

ภาคผนวก จ

เอกสารรับรองเครื่องมือการตรวจวัด



Request No. : 22-66 / 0213

MTC No. : PSL-P 0060 / 66

CERTIFICATE OF CALIBRATION

Nomenclature : Digital Lux Meter

Serial No. : R.031886

Maker : DIGICON

Model : LX-73

Customer : M GREEN GROUP CO., LTD.

Address : 188/46, Pracha-Utd Rd., Thungkru, Bangkok 10140

Date of receipt : 12 January 2023

Date of calibration : 23 January 2023

Place of calibration : Photometry and Temperature Standards Laboratory, MTC. (Bangpoo)

Basis of calibration : calibration at 0 ~ 5000 lux.

Condition of calibration : - Ambient temperature : $(25 \pm 2) ^\circ\text{C}$

- Relative humidity : $(60 \pm 20) \%$

Reference Standard : Working Standard Luminous Intensity Lamp, Serial No.: FEL003 and 3501,

can be traceable to international system of units (SI), through calibration certificate

MTC No. PSL-P 132/65 and PSL-P 133/65, date of calibration 12 May 2022.

Traceability : This certificate is traceable to SI units through the National Institute of Metrology (Thailand).

calibration certificate No. TP-1003-21, TP-1004-21 and TP-1005-21

Support Equipment : 1. Photometric bench, 3.0 meter long

2. DC power supply, Serial No.: BC - 341006035007/2

3. Digital Multimeter, Model : R 6551 , S/N : 92041186 and 92041192

Calibration Procedure : The measurement was done in accordance with WLCF.10.

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

R.P.

page 1 of 2

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E-mail : sumalee@tistr.or.th



Request No. : 22-66 / 0213

MTC No. : PSL-P 0060 / 66

Serial No. : R.031886

Results :

UUC Range (lux)	Standard (lux)	*UUC Reading (lux)	Uncertainty of Measurement \pm (lux)
40	10	9.56	0.23
	20	19.13	0.46
	30	28.45	0.68
	40	37.61	0.91
400	100	99.6	2.2
	200	196.7	4.4
	300	293.4	6.5
	400	388.1	8.7
4000	1000	985	22
	2000	1974	44
	3000	2947	65
	4000	3901	87
40000 ($\times 10$)	4000	400	90
	5000	499	110

Note : *UUC = Unit Under Calibration.

...end of certificate...

Calibrated by :

Rattana

(Ms. Rattanaadee Pholprom)

Approved by :

Mr. Kamol

(Mr. Kamol Singhapiwat)

Photometry and Temperature Standards Laboratory

Ref. : 2012266011200117001

Issued date : 24 January 2002

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Certificate of Calibration

Certificate Number : SPR23010011-2
Customer : M Green Group Co.,Ltd
188/46, Pracha-Utd Rd., Thungkru, Bangkok 10140, Thailand

Page : 1 of 3

Equipment Name : Sound Level Meter
Manufacturer : Pulsar
Model : 44
Serial Number : PN2323
ID. Number : N/A

Environmental Conditions
Ambient Temperature : $23^{\circ}\text{C} \pm 3^{\circ}\text{C}$ Received Date : 04 Jan 2023
Relative Humidity : $50\% \pm 15\%$ Calibration Date : 05 Jan 2023
Location of Calibration : In-Lab Recommend Due Date : 05 Jan 2024
Calibration Procedure : SP-CPE-04-01 Date of Issue : 06 Jan 2023

Method of Calibration

This certifies that the above instrument was calibrated in compliance with the calibration system requirement of ISO/IEC 17025:2017 in accordance with reference procedure. Standards used to perform this calibration are certified by to NIST or equivalent, National metrology institute, Natural physical constants, consensus standards. The result reported herein apply only to the calibration of the item described above as received. Our decision rule is to contact the customer if the item pass and fail calibration when the results include the uncertainties and the customer must determine if the results meets their needs.
All calibrations are performed within manufacture's specifications. The calibration certificate shall not be reproduced except in full, without written approval of SP Metrology System (Thailand).

Calibrated by : Mr.Karoon Pengsalung
Approved by :
(Mr.Worapong Sinthusopa)
Calibration Officer
Authorized Signatory



Calibration Report

Certificate Number : SPR23010011-2

Page : 2 of 3

Reference Standards

Equipment Name	Model	Serial No.	Certificate No.	Due. Date
Sound Level Calibrator	SC-942	B014059	EEL.BP. 34/1264	22 Dec 2023

Traceability

This certification is traceable to the International System of Unit maintained at :
TISTR - Thailand Institute of Scientific and Technological Research



Result of Calibration

Certificate No. : SPR23010011-2

Page : 3 of 3

Range : 94 to 114 dB Function : @1kHz

Standard Setting	UUC Reading		Error		Uncertainty (±)
	Fast	Slow	Fast	Slow	
94	93.9	93.9	-0.1	-0.1	0.15
114	113.9	113.9	-0.1	-0.1	0.15

Select A Unit : dB

Standard Setting	UUC Reading		Error		Uncertainty (±)
	Fast	Slow	Fast	Slow	
94	94.2	94.2	0.2	0.2	0.15
114	114.1	114.1	0.1	0.1	0.15

Select C Unit : dB

Note:

The result of calibration was found accurate as show on date and place of calibration only.
This Certificate is not certified for any commercial transaction.

Measurement Uncertainty

The reported uncertainty of measurement is the expanded uncertainty obtained by multiplying the standard uncertainty with the coverage factor $k = 2.00$, providing a level of confidence approximately 95%.

– End of Certificate –



METROLOGY SYSTEM (THAILAND) CO.,LTD.



Certificate of Calibration

Certificate Number : SPR23010011-6

Page : 1 of 3

Customer : M Green Group Co.,Ltd

188/46, Pracha-Utd Rd., Thungkru, Bangkok 10140, Thailand

Equipment Name : Noise Dose Meter

Manufacturer : Tenmars

Model : ST-130

Serial Number : 220100171

ID. Number : N/A

Environmental Conditions

Ambient Temperature : $23^{\circ}\text{C} \pm 3^{\circ}\text{C}$ Received Date : 04 Jan 2023

Relative Humidity : $50\% \pm 15\%$ Calibration Date : 05 Jan 2023

Location of Calibration : In-Lab Recommend Due Date : 05 Jan 2024

Calibration Procedure : SP-CPE-04-01 Date of Issue : 06 Jan 2023

Method of Calibration

This certifies that the above instrument was calibrated in compliance with the calibration system requirement of ISO/IEC 17025:2017 in accordance with reference procedure. Standards used to perform this calibration are certified by to NIST or equivalent, National metrology institute, Natural physical constants, consensus standards. The result reported herein apply only to the calibration of the item described above as received. Our decision rule is to contact the customer if the item pass and fail calibration when the results include the uncertainties and the customer must determine if the results meets their needs.

All calibrations are performed within manufacture's specifications. The calibration certificate shall not be reproduced except in full, without written approval of SP Metrology System (Thailand).

Calibrated by : Mr.Karoon Pengsalung

Approved by :

Calibration Officer

(Mr.Worapong Sinthusopa)

Authorized Signatory



METROLOGY SYSTEM (THAILAND) CO.,LTD.



Calibration Report

Certificate Number : SPR23010011-6

Page : 2 of 3

Customer : TISTR

Reference Standards

Equipment Name	Model	Serial No.	Certificate No.	Due. Date
Sound Level Calibrator	SC-942	B014059	EELBP. 34/1264	22 Dec 2023

Traceability

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

TISTR - Thailand Institute of Scientific and Technological Research



Result of Calibration

Certificate No. : SPR23010011-6

Page : 3 of 3

Range : 94 to 114 dB Function : @1kHz

Select A	Standard Setting	UUC Reading		Error		Uncertainty (±)
		Fast	Slow	Fast	Slow	
94		94.1	94.1	0.1	0.1	0.15
114		114.1	114.1	0.1	0.1	0.15

Unit : dB

Select C	Standard Setting	UUC Reading		Error		Uncertainty (±)
		Fast	Slow	Fast	Slow	
94		94.0	94.0	0.0	0.0	0.15
114		114.0	114.0	0.0	0.0	0.15

Unit : dB

Note:

The result of calibration was found accurate as show on date and place of calibration only.
This Certificate is not certified for any commercial transaction.

Measurement Uncertainty

The reported uncertainty of measurement is the expanded uncertainty obtained by multiplying the standard uncertainty with the coverage factor $k = 2.00$, providing a level of confidence approximately 95%.

- End of Certificate -



กรมการมาตรฐาน
ประเทศไทย

กระทรวงอุตสาหกรรม

Request No. 22-66 / 0214

MTC No. PSL-H 0085 / 66

Certificate of Calibration

Customer : M Green Group Co.,Ltd.
188/46, Pracha-Utd Rd., Thungkru, Bangkok, 10140

Item : Thermo-Hygrometer (Thermal Environment Monitor)

Model / Type : QUESTemp[®]32

Serial Number : TPJ070016

Manufacturer : 3M, QUEST Technologies

Date of Request : 12 January 2023

Date of Calibration : 26 January 2023

The certifies the above equipment was calibrated in accordance with the recognised International Standard ISO/IEC 17025:2017 and the operation according to procedure no. WI.CP.18.

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

Calibrated by :

Panit T.

(Ms. Panit Thummasri)

Approved by :

K. Kanchan Singhapawat

(Mr. Kanchan Singhapawat)

Director

Photometry and Temperature Standards Laboratory

Ref. No : 2012266011200118002

Issued Date : 13 February 2023

Page 1 of 4

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กรมการมาตรฐาน
ประเทศไทย

กระทรวงอุตสาหกรรม

Request No. 22-66 / 0214

MTC No. PSL-H 0085 / 66

Description of Unit Under Calibration :

Customer : M Green Group Co.,Ltd.

Address : 188/46, Pracha-Utd Rd., Thungkru, Bangkok, 10140

Item : Thermo-Hygrometer (Thermal Environment Monitor)

Serial Number : TPJ070016

Calibration Required : Temperature at (30, 35, 40) °C

Ambient Condition : Ambient temperature (23 ± 3) °C

Relative humidity : (55 ± 20) %

Laboratory Address : Photometry and Temperature Standards Laboratory
Sri 1, Bangpoo Industrial Estate, Sukhumvit Rd., Samutprakan

Reference Standard :

Digital Thermometer with Sensor, Model : F250H, S/N : 9345 008 2331, Sensor RTD Probe No. RTD-01 and RTD-02 which was calibrated by Industrial Metrology and Testing Service Centre, Certificate No. PSL-T 0786/65.

The temperature scale in use of this laboratory is the International Temperature Scale of 1990.

Calibration Procedure :

The certifies the above equipment was calibrated according to procedure no. WI.CP.18.

Support Equipment :

Temperature & Humidity Controlled Chamber, Model : 9141-5110, S/N : 1205101

Adjustments :

NONE

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MEASUREMENTS STANDARDS
CALIBRATION DIVISION

Request No. 22-66 / 0214

MTC No. PSL-H 0085 / 66

Results of Calibration :-

(/) Without Adjustment

() After Adjustment

Table : Temperature Measurement @ Wet Bulb

Average Measured Temperature (°C)	Average Displayed of UUC (°C)	Correction Measured of UUC (°C)	Expanded Uncertainty of Measurement (± °C)
30.0	30.2	-0.2	0.50
34.9	35.0	-0.1	0.50
39.9	40.0	-0.1	0.50

Table : Temperature Measurement @ Dry Bulb

Average Measured Temperature (°C)	Average Displayed of UUC (°C)	Correction Measured of UUC (°C)	Expanded Uncertainty of Measurement (± °C)
30.0	30.1	-0.1	0.50
34.9	35.0	-0.1	0.50
39.9	39.9	0.0	0.50

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P.T.

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๓๓-TISTR

MEASUREMENTS STANDARDS
CALIBRATION DIVISION

Request No. 22-66 / 0214

MTC No. PSL-H 0085 / 66

Results of Calibration :-

Table : Temperature Measurement @ Globe Bulb

Average Measured Temperature (°C)	Average Displayed of UUC (°C)	Correction Measured of UUC (°C)	Expanded Uncertainty of Measurement (± °C)
30.0	29.9	0.1	0.50
34.9	34.8	0.1	0.50
39.9	39.8	0.1	0.50

Note :

1. This calibration was done without removing reservoir cover, white plates and blackened copper sphere of the instrument.
2. The calibration data for instrument in this report is reported within the condition existing at the time of measurement only.

...end of certificate...

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P.T.

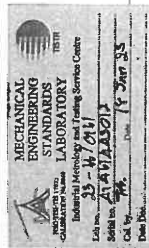
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THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)
Mechanical Engineering Standards Laboratory Sol 1, Bangpoo Industrial Estate, Muang, Samutprakan 10280, Thailand.

Request No.23-66/0161

MTC.No.23-66/0161

Number of page(s) 2

CALIBRATION CERTIFICATE

Nomenclature : MASS FLOWMETER

Manufacturer : TSI

Serial No.: 41461443012

Model : 4199

Scale range : 0 l/min to 20 l/min

Subdivision : 0.001 l/min

Submitted by : M GREEN GROUP CO.,LTD

188/46, Pracha-Utd Rd.,

Thungkru, Bangkok 10140, Thailand.

Received date : 10 January 2023 Condition of measured item : Normal

Calibration date : 18 January 2023

Standard :

Standard	Certificate No.	Date due	Traceability
RTD Thermometer	PSL-T 643/65	1-Jun-24	TISTR
Molbox/Pressure Transducer/UpStream	MP-0013-21	25-Jan-23	NIMT
Primary Flow Calibrator S/N 117982	MW-0011-21	8-Apr-23	NIMT
Primary Flow Calibrator S/N 119521	MW-0012-21	31-Mar-23	NIMT

Calibrated by : Terasak Panna

Approved by : (Ms.Kirana Luanghirun)

Mechanical Engineering Standards Laboratory

Ref. 2013266011000059001

Issued Date 18 January 2023

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Request No.23-66/0161

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MTC.No.23-66/0161

Calibration point : (0.05, 0.1, 0.2, 0.3, 0.4, 0.5, 1, 2, 3) l/min
Ambient condition : Temperature (23 ± 3) °C, Relative humidity (55 ± 15) %

Atmospheric pressure (1010 ± 13) hPa

Calibration method : The flowmeter (UUC) was calibrated by comparison method with standard flowmeter according to CP-370.01.

The reported value is the value that converted to value at reference condition within pressure and temperature of the actual gas entering the UUC

Measurement data :

UUC Value (l/min)	Standard Value (l/min)	Temperature (°C)	Pressure (hPa)	Deviation (%)	Uncertainty (%)
0.054	0.0572	24.920	1008.08	-5.52	1.42
0.105	0.1060	24.903	1008.16	-0.90	1.13
0.204	0.2058	24.897	1008.25	-0.88	1.02
0.304	0.3038	24.922	1008.32	-0.05	1.02
0.402	0.4039	24.937	1008.38	-0.47	1.03
0.504	0.5032	24.919	1008.45	+0.23	1.02
0.999	0.9948	24.906	1008.60	+0.45	0.92
2.003	1.9789	24.922	1009.20	+1.22	0.87
3.007	2.9759	24.923	1009.90	+1.04	0.87

The reported expanded uncertainties are based on standard uncertainties multiplied by a coverage factor $k=2$, which provides a level of confidence of approximately 95%.

The end of calibration certificate.

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FMBLMTC.002 Rev.4



Certificate of Calibration

Certificate No. : 65-200300-1

Page : 1 of 2

Submitted by :

M Green Group Co., Ltd.

188/46 Wisutesuknakhon 25, Pracha-Utd Rd., Thungkru, Bangkok 10140 Thailand

Equipment :

Electronic Balance

Manufacturer : SHIMADZU Model : AP225WD

Serial No. : D316300690

Capacity : 220 g Resolution : 0.00001g/102g, 0.0001g/220g

Environment :

On site calibration was carried out at the Laboratory, M Green Group Co., Ltd.

Ambient Temperature : (26.1 to 26.3) °C

Relative Humidity : (62.1 to 64.5) %

Air Pressure : 1007.0 mbar

Date of Received :

21 September 2022

Date of Calibration :

21 September 2022

Date of Issue :

24 September 2022

Calibrated by :

Akaradath Thippichai

Calibration Method :

In-house method CAL-M2001 based on UKAS Publication ref : LAB 14

Edition 5, July 2015

Reference Standard Instruments : This certification is traceable to the International System of Units

Standard Weights

ID No.	Cart.No.	Due Date	Traceability
E261-E2624	C02213103	18 Nov 2022	National Institute of Metrology (Thailand), (NIMT)

Approved by :

(Surachai Promthong)
Laboratory Manager

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 Calibratech Co., Ltd.



Certificate of Calibration

Certificate No. : 65-200300-1

Page : 2 of 2

Result of Calibration : Without Adjustment

UUC Condition As-Received : Good

Departure of indication from nominal value

Nominal Value (g)	Correction (g)	Uncertainty ± (g)
0.001	0.00001	0.000012
0.01	0.00000	0.000014
0.1	0.00001	0.000018
1	0.00000	0.000026
10	0.00000	0.000033
20	-0.00001	0.000071
50	0.00001	0.00011
100	-0.00003	0.00020
150	-0.0001	0.00038
200	-0.0001	0.00038

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

This reported uncertainty of measurement was based on a standard uncertainty multiplied by a coverage factor $k = 2.15$, providing a level of confidence of approximately 95%

Eccentric error	Load test : 50 g	
	A B C D E	C B E D A
	0.00001 0.00006 0.00004 -0.00006 0.00000 g	

Repeatability

Load test : 200 g

Stdev. : 0.000053 g

-o-o-





Certificate of Calibration

Certificate No. : 65-210457-1

Page : 1 of 2

Submitted by :

M Green Group Co., Ltd.

188/46 Wisasuknakhon25, Pracha-Utd Rd., Thungkru, Bangkok 10140 Thailand

Equipment :

Weight

Manufacturer : N/A

Material : Stainless Steel

Weight size : 1 g

ID No. : 63-210391-1

Assumed density of weight : 7950 kg / m³

Assumed Air density : 1.2 kg / m³

Ambient Temperature : (20 ± 2) °C

Relative Humidity : (50 ± 10) %

Air Pressure : 1001.1 mbar

Date of Received : 21 September 2022

Date of Calibration : 28 September 2022

Date of Issue : 28 September 2022

Calibrated by : Wuttichai Swatphong

Calibration Method : In-house method CAL-M2101 based on OIML R 111-1 : 2004(E)

Reference Standard Instruments : This certification is traceable to the International System of Units

Standard Weights

ID No.

E221-E2210

Cert. No.

MM-0042-22

Due Date

21 Mar 2025

Traceability

National Institute of Metrology (Thailand), (NIMT)

Approved by :

(Surachai Promthong)
Laboratory Manager

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 Calibratech Co.,Ltd.



Certificate of Calibration

Certificate No. : 65-210457-1

Page : 2 of 2

Result of Calibration : Without Adjustment

UUC Condition As-Received : Good

No.	Nominal Value	Id.Mark	Conventional mass Value	Measuring Uncertainty
1	1 g	none	1 g -0.016 mg	± 0.023 mg

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

This 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%

-o0o-





Certificate of Calibration

Certificate No. : 65-210457-2 Page : 1 of 2

Submitted by : M Green Group Co., Ltd.
188/46 Wisasuknakhon25, Pracha-Utd Rd., Thungkru, Bangkok 10140 ThailandEquipment : Weight
Manufacturer : N/A Material : Stainless Steel
Weight size : 100 gID No. : 63-210391-2
Assumed density of weight : 7950 kg / m³
Assumed Air density : 1.2 kg / m³Environment : Ambient Temperature : (20 ± 2) °C
Relative Humidity : (50 ± 10) %
Air Pressure : 1001.8 mbar

Date of Received : 21 September 2022

Date of Calibration : 28 September 2022

Date of Issue : 28 September 2022

Calibrated by : Wuttichai Swatphong

Calibration Method : In-house method CAL-M2101 based on OIML R 111-1 : 2004(E)

Reference Standard Instruments : This certification is traceable to the International System of Units

Standard Weights

ID No.	Cert. No.	Due Date	Traceability
E221-E2210	MM-0042-22	21 Mar 2025	National Institute of Metrology (Thailand), (NIMT)

Approved by :
(Surachai Promthong)
Laboratory Manager

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 Calibratech Co.,Ltd.



Certificate of Calibration

Certificate No. : 65-210457-2 Page : 2 of 2

Result of Calibration : Without Adjustment

UUC Condition As-Received : Good

No.	Nominal Value	Id.Mark	Conventional mass Value	Measuring Uncertainty
1	100 g	none	100 g -0.17 mg	± 0.11 mg

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

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

- o / o -



CAL

Calibratech Co.,Ltd.

7/106-7 Moo 2, Sukhprachasam 3 Rd., Banggood, Pakkred, Nonthaburi 11120
Tel:(02) 964-6211 Fax:(02) 964-5155 e-mail : calibratech.cal@yahoocom, calibratech.cal@hotmail.com



NSC-TISI-TS17025
CALIBRATION 0030

Certificate of Calibration

Certificate No. : 65-210457-3

Page : 1 of 2

Submitted by :

M Green Group Co., Ltd.

188/46 Wisasuknakhon25, Pracha-Utd Rd., Thungkru, Bangkok 10140 Thailand

Equipment :

Weight

Manufacturer : N/A

Material : Stainless Steel

Weight size : 200 g

ID No. : 63-210391-3

Assumed density of weight : 7950 kg / m³

Assumed Air density : 1.2 kg / m³

Environment : Ambient Temperature : (20 ± 2) °C

Relative Humidity : (50 ± 10) %

Air Pressure : 1001.8 mbar

Date of Received : 21 September 2022

Date of Calibration : 28 September 2022

Date of Issue : 28 September 2022

Calibrated by : Wutichai Swatphong

Calibration Method : In-house method CAL-M2101 based on OIML R 111-1 : 2004(E)

Reference Standard Instruments : This certification is traceable to the International System of Units

Standard Weights

ID.No. Cert.No.

E221-E2210 MM-0042-22

Due Date

21 Mar 2025

Traceability

National Institute of Metrology (Thailand), (NIMT)

Approved by :

(Surachai Promthong)
Laboratory Manager

The Uncertainties are for a confidence probability of approximately 95%

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CAL-F0031-03



CAL

Calibratech Co.,Ltd.

7/106-7 Moo 2, Sukhprachasam 3 Rd., Banggood, Pakkred, Nonthaburi 11120
Tel:(02) 964-6211 Fax:(02) 964-5155 e-mail : calibratech.cal@yahoocom, calibratech.cal@hotmail.com

Certificate of Calibration

Certificate No. : 65-210457-3

Page : 2 of 2

Submitted by :

Result of Calibration : Without Adjustment

UUC Condition As-Received : Good

Equipment :

Weight

Manufacturer : N/A

Material : Stainless Steel

Weight size : 200 g

ID No. : 63-210391-3

Assumed density of weight : 7950 kg / m³

Assumed Air density : 1.2 kg / m³

Environment : Ambient Temperature : (20 ± 2) °C

Relative Humidity : (50 ± 10) %

Air Pressure : 1001.8 mbar

Date of Received : 21 September 2022

Date of Calibration : 28 September 2022

Date of Issue : 28 September 2022

Calibrated by : Wutichai Swatphong

Calibration Method : In-house method CAL-M2101 based on OIML R 111-1 : 2004(E)

Reference Standard Instruments : This certification is traceable to the International System of Units

Standard Weights

ID.No. Cert.No.

E221-E2210 MM-0042-22

Due Date

21 Mar 2025

Traceability

National Institute of Metrology (Thailand), (NIMT)

Approved by :

(Surachai Promthong)
Laboratory Manager

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 Calibratech Co., Ltd.

