

ภาคผนวก ฎ

เอกสารสอบเทียบเครื่องมือ



ภาคผนวก ฅ

เอกสารสอบเทียบเครื่องมือ



List of Instruments Certification for Air & Noise Quality Analysis

No.	Instrument/Equipment	Parameter	Manufacturer	Model/Serial No.	Calibrator	Certification No.	Date of Calibration	Due date of Calibration	Remark
Ambient									
1	Orifice Transfer Standard Calibrator	Total Suspended Particulate (TSP) Particulate Matter < 10 µm (PM ₁₀)	Andersen Instruments, Inc	G25A 11MX	Tisch Environmental, Inc.	28062022	28 Jun 22	27 Jun 24	-
2	U-Tube Manometer	Total Suspended Particulate (TSP) Particulate Matter < 10 µm (PM ₁₀)	Dwyer	1221-36-W/M -	Technology Promotion Association (Thailand-Japan)	22P800	12 Mar 22	11 Mar 23	-
3	Mass Flow Meter	BTEXs	Alicat Scientific, Inc.	MB-5SCCM-D/5M 71015	Miracle International Technology Co., Ltd.	AD2110-274-0002	1 Nov 21	31 Oct 22	-
4	Aneroid Barometer	Total Suspended Particulate (TSP) Particulate Matter < 10 µm (PM ₁₀) BTEXs	Barigo, Germany	-	Technology Promotion Association (Thailand-Japan)	21P2499	21 Jul 21	20 Jul 22	-
5	Dial Thermo-Hygrometer	Total Suspended Particulate (TSP) Particulate Matter < 10 µm (PM ₁₀) BTEXs	Barigo, Germany	-	Technology Promotion Association (Thailand-Japan)	22H771	5 Apr 22	4 Apr 23	-
6	Nitrogen Dioxide Analyzer	Nitrogen Dioxide	Thermo Scientific	42i 1180540062	UAE Consultant Co., Ltd.	19072021	19 Jul 21	18 Jul 22	-
7	Nitrogen Dioxide Analyzer	Nitrogen Dioxide	Thermo Scientific	42i 1182920008	UAE Consultant Co., Ltd.	09072021	9 Jul 21	8 Jul 22	-
8	Standard Gases (Mixture)	Nitrogen Dioxide	Airgas	EB0143262 2015PSIG	Airgas an Air Liquide company	E04NI99E15A01D3	21 Jun 21	21 Jun 24	-
9	Sulphur Dioxide Analyzer	Sulphur Dioxide	Thermo Scientific	43i 1200906875	UAE Consultant Co., Ltd.	14062021	14 Jun 21	13 Jun 22	-
10	Sulphur Dioxide Analyzer	Sulphur Dioxide	Thermo Scientific	43i 1201778112	UAE Consultant Co., Ltd.	14062021	14 Jun 21	13 Jun 22	-
11	Sulphur Dioxide Analyzer	Sulphur Dioxide	Thermo Scientific	43i 1201778116	UAE Consultant Co., Ltd.	09062021	9 Jun 21	8 Jun 22	-
12	Standard Gases (Mixture)	Sulphur Dioxide	Airgas	EB0143262 2015PSIG	Airgas an Air Liquide company	E04NI99E15A01D3	21 Jun 21	21 Jun 24	-

List of Instruments Certification for Air & Noise Quality Analysis

No.	Instrument/Equipment	Parameter	Manufacturer	Model/Serial No.	Calibrator	Certification No.	Date of Calibration	Due date of Calibration	Remark
Ambient									
13	Carbon Monoxide Analyzer	Carbon Monoxide	Thermo	48i 1180540068	UAE Consultant Co.,Ltd.	14102021	14 Oct 21	13 Oct 22	-
14	Carbon Monoxide Analyzer	Carbon Monoxide	Thermo	48i CM08140004	UAE Consultant Co.,Ltd.	14102021	14 Oct 21	13 Oct 22	-
15	Carbon Monoxide Analyzer	Carbon Monoxide	Thermo	48i 1201778119	UAE Consultant Co.,Ltd.	21122021	21 Dec 21	20 Dec 22	-
16	Standard Gases (Mixture)	Carbon Monoxide	Airgas	EB0143262 2015PSIG	Airgas an Air Liquide company	E04NI99E15A01D3	21 Jun 21	21 Jun 24	-
17	Wind Speed/Wind Direction	WS/WD	LSI LASTEM	E-LOG305 19040308	Thai Meteorological Department	385/21	16 Aug 21	15 Aug 22	-
18	Wind Speed/Wind Direction	WS/WD	LSI LASTEM	E-LOG305 19040406	Thai Meteorological Department	354/21	20 Jul 21	19 Jul 22	-
19	Wind Speed/Wind Direction	WS/WD	LSI LASTEM	05103-5 30905375	Thai Meteorological Department	212/21	14 Apr 21	13 Apr 22	-
20	Sound Level Calibrator (Acoustic Calibrator)	Calibrate Sound Level Meter	Larson Davis	CAL150 6171	Innovative Instrument Co.,Ltd.	21-ACT-327	24 Aug 21	23 Aug 22	-
21	Sound Level Meter	$L_{Aeq\ 24\ hr}$, L_{Amax} , L_{Adn} , L_{A90}	Rion, Japan	NL-62 00511776	Sithiporn Associates Co., Ltd.	ACL22095	22 Apr 22	21 Apr 23	-
22	Sound Level Meter	$L_{Aeq\ 24\ hr}$, L_{Amax} , L_{Adn} , L_{A90}	Rion, Japan	NL-62 00901703	Sithiporn Associates Co., Ltd.	ACL22096	22 Apr 22	21 Apr 23	-
23	Sound Level Meter	$L_{Aeq\ 24\ hr}$, L_{Amax} , L_{Adn} , L_{A90}	Rion, Japan	NL-62 00901739	Sithiporn Associates Co., Ltd.	ACL22097	22 Apr 22	21 Apr 23	-

List of Instruments Certification for Water Quality Analysis

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

Certificate of Calibration

Calibration Certification Information			
Cal. Date: June 28, 2021	Rootmeter S/N: 438320	Ta: 297	°K
Operator: Jim Tisch		Pa: 753.6	mm Hg
Calibration Model #: G25A	Calibrator S/N: 11MX		

Run	Vol. Init (m3)	Vol. Final (m3)	ΔVol. (m3)	ΔTime (min)	ΔP (mm Hg)	ΔH (in H2O)
1	1	2	1	1.3910	3.3	2.00
2	3	4	1	0.9890	6.4	4.00
3	5	6	1	0.8850	8.0	5.00
4	7	8	1	0.8430	9.0	5.50
5	9	10	1	0.6970	12.9	8.00

Data Tabulation					
Vstd (m3)	Qstd (x-axis)	$\sqrt{\Delta H \left(\frac{Pa}{Pstd} \right) \left(\frac{Tstd}{Ta} \right)}$ (y-axis)	Va	Qa (x-axis)	$\sqrt{\Delta H \left(\frac{Ta}{Pa} \right)}$ (y-axis)
0.9906	0.7121	1.4106	0.9956	0.7158	0.8878
0.9865	0.9975	1.9949	0.9915	1.0025	1.2555
0.9844	1.1123	2.2304	0.9894	1.1179	1.4037
0.9831	1.1661	2.3393	0.9881	1.1721	1.4723
0.9779	1.4030	2.8213	0.9829	1.4102	1.7756
		m= 2.04215			m= 1.27876
		b= -0.04258			b= -0.02680
		r= 1.00000			r= 1.00000

Calculations	
$V_{std} = \Delta Vol((Pa - \Delta P) / P_{std})(T_{std} / T_a)$	$V_a = \Delta Vol((Pa - \Delta P) / P_a)$
$Q_{std} = V_{std} / \Delta Time$	$Q_a = V_a / \Delta Time$
For subsequent flow rate calculations:	
$Q_{std} = 1/m \left(\sqrt{\Delta H \left(\frac{Pa}{P_{std}} \right) \left(\frac{T_{std}}{T_a} \right)} - b \right)$	$Q_a = 1/m \left(\sqrt{\Delta H \left(\frac{T_a}{Pa} \right)} - b \right)$

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

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

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

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

Certificate of Calibration

Certificate No.: 22P800
Page: 1 of 2

Equipment: U-Tube Manometer
Manufacturer: Dwyer
Model: 1221-36-W/M
Serial No.: -
ID No.: UAE.EFM.022/2560

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

Condition As-Received: Used Item
Received Date: 03 March 2022
Calibration Date: 12 March 2022

Reference: 2203-0131WSC
Ambient Temperature: (23 ± 2) °C
Relative Humidity: (50 ± 15) %
Atmospheric Pressure: 1010 mbar
Submitted by: United Analyst and Engineering Consultant Co., Ltd.
81 Soi Udomsuk 41, Sukhumvit Road, Bangchak, Phrakhanong, Bangkok 10260

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

Condition of this result of calibration

1. Reference standards instruments :

Instrument	Model	Serial No.	Certificate No.	Due Date
1) Pressure Calibrator	PC106P	1189	MP-0110-21	09 Aug 2022
2. This result of calibration was made on requested at the point specified by customer.				
3. Scale and conversion factor is 1 kPa = 4.0146293 inH2O				
4. This instrument was used clean air as pressure media.				
5. This instrument was calibrated by applied pressure to high-port (+) side and low-port (-) side open to atmospheric pressure.				
6. This instrument was installed in vertical orientation and top of the pressure port was used as the reference level.				
7. The certificate is valid only to the item calibrated on date and place of calibration.				
8. This Certification is traceable to the International System of Unit maintained at:- -National Institute of Metrology Thailand (NIMT)				

Calibrated by: Sunil Aunsarree
Issue Date: 14 March 2022

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

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

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

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

UUC Indication				
Applied Pressure (inH2O)	High-port side (inH2O)	Low-port side (inH2O)	ΔP (inH2O)	Error (inH2O)
0.00	0.00	0.00	0.00	0.00
2.00	1.00	-1.00	2.00	0.00
4.00	2.00	-2.00	4.00	0.00
6.00	3.00	-3.00	6.00	0.00
8.00	4.00	-4.00	8.00	0.00
10.00	5.00	-5.02	10.02	0.02
12.00	6.00	-6.02	12.02	0.02
14.00	7.00	-7.04	14.04	0.04
16.00	8.00	-8.04	16.04	0.04
18.00	9.00	-9.04	18.04	0.04
20.00	10.00	-10.04	20.04	0.04
22.00	11.00	-11.02	22.02	0.02
24.00	12.00	-12.02	24.02	0.02
26.00	13.00	-13.02	26.02	0.02
28.00	14.00	-14.04	28.04	0.04
30.00	15.00	-15.04	30.04	0.04
32.00	16.00	-16.04	32.04	0.04
34.00	16.98	-17.06	34.04	0.04
35.80	17.98	-18.00	35.98	0.18

The uncertainty of measurement was ± 0.11 inH2O
* UUC = Unit Under Calibration
* ΔP = High-port side - Low-port side
The reported uncertainty of measurement was based on a standard uncertainty multiplied by a coverage factor k = 2, providing a level of confidence of approximately 95 %.

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



CALIBRATION CERTIFICATE

Certificate No.: AD2110-274-0002
Date Issued: 02-Nov-21

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

Equipment: Mass Flow Meter

Manufacturer: Alicat Scientific
Model: MB-5SCCM-D/5M
Serial No.: 71015
ID No./Tag No.: UAE.EMA2.119/2555
Date Received: 22-Oct-21
Date Calibrated: 01-Nov-21

Calibrated by: Mr. Somjet Onbua

Calibration Method or Calibration Procedure Used

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

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

Result of Calibration

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

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

Approved by: K. Nanthang
(Mr. Nathapong Krudaum)



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Certificate No. : AD2110-274-0002

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

Capacity Range : 5 ml/min

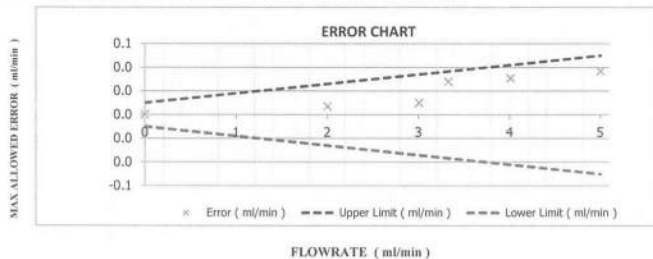
Calibration Media : Air

Type : Mass Flowmeter

Unit Under Calibration Reference Condition :		Pressure 101.325 kPa(abs) , 25 °C , Air			
Temperature (°C)	Pressure (kPa)	UUC Reading (ml/min)	STD Reading (ml/min)	Error (ml/min)	Uncertainty (± ml/min)
24.32	100.87	0	0 *	0	0.063
24.36	100.96	2.002	1.995 *	0.007	0.094
24.41	101.03	3.008	2.998	0.010	0.13
24.46	101.07	3.333	3.305	0.028	0.14
24.52	101.14	4.012	3.981	0.031	0.16
24.56	101.26	5.005	4.968	0.037	0.19

Error = Unit Under Calibration - Standard

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



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Certificate No. : AD2110-274-0002

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

$$Q_{Meas} = Q_{Ref} \times \frac{P_{Ref}}{P_{Meas}} \times \frac{T_{Meas}}{T_{Ref}}$$

; Q = Flow rate

; P = Absolute pressure

; T = Absolute temperature

; Subscript "Meas" = Measurement condition

; Subscript "Ref" = Reference condition

Traceability of Certificate :

The International System of Units (SI) through

NIMT Calibration Certificate No. MW-0003-20 for Mass Flow Calibrator (20 SCCM) Serial No. G500971G20, Due 22-Jan-22

End of Certificate

Page 3 of 3

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



Certificate of Calibration

Certificate No. : 21P2499
Page : 1 of 2

Equipment : Aneroid Barometer

Manufacturer : Barigo

Model : -

Serial No. : -

ID No. : UAE-ANV.122/2550

Condition As-Received: Used Item

Received Date: 20 July 2021

Calibration Date: 21 July 2021

Reference: 2107-0570WSC

Ambient Temperature: (23 ± 2) °C

Relative Humidity: (50 ± 15) %

Atmospheric Pressure: 1009 mbar

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

81 Soi Udomsuk 41, Sukhumvit Road, Bangchak,

Phrakhanong, Bangkok 10260

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

Condition of this result of calibration

1.Reference standards instruments :

Instrument	Model	Serial No.	Certificate No.	Due Date
1) Standard Barometer	DP1142	1422505046	MP-0053-21	08 Apr 2022

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

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

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

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

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

-National Institute of Metrology Thailand (NIMT)

Calibrated by : Suwit Ausarnee
Issue Date : 22 July 2021

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

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

Result of calibration:- Without adjustment

Range : 960 hPa to 1030 hPa

Function:- Absolute Pressure Measurement

Scale Interval : 1 hPa(The Fifth Estimate)

Increasing Pressure

Applied Pressure (hPa)	957.66	969.27	980.15	990.48	1000.69	1010.75	1020.58	1029.49
UUC* Indication (hPa)	969.0	970.0	980.0	990.0	1000.0	1010.0	1020.0	1030.0
Error (hPa)	2.34	0.73	-0.15	-0.48	-0.69	-0.75	-0.58	0.51

Decreasing Pressure

Applied Pressure (hPa)	1029.61	1020.69	1010.80	1000.75	990.59	980.30	969.41	957.79
UUC* Indication (hPa)	1030.0	1020.0	1010.0	1000.0	990.0	980.0	970.0	960.0
Error (hPa)	0.39	-0.69	-0.60	-0.75	-0.59	-0.30	0.59	2.21

The uncertainty of measurement was ± 0.30 hPa

* UUC = Unit Under Calibration

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

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Certificate of Calibration

Certificate No.: 22H771
Page: 1 of 2

Equipment: Dial Thermo-Hygrometer

Manufacturer: Barigo

Model: -

Serial No.: -

ID No.: UAE.ANV.003/2548

Condition As-Received: Used Item

Received Date: 30 March 2022

Calibration Date: 01 April 2022

Reference: 2203-1124WSC

Ambient Temperature: (25 ± 3) °C

Relative Humidity: (50 ± 20) %

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except with the prior written approval of the head of
Corporate Services 3: Equipment Calibration and Testing Services.

