4 pH buffer 4.006 (Primary pH buffer Solution)	790012	CPAchem	PH216.L5	21 November 2023
2.5 pH buffer 6.865 (Primary pH buffer Solution)	790013	CPAchem	PH217.L5	21 November 2023
2.6 pH buffer 10.01 (Primary pH buffer Solution)	790015	CPAchem	PH220.L5	21 November 2022
2.7 pH buffer 7.00 (Standard pH buffer Solution)	776840	CPAchem	PH107.L5	8 November 2022

3. The certification 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-Hanna Ltd using calibrated thermometer, barometer, and rainoutmeter. 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 RefN HI-7 Loth 30.04.2020; BSM RefN HI-9 Loth 28.05.2020; BSM RefN HI-8 Loth 30.04.2020; BSM RefN HI-10 Loth 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. The 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.: 2202097-001-01
Equipment: pH Meter
Resolution: 0.01 pH ; 0.1 mV
Manufacturer: HANNA INSTRUMENTS Model: HI 2211
Serial No.: 08165345 Type: Benchtop
ID No.: UAE.WAT.0042556
Date of Calibration: 16 March 2022 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		
0	414.117	414	0.00	0.58	2.00
3	295.611	295.7	3.00	0.063	2.00
4	177.462	177.4	4.00	0.063	2.00
6	55.159	55.2	6.00	0.063	2.00
7	-0.001	0.1	7.00	0.063	2.00
8	-59.159	-59.1	8.00	0.063	2.00
10	-177.463	-177.3	10.00	0.063	2.00
12	-295.612	-295.6	12.00	0.063	2.00
14	-414.115	-414	14.00	0.58	2.00

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

Equipment: pH Electrode Type: Combined Electrode
Manufacturer: METTLER TOLEDO Model: LE420
Serial No.: 1142902 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	180.5	99.3	0.0071	2.00
6.899	6.87	12.5	-	0.0074	2.00
10.015	10.01	-171.5	99.1	0.0060	2.00
6.993	6.98	5.2	-	0.0062	2.00

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

เอกสารไม่ควบคุม

Calibration Report

Certificate No.: 2202097-001-01
Equipment: Digital Thermometer with RTD (pH Meter)
Resolution: 0.1 °C Model: HI 2211
Serial No.: 08165345 ID No.: UAE.WAT.0042556
Manufacturer: HANNA INSTRUMENTS
Date of Calibration: 16 March 2022 Page 4 of 5

Location: Chemical Calibration Laboratory, National Food Institute

Environment Condition: Ambient Temperature (23.0 ± 1.0) °C
Relative Humidity (50 ± 4) %

Condition of this results of Calibration:

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

Instrument	Model	Serial No.	Certificate No.	Due Date	Through
HANDHELD THERMOMETER	1523	2118154	PSL-T 0851/64	24-Jun-22	TSTR
Platinum Resistance Thermometer (PRT)	5627A	877332			

Support Equipment : - Low Temperature Bath (GSCAL-6), Model: Europa-6 Plus Basic, S/N: 3410522

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 ☐ Without adjustment ☐ After adjustment
7. Result of Calibration :

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

เอกสารไม่ควบคุม

Calibration Report

Certificate No.: 2202097-001-01
Equipment: Digital Thermometer with RTD (pH Meter)
Resolution: 0.1 °C Model: HI 2211
Serial No.: 08165345 ID No.: UAE.WAT.0042556
Manufacturer: HANNA INSTRUMENTS
Date of Calibration: 16 March 2022 Page 5 of 5

Calibration point: 15.0, 25.0 and 35.0 °C

Calibration result:

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

- Description of probe, model : N/A S/N : N/A

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

Sheath material : Stainless Steel

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

Note : - UUC* : Unit Under Calibration

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

----- End -----

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

เอกสารไม่ควบคุม

Calibration Certificate

Certificate No.: 2203120-001-01
Client name: UNITED ANALYST AND ENGINEERING CONSULTANT CO., LTD.
Address: 3 Soi Udomsuk 41, Sukhumvit Road,
Bangchack, Prakhonong, Bangkok 10260