CAL-F0031-03



No.	Nominal Value	Idl Mark	Conventional mass Value	Measuring Uncertainty
1	200 g	none	200 g +0.09 mg	± 0.17 mg

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

This 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%

-o0o-

CAL-F0031-03



WO-02222521/2023

MAINTENANCE REPORT AND CALIBRATION CERTIFICATE ATOMIC ABSORPTION SPECTROPHOTOMETER MODEL

AAAnalyst 200/400

Customer : บริษัท เอ็มเน็กซ์ แอสโซซิเอชั่น จำกัด Date Tested: March 14, 2023
Address : 27, 29 ซอยพระรามที่ 2 ซอย 30 Recommendation Recertification Period 6 Months
แขวง บางมด เขตจอมทอง Recertification Due: September 14, 2023
กรุงเทพมหานคร 10150 Date Last Certified: September 1, 2022
User Name: คุณ กาญจนา จันทะ Visit Number: 1 OF 2
Phone: 02-5671128 PerkinElmer Phone: 02-719-6420 ext 203
Email: emex_envi@yahoo.com PerkinElmer Fax: 02-318-5597

CONFIGURATION TESTED

MODEL	SERIAL NUMBER	SOFTWARE
AAAnalyst 200	200S9030303	AA WinLab32 Version 6.5
TEST STANDARD USED	PART NUMBER	EXPIRATION DATE
Copper	N930-0183	January 30, 2024
Nickel	N9300-244	June 30, 2023
MG0-135	N101-3000	
MG2-258	N101-3002	

Page 1 of 5



ห้องปฏิบัติการวิเคราะห์เอกชน
เลขทะเบียน ว-244

PerkinElmer Ltd. 290 Soi 17, Rama 9 Road, Bangkok, Huay Kwang, Bangkok 10310

PerkinElmer Ltd. 290 Soi 17, Rama 9 Road, Bangkok, Huay Kwang, Bangkok 10310
เลขทะเบียน ว-244
18/03/66

MAINTENANCE REPORT AND CALIBRATION CERTIFICATE

ATOMIC ABSORPTION SPECTROPHOTOMETER MODEL

AAAnalyst 200/400

SERIAL NUMBER	200S9030303	DATE TESTED	March 14, 2023
1. INSTRUMENT CHECKS			
A. The mirror, prism and lenses condition. Clean if necessary.			
B. Inspect the grating.			
C. Inspect and clean or replace the dust filler.			
D. Clean the burner head, chamber and end cap.			
E. Clean the nebulizer.			
F. Check the condition of the end cap, chamber and nebulizer o-rings.			
G. Clean the drain system.			
H. Clean exterior the instrument.			
2. GAS SYSTEM CHECKS			
A. Leak test all internal and external gas box joints			
B. Inspect the acetylene cartridge filler. (Replacement cartridge filler every 1 year)			
C. Inspect the air cartridge filler. (Replacement cartridge filler every 6 months)			
3. ELECTRICAL			
A. Check incoming AC line voltage for proper levels and grounding.			
B. Check unit's software and firmware revisions and upgrade if necessary.			
4. FIAS CHECKS			
A. Pump and 5 Port Valve			
B. Chemifold and Tubing			
C. Power Supply			
D. Flow meter and Gas system			

MAINTENANCE REPORT AND CALIBRATION CERTIFICATE

ATOMIC ABSORPTION SPECTROPHOTOMETER MODEL

AAAnalyst 200/400

SERIAL NUMBER	200S9030303	DATE TESTED	March 14, 2023
PARAMETER			
5. PERFORMANCE TESTS			
1. Detector-Linearity with Barium (553.55 nm).			
Neutral Density Filter 0.2 :			
Neutral Density Filter 1.0 :			
Baseline Noise at 1 Abs with Barium (553.55 nm).			
(at an integration time of 0.5 seconds			
and 99 replicates)			
SD \leq 0.010 Abs.			
0.0014 Abs.			
2. AA Baseline with Copper (Cu 324.75 nm).			
(at an integration time of 0.5 seconds			
and 99 replicates)			
SD \leq 0.001 Abs.			
0.0002 Abs.			
3. D ₂ Background Compensation (Copper 324.75 nm).			
with Neutral Density Filter 1.0			
Absorbance \leq 0.010 Abs			
5. AA-BG Baseline Noise with Copper (324.75 nm).			
(at an integration time of 2.0 seconds			
and 99 replicates)			
SD \leq 0.005 Abs.			
0.0004 Abs.			
6. Flame Safety Interlock all Functions.			
OK			

MAINTENANCE REPORT AND CALIBRATION CERTIFICATE

ATOMIC ABSORPTION SPECTROPHOTOMETER MODEL

AAAnalyst 200/400

SERIAL NUMBER 200S9030303

DATE TESTED March 14, 2023

PARAMETER

ACTUAL VAUE

SPECIFICATION

7. Wavelength Accuracy with Nickel (232.00 nm).

Nickel Prism Position

± 180 steps

+ 7 Steps

Nickel Grating Position

+ 380, - 260 steps

+ 112 Steps

3 mg/L Ni Standard Mean Abs

≥ 0.200 Abs

0.250 Abs.

8. Flame Sensitivity with Copper (324.75 nm).

Cu Prism Position

± 120

+32 Steps

Cu Grating Position

± 380

+120 Steps

(2 mg/L Cu Standard at an integration time

of 10 seconds and 10 replicates)

Mean Absorbance

≥ 0.250

0.334 Abs.

Capacitance value

≥ 1.0 pF

2.5 pF

MAINTENANCE REPORT AND CALIBRATION CERTIFICATE

ATOMIC ABSORPTION SPECTROPHOTOMETER MODEL

AAAnalyst 200/400

SERIAL NUMBER 200S9030303

DATE TESTED March 14, 2023

Remarks :

- Neutral Density Filter refer to data sheet

This is to certify that the above tests have been performed and the configuration tested

☒ meets

☐ does not meet

the PerkinElmer Specifications listed on this certificate.

This certificate does not modify PerkinElmer's standard terms and condition of sale,

including warranty terms.

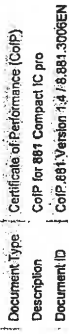
Service Department PerkinElmer Ltd.

วพหอ พรณม จิต

Customer Service Engineer.

(Wphan Pronlunda)

Service Engineer



Certificate of Performance (CoP) for
881 Compact IC pro

Instrument details

Type: 18810000

Serial No.: PM220395/ME (1881000010137)

Manufacturer:

- Ionenstrasse
- CH-9100 Herisau

Switzerland

Firmware: ; 5.850.0113

Customer Instrument ID: N/A

Customer details

Name of company: EMEX Association Co., Ltd.
Address: 27, 29 Bang Mot Chomlontha, Bangkok 10150

Department: _____ Laboratory: _____

Responsible person: **คุณฉัตรภา วรรณิ**

Calibration place:
Laboratory
EMEX Association Co., Ltd

Date and time of calibration: 22/12/2022 - 08:30



ห้องปฏิบัติการวิเคราะห์เอกชน
เลขทะเบียน ว-244



Certificate of Performance (CoP) No.: PM220395ME (188700001000)
 ๐๘:๓๐
 กองส่งเสริมการค้าและการบริการวิเทศสหราชอาณาจักร
 เลขทะเบียน ๖-244



Document Type: Certificate of Performance (CoP)
Description: CoP for 881 Compact IC pro
Document ID: CoP-881 Version 1.4 / 8.881.3008EN

Certificate of Performance (CoP)

Introduction

The instrument stated above has been inspected in accordance with the corresponding test instructions of Metrohm Ltd. Servicing instructions are compiled and checked for correctness with account taken of the technical apparatus and ambient conditions available to the service engineer at the servicing location. This Certificate of Performance (CoP) declares the results regarding calibration and operational status obtained when carrying out the test instructions referred to below.

Calibration status

We certify that the instrument stated above meets or exceeds the electrical specifications at the points tested. Test equipment is calibrated and traceable back to national and/or international standards (ISO 17025, NIST).

Operational status

We certify that the instrument stated above executes the instrument's specific functions tested except where detailed otherwise.

Declaration

Document

Test instructions used: C.1 Test instructions for 881 Compact IC pro, Version 1.4

Reference standards

Type / Model	Manufacturer	Serial No. / Batch No.	Certificate No.	Expiry date
Multiweigher	Fuke	84-00190	EU222184	25/05/2023
Temperaturing mass. Instr.	Fuke	82030101	TM221823	10/06/2023
High pressure gauge	Metrohm	30660018813	CC_00817008	11/04/2023
Flow meter	ANALYT-ATC	91300	A02201-280-001	31/01/2023

Protocol

Instrument had to be repaired beforehand

If yes, see Certificate of Performance (CoP) No.:

Instrument had to be readjusted beforehand

If yes, see Certificate of Performance (CoP) No.:

Yes No
☐ ☒
☐ ☒



Certificate of Performance (CoP) No.: PM220395/ME (1881000010137) - 22/12/2022 - ASSOCIATION CO., LTD.
08:30

ห้องปฏิบัติการวิเคราะห์ออกซิเจน

เลขทะเบียน ว-244



Document Type: Certificate of Performance (CoP)
Description: CoP for 881 Compact IC pro
Document ID: CoP-881 Version 1.4 / 8.881.3008EN

Conclusion of test results

Instrument satisfies the specified technical requirements

Recommended date for next maintenance:

Comments

Metrohm representative

Metrohm representative confirms correct execution of instrument calibration

Date 22/12/2022 Signature ปรียา คุ้มภัย

Customer representative

Customer representative accepts results of instrument calibration

Date 22/12/2022 Signature ปรียา คุ้มภัย



Certificate of Performance (CoP) No.: PM220395/ME (1881000010137) - 22/12/2022 - ASSOCIATION CO., LTD.
08:30

ห้องปฏิบัติการวิเคราะห์ออกซิเจน

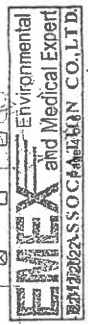
เลขทะเบียน ว-244



Document Type : Certificate of Performance (CoP)
Description : CoP for 881 Compact IC pro
Document ID : CoP-881-Version 1.4/18.881.3006EN

Test results

No.	Title	Comments	Pass	
			Yes	No
100	Visual test		<input checked="" type="checkbox"/>	<input type="checkbox"/>
101	Safety test		<input checked="" type="checkbox"/>	<input type="checkbox"/>
102	LED		<input checked="" type="checkbox"/>	<input type="checkbox"/>
103	Fan		<input checked="" type="checkbox"/>	<input type="checkbox"/>
104	Communication		<input checked="" type="checkbox"/>	<input type="checkbox"/>
105	Leak detector		<input checked="" type="checkbox"/>	<input type="checkbox"/>
106	MSB Interface		<input checked="" type="checkbox"/>	<input type="checkbox"/>
107	USB interface		<input checked="" type="checkbox"/>	<input type="checkbox"/>
108	Column plug interface		<input checked="" type="checkbox"/>	<input type="checkbox"/>
109	Column heater		<input checked="" type="checkbox"/>	<input type="checkbox"/>
110	IC pump		<input checked="" type="checkbox"/>	<input type="checkbox"/>
111	Injector		<input checked="" type="checkbox"/>	<input type="checkbox"/>
112	Degasser		<input checked="" type="checkbox"/>	<input type="checkbox"/>
113	MSM (option)		<input checked="" type="checkbox"/>	<input type="checkbox"/>



Certificate of Performance (CoP) No.: PM220395IME (1881000010137) - 20220322
08:30

ห่องปฏิบัติการวิเคราะห์เทคนิค

เลขทะเบียน ว-244



Document Type : Certificate of Performance (CoP)
Description : CoP for 881 Compact IC pro
Document ID : CoP-881-Version 1.4/18.881.3006EN

No.	Title	Comments	Pass	
			Yes	No
114	Peristaltic pump (option)		<input checked="" type="checkbox"/>	<input type="checkbox"/>
115	MCS (option)		<input checked="" type="checkbox"/>	<input type="checkbox"/>



Certificate of Performance (CoP) No.: PM220395IME (1881000010137) - 20220322
08:30

ห่องปฏิบัติการวิเคราะห์เทคนิค

เลขทะเบียน ว-244



Document Type: Certificate of Performance (CoP)
Description: CoP for 881 Compact IC pro
Document ID: CoP-881 Version 1.4 / 8.881.3006EN

CoP-881 Document History

Date	Version	Author	Description/Changes
16.04.2012	8.881.3004EN	pr	Layout adapted to Metrohm Compliance Service
20.02.2013	8.881.3006EN	pr	Test step 113.2 tolerance increased according C.3 notice of modification CRM-10456
30.03.2021	1.4	pr	Change of document history and versioning (article no. remains the same; new versions are indicated by increase of version number only). Test no. 103 Fan depends on the installed power supply version according C.3 notice of modification CRM-28906.

End of CoP Document



Certificate of Performance (CoP) No.: PM220395/ME (1881000010137) - 22
08:30

ห้องปฏิบัติการวิเคราะห์เอกชน

เลขทะเบียน ว-244



Document Type: Certificate of Performance (CoP)
Description: CoP for 850.9010 Conductivity Detector
Document ID: CoP-850 Version 1.3 / 8.850.3023EN

Metrohm Compliance Service

Certificate of Performance (CoP) for 850.9010 Conductivity Detector

Instrument details

Type:	18509010
Serial No.:	PM220395/ME (1850901012155)
Manufacturer:	Metrohm AG, Ionensfrasse, CH-9100 Herisau Switzerland
Customer instrument ID:	N/A

Control device details

Type:	1.881.0030
Serial No.:	1881000010137
Firmware:	5.850.0113

Customer details

Name of company:	EMEX Association Co. Ltd.
Address:	27, 29 Bang Mot, Chomthong, Bangkok 10150

Department:	Laboratory
Responsible person:	คุณวิภากร วัฒนกุล
Calibration place:	Laboratory EMEX Association Co., Ltd

Date and time of calibration: 22/12/2022 - 08:30



Certificate of Performance (CoP) No.: PM220395/ME (1850901012155)
08:30

ห้องปฏิบัติการวิเคราะห์เอกชน

เลขทะเบียน ว-244



Document Type Certificate of Performance (CoP)
Description CoP for 850.9010 Conductivity Detector
Document ID CoP.850.Version 1.3 / 8.850.3023EN

Certificate of Performance (CoP)

Introduction

The instrument stated above has been inspected in accordance with the corresponding test instructions of Metrohm Ltd. Servicing instructions are compiled and checked for correctness with account taken of the technical apparatus and ambient conditions available to the service engineer at the servicing location. This Certificate of Performance (CoP) declares the results regarding calibration and operational status obtained when carrying out the test instructions referred to below.

Calibration status

We certify that the instrument stated above meets or exceeds the electrical specifications at the points tested. Test equipment is calibrated and traceable back to national and/or international standards (ISO 17025, NIST).

Operational status

We certify that the instrument stated above executes the instrument's specific functions tested except where detailed overleaf.

Declaration

Document

Test instructions used: C.1 Test Instructions for 850.9010 Conductivity Detector, Version 1.3

Reference standards

Type / Model	Manufacturer	Serial No. / Batch No.	Certificate No.	Due date / Expiry date
Temperature meas. instr.	Fluke	82095101	TM121123	10/09/2023
Conductivity standard (mol)	N/A	N/A	N/A	N/A

Protocol

Instrument had to be repaired beforehand

If yes, see Certificate of Performance (CoP) No.:

Instrument had to be readjusted beforehand

If yes, see Certificate of Performance (CoP) No.:

Yes	No
<input type="checkbox"/>	<input checked="" type="checkbox"/>
<input type="checkbox"/>	<input checked="" type="checkbox"/>



Document Type Certificate of Performance (CoP)
Description CoP for 850.9010 Conductivity Detector
Document ID CoP.850.Version 1.3 / 8.850.3023EN

Certificate of Performance (CoP) No.: PM220395/ME (1850901012155) - 22/12/2022 Page 2 of 4
หอนปฏิบัติการวิเคราะห์เอกชน

เลขทะเบียน ว-244



Document Type Certificate of Performance (CoP)
Description CoP for 850.9010 Conductivity Detector
Document ID CoP.850.Version 1.3 / 8.850.3023EN

Conclusion of test results

Instrument satisfies the specified technical requirements

Recommended date for next maintenance:

Comments

Yes	No
<input type="checkbox"/>	<input checked="" type="checkbox"/>

Metrohm representative

Metrohm representative confirms correct execution of instrument calibration

Date	Name	Signature
22/12/2022	Mr. Prutchaya Kumpairae	ปฐชา คุ้มไกร

Customer representative

Customer representative accepts results of instrument calibration

Date	Name	Signature
22/12/2022	คุณจักร รักษ์	จักร

Document Type Certificate of Performance (CoP)
Description CoP for 850.9010 Conductivity Detector
Document ID CoP.850.Version 1.3 / 8.850.3023EN

Certificate of Performance (CoP) No.: PM220395/ME (1850901012155) - 22/12/2022 Page 3 of 4
หอนปฏิบัติการวิเคราะห์เอกชน

เลขทะเบียน ว-244



Document Type Certificate of Performance (CoP)
Description CoP for 850.8510 Conductivity Detector
Document ID CoP.850 Version 1.3 / 8.850.3023EN

Test results

No.	Title	Comments	Pass	
			Yes	No
100	Visual Inspection		<input checked="" type="checkbox"/>	<input type="checkbox"/>
101	Temperature absolute		<input checked="" type="checkbox"/>	<input type="checkbox"/>
102	Temperature stability		<input checked="" type="checkbox"/>	<input type="checkbox"/>
103	Signal noise		<input checked="" type="checkbox"/>	<input type="checkbox"/>
104	Conductivity dry test		<input type="checkbox"/>	<input checked="" type="checkbox"/>
105	Conductivity cell (optional)		<input type="checkbox"/>	<input checked="" type="checkbox"/>

CoP.850 Document History

Date	Article No.	Author	Description/Changes
26.04.2012	8.850.3023EN	Philipp Rüegg	Layout adapted to Metrohm Compliance Service

End of CoP Document

Certificate of Performance (CoP) No.: PM220395/ME (1850901012) 8.850.3023EN
08:30

EMEX Environmental and Medical Expert
SOCIETY CO., LTD.
ห้องปฏิบัติการวิเคราะห์เอกชน
เลขทะเบียน ว-244



Environmental Solution Integrator Co., Ltd.
Web Site : www.esithailand.com
E-mail : info@esithailand.com

METHOD 5 CONSOLE CALIBRATION
USING REFERENCE WET TEST METER W-NK-2.5B No.545141
5-POINT METRIC UNIT

Meter Console Information	
Console Model Number	XD-502-MV
Console Serial Number	A2003235
DGM Model Number	SK25EX-100B
DGM Serial Number	2024980

Calibration Conditions		
Date	Time	11-May-23 9:00 AM
Calibration Reference No.	SE86AP010	
Barometric Pressure	759.00	mm Hg
Calibration Meter Gamme	1.001	

Factors/Conversions		
Std Temp	293	K
Std Press	760	mm Hg
K ₁	0.398	
Console Leak Check	PASS	

Calibration Data									
Run Time		Metering Console				Calibration Meter			
Elapsed (t)	DGM Orifice (P _o)	Volume Initial (V _o)	Volume Final (V _o)	Outlet Temp Initial (t _o)	Outlet Temp Final (t _o)	Volume Initial (V _o)	Volume Final (V _o)	Outlet Temp Initial (t _o)	Outlet Temp Final (t _o)
min	mm H ₂ O	m ³	m ³	°C	°C	m ³	m ³	°C	°C
12.23	13.0	0.0000	0.1400	22	22	523.045200	523.182640	22	22
12.17	13.0	0.1400	0.2800	22	22	523.182640	523.319340	22	22
8.65	26.0	0.3090	0.4490	22	22	523.348140	523.486020	22	22
8.65	26.0	0.4490	0.5890	22	22	523.486020	523.622860	22	21
13.98	40.0	0.6350	0.9150	22	22	523.668200	523.939380	21	21
14.00	40.0	0.9150	1.1950	23	23	523.939380	524.212220	21	21
12.13	50.0	1.3000	1.5800	23	23	524.309200	524.576200	21	21
12.13	50.0	1.5800	1.8600	23	23	524.576200	524.844120	21	21
9.78	70.0	1.9410	2.2210	23	24	524.917000	525.183700	21	21
10.23	70.0	2.2210	2.5010	24	24	525.183700	525.450360	21	21



F-SER037 R:00 02-10-60

1 of 4



Environmental Solution Integrator Co., Ltd.
Web Site : www.esithailand.com
E-mail : info@esithailand.com

METHOD 5 CONSOLE CALIBRATION
USING REFERENCE WET TEST METER W-NK-2.5B No.545141
5-POINT METRIC UNIT

Calibration Data								
Standardized Data					Results			
Dry Gas Meter		Calibration Meter		Calibration Factor	Dry Gas Meter			
(V _o) m ³	(Q _o) m ³ /min	(V _o) m ³	(Q _o) m ³ /min		Value (Y)	Variation (ΔY)	Flowrate Std & Corr (Q _o) m ³ /min	Variation (ΔΔH _o)
0.139	0.011	0.136	0.011	0.981	0.016	0.011	46.843	-0.002
0.139	0.011	0.136	0.011	0.976	0.011	0.011	46.837	-0.008
0.139	0.016	0.137	0.016	0.983	0.016	0.016	46.859	-0.186
0.139	0.016	0.136	0.016	0.978	0.011	0.016	47.291	0.446
0.280	0.020	0.270	0.019	0.966	0.001	0.019	48.462	1.617
0.280	0.020	0.272	0.019	0.972	0.007	0.019	47.968	1.143
0.280	0.023	0.266	0.022	0.950	-0.015	0.022	47.139	0.294
0.280	0.023	0.267	0.022	0.953	-0.012	0.022	46.816	-0.029
0.281	0.029	0.266	0.027	0.947	-0.018	0.027	43.169	-3.676
0.281	0.027	0.266	0.026	0.947	-0.018	0.026	47.248	0.401
				0.985	Y Average		46.845	ΔH _o Average



Note: For Calibration Factor Y, the ratio of the reading of the calibration meter to the dry gas meter, acceptable tolerance of individual values from the average is ± 0.02 .
Note: For ΔH_o , orifice pressure differential that equates to 0.75cm (0.0212m³/min) at standard temperature and pressure, acceptable tolerance of individual values from the average is ± 0.2 inches (5.1mm) H₂O.

Calibrated by:

Kiatkwin

Approved by:

Boonin Sangthong

Date

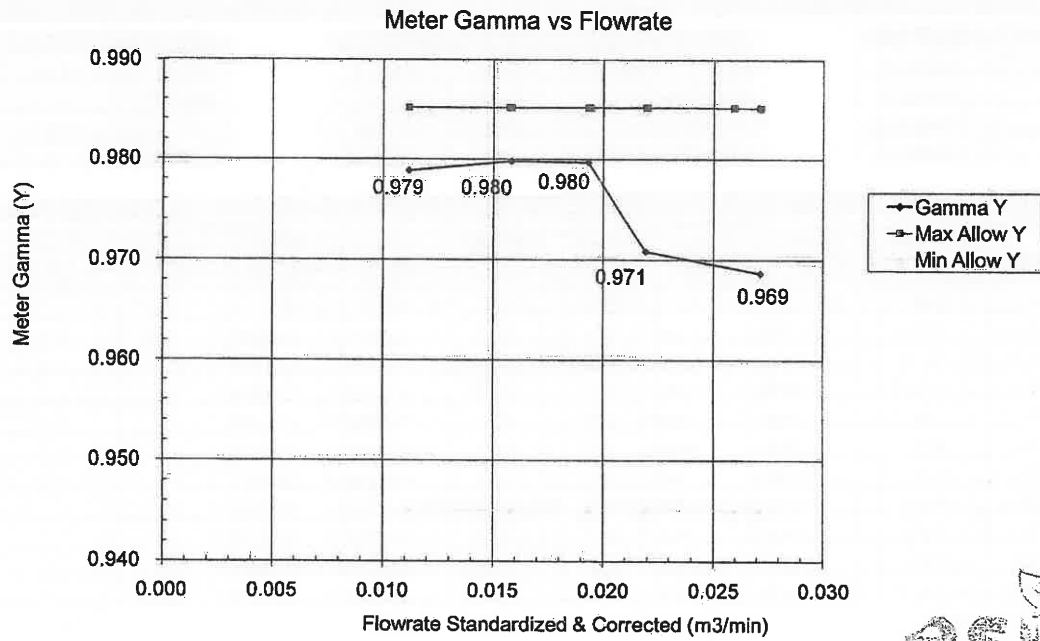
11-May-23

F-SER037 R:00 02-10-60

2 of 4

Calibration Date: 11-5-2023

Calibration Reference No: SE86AP010



Console Serial: A2003235

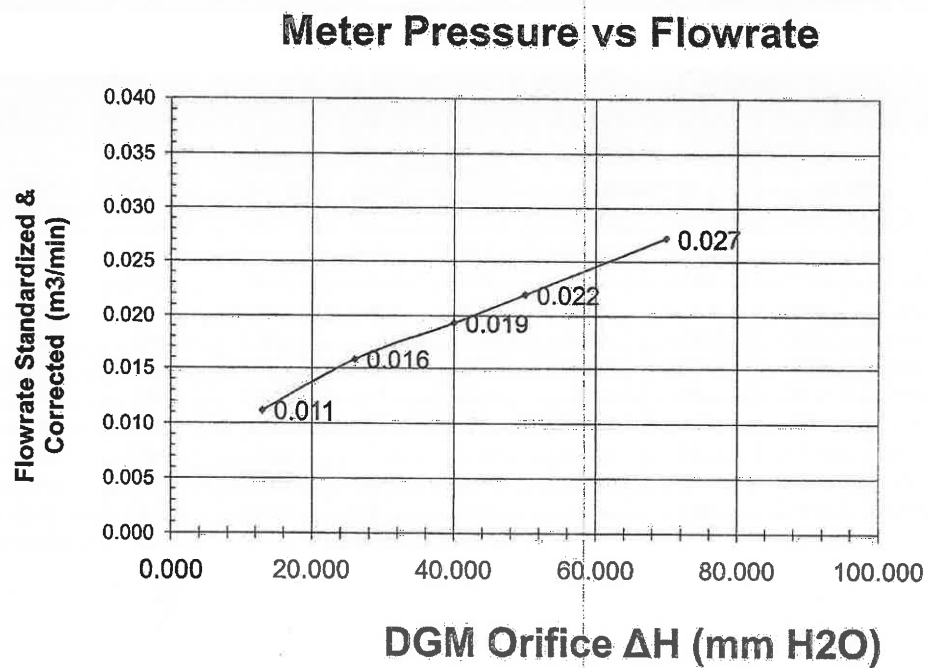
Console Model: XD-502-MV

F-SER037 R:00 02-10-80

3 of 4

Calibration Date: 11-5-2023

Calibration Reference No: SE86AP010



F-SER037 R:00 02-10-80

4 of 4



Environmental Solution Integrator Co., Ltd.
Web Site : www.esi-thailand.com
E-mail : info@esi-thailand.com

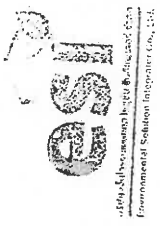
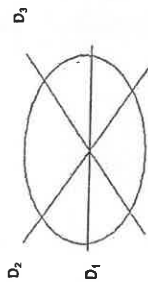
NOZZLE CALIBRATION

Sampling System Equipment Information		Calibration Conditions	
Console Model Number	XD-502-MV	Date	11-May-23
Console Serial Number	A2003235	Calibration Reference No.	SE66AP010
DGM Model Number	SK25EX-100B	Calibration	755
DGM Serial Number	2024990	Calibration	Vernier 0-150 mm
Nozzle Types	Stainless	Method Reference	US EPA Method

Calibration Data		Results	
Nozzle ID	Nozzle Diameter	Different	$(D_1 + D_2 + D_3) / 3$
Sizes	D ₁ D ₂ D ₃	AD	Davg
4	3.2 2.98 2.97	0.006	2.973
5	3.9 3.67 3.65	0.010	3.660
6	4.5 4.63 4.60	0.015	4.613
7	5.3 5.37 5.36	0.015	5.373
8	6.2 6.11 6.14	0.017	6.120
9	7.1 7.10 7.08	0.020	7.080
10	7.8 7.80 7.81	0.010	7.810

Where :

D₁, D₂, D₃ = Three difference nozzle diameters , mm ; diameter must be within 0.025 mm
AD = Maximum difference between any two diameters, must be ≤ 0.100 mm
Davg = $(D_1 + D_2 + D_3) / 3$



Environmental Solution Integrator Co., Ltd.