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

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

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

Condition of this result of calibration

1. Reference standards instruments:

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

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

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

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

-National Institute of Metrology Thailand (NIMT)

Calibrated by: Somchai Dumvor
Issue Date: 08 April 2022

Approved Signatory:

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

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Cert. No.: 22H771
Page: 2 of 2

Result of Calibration:-

Function: Humidity measurement.

Reference Temperature (°C)	Standard Humidity (%R.H.)	UUC* Reading (%R.H.)	Error (%R.H.)	Uncertainty of Measurement (±%R.H.)
25.0	40.1	42	1.9	1.6
25.0	60.0	61	1.0	1.8
25.0	80.0	78	-2.0	2.0

Result of Calibration:-

Function: Temperature measurement.

Standard Temperature (°C)	UUC* Reading (°C)	Error (°C)	Uncertainty of Measurement (±°C)
20.02	20.0	-0.02	0.72
29.98	30.0	0.02	0.72
35.02	35.0	-0.02	0.72
40.03	40.0	-0.03	0.72

UUC*: Unit Under Calibration

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

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a 1104141



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Tel. 0 2763 2828 Fax 0 2763 2800 www.uaeconsultant.com E-mail: uae@uaeconsultant.com

MULTI-POINT GAS TEST REPORT

Test Date: July 19, 2021

Equipment: Gas Analyzer (NO₂) Model: 42i
Manufacturer: Thermo Scientific Serial Number: 1180540062

Standard Gas Concentration

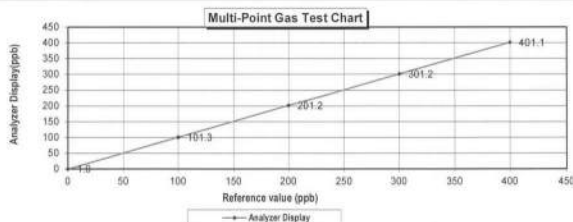
Sulphur Dioxide (SO ₂)	44.75	PPM	Manufacturer:	Thermo Scientific
Nitric Oxide (NO)	45.35	PPM	Model:	146i
Methane (CH ₄)	-	PPM	Serial Number:	1180540071
Carbon Monoxide (CO)	1007			
Cylinder No.:	CC159599			
Expiration Date:	Jul 30, 2022			

Dilutor Detail

Multi-point gas test data

	Reference Value (ppb)	Analyzer Display (ppb)	Difference Error	Percent Error	[% Error]
Level 1	Zero	0.0	1.0	1.00	1.00
Level 2	20.00%	100.0	101.3	1.30	1.28
Level 3	40.00%	200.0	201.2	1.20	0.60
Level 4	60.00%	300.0	301.2	1.20	0.40
Level 5	80.00%	400.0	401.1	1.10	0.27
Remark: Measuring Range	500.0 ppb		Average Difference (%)		0.71

:Acceptable Limit ± 5%



Calculate by

Signature
19 July 2021

Approve by

Signature
19 July 2021

MULTI-POINT GAS TEST REPORT

Test Date: July 9, 2021

Equipment: Gas Analyzer (NO₂) Model: 42i
Manufacturer: Thermo Scientific Serial Number: 1182920008

Standard Gas Concentration

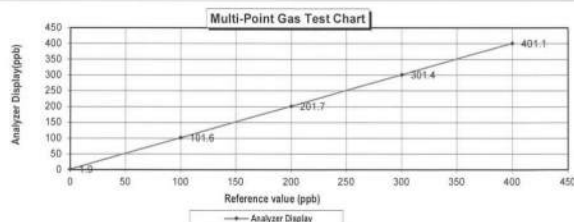
Sulphur Dioxide (SO ₂)	44.75	PPM	Manufacturer:	Thermo Scientific
Nitric Oxide (NO)	45.35	PPM	Model:	146i
Methane (CH ₄)	-	PPM	Serial Number:	1180540071
Carbon Monoxide (CO)	1007			
Cylinder No.:	CC159599			
Expiration Date:	Jul 30, 2022			

Dilutor Detail

Multi-point gas test data

	Reference Value (ppb)	Analyzer Display (ppb)	Difference Error	Percent Error	[% Error]
Level 1	Zero	0.0	1.9	1.90	1.90
Level 2	20.00%	100.0	101.6	1.60	1.57
Level 3	40.00%	200.0	201.7	1.70	0.84
Level 4	60.00%	300.0	301.4	1.40	0.46
Level 5	80.00%	400.0	401.1	1.10	0.27
Remark: Measuring Range	500.0 ppb		Average Difference (%)		1.01

:Acceptable Limit ± 5%



Calculate by

Signature
9 July 2021

Approve by

Signature
10 July 2021

CERTIFICATE OF ANALYSIS
Grade of Product: EPA Protocol

Part Number: E04N199E15A01D3 Reference Number: 122-402135167-1
Cylinder Number: EB0143262 Cylinder Volume: 144.4 CF
Laboratory: 124 - Durham (SAP) - NC Cylinder Pressure: 2015 PSIG
PGVP Number: B22021 Valve Outlet: 650
Gas Code: CO,NO,NOX,SO2,BALN Certification Date: Jun 21, 2021

Expiration Date: Jun 21, 2024

Certification performed in accordance with "EPA Traceability Protocol for Assay and Certification of Gaseous Calibration Standards (May 2012)" document EPA 800R-12/31, using the assay procedures listed. Analytical Methodology does not require correction for analytical interference. This cylinder has a total analytical uncertainty as stated below with a confidence level of 95%. There are no significant impurities which affect the use of this calibration mixture. All concentrations are on a mole/mole basis unless otherwise noted.
Do Not Use This Cylinder below 100 psig, i.e. 0.7 megapascals.

Component	Requested Concentration	Actual Concentration	Protocol Method	Total Relative Uncertainty	Assay Dates
NOX	45.00 PPM	45.98 PPM	G1	+/- 1.4% NIST Traceable	09/14/2021, 09/21/2021
NITRIC OXIDE	45.00 PPM	45.94 PPM	G1	+/- 1.4% NIST Traceable	09/14/2021, 09/21/2021
SULFUR DIOXIDE	45.00 PPM	44.98 PPM	G1	+/- 1.0% NIST Traceable	09/14/2021, 09/21/2021
CARBON MONOXIDE	1000 PPM	984.8 PPM	G1	+/- 0.7% NIST Traceable	08/14/2021
NITROGEN	Balance				

Type	Lot ID	Cylinder No	Concentration	Uncertainty	Expiration Date
NTRM	20081120	CC708098	48.82 PPM NITRIC OXIDE/NITROGEN	+/- 1.0%	Feb 02, 2025
PRM	12388	D865025	9.91 PPM NITROGEN DIOXIDE/AIR	+/- 2.0%	Feb 20, 2020
GMIS	40142383102	CC505881	4.348 PPM NITROGEN DIOXIDE/NITROGEN	+/- 2.1	Feb 18, 2023
NTRM	16011043	CC473277	46.02 PPM SULFUR DIOXIDE/NITROGEN	+/- 0.8%	Jun 17, 2022
NTRM	16060119	CC434277	990.9 PPM CARBON MONOXIDE/NITROGEN	+/- 0.6%	Nov 15, 2025

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

Triad Data Available Upon Request

NOTES: PO #5221002807
GROSS WT: 28.40kg
NET WT: 4.73kg



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

Approved for Release



MULTI-POINT GAS TEST REPORT

Test Date : June 14, 2021

Equipment : Gas Analyzer (SO₂) Model : 43i
Manufacturer : Thermo Scientific Serial Number : 1200906875

Standard Gas Concentration

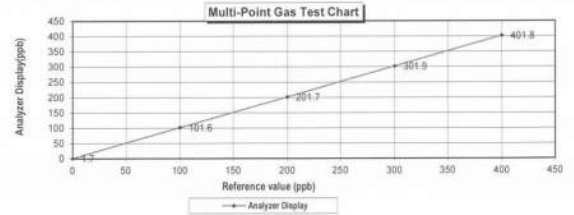
Sulphur Dioxide (SO₂) 44.75 PPM
Nitric Oxide (NO) 45.35 PPM
Methane (CH₄) -
Carbon Monoxide (CO) 1007 PPM
Cylinder No. : CC159599
Expiration Date : Jul 30, 2022

Dilutor Detail

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

Multi-point gas test data

Reference Value (ppb)	Analyzer Display (ppb)	Difference Error	Percent Error	[% Error]
Level 1 Zero	0.0	1.70	1.70	1.70
Level 2 20.00%	100.0	1.60	1.57	1.57
Level 3 40.00%	200.0	201.7	0.84	0.84
Level 4 60.00%	300.0	301.9	0.63	0.63
Level 5 80.00%	400.0	401.8	0.45	0.45
Remark : Measuring Range	500.0 ppb	Average Difference (%)	1.04	
:Acceptable Limit ± 5%				



Calculate by
Sirichan Y.
14 June 2021

Approve by
P. K. K.
14 June 2021

Page 1 of 1

เอกสารไม่ควบคุม

MULTI-POINT GAS TEST REPORT

Test Date : June 14, 2021

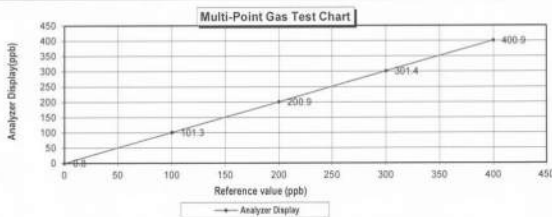
Equipment : Gas Analyzer (SO₂) Model : 43i
Manufacturer : Thermo SCIENTIFIC Serial Number : 1201778112

Standard Gas Concentration

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

Multi-point gas test data

Reference Value (ppb)	Analyzer Display (ppb)	Difference Error	Percent Error	[% Error]
Level 1 Zero	0.0	0.80	0.80	0.80
Level 2 20.00%	100.0	101.3	1.30	1.28
Level 3 40.00%	200.0	200.9	0.45	0.45
Level 4 60.00%	300.0	301.4	0.46	0.46
Level 5 80.00%	400.0	400.9	0.22	0.22
Remark : Measuring Range	500.0 ppb	Average Difference (%)	0.64	
:Acceptable Limit ± 5%				



Calculate by
Sirichan Y.
14 June 2021

Approve by
P. K. K.
14 June 2021

Page 1 of 1

เอกสารไม่ควบคุม

MULTI-POINT GAS TEST REPORT

Test Date : June 9, 2021

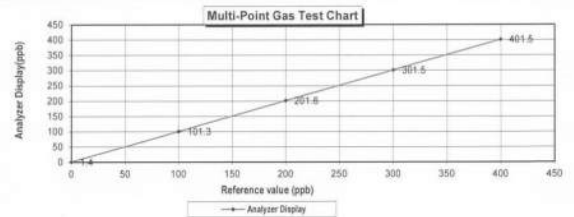
Equipment : Gas Analyzer (SO₂) Model : 43i
Manufacturer : Thermo SCIENTIFIC Serial Number : 1201778116

Standard Gas Concentration

Sulphur Dioxide (SO₂) 44.75 PPM Manufacturer : Thermo SCIENTIFIC
Nitric Oxide (NO) 45.35 PPM Model : 146i
Methane (CH₄) - PPM Serial Number : 1201778116
Carbon Monoxide (CO) 1007 PPM
Cylinder No. : CC159599
Expiration Date : Jul 30, 2022

Multi-point gas test data

Reference Value (ppb)	Analyzer Display (ppb)	Difference Error	Percent Error	[% Error]
Level 1 Zero	0.0	1.40	1.40	1.40
Level 2 20.00%	100.0	101.3	1.30	1.28
Level 3 40.00%	200.0	201.6	0.79	0.79
Level 4 60.00%	300.0	301.5	0.50	0.50
Level 5 80.00%	400.0	401.5	0.37	0.37
Remark : Measuring Range	500.0 ppb	Average Difference (%)	0.87	
:Acceptable Limit ± 5%				



Calculate by
Sirichan Y.
10 June 2021

Approve by
P. K. K.
10 June 2021

Page 1 of 1

เอกสารไม่ควบคุม

CERTIFICATE OF ANALYSIS

Grade of Product: EPA Protocol

Part Number: E04N09E15A01D3 Reference Number: 122-402135167-1
Cylinder Number: EB0143262 Cylinder Volume: 144.4 CF
Laboratory: 124 - Durham (SAP) - NC Cylinder Pressure: 2015 PSIG
PGVP Number: B22021 Valve Outlet: 650
Gas Code: CO,NO,NOX,SO2,BALN Certification Date: Jun 21, 2021

Expiration Date: Jun 21, 2024

Certification performed in accordance with "EPA Traceability Protocol for Assay and Certification of Gaseous Calibration Standards (May 2012)" document EPA 800R-12/31, using the assay procedures listed. Analytical Methodology does not require correction for analytical interference. This cylinder has a total analytical uncertainty as stated below with a confidence level of 95%. There are no significant impurities which affect the use of this calibration mixture. All concentrations are on a mole/mole basis unless otherwise noted.
Do Not Use This Cylinder below 100 psig, i.e. 0.7 megapascals.