Page 1 of 3

Equipment: Electronic Balance

Manufacturer: METTLER TOLEDO

Model: AB204-S/FACT

Serial No.: 1129361010

ID No.: UAE.WAS.002/2552

Order No.: 2203120

Operation No.: 2203120-001

Date of Receipt: 1 June 2022

Date of Calibration: 1 June 2022

Calibrated by Mr.Taveesak Seilee
Scientist

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

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: 01 Date: 20-04-65

เอกสารไม่ควบคุม

Calibration Report

Certificate No.: 2203120-001-01
Equipment: Electronic Balance
Model: AB204-S/FACT
Serial No.: 1129361010
Capacity: 220 g
Manufacturer: METTLER TOLEDO
Resolution: 0.0001 g
ID No.: UAE.WAS.002/2552

Date of Calibration: 1 June 2022 **Page 2 of 3**

Environment Condition: Ambient Temperature: 19.9 ± 0.3 °C Relative Humidity: 45 ± 1.5 %

Place of Calibration: 108, Balance Room, UNITED ANALYST AND ENGINEERING CONSULTANT CO., LTD.

Condition of Equipment: Good Condition

Condition of This Results of Calibration:

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

2. Reference Standards:

Reference Standard	Model	Serial No.	Calibrated By	Certificate No.	Due Date
Standard Weight Class E2	1-500mg	B308068594	TCS	HQ2010205	6 January 2023
Standard Weight Class E2	1-500g	B308068128	TCS	HQ2010215	6 January 2023

Instrument	Model	Serial No.	Calibrated By	Certificate No.	Due Date
Thermo-Hygro Meter	PONPE 490	NFLBTH 010/18	Quality Room	QR22-0390	18 February 2023

3. This certification is traceable to SI UNIT

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

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

Calibration Results:

1. Repeatability of Reading:

Nominal Value (g)	Standard Deviation of Reading (g)
100	0.000046
200	0.000052

2. Off-Center Error:

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

The balance reading obtained is given in the table.

ading obtained is given in the table.

1	2	3	4	5	6	(Maximum Difference)
(g)	(g)	(g)	(g)	(g)	(g)	(g)
49.9992	49.9998	49.9998	49.9999	49.9998	49.9998	0.0001

F-CS-012 Revision: 01 Date: 20-04-65

เอกสารไม่ควบคุม

Calibration Report

Certificate No.: 2203120-001-01
Equipment: Electronic Balance
Model: AB204-S/FACT
Serial No.: 1129361010
Capacity: 220 g
Manufacturer: METTLER TOLEDO
Resolution: 0.0001 g
ID No.: UAE.WAS.002/2552

Date of Calibration: 1 June 2022 **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
Unloaded	0.00000	0.0000	0.0000	0.000088	2.00
0.01	0.01000	0.0100	0.0000	0.000088	2.00
0.05	0.05000	0.0499	0.0001	0.000088	2.00
0.1	0.10000	0.1000	0.0000	0.000088	2.00
0.2	0.20000	0.2000	0.0000	0.000088	2.00
0.5	0.50000	0.5000	0.0000	0.000088	2.00
1	1.00000	0.9999	0.0001	0.000088	2.00
2	2.00000	1.9999	0.0001	0.000088	2.00
5	5.00000	5.0000	0.0000	0.000088	2.00
10	9.99998	9.9999	0.0001	0.000088	2.00
20	19.99999	19.9999	0.0001	0.000088	2.00
50	49.99990	49.9999	0.0001	0.000112	2.00
70	69.99989	69.9998	0.0001	0.000114	2.00
100	100.00001	99.9999	0.0001	0.000117	2.00
150	149.99991	149.9997	0.0002	0.000222	2.00
200	200.00007	199.9998	0.0003	0.000330	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: 01 Date: 20-04-65

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, Prakhonong, Bangkok 10260

Page 1 of 4

Equipment: Electronic Balance

Manufacturer: METTLER TOLEDO

Model: AX 105 DR

Serial No.: 1122100406

ID No.: UAE.WAO.004/2546

Order No.: 2200708

Operation No.: 2200708-001

Date of Receipt: 24 November 2021

Date of Calibration: 24 November 2021

Calibrated by Mr.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	www.kid.BTH 003/55	Quality Room	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	0.000084
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.