Calibrated by : Kiatkavin

Approved by : Tanby Santhong



Environmental Solution Integrator Co., Ltd.
Web Site : www.esi-thailand.com
E-mail : info@esi-thailand.com

THERMOCOUPLES SYSTEM CALIBRATION

Sampling System Equipment Information		Calibration Conditions	
Console Model Number	XD-502-MV	Date	10-May-23
Console Serial Number	A2003235	Calibration Reference No.	SE66AP010
DGM Model Number	SK25EX-100B	Reference Thermometer	FLUKE 714
DGM Serial Number	2024990	Serial Number	1812153
Meter Box Model Number	TC8	Dry Box Calibrator	Pyros 850
Meter Box Serial Number	200306-02	Serial Number	K36111

Results	
Console Thermocouple Simulator	
Channel and test point	Meter Box Channel Temperature Reading (°C)
Stack	-18.0 25.0 36.0 93.0 149.0 260.0 371.0 482.0 593.0 816.0 1038.0
Filter	-17 24 37 93 148 259 370 481 592 815 1037
Aux	-17 24 37 93 148
Probe	-17 24 37 93 148
Oven	-16 24 37 93 148
Exit	-16 24 37

OUTLET DGM Thermocouple	
Set Point	Reference Thermocouple Probe Thermocouple Difference
30	30.0 28 0.66
40	40.0 38 0.64
50	50.0 47 0.93

Sample Probe Thermocouple	
Set Point	Reference Thermocouple Probe Thermocouple Difference
100	100.0 98 0.54
250	250.0 249 0.19
300	300.0 296 0.70
350	350.0 348 0.32

Stack
DGM
Probe

Tolerances Range
± 1.50% Absolute
± 3.0 °C
± 3.0 °C

Meter
Filter
Exit

± 3.0 °C
± 3.0 °C
± 2.0 °C

Calibrated by : Kiatkavin

Approved by : Tanby Santhong

PITOT TUBE CALIBRATION

Sample System Equipment Information	
Console Model Number	XD-502-MV
Console Serial Number	A2003235
DGM Model Number	SK25EX-100B
DGM Serial Number	2024990
Pitot tube Number	A9038

Calibration Conditions	
Date	12-May-23
Calibration Reference No.	SE68A010
Barometric Pressure	759
Pitot Tube Type	S
Pitot Tube Size (OD)	3/8
Standard Pitot Tube ID Number	160-12
C _p (std)	0.99

Results				
"A" SIDE CALIBRATION				
RUN No.	Δp std mm H ₂ O	Δp (s)	Cp (s)	DEVIATION Cp(s)-Cp(A)
1	6.4	8.8	0.844	-0.004
2	16.4	22.2	0.851	0.003
3	30.8	41.8	0.850	0.001
AVERAGE			0.848	-0.001

Results				
"B" SIDE CALIBRATION				
RUN No.	Δp std mm H ₂ O	Δp (s)	Cp (s)	DEVIATION Cp(s)-Cp(B)
1	6.4	8.8	0.844	0.001
2	16.4	22.4	0.847	0.003
3	30.8	42.8	0.840	-0.004
AVERAGE			0.844	0.003

[CpA (SIDE A) - Cp (SIDE B)] = 0.005 (must be ≤ 0.01)

Note: Average deviation must be < 0.01

Calibrated by: Kirthavin

Approved by: Ravi Sankar



บริษัท ไคเนติกส์ คอร์ปอเรชั่น จำกัด

KINETICS CORPORATION LTD.

สำนักงานมาตรฐานเครื่องมือและปรับเทียบอุปกรณ์วัดคุณภาพอากาศ

วันที่ : 28 กันยายน 2565

บริษัทผู้ผลิต : EMEX ASSOCIATION CO.,LTD.

รุ่นของอุปกรณ์ / เครื่องมือ : CO Analyzer

หมายเลขอุปกรณ์ / เครื่องมือ : 7300

TEST VALUES			BEFORE	AFTER
1	RANGE	1 - 1000 PPM	50.0	50.0
2	STABILITY	≤ 1 PPM	0.1	0.0
3	CO MEASURE	2500 - 4800 mV	3444.4	3445.2
4	CO REFERENCE	2000 - 4800 mV	2850.4	2875.6
5	IR RATION	1.1 ± 1.3	1.218	1.222
6	PRESEELURE	25 - 35 in. Hg-A	30.0	25.7
7	SAMPLE FLOW	800 ± 10% cc/min	874	824
8	SAMPLE TEMP	46 ± 1 °C	47.2	46.5
9	BENCH TEMP	48 ± 2 °C	48.0	48.0
10	WHEEL TEMP	66 ± 2 °C	66.1	66.0
11	BOX TEMP	AMBIENT ± 5 °C	31.2	31.0
12	PIT DRIVE	250-4750 Mv	2916.8	2914.7
13	CO SLOPE	1.0 ± 0.3	0.823	0.843
14	CO OFFSET	0.0 ± 0.3	0.012	0.012
15	CO READING (AMBIENT)	PPM	2.2	0.8
16	ELECTRICAL TEST	40 ± 2 PPM	40.3	40.3
17	VOLTAGE TEST	+5 V +12 V +15 V -15 V	5.18 / 12.13 / 16.53 / -15.10	5.18 / 12.13 / 16.53 / -15.10
18	ZERO GAS	0.00 PPM	0.8	0.0
19	SPAN GAS	40.0 PPM	42.0	39.9

หมายเหตุ

- บันทึก O-ring 2 ชิ้น, Spring 1 ชิ้น, Sintered Filter 1 ชิ้น

ใบรับรองการสอบเทียบ “เครื่องวัดก๊าซคาร์บอนมอนอกไซด์”

(Calibration Certificate of CO Analyzer)



บริษัท ไคเนติกส์ คอร์ปอเรชั่น จำกัด



ห้องปฏิบัติการวิเคราะห์เอกชน

เลขทะเบียน ๖-244

(นายพรชัย นาคินนากษ์)

ลงนามเจ้าหน้าที่ (Signature)

ต้องการข้อมูลเพิ่มเติมทางสำนักงานติดต่อ : คุณพรชัย นาคินนากษ์ โทรศัพท์ : 0-2515-6987



ห้องปฏิบัติการวิเคราะห์เอกชน

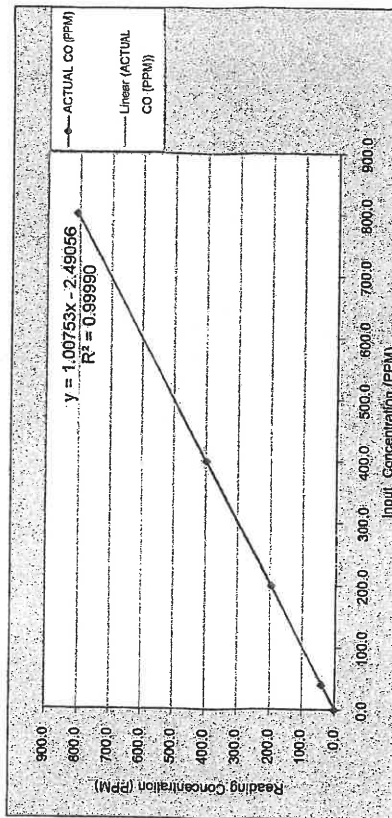
เลขทะเบียน ๖-244

MULTI POINT CALIBRATION REPORT

CUSTOMER NAME : EMEX ASSOCIATION COMPANY LIMITED		
EQUIPMENT NAME : CO Analyzer		
MANUFACTURER : Teledyne - API	MODEL : T300	SERIAL NO : 92
STANDARD GAS CONCENTRATION (PPM) : 4512		
CYLINDER PRESSURE (psig) : 1700		
CERTIFIED DATE : Mar 10, 2021		
EXPIRED DATE : Mar 10, 2029		

CALIBRATION RESULTS

POINT NO	CALIBRATION RESULTS		
	IDEAL (PPM)	ACTUAL CO (PPM)	% ERROR CO
ZERO	0.00	0.00	0.00
1	40.00	39.90	-0.10
2	195.20	195.00	-4.20
3	400.30	396.70	-3.60
4	800.90	807.20	6.30
AVERAGE (%)			1.01



EMEX Environmental and Medical Expert

EMEX ASSOCIATION CO., LTD.

บริษัท อีเม็กซ์ ออสโมซิส จำกัด

CALIBRATED BY : คุณพรชัย ชาติวนิชกุล

ต้องการข้อมูลเพิ่มเติมด้านเทคนิคเพิ่มเติม : คุณพรชัย ชาติวนิชกุล โทร : 02-2515-8998

เลขที่ 388 ถนนรัชดาภิเษก แขวงจันทระเกษม เขตจตุจักร กรุงเทพฯ 10500 โทรศัพท์ : 0-2515-8998 E-Mail : info@kinetics.co.th

DATE : 26 กันยายน 2565

Signature: [Handwritten Signature]

เลขที่ใบรายงาน 7-244

Certificate of System Qualification

GC-OQ

System ID: GC-FID_CN12211142
Organization Name: Emex Association Co., Ltd.
Organization Location: 29 Rama 2 Soi.30, Bangmod, Jomthong, Bangkok 10150 Thailand

Date: September 13, 2022 8:58:30 AM
EQP Name: AgilentRecommended
EQP Revision: GC-02.51
Overall Qualification Status: Pass

System Inspection and Basic Safety and Operation

Name: 7890

Setpoint Status: Pass

Overall System Inspection and Basic Safety and Operation Test Status
Pass

Inlet Pressure Decay

Name: 7890
Front SSL

Setpoint Status: Pass
Pressure: 25.0 psi
Pressure Change: -0.1 psi /5 minutes
Agilent Recommended: >= -2.0 and <= 0.5

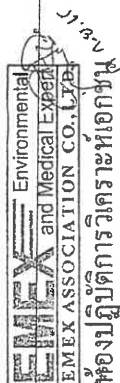
Overall Inlet Pressure Decay Test Status

Pass

Inlet Pressure Accuracy

Name: 7890
Front SSL

Date: September 13, 2022 8:58:30 AM
System ID: GC-FID_CN12211142



Page 1 ห้องปฏิบัติการวิเคราะห์เอกชน
เลขทะเบียน ว-244

ใบรับรองการสอบเทียบ “เครื่อง Gas Chromatography-FID”
(Calibration Certificate of Gas Chromatography-FID)



ห้องปฏิบัติการวิเคราะห์เอกชน
เลขทะเบียน ว-244

Setpoint Status: Pass

Inlet Pressure: 25.0 psi Actual 24.9 psi
Accuracy: 0.1 psi
Agilent Recommended: ≤ 1.2

Overall Inlet Pressure Accuracy Test Status
Pass

Detector Flow Accuracy

Name: 7890 Front FID

Setpoint Status: Pass

Flow Type: Fuel

Setpoint: 30.0 mL/min Measured Flow: 29.9 mL/min

Accuracy: 0.1 mL/min

Agilent Recommended: ≤ 10.0 % setpoint (3.0 mL/min)

Limit is percentage of setpoint or 0.5 mL/minute, whichever is largest.

Setpoint Status: Pass

Flow Type: Oxidizer

Setpoint: 400.0 mL/min Measured Flow: 400 mL/min

Accuracy: 0.0 mL/min

Agilent Recommended: ≤ 10.0 % setpoint (40.0 mL/min)

Limit is percentage of setpoint or 0.5 mL/minute, whichever is largest.

Setpoint Status: Pass

Flow Type: Makeup

Setpoint: 25.0 mL/min Measured Flow: 24.9 mL/min

Accuracy: 0.1 mL/min

Agilent Recommended: ≤ 10.0 % setpoint (2.5 mL/min)

Limit is percentage of setpoint or 0.5 mL/minute, whichever is largest.

Date: September 13, 2022 8:58:30 AM
System ID: GC-FID_CN1211142

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ห้องปฏิบัติการวิเคราะห์เอกชน
เลขทะเบียน ว-244

Overall Detector Flow Accuracy Test Status
Pass

GC Oven Temperature Accuracy

Name: 7890

Setpoint Status: Pass

Zone: Oven

Temperature: 230.0 Setpoint/Actual 230.6 °C

Accuracy: 0.6 °C

Agilent Recommended: ≥ -1.0 % setpoint in K (-5.0 °C)
≤ 1.0 % setpoint in K (5.0 °C)

Setpoint Status: Pass

Zone: Oven

Temperature: 100.0 Setpoint/Actual 100.3 °C

Accuracy: 0.3 °C

Agilent Recommended: ≥ -1.0 % setpoint in K (-3.7 °C)
≤ 1.0 % setpoint in K (3.7 °C)

Overall GC Oven Temperature Accuracy Test Status
Pass

GC Oven Temperature Stability

Name: 7890

Setpoint Status: Pass

Temperature: 100.0 Setpoint/Average 100.2333 °C

Stability: 0.1 °C

Agilent Recommended: ≤ 0.5

Overall GC Oven Temperature Stability Test Status
Pass

Date: September 13, 2022 8:58:30 AM
System ID: GC-FID_CN1211142

Page 3



ห้องปฏิบัติการวิเคราะห์เอกชน
เลขทะเบียน ว-244

Scouting Run

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

Setpoint Status: Completed

Injection Volume on Column: 1.0 uL

Overall Scouting Run Status
Completed

Noise and Drift

Tested Combination1 Front / Front FID
Name: 7690

Setpoint Status: Pass

Base Signal: 15.17 pA
ASTM Noise
pA
0.05
0.10
Drift
pA/Hr
0.08
2.50

Overall Noise and Drift Test Status
Pass

Injection Precision

Tested Combination1 Front / Front FID
Name: 7693A

Setpoint Status: Pass

Injection Volume on Column: 1.0 uL

Area RSD: 0.85 % Retention Time RSD: 0.84 %

Agilent Recommended: <= 3.00 <= 1.00

Overall Injection Precision Test Status
Pass

Signal to Noise

Tested Combination1 Front / Front FID
Injection Tower
Name: 7690

Setpoint Status: Pass

Signal to Noise: 414852

Agilent Recommended: >= 300000

Overall Signal to Noise Test Status
Pass

Instrument Details

Purpose

This section describes the as found system configuration.

Details

System

System ID GC-FID_CN1221142

Manufacturer Agilent Technologies

Name 7890

Flow Data Input Manual Data

Temperature Data Input Manual Data or Other Data Logging

Tested Combination1

Injection Technique

Injection Tower

Inlet Front

Detector Front

LTM Included? No

Sampler 1

Manufacturer

Agilent Technologies

Injection Tower

Type 7693A

Name G4513A

Model Number CN12280137

Serial Number A.10.08

Firmware Revision Sample Injection

Usage Front

Location 10

Syringe Volume (µL)

Date:

System ID:

September 13, 2022 8:58:30 AM

GC-FID_CN1221142



ห้องปฏิบัติการวิเคราะห์เอกชน

เลขทะเบียน ว-244

Sampler 2

Manufacturer

Agilent Technologies

Type

Tray

Name

7693A

Model Number

G4514A

Serial Number

CN12230009

Firmware Revision

A.10.16

Vial Heater

Not installed

Mainframe 1

Manufacturer

Agilent Technologies

Name

7890

Model Number

G3440A

Serial Number

CN12211142

Firmware Revision

A.01.15

Oven Type

Standard

Inlet 1

Manufacturer

Agilent Technologies

Name

7890

Type

SSL

Location

Front

Carrier Gas

Helium

Control Type

Electronic Pressure Control (EPC)

Purged Inlet

Yes

Detector 1

Manufacturer

Agilent Technologies

Name

7890

Type

FID

Adapter

Capillary

Control Type

Electronic Pressure Control (EPC)

Location

Front

Makeup Gas

Nitrogen

Date:

System ID:

September 13, 2022 8:58:30 AM

GC-FID_CN1221142



ห้องปฏิบัติการวิเคราะห์เอกชน

เลขทะเบียน ว-244

Electronic Signature

Purpose

This signature page was created and published because the ACE sign-off action was executed, which is valid for the entire document, including attachments. The ACE sign-off is an electronic signature that requires two distinct identification components: unique username and personal password. The Agilent representative who has delivered this service understands the meaning and legal status of an electronic signature. As a trained official operator, the Agilent representative has a unique password and login to access ACE and electronically sign this document. (Other e-signatures can be applied to this document using a Document Content Management or other suitable method defined in your data access and control procedures.)

Details

Full Name of Signer: Saengulhai Tarak
Logged On User Name: saengulhai.tarak@non.agilent.com
Signature Creation Date: September 13, 2022
Reason for Signature: Executed protocol and published this original version of document

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Date: September 13, 2022 8:58:30 AM
System ID: GC-FID_CN1221142



ห้้องปฏิบัติการวิเคราะห์เอกสาร
Page 8 / 15 เลขทะเบียน ว-244

User Name: saengulhai.tarak
Host Name: LAPTOP-CQ3SKG5V
Print Date: September 13, 2022 8:58:31 AM

Emex_GC-FID_CN1221142 Transaction Log :

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
September 12, 2022 11:23:19 AM	Audit	Session Created	Session	None
September 12, 2022 11:23:19 AM	Start	Configuration	Session	None
September 12, 2022 11:23:19 AM	Audit	Endment	Licensing	User is Monitoring and does not require an unlock code
September 12, 2022 12:53:42 PM	Audit	Export loaded	Session	EQP details for primary technique (GC) - File path: [PratoolPath]\GC\Config\ant ions\02.5\1\GC\02.5.1.appl EQP File Name: [GC-02.51.appl], EQP Name: [AgilentRecommended]
September 12, 2022 12:53:47 PM	End	Configuration	Session	None
September 12, 2022 12:53:53 PM	Start	Qualification	Session	OQ
September 12, 2022 12:53:53 PM	Start	Execution	System Inspection and Basic Safety and Operation - 7890 - Qualitative Test - No endpoints associated	None
September 12, 2022 1:34:07 PM	Audit	AcqClosed	Session	None
September 13, 2022 8:34:07 AM	Audit	AcqRestarted	Session	None
September 13, 2022 8:34:29 AM	Audit	SessionReaborted	Session	None
September 13, 2022 8:34:30 AM	Start	Qualification	Session	OQ

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Date: September 13, 2022 8:58:30 AM
System ID: GC-FID_CN1221142



ห้้องปฏิบัติการวิเคราะห์เอกสาร
Page 9 / 15 เลขทะเบียน ว-244

User Name: sangnathalak
Host Name: LAPTOP-COSKODV
System ID: GC-FID_CN1221142
Print Date: September 13, 2022 8:58:31 AM

Emex_GC-FID_CN1221142 Transaction log :

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
September 13, 2022 8:34:30 AM	Start	Execution	System Inspection and Basic Safety and Operation - 7890 - Qualitative Test - No subpoints associated	None
September 13, 2022 8:34:57 AM	End	Execution	System Inspection and Basic Safety and Operation - 7890 - Qualitative Test - No subpoints associated	Run Count: 1
September 13, 2022 8:34:59 AM	Start	Execution	Inlet Pressure Decay - Front SSL - Pressure Controlled Inlet - S: 25.0 psi - L: >= -2.0 psi and <= 0.5 psi	None
September 13, 2022 8:36:13 AM	End	Execution	Inlet Pressure Decay - Front SSL - Pressure Controlled Inlet - S: 25.0 psi - L: >= -2.0 psi and <= 0.5 psi	Run Count: 1
September 13, 2022 8:36:15 AM	Start	Execution	Inlet Pressure Accuracy - Front SSL - Pressure Controlled Inlet - S: 25.0 psi - L: <= 1.2 psi	None
September 13, 2022 8:36:26 AM	End	Execution	Inlet Pressure Accuracy - Front SSL - Pressure Controlled Inlet - S: 25.0 psi - L: <= 1.2 psi	Run Count: 1
September 13, 2022 8:36:29 AM	Start	Execution	Detector Flow Accuracy - Front FID - Type: FID - S: 30.0 mL/min - L: <= 10.0% setpoint	None
September 13, 2022 8:36:36 AM	Audit	Data	Detector Flow Accuracy - Front FID - Type: FID - S: 30.0 mL/min - L: <= 10.0% setpoint	Manual Data Entry
September 13, 2022 8:37:02 AM	End	Execution	Detector Flow Accuracy - Front FID - Type: FID - S: 30.0 mL/min - L: <= 10.0% setpoint	Run Count: 1

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Date: September 13, 2022 8:58:30 AM
System ID: GC-FID_CN1221142



ห้องปฏิบัติการวิเคราะห์เอกชน
เลขทะเบียน จ-244

User Name: sangnathalak
Host Name: LAPTOP-COSKODV
System ID: GC-FID_CN1221142
Print Date: September 13, 2022 8:58:31 AM

Emex_GC-FID_CN1221142 Transaction log :

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
September 13, 2022 8:37:04 AM	Start	Execution	Detector Flow Accuracy - Front FID - Type: FID - S: 30.0 mL/min - L: <= 10.0% setpoint	None
September 13, 2022 8:37:19 AM	Audit	Data	Detector Flow Accuracy - Front FID - Type: FID - S: 30.0 mL/min - L: <= 10.0% setpoint	Manual Data Entry
September 13, 2022 8:37:22 AM	End	Execution	Detector Flow Accuracy - Front FID - Type: FID - S: 30.0 mL/min - L: <= 10.0% setpoint	Run Count: 1
September 13, 2022 8:37:25 AM	Start	Execution	Detector Flow Accuracy - Front FID - Type: Makeup - S: 25.0 mL/min - L: <= 10.0% setpoint	None
September 13, 2022 8:37:59 AM	Audit	Data	Detector Flow Accuracy - Front FID - Type: Makeup - S: 25.0 mL/min - L: <= 10.0% setpoint	Manual Data Entry
September 13, 2022 8:37:59 AM	End	Execution	Detector Flow Accuracy - Front FID - Type: Makeup - S: 25.0 mL/min - L: <= 10.0% setpoint	Run Count: 1
September 13, 2022 8:37:59 AM	Start	Execution	GC Oven Temperature Accuracy - 7890 - Temperature : Oven - S: 230.0°C - L: >= -1.0 AND <= 1.0 % setpoint in K	None
September 13, 2022 8:38:15 AM	Audit	Data	GC Oven Temperature Accuracy - 7890 - Temperature : Oven - S: 230.0°C - L: >= -1.0 AND <= 1.0 % setpoint in K	Manual Data Entry
September 13, 2022 8:38:16 AM	End	Execution	GC Oven Temperature Accuracy - 7890 - Temperature : Oven - S: 230.0°C - L: >= -1.0 AND <= 1.0 % setpoint in K	Run Count: 1

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Date: September 13, 2022 8:58:30 AM
System ID: GC-FID_CN1221142



ห้องปฏิบัติการวิเคราะห์เอกชน
เลขทะเบียน จ-244

User Name: sarnjuthat.lach.
Host Name: LAPTOP-GQ3SKD9V

System ID: GC-FID_CN1221142
Print Date: September 13, 2022 8:58:31 AM

Enes_GC-FID_CN1221142 Transaction log:

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
September 13, 2022 8:38:18 AM	Start	Execution	GC Oven Temperature Accuracy - 7890: - Temperature : Oven - S: 100.0°C - L: >= -1.0 AND <= 1.0 % setpoint in K	None
September 13, 2022 8:38:24 AM	Audit	Data	GC Oven Temperature Accuracy - 7890: - Temperature : Oven - S: 100.0°C - L: >= -1.0 AND <= 1.0 % setpoint in K	Manual Data Entry
September 13, 2022 8:38:39 AM	End	Execution	GC Oven Temperature Accuracy - 7890: - Temperature : Oven - S: 100.0°C - L: >= -1.0 AND <= 1.0 % setpoint in K	Run Count: 1
September 13, 2022 8:38:39 AM	Start	Execution	GC Oven Temperature Stability - 7890: - Temperature: Oven - S: 100.0°C - L: <= 0.5°C	None
September 13, 2022 8:39:29 AM	Audit	Data	GC Oven Temperature Stability - 7890: - Temperature: Oven - S: 100.0°C - L: <= 0.5°C	Manual Data Entry
September 13, 2022 8:39:29 AM	End	Execution	GC Oven Temperature Stability - 7890: - Temperature: Oven - S: 100.0°C - L: <= 0.5°C	Run Count: 1
September 13, 2022 8:39:29 AM	Start	Execution	GC Scouting Run - Injection Tower, Front SSL, Front FID: - Part of System Preparation - No limits associated	None
September 13, 2022 8:39:44 AM	Audit	Data	GC Scouting Run - Injection Tower, Front SSL, Front FID: - Part of System Preparation - No limits associated	Data files Path: E:\SCN13.D\FID1A.ch
September 13, 2022 8:40:09 AM	End	Execution	GC Scouting Run - Injection Tower, Front SSL, Front FID: - Part of System Preparation - No limits associated	Run Count: 1

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Date: September 13, 2022 8:58:30 AM
System ID: GC-FID_CN1221142



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ห้องปฏิบัติการวิเคราะห์เอกสาร
Page 12 / 15 เลขทะเบียน ว-244

User Name: sarnjuthat.lach.
Host Name: LAPTOP-GQ3SKD9V

System ID: GC-FID_CN1221142
Print Date: September 13, 2022 8:58:34 AM

Enes_GC-FID_CN1221142 Transaction log:

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
September 13, 2022 8:40:10 AM	Start	Execution	Noise and Drift - Front FID: - Detector FID - L (Noise): <= 0.10 pA - L (Drift): <= 2.50 pA/hour	None
September 13, 2022 8:40:39 AM	Audit	Data	Noise and Drift - Front FID: - Detector FID - L (Noise): <= 0.10 pA - L (Drift): <= 2.50 pA/hour	Data files Path: E:\IND13.D\FID1A.ch
September 13, 2022 8:40:49 AM	End	Execution	Noise and Drift - Front FID: - Detector FID - L (Noise): <= 0.10 pA - L (Drift): <= 2.50 pA/hour	Run Count: 1
September 13, 2022 8:40:51 AM	Start	Execution	Injection Precision - Injection Tower, Front SSL, Front FID: - GC - L (Area): <= 3.00% - L (Ret. Time): <= 1.00%	None
September 13, 2022 8:41:04 AM	Audit	Data	Injection Precision - Injection Tower, Front SSL, Front FID: - GC - L (Area): <= 3.00% - L (Ret. Time): <= 1.00%	Data files Path: E:\PRE105.D\FID1A.ch
September 13, 2022 8:41:04 AM	Audit	Data	Injection Precision - Injection Tower, Front SSL, Front FID: - GC - L (Area): <= 3.00% - L (Ret. Time): <= 1.00%	Data files Path: E:\PRE106.D\FID1A.ch
September 13, 2022 8:41:04 AM	Audit	Data	Injection Precision - Injection Tower, Front SSL, Front FID: - GC - L (Area): <= 3.00% - L (Ret. Time): <= 1.00%	Data files Path: E:\PRE107.D\FID1A.ch
September 13, 2022 8:41:04 AM	Audit	Data	Injection Precision - Injection Tower, Front SSL, Front FID: - GC - L (Area): <= 3.00% - L (Ret. Time): <= 1.00%	Data files Path: E:\PRE108.D\FID1A.ch

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Date: September 13, 2022 8:58:30 AM
System ID: GC-FID_CN1221142



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ห้องปฏิบัติการวิเคราะห์เอกสาร
Page 13 / 15 เลขทะเบียน ว-244

User Name: vanusathai.luck
Host Name: LAPTOP-CQ35KQWV
System ID: GC-FID_CN12211142
Print Date: September 13, 2022 8:58:31 AM

Emex_GC-FID_CN12211142 Transaction log:

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
September 13, 2022 8:41:04 AM	Audit	Data	Injection Precision - Injection Tower Front SSL Front FID - GC - L (Met): <= 3.00% - L (Ret. Time): <= 1.00%	Data File Path: EXPED10.D\FID\A.ch
September 13, 2022 8:41:04 AM	Audit	Data	Injection Precision - Injection Tower Front SSL Front FID - GC - L (Met): <= 3.00% - L (Ret. Time): <= 1.00%	Data File Path: EXPED10.D\FID\A.ch
September 13, 2022 8:41:19 AM	End	Execution	Injection Precision - Injection Tower Front SSL Front FID - GC - L (Met): <= 3.00% - L (Ret. Time): <= 1.00%	Run Count: 1
September 13, 2022 8:41:23 AM	Start	Execution	Signal to Noise - Injection Tower Front SSL Front FID - Detector FID - L: >= 300000	None
September 13, 2022 8:41:34 AM	Audit	Data	Signal to Noise - Injection Tower Front SSL Front FID - Detector FID - L: >= 300000	Data File Path: EXPED10.D\FID\A.ch
September 13, 2022 8:41:53 AM	End	Execution	Signal to Noise - Injection Tower Front SSL Front FID - Detector FID - L: >= 300000	Run Count: 1
September 13, 2022 8:41:56 AM	End	Qualification	Session	OQ
September 13, 2022 8:41:56 AM	Start	Reporting	Session	None
September 13, 2022 8:41:56 AM	Audit	AcqClosed	Session	None
September 13, 2022 8:47:56 AM	Audit	AcqResumed	Session	None
September 13, 2022 8:48:27 AM	Audit	SessionReleased	Session	None



ห้องปฏิบัติการวิเคราะห์ห้อกษณ
Page 14 / 15 เลขทะเบียน ว-244

User Name: vanusathai.luck
Host Name: LAPTOP-CQ35KQWV
System ID: GC-FID_CN12211142
Print Date: September 13, 2022 8:58:31 AM

Emex_GC-FID_CN12211142 Transaction log:

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
September 13, 2022 8:48:31 AM	Start	Qualification	Session	OQ
September 13, 2022 8:57:46 AM	Audit	Reporting	Session	Report Generated: Certificate



ห้องปฏิบัติการวิเคราะห์ห้อกษณ
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BECTHAI BANGKOK EQUIPMENT & CHEMICAL CO., LTD.
CALIBRATION LABORATORY

300 Phaholyothin Road, Phayathai, Bangkok 10400, Thailand Tel: +66 2615-2323 Fax: +66 2615-2350-1
E-mail: bkk@becthai.com Website: www.becthai.com



Certificate No. : CAL-23-446

Page : 1 of 3

CERTIFICATE OF CALIBRATION

Equipment	: Spectrophotometer
Manufacturer	: Thermo Scientific
Model	: Genesys 10S VIS
Serial No.	: 2E8R020104
ID No.	: N/A
Customer	: Emex Association Co., Ltd.
	: 27, 29 Soi Rama 2, Soi 30, Rama Road,
	: Bangmod, Jomthong, Bangkok 10150
Location	: Customer Laboratory
Date of Receipt	: 7 July 2023
Date of Calibration	: 7 July 2023
Date of Issue	: 7 July 2023
Ambient Temperature	: (25±10) °C
Relative Humidity	: (60±20) %
Condition As-Received	: Used Item

Calibrated by

Kitikorn Boonprapai

(Mr. Kitikorn Boonprapai)

Calibration Engineer

Approved by

Jintana Sangthajaroenlap

(Ms. Jintana Sangthajaroenlap)

Calibration Manager

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

This certificate may not be reproduced other than in full, except with the prior written approval of the head of Calibration Laboratory. Indicated values are valid for the state of the Spectrophotometer at the time of calibration only.



ห้องปฏิบัติการวิเคราะห์เอกชน

เลขทะเบียน ว-244



ห้องปฏิบัติการวิเคราะห์เอกชน

เลขทะเบียน ว-244

ISSUE: 5 REV:4

FM-CAL-33/2

1505/61



BECTHAI BANGKOK EQUIPMENT & CHEMICAL CO., LTD.

CALIBRATION LABORATORY

300 Phaholyothin Road, Phayathai, Bangkok 10400, Thailand Tel: +66 2615-2929 Fax: +66 2615-2350-1
E-mail: bkk@becthai.com Website: www.becthai.com



ISO/IEC 17025
CALIBRATION

Certificate No. : CAL-23-446

Page : 2 of 3

CALIBRATION REPORT

Conditions of this result of calibration

1. Reference Standard Material :

Material	Model	Serial No.	Cert.No.	Due date
Holmium Glass Filter	RM-HG	24563	109211	13 Feb 25
Didymium Glass Filter	RM-DG	24562	109212	13 Feb 25
Neutral Density Filter	RM-1N2N3N	24568	109249	14 Feb 25

2. Traceability : This certification is traceable to the International System of Unit maintained at;

The Sigma Scientific Ltd. Accredited Calibration Laboratory No. 0659.

3. Method of calibration :

The calibration procedure was carried out according to ASTM E275-08 (2022) and ASTM E925-09 (2014).

4. Result of calibration :

(✓) without adjustment () after adjustment

5. Equipment Specifications:

Spectral Bandwidth :	5	nm
Data Interval :	1	nm
Scan Speed :	Slow	nm/min



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เลขทะเบียน ว-244

ISSUE: 5 REV:4

FM-CAL-33/2

15/05/61



BECTHAI BANGKOK EQUIPMENT & CHEMICAL CO., LTD.

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E-mail: bkk@becthai.com Website: www.becthai.com



ISO/IEC 17025
CALIBRATION

Certificate No. : CAL-23-446

Page : 3 of 3

CALIBRATION REPORT

Wavelength Calibration

Certified Values of Reference Material (nm)	Nominal Value (nm)	UUC*Reading (nm)	Error (nm)	Uncertainty of Measurement (± nm)
361.40	361.40	362	0.60	0.59
528.59	528.59	529	0.41	0.59
879.68	879.68	879	-0.68	0.59

Photometric Calibration for Visible

Wavelength (nm)	Certified Values of Reference Material (A)	UUC* Reading (A)	Error (A)	Uncertainty of Measurement (± A)
420.0	Zero	0.000	0.0000	0.0028
	0.5835	0.584	0.0005	0.0044
	0.725	0.725	0.0000	0.0040
	1.0367	1.037	0.0003	0.0039
440.0	Zero	0.000	0.0000	0.0028
	0.5662	0.566	-0.0002	0.0042
	0.7106	0.710	-0.0006	0.0037
	1.0159	1.014	-0.0019	0.0037
465.0	Zero	0.000	0.0000	0.0028
	0.5237	0.526	0.0003	0.0044
	0.6682	0.668	-0.0002	0.0039
	0.9547	0.954	-0.0007	0.0034
546.1 (546.0)	Zero	0.000	0.0000	0.0028
	0.5226	0.522	-0.0006	0.0036
	0.6939	0.692	-0.0019	0.0039
	0.9919	0.989	-0.0029	0.0032
590.0	Zero	0.000	0.0000	0.0028
	0.5557	0.555	-0.0017	0.0035
	0.7502	0.748	-0.0022	0.0037
	1.0732	1.071	-0.0022	0.0034
635.0	Zero	0.000	0.0000	0.0028
	0.5643	0.563	-0.0013	0.0035
	0.7299	0.729	-0.0009	0.0039
	1.0437	1.042	-0.0017	0.0034

Remark : Each individual filter is measured against the empty filter holder (blank) used to zero the Spectrophotometer.

Note:

UUC* : Unit Under Calibration



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เลขทะเบียน ว-244

- End of Report -

ISSUE: 5 REV:4

FM-CAL-33/2

15/05/61



61135A) 4315.1.2005 17165V2116

CUSTOMER NAME : M GREEN GROUP COMPANY LIMITED

EQUIPMENT NAME : SO₂ Analyzer

MANUFACTURER : HORIBA

STANDARD GAS CONCENTRATION (PPM) : 53.29 PPM

CYLINDER PRESSURE (PSI) : 1,000 PSI

CERTIFIED BY : AIRGAS

MANUFACTURER : HORIBA
MODEL : APSA-370

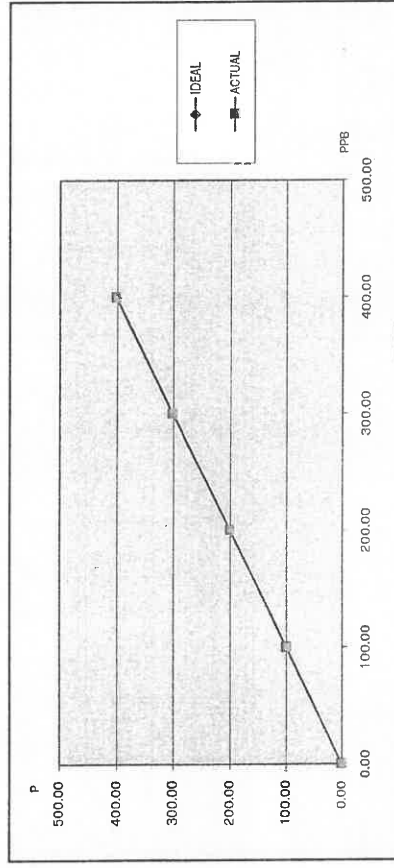
STANDARD GAS CONCENTRATION (PPM) : 53.29 PPM
CYLINDER

CYLINDER PRESSURE (PSI) : 1,000 PSI

CERTIFIED BY : AIRGAS

TEST RESULTS

POINT NO	TEST RESULTS		
	IDEAL	ACTUAL	%ERROR
ZERO	0.00	0.050	0.05
1	100.00	99.010	-1.0
2	200.00	200.420	0.4
3	300.00	300.460	0.5
4	400.00	400.650	0.6
AVERAGE (%)			0.12



CALIBRATED BY: STYMA MATH DATE 11/10/65

CHECKED BY: MCJ 2/2/65 11/10/65
FORWARDED TO ASSOCIATES ON DATE:

ต้องการซ่อมแซมคันเบ็ดเพิ่มเติม : เจ้าหน้าที่ฝ่ายบริการลูกค้า, โทร 02-868-0812 # 15-16, E-Mail : Engineer@iranatee.com

เลขที่ 63/14-15,67/35-36 ถนน ซอยเพชรเกษม 7,7/1 เพชรเกษม แขวงวัดท่าพระ เขตบางกอกใหญ่ กรุงเทพฯ 10600 โทร 02-868-0812-13 โทรสาร 02-868-1889

FO-EN-206 R01/22-10-14

CHECK LIST



HESS, J. 1953. *Archiv für die Geschichte der Naturwissenschaften* 1: 1-11.

CUSTOMER NAME : M GREEN GROUP COMPANY LIMITED

EQUIPMENT NAME : SO₂ Analyzer

MANUFACTURER	: HORIBA	MODEL : APSA-370	SERIAL NO. : G8K6HRMX
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TEST VALUES

NO.	Ambient SO ₂ Monitor	UNIT	BEFORE	AFTER
1	SIGNAL	mV (Voltage of the measured SO ₂ Value)	6.40	9.30
2	LAMP	mV (200mV to 1200 mV)	719.10	1001.70
3	CELL	°C (Ambient temblent temperature +45°C to 15°C))	38.90	32.20
4	PUMP	kPa (65 kPa or less)	44.40	46.00
5	AMBIENT	kPa	101.50	101.80
6	SAMPLE	L/min (0.6 L/min to 1.0 L/min)	-	-
7	DC 24 V	V (24 V ± 0.5 V)	23.90	23.90
8	DC 5 V	V (5 V ± 0.5 V)	5.00	5.00
9	SAMPLE SO2 Reading	PPB	3.77	0.41
10	Zero	PPB	0.41	0.05
11	Span	PPB	420.10	400.65

Remark : Reference EX-EN-019-56 , Ambient SO2 Monitor APSA-370 Operation Manual Page #78

(Ambient temperature = 5°C to 40°C)

อาการที่ตรวจพบ

รายละเอียดการดำเนินการ

ผลการดำเนินการ

[illegible]

CALIBRATED BY: STAN MARY DATE: 11/10/05

CHECKED BY: New DATE: 11/10/65

ต้องการข้อมูลราคาก่อนขอใบเสนอราคาเพิ่มเติม : กรุณาทักผ่านบริการลูกค้าขาย โทร 02-868-0812 # 15-16, E-Mail : Engineer@liranatee.com

เลขที่ 63/14-15 , 67/35-36 ซอยเพชรเกษม 7/71 ถนนเพชรเกษม แขวงวัดท่าพระ เขตบางกอกใหญ่ กรุงเทพฯ 10600 โทร : 02-868-0812-13 โทรสาร : 02-868-1889

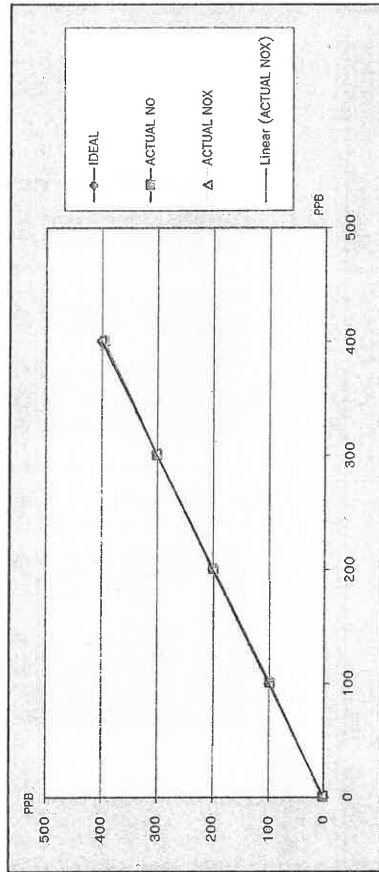
FO-EN-207 R01/28-09-14

TEST REPORT

CUSTOMER NAME	: M GREEN GROUP COMPANY LIMITED		
EQUIPMENT NAME	: NO _x Analyzer		
MANUFACTURER	: HORIBA	MODEL :	APNA-370
		SERIAL NO	: RSBHK673
STANDARD GAS CONCENTRATION (PPM)	: 53.15 PPM		
CYLINDER NO	: CCT34373		
CERTIFIED DATE	: 12/05/2020		
CYLINDER PRESSURE (Psi)	: 1,000 Psi		
CERTIFIED BY : AIRGAS		EXPIRED DATE	: 12/05/2028

TEST RESULTS

POINT NO	TEST RESULTS					
	IDEAL	ACTUAL NO	ERROR NO	%ERROR NO	ACTUAL NO _x	ERROR NO _x %ERROR NO _x
ZERO	0.00	-0.43	-0.43	-	-0.13	-0.13
1	100.00	99.54	-0.46	-0.46	99.40	-0.60
2	200.00	198.72	-1.28	-0.64	198.71	-1.29
3	300.00	299.84	-0.16	-0.05	299.91	-0.09
4	400.00	400.27	0.27	0.07	400.12	0.12
AVERAGE (%)			-0.27			-0.31



CALIBRATED BY : กรรวิทย์ โชดสังข์ DATE : 11/10/65
 CHECKED BY : ศิวะ อดิภาณ DATE : 11/10/65

ต้องการข้อมูลทางด้านเทคนิคเพิ่มเติม : เจ้าหน้าที่ฝ่ายบริการหลังการขาย , โทร 02-868-0812 # 15-16 , E-Mail : Engineer@iranatec.com
 เลขที่ 63/14-15.67/35-36 ซอยเพชรเกษม 7/71 ถนนเพชรเกษม แขวงวัดท่าพระ เขตบางกอกใหญ่ กรุงเทพฯ 10600 โทร 02-868-0812-13 โทรสาร 02-868-1889

CHECK LIST

CUSTOMER NAME	: M GREEN GROUP COMPANY LIMITED		
EQUIPMENT NAME	: NO _x Analyzer		
MANUFACTURER	: HORIBA	MODEL :	APNA-370
		SERIAL NO. :	RSBHK673

TEST VALUES

NO.	NO _x Analyzer (APNA-370)	UNIT	BEFORE	AFTER
1	Signal (NO)	mV	4,300	2,900
2	Signal (NO _x)	mV	15,300	9,700
3	Detector	Temp °C, Standard Value : Ambient temp+5°C(±0.5°C) Pressure kPa , Standard Value : (Ambient/1013x100-20)±4kPa	42,900	42,900
4	AMBIENT	kPa	77,900	77,600
5	SAMPLE	L/min (1.1 L/min ± 0.3 L/min)	101,500	101,200
6	DC 24 V	V (24 V ± 0.5 V)	23,700	23,900
7	DC 5 V	V (5 V ± 0.5 V)	5,000	5,000
8	Sampling NO Reading	PPB	5,610	3,710
9	Sampling NO ₂ Reading	PPB	15,280	12,560
10	Sampling NO _x Reading	PPB	20,900	16,280
11	Zero (NO)	PPB	0.420	-0.430
12	Span(NO)	PPB	390.120	400.270
13	Zero (NO _x)	PPB	4.150	-0.130
14	Span (NO _x)	PPB	396.410	400.120

Remark : Reference EX-EN-022-56 , "Ambient NO_x Monitor APNA-370 Operation Manual " Page #48

(Ambient temperature = 5°C to 40°C)

อาการที่ตรวจพบ

รายละเอียดการดำเนินการ

ผลการดำเนินการ

- เรียบร้อย เครื่องสามารถดำเนินการตรวจวัดได้ตามปกติ

CALIBRATED BY : กรรวิทย์ โชดสังข์ DATE : 11/10/65
 CHECKED BY : ศิวะ อดิภาณ DATE : 11/10/65

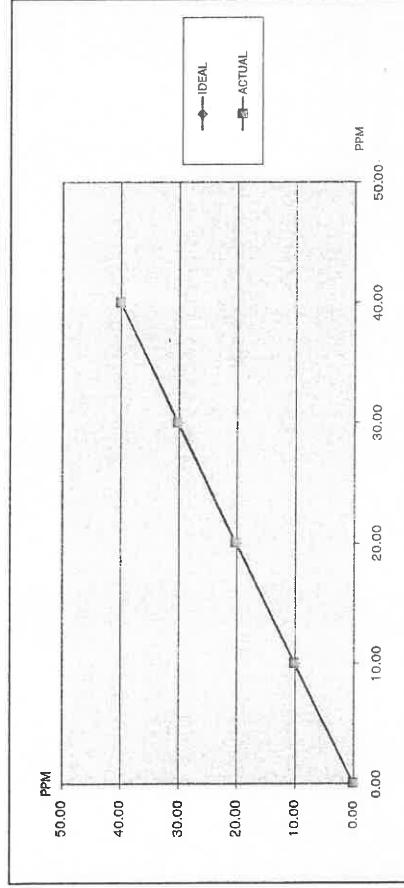
ต้องการข้อมูลทางด้านเทคนิคเพิ่มเติม : เจ้าหน้าที่ฝ่ายบริการหลังการขาย , โทร 02-868-0812 # 15-16 , E-Mail : Engineer@iranatec.com
 เลขที่ 63/14-15.67/35-36 ซอยเพชรเกษม 7/71 ถนนเพชรเกษม แขวงวัดท่าพระ เขตบางกอกใหญ่ กรุงเทพฯ 10600 โทร 02-868-0812-13 โทรสาร 02-868-1889

TEST REPORT

CUSTOMER NAME : M. GREEN GROUP COMPANY LIMITED		MODEL : APMA-370		SERIAL NO : 84XJ1GRC
EQUIPMENT NAME : CO Analyzer		MANUFACTURER : HORIBA		CYLINDER NO : CC734373
STANDARD GAS CONCENTRATION (PPM) : 4533 PPM		CYLINDER PRESSURE (PSI) : 1,000 PSI		CERTIFIED DATE : 12/05/2020
CERTIFIED BY : AIRGAS		EXPIRED DATE : 12/05/2028		

TEST RESULTS

POINT NO	CALIBRATION RESULTS		
	IDEAL	ACTUAL	%ERROR
ZERO	0.00	0.0000	0.00
1	10.00	10.0800	0.1
2	20.00	20.1200	0.1
3	30.00	30.1600	0.2
4	40.00	40.0100	0.0
AVERAGE (%)			0.49



CALIBRATED BY : กิจภัท หนาสื่อ DATE : 11/10/65
CHECKED BY : กิจภัท หนาสื่อ DATE : 11/10/65

ต้องการข้อมูลเพิ่มเติม : กรุณาติดต่อฝ่ายบริการลูกค้า โทร 02-8681246 E-Mail : mail@sale@okla-testing.com
63/14-15.67/25-36 ซอยเพชรเกษม 77/1 แขวงคลองใหญ่ เขตคลองเตย กรุงเทพฯ 10600 โทร 02-8681246 แฟกซ์ 02-8680860

CHECK LIST

CUSTOMER NAME : M. GREEN GROUP COMPANY LIMITED		MODEL : APMA-370		SERIAL NO : 84XJ1GRC
EQUIPMENT NAME : CO Analyzer		MANUFACTURER : HORIBA		

TEST VALUES				
NO.	CO Analyzer (APMA-370)	UNIT	BEFORE	AFTER
1	Signal (MAIN)	mV	-0.200	4.000
2	Signal (COMP)	mV	0.000	0.200
3	CELL	°C , Standard Value : Ambient temperature + (5°C to 15°C)	35.600	35.400
4	PUMP	kPa	39.600	39.700
5	AMBIENT	kPa	101.300	101.500
6	SAMPLE	L/min (1 L/min to L/min)	-	-
7	OVER FLOW	L/min (1.2 L/min or more)	0.000	0.000
8	DC 24 V	V (24 V ± 0.5 V)	23.900	23.900
9	DC 5 V	V (5 V ± 0.5 V)	4.900	4.900
10	Sample Reading	PPM	0.370	0.250
11	Zero	PPM	0.370	0.000
12	Span	PPM	37.000	40.010

Remark : Reference EX-SM-100-58 , "Ambient CO Monitor APMA-370 Operation Manual" Page #48

(Ambient temperature = 5°C to 40°C)

อาการที่ตรวจพบ

รายละเอียดการดำเนินการ

- ทำ Check List Analyzer , ทำ Calibration Zero/Span , Multipoint , เช็ค Diagnostics

ผลการดำเนินการ

- เรียบร้อยแล้ว เครื่องสามารถดำเนินการตรวจวัดได้ตามปกติ

CALIBRATED BY : กิจภัท หนาสื่อ DATE : 11/10/65
CHECKED BY : กิจภัท หนาสื่อ DATE : 11/10/65

ต้องการข้อมูลเพิ่มเติม : กรุณาติดต่อฝ่ายบริการลูกค้า โทร 02-8681246 E-Mail : Engineer@iranatee.com

63/14-15.67/25-36 ซอยเพชรเกษม 77/1 แขวงคลองใหญ่ เขตคลองเตย กรุงเทพฯ 10600 โทร 02-8681246 แฟกซ์ 02-8681889



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



NECTEC'S 17093
CALIBRATION 0119

Certificate No.: CP20230034EA
Operation No.: CP2023010028

Certificate of Calibration

Equipment: Sound Calibrator

Manufacturer: Scarlet Tech

Model/Type: ST-120

Serial No.: ST120C0247E

ID No.: -

Customer: M Green Group Co.,Ltd.