Component	Requested Concentration	Actual Concentration	Protocol Method	Total Relative Uncertainty	Assay Dates
NOX	45.00 PPM	45.98 PPM	G1	+/- 1.4% NIST Traceable	09/14/2021, 09/21/2021
NITRIC OXIDE	45.00 PPM	45.94 PPM	G1	+/- 1.4% NIST Traceable	09/14/2021, 09/21/2021
SULFUR DIOXIDE	45.00 PPM	44.98 PPM	G1	+/- 1.0% NIST Traceable	09/14/2021, 09/21/2021
CARBON MONOXIDE	1000 PPM	984.8 PPM	G1	+/- 0.7% NIST Traceable	08/14/2021
NITROGEN	Balance				

Type	Lot ID	Cylinder No	Concentration	Uncertainty	Expiration Date
NTRM	20081120	CC708098	48.82 PPM NITRIC OXIDE/NITROGEN	+/- 1.0%	Feb 02, 2025
PRM	12388	D865025	9.91 PPM NITROGEN DIOXIDE/AIR	+/- 2.0%	Feb 20, 2020
GMIS	401423838102	CC505581	4.348 PPM NITROGEN DIOXIDE/NITROGEN	+/- 2.1	Feb 18, 2023
NTRM	16011043	CC473277	49.02 PPM SULFUR DIOXIDE/NITROGEN	+/- 0.8%	Jun 17, 2022
NTRM	14060119	CC434277	990.9 PPM CARBON MONOXIDE/NITROGEN	+/- 0.6%	Nov 15, 2025

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

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

Triad Data Available Upon Request

NOTES: PO #5221002807

GROSS WT: 28.40kg

NET WT: 4.73kg



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

[Signature]
Approved for Release



MULTI-POINT GAS TEST REPORT

Test Date : Oct 14, 2021

Equipment : Gas Analyzer (CO) Model : 48i
Manufacturer : Thermo Scientific Serial Number : 1180540068

Standard Gas Concentration

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

Dilutor Detail

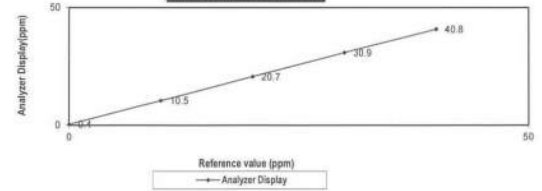
Manufacturer : Thermo Scientific
Model : 146i
Serial Number : 1180540071

Multi-point gas test data

Reference Value (ppm)	Analyzer Display (ppm)	Difference Error	Percent Error	[% Error]
Level 1 Zero	0.0	0.4	0.4	0.4
Level 2 20.00%	10.0	0.5	4.8	4.8
Level 3 40.00%	20.0	0.7	3.4	3.4
Level 4 60.00%	30.0	0.9	2.9	2.9
Level 5 80.00%	40.0	0.8	2.0	2.0

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

Multi-Point Gas Test Chart



Calculate by

[Signature]
14/10/21

Approve by

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14/10/21

Page 1 of 1

เอกสารไม่ควบคุม

MULTI-POINT GAS TEST REPORT

Test Date : Oct 14, 2021

Equipment : Gas Analyzer (CO) Model : 48i
Manufacturer : Thermo SCIENTIFIC Serial Number : CM08140004

Standard Gas Concentration

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

Dilutor Detail

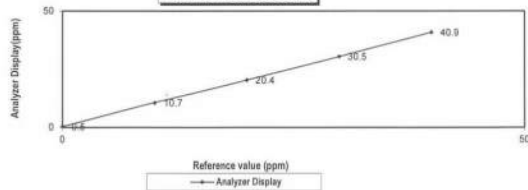
Manufacturer : Thermo SCIENTIFIC
Model : 146i
Serial Number : 1180540071

Multi-point gas test data

Reference Value (ppm)	Analyzer Display (ppm)	Difference Error	Percent Error	[% Error]
Level 1 Zero	0.0	0.5	0.5	0.5
Level 2 20.00%	10.0	0.7	6.5	6.5
Level 3 40.00%	20.0	0.4	2.0	2.0
Level 4 60.00%	30.0	0.5	1.6	1.6
Level 5 80.00%	40.0	0.9	2.2	2.2

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

Multi-Point Gas Test Chart



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14/10/21

Page 1 of 1

เอกสารไม่ควบคุม

MULTI-POINT GAS TEST REPORT

Test Date : Dec 21, 2021

Equipment : Gas Analyzer (CO) Model : 48i
Manufacturer : Thermo Scientific Serial Number : 1201778119

Standard Gas Concentration

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

Dilutor Detail

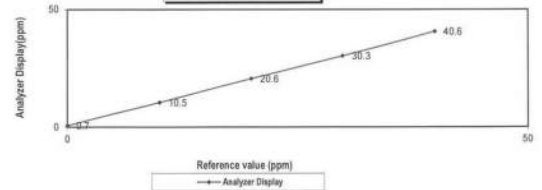
Manufacturer : Thermo Scientific
Model : 146i
Serial Number : 1180540071

Multi-point gas test data

Reference Value (ppm)	Analyzer Display (ppm)	Difference Error	Percent Error	[% Error]
Level 1 Zero	0.0	0.7	0.7	0.7
Level 2 20.00%	10.0	0.5	4.8	4.8
Level 3 40.00%	20.0	0.6	2.9	2.9
Level 4 60.00%	30.0	0.3	1.0	1.0
Level 5 80.00%	40.0	0.6	1.5	1.5

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

Multi-Point Gas Test Chart



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21/12/21

Approve by

[Signature]
21/12/21

Page 1 of 1

เอกสารไม่ควบคุม

CERTIFICATE OF ANALYSIS

Grade of Product: EPA Protocol

Part Number: E04N199E15A01D3 Reference Number: 122-402135167-1
Cylinder Number: EB0143262 Cylinder Volume: 144.4 CF
Laboratory: 124 - Durham (SAP) - NC Cylinder Pressure: 2015 PSIG
PGVP Number: B22021 Valve Outlet: 650
Gas Code: CO,NO,NOX,SO2,BALN Certification Date: Jun 21, 2021

Expiration Date: Jun 21, 2024

Certification performed in accordance with "EPA Traceability Protocol for Assay and Certification of Gaseous Calibration Standards (May 2012)" document EPA 800R-12/031, using the assay procedures listed. Analytical Methodology does not require correction for analytical interference. This cylinder has a total analytical uncertainty as stated below with a confidence level of 95%. There are no significant impurities which affect the use of this calibration mixture. All concentrations are on a mole/mole basis unless otherwise noted.
Do Not Use This Cylinder below 100 psig, i.e. 0.7 megapascals.

Component	Requested Concentration	Actual Concentration	Protocol Method	Total Relative Uncertainty	Assay Dates
NOX	45.00 PPM	45.98 PPM	G1	+/- 1.4% NIST Traceable	09/14/2021, 09/21/2021
NITRIC OXIDE	45.00 PPM	45.94 PPM	G1	+/- 1.4% NIST Traceable	09/14/2021, 09/21/2021
SULFUR DIOXIDE	45.00 PPM	44.98 PPM	G1	+/- 1.0% NIST Traceable	09/14/2021, 09/21/2021
CARBON MONOXIDE	1000 PPM	984.8 PPM	G1	+/- 0.7% NIST Traceable	08/14/2021
NITROGEN	Balance				

Type	Lot ID	Cylinder No	Concentration	Uncertainty	Expiration Date
NTRM	20081120	CC708098	48.82 PPM NITRIC OXIDE/NITROGEN	+/- 1.0%	Feb 02, 2025
PRM	12388	D885025	9.91 PPM NITROGEN DIOXIDE/AIR	+/- 2.0%	Feb 20, 2020
GMIS	401423838102	CC505581	4.348 PPM NITROGEN DIOXIDE/NITROGEN	+/- 2.1	Feb 18, 2023
NTRM	16011043	CC473277	46.02 PPM SULFUR DIOXIDE/NITROGEN	+/- 0.8%	Jun 17, 2022
NTRM	14060119	CC434277	990.9 PPM CARBON MONOXIDE/NITROGEN	+/- 0.6%	Nov 15, 2025

The SRM, PRM or RQM noted above is only in reference to the GMIS used in the assay and not part of the analysis.

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

Triad Data Available Upon Request

NOTES: PO #5221002807
GROSS WT: 28.40kg
NET WT: 4.73kg



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

[Signature]
Approved for Release



เอกสารไม่ควบคุม

THAI METEOROLOGICAL DEPARTMENT

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

Calibration Certificate

Issued by : Calibration & Test Section : Meteorological Instruments Bureau

Date of Issue : 16 August, 2021

Certification No. : 385/21

Page : 1 of 7

Object : เครื่องมือตรวจวัดอุตุนิยมวิทยา

Manufacturer : LSI

Type : Dato Logger E-LOG 305 wind speed and wind direction DNA 827

Thermoisgrometers DMA875 Barometer DQA 801

Mfg Code : Dato Logger 19040308 wind speed and wind direction 19020211

Thermoisgrometers 19010187 Barometer 19040219

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

81 Soi Udomsuk 41, Sukhumvit Road,

Bangchak, Prakanong, Bangkok 10260.

Calibration Condition : Temperature 25.1 °C Barometric Pressure 1011.2 hPa

NATIONAL STANDARD WIND TUNNEL : Thermal Anemometer 642 S/N 91563

: HOOK GAGE NO 1425 : Wind Aloft Plotting Board

N.I.S.T. Test Reference Number 731/241480

: Ultrasonic Anemometer Model DA-650-3TV (sensor TR-90AH)

Serial Number 110730029 (sensor 120629586)

JAPAN QUALITY ASSURANCE ORGANIZATION

STANDARD THERMOMETER : Theodor Friedrich : Dry No.8390/94 Wet No. 8389/94

: testo, testo 645 Serial No. 02848057 : ThermoSchneider No.918802

STANDARD BAROMETER : Digital Barometer Vaisala Type PTB330 No. 1920015

: Digital Barometer Vaisala Type PTB330 No. 1920015

Calibrated by : *[Signature]*

Signed : *[Signature]*

Mr. Watcharapol Subwat

Mr. Pissod Promsut

Mechanical Engineer

(Authorized Signatory)

เอกสารไม่ควบคุม

THAI METEOROLOGICAL DEPARTMENT

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

The Result of Calibration

Wind Speed And Wind Direction

Certification No. 385/21

16 August, 2021 Model DNAS21 S/N 19020211

Page : 2 of 7

Standard	HOOK GAGE NO. 1425	TESTED ANEMOMETER
Ultrasonic Anemometer	Pressure Vacuum Pressure	Velocity Correction
m/sec	inches inches hPa	m/sec m/sec
1.00	- - -	1.0 0.00
3.02	- - -	2.7 0.32
5.00	- - -	5.0 0.00
7.04	- - -	6.7 0.34
9.02	- - -	9.0 0.02
11.02	- - -	10.7 0.32
13.01	- - -	13.0 0.01
15.01	- - -	14.7 0.31
17.02	- - -	17.0 0.02
20.02	- - -	19.7 0.32

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

Calibrated by : *[Signature]*

Mr. Watcharapol Subwat

Mechanical Engineer

Calibration & Test Section

Meteorological Instruments Bureau

เอกสารไม่ควบคุม

THAI METEOROLOGICAL DEPARTMENT

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

Calibration Certificate

Issued by : Calibration & Test Section : Meteorological Instruments Bureau

Date of Issue : 20 July, 2021

Certification No. : 354/21

Page : 1 of 7

Object : เครื่องมือตรวจวัดอุตุนิยมวิทยา

Manufacturer : LSI

Type : Dato Logger E-LOG 305 wind speed and wind direction DNA 827

Thermoisgrometers DMA875 Barometer DQA 801

Mfg Code : Dato Logger 19040406 wind speed and wind direction 19020214

Thermoisgrometers 19050007 Barometer 19040190

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

81 Soi Udomsuk 41, Sukhumvit Road,

Bangchak, Prakanong, Bangkok 10260.

Calibration Condition : Temperature 25.1 °C Barometric Pressure 1007.8 hPa

NATIONAL STANDARD WIND TUNNEL : Thermal Anemometer 642 S/N 91563

: HOOK GAGE NO 1425 : Wind Aloft Plotting Board

N.I.S.T. Test Reference Number 731/241480

: Ultrasonic Anemometer Model DA-650-3TV (sensor TR-90AH)

Serial Number 110730029 (sensor 120629586)

JAPAN QUALITY ASSURANCE ORGANIZATION

STANDARD THERMOMETER : Theodor Friedrich : Dry No.8390/94 Wet No. 8389/94

: testo, testo 645 Serial No. 02848057 : ThermoSchneider No.918802

STANDARD BAROMETER : Digital Barometer Vaisala Type PTB330 No. 1920015

: Digital Barometer Vaisala Type PTB330 No. 1920015

Calibrated by : *[Signature]*

Signed : *[Signature]*

Mr. Watcharapol Subwat

Mr. Pissod Promsut

Mechanical Engineer

(Authorized Signatory)

เอกสารไม่ควบคุม



THAI METEOROLOGICAL DEPARTMENT

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

The Result of Calibration

Wind Speed And Wind Direction

Certification No. 354/21

20 July, 2021 Model DNAR21 S/N 19020214

Page : 2 of 7

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

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

Calibrated by :

Mr. Watcharapol Subwat
Mechanical Engineer

Calibration & Test Section
Meteorological Instruments Bureau



THAI METEOROLOGICAL DEPARTMENT

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

Calibration Certificate

Issued by : Calibration & Test Section : Meteorological Instruments Bureau

Date of Issue : 14 April, 2021

Certification No. 212/21

Page : 1 of 2

Object : Wind speed and wind direction

Manufacturer : Sensor : YOUNG
Basic Datalogger : NRG

Type : Sensor : 05103-5 Basic Datalogger : LR20

Serial No. : Sensor : 79468 Basic Datalogger : 30905375

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

Calibration Condition : Temperature 25.1 °C Barometric Pressure 1013.1 hPa

NATIONAL STANDARD WIND TUNNEL :

: Thermal Anemometer 642 S/N 91563

: HOOK GAGE NO 1425 Pilot Tube Theodor Friedrichs Type 0800.0000 serial 9023

N.I.S.T. Test Reference Number 731/241460

: Ultrasonic Anemometer Model DA-650-3TV (sensor TR-90AH)

Serial Number 110730029 (sensor 120629586)

JAPAN QUALITY ASSURANCE ORGANIZATION

Calibrated by :

Mr. Watcharapol Subwat
Mechanical Engineer

Signed :

Mr. Pisod Promsut

(Authorized Signatory)

for the Chief

Substandard Instrument

เอกสารไม่ควบคุม



THAI METEOROLOGICAL DEPARTMENT

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

The Result of Calibration

Certification No. 212/21

14 April, 2021

Page : 2 of 2

Standard	HOOK GAGE NO. 1425			TESTED ANEMOMETER	
	Pressure	Vacuum	Pressure	Velocity	Correction
Ultrasonic Anemometer	m/sec	inches	inches	m/sec	m/sec
1.00	-	-	-	0.81	0.19
3.02	-	-	-	2.81	0.21
5.00	-	-	-	4.81	0.19
7.04	-	-	-	7.00	0.04
9.02	-	-	-	9.00	0.02
11.01	-	-	-	11.00	0.01
13.01	-	-	-	13.00	0.01
15.01	-	-	-	15.06	-0.05
17.02	-	-	-	17.00	0.02
20.02	-	-	-	20.19	-0.17

Wind Aloft Plotting Board.	
U.S. DEPARTMENT OF COMMERCE WEATHER BUREAU	
WIND DIRECTION	TESTED WIND DIRECTION
0	0
90.0	90
180.0	180
270.0	270

Calibrated by :