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: AX 105 DR
Serial No.: 1122100406
Capacity: 110 g
Manufacturer: METTLER TOLEDO
Resolution: 0.0001 g / 0.0001 g
ID No.: UAE.WAO.004/2546

Date of Calibration: 24 November 2021 **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: 0.0001 g)

Nominal Value (g)	Standard Value (g)	Average Reading (g)	Correction (g)	Uncertainty (± g)	Coverage Factor k
Unload	0.00000	0.00000	0.00000	0.0000009	2.00
0.01	0.009998	0.01000	0.00000	0.000011	2.00
0.02	0.019997	0.02000	0.00000	0.000012	2.00
0.05	0.050001	0.05000	0.00000	0.000011	2.00
0.1	0.100002	0.10000	0.00000	0.000012	2.00
0.2	0.200004	0.20000	0.00000	0.000013	2.00
0.5	0.499994	0.50000	-0.00001	0.000014	2.00
1	0.999986	1.00000	-0.00001	0.000026	2.00
2	1.999989	1.99998	0.00001	0.000019	2.00
5	4.999979	4.99998	0.00000	0.000022	2.00
10	10.000026	9.99994	0.00009	0.000074	2.00
20	20.000037	19.99991	0.00013	0.000099	2.00
30	30.000063	30.00000	0.00006	0.00013	2.00

F-CS-012 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: 0.0001 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 k
40	40.00000	39.99999	0.00001	0.00014	2.00
45	44.99998	44.99999	0.00001	0.00015	2.00
50	49.99999	49.99999	0.00001	0.00016	2.00
55	54.99997	54.99998	0.00002	0.00016	2.00
60	60.00002	59.99999	0.00003	0.00018	2.00
65	65.00000	64.99999	0.00001	0.00018	2.00
70	70.00003	69.99999	0.00004	0.00019	2.00
75	75.00001	74.99999	0.00002	0.00020	2.00
80	80.00005	79.99998	0.00007	0.00021	2.00
85	85.00003	84.99998	0.00005	0.00022	2.00
90	89.99999	89.99998	0.00001	0.00021	2.00
100	99.99997	99.99998	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



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 554/4 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG BANGKOK 10250
 TEL. 0-2713-3000-27 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,
 Bangkok, Phrakhanong,
 Bangkok 10260
Location: Lab Floor 2
Received Order: 29 October 2021
Calibration Date: 29 October 2021
Ambient Temperature: (26 ± 10) °C
Relative Humidity: (50 ± 30) %
Calibrated by: Kunchit Promprat
Approved by:
 Approved Signatory
 () 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 & Equipment Calibration and Testing Services.



Equipment: Hot Air Oven
Condition As-Received: Used Item
Reference: 2110-0701OC-1

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

Procedure Used :-

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

The temperature scale used was based on ITS-90.

Condition of this result of calibration

1. Reference standard instrument:-

Instrument	Model	Serial No.	Cert. No.	Due Date
1) Data Acquisition	34970A	MY44067817	21LM10	29 Jul 2022

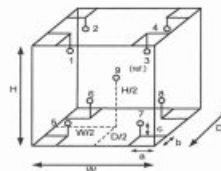
2. This certificate is valid only to the item calibrated on date and place of calibration.

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
AC 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

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

เอกสารไม่ควบคุม

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



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Cert. No.: 22TM563
 Page: 1 of 3

Certificate of Calibration

Equipment : Incubator
 Manufacturer : Mammart
 Model : IPP 260
 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 : 7 April 2022
 Calibration Date : 7 April 2022
 Ambient Temperature : (26 ± 10) °C
 Relative Humidity : (50 ± 30) %
 Calibrated by : Prawit Sodavitchit

Approved by :
 Approved Signatory

() Ponthippa Tameyakul
 (✓) Malee Butkrues
 () Suwit Imjai

Issue Date : 18 April 2022

The Uncertainties are for a confidence probability of approximately 95 %

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เอกสารไม่ควบคุม

A 0040248



Equipment : Incubator
 Condition As-Received : Used Item
 Reference : 2204-0016OC-1

Cert. No.: 22TM563
 Page: 2 of 3

Procedure Used :-
 Calibration were conducted using calibration procedure CP-OT02 according to direct measurement method with Data Acquisition which connected with Resistance Temperature Detector (RTD).
 The temperature scale used was based on ITS-90.