Address: 188/46, Pracha-Uttid Rd.,
Thungkru, Bangkok 10140 Thailand.

Received Date: 12 January 2023

Calibrated Date: 16 January 2023

Issued Date: 18 January 2023

Calibrated by: Ms. Juntaporn Kunhakom

Approved by: 
(Mr. Sittichai Swaksuriyawong)
Group Manager

This report was prepared electronically using applicable electronic signature. Printing or copy of file are considered as a copy of the document.
The reported uncertainty of measurement was based on standard uncertainty multiplied by a coverage factor (k) providing a level of confidence of approximately 95%. This certificate may not be reproduced other than in full except with the prior written approval of the Electrical and Electronics Institute, Foundation for Industrial Development.



สมาคมวิศวกรรมไฟฟ้า
มูลนิธิเพื่อการพัฒนาอุตสาหกรรม

ELECTRICAL AND ELECTRONICS INSTITUTE
FOUNDATION FOR INDUSTRIAL DEVELOPMENT

Certificate No.: CP20230034EA

Calibration Report

Equipment: Sound Calibrator
Manufacturer: Scarlet Tech
Model/Type: ST-120
Serial No.: ST120C0247E
ID No.: -
Ambient Temperature: (23 ± 2) °C
Relative Humidity: (50 ± 15) %
Pressure: (101.3 ± 1.5) kPa
Method of Calibration :-
IEC 60942:2017

Condition of this result of calibration

1. Reference standards instrument :-

Instrument	Model	Serial No.	Cert. No.	Due Date
1) Standard microphone	4180	2661000	AA-1020-22	14 June 2023
2) Waveform Generator	33511B	MY52302264	CK20220038EA	19 June 2023
3) Audio Analyzing DMM	2015-P	4079144	EIU221042	16 March 2023
4) Pressure humidity and Temperature Transmitter	PTU301	F0640002	CL1-P220024 CD20220164EA	17 March 2023 24 July 2023

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

3. This certification is traceable to the international system of unit maintained at :-

Reference standards instrument for Acoustic function

- National Institute of Metrology (Thailand)

Reference standards instrument for Electrical function

- Electrical and Electronics Institute; NSC Accredited Calibration No.0119

Result of Calibration:-

1. Function : Sound pressure level

Nominal Frequency (Hz)	Specified Sound Pressure level (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limit ⁽³⁾ (dB)
1000	94	94.04	0.04	±0.25
1000	114	114.10	0.10	±0.25

2. Function : Frequency

Normal Sound Pressure level (dB)	Specified Frequency (Hz)	Measured value (Hz)	Deviated value (%)	Acceptance limit ⁽³⁾ (%)
94	1000	999.5	0.0	±0.7
114	1000	999.6	0.0	±0.7



Certificate No.: CP20230034EA

Calibration Report

3. Function : Total distortion + noise

Sound Pressure level (dB)	Nominal Frequency (Hz)	Measured value (%) ^[4]	Acceptance limit (%) ^[5]
94	1000	0.5	2.5
114	1000	0.4	2.5

Uncertainty of measurement

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

Note: [1] The deviated value is the absolute value of the difference between the measured value

and the corresponding specified sound pressure level.

[2] The deviated value is the absolute value of the difference in percent between the measured value

and the corresponding specified frequency.

[3] The acceptance limit is for the deviated value.

[4] The measured value is the total distortion + noise, measured over the frequency range from 20 Hz to 20 kHz.

[5] The acceptance limit is for the Measured value.

Remarks: 1. Acceptance limit was IEC 60942:2017 Class 1.

2. The coverage factor $k = 2.00$

-- End of Report --

ห้างหุ้นส่วนจำกัด บลู คอนซัลแตนท์ Blue Consultant Limited Partnership

32/751 ถนนประชาอุทิศ แขวงทุ่งครุ เขตทุ่งครุ กรุงเทพฯ 10140

โทร.0-2873-6045-6 โทรสาร 0-2873-6046

ห้องปฏิบัติการวิเคราะห์เอกซเรย์อนุญาตลงวันที่ 14 สิงหาคม 2563

CALIBRATION REPORT

Equipment : NOx Analyzer
Serial No. : 17C-68152-359

Brand/Model: Thermo/17C
Date of Calibrate : May 12, 2023

Reference Standard

Certification Date: October 29, 2019

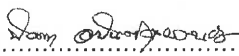
Component: SO₂: 55.62 ppm , NO: 57.21 ppm , CO : 4,551 ppm

Cylinder No.: EB0128767

Expiry Date: October 29, 2027

Calibration Check (Before adjust)						
Serial No.	Zero			Span		
	Reading Value (ppb)	Expected Value (ppb)	Drift (ppb)	Reading Value (ppb)	Expected Value (ppb)	Drift (ppb)
	NO/NO ₂ /NO _x	NO/NO ₂ /NO _x	NO/NO ₂ /NO _x	NO/NO ₂ /NO _x	NO/NO ₂ /NO _x	NO/NO ₂ /NO _x
17C-68152-359	3.5/1.3/4.8	0/0/0	3.5/1.3/4.8	396.7/4.1/400.8	400/0/400	-3.3/4.1/0.8
Calibration Check (After adjust)						
Serial No.	Zero			Span		
	Reading Value (ppb)	Expected Value (ppb)	Drift (ppb)	Reading Value (ppb)	Expected Value (ppb)	Drift (ppb)
	NO/NO ₂ /NO _x	NO/NO ₂ /NO _x	NO/NO ₂ /NO _x	NO/NO ₂ /NO _x	NO/NO ₂ /NO _x	NO/NO ₂ /NO _x
17C-68152-359	0/0/0	0/0/0	0/0/0	400/0/400	400/0/400	0/0/0

ในนามห้องปฏิบัติการห้างหุ้นส่วนจำกัด บลู คอนซัลแตนท์
BLUE CONSULTANT
Limited Partnership


(นางสาวนิดดา อนันต์สุวรรณชัย)
ผู้จัดการห้องปฏิบัติการ

Equipment Operational Qualification Report

Report No. SV2305/21210

Equipment GC-MS

System Model SQ

System ID GQS1203F021

Equipment Details Bruker

Test Protocol Scion OQ Protocol

Protocol Rev. A

Date 23-May-23

Report Type Report

Org. Name United Analyst and Engineering Consultant Co.,Ltd

Org. Location 3 Soi Udomsuk 41 Sukhumvit Rd.
Bangchak Phrakhanong Bangkok
Thailand 10260

เอกสารไม่ควบคุม

ใบรับรองการปฏิบัติงาน (Operational Qualification Report)
M Green Group Co., Ltd.

List Certificate of Laboratory Instrument

No.	Instrument/Equipment	Parameter	Manufacturer	Model/Serial No.	Calibrator	Certification No.	Date of Calibration	Due date of Calibration*	Remark
Laboratory Instrument for Soil Quality Analysis									
1	Gas Chromatography - Mass Spectrometer (GC-MS)	Dechloromethane Tetrachloroethylene Trichloroethylene	Bruker Scion	451-GC / 8132014099 Scion-SQ / GQS1203F021 CP900 / 8132024531	The Unique Co.,Ltd.	SV2305/21210	23 May 23	21 May 24	-
2	Atomic Absorption Spectrophotometer (AAS)	Cadmium Lead	Agilent Technologies	System 5164A3A AA200PS / MT3160001	Thailand Institute of Scientific and Technological Research (TISTR)	MTC_AQ_No. 382/66	2 Feb 23	1 Feb 24	-
3	Cold Vapor Atomic Absorption (CVAAS)	Mercury	Milestone	DMA40 / 11059182	Seihopon Associates Co.,Ltd.	Service Protocol Report	18 Nov 22	17 Nov 23	-
4	UV-VIS Spectrophotometer	Chromium hexavalent	Hitchi	U-1900 / 2021-064	DOE Services Co.,Ltd.	SP23-007	6 Jan 23	5 Jan 24	-
Laboratory Instrument for Ambient Quality Analysis									
5	Gas Chromatography - Mass Spectrometer (GC-MS)	Ammonium Nitrate (NO3)	Agilent Technologies	System ID: 620094037 8891635494 / 0119450496 5978 / 1300094037	Agilent Technologies (Thailand) Co.,Ltd.	Preventive Maintenance Checklist	14 Jan 23	12 Jan 24	-

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

เอกสารไม่ควบคุม

บันทึกข้อมูล การปฏิบัติงาน (Operational Qualification Report)
M Green Group Co., Ltd.



บริษัท ไทยยูนิค จำกัด THAI UNIQUE CO., LTD.

80-82 ถนนประชาภิเษม แขวงบางขุนพรหม เขตพระนคร กรุงเทพฯ 10200

80-82 Prachathipat Rd., Bangkokphrom, Pranakorn, Bangkok 10200

Tel. 0-2629-0191-6, 0-2280-1787, Fax. 0-2280-1788, E-mail : thawai@thaiunique.com, Website : www.thaiunique.com

CERTIFICATE OF CALIBRATION

GAS CHROMATOGRAPH MASS SPECTROMETER

Certificate No.: SV2305/21210

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

Address: 3 Soi Udomsuk 41 Sukhumvit Rd. Bangchak
Phrakhanong Bagkok 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

Air Water Check Test

Tune Test EI

Signal to Noise Test (EI) SCAN

Injection EI Area Precision Test

Injection EI RT Precision Test

User Demonstration

☒ PASS

☐ FAIL

☒ PASS

☐ FAIL

☒ PASS

☐ FAIL

☒ PASS

☐ FAIL

☒ PASS

☐ FAIL

☒ PASS

☐ FAIL

☒ PASS

☐ FAIL



Engineer

Somchai Pohtongkam

Date

23 May 2023



Thai Unique Co., Ltd.

Service Division

เอกสารไม่ควบคุม

เอกสารไม่ควบคุม

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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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

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	
Initials	SOMCHAI
Date	23 MAY 23

Name (Print)	
Title	
Signature	
Initials	
Date	

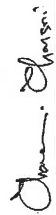
2.2 Reviewer Details

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	23 MAY 2023

Name (Print)	
Title	
Signature	
Initials	
Date	

Print Date: 23 May 2023 12:28:31

Chromatogram Plots

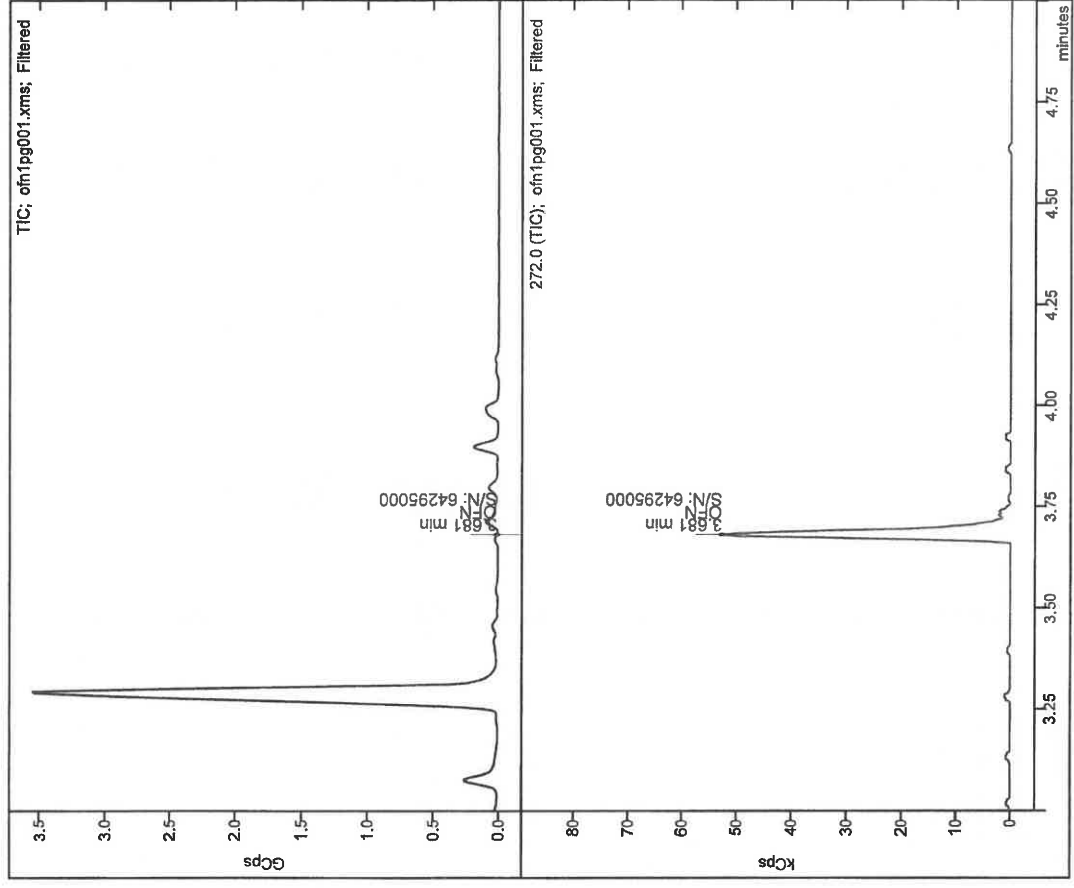
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Date: 23/5/2566 12:06



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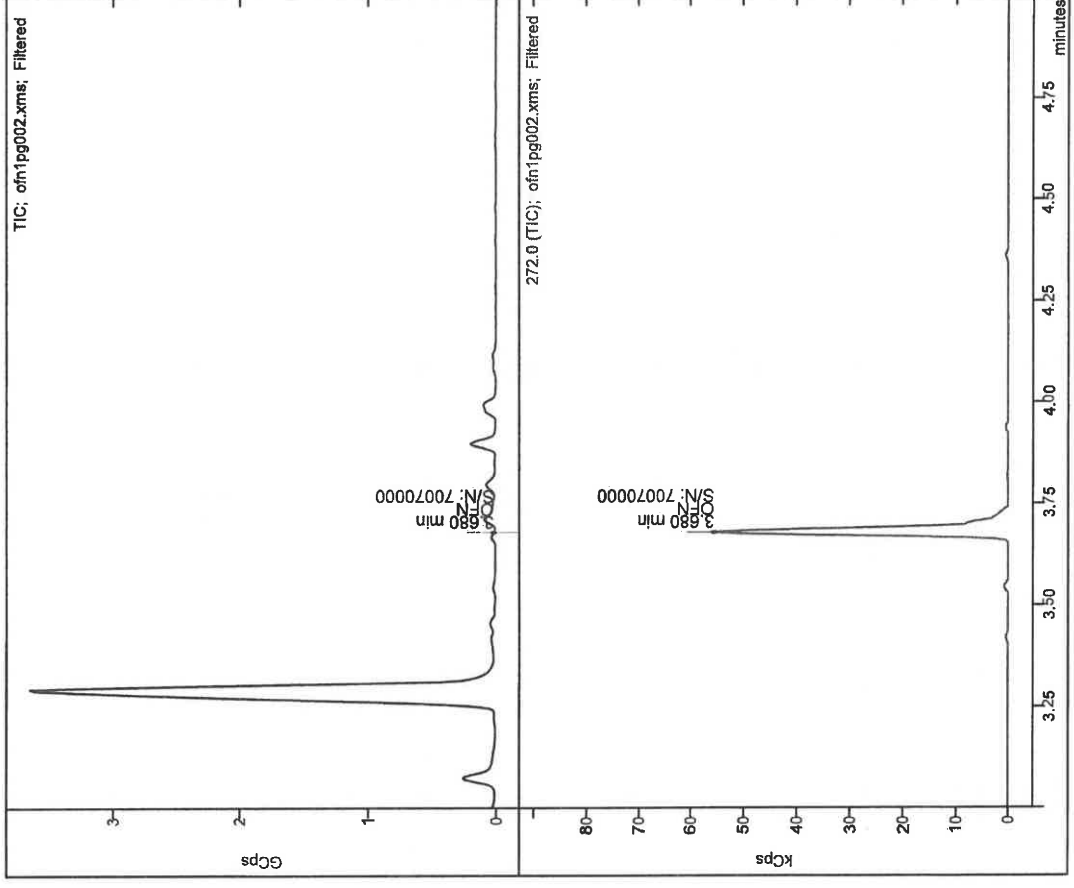
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Operator: TU

Date: 23/5/2566 12:19



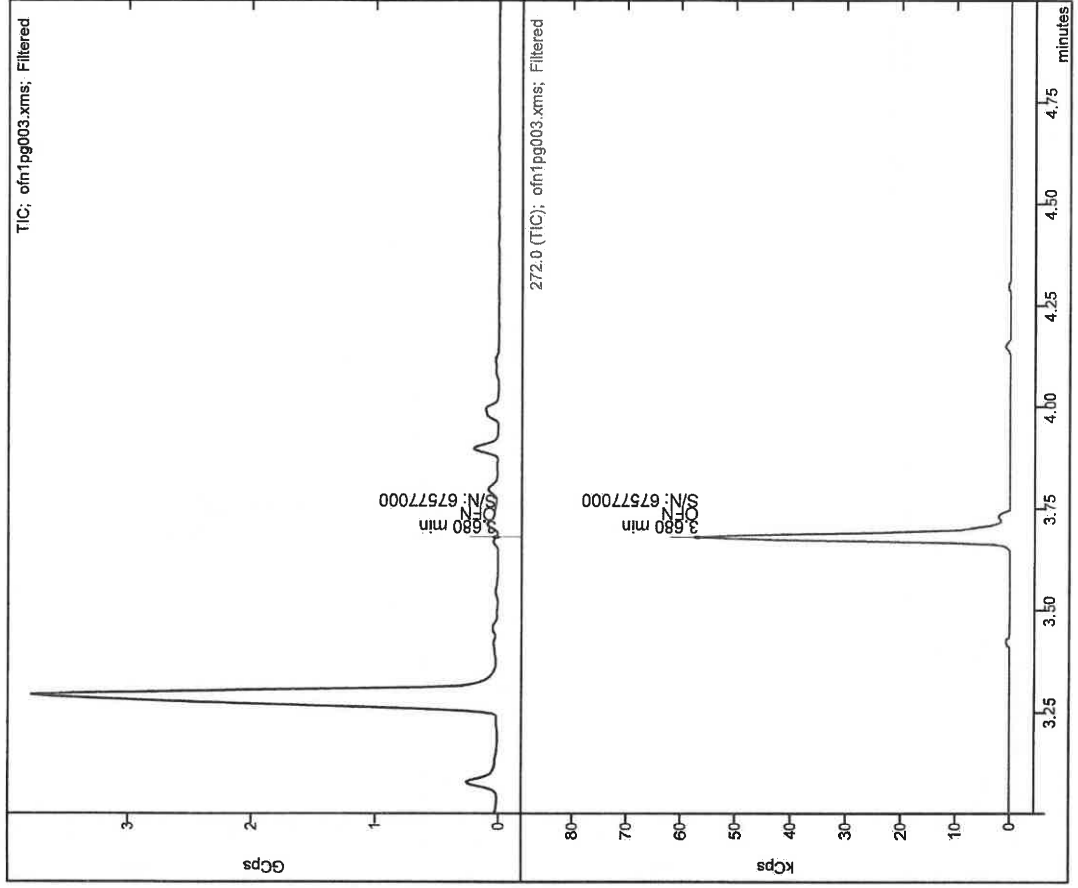
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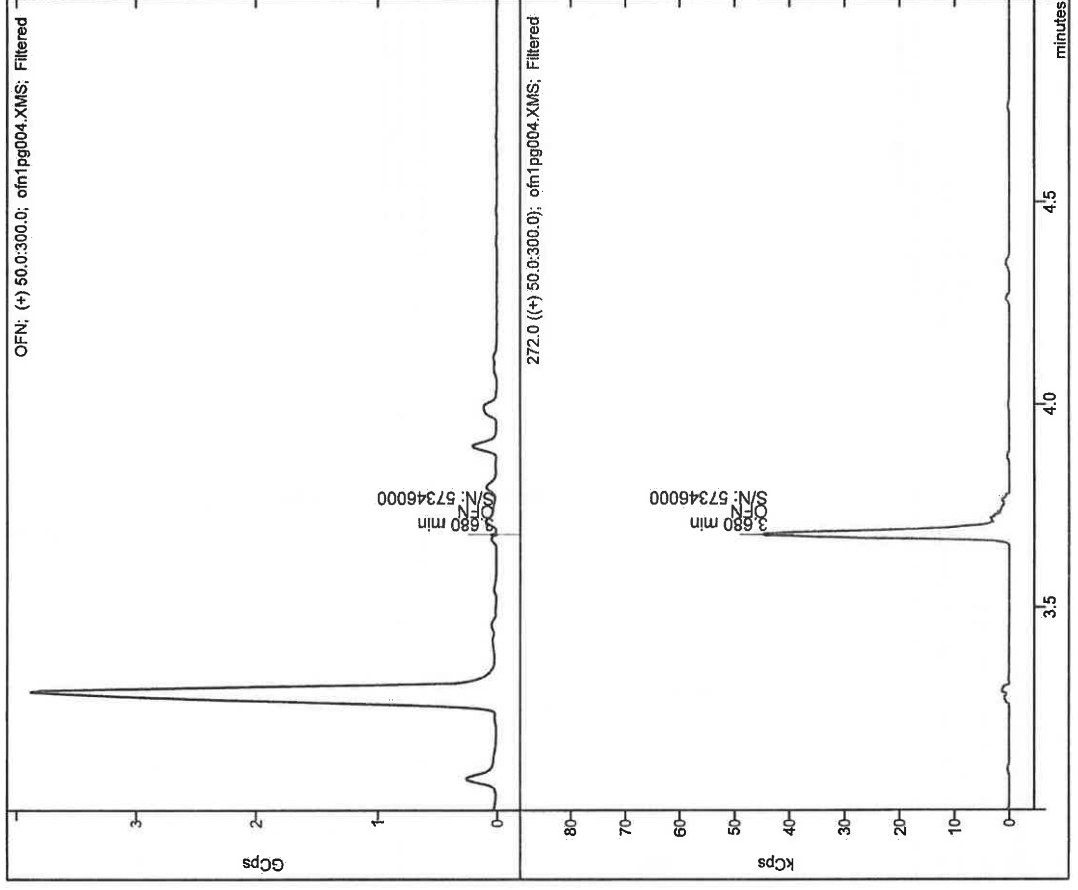
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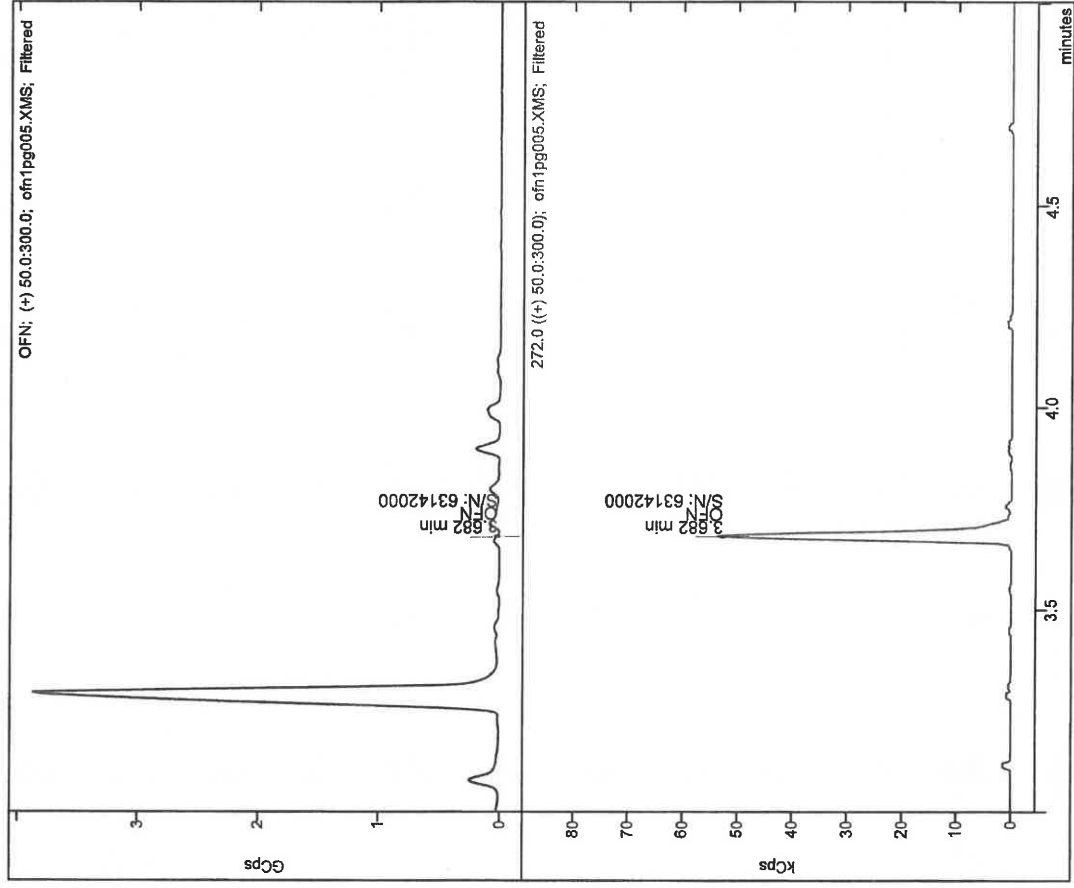
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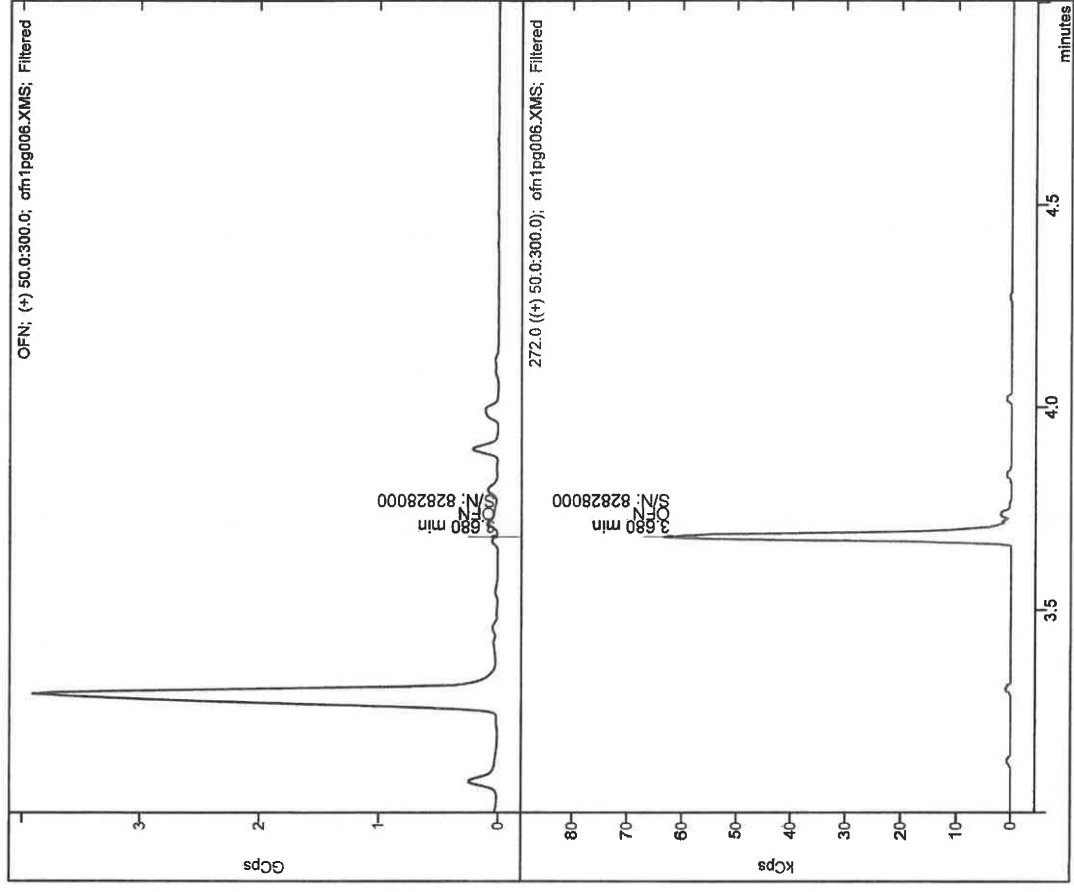
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Date: 23/5/2566 13:12