Mr. Watcharapol Subwat
Mechanical Engineer

Calibration & Test Section
Meteorological Instruments Bureau



เอกสารไม่ควบคุม

INNOVATIVE INSTRUMENT CALIBRATION LAB
INNOVATIVE INSTRUMENT CO., LTD. HEAD OFFICE
7-139 MOO 13, SOI SUNTEKAKORN 11 TAMBON BANG KAE0,
AMPHOE BANG PHI SAMUT PRAKARN PROVINCE 10540 THAILAND
TEL: (66)0-2118-5900-1 FAX: (66)0-2116-7140



Certificate of Calibration

Customer

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

Certificate No : 21-ACT-327

Address : 81 Soi Udomsuk 41, Sukhumvit Road, Bangchak,

Request No : Req-2021-0995

Prakanong, Bangkok 10260

Unit Under Calibration Details

Measurement item : Acoustic Calibrator

Class : 2

Manufacturer : LARSON DAVIS

Range : 94 , 114 dB / 1000 Hz

Model : CAL150

Instrument Status : Used

Serial Number : 6171

ID : UAE.EFM.117/2562

Calibration Environment and Details

Temperature : (23 ± 2 °C)

Humidity : (50 ± 20 %RH)

Barometric Pressure : (1013 ± 10.0 hPa)

Received Date : 22 July 2021

Calibration Date : 24 August 2021

Location of Calibration : LAB 1 Acoustic

Calibration Procedure : In-house method CP-ACT-02 based on IEC 60942:2017 Electroacoustics - Sound calibrators

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

Traceability

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

Note

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

Calibrated By :

Mr. Noppadon Luangart
Service Calibration Engineer

Approved By :

Mr. Pacit Mathavorn
Calibration Engineer Supervisor

Issue Date : 24 August 2021

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

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Certificate No : 21-ACT-327
Request No : Req-2021-0995

Sound pressure level

Calibration Results : Without Adjustment

Calibration Range (dB)	Without Adjustment (dB)		Adjustment (dB)		Uncertainty (\pm dB)	Acceptance limit Class 2 (\pm dB)
	Measured	Error	Measured	Error		
94 dB / 1000 Hz	94.10	0.10	-	-	0.12	0.40
114 dB / 1000 Hz	114.12	0.12	-	-	0.11	0.40

Frequency of Sound pressure level

Calibration Range (Hz)	Without Adjustment		Adjustment		Uncertainty (\pm %)	Acceptance limit Class 2 (\pm %)
	Measured (Hz)	Error (%)	Measured (Hz)	Error (%)		
94 dB / 1000 Hz	1000.00	0.00	-	-	0.10	1.7
114 dB / 1000 Hz	1000.00	0.00	-	-	0.10	1.7

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

Calibration Range (Hz)	Without Adjustment		Adjustment		Uncertainty (\pm %)	Acceptance limit Class 2 (\pm %)
	Measured (%)	Error (%)	Measured (%)	Error (%)		
94 dB / 1000 Hz	0.04	-	-	-	0.40	3.0
114 dB / 1000 Hz	0.21	-	-	-	0.40	3.0

Note :

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

End of Calibration

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

เอกสารไม่ควบคุม 077/19

SITHIPORN SITHIPORN ASSOCIATES CO.,LTD.
associates CALIBRATION LABORATORY

Continuation of Calibration Certificate

Cert. No. : ACL22095
Job No. : VC65AC0045
Pages : 2 of 8

Calibration Procedure : CP-AC-01

Calibration Method :

This equipment was calibrated by based on IEC-61672-3 (2013) Standard for sound level meter (SLM).
The SLM had tests to Acoustical and Electrical signal tests of frequency weighting with Anechoic chamber and Reference Standard Instruments.
For tests results of each items were made by observation of each Instruments display and also with SLM's display.

Condition of this result of calibration :

1. Reference Standard Instruments :

Instrument	Model	Serial No.	Cert. No.	Due Date
Waveform Generator	33210A	MY48017076	EF-0007-22	04-Feb-23
Waveform Generator	33511B	MY52302742	EF-0008-22	04-Feb-23
Digital Multimeter	33461A	MY53220104	EEL-BP, 04/0265	09-Feb-23
Digital Multimeter	33461A	MY53220076	EEL-BP, 03/0265	09-Feb-23
Digital Multimeter	34461A	MY60024273	EEL-BP, 05/0265	09-Feb-23
Programmable Attenuator	MAT-1070	62100114	EF-0009-22	07-Feb-23
Condenser Microphone	4180	2977900	AA-1013-22	24-Feb-23
Measuring Amplifier	NA-42KAI	34560495	AA-3005-22	22-Feb-23

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

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

- 3.1 National Institute of Metrology (Thailand).
- 3.2 Thailand Institute of Scientific and Technological Research (TISTR).

เอกสารไม่ควบคุม

QF-TS12-04-04-020664

SITHIPORN ASSOCIATES CO.,LTD.
CALIBRATION LABORATORY

451-451/1 Sirinthorn Rd.,Bangbunru, Bangplud Bangkok 10700 THAILAND.
Tel.0-2435-8800 Fax.0-2433-1679 e-mail:cal-center@sithiphorn.com http://www.sithiphorn.com



Cert. No. : ACL22095
Pages : 1 of 8

Calibration Certificate

Equipment : SOUND LEVEL METER
Manufacturer : RION
Model : NL-62/ Microphone UC-59L / Preamplifier NH-26
Serial No.: 00511776 / 02267 / 11974
ID No.: -

Condition As Found : GOOD

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

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

Received Date : 11 APRIL 2022
Calibration Date : 18-22 APRIL 2022
Date of Issue : 25 APRIL 2022

Calibrated by : Nathakorn Pisutpaisan

Approved by :

T. Petchur
(Thanakul Petchurai)

This certificate is issued in accordance with the requirements of ISO/IEC 17025 standard, may not be reproduced other than in full, except with the prior written approval of the head of Calibration Laboratory.

เอกสารไม่ควบคุม

QF-TS12-04-04-020664

SITHIPORN SITHIPORN ASSOCIATES CO.,LTD.
associates CALIBRATION LABORATORY

Continuation of Calibration Certificate

Cert. No. : ACL22095
Job No. : VC65AC0045
Pages : 3 of 8

Summary of Measurement Result :

Parameter	Pass	Fail	Uncertainty (dB)	Maximum-permitted uncertainty of measurement (dB)
1. Absolute sensitivity	✓	-	0.2	N/A
2. Self-generated noise	✓	-	0.5	N/A
3. Acoustical signal tests of frequency weightings				
125 Hz	✓	-	0.3	0.6
1000 Hz	✓	-	0.3	0.6
8000 Hz	✓	-	0.3	0.7
4. Electrical signal tests of frequency weightings				
For 10 Hz to 4 kHz	✓	-	0.3	0.6
For > 4 kHz to 10 kHz	✓	-	0.3	0.7
For > 10 kHz to 20 kHz	✓	-	0.3	1.0
5. Frequency and time weightings at 1 kHz	✓	-	0.2	0.2
6. Long - term stability	✓	-	0.1	0.1
7. Level linearity on the reference level range	✓	-	0.2	0.3
8. Level linearity including the level range control	✓	-	0.2	0.3
9. Tone burst response	✓	-	0.2	0.3
10. Peak C sound level	✓	-	0.2	0.35
11. Overload indication	✓	-	0.2	0.25
12. High level stability	✓	-	0.1	0.1

เอกสารไม่ควบคุม

QF-TS12-04-04-020664

Cert. No. : ACL22095
Job No. : VC65AC0045
Pages : 4 of 8

Result of calibration :

1. Absolute sensitivity

Reference Acoustic Signal (dB)	Measured Value (dB)	Deviation (dB)	Acceptance Limit (dB)
93.9 (93.95)	94.0	0.0	±0.3

2. Self-generated noise

2.1 Normal test

Measured Value (dB)
14.6

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

Frequency Weighting	Measured value (dB)
A - weight	11.2
C - weight	16.2
Flat	24.1

3. Acoustical signal tests of frequency weightings

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

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)			
	Flat	C-weight	A-weight	Acceptance Limits
125	0.5	0.5	0.5	± 1.0
1000	0.4	0.4	0.4	± 0.7
8000	0.4	0.5	0.5	+ 1.5, - 2.5

QF-TS12-04-04-020664

เอกสารไม่ควบคุม

T. Retch

Cert. No. : ACL22095
Job No. : VC65AC0045
Pages : 6 of 8

7. Level linearity on the reference level range

Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
137.0	137.0	0.0	±0.8
136.0	136.0	0.0	±0.8
135.0	135.0	0.0	±0.8
134.0	134.0	0.0	±0.8
133.0	133.0	0.0	±0.8
132.0	132.0	0.0	±0.8
131.0	131.0	0.0	±0.8
129.0	129.0	0.0	±0.8
124.0	124.0	0.0	±0.8
119.0	119.0	0.0	±0.8
114.0	114.0	0.0	±0.8
109.0	109.0	0.0	±0.8
104.0	104.0	0.0	±0.8
99.0	99.0	0.0	±0.8
94.0	94.0	0.0	±0.8
89.0	89.0	0.0	±0.8
84.0	84.0	0.0	±0.8
79.0	79.0	0.0	±0.8
74.0	74.1	0.1	±0.8
69.0	69.1	0.1	±0.8
64.0	64.0	0.0	±0.8
59.0	59.1	0.1	±0.8
54.0	54.0	0.0	±0.8
49.0	49.0	0.0	±0.8
44.0	44.0	0.0	±0.8
39.0	39.0	0.0	±0.8
34.0	34.0	0.0	±0.8
30.0	30.0	0.0	±0.8
29.0	29.0	0.0	±0.8
28.0	28.0	0.0	±0.8
27.0	27.0	0.0	±0.8
26.0	26.0	0.0	±0.8
25.0	25.0	0.0	±0.8

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เอกสารไม่ควบคุม

T. Retch

Cert. No. : ACL22095
Job No. : VC65AC0045
Pages : 5 of 8

4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)			
	Flat	C-weight	A-weight	Acceptance Limits
63	0.1	-0.1	0.0	±1.0
125	0.0	0.0	0.0	±1.0
250	0.0	0.0	0.0	±1.0
500	0.0	0.0	0.0	±1.0
1000	0.0	0.0	0.0	±1.0
2000	0.0	0.0	0.0	±1.0
4000	0.0	0.0	0.0	±1.0
8000	0.0	0.1	0.1	+ 1.5, - 2.5
16000	0.0	-1.2	-1.2	+ 2.5, -16.0

5. Frequency and time weightings at 1 kHz

5.1 Frequency weightings at 1 kHz

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

5.2 Time weighting at 1 kHz

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

6. Long - term stability

Frequency Weighting	SLM Display at initial (dB)	SLM Display at final (dB)	Deviated Value (dB)	Acceptance Limits (dB)
A - weight	94.0	94.0	0.0	± 0.1

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เอกสารไม่ควบคุม

T. Retch

Cert. No. : ACL22095
Job No. : VC65AC0045
Pages : 7 of 8

8. Level linearity including the level range control

Range	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Auto	94.0	94.0	0.0	±0.8

9. Tone burst response

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

10. Peak C sound level

Number of cycle in test signal	Anticipated Value (dB)	Measured Value, L _{peak} (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.0	0.0	-
One	136.4	136.3	-0.1	±2.0

Number of cycle in test signal	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.0	0.0	-
Positive half cycle	135.4	135.2	-0.2	±1.0
Negative half cycle	135.4	135.2	-0.2	±1.0

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เอกสารไม่ควบคุม

T. Retch

Continuation of Calibration Certificate

Cert. No. : ACL22095
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11. Overload indication

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

12. High level stability

Frequency Weighting	SLM Display at initial (dB)	SLM Display at final (dB)	Deviated Value (dB)	Acceptance Limits (dB)
A - weight	137.0	137.0	0.0	±0.1

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

End of Calibration Certificate

QF-TS12-04-04-020664

เอกสารไม่ควบคุม

T. Petchurai

Continuation of Calibration Certificate

Cert. No. : ACL22096
Job No. : VC65AC0045
Pages : 2 of 8

Calibration Procedure : CP-AC-01

Calibration Method :

This equipment was calibrated by based on IEC-61672-3 (2013) Standard for sound level meter (SLM).
The SLM had tests to Acoustical and Electrical signal tests of frequency weighting with Anechoic chamber and Reference Standard Instruments.
For tests results of each items were made by observation of each Instruments display and also with SLM's display.

Condition of this result of calibration :

1. Reference Standard Instruments :

Instrument	Model	Serial No.	Cert. No.	Due Date
Waveform Generator	33210A	MY48017076	EF-0007-22	04-Feb-23
Waveform Generator	33511B	MY52302742	EF-0008-22	04-Feb-23
Digital Multimeter	33461A	MY53220104	EEL.BP. 04/0265	09-Feb-23
Digital Multimeter	33461A	MY53220076	EEL.BP. 03/0265	09-Feb-23
Digital Multimeter	34461A	MY60024273	EEL.BP. 05/0265	09-Feb-23
Programmable Attenuator	MAT-1070	62100114	EF-0009-22	07-Feb-23
Condenser Microphone	4180	2977900	AA-1013-22	24-Feb-23
Measuring Amplifier	NA-42KAI	34560495	AA-3005-22	22-Feb-23

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

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

3.1 National Institute of Metrology (Thailand).

3.2 Thailand Institute of Scientific and Technological Research (TISTR).

QF-TS12-04-04-020664

เอกสารไม่ควบคุม

T. Petchurai

451-451/1 Sirinthon Rd., Bangbunru, Bangplud Bangkok 10700 THAILAND.
Tel.0-2435-8800 Fax.0-2433-1679 e-mail:cal-center@sithiporn.com http://www.sithiporn.comCert. No. : ACL22096
Pages : 1 of 8

Calibration Certificate

Equipment : SOUND LEVEL METER
Manufacturer : RION
Model : NL-62/ Microphone UC-59L / Preamplifier NH-26
Serial No.: 00901703 / 02315 / 01808
ID No.: -

Condition As Found : GOOD

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

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

Received Date : 11 APRIL 2022
Calibration Date : 18-22 APRIL 2022
Date of Issue : 25 APRIL 2022

Calibrated by : Nathakorn Pisutpaisan

Approved by :

T. Petchurai
(Thanakul Petchurai)

This certificate is issued in accordance with the requirements of ISO/IEC 17025 standard, may not be reproduced other than in full, except with the prior written approval of the head of Calibration Laboratory.