Condition of this result of calibration

1. Reference standard instrument:-

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

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

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

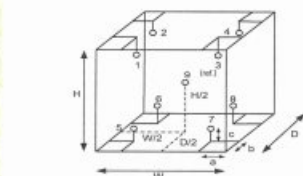
Result of Calibration :- (*) Without Adjustment

Function of UUC* : Temperature Source

Fresh air setting : Close

Environment during calibration		
	Beginning	Finished
Temp. (°C)	26	26
REL.Humid. (%)	60	62
AC Supply (Volt)	220	220

Position :	Ref. Std. ID No.:
1	15RTD2/11
2	15RTD2/12
3	15RTD2/13
4	15RTD2/14
5	15RTD2/15
6	15RTD2/16
7	15RTD2/17
8	15RTD2/18
9 (ref.)	15RTD2/19



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

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เอกสารไม่ควบคุม

a 1104310



Equipment : Incubator
 Condition As-Received : Used Item
 Reference : 2204-0016OC-1
 Result of Calibration :- (*) Without Adjustment
 Function of UUC* : Temperature Source
 Fresh air setting : Close

Cert. No.: 22TM563
 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	0.12	0.53	0.79	0.30	2

Calibration Point (°C)	Measured Temperature (°C)								
	Position								
	1	2	3	4	5	6	7	8	9 (ref.)
35.0	35.170	35.167	34.938	34.844	34.816	34.854	34.584	34.730	34.780

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 1104309



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



Cert. No.: 22TM672
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 : 3 May 2022
Calibration Date : 5 May 2022
Ambient Temperature : (26 ± 10) °C
Relative Humidity : (50 ± 30) %
Calibrated by : Preecha Hiahib
Approved by :
() Pornthippa Tameyakul
(✓) Malee Butkruea
() Suwit Imjai

Issue Date : 11 May 2022

The Uncertainties are for a confidence probability of approximately 95%

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

เอกสารไม่ควบคุม



Equipment : Incubator
Condition As-Received : Used Item
Reference : 2205-0003OC-3
Procedure Used :-

Cert. No.: 22TM672
Page.: 2 of 3

Calibration was conducted using calibration procedure CP-OT02 according to direct measurement method with Data Acquisition which connected with Resistance Temperature Detector (RTD).
The temperature scale used was based on ITS-90.

Condition of this result of calibration

1. Reference standard instrument:-

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

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

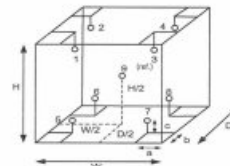
3. This certification is traceable to the International System of Unit.

Result of Calibration :- (*) Without Adjustment

Function of UUC* : Temperature Source

Fresh air setting : Not Available

Environment during calibration		
	Beginning	Finished
Temp. (°C)	25	23
REL.Humid. (%)	62	57
AC Supply (Volt)	221	221



Probe Installation Details :

a = 5.0 cm
b = 5.0 cm
c = 5.0 cm

Dimension of Chamber :

D = 0.50 m
W = 0.60 m
H = 0.80 m
Capacity = 0.24 m³

Position :	Ref. Std. ID No.:
1	19-15RTD-01
2	19-15RTD-02
3	19-15RTD-03
4	19-15RTD-04
5	19-15RTD-05
6	21-15RTD-06
7	19-15RTD-07
8	19-15RTD-08
9 (ref.)	19-15RTD-09

เอกสารไม่ควบคุม



Equipment : Incubator
Condition As-Received : Used Item
Reference : 2205-0003OC-3
Result of Calibration :- (*) Without Adjustment
Function of UUC* : Temperature Source
Fresh air setting : Not Available