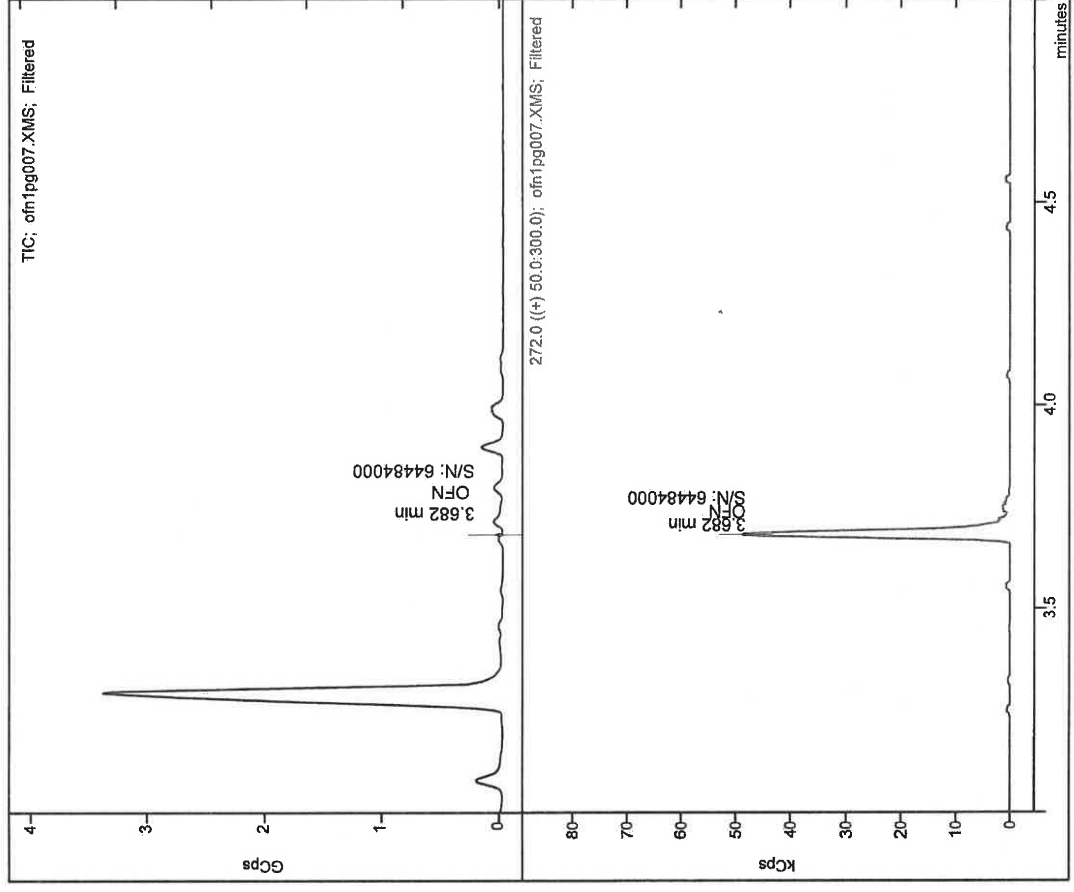
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Operator: TU
Date: 23/5/2566 13:25



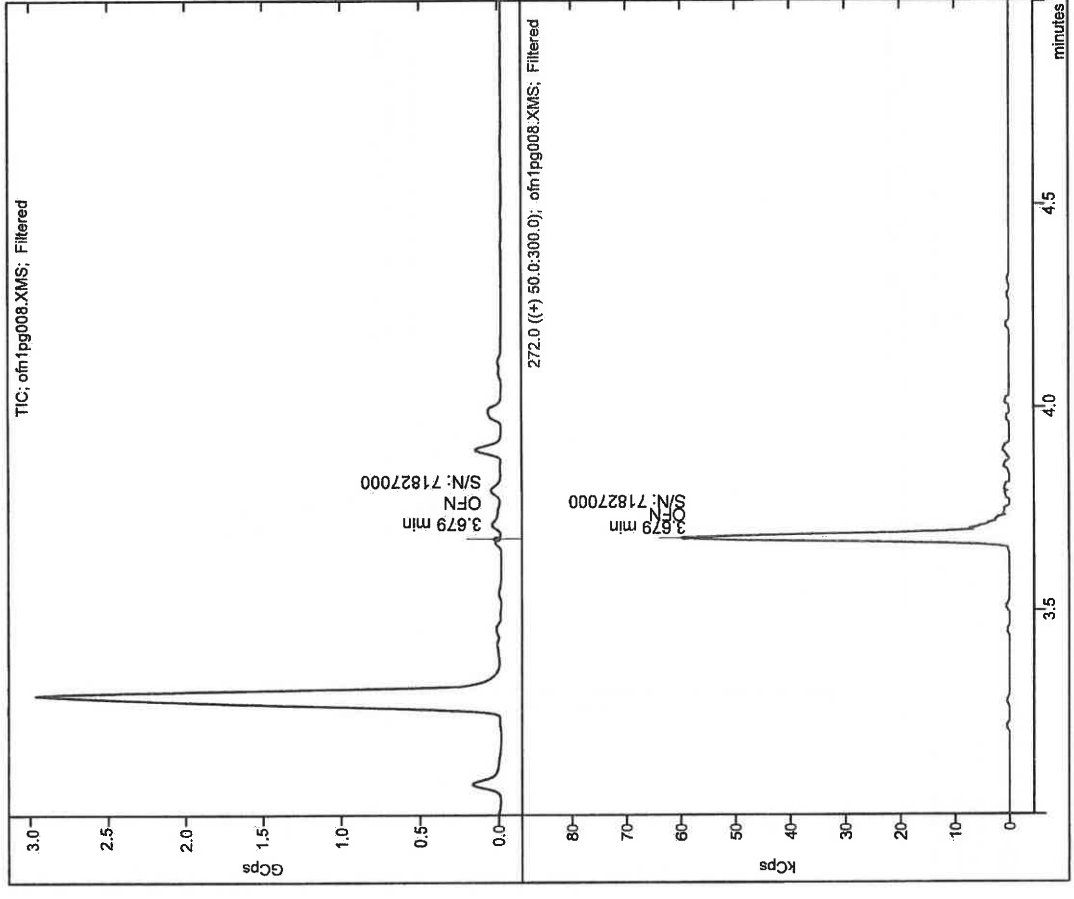
เอกสารไม่ควบคุม

Print Date: 23 May 2023 13:54:59

Chromatogram Plots

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Sample: ofn1pg
Scan Range: 1 - 564 Time Range: 3.00 - 5.00 min.

Operator: TU
Date: 23/5/2566 13:38



เอกสารไม่ควบคุม

Print Date: 23 May 2023 14:03:39

Chromatogram Plots

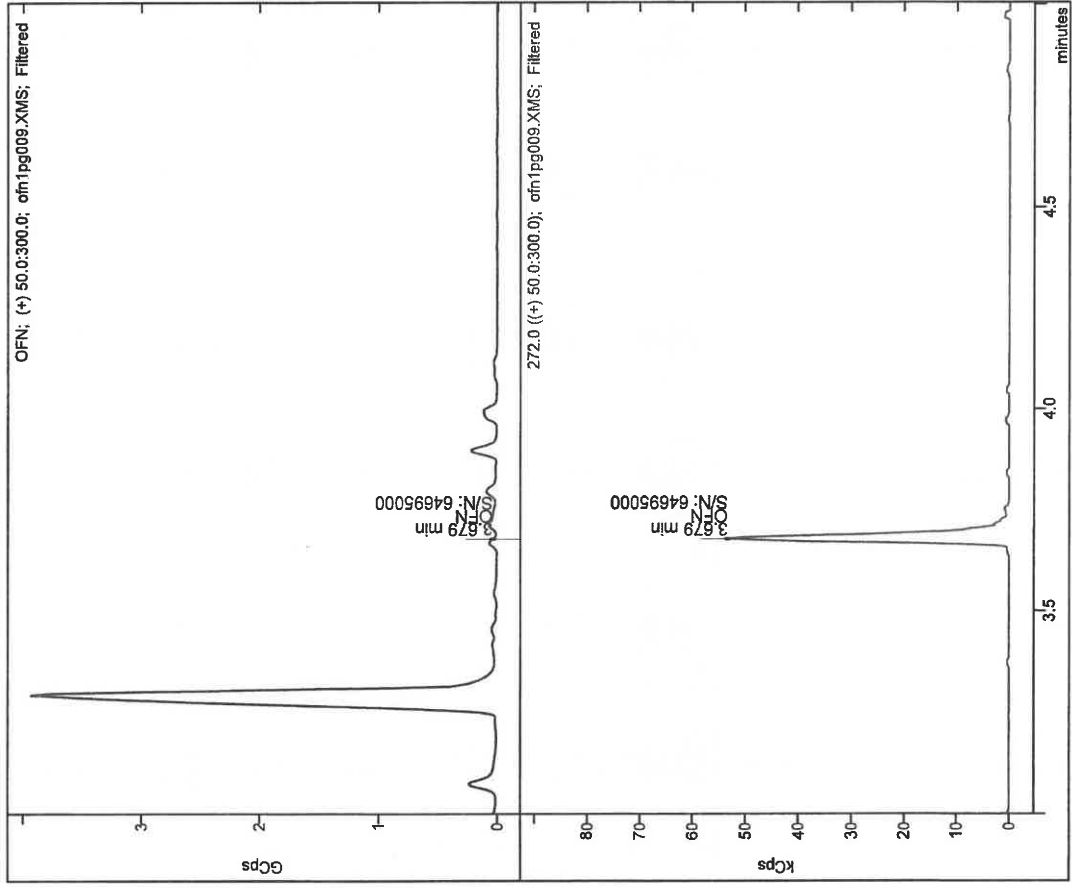
File: e:\tupm2023\p2023\ofn1pg009.xml

Sample: ofn1pg

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

Operator: TU

Date: 23/5/2566 13:51



เอกสารไม่ควบคุม

Date: 23 MAY 23 10:52 AM

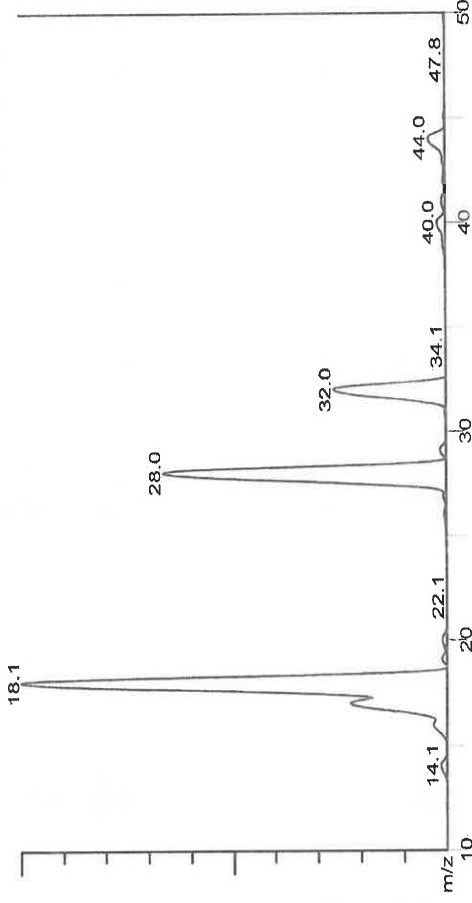
scan 339855 (15 uscans) (3 parateged)

Notes: EI, EDR On (1)

Compounds: OFN

(+)-10-50>

6.18e+006 Cps



28 absolute size (cps)

- Normal < 9.0e7

- Measured 4.05e6

28/32 Ratio

- Normal < 2.8:1 or > 4.2:1

- Measured 2.5:1

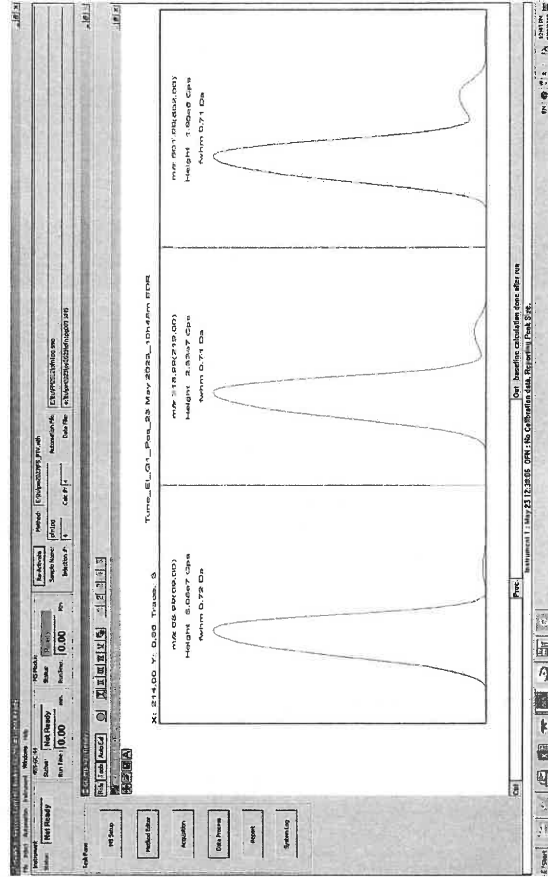
28/18 Ratio

- Normal < 2.0:1

- Measured 0.7:1

เอกสารไม่ควบคุม

Addendum Procedure: Δ. Certificate Page Number: 1



เอกสารแนบ

Qualification Rep. Initials	Reviewer Initials	QA/QC Initials
<i>Sadun P.</i>		
Date	Date	Date
23 MAY 23		



เอกสารแนบ

Operational Qualification Protocol Certification

for

SCION

with the serial number

GOS1203F021

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



Scion Certified Engineer

SOMCHAI POHTONGKAM

Name (please print)

Sachin P.

Signature

23 MAY 23

Date

Authorized Customer Representative

Name / Function (please print)

Signature

Date

Customer Address

United Analyst and Engineering Consultant Co., Ltd.



Request No. 25-66 / 0323

MTC. ACL.No. 387 / 66

CALIBRATION CERTIFICATE

NOMENCLATURE : 1. Atomic Absorption Spectrophotometer "Agilent Technologies"

Model AA240FS, Serial No. MY13160001

2. Working standard solution "Inorganic Ventures"

Multi Analyte Custom Grade Solution, Lot No. S2-MEB708640

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

3 Sol Udomsuk41, Sukhumvit Road, Bangchak, Prakanong, Bangkok 10260

CALIBRATION PROCEDURE : 1. Performance Verification of Atomic Absorption Spectrophotometer
(WI-500-02-30)

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

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

CALIBRATION DATE : 2 February 2023

REFERENCE MATERIAL : Traceable to NIST "Carlo Erba", "PanReac AppliChem"

Cadmium Lot No. 1152457, Chromium Lot No. 1793249, Copper Batch No. T117098A, Iron Batch No. T126087A,

Lead Lot No. 1227873, Manganese Batch No. T109228A, Nickel Batch No. T270178A, Zinc Batch No. T820140A

AMBIENT CONDITIONS : Temperature 22 °C Relative humidity 58 %

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

Calibrated by 1. *Dani Srithongkum*
(Mr. Danal Srithongkum)

Approved by

(Miss Sussada Deavong)

Senior Analyst Officer

2. *Atipat Ratana*

(Mr. Atipat Ratana)

Acting Director of Analytical Chemistry Laboratory

Ref. 2015266012600366001

Issued Date : 15 February 2023

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Request No. 25-66 / 0323

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MTC. ACL. No. 387 / 66

CALIBRATION DATA

1. Noise Level

Element	Cd	Cr	Cu	Fe	Pb	Mn	Ni	Zn
Absorbance	0.0020	0.0000	0.0008	0.0000	-0.0009	0.0021	-0.0016	-0.0022
	0.0015	0.0006	0.0005	-0.0009	-0.0014	0.0018	0.0002	-0.0023
	0.0014	0.0006	0.0010	-0.0009	0.0015	0.0008	-0.0004	-0.0015
	0.0021	-0.0008	0.0013	-0.0010	0.0005	0.0005	-0.0008	-0.0004
	0.0020	-0.0012	0.0004	0.0003	-0.0004	0.0001	-0.0024	-0.001
	0.0021	-0.0011	0.0011	0.0003	0.0006	0.0009	-0.0002	-0.0013
	0.0017	-0.0009	0.0001	-0.0015	0.0010	0.0007	0.0001	-0.0016
	0.0024	-0.0012	0.0004	-0.0002	0.0008	-0.0005	-0.0012	-0.0019
	0.0011	-0.0002	0.0015	-0.0004	0.0004	0.0008	-0.0003	-0.0017
	0.0017	0.0000	0.0009	0.0004	0.0001	0.0015	-0.0009	-0.0024
	0.0019	-0.0004	0.0004	0.0000	0.0006	0.0010	-0.0005	-0.0016
	0.0016	-0.0025	0.0003	0.0005	0.0009	-0.0004	-0.0013	-0.0016
	0.0018	-0.0014	0.001	-0.0009	-0.0006	0.0010	-0.0004	-0.0017
	0.0019	-0.0006	0.0011	-0.0008	0.0011	0.0004	-0.0003	-0.0005
	0.0024	0.0003	0.0005	-0.0012	-0.0002	0.0012	-0.0006	-0.0011
	0.0023	-0.0012	0.0006	-0.0007	0.0002	0.0014	-0.0012	-0.0013
	0.0020	-0.0014	0.0009	-0.0018	0.0003	0.0012	-0.0012	-0.0013
	0.0010	-0.0015	0.0002	0.0004	0.0017	0.0011	-0.0018	-0.0013
	0.0016	-0.0011	0.0013	0.0003	0.0007	0.0026	-0.0006	-0.0006
	0.0001	-0.0007	0.0009	-0.0003	0.0008	0.0008	0.0000	-0.0001
Average Absorbance	0.002	-0.001	0.001	0.000	0.000	0.001	-0.001	-0.001

Continue 2 / 5

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Request No. 25-66 / 0323

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MTC. ACL. No. 387 / 66

2. Precision

Element	Conc. (mg/l)	Absorbance										Ave. Abs.	SD	%RSD
		0.02	0.0085	0.0084	0.0090	0.0089	0.0089	0.0090	0.0086	0.0092	0.0090	0.0089	0.009	0.0003
Cd	0.30	0.0993	0.1001	0.1007	0.1004	0.1004	0.1004	0.0995	0.0997	0.0998	0.0999	0.0996	0.100	0.0005
	0.70	0.2238	0.2229	0.2244	0.2249	0.2243	0.2243	0.2233	0.2235	0.2231	0.2251	0.2240	0.224	0.0007
	0.10	0.0088	0.0087	0.0094	0.0086	0.0086	0.0091	0.0099	0.0099	0.0095	0.0076	0.0085	0.009	0.0006
Cr	0.30	0.0257	0.0265	0.0255	0.0270	0.0266	0.0258	0.0261	0.0261	0.0262	0.0274	0.0262	0.026	0.0006
	0.70	0.0573	0.0590	0.0580	0.0576	0.0578	0.0579	0.0593	0.0593	0.0599	0.0586	0.0594	0.058	0.0009
	0.05	0.0083	0.0084	0.0084	0.0075	0.0086	0.0086	0.0086	0.0081	0.0080	0.0087	0.0092	0.008	0.0005
Cu	0.30	0.0430	0.0444	0.0426	0.0429	0.0435	0.0432	0.0428	0.0441	0.0427	0.0436	0.0436	0.043	0.0006
	0.70	0.0981	0.0992	0.0990	0.0997	0.0977	0.0986	0.0990	0.0982	0.0988	0.0988	0.0980	0.099	0.0006
	0.10	0.0109	0.0104	0.0087	0.0100	0.0087	0.0094	0.0102	0.0092	0.0094	0.0100	0.0100	0.010	0.0007
Fe	0.50	0.0456	0.0442	0.0450	0.0444	0.0450	0.0455	0.0455	0.0441	0.0446	0.0446	0.0444	0.045	0.0006
	1.00	0.0904	0.0901	0.0891	0.0876	0.0873	0.0901	0.0876	0.0886	0.0879	0.0901	0.089	0.090	0.0012
	0.20	0.0093	0.0099	0.0104	0.0102	0.0104	0.0109	0.0102	0.0103	0.0115	0.0117	0.0110	0.010	0.0007
Pb	0.70	0.0344	0.0336	0.0336	0.0328	0.0338	0.0346	0.0336	0.0331	0.0343	0.0343	0.0350	0.034	0.0007
	1.50	0.0709	0.0718	0.0706	0.0713	0.0698	0.0718	0.0712	0.0713	0.0715	0.0719	0.0719	0.071	0.0006
	0.05	0.0115	0.0130	0.0131	0.0127	0.0135	0.0136	0.0124	0.0133	0.0124	0.0130	0.013	0.013	0.0006
Mn	0.30	0.0709	0.0700	0.0714	0.0704	0.0700	0.0705	0.0714	0.0698	0.0694	0.0700	0.0700	0.070	0.0007
	0.70	0.1619	0.1633	0.1646	0.1638	0.1646	0.1614	0.1632	0.1614	0.1632	0.1636	0.1652	0.163	0.0014
	0.10	0.0113	0.0105	0.0113	0.0114	0.0110	0.0113	0.0117	0.0112	0.0107	0.0117	0.0111	0.011	0.0004
Ni	0.50	0.0509	0.0517	0.0508	0.0502	0.0517	0.0516	0.0516	0.0523	0.0518	0.0503	0.051	0.051	0.0007
	1.00	0.0997	0.1006	0.1006	0.1006	0.0996	0.0998	0.1007	0.1000	0.1013	0.0999	0.100	0.099	0.0006
	0.05	0.0315	0.0309	0.0322	0.0304	0.0329	0.0312	0.0313	0.0319	0.0308	0.0311	0.031	0.031	0.0007
Zn	0.30	0.1705	0.1728	0.1688	0.1693	0.1711	0.1704	0.1704	0.1704	0.1707	0.1708	0.1688	0.170	0.0012
	0.70	0.3559	0.3572	0.3548	0.3560	0.3559	0.3559	0.3579	0.3552	0.3574	0.3573	0.356	0.0011	0.001