QF-TS12-04-04-020664

เอกสารไม่ควบคุม

Continuation of Calibration Certificate

Cert. No. : ACL22096
Job No. : VC65AC0045
Pages : 3 of 8

Summary of Measurement Result :

Parameter	Pass	Fail	Uncertainty (dB)	Maximum-permitted uncertainty of measurement (dB)
1. Absolute sensitivity	✓	-	0.2	N/A
2. Self-generated noise	✓	-	0.4	N/A
3. Acoustical signal tests of frequency weightings				
125 Hz	✓	-	0.3	0.6
1000 Hz	✓	-	0.3	0.6
8000 Hz	✓	-	0.4	0.7
4. Electrical signal tests of frequency weightings				
For 10 Hz to 4 kHz	✓	-	0.3	0.6
For > 4 kHz to 10 kHz	✓	-	0.3	0.7
For > 10 kHz to 20 kHz	✓	-	0.3	1.0
5. Frequency and time weightings at 1 kHz	✓	-	0.2	0.2
6. Long - term stability	✓	-	0.1	0.1
7. Level linearity on the reference level range	✓	-	0.2	0.3
8. Level linearity including the level range control	✓	-	0.2	0.3
9. Tone burst response	✓	-	0.2	0.3
10. Peak C sound level	✓	-	0.2	0.35
11. Overload indication	✓	-	0.2	0.25
12. High level stability	✓	-	0.1	0.1

QF-TS12-04-04-020664

เอกสารไม่ควบคุม

T. Petchurai

Cert. No. : ACL22096
Job No. : VC65AC0045
Pages : 4 of 8

Result of calibration :

1. Absolute sensitivity

Reference Acoustic Signal (dB)	Measured Value (dB)	Deviation (dB)	Acceptance Limit (dB)
93.9 (93.95)	94.0	0.0	±0.3

2. Self-generated noise

2.1 Normal test

Measured Value (dB)
16.1

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

Frequency Weighting	Measured value (dB)
A - weight	12.6
C - weight	17.3
Flat	24.8

3. Acoustical signal tests of frequency weightings

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

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)			
	Flat	C-weight	A-weight	Acceptance Limits
125	0.5	0.5	0.5	± 1.0
1000	0.4	0.4	0.4	± 0.7
8000	0.9	0.8	0.7	+ 1.5, - 2.5

QF-TS12-04-04-020664

เอกสารไม่ควบคุม

T. Retha.

Cert. No. : ACL22096
Job No. : VC65AC0045
Pages : 6 of 8

7. Level linearity on the reference level range

Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
137.0	137.0	0.0	±0.8
136.0	136.0	0.0	±0.8
135.0	135.0	0.0	±0.8
134.0	134.0	0.0	±0.8
133.0	133.0	0.0	±0.8
132.0	132.0	0.0	±0.8
131.0	131.0	0.0	±0.8
129.0	129.0	0.0	±0.8
124.0	124.0	0.0	±0.8
119.0	119.0	0.0	±0.8
114.0	114.0	0.0	±0.8
109.0	109.0	0.0	±0.8
104.0	104.0	0.0	±0.8
99.0	99.0	0.0	±0.8
94.0	94.0	0.0	±0.8
89.0	89.0	0.0	±0.8
84.0	84.0	0.0	±0.8
79.0	79.0	0.0	±0.8
74.0	74.0	0.0	±0.8
69.0	69.0	0.0	±0.8
64.0	64.0	0.0	±0.8
59.0	59.0	0.0	±0.8
54.0	53.9	-0.1	±0.8
49.0	49.0	0.0	±0.8
44.0	44.0	0.0	±0.8
39.0	38.9	-0.1	±0.8
34.0	34.0	0.0	±0.8
30.0	29.9	-0.1	±0.8
29.0	29.0	0.0	±0.8
28.0	28.0	0.0	±0.8
27.0	27.0	0.0	±0.8
26.0	26.0	0.0	±0.8
25.0	25.0	0.0	±0.8

QF-TS12-04-04-020664

เอกสารไม่ควบคุม

T. Retha.

Cert. No. : ACL22096
Job No. : VC65AC0045
Pages : 5 of 8

4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)			
	Flat	C-weight	A-weight	Acceptance Limits
63	0.0	-0.1	0.0	±1.0
125	0.0	0.0	0.0	±1.0
250	0.0	0.0	0.0	±1.0
500	0.0	0.0	0.0	±1.0
1000	0.0	0.0	0.0	±1.0
2000	0.0	0.0	0.0	±1.0
4000	0.0	0.0	0.0	±1.0
8000	0.0	0.1	0.1	+ 1.5, - 2.5
16000	0.0	-1.2	-1.1	+ 2.5, -16.0

5. Frequency and time weightings at 1 kHz

5.1 Frequency weightings at 1 kHz

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

5.2 Time weighting at 1 kHz

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

6. Long - term stability

Frequency Weighting	SLM Display at initial (dB)	SLM Display at final (dB)	Deviated Value (dB)	Acceptance Limits (dB)
A - weight	94.0	94.0	0.0	± 0.1

QF-TS12-04-04-020664

เอกสารไม่ควบคุม

T. Retha.

Cert. No. : ACL22096
Job No. : VC65AC0045
Pages : 7 of 8

8. Level linearity including the level range control

Range	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Auto	94.0	94.0	0.0	±0.8

9. Tone burst response

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

10. Peak C sound level

Number of cycle in test signal	Anticipated Value (dB)	Measured Value, Lcpeak (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.0	0.0	-
One	136.4	135.9	-0.5	±2.0

Number of cycle in test signal	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.0	0.0	-
Positive half cycle	135.4	135.2	-0.2	±1.0
Negative half cycle	135.4	135.2	-0.2	±1.0

QF-TS12-04-04-020664

เอกสารไม่ควบคุม

T. Retha.

Continuation of Calibration Certificate

Cert. No. : ACL22096
Job No. : VC65AC0045
Pages : 8 of 8

11. Overload indication

Measured value (dB)		Deviated Value (dB)	Acceptance Limits (dB)
Positive one-half cycle	Negative one-half cycle		
89.5	89.5	0.0	±1.5

12. High level stability

Frequency Weighting	SLM Display at initial (dB)	SLM Display at final (dB)	Deviated Value (dB)	Acceptance Limits (dB)
A - weight	137.0	137.0	0.0	±0.1

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

End of Calibration Certificate

QF-TS12-04-04-020664

เอกสารไม่ควบคุม
T. Petchur

Continuation of Calibration Certificate

Cert. No. : ACL22097
Job No. : VC65AC0045
Pages : 2 of 8

Calibration Procedure : CP-AC-01

Calibration Method :

This equipment was calibrated by based on IEC-61672-3 (2013) Standard for sound level meter (SLM).
The SLM had tests to Acoustical and Electrical signal tests of frequency weighting with Anechoic chamber and Reference Standard Instruments.
For tests results of each items were made by observation of each Instruments display and also with SLM's display.

Condition of this result of calibration :

1. Reference Standard Instruments :

Instrument	Model	Serial No.	Cert. No.	Due Date
Waveform Generator	33210A	MY48017076	EF-0007-22	04-Feb-23
Waveform Generator	33511B	MY52302742	EF-0008-22	04-Feb-23
Digital Multimeter	33461A	MY53220104	EEL.BP. 04/0265	09-Feb-23
Digital Multimeter	33461A	MY53220076	EEL.BP. 03/0265	09-Feb-23
Digital Multimeter	34461A	MY60024273	EEL.BP. 05/0265	09-Feb-23
Programmable Attenuator	MAT-1070	62100114	EF-0009-22	07-Feb-23
Condenser Microphone	4180	2977900	AA-1013-22	24-Feb-23
Measuring Amplifier	NA-42KAI	34560495	AA-3005-22	22-Feb-23

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

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

3.1 National Institute of Metrology (Thailand).

3.2 Thailand Institute of Scientific and Technological Research (TISTR).

QF-TS12-04-04-020664

เอกสารไม่ควบคุม
T. Petchur

451-451/1 Sirinthorn Rd.,Bangbunru, Bangplud Bangkok 10700 THAILAND.
Tel.0-2435-8800 Fax.0-2433-1679 e-mail:cal-center@sithiporn.com http://www.sithiporn.com



Cert. No. : ACL22097
Pages : 1 of 8

Calibration Certificate

Equipment : SOUND LEVEL METER
Manufacturer : RION
Model : NL-62/ Microphone UC-59L / Preamplifier NH-26
Serial No.: 00901739 / 02377 / 01844
ID No.: -

Condition As Found : GOOD

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

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

Received Date : 11 APRIL 2022
Calibration Date : 18-22 APRIL 2022
Date of Issue : 25 APRIL 2022

Calibrated by : Nathakorn Pisutpaisan

Approved by :

T. Petchur
(Thanakul Petchurai)

This certificate is issued in accordance with the requirements of ISO/IEC 17025 standard, may not be reproduced other than in full, except with the prior written approval of the head of Calibration Laboratory.

QF-TS12-04-04-020664

เอกสารไม่ควบคุม

Continuation of Calibration Certificate

Cert. No. : ACL22097
Job No. : VC65AC0045
Pages : 3 of 8

Summary of Measurement Result :

Parameter	Pass	Fail	Uncertainty (dB)	Maximum-permitted uncertainty of measurement (dB)
1. Absolute sensitivity	✓	-	0.2	N/A
2. Self-generated noise	✓	-	0.5	N/A
3. Acoustical signal tests of frequency weightings				
125 Hz	✓	-	0.3	0.6
1000 Hz	✓	-	0.3	0.6
8000 Hz	✓	-	0.3	0.7
4. Electrical signal tests of frequency weightings				
For 10 Hz to 4 kHz	✓	-	0.3	0.6
For > 4 kHz to 10 kHz	✓	-	0.3	0.7
For > 10 kHz to 20 kHz	✓	-	0.3	1.0
5. Frequency and time weightings at 1 kHz	✓	-	0.2	0.2
6. Long - term stability	✓	-	0.1	0.1
7. Level linearity on the reference level range	✓	-	0.2	0.3
8. Level linearity including the level range control	✓	-	0.2	0.3
9. Tone burst response	✓	-	0.2	0.3
10. Peak C sound level	✓	-	0.2	0.35
11. Overload indication	✓	-	0.2	0.25
12. High level stability	✓	-	0.1	0.1

QF-TS12-04-04-020664

เอกสารไม่ควบคุม
T. Petchur

Cert. No. : ACL22097
Job No. : VC65AC0045
Pages : 4 of 8

Result of calibration :

1. Absolute sensitivity

Reference Acoustic Signal (dB)	Measured Value (dB)	Deviation (dB)	Acceptance Limit (dB)
93.9 (93.95)	94.0	0.0	±0.3

2. Self-generated noise

2.1 Normal test

Measured Value (dB)
14.4

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

Frequency Weighting	Measured value (dB)
A - weight	11.5
C - weight	16.7
Flat	25.2

3. Acoustical signal tests of frequency weightings

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

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)			
	Flat	C-weight	A-weight	Acceptance Limits
125	0.5	0.5	0.5	± 1.0
1000	0.4	0.4	0.4	± 0.7
8000	0.5	0.5	0.6	+ 1.5, - 2.5

QF-TS12-04-04-020664

เอกสารไม่ควบคุม

T. Petch.

Cert. No. : ACL22097
Job No. : VC65AC0045
Pages : 6 of 8

7. Level linearity on the reference level range

Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
137.0	137.0	0.0	±0.8
136.0	136.0	0.0	±0.8
135.0	135.0	0.0	±0.8
134.0	134.0	0.0	±0.8
133.0	133.0	0.0	±0.8
132.0	132.0	0.0	±0.8
131.0	131.0	0.0	±0.8
129.0	129.0	0.0	±0.8
124.0	124.0	0.0	±0.8
119.0	119.0	0.0	±0.8
114.0	114.0	0.0	±0.8
109.0	109.0	0.0	±0.8
104.0	104.0	0.0	±0.8
99.0	99.0	0.0	±0.8
94.0	94.0	0.0	±0.8
89.0	89.0	0.0	±0.8
84.0	84.0	0.0	±0.8
79.0	79.0	0.0	±0.8
74.0	74.0	0.0	±0.8
69.0	69.0	0.0	±0.8
64.0	64.0	0.0	±0.8
59.0	59.0	0.0	±0.8
54.0	54.0	0.0	±0.8
49.0	49.0	0.0	±0.8
44.0	44.0	0.0	±0.8
39.0	39.0	0.0	±0.8
34.0	34.0	0.0	±0.8
30.0	29.9	-0.1	±0.8
29.0	28.9	-0.1	±0.8
28.0	27.9	-0.1	±0.8
27.0	27.0	0.0	±0.8
26.0	26.0	0.0	±0.8
25.0	24.9	-0.1	±0.8

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เอกสารไม่ควบคุม

T. Petch.

Cert. No. : ACL22097
Job No. : VC65AC0045
Pages : 5 of 8

4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)			
	Flat	C-weight	A-weight	Acceptance Limits
63	0.1	0.0	0.1	±1.0
125	0.1	0.1	0.1	±1.0
250	0.1	0.1	0.0	±1.0
500	0.1	0.1	0.0	±1.0
1000	0.0	0.0	0.0	±1.0
2000	0.0	0.1	0.0	±1.0
4000	0.0	0.0	0.0	±1.0
8000	0.0	0.1	0.1	+ 1.5, - 2.5
16000	0.0	-1.2	-1.1	+ 2.5, -16.0

5. Frequency and time weightings at 1 kHz

5.1 Frequency weightings at 1 kHz

Frequency Weighting	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
A - weight	94.0	0.0	-
C - weight	94.1	0.0	± 0.2
Flat	94.1	0.0	± 0.2

5.2 Time weighting at 1 kHz

Frequency Weighting	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Fast	94.0	0.0	-
Slow	94.0	0.0	± 0.1
Leq	94.1	0.0	± 0.1

6. Long - term stability

Frequency Weighting	SLM Display at initial (dB)	SLM Display at final (dB)	Deviated Value (dB)	Acceptance Limits (dB)
A - weight	94.0	94.1	0.1	± 0.1

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เอกสารไม่ควบคุม

T. Petch.

Cert. No. : ACL22097
Job No. : VC65AC0045
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8. Level linearity including the level range control

Range	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Auto	94.0	94.0	0.0	±0.8

9. Tone burst response

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

10. Peak C sound level

Number of cycle in test signal	Anticipated Value (dB)	Measured Value, Lcpeak (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.0	0.0	-
One	136.4	136.2	-0.2	±2.0

Number of cycle in test signal	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.0	0.0	-
Positive half cycle	135.4	135.1	-0.3	±1.0
Negative half cycle	135.4	135.1	-0.3	±1.0

QF-TS12-04-04-020664

เอกสารไม่ควบคุม

T. Petch.

Continuation of Calibration Certificate

Cert. No. : ACL22097
Job No. : VC65AC0045
Pages : 8 of 8

11. Overload indication

Measured value (dB)		Deviated Value (dB)	Acceptance Limits (dB)
Positive one-half cycle	Negative one-half cycle		
89.5	89.5	0.0	±1.5

12. High level stability

Frequency Weighting	SLM Display at initial (dB)	SLM Display at final (dB)	Deviated Value (dB)	Acceptance Limits (dB)
A - weight	137.0	137.0	0.0	±0.1

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

End of Calibration Certificate

QF-TS12-04-04-020664

เอกสารไม่ควบคุม

[Signature]



TECHNOLOGY PROMOTION ASSOCIATION (TPA) AND JAPAN CALIBRATION SERVICE (JCS)
CORPORATE SERVICES & EQUIPMENT CALIBRATION AND TRADING SERVICES
514/5 TAT ANAKAT ROAD SOI 15, SUANLUANG, SUANLUANG DISTRICT 10710
TEL. 0-27 2-9281-97 FAX. 0-271 0954