Cert. No.: 22TM672
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	25.0	0.021	0.18	0.33	0.30	2
36.0	36.0	36.0	0.077	0.96	1.8	0.33	2

Calibration Point (°C)	Measured Temperature (°C)								
	Position								
25.0	25.221	25.146	25.127	25.113	24.968	24.986	24.933	25.017	25.047
36.0	35.637	35.238	36.130	36.515	36.928	36.845	36.630	36.761	36.113

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

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

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

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

UUC* : Unit Under Calibration

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

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

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TEL. 0-2717-3000-27 FAX. 0-2719-9484



Cert. No.: 22TM333
Page.: 1 of 3

Certificate of Calibration

Equipment : Water Bath
Manufacturer : Memmert
Model : WNE 14
Serial No. : L416.0606
ID No. : UAE.MIC.002/2560
Submitted by : United Analyst and Engineering Consultant Co.,Ltd.
3 Soi Udomsuk 41, Sukhumvit Road,
Bangchak, Phrakhanong,
Bangkok 10260
Location : Microbiology Laboratory
Received Order : 17 February 2022
Calibration Date : 17 February 2022
Ambient Temperature : (26 ± 10) °C
Relative Humidity : (50 ± 30) %
Calibrated by : Suwit Imjai

Approved by :
Approved Signatory

(✓) Pornthippa Tameyakul
(✓) Malee Butkruea

Issue Date : 22 February 2022

The Uncertainties are for a confidence probability of approximately 95%

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

เอกสารไม่ควบคุม



Equipment : Water Bath
Condition As-Received : Used Item
Reference : 2202-0444OC-3

Cert. No.: 22TM333
Page.: 2 of 3

Procedure Used :-

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

The temperature scale used was based on ITS-90.

Condition of this result of calibration

1. Reference standard instrument:-

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

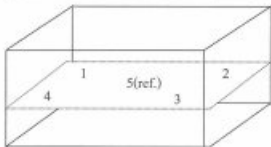
2. This certificate is valid only to the item calibrated on date and place of calibration.

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

Result of Calibration :- (*) Without Adjustment

Function of UUC* : Temperature Source

	Environmental		AC Voltage Supply
	(°C)	(%R.H.)	(Volt)
Beginning of Calibration	21	65	229
Finished of Calibration	22	58	230



Front

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

เอกสารไม่ควบคุม



Equipment : Water Bath
Condition As-Received : Used Item
Reference : 2202-0444OC-3

Cert. No.: 22TM333
Page.: 3 of 3

Procedure Used :-

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

The temperature scale used was based on ITS-90.

Condition of this result of calibration

1. Reference standard instrument:-

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

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

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

Result of Calibration :- (*) Without Adjustment

Function of UUC* : Temperature Source

Calibration point (°C)	UUC* Setting (°C)	UUC* Reading (°C)	Average* Standard Reading (°C)				
			Position				
			1	2	3	4	5 (ref.)
44.5	44.5	44.5	44.498	44.491	44.482	44.518	44.534

Calibration point (°C)	Uniformity (°C)	Stability (± °C)	Uncertainty (± °C)	Coverage Factor k
44.5	0.13	0.057	0.15	2

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

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

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

UUC* : Unit Under Calibration

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

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

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

Certificate of Calibration

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

Approved by :
Approved Signatory

() Pornthippa Tameyakul
(/) Malee Butkrusa

Issue Date : 22 February 2022

The Uncertainties are for a confidence probability of approximately 95%

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

เอกสารไม่ควบคุม

A 0038095



Equipment : Water Bath
Condition As-Received : Used Item
Reference : 2202-0444OC-4

Cert. No.: 22TM334
Page.: 2 of 3

Procedure Used :-

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

The temperature scale used was based on ITS-90.

Condition of this result of calibration

1. Reference standard instrument:-

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

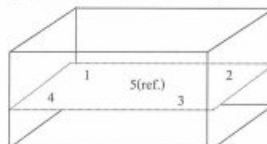
2. This certificate is valid only to the item calibrated on date and place of calibration.