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Request No. 25-66 / 0323

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MTC. ACL. No. 387 / 66

3. Trueness

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

Element	Standard Value of RM (mg/l)	Reading (mg/l)	Error of Measurement (mg/l)	Error of Measurement (%)	Uncertainty (mg/l)
Cd	0.02002	0.021	0.001	4.90	± 0.005
	0.30030	0.298	-0.002	0.77	± 0.005
	0.70070	0.675	-0.026	3.67	± 0.008

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

Element	Standard Value of RM (mg/l)	Reading (mg/l)	Error of Measurement (mg/l)	Error of Measurement (%)	Uncertainty (mg/l)
Cr	0.1001	0.101	0.001	0.90	± 0.009
	0.3003	0.293	-0.007	2.43	± 0.012
	0.7007	0.648	-0.053	7.52	± 0.023

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

Element	Standard Value of RM (mg/l)	Reading (mg/l)	Error of Measurement (mg/l)	Error of Measurement (%)	Uncertainty (mg/l)
Cu	0.050	0.046	-0.004	8.00	± 0.003
	0.300	0.289	-0.011	3.67	± 0.009
	0.700	0.674	-0.026	3.71	± 0.020

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Request No. 25-66 / 0323

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MTC. ACL. No. 387 / 66

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

Element	Standard Value of RM (mg/l)	Reading (mg/l)	Error of Measurement (mg/l)	Error of Measurement (%)	Uncertainty (mg/l)
Fe	0.100	0.095	-0.005	5.00	± 0.014
	0.500	0.474	-0.026	5.20	± 0.016
	1.000	0.950	-0.050	5.00	± 0.029

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

Element	Standard Value of RM (mg/l)	Reading (mg/l)	Error of Measurement (mg/l)	Error of Measurement (%)	Uncertainty (mg/l)
Pb	0.200	0.207	0.007	3.50	± 0.014
	0.700	0.673	-0.027	3.86	± 0.030
	1.500	1.417	-0.083	5.53	± 0.061

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

Element	Standard Value of RM (mg/l)	Reading (mg/l)	Error of Measurement (mg/l)	Error of Measurement (%)	Uncertainty (mg/l)
Mn	0.04995	0.046	-0.004	7.91	± 0.005
	0.29970	0.294	-0.0057	1.90	± 0.007
	0.69930	0.694	-0.0053	0.76	± 0.014

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Request No. 25-66 / 0323

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MTC. ACL. No. 387 / 66

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

Element	Standard Value of RM (mg/l)	Reading (mg/l)	Error of Measurement (mg/l)	Error of Measurement (%)	Uncertainty (mg/l)
Ni	0.1001	0.103	0.003	2.90	± 0.013
	0.5005	0.501	0.001	0.10	± 0.018
	1.0010	0.987	-0.014	1.40	± 0.032

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

Element	Standard Value of RM (mg/l)	Reading (mg/l)	Error of Measurement (mg/l)	Error of Measurement (%)	Uncertainty (mg/l)
Zn	0.050	0.046	-0.004	8.00	± 0.013
	0.300	0.311	0.011	3.67	± 0.013
	0.700	0.665	-0.035	5.00	± 0.019

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

Calibrated by 1.

(Mr. Danai Sirithongkum)

2.

(Mr. Atipat Ratana)

Approved by,

(Miss Suladda Deavong)

Senior Technical Officer

Acting Director of

Analytical Chemistry Laboratory

Issued Date : 15 February 2023

INDUSTRIAL METROLOGY AND TESTING SERVICE CENTRE

End of Certificate

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E-mail : mtc@tistr.or.th

SPA001-001 Milestone DMA-80 Service Protocol

DMA-80 Direct Mercury Analyzer SERVICE PROTOCOL REPORT

To be filled in before service visit (1st page)

Customer information:

Company:	บริษัท อีโคโนมิค เทคโนโลยี จำกัด
Department:	Lab
Person in charge:	นาย อดิศักดิ์
Address:	3 หมู่ 3 ตำบล...
Tel.:	
E-mail:	

Technical data:

Unit Serial Number:	11030082
Terminal type or USB-640 Gateway:	Terminal 640
Software, type and revision:	Easy control
Air Compressor (if present)	SN 101000001
Gas system pump (if present)	Rev. 02-P
Installation and last maintenance dates:	SN
Maint. on:	SN

NOTE: after achievement of the following protocol a filled and signed copy of this report has to be sent to Milestone srl at service@milestonesrl.com

For the best result of the test below we recommended to use the Milestone DMA-80 Service Kit (PN DMA-SKIT).

1. VISUAL INSPECTION

	Good	Damaged	Corroded/Dirty
External chassis	✓		
Inside	✓		
Electric parts	✓		
Screws	✓		

2. ELECTRICAL SAFETY TEST

Using a suitable testing device check the below reported parameters and take note of the results.

Parameter	Result	OK	Not OK
Insulating resistance: R_{500} 0.5MΩ	Actual value: 0.5 MΩ	✓	
Grounding resistance: R_{500} 100mΩ	Actual value: 0.3 MΩ	✓	

3. PRESSURE CHECK

	Oxygen (purity O ₂ >99.95%)	Milestone air compressor
--	--	--------------------------

Gas carrier

Purity: 99.99%

The pressure at the supply source manometer should be approx. 4.0bar
The flowrate depends by type of cuvette installed on the DMA-80 unit.

	Correct value	Actual value	Correct value	Final value	Actual value	Final value
Inlet pressure	3.1 bar	-	3.1 bar	3.1 bar	3.1 bar	3.1 bar
Flow rate	10-12 l/h	-	8-10 l/h	6.8 l/h	7 l/h	6.8 l/h

Check all possible leakage points and their conditions:

	Good	Damaged	Corroded
Tubing	✓		
Silicon joints	✓		
O-rings	✓		
Cuvette sealing O-rings	✓		
Gas connections	✓		
Valves	✓		
Sample boat carrier	✓		
Catalyst flange	✓		

4. AUTOSAMPLER SYSTEM

	OK	Not OK	Re-Adjusted
Calibration of autosampler motor	✓		
Cylinders alignment	✓		

	Fast	Slow	Normal
Speed of pneumatic cylinders			✓

Using the maintenance grease, periodically lightly lubricate all exposed steel rods of the horizontal and vertical cylinders.

5. COMPONENTS CHECK

Conditions of the different parts used/installed on DMA unit:

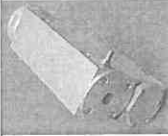
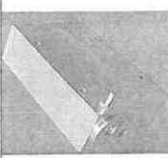

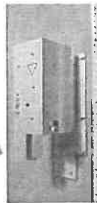
	OK	Not OK	Replaced	Cleaned
Catalyst tube			✓	
Amalgamator			✓	
Quartz boats			✓	
Nickel boats				
Autosampler plate	✓			
Gas kit accessories				

6. TEMPERATURES

	Correct value	Actual value	Final value
Drying/ Decomposition furnace	If controlled by Infrared sensor 850°C ± 10°C	-	-
Catalyst furnace	If controlled by thermocouple 650°C ± 10°C	550	650
Amalgamator stand by temperature	170°C ± 10°C	550	650
Amalgamator heating temperature	850°C ± 10°C	770	650
Cuvette	125°C ± 5°C	850	650

7. SPECTROMETER

The spectrometer can be equipped with a single beam system (ducon lamp) or with a dual beam system (tricon lamp)

Old cuvette type				Actual cuvette type			
							
Gain				Offset			
Correct value	Actual value	Final value	Correct value	Actual value	Final value	Correct value	Actual value
3.6VDC	-	-	0.015VDC	-	-	0.015VDC	-
-	-	-	0.005VDC	-	-	0.005VDC	-
Dualcell system	-	-	-	3.9V	0.015VDC	0.015V	0.015V
Tricell system *	-	-	-	-	-	0.005VDC	-

(*)The recommended Hg lamp operating signal should be around 3.96VDC (for detector 2) and 3.93VDC (for detector 1).

		OK	Not OK
Conditions of the spectrometer system		✓	
Alignment between lamp, cuvette and detector		✓	
Cuvette cleaning (glass windows, sealing O-rings...)		✓	
Lamp intensity		✓	
Operation of the mechanical shutter (if present)		✓	

8. MILESTONE AIR COMPRESSOR

N. A.

Maintenance	OK	Date last service
Drain (compressor)		
Replacing air filters (air filter)		
Check sealing connections		

9. PARTS TO BE REPLACED

PN	DESCRIPTION	Replaced	Not
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4

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5

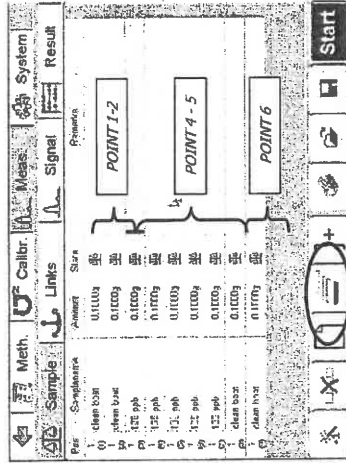
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			Replaced
DMA8133	Catalyst tube: 6 months if the unit runs daily, 1 year if the unit is used rarely. In case of analyse of sample with high organic concentration the lifetime of the catalyst can be less than 6 months.	✓	
DMA8134	Amalgamator: 6 months if the unit runs daily 1 year if the unit is used rarely	✓	
DMA8195A	Hg lamp In-cell (model 2011) (for kit p/n DMA8355): 2 years	-	
DMA8137	Hg lamp dual-cell: 2 years		✓
70200	Hg trap 1 year		✓
DMA8058/B	Amalgamator coil 1 year or as soon as the heating is not more homogeneous		✓
DMA8142	Nickel sample boats (set of 40pcs) 2 years	-	
DMA8347	Quartz sample boats (set of 10pcs) 4 years	✓	
DMA8335	Metal sample boat carrier 2 years		✓
SL0108	PU-tube diam. 6/4 mm for internal Ozair supply 2 years		✓
SO0376D	Heating coil for drying/decomposition 2 years		✓

10. TESTING PROCEDURE

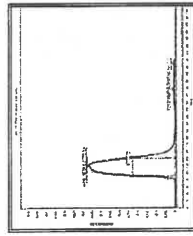
It consists to run some measurements for the evaluation of the analytical performance of the unit, like: absorbance, peaks shape, temperatures, lamp signal and verify the proper working of whole system.

- 1) Run minimum 2 blanks on the same sample boat (quartz if possible) in manner to clean it
- 2) Run blanks until absorbance value (Height) decrease under 0.0020
- 3) Set a fresh and stabilized 100µg/L Hg standard according to the prescriptions reported on the DMA80 User Manual. The quality of the used standard is fundamental for the success of the entire procedure
- 4) Weight approximately 100µg of the fresh 100µg/L – Standard (10ng) and start the analysis as a single measurement mode
- 5) Repeat five times the test
- 6) Run again two blanks measurements



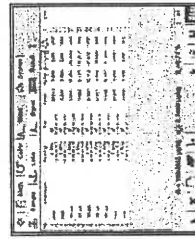
Now, it is possible to evaluate:

- Peaks



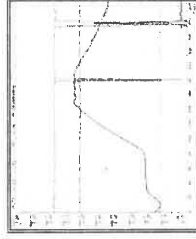
- The shape of the peak must be regular.
- The distance between Peak Cell 1 and Peak Cell 2 must be between 11 to 15 seconds.

- Results



- The obtained absorbance (height) of the Blank must be < 0.0020 .
- The obtained absorbance (height) must be > 0.42 for each 100ppb analysis (0.22 with cuvette installed until December 2005, DMA s/n 05120292.)
- The relative standard deviation (rsd) is $< 1.5\%$.
- After two blanks (after 10mg measurements), the absorbance is < 0.0020 .

-Temperatures & signal profiles



- The Hg lamp signal must be between 3.8 and 4.5V and stable. A few minutes after the start of the analysis the lamp does switch off because of the zero detection but then it instantly returns to the original condition. In case of Tricell configuration two green colour graphics are reported. After the zero shuttering the time necessary to return to full signal is longer on Tricell compare to Ducon lamp.
- During the run the catalyst oven temperature must be stable around to 615°C.
- The drying and ashing furnace must follow the set temperature method.
- During the run the Amalgamator furnace temperature must be stable at the stand by temperature (170°C). Then at the release step it must raise up to 850/900°C.
- The Cuvette temperature must be stable at approximately 125°C.
- The Hg absorbance peaks must be correctly detected and reported.

11. FINAL REPORT

All screws inserted and tightened	Pass
All tubing sealing connections checked, cleaned or replaced and tightened	Pass
All heating elements are working	Pass
Sensors installed, checked and tightened	Pass
Safety devices (thermo switch) fully checked	Pass
All exhaust and cooling fans are functioning	Pass
Testing procedure successfully passed	Pass
Necessary tools available at customer's site	Pass
Last revision of User Manual available at customer's site	Pass
Advised customer about care and maintenance instructions	Pass

Remarks:

Date	Service Engineer Name	Signature
18/11/16	dominik	dominik

Laboratory Manager / Operator
acceptance signature:

Calibrated by : _____
Approved by : _____

(Mr.Tanavur Ritridach)

Technical Manager

(Ms.Chonticha Saunggem)

Quality Manager

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

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



REPORT OF CALIBRATION

Certificate No. : SP23-007

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Environment Condition : Ambient Temperature $25 \pm 5^{\circ}\text{C}$ Relative humidity $55 \pm 20\% \text{RH}$

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

Certified Reference Materials :

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

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

Institute of Standards and Technology (NIST) through Starna Scientific Limited

Spectral Band Width of UUC : 4.0 nm.

Scan Speed of UUC : 200 nm/min

Scan Interval of UUC : 0.1 nm.

Resolution of UUC : Photometric 0.001 Abs.

Wavelength 0.1 nm.

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REPORT OF CALIBRATION

Certificate No. : SP23-007

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Calibration Results : Without adjustment

Photometric Accuracy :

Wavelength (nm.)	CRMs Values (Abs)	UUC Reading (Abs)	Correction (Abs)	Uncertainty (Abs)	Coverage factor k
420	0.0000	0.000	0.0000	0.0028	2.00
	0.5787	0.575	0.0037	0.0031	2.00
	1.0490	1.044	0.0050	0.0029	2.00
440	2.1900	2.181	0.0090	0.0080	2.00
	0.0000	0.000	0.0000	0.0028	2.00
	0.5607	0.558	0.0027	0.0034	2.00
465	1.0247	1.021	0.0037	0.0035	2.00
	2.1229	2.115	0.0079	0.0081	2.00
	0.0000	0.000	0.0000	0.0028	2.00
546.1	0.5236	0.520	0.0036	0.0030	2.00
	0.9634	0.961	0.0024	0.0029	2.00
	1.9763	1.968	0.0083	0.0070	2.00
590	0.0000	0.000	0.0000	0.0028	2.00
	0.5191	0.518	0.0011	0.0031	2.00
	1.0003	1.000	0.0003	0.0033	2.00
635	1.9987	1.993	0.0057	0.0084	2.00
	0.0000	0.000	0.0000	0.0028	2.00
	0.5523	0.552	0.0003	0.0030	2.00
635	1.0809	1.082	-0.0011	0.0030	2.00
	2.0391	2.031	0.0081	0.0080	2.00
	0.0000	0.000	0.0000	0.0028	2.00
635	0.5601	0.562	-0.0019	0.0032	2.00
	1.0512	1.052	-0.0008	0.0030	2.00
	1.9294	1.923	0.0064	0.0079	2.00

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REPORT OF CALIBRATION

Certificate No.: SP23-007

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Photometric Accuracy :

Wavelength (nm.)	CRMs Values (Abs)	UUC Reading (Abs)	Correction (Abs)	Uncertainty (Abs)	Coverage factor <i>k</i>
235	0.0000 0.7478	0.000 0.743	0.0000 0.0048	0.0050 0.0057	2.00 2.00
257	0.0000 0.8686	0.000 0.861	0.0000 0.0076	0.0050 0.0059	2.00 2.00
313	0.0000 0.2912	0.000 0.291	0.0000 0.0002	0.0050 0.0051	2.00 2.00
350	0.0000 0.6448	0.000 0.639	0.0000 0.0058	0.0050 0.0055	2.00 2.00

Remark: - UUC = Unit Under Calibration

- N/A = Not Available

- The result expanded uncertainty of measurement U is stated as the standard uncertainty multiplied by the coverage factor k .

which for a normal distribution corresponds to a coverage probability of approximately 95%

- * Indicates non TISI accredited

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FM-708-02 R01 1/11/2021

REPORT OF CALIBRATION

Certificate No.: SP23-007

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Wavelength Accuracy :

CRMs Values	UUC Reading	Correction	Uncertainty	Coverage factor
(mm.)	(mm.)	(mm.)	(mm.)	k
241.54	240.8	0.74	0.18	2.00
279.40	278.5	0.90	0.18	2.00
288.70	288.0	0.70	0.18	2.00
334.22	333.5	0.72	0.18	2.00
361.26	360.5	0.76	0.18	2.00
418.48	417.8	0.68	0.21	2.00
446.70	445.9	0.80	0.18	2.00
453.20	452.5	0.70	0.18	2.00
460.06	459.5	0.56	0.18	2.00
536.90	536.0	0.90	0.18	2.00
637.94	637.1	0.84	0.18	2.00
440.74	440.0	0.74	0.18	2.00
472.22	471.5	0.72	0.18	2.00
513.70	513.0	0.70	0.18	2.00
528.72	528.0	0.72	0.18	2.00
574.60	574.0	0.60	0.18	2.00
585.48	584.6	0.88	0.20	2.00
684.63	684.0	0.63	0.18	2.00
740.27	740.0	0.27	0.20	2.00
748.28	747.5	0.78	0.18	2.00
807.16	806.5	0.66	0.18	2.00
879.70	879.0	0.70	0.18	2.00

Remark: - UUC = Unit Under Calibration

- N/A = Not Available

- The result expanded uncertainty of measurement U is stated as the standard uncertainty multiplied by the coverage factor k .

which for a normal distribution corresponds to a coverage probability of approximately 95%

- * Indicates non TISI accredited

- End of Certificate -

FM-708-02 R01 1/11/2021

Introduction

Agilent CrossLab Start Up Services

Agilent GCMS Preventive Maintenance Checklist

Select the appropriate PM to be done and then perform the checklist under that section

- ☐ Interim Preventive Maintenance
☒ Major Preventive Maintenance

6 months

Yearly

This checklist covers the following model(s):

Type	Model
SQ	5973 Series MSD
SQ	5975 Series MSD
SQ	5977 Series MSD
TQ	7000 Series MS/MS
TQ	7010 Series MS/MS
QTOF	7200 Series QTOF
QTOF	7250 Series QTOF

Agilent Preventive Maintenance provides factory recommended service for your analytical instruments 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 preventive maintenance activities.

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. Customers are responsible for regular maintenance and are encouraged to observe the service representative.
- 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.

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/agilentresourcecenter>.
- 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.
- 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 services in the most logical order relevant to the individual system service in the order of the tasks listed.
- Complete the Service Review section together with the customer.
- Ask the customer to sign the Service Completion section including the customer's and your signature.

Additional Instruction Notes

- Preventive maintenance is a factory recommended procedure designed to reduce the likelihood of electromechanical failures. Failure to perform preventive maintenance may reduce the long-term reliability of certain instruments and systems. **Two preventative maintenances (PMs) per year are recommended, the Major PM Service will be performed annually with an Interim PM performed 6 months after the Major PM.**

System Checks	
Yes/No	Description
<input checked="" type="checkbox"/>	Verify that calibration peaks were seen prior to starting the PM
<input checked="" type="checkbox"/>	Vent the instrument
<input checked="" type="checkbox"/>	Inspect vacuum/adapters, pump, exhaust tubing, and power cords for excessive wear
<input checked="" type="checkbox"/>	Visually inspect calibrant levels – PFI/BA (PFTD) (if appl.), IRM (if appl.). Refill if available.
<input checked="" type="checkbox"/>	Look for any obvious external damage or problems.
<input checked="" type="checkbox"/>	Clean air intake(s). Cosmetics/cover(s) may need to be removed.
<input checked="" type="checkbox"/>	Verify system line voltage meets instrument specifications: Yes <input checked="" type="checkbox"/> No <input type="checkbox"/>

Wet Mechanical vacuum pumps	
Yes/No	Description
<input checked="" type="checkbox"/>	Check for evidence of oil leakage. Check pump gasket for leakage.
<input checked="" type="checkbox"/>	Drain and replace mechanical pump oil.
<input checked="" type="checkbox"/>	Replace Oil Mist Filter if applicable.
<input checked="" type="checkbox"/>	Discuss with customer the need for more frequent oil changes if the oil is dirty
<input checked="" type="checkbox"/>	Don't use mist filters with Chemical Ionization
<input checked="" type="checkbox"/>	Perform anti-suckback valve test. Power on until side plate is held closed, power off and check that side plate holds closed. Visually confirm that no oil returns up vacuum hose.
<input checked="" type="checkbox"/>	Dry Mechanical vacuum pumps – Diaphragm
<input checked="" type="checkbox"/>	Check for evidence of poor vacuum – Turbo power demand, poor manifold vacuum, etc.
<input checked="" type="checkbox"/>	Clear air flow paths of dust.
<input checked="" type="checkbox"/>	If vacuum is poor, then replace the diaphragm pump.
<input checked="" type="checkbox"/>	Perform anti-suckback valve test. Power on until side plate is held closed, power off and check that side plate holds closed.

Dry Mechanical vacuum pumps - Scroll	
Yes/No	Description
<input checked="" type="checkbox"/>	Replace the lips seal on the IDP pump.
<input checked="" type="checkbox"/>	Check for evidence of poor vacuum – Turbo power demand, poor manifold vacuum, etc.
<input checked="" type="checkbox"/>	Replace the Exhaust Filter if required.
<input checked="" type="checkbox"/>	Discuss with customer the need for more frequent changes, if needed.
<input checked="" type="checkbox"/>	Inform customer that pump gas ballast should be installed all the time.
<input checked="" type="checkbox"/>	Perform anti-suckback valve test. Power on until side plate is held closed, power off and check that side plate holds closed.

Cleaning System and Filters	
Yes/No	Description
<input checked="" type="checkbox"/>	Fans
<input checked="" type="checkbox"/>	Remove dust from fans and vent covers.
<input checked="" type="checkbox"/>	Verify fans are functional and that there is enough space around the instrument for proper cooling.
<input checked="" type="checkbox"/>	Source cleaning
<input checked="" type="checkbox"/>	Open analyzer and remove the source.
<input checked="" type="checkbox"/>	Disassemble, Clean, Re-assemble source.
<input checked="" type="checkbox"/>	Re-install source and close analyzer.
<input checked="" type="checkbox"/>	Filters
<input checked="" type="checkbox"/>	Replace RMSSH-2 Helium gas filter – if applicable.
<input checked="" type="checkbox"/>	Replace RMSN-2 Nitrogen gas filter – if applicable.
<input checked="" type="checkbox"/>	Replace RMSSH-2 Hydrogen gas filter – if applicable.
<input checked="" type="checkbox"/>	CP17988 – Gas Clean Carrier Gas Kit for 7690 for Nitrogen or Helium; Bracket, Mount, and Filter – if applicable.
<input checked="" type="checkbox"/>	CP17974 – Gas Clean Filter Kit GC/MS 1/8" Mount and Filter – if applicable.
<input checked="" type="checkbox"/>	CP17973 – Gas Clean Filter, Replacement Filter – if applicable.
<input checked="" type="checkbox"/>	S190-9071 – Methane Gas Filter – if applicable

Guidance: If gas filter is replaced, write the change date on the filter using a permanent marker.