Cert.No.: 72CH60
Page.: 1 of 3

Certificate of Calibration

Equipment : pH Meter
Manufacturer : EcoScience
Model : pH100A
Serial No. : JC03354
ID No. : UAE.EFM.003/2562/ENV.pH 03/82)
Condition As-Received: Used Item
Received Date : 12 January 2022
Calibration Date : 13 January 2022
Reference : Z2C1 0350WBC-1
Submitted by : United Analyst and Engineering Consultant Co., Ltd.
3 Sol Udomsuk 41, Sukhumvit Road, Bangchak, Phrakhanong, Bangkok 10260
Ambient Temperature : (25 ± 2.5) °C
Relative Humidity : (50 ± 15) %
Calibration Procedure : In - house method
- CP-CH5 by direct measurement with standard voltage calibrator and direct measurement with certified reference material (CRM)
- CP-CH8 by comparison with standard thermometer

Calibrated by : Warakorn Larnagatrakul

Approved by : *[Signature]*
Approved Signatory

() Maloe Butkrua
() Sathip Meangmai
() Warakorn Larnagatrakul

Issue Date : 17 January 2022

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

This certificate is valid only if used as a reference for the purpose of the procedure
Approval of the head of Corporate Services & Equipment Calibration and Trading Services

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Cert.No.: 22CH60
Page.: 2 of 3

Condition of this calibration result

1. Reference Standard Instrument : -

Instrument	Serial No.	ID No.	Cert. No.	Due Date
1) Document Process Calibrator	54090348	130RC118	21E2662	25 Aug 2022
2) Ref. Standard Thermometer	4982054	110RC044	2111201	26 Oct 2022

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

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

Buffer Solution	Manufacturer	Lot No.	Exp. date
pH 4.008	CPA Chem	766823	23 Sep 2023
pH 6.882	CPA Chem	761017	02 Aug 2022
pH 10.015	CPA Chem	765824	04 Sep 2022

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

Calibration Results

Function : mV Measurement

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

Unit Under Calibration	Nominal Value	Standard Voltage Input	Actual Reading		Uncertainty of Measurement (±mV)	Coverage factor k
	pH	mV	mV	pH		
pH Meter S/N.: JC03354	4.00	177.48	177	4.01	0.58	2.00
	7.00	0.00	0	7.00	0.58	2.00
	7.00	0.00	0	7.00	0.58	2.00
	10.00	-177.48	-178	10.01	0.58	2.00



Cert.No.: 22CH60
Page.: 3 of 3

Calibration Results

Function : pH Measurement

Performing three buffers standard curve by using buffer nominal pH (4.7)(7.10)

Unit Under Calibration	Standard pH Buffer Solution	Actual pH Reading	Actual mV Reading (mV)	Uncertainty of pH measurement (±)	Coverage factor k
pH Electrode S/N.:200720SIA605377	4.008	4.01	144	0.0079	2.00
	6.862	6.98	-26	0.011	2.00
	6.862	6.98	-27	0.0098	2.00
	10.015	10.01	-200	0.0096	2.00

Function : Temperature Measurement

(°) Without adjustment

This equipment was connected with Temperature Probe;

- Model : -
- Serial No. : 200720SIA605377
Dimension of probe:
- Length : 112 mm.
- Diameter : 2 mm.
- Immersion Depth : 100 mm.

Calibration Point (°C)	Standard Temperature (°C)	UUC ^a Reading (°C)	Error (°C)	Uncertainty of measurement (± °C)	Coverage factor k
25.0	25.003	25.1	0.097	0.13	2.00
30.0	30.002	30.1	0.098	0.13	2.00
35.0	35.004	35.0	-0.004	0.13	2.00

Remark : - UUC^a = Unit Under Calibration

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

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เอกสารไม่ควบคุม

เอกสารไม่ควบคุม



Certificate of Calibration

Equipment : Conductivity Meter
Manufacturer : YS
Model : Pro 30
Serial No. : 18C105225
ID No. : UAF.EFM.206/2501 (ENV.SCI.04/61)
Condition As-Received: Used Item
Received Date : 19 October 2021
Calibration Date : 21 October 2021
Reference : 2110-0634WSC 4
Submitted by : United Analyst and Engineering Consultant Co., Ltd.
3 Soi Udomsak 41, Sukhumvit Road,
Bangchak, Phrakharong, Bangkok 10260
Ambient Temperature : (25 ± 2.5) °C
Relative Humidity : (50 ± 15) %
Calibration Procedure: In-house method :
- CP-CH5 by direct measurement
with certified reference material (CRM);
- CP-CH8 by comparison with standard thermometer

Calibrated by : Warakorn Lemgagtrakul

Approved by :

✓) Maloo Butkruea
{) Sathip Meangmai
{) Warakorn Lemgagtrakul

Issue Date : 29 October 2021

The Uncertainties are for a confidence probability of approximately 95%

This calibration may not be re-calibrated after this in full storage without prior action
Approval of the Head of Calibration Services : Equipment Calibration and Testing Service

เอกสารไม่ควบคุม
A 0033914



Condition of this result of calibration

1. Reference Standard Instrument :-

Instrument	Serial No.	ID No.	Certificate No.	Due date
1) Thermometer	1963878	130RC095	211977	17 Sep 2022
2) Ref. Std. Thermometer	3240076	60RC033	211193	14 Feb 2022

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

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

2. Certified Reference Materials :-

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

Conductivity Solution	Manufacturer	Lot No.	Exp. date
1413.0 µS/cm	CPA Chem	761021	02 Aug 2022
12.8806 mS/cm	CPA Chem	754037	28 June 2022

- Control Conductivity calibration solution temperature by Water bath (25±0.1) °C

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

Calibration results

Function : Conductivity Measurement

{*} After Adjustment at 1413.0 µS/cm

Conductivity Electrode Serial No.: 18C100559

Standard Conductivity Solution	Before Adjustment UUC* Reading	After Adjustment UUC* Reading	Uncertainty of Measurement (±)	Coverage factor k
1413.0 µS/cm	1390 µS/cm	1413 µS/cm	9.1 µS/cm	2.00
12.8806 mS/cm	12.73 mS/cm	12.85 mS/cm	0.082 mS/cm	2.00

Remark : - UUC* = Unit Under Calibration

เอกสารไม่ควบคุม
a 1079152



Calibration Results

Function : Temperature Measurement

{*} Without adjustment

This equipment was connected with Temperature Probe;

- Model : PRO 30 COND-T

- Serial No. : 18C100559

Dimension of probe;

- Length : 8 mm.

- Diameter : 2.5 mm.

- Immersion Depth : 80 mm.

Calibration Point (°C)	Standard Temperature (°C)	UUC* Reading (°C)	Error (°C)	Uncertainty of Measurement (± °C)	Coverage factor k
25.0	25.005	25.0	-0.005	0.20	2.00
30.0	30.004	30.0	-0.004	0.20	2.00
35.0	35.004	35.0	-0.004	0.20	2.00

Remark : - UUC* = Unit Under Calibration

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

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เอกสารไม่ควบคุม
a 1079152

โครงการผลิตปิโตรเลียมบนบกพื้นที่ผลิตวีเชียบุรีส่วนขยาย (WBEXT) ระยะที่ 2 แปลงสำรวจบนบกหมายเลข L44/43 จังหวัดเพชรบูรณ์
ระหว่างเดือนมกราคม - มิถุนายน พ.ศ. 2565
บริษัท อีเค โอเรียนท์ ซีเอสเอส (ประเทศไทย) จำกัด

ใบรับรองสอบเทียบเครื่องมือประจำห้องปฏิบัติการ สำหรับตรวจวัดคุณภาพสิ่งแวดล้อม

No.	Instrument/Equipment	Parameter	Manufacturer	Model/Serial No.	Calibrator	Certification No.	Date of Calibration	Due date of Calibration*	Remark
เครื่องมือประจำห้องปฏิบัติการวิเคราะห์ สำหรับวิเคราะห์คุณภาพอากาศในบรรยากาศโดยทั่วไป									
1	Analytical Balance (Readability 0.1 mg)	ฝุ่นละอองรวม (TSP) ฝุ่นละอองขนาดเล็กไม่เกิน 10 ไมครอน (PM-10)	Mettler-Toledo	AB204-S / 1128312528	National Food Institute, Ministry of Industry, Thailand	2200704-001-01	24 Nov 21	23 Nov 22	-
2	Analytical Balance (Readability 0.1 mg)		Mettler-Toledo	AB204-S/FACT / B108115858	National Food Institute, Ministry of Industry, Thailand	2102572-001-01	26 Apr 21	25 Apr 22	-
3	Gas Chromatography - Mass Spectrometer (GC-MS)	สารกลุ่ม BTEX เบนซีน (Benzene), โทลูอีน (Toluene), เอทิลเบนซีน (Ethylbenzene), ไซลีนทั้งหมด (Total Xylene)	Bruker Scion	451-GC / BR1201M099 Scion-SQ / GQS1203F021 CP8400 / BR1203M331	World Tech Enterprise Co.,Ltd.	Certificate of Calibration PM/OQ	19 Apr 22	18 Apr 23	-
เครื่องมือประจำห้องปฏิบัติการวิเคราะห์ สำหรับวิเคราะห์คุณภาพน้ำ									
4	Inductively Coupled Plasma- Optical Emission Spectrometer (ICP-OES)	กลุ่มโลหะหนัก : ตะกั่ว (Pb), นิกเกิล (Ni), แบเรียม (Ba), ปรอท (Hg), โคโรเนียม (Cr), ซีลีเนียม (Se),	Agilent Technologies	System ID:G8015A G8015AA / MY18030001	Agilent Technologies (Thailand) Co.,Ltd.	Preventive Maintenance Checklist	9 Dec 21	8 Dec 22	-
5	Atomic Absorption Spectrometer (AAS)	ทองแดง (Cu),แมงกานีส (Mn),สังกะสี (Zn), เหล็ก (Fe), สารหนู (As), แคดเมียม (Cd), โครเมียมเฮกซะวาเลนท์ (Cr6+)	Agilent Technologies	System ID:G8432A AA240FS / MY13160001	Thailand Institute of Scientific and Technological Research (TISTR).	MTC.ACL. No. 335/64	28 Jan 22	27 Jan 23	-
6	Conductivity Meter	การนำไฟฟ้า(EC)	SI Analytics	Lab955 / 16300356	SPC Calibration Center Co.,Ltd.	C24210091	29 Mar 21	28 Mar 22	-
7	pH Meter	ค่าความเป็นกรด-ด่าง (pH) อุณหภูมิ (Temperature)	Mettler-Toledo	Seven Easy S20 / 1231155210	National Food Institute, Ministry of Industry, Thailand	2103189-002-01	14 Jun 21	13 Jun 22	-
8	pH Meter		Hanna Instrument	HI2211 / 8165345	National Food Institute, Ministry of Industry, Thailand	2102015-001-01	16 Mar 22	15 Mar 23	-

โครงการผลิตปีโตรเลียมแบบกึ่งพื้นที่ผลิตปิโตรเคมีส่วนขยาย (WBEXT) ระยะที่ 2 แปลงสำรวจแบบหมายเลข L44/43 จังหวัดเพชรบูรณ์
ระหว่างเดือนมกราคม - มิถุนายน พ.ศ. 2565
บริษัท อีเค โอเรียนท์ ซีเอสเอส (ประเทศไทย) จำกัด

ใบรับรองสอบเทียบเครื่องมือประจำห้องปฏิบัติการ สำหรับตรวจวัดคุณภาพสิ่งแวดล้อม

No.	Instrument/Equipment	Parameter	Manufacturer	Model/Serial No.	Calibrator	Certification No.	Date of Calibration	Due date of Calibration*	Remark
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เครื่องมือประจำห้องปฏิบัติการวิเคราะห์ สำหรับวิเคราะห์คุณภาพน้ำ									
9	Analytical Balance (Repeatability 0.1 mg)	ปิโตรเลียมไฮโดรคาร์บอนทั้งหมด (TPH)	Mettler-Toledo	AB-2045/FACT / 1129361010	National Food Institute, Ministry of Industry, Thailand	2103270-001-01	11 Jun 21	10 Jun 22	-
10	Analytical Balance (Repeatability 0.01 mg)	ของแข็งแขวนลอยทั้งหมด (Total Suspended Solids ,SS)	Mettler-Toledo	AX105DR / 1122100406	National Food Institute, Ministry of Industry, Thailand	2200708-001-01	24 Nov 21	23 Nov 22	-
11	Hot Air Oven		Memmert	UF55 / B216.1666	Technology Promotion Association (Thailand-Japan)	21TM1876	29 Oct 21	28 Oct 22	-
12	UV-VIS Spectrophotometer		Agilent	Cary60 G6860A / MY15410009	DQE Services Co.,Ltd.	SP21-015	29 May 21	28 May 22	-
13	UV-VIS Spectrophotometer	ซัลเฟต (SO ₄ ²⁻) โครเมียมชนิดเฮกซะวาเลนต์ (Cr ⁶⁺)	Hitachi	U-1900 / 2021-064	DQE Services Co.,Ltd.	SP21-008	20 Jan 22	19 Jan 23	-
14	UV-VIS Spectrophotometer		Hitachi	U-2900 / 21E22-009	DQE Services Co.,Ltd.	SP22-008	20 Jan 22	19 Jan 23	-
15	Incubator		Memmert	IPP 260 / V615.0187	Technology Promotion Association (Thailand-Japan)	21TM706	21 Apr 21	20 Apr 22	-
16	Incubator		Memmert	IPP 260 / V616.0066	Technology Promotion Association (Thailand-Japan)	21TM1874	28 Oct 21	27 Oct 22	-
17	Water Bath		Memmert	WNE 14 / L416.0606	Technology Promotion Association (Thailand-Japan)	21TM422	17 Feb 22	16 Feb 23	-

เครื่องมือประจำห้องปฏิบัติการวิเคราะห์ สำหรับวิเคราะห์คุณภาพน้ำ									
18	Water Bath		Memmert	WNE 14 / L416.0612	Technology Promotion Association (Thailand-Japan)	21TM423	17 Feb 22	16 Feb 23	-
19	Analytical Balance		Mettler-Toledo	MS6035 / B0070110311	National Food Institute, Ministry of Industry, Thailand	2100858-001-001	8 Dec 20	7 Dec 21	-
20	Auto Clave		ALP	CL-40L / 808763	Technology Promotion Association (Thailand-Japan)	22TM681	27 May 22	26 May 23	-

โครงการผลิตปิโตรเลียมบนบกพื้นที่ผลิตวีเชียรวิสัย (WBEXT) ระยะที่ 2 แปลงสำรวจบนบกหมายเลข L44/43 จังหวัดเพชรบูรณ์
ระหว่างเดือนมกราคม - มิถุนายน พ.ศ. 2565
บริษัท อีเค โอเรียนท์ ซีเอสเอส (ประเทศไทย) จำกัด

ใบรับรองสอบเทียบเครื่องมือประจำห้องปฏิบัติการ สำหรับตรวจวัดคุณภาพสิ่งแวดล้อม

No.	Instrument/Equipment	Parameter	Manufacturer	Model/Serial No.	Calibrator	Certification No.	Date of Calibration	Due date of Calibration*	Remark
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Due Date of Calibration* : กำหนดตามแผนการสอบเทียบประจำปี อย่างน้อยปีละ 1 ครั้ง

	Gas Chromatography - Mass Spectrometer (GC-MS)	ตรวจกลุ่ม BTEX เบนซีน (Benzene), โทลูอีน (Toluene), เอทิลเบนซีน (Ethylbenzene), ไซลีนทั้งหมด (Total Xylene)	Bruker Scion	451-GC / BR1201M099 Scion-SQ / GQS1203F021 CP8400 / BR1203M331	World Tech Enterprise Co.,Ltd.	Certificate of Calibration PM/OO	19 Apr 22	18 Apr 23	-
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Mettler-Toledo (Thailand) Ltd.
846/4 - 846/5 Lasalle Rd., Bangna Tai Sub-District
Bangna District, Bangkok 10260
+66 2723 0382
MT-TH.ServiceSupport@mt.com



Accuracy Calibration Certificate

Customer

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

Weighing Device

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

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

Procedure

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

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

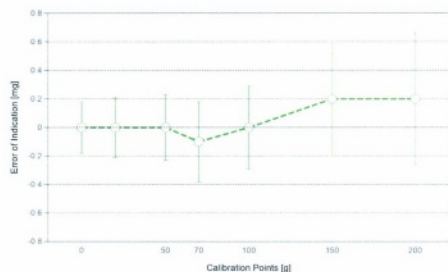
The sensitivity span of the weighing instrument was adjusted before calibration with a built-in weight.
In accordance with EURAMET cg-18 (11/2015), the test loads were selected to reflect the specific use of the weighing device or to accommodate specific calibration conditions.