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

Result of Calibration :- (*) Without Adjustment

Function of UUC* : Temperature Source

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



Front

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

เอกสารไม่ควบคุม

a 1096055



Equipment : Water Bath
Condition As-Received : Used Item
Reference : Z202-0444OC-4
Result of Calibration :- (*) Without Adjustment
Function of UUC* : Temperature Source

Cert. No.: 22TM334
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	44.572	44.514	44.507	44.530	44.565

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

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

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

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

UUC* : Unit Under Calibration

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

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

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เอกสารไม่ควบคุม
a 1096054

Calibration Certificate ID
TH2058-096-040722-ACC-TH

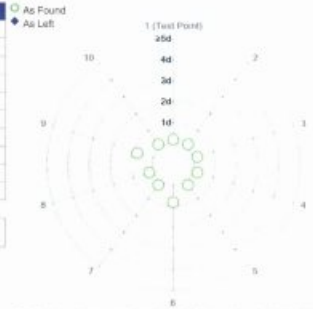
METTLER TOLEDO Service

Measurement Results

Repeatability

Test Load: 200 g

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



The "1d" in the graph represents the readability of the range/interval in which the test was performed.
The results of this graph are based upon the absolute values of the difference from the mean value.

Eccentricity

Test Load: 200 g

Position	As Found	As Left
1	200.001 g	N/A
2	200.001 g	N/A
3	200.002 g	N/A
4	200.002 g	N/A
5	200.000 g	N/A
Maximum Deviation	0.001 g	N/A



The "1d" in the graph represents the readability of the range/interval in which the test was performed.

Calibration Certificate ID
TH2058-096-040722-ACC-TH

METTLER TOLEDO

Mettler-Toledo (Thailand) Ltd.
846/4 - 846/5 Lasalle Rd., Bangna Tai Sub-District
Bangna District, Bangkok 10260
+66 2723 0362
MT-TH.ServiceSupport@mt.com



Accuracy Calibration Certificate

Customer

Company: United Analyst and Engineering Consultant Co., Ltd.
Address: 3 Soi Udom Suk 41, Sukhumvit Rd., Bang Chak
City: Phra Khanong Contact: Suret Chotnork
Zip / Postal: 10260
State / Province: Bangkok
Order Number: 0352401494

Weighing Device

Manufacturer: Mettler Toledo Instrument Type: Weighing Instrument
Model: MS603B/01 Asset Number: UAE.MC.008/2553
Serial No.: 9007010311 Terminal Model: N/A
Building: N/A Terminal Serial No.: N/A
Room: 2 Terminal Asset No.: N/A
Balance Room (206)

Range	Max. Capacity	Readability (d)
1	620 g	0.001 g

Procedure

Calibration Guideline: EURAMET cg-18 v. 4.0 (11/2015)

METTLER TOLEDO Work Instruction: CP-W002/20

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

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

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

	Temperature	Humidity
As Found	Start: 22.6 °C End: 23.0 °C	Start: 49.9 % End: 58.3 %

As Found Calibration Date: 07-Apr-2022

As Left Calibration Date: N/A

Issue Date: 08-Apr-2022

Calibrator:

Approved Signatory:

Signature: Suret Chotnork
Name: Suret Chotnork
Title: Kalasakorn Tassanachaisakul
Sant Jiriyom
Sureshet Sukkate

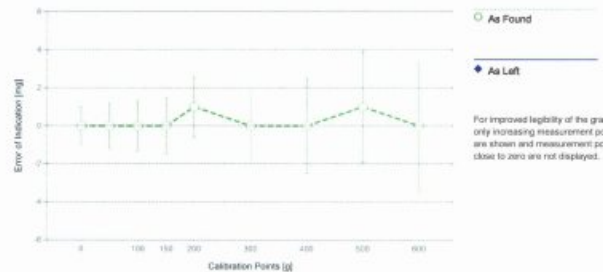
Calibration Certificate ID
TH2058-096-040722-ACC-TH