Agilent GC/MS Preventive Maintenance Checklist

System post-check	
Yes/No	Description
<input checked="" type="checkbox"/>	Pump system back down. Wait until system stability has been achieved.
<input checked="" type="checkbox"/>	Verify system vacuum reading(s) via the gauge controller.
<input checked="" type="checkbox"/>	Leak Check
<input checked="" type="checkbox"/>	Verify system in manual tune
<input checked="" type="checkbox"/>	Compare against previous tune file report(s)
<input checked="" type="checkbox"/>	Change to Tune and verify that all temperatures, pressures, and gas flows reach method set points
<input checked="" type="checkbox"/>	Check manually that you have calibration peaks.
<input checked="" type="checkbox"/>	EI Autotune Performed

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

Service Review

- ☒ Attach available reports/printouts of all tests to this documentation.
- ☒ Record the Preventive Maintenance service activity in the customer's records/logbook. Record the PM event in the Smart Alerts logbook, if applicable.
- ☒ 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 Comment box. Systems in a compliant environment may need additional documentation.

Agilent Test Results Table

Test Description	Expected Test Result	Actual Test Result
Auto tune	pass	pass
Evaluate tune	pass	pass

Agilent GC/MS Preventive Maintenance Checklist

Agilent Consumed Parts List Table

Section not applicable

Part Description	Part Number	Product or Model# where used	Quantity consumed

Signature Page

Service Engineer Comments (optional)

If there are any specific points you wish to note as part of performing the installation or other at this point for the customer, please write it here.

Service Completion

Service request number 600495594 Date service completed 14 June 2023

Agilent signature [Signature] Customer signature ดร. พงษ์อภินันท์

Total number of pages in this document 9 pages

Agilent CrossLab Start Up Services
Agilent 8890 Gas Chromatograph
Preventive Maintenance Checklist



Agilent Preventive Maintenance provides factory recommended service for your analytical instruments 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 preventive maintenance activities.

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 procedure.
- 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.

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>
- The **Agilent Community** is an excellent place to get answers, collaborate with others about applications and Agilent products, and find in-depth documents and videos relevant to Agilent technologies. Visit <https://community.agilent.com/welcome>.
- 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** <http://www.agilent.com/search/support>.
- Videos about specific preparation requirements for your instrument can be found by searching the **Agilent YouTube channel** at <https://www.youtube.com/user/agilent>.

Service Engineer's Responsibilities

- Contact the customer and ensure that all necessary supplies are available before the preventive maintenance visit.
- 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 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**.

Additional Instruction Notes

- Check for any active service notes for this unit. If there are any applicable "Safety" or "Modification Recommended" Service notes, plan to implement the changes on this unit before doing any modification service.
- Do not implement firmware updates, unless you get approval from the customer and are sure that they are compatible with the instrument control software.

System Information

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

Instrument System Name and ID	CN1945A066
Instrument System Site and Location	UAE GCMS (405)

List System Component Product Numbers	List the Serial Numbers of each Component
1. 67424A	CN1945A066
2.	
3.	
4.	
5.	
6.	
7.	
8.	
9.	
10.	

Preparation

- ☒ Discuss any specific issues with the customer before starting.
- ☒ 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.
- ☒ Before starting the following procedures, record the Detector Signal Output(s) in the results table. If the GC is turned OFF or in a service mode, comparing the detector outputs before and after the service is not possible.

Preventive Maintenance Procedure

Clean and inspect GC

- ☒ Unplug power cord from the power source.
- ☒ Open GC covers and vacuum/remove any dust/debris. Pay particular attention to cooling fans.
- ☒ Inspect internal connectors for proper contact and placement.
- ☒ Reconnect Power to the GC. Power the GC on and verify the power on self-test passed.
- ☒ Verify oven motor spins freely and turns on with the oven door closed; off when the door is opened.
- ☒ Verify operation of all other fans - the inlet and EPC cooling fans.
- ☒ Verify oven intake/outlet flap assembly is operating smoothly while heating and cooling the oven

Inlet and detector consumable replacement

- ☒ Replace the split vent trap cartridge filter using the Maintenance procedure from either the Browser User Interfaces on units with these Inlets: Split/Splitless Capillary (SSL), Multi-Mode Inlet (MMI), Programmed Temperature Vaporizer (PTV), Volatiles Interface (VI).
- ☒ If the inlet system is used in Split Mode with viscous samples, inspect and clean the split vent tube on the inlet and flush or replace the tubing between the inlet and the split vent trap.
- ☒ For the inlets installed, perform inlet maintenance using the Maintenance procedure from the Browser User Interfaces. Record the results. (Leak and Restriction Test)
- ☐ If the GC includes a Flame Ionization Detector (FID), replace the jet. If the ignitor shows any buildup of sample or corrosion, replace the ignitor. Examine the FID collector and castile assemblies for contamination - clean as necessary.

Zero Sensors and Leak test

- ☒ Zero all pressure sensors using the Browser interface.
- ☒ Perform inlet pressure decay test(s) from the diagnostics screen on the Browser User interface. Record if test passed or failed in the results table.

Note: If the PM is done in preparation for an Operational Qualification, then the pressure decay test defined within that protocol can be used for the PM.

Agilent 8890 GC Preventive Maintenance Checklist

ALS Maintenance

- ☒ **Section NOT applicable**
- ☐ Check all cabling and configuration settings between GC, tray, and injectors.
- ☐ Vacuum or remove any dust, especially around fans.
- ☐ Check operation of all fans.
- ☐ Check syringe for smooth plunger operation.
- ☐ Check for smooth operation of the needle support – clean if necessary

Restore Instrument

- ☒ Restore the normal operating conditions or customer method using the Browser interface or Data System.
- ☒ Purge the system with carrier flow for 15 minutes
- ☒ Bake out the system, then restore the normal operating conditions
- ☒ After equilibration, check and record the post PM detector signal output values. Results should be similar or lower than the detector outputs recorded prior to PM.
- ☐ Perform a chemical checkout. If this is a routine PM, inject the customer's sample using the ALS if applicable. This will act as a final checkout of both the ALS and the GC.

Note: 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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Agilent 8890 GC Preventive Maintenance Checklist

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 with the customer this service, parts replaced, and test results obtained.
- ☐ 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.
- ☐ Supply the customer with a copy of the Smart Alerts flyer.
- ☐ Describe Smart Alerts to the customer.
- ☐ Install Smart Alerts if requested.

PM Test Results Table

Test description	Before PM Service	After PM Service
Front detector output	N/A	N/A
Back detector output	N/A	N/A
AUX 1 detector output	N/A	N/A
AUX 2 detector output	N/A	N/A
Test description	Expected test result	Actual test result
Leak and Restriction Test after front inlet maintenance	Pass	Pass
Leak and Restriction Test after back inlet maintenance	N/A	N/A
Leak and Restriction Test after front inlet Split Vent	Pass	Pass
Trap replacement	Pass	N/A
Leak and Restriction Test after back inlet Split Vent	Pass	Pass
Trap replacement	Pass	N/A
Front inlet pressure decay test	Pass	N/A
Back inlet pressure decay test	Pass	N/A

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PM Parts List Table

Note: The following kits are recommended for capillary and purged packed inlets. If this is a general PM and the customer has a preferred set of consumables, you may use the customer's consumables.

Part description	Part number	Product or model# where used	Quantity consumed
GC Capillary Inlet PM kit, Split	5100-6497	8890 GC	1
SSL Capillary Inlet PM kit, Split	5188-6496	8890 GC	1
SSL Capillary Ultra Inert Inlet Gold Seal with Washer	5190-6144	8890 GC	N/A
SSL Capillary Ultra Inert Inlet Splitless Liner - Single taper with Glass Wool	5190-6092	8890 GC	N/A
SSL Capillary Ultra Inert Inlet Low Pressure Drop Split Liner - with Glass Wool	5190-2295	8890 GC	N/A
PP Inlet PM kit	5188-6498	8890 GC	N/A
Capillary Inlet PM kit, splitless configuration (for MMI, PTV & VI)	5188-6495	8890 GC	N/A
MMI Cleaning Kit	G3510-60820	8890 GC	N/A
PTV Septumless Head Rebuild Kit	5182-9747	8890 GC	N/A
PTV septumless head inlet guide Ignitor (glow plug) assembly with O-ring	3162-9140	8890 GC	N/A
	19231-60680	8890 GC	N/A
FID Collector Rebuild/Cleaning Kit	G1531-67000	8890 GC	N/A
FID Collimator Replenishment Kit	G1531-67001	8890 GC	N/A
Standard .011-inch FID Jet	5200-0176	8890 GC	N/A
Universal .018-inch FID Jet	5200-0177	8890 GC	N/A

Service Engineer Comments

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

Service Completion

Service request number 600 59135-99 Date service completed 14 June 2023
Agilent signature [Signature] Customer signature _____
Total number of pages in this document 9 pages

Introduction

Agilent CrossLab Start Up Services

Agilent GCMS Preventive Maintenance Checklist

Select the appropriate PM to be done and then perform the checklist under that section

- ☐ Interim Preventive Maintenance
☒ Major Preventive Maintenance

6 months

Yearly

This checklist covers the following model(s):

Type	Model
SQ	5973 Series MSD
SQ	5975 Series MSD
SQ	5977 Series MSD
TQ	7000 Series MS/MS
TQ	7010 Series MS/MS
QTOF	7200 Series QTOF
QTOF	7250 Series QTOF

Agilent Preventive Maintenance provides factory recommended service for your analytical instruments 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 preventive maintenance activities.

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. Customers are responsible for regular maintenance and are encouraged to observe the service representative.
- 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.

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-center>
- 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.
- 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 services in the most logical order relevant to the individual system service in the order of the tasks listed.
- Complete the Service Review section together with the customer.
- Ask the customer to sign the Service Completion section including the customer's and your signature.

Additional Instruction Notes

- Preventive maintenance is a factory recommended procedure designed to reduce the likelihood of electromechanical failures. Failure to perform preventive maintenance may reduce the long-term reliability of certain instruments and systems. **Two preventative maintenances (PMs) per year are recommended, the Major PM Service will be performed annually with an Interim PM performed 6 months after the Major PM.**

System Information

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

Instrument System Name and ID	VS2009 M037
Instrument System Site and Location	United Analyst And Engineering Lab

List System Component Product Numbers	List the Serial Numbers of each Component
1. 67077B	VS2009M037
2.	
3.	
4.	
5.	
6.	
7.	
8.	

Preparation

- Discuss any specific issues with the customer before starting.
- 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 and settings as defined by current Service Notes
- Check for firmware updates and verify with customers if they would like them installed. Firmware update(s) are strongly recommended.

Customer Responsibilities

Customers should ensure that all necessary operating supplies, consumables, and usage-dependent items such as gases, vials, syringes, calibrant solution and solvents required for successful preventive maintenance are available. A customer representative should be available while the preventive maintenance is being performed.

Agilent GCMS Preventive Maintenance Checklist

Important notice for customers

The customer should complete the following before the Support Provider arrives on site:

- ☒ Perform an autotune and retain the printed tune report just prior to the start of the PM to verify performance of the equipment.

Note: it is recommended to have the customer run the autotune and tune evaluation prior to the PM and then start the tune cycle so that the instrument will be ready for the service representative.

Definition of the Task/Recommended items within the document

Task	Recommended
Yes	No Interim / Major / As needed
<input checked="" type="checkbox"/>	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>
<input type="checkbox"/>	<input checked="" type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/> <input checked="" type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/> <input type="checkbox"/> <input checked="" type="checkbox"/> <input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input checked="" type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input checked="" type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input checked="" type="checkbox"/>

Preventive Maintenance Procedures

Yes/No	Interim/Major	Description
<input checked="" type="checkbox"/>	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	Perform general inspection of system for cleanliness
<input checked="" type="checkbox"/>	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	Discuss any problems the customer is having with the instrument
<input checked="" type="checkbox"/>	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	Review customer maintenance records and exclude maintenance on recently serviced items
<input checked="" type="checkbox"/>	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	Review the most recent autotune report. This will give a starting point for evaluating spectral peaks, baseline noise, peak shape, mass assignments and resolution.
GCMS		
<input checked="" type="checkbox"/>	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	Record instrument model no.
<input checked="" type="checkbox"/>	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	Record instrument serial no.
<input checked="" type="checkbox"/>	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	Record Rough Vacuum
<input checked="" type="checkbox"/>	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	Record Manifold Vacuum
<input checked="" type="checkbox"/>	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	Type of Column installed

Agilent GCMS Preventive Maintenance Checklist

Yes/No	Interim/Major	Description
<input checked="" type="checkbox"/>	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	Verify that calibration peaks were seen prior to starting the PM
<input checked="" type="checkbox"/>	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	Vent the instrument
<input checked="" type="checkbox"/>	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	Inspect vacuum hoses, pump, exhaust tubing, and power cords for excessive wear
<input checked="" type="checkbox"/>	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	Visually inspect calibrant levels – PFTBA PBD10 (if appl.), IRM (if appl.). Refill if available.
<input checked="" type="checkbox"/>	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	Look for any obvious external damage or problems.
<input checked="" type="checkbox"/>	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	Clean air intake(s). Cosmetic cover(s) may need to be removed.
<input checked="" type="checkbox"/>	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	Verify system line voltage meets instrument specifications: Yes <input checked="" type="checkbox"/> No <input type="checkbox"/>
Wet Mechanical vacuum pumps		
<input checked="" type="checkbox"/>	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	Check for evidence of oil leakage. Check pump gasket for leakage.
<input checked="" type="checkbox"/>	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	Drain and replace mechanical pump oil.
<input checked="" type="checkbox"/>	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	Replace Oil Mist Filter if applicable.
<input checked="" type="checkbox"/>	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	Discuss with customer the need for more frequent oil changes if the oil is dirty
<input checked="" type="checkbox"/>	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	Don't use mist filters with Chemical Ionization.
<input checked="" type="checkbox"/>	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	Perform anti-suckback valve test. Power on until side plate is held closed, power off and check that side plate holds closed. Visually confirm that no oil returns up vacuum hose.
Dry Mechanical vacuum pumps - Diaphragm		
<input checked="" type="checkbox"/>	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	Check for evidence of poor vacuum – Turbo power demand, poor manifold vacuum, etc.
<input checked="" type="checkbox"/>	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	Clear air flow paths of dust.
<input checked="" type="checkbox"/>	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	If vacuum is poor, then replace the diaphragm pump.
<input checked="" type="checkbox"/>	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	Perform anti-suckback valve test. Power on until side plate is held closed, power off and check that side plate holds closed.
Dry Mechanical vacuum pumps - Scroll		
<input checked="" type="checkbox"/>	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	Replace the tips seal on the IDP pump.
<input checked="" type="checkbox"/>	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	Check for evidence of poor vacuum – Turbo power demand, poor manifold vacuum, etc.
<input checked="" type="checkbox"/>	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	Replace the Exhaust Filter if required.
<input checked="" type="checkbox"/>	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	Discuss with customer the need for more frequent changes, if needed.
<input checked="" type="checkbox"/>	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	Inform customer that pump gas ballast should be installed all the time.
<input checked="" type="checkbox"/>	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	Perform anti-suckback valve test. Power on until side plate is held closed, power off and check that side plate holds closed.
Cleaning System and Filters		
Fans		
<input checked="" type="checkbox"/>	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	Remove dust from fans and vent covers.
<input checked="" type="checkbox"/>	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	Verify fans are functional and that there is enough space around the instrument for proper cooling.
Source cleaning		
<input checked="" type="checkbox"/>	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	Open analyzer and remove the source.
<input checked="" type="checkbox"/>	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	Disassemble, Clean, Re-assemble source.
<input checked="" type="checkbox"/>	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	Re-install source and close analyzer.
Filters		
<input checked="" type="checkbox"/>	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	Replace RM5H-2 Helium gas filter – if applicable.
<input checked="" type="checkbox"/>	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	Replace RM5H-2 Nitrogen gas filter – if applicable.
<input checked="" type="checkbox"/>	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	Replace RM5H-2 Hydrogen gas filter – if applicable.
<input checked="" type="checkbox"/>	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	CP17988 – Gas Clean Carrier Gas Kit for 7890 for Nitrogen or Helium; Bracket, Mount, and Filter – if applicable.
<input checked="" type="checkbox"/>	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	CP17974 – Gas Clean Filter Kit GC/MS 1/8" Mount and Filter – if applicable.
<input checked="" type="checkbox"/>	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	CP17073 – Gas Clean Filter; Replacement Filter – if applicable.
<input checked="" type="checkbox"/>	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	5190-9071 – Methane Gas Filter – if applicable

Guidance: If gas filter is replaced, write the change date on the filter using a permanent marker.

System post-check	
Yes/No	Description
<input checked="" type="checkbox"/>	Pump system back down. Wait until system stability has been achieved.
<input checked="" type="checkbox"/>	Verify system vacuum reading(s) via the gauge controller.
<input checked="" type="checkbox"/>	Leak Check
<input checked="" type="checkbox"/>	Verify system in manual tune
<input checked="" type="checkbox"/>	Compare against previous tune file report(s)
<input checked="" type="checkbox"/>	Change to Tune and verify that all temperatures, pressures, and gas flows reach method set points
<input checked="" type="checkbox"/>	Check manually that you have calibration peaks.
<input checked="" type="checkbox"/>	EI Autotune Performed

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

Service Review

- ☒ Attach available reports/printouts of all tests to this documentation.
- ☒ Record the Preventive Maintenance service activity in the customer's records/logbook. Record the PM event in the Smart Alerts logbook, if applicable.
- ☒ 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 Comment box. Systems in a compliant environment may need additional documentation.

Agilent Test Results Table

Test Description	Expected Test Result	Actual Test Result
Auto tune	pass	pass
Evaluate tune	pass	pass

Agilent Consumed Parts List Table

Section not applicable

Part Description	Part Number	Product or Model# where used	Quantity consumed

Signature Page

Service Engineer Comments (optional)

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

Service Completion

Service request number 6009015509 Date service completed 14 June 2023
Agilent signature [Signature] Customer signature ดร. ชัยเชาวน์

Total number of pages in this document 9 pages

Agilent CrossLab Start Up Services Agilent 8890 Gas Chromatograph Preventive Maintenance Checklist



Agilent Preventive Maintenance provides factory recommended service for your analytical instruments to assure reliable operation and the longevity of your testing.

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 preventive maintenance activities.

Agilent 8890 GC Preventive Maintenance Checklist

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 procedure.
- 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.

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>
- The **Agilent Community** is an excellent place to get answers, collaborate with others about applications and Agilent products, and find in-depth documents and videos relevant to Agilent technologies. Visit <https://community.agilent.com/welcome>.
- 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** <http://www.agilent.com/search/support>.
- Videos about specific preparation requirements for your instrument can be found by searching the **Agilent YouTube** channel at <https://www.youtube.com/user/agilent>.

เอกสารไม่ควบคุม

Agilent 8890 GC Preventive Maintenance Checklist

Service Engineer's Responsibilities

- Contact the customer and ensure that all necessary supplies are available before the preventive maintenance visit.
- 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 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.

Additional Instruction Notes

- Check for any active service notes for this unit. If there are any applicable "Safety" or "Modification Recommended" Service notes, plan to implement the changes on this unit before doing any maintenance service.
- Do not implement firmware updates, unless you get approval from the customer and are sure that they are compatible with the instrument control software.

เอกสารไม่ควบคุม

Agilent 8890 GC Preventive Maintenance Checklist

System Information

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

Instrument System Name and ID	CN1945A066
Instrument System Site and Location	UAE GCMS (405)

List System Component Product Numbers	List the Serial Numbers of each Component
1. 67222A	CN1945A066
2.	
3.	
4.	
5.	
6.	
7.	
8.	
9.	
10.	

Preparation

- ☒ Discuss any specific issues with the customer before starting.
- ☒ 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.
- ☒ Before starting the following procedures, record the Detector Signal Output(s) in the results table. If the GC is turned OFF or in a service mode, comparing the detector outputs before and after the service is not possible.

เอกสารไม่ควบคุม

Agilent 8890 GC Preventive Maintenance Checklist

Preventive Maintenance Procedure

Clean and inspect GC

- ☒ Unplug power cord from the power source.
- ☒ Open GC covers and vacuum/remove any dust/debris. Pay particular attention to cooling fans.
- ☒ Inspect internal connectors for proper contact and placement.
- ☒ Reconnect Power to the GC. Power the GC on and verify the power on self-test passed.
- ☒ Verify oven motor spins freely and turns on with the oven door closed; off when the door is opened.
- ☒ Verify operation of all other fans - the inlet and EPC cooling fans.
- ☒ Verify oven intake/outlet flap assembly is operating smoothly while heating and cooling the oven

Inlet and detector consumable replacement

- ☒ Replace the split vent trap cartridge filter using the Maintenance procedure from either the Browser User interfaces on units with these Inlets: Split/Splitless Capillary (SSL), Multi-Mode Inlet (MMI), Programmed Temperature Vaporizer (PTV), Volatiles Interface (VI).
- ☒ If the inlet system is used in Split Mode with viscous samples, inspect and clean the split vent tube on the inlet and flush or replace the tubing between the inlet and the split vent trap.
- ☒ For the inlets installed, perform inlet maintenance using the Maintenance procedure from the Browser User interfaces. Record the results. (Leak and Restriction Test)
- ☐ If the GC includes a Flame Ionization Detector (FID), replace the jet. If the ignitor shows any buildup of sample or corrosion, replace the ignitor. Examine the FID collector and castle assemblies for contamination – clean as necessary.

Zero Sensors and Leak test

- ☒ Zero all pressure sensors using the Browser interface.
- ☒ Perform inlet pressure decay test(s) from the diagnostics screen on the Browser User interface. Record if test passed or failed in the results table.

Note: If the PM is done in preparation for an Operational Qualification, then the pressure decay test defined within that protocol can be used for the PM.

เอกสารไม่ควบคุม

ALS Maintenance

- ☒ **Section NOT applicable**
- ☐ Check all cabling and configuration settings between GC, tray, and injectors.
- ☐ Vacuum or remove any dust, especially around fans.
- ☐ Check operation of all fans.
- ☐ Check syringe for smooth plunger operation.
- ☐ Check for smooth operation of the needle support – clean if necessary

Restore Instrument

- ☒ Restore the normal operating conditions or customer method using the Browser interface or Data System.
- ☒ Purge the system with carrier flow for 15 minutes
- ☒ Bake out the system, then restore the normal operating conditions
- ☒ After equilibration, check and record the post PM detector signal output values. Results should be similar or lower than the detector outputs recorded prior to PM.
- ☐ Perform a chemical checkout. If this is a routine PM, inject the customer's sample using the ALS if applicable. This will act as a final checkout of both the ALS and the GC.

Note: 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.

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 with the customer this service, parts replaced, and test results obtained.
- ☐ 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.
- ☐ Supply the customer with a copy of the Smart Alerts flyer.
- ☐ Describe Smart Alerts to the customer.
- ☐ Install Smart Alerts if requested.

PM Test Results Table

Test description	Before PM Service	After PM Service
Front detector output	N/A	N/A
Back detector output	N/A	N/A
AUX 1 detector output	N/A	N/A
AUX 2 detector output	N/A	N/A
Test description	Expected test result	Actual test result
Leak and Restriction Test after front inlet maintenance	Pass	Pass
Leak and Restriction Test after back inlet maintenance	Pass	N/A
Leak and Restriction Test after front inlet Split Vent	Pass	Pass
Trap replacement	Pass	N/A
Leak and Restriction Test after back inlet Split Vent	Pass	Pass
Trap replacement	Pass	N/A
Front inlet pressure decay test	Pass	Pass
Back inlet pressure decay test	Pass	N/A

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PM Parts List Table

Note: The following kits are recommended for capillary and purged packed inlets. If this is a general PM and the customer has a preferred set of consumables, you may use the customer's consumables.

Part description	Part number	Product or model# where used	Quantity consumed
GC Capillary Inlet PM kit, Capillary	5100-6497	8890 GC	1
SSL Capillary Inlet PM kit, Split	5188-6496	8890 GC	1
SSL Capillary Ultra Inert Inlet Gold Seal with Washer	5190-6144	8890 GC	N/A
SSL Capillary Ultra Inert Inlet Splitless Liner - Single Inlet with Glass Wool	5190-2002	8890 GC	N/A
SSL Capillary Ultra Inert Inlet Low Pressure Drop Split Liner - with Glass Wool	5190-2295	8890 GC	N/A
PP Inlet PM kit	5188-6498	8890 GC	N/A
Capillary Inlet PM kit, single sealless (for MMI, PTV & VI)	5188-6495	8890 GC	N/A
MMI Cleaning Kit	63510-60820	8890 GC	N/A
PTV Septumless Head Rebuild Kit	5182-9747	8890 GC	N/A
PTV Septumless Head Inlet Valve Ignitor (glow plug) assembly with O-ring	3162-9740	8890 GC	N/A
	19231-50680	8890 GC	N/A
FID Collector Rebuild/Cleaning Kit	G1531-67000	8890 GC	N/A
FID Collimator Replacement Kit	G1531-67001	8890 GC	N/A
Standard .011-inch FID Jet	5200-0176	8890 GC	N/A
Universal .018-inch FID Jet	5200-0177	8890 GC	N/A

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Service Engineer Comments

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

Service Completion

Service request number 6005953599 Date service completed 14 June 2023
Agilent signature [Signature] Customer signature [Signature]
Total number of pages in this document 8 pages

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