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

As Found Calibration Date: 07-Apr-2022
As Left Calibration Date: N/A
Issue Date: 08-Apr-2022
Calibrator: 
Approved Signatory: 
☒ Kassakorn Tassanachaisakul
☐ Sans Jitnyom
☐ Surachet Sukate

Error of Indication

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



As Found
As Left
For improved legibility of the graphics only increasing measurement points are shown and measurement points close to zero are not displayed.

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

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

Test Equipment

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

Weight Set 1: OIML E2

Weight Set No.: WS80 Date of Issue: 23-Feb-2022
Certificate Number: C208581631 Calibration Due Date: 14-Aug-2023

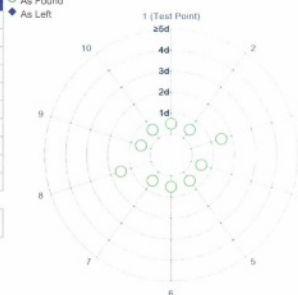
Thermo Hygrometer

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

Measurement Results

Repeatability

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



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

Eccentricity

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



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

Remarks

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

End of Accredited Section

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

Measurement Uncertainty of the Weighing Instrument in Use

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

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

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

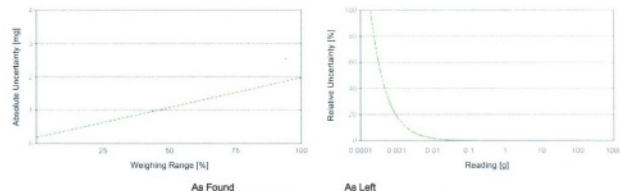
Linearization of Uncertainty Equation

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

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

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

Net Indication	As Found		As Left	
0.0220 g	0.19 mg	0.86%	N/A	N/A
0.2200 g	0.19 mg	0.087%	N/A	N/A
2.2000 g	0.21 mg	0.0095%	N/A	N/A
22.0000 g	0.37 mg	0.0017%	N/A	N/A
220.0000 g	2.0 mg	0.00090%	N/A	N/A



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846/4 - 846/5 Lasaile Rd., Bangna Tai Sub-District
Bangna District, Bangkok 10260
+66 2723 0382
MT-TH.ServiceSupport@mt.com

Accuracy Calibration Certificate

Customer

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

Contact: Suwit Chotnork

Weighing Device

Manufacturer: Mettler Toledo
Model: AB204-S/FACT
Serial No.: B108115858
Building: N/A
Floor: 2
Room: Balance Room 2 (206)

Instrument Type: Weighing Instrument
Asset Number: UAE.AIR.016/2555
Terminal Model: N/A
Terminal Serial No.: N/A
Terminal Asset No.: N/A

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

Procedure

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

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

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

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

	Temperature		Humidity	
	Start	End	Start	End
As Found	22.6 °C	22.1 °C	56.0 %	51.9 %
As Left	22.3 °C	22.4 °C	46.2 %	55.8 %

As Found Calibration Date: 07-Apr-2022

As Left Calibration Date: 07-Apr-2022

Issue Date: 08-Apr-2022

Calibrator:

Sravit Chamchan

Approved Signatory:

☒ Kasakorn Tassanachaisakul
☐ Santi Jitinyom
☐ Surachet Sukkate

Measurement Results

Repeatability

Test Load: 100 g

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

Standard Deviation	0.00007 g	0.00007 g
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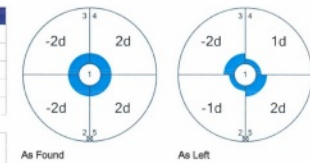
The "d" in the graph represents the readability of the range interval in which the test was performed.
The results of this graph are based upon the absolute values of the differences from the mean value.

Eccentricity

Test Load: 100 g

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

Maximum Deviation	0.0002 g	0.0002 g
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The "d" in the graph represents the readability of the range interval in which the test was performed.

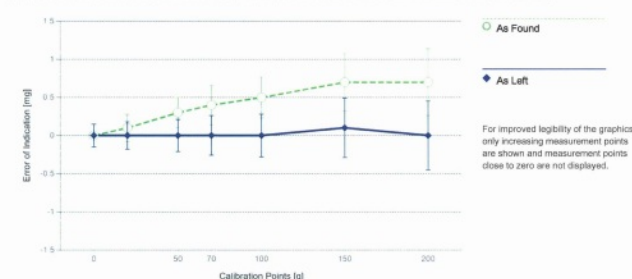
Error of Indication

As Found

	Reference Value	Indication	Error of Indication	Expanded Uncertainty	k
1	0.0000 g	0.0000 g	0.0000 g	0.15 mg	2
2	0.1000 g	0.1001 g	0.0001 g	0.16 mg	2
3	1.0000 g	0.9999 g	-0.0001 g	0.16 mg	2
4	5.0000 g	5.0000 g	0.0000 g	0.16 mg	2
5	10.0000 g	10.0001 g	0.0001 g	0.17 mg	2
6	20.0000 g	20.0001 g	0.0001 g	0.18 mg	2
7	50.0000 g	50.0003 g	0.0003 g	0.20 mg	2
8	70.0001 g	70.0005 g	0.0004 g	0.26 mg	2
9	100.0000 g	100.0005 g	0.0005 g	0.27 mg	2
10	150.0000 g	150.0007 g	0.0007 g	0.38 mg	2
11	200.0001 g	200.0008 g	0.0007 g	0.44 mg	2

As Left

	Reference Value	Indication	Error of Indication	Expanded Uncertainty	k
1	0.0000 g	0.0000 g	0.0000 g	0.15 mg	2
2	0.1000 g	0.1000 g	0.0000 g	0.16 mg	2
3	1.0000 g	0.9999 g	-0.0001 g	0.17 mg	2
4	5.0000 g	5.0000 g	0.0000 g	0.17 mg	2
5	10.0000 g	10.0000 g	0.0000 g	0.18 mg	2
6	20.0000 g	20.0000 g	0.0000 g	0.18 mg	2
7	50.0000 g	50.0000 g	0.0000 g	0.21 mg	2
8	70.0001 g	70.0001 g	0.0000 g	0.26 mg	2
9	100.0000 g	100.0000 g	0.0000 g	0.28 mg	2
10	150.0000 g	150.0001 g	0.0001 g	0.39 mg	2
11	200.0001 g	200.0001 g	0.0000 g	0.45 mg	2



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

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

Test Equipment

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

Weight Set 1: OIML E2

Weight Set No.: W580 Date of Issue: 23-Feb-2022
Certificate Number: C208581631 Calibration Due Date: 14-Aug-2023

Thermo Hygrometer

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

Remarks

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

End of Accredited Section

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

Measurement Uncertainty of the Weighing Instrument in Use

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

Temperature coefficient for the evaluation of the measurement uncertainty in use: $2.5 \cdot 10^{-4} / K$
Temperature range on site for the evaluation of the measurement uncertainty in use: 3 K

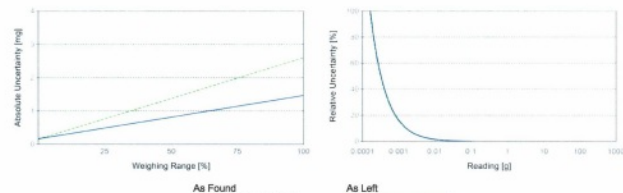
Linearization of Uncertainty Equation

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

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

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

Net Indication	As Found	As Left
0.0220 g	0.16 mg 0.73%	0.16 mg 0.73%
0.2200 g	0.16 mg 0.074%	0.16 mg 0.073%
2.2000 g	0.18 mg 0.0084%	0.17 mg 0.0079%
22.0000 g	0.40 mg 0.0018%	0.29 mg 0.0013%
220.0000 g	2.6 mg 0.0012%	1.5 mg 0.00066%



บริษัท ไทยยูนิค จำกัด THAI UNIQUE CO., LTD.

80-82 ถนนประชาธิปไตย แขวงบางขุนพรหม เขตพระนคร กรุงเทพฯ 10200
80-82 Prachathipatai Rd., Bangkhunphrom, Pranakorn, Bangkok 10200

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

CERTIFICATE OF CALIBRATION GAS CHROMATOGRAPH MASS SPECTROMETER

Certificate No.: SV2205/20385

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

Address: 3 Soi Udomsuk 41 Sukhumvit Rd. Bangchak
Phrakhanong Bangkok Thailand 10260

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

Standard Reference Number: 393065201

Procedure Document Number: 394207000

System Test

PM perform and Diagnostic Test ☒ PASS ☐ FAIL
Air Water Check Test ☒ PASS ☐ FAIL
Tune Test EI ☒ PASS ☐ FAIL
Signal to Noise Test (EI) SCAN ☒ PASS ☐ FAIL
Injection EI Area Precision Test ☒ PASS ☐ FAIL
Injection EI RT Precision Test ☒ PASS ☐ FAIL
User Demonstration ☒ PASS ☐ FAIL

Engineer Somchai P.
Somchai Pohtongkam

Date 19 May 2022

SCION™ Operational Qualification Protocol

For SCION Instrument

Name and Model:

Serial Number:

System ID Number:

Publication no. 394207000

Revision A

November 2011

Contact

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

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



www.scion.com/support.html

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2.0 Qualification Representative and Reviewer Details

2.1 Qualification Representative Details

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

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

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

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

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

Name (Print)	
Title	
Signature	
Initials	
Date	

เอกสารไม่ควบคุม

1.0 Revision History

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

Issue Number	Date	Comments

เอกสารไม่ควบคุม

2.3 Quality Assurance/Control Details

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

Name (Print)	
Title	
Signature	
Initials	
Date	

Name (Print)	
Title	
Signature	
Initials	
Date	

เอกสารไม่ควบคุม


2.2 Reviewer Details

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

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

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

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

Name (Print)	CHANA CHANSRI
Title	ENGINEER
Signature	
Initials	
Date	19 MAY 2022


Name (Print)	
Title	
Signature	
Initials	
Date	

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3.0 Customer Responsibilities

The customer shall ensure that the Preventive Maintenance (PM) or Installation Qualification (IQ) up to point 9.1.1 is completed. A customer representative should be available at all times during the Operational Qualification Protocol.

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

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

เอกสารไม่ควบคุม

4.0 Qualification Guidelines and GMP Documentation

4.1 Qualification Summary

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

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

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

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

4.2 Qualification Guidelines

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

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

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

4.3 Page Numbering of Appendices

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

For example, pages inserted after Appendix C are numbered

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

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

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

Qualification Rep. Initials	<i>Sachin P.</i>	Reviewer Initials		QA/QC Initials	
Date	19 MAY 02	Date		Date	

เอกสารไม่ควบคุม

4.4 Exception Reports

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

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

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

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

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

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

Qualification Rep. Initials	<i>Sachin P.</i>	Reviewer Initials		QA/QC Initials	
Date	19 MAY 02	Date		Date	

เอกสารไม่ควบคุม

4.5 Reference Documents

The following documents are relevant to this Qualification:

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

Qualification Rep. Initials	<i>Sachin P.</i>	Reviewer Initials		QA/QC Initials	
Date	19 MAY 02	Date		Date	

เอกสารไม่ควบคุม

4.6 Required Materials

The following stock solutions are required:

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

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

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

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

4.7 General Guidelines

The following are general cGMP guidelines.

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

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

4.8 Specific Instructions for Documentation

The Reviewer designates specific documentation instructions as follows.

Permanent Ink Color	Blue
Preferred Date Format	19 MAY 22

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

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

เอกสารไม่ควบคุม

เอกสารไม่ควบคุม

4.9 Documentation Corrections

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

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

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

4.10 Marking Procedures Not Applicable

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

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

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

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

4.11 Addendums

The following are reasons to complete an addendum sheet:

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

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

4.12 Addendum Example

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

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

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

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

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5.0 Operational Qualification

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

5.1 OQ Preparation

The following must be done before starting the OQ:

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

Addendum P.M. Protocol

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

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

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

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

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

เอกสารไม่ควบคุม

5.2 System Description

5.2.1 SCION Description

Installation Date: 2015	Principal Operator:	Phone Number:
Company Information		
Company: United Analyst and Engineering		
Name:	Building:	Installation Site: LAB
Address: 3 Soi Wadomsuk 41	Address/Location: Sukhumvit Rd.	
City, State: Bangkok, Prachinburi	City, State: Bangkok	
Zip/Country: Thailand	Zip/Country: 10260	
System Description		
SCION: SQ	Serial Number: GQS 1203F021	
Sales Order Number:	Sales Order Addendum Number:	
GC		
Module Type: Scion 151	Serial Number: BR1203M099	
AutoSampler		
Module Type: dp 8400	Serial Number: BR1203M331	
MS Workstation		
Version: MSWS 8.2.1	Serial Number: 01106-6711-BBQ-4502	
Computer Operating System		
Operating System: Windows 7	Version: Pro	Service Pack: -
Computer		
Make: Dell	Model: optiplex	Serial No.: DNNYHSI
		Hard Drive: 1TB
		Size/RAM: 16GB
Addendum Number(s): 2. System description		

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

เอกสารไม่ควบคุม

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

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

เอกสารไม่ควบคุม

5.3 Data Sheet Specifications

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

Table 5-1 TQ Specification

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

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

‡ CI tests use methane gas as reagent gas.