METTLER TOLEDO Service

Error of Indication

As Found

	Reference Value	Indication	Error of Indication	Expanded Uncertainty	k
1	0.000 g	0.000 g	0.000 g	1.0 mg	2
2	0.500 g	0.500 g	0.000 g	1.2 mg	2
3	1.000 g	1.000 g	0.000 g	1.2 mg	2
4	50.000 g	50.000 g	0.000 g	1.2 mg	2
5	100.000 g	100.000 g	0.000 g	1.3 mg	2
6	150.000 g	150.000 g	0.000 g	1.5 mg	2
7	200.000 g	200.001 g	0.001 g	1.6 mg	2
8	300.001 g	300.001 g	0.000 g	2.0 mg	2
9	400.001 g	400.001 g	0.000 g	2.5 mg	2
10	500.001 g	500.002 g	0.001 g	2.9 mg	2
11	600.001 g	600.001 g	0.000 g	3.4 mg	2



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

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

Test Equipment

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

Weight Set 1: OIML F1

Weight Set No.: W555 Date of Issue: 09-Jul-2021
Certificate Number: CCM-0137-21-C Calibration Due Date: 07-Jul-2022

Weight Set 2: OIML E2

Weight Set No.: W580 Date of Issue: 23-Feb-2022
Certificate Number: C208581831 Calibration Due Date: 14-Aug-2023

Thermo Hygrometer

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

Remarks

FACT adjustment functionality activated
Equipment condition: Good
Next calibration according to customer's procedure
Calibration data not decide by calibration laboratory

End of Accredited Section

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

Measurement Uncertainty of the Weighing Instrument in Use

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

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

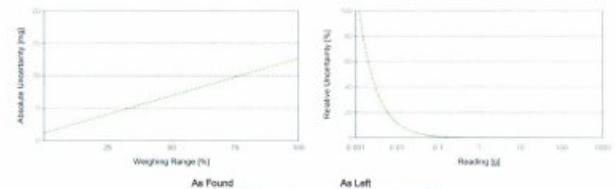
Linearization of Uncertainty Equation

Range	As Found	As Left
d	Max	
1 0.001 g	620 g	$U_1 = 1.2 \text{ mg} + 0.0186 \text{ mg/g} \cdot R$
		N/A

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

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

Net Indication	As Found	As Left
0.002 g	1.2 mg	1.9%
0.020 g	1.2 mg	0.20%
0.200 g	1.3 mg	0.031%
2.000 g	2.4 mg	0.0038%
20.000 g	13 mg	0.0021%



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



Cert. No.: 22TM681
Page.: 1 of 3

Certificate of Calibration

Equipment : Autoclave
Manufacturer : ALP
Model : CL-40L
Serial No. : 808763
ID No. : UAE.MIC.026/2563
Submitted by : United Analyst and Engineering Consultant Co.,Ltd.
3 Soi Udomsuk 41, Sukhumvit Road,
Bangchak, Phrakhanong,
Bangkok 10260
Location : Microbiology Laboratory (301)
Received Order : 27 May 2022
Calibration Date : 27 May 2022
Ambient Temperature : $(26 \pm 10) ^\circ C$
Relative Humidity : $(50 \pm 30) \%$
Calibrated by : Preecha Hiahb
Approved by :
(/) Pornthippa Tameyakul
(/) Malee Bulkrues
(/) Suwit Imjai

Issue Date : 2 June 2022

The Uncertainties are for a confidence probability of approximately 95%

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เอกสารไม่ควบคุม



Equipment : Autoclave
Condition As-Received : Used Item
Reference : 2205-07640C-2
Procedure Used :-

Cert. No.: 22TM681
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	Model	Serial No.	Cert. No.	Due Date
1) Data Acquisition	34970A	MY44060450	22LM46	28 Mar 2023

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

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

4. This result of calibration covers laboratory autoclaves for the sterilization of goods and material which

can 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.

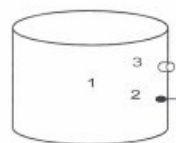
This result of calibration does not apply to sterilizers or disinfectors used for medical, dental, pharmaceutical

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.

Result of Calibration :- (*) Without Adjustment

Function of UUC* : Temperature Source



	Environmental		
	($^{\circ} C$)	(%R.H.)	(Volt)
Beginning of Calibration	27	56	220
Finished of Calibration	27	59	221

Position	Description	Ref. Std. ID No.:
1 =	Center of chamber	22-14TC-01
2 =	Temperature sensor	22-14TC-02
3 =	Exhaust port	22-14TC-03

เอกสารไม่ควบคุม



Equipment : Autoclave
 Condition As-Received : Used Item
 Reference : 2205-0764OC-2
 Result of Calibration :- (*) Without Adjustment

Cert. No.: 22TM681
 Page.: 3 of 3

Operating parameter Set : Temperature = 115.0 °C Sterilization period = 15 minute							
UUC* Setting (°C)	UUC* Reading (°C)	Position	Average* Standard Reading (°C)	Stability (± °C)	Pressure Reading (MPa)	Uncertainty (± °C)	Coverage Factor k
115.0	115.0	1	115.553	0.4	0.08	0.52	2
		2	115.582				
		3	115.325				

Operating parameter Set : Temperature = 121 °C Sterilization period = 30 minute							
UUC* Setting (°C)	UUC* Reading (°C)	Position	Average* Standard Reading (°C)	Stability (± °C)	Pressure Reading (MPa)	Uncertainty (± °C)	Coverage Factor k
121.0	121.0	1	121.484	0.21	1.1	0.75	2
		2	121.581				
		3	121.311				

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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เอกสารไม่ควบคุม



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Certificate of Calibration

Cert. No.: 22TM333
 Page.: 1 of 3

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,
 Bangkok, Phrakhanong,
 Bangkok 10260
 Location : Microbiology Laboratory
 Received Order : 17 February 2022
 Calibration Date : 17 February 2022
 Ambient Temperature : (26 ± 10) °C
 Relative Humidity : (50 ± 30) %
 Calibrated by : Suwit Imjai

Approved by : 
 Approved Signatory
 (/) Pornthippa Tameyaku
 (/) Malee Butkrusa

Issue Date : 22 February 2022
 The Uncertainties are for a confidence probability of approximately 95 %
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 Approval of the head of Corporate Services 3: Equipment Calibration and Testing Services.

เอกสารไม่ควบคุม



Equipment : Water Bath
 Condition As-Received : Used Item
 Reference : 2202-0444OC-3
 Procedure Used :-

Cert. No.: 22TM333
 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	Model	Serial No.	Cert. No.	Due Date
1) Data Acquisition	34970A	MY44067817	21LM10	20 Jul 2022

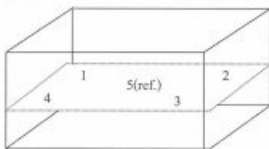
2. This certificate is valid only to the item calibrated on date and place of calibration.

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

Result of Calibration :- (*) Without Adjustment

Function of UUC* : Temperature Source

	Environmental		AC Voltage Supply
	(°C)	(%R.H.)	
Beginning of Calibration	21	65	229
Finished of Calibration	22	58	230



Front

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

เอกสารไม่ควบคุม



Equipment : Water Bath
 Condition As-Received : Used Item
 Reference : 2202-0444OC-3
 Result of Calibration :- (*) Without Adjustment
 Function of UUC* : Temperature Source

Cert. No.: 22TM333
 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	44.498	44.481	44.482	44.518	44.534

Calibration point (°C)	Uniformity (°C)	Stability (± °C)	Uncertainty (± °C)	Coverage Factor k
44.5	0.13	0.057	0.15	2

Average* : The average of 30 values in each position.
 Uniformity : The maximum difference of measured temperatures at any sensors and the measured temperature at the reference location which are observed at the same time or at as close an observation time as possible to determine the temperature pattern or homogeneity within the chamber under steady-state conditions.
 Stability : One-half of the greatest maximum difference of measured temperature at any one probe.
 UUC* : Unit Under Calibration
 Note : The reported uncertainty of measurement was included stability and excluded uniformity.

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

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