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

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

Table 5-2 SQ Specification

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

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

เอกสารไม่ควบคุม

5.4 EI Precision Test TQ

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

The following is the required precision for 10 consecutive injections:

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

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

Addendum N/A

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

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

Addendum N/A

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

5.5 EI Precision Test SQ

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

The following is the required precision for 10 consecutive injections:

Injection	Retention Time	Peak Area
1	3.670	70230
2	3.668	80953
3	3.669	78832
4	3.667	75823
5	3.668	79060
6	3.669	81481
7	3.670	81684
8	3.671	72531
9	3.670	79852
10	3.668	81366
% RSD	0.03	4.16

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

Addendum _____

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

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

Addendum N/A

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

Addendum N/A

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5.6 Final Evaluation

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

Qualification Rep. Initials	<u>Sadum P.</u>	Reviewer Initials		QA/QC Initials	
Date	<u>19 MAY 12</u>	Date		Date	

เอกสารไม่ควบคุม

6.0 Protocol Approval

6.1 Protocol Acceptance / Approval by Customer

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

Instrument(s): Scion 451 SQ with CPS400

Serial Number(s): GQS1203F021

Sales Order Number:

Company Name: United Analyst and Engineering Consultant Co. Ltd.

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

Authorized Customer Representative

Name (Print)	
Title	
Signature	
Initials	
Date	

เอกสารไม่ควบคุม

6.2 Operational Qualification Protocol Assignment

This Operational Qualification Protocol document is used for:

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

6.3 Protocol Acceptance / Protocol Approval by Scion

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

Instrument(s): Scion 451 SQ with CPS400

Serial Number(s): GQS1203F21

Sales Order Number:

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

เอกสารไม่ควบคุม

Scion Certified Engineer

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

6.4 Remarks

Appendices

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

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

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

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

เอกสารไม่ควบคุม

เอกสารไม่ควบคุม

A.1 Qualification Representative Details

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

No. of Pages Inserted

This area is intentionally left blank.

เอกสารไม่ควบคุม



Certificate

It is hereby certified that

Mr.Somchai Pohtongkam

Has successfully completed the Service & Application Training for

Scion Chromatography Products

Training Contents were:

Hardware Operation, Software operation, Data analysis and Installation, & Troubleshooting of Model:

SCION GC, GCMS SQ, GCMS TQ

At Techcomp Singapore
By Mr. Michael Mei (Service Manager)

On 11th–15th July 2016


Hans van den Heuvel
Commercial Director
Scion Instruments

Date: 19 July 2016

Cert. No. : TSG-SCIONGC-15011602

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

B.1 Exceptions

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

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

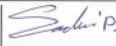
Insert Exception Reports (if any) after this page.

No. of Pages Inserted

N/A

This area is intentionally left blank.

เอกสารไม่ควบคุม

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

เอกสารไม่ควบคุม



บริษัท ไทยยูนิค จำกัด

THAI UNIQUE CO., LTD.

80-82 ถนนประชาธิปไตย แขวงบางขุนพรหม เขตพระนคร กรุงเทพฯ 10200
80-82 Prachathipatai Rd., Bangkhunphrom, Pranakorn, Bangkok 10200
Tel. 0-2629-0191-6, 0-2280-1787, Fax. 0-2280-1788, E-mail : thawan@thaiunique.com, Website : www.thaiunique.com

PREVENTIVE MAINTENANCE PROTOCOL
FOR GAS CHROMATOGRAPH MASS SPECTROMETER

Model & Serial Number: SQ S/N 3Q31203F021
Customer: United Analyst and Engineering Consultant Co., Ltd.
Date: 19 MAY 2022

GC System

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

MS System

- ☒ Check fan motor MS
- ☒ Check circuit board connector and cable
- ☒ Run electronic Diagnostics
- ☒ Check Gas Clean Filter
- ☒ Check for leak system
- ☒ Check turbo pump (system status)
- ☒ Check vacuum oil
- ☒ Check temperature zone
- ☒ Check air/water (mass 18:19; 28)
- ☒ Check HMN
- ☒ Clean Trap (Satum,MS200, 4000 Series) or Ion source (1200L, 300, SQ,TQ Series)
- ☒ Check Electron multiplier (If close to 2,000 Volts, Change the multiplier)
- ☒ Check Cal Gas (FC-43)
- ☒ Sensitivity (EI Scan Mode S/N Ratio with for OFN)
- ☒ Check %RSD of Area (EI Scan Mode , for OFN)
- ☒ Check %RSD of RT (EI Scan Mode , for OFN)

SIGN :

Engineer : Somchai P. Customer : Somchai P.
(Somchai P. Petchsorn) (.....)

Version information

About 451-GC Details

Software Version: 5.09

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

Software Version: 4.05

GC_Application: 27267
LUI_Application: 0

Ok

Version information

About 451-GC Details

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

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

Ok

เอกสารไม่ควบคุม

เอกสารไม่ควบคุม

Version information

About 451-GC Details

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

Ok

Version information

About 451-GC Details

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

Ok

Version information

About 451-GC Details

Autosampler:
CP84xxMBus: 2.0
CP84xxTS1: 1.0
CP84xxTS6: 1.20
CP84xxTray: 1.20
CP84xxTower: 1.20
CP84xxSyringe: 1.21
CP84xxPlunger: 1.20

GC Application build info:

Ok

เอกสารไม่ควบคุม

เอกสารไม่ควบคุม

Version information

About 451-GC Details

CP84xTray: 1.20
 CP84xTower: 1.20
 CP84xSyringe: 1.21
 CP84xPlunger: 1.20

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

Ok

451-GC Setup

Solution Given Zone: Temp Limit 250.0 C; No Coolant
 Zone 1: Front S/SL : Temp Limit 250.0 C; No Coolant
 Zone 2: Mid PTV : Temp Limit 325.0 C; LN2 Coolant
 Zone 3: Not Configured!
 Zone 4: Not Configured!
 Zone 5: Not Configured!
 Zone 6: Not Configured!
 Valve 01 is Unused
 Valve 02 is Unused
 Valve 03 is Unused
 Valve 04 is Unused
 Valve 05 is Unused
 Valve 06 is Unused
 Valve 07 is Unused
 Valves 8-15 not installed; require option board

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

Front Column (Type WCDT) is Configured with L=3000 cm, D=250 microns, He Carrier Gas
 DBS24
 Mid Column (Type WCDT) is Configured with L=3000 cm, D=250 microns, He Carrier Gas
 BR-5ms
 Rear Column not Configured

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

8400 Dual Mode Setup Print OK

เอกสารไม่ควบคุม

MSWS 8.2.1 for TQ MS

BRUKER Daltonics
MS Workstation

System Control Version 8.2.1

Copyright ? 2016, Bruker Service Code: MSWS-01106

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

Installation History:
 MS Workstation
 S/N: 01106-6711-BB0-450C
 Installed by Bruker
 Organization: Microsoft
 Installation date: 14/8/2563 9:27

Validate Installed Files Close

เอกสารไม่ควบคุม

SCION Operational Qualification Protocol

Addendum Procedure: 2. System description Page Number: 5

SCION Operational Qualification Protocol

Addendum Procedure: 3. Test Result Page Number: 30

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

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

เอกสารไม่ควบคุม

เอกสารไม่ควบคุม

SCION MS system hardware test

Test date 5-18-2022

Main module test

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

CIDV module test

5-18-2022

vent valve can only be tested when vented
pressure sensor and pneumatics not tested in single quad system
Passed -> CIDV module test

env module test

5-18-2022

Passed -> env module test

CIG Tests only performed on a CI system

EI module test

5-18-2022

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

CI Tests only performed on a CI system

Det module test

5-18-2022

Detector module test

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

5-18-2022

Passed -> QB module test

Q1 module test

5-18-2022

Passed -> Q1 module test

เอกสารไม่ควบคุม

เอกสารไม่ควบคุม

Main module test

5-18-2022

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

CIDV module test

5-18-2022

Passed -> CIDV Power supply test
Passed -> Turbo control test
vent valve can only be tested when vented
pressure sensor and pneumatics not tested in single quad system

Passed -> cidv module test

เอกสารไม่ควบคุม

เอกสารไม่ควบคุม

env module test

5-18-2022

Passed -> Power supply test
Passed -> temp sensor test
Passed -> Valve current test
Passed -> env fan test
Passed -> heater current test

Passed -> env module test

EI module test

5-18-2022

Passed -> EI Power supply test
Passed -> EI High voltage DC rail test
Passed -> EI Lens 1 test
Passed -> Lens 2 test
Passed -> Repeller test
Passed -> Electron energy test
Passed -> AMP test
Passed -> EI Filament test
Check maximum heater current and heater wattage
Max Heater Current = 1.27 Wattage = 29.46
Source heater wattage measures OK
Passed -> EI Heater test
Passed -> EI Source test

เอกสารไม่ควบคุม

เอกสารไม่ควบคุม

Det module test

5-18-2022

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

Q0 module test

5-18-2022

Passed -> Power supply test
Passed -> Q0 High voltage DC rail test
Passed -> Q0 DAC test
Passed -> Quad offset test
Passed -> RF detector test
Passed -> RF modulator test
Passed -> RF current test
Passed -> heater current test

Passed -> Q0 module test

เอกสารไม่ควบคุม

เอกสารไม่ควบคุม

Sample ID:	ofn1pg	Operator:	TU
Instrument ID:	Braker GC/MS #1	Last Calibration:	26/11/2557 15:55
Measurement Type:	Area	Calibration Type:	External Standard
Acquisition Date:	19/5/2565 12:23	Data File:	...022\oq\ofn1pg008.xmls
Calculation Date:	19/5/2565 12:28	Method:	...ds\pm2017\fs_ptv.mth
Sample Type:	Analysis		
Inj. Sample Notes:	None		

Compound Information

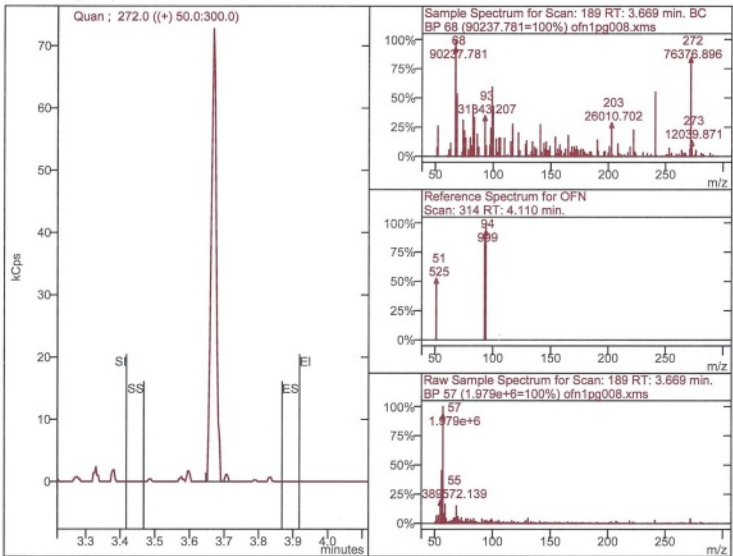
Peak Name:	OFN	Compound Number:	CAS Number:	Identified
Result Index:	1	1	None	

Identification

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

Integration and Quantitation

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



เอกสารไม่ควบคุม

Sample ID:	ofn1pg	Operator:	TU
Instrument ID:	Braker GC/MS #1	Last Calibration:	26/11/2557 15:55
Measurement Type:	Area	Calibration Type:	External Standard
Acquisition Date:	19/5/2565 12:36	Data File:	...022\oq\ofn1pg009.xmls
Calculation Date:	19/5/2565 12:41	Method:	...ds\pm2017\fs_ptv.mth
Sample Type:	Analysis		
Inj. Sample Notes:	None		

Compound Information

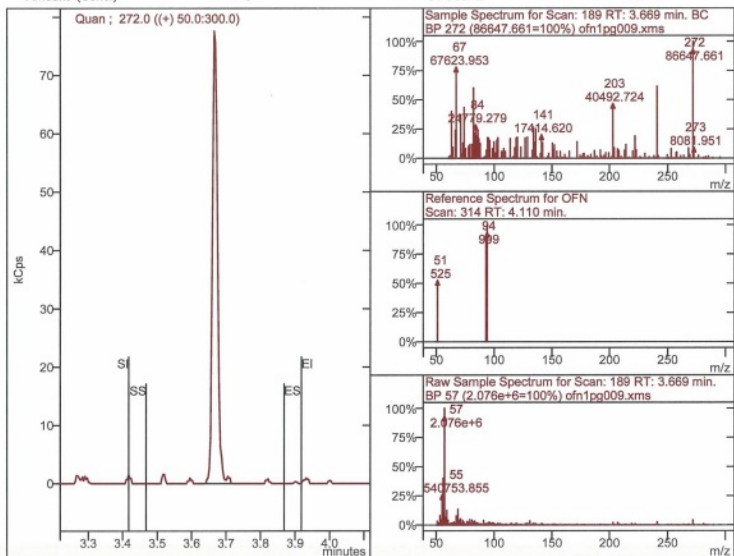
Peak Name:	OFN	Compound Number:	CAS Number:	Identified
Result Index:	1	1	None	

Identification

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

Integration and Quantitation

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



เอกสารไม่ควบคุม

Sample ID:	ofn1pg	Operator:	TU
Instrument ID:	Braker GC/MS #1	Last Calibration:	26/11/2557 15:55
Measurement Type:	Area	Calibration Type:	External Standard
Acquisition Date:	19/5/2565 12:49	Data File:	...022\oq\ofn1pg010.xmls
Calculation Date:	19/5/2565 12:55	Method:	...ds\pm2017\fs_ptv.mth
Sample Type:	Analysis		
Inj. Sample Notes:	None		

Compound Information

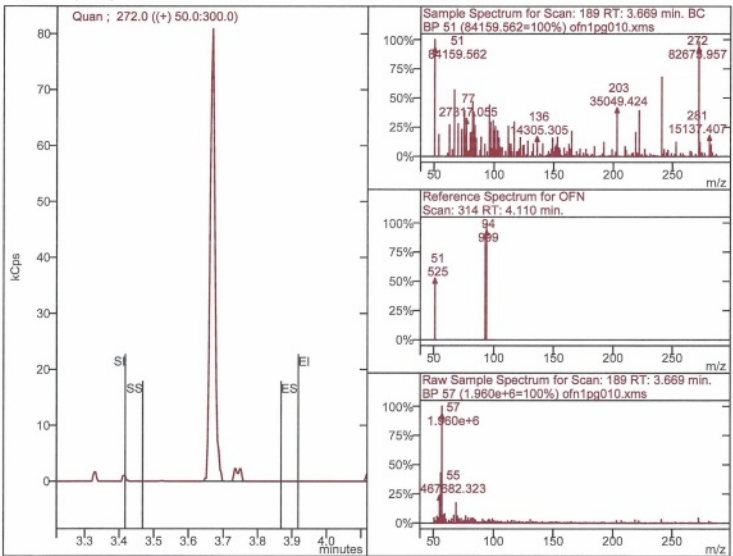
Peak Name:	OFN	Compound Number:	CAS Number:	Identified
Result Index:	1	1	None	

Identification

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

Integration and Quantitation

Parameter	Specification	Actual	Status
Quan Ions	272.0		
Calibration Equation	Average		
Area	>=10	78832	Pass
Height		80882	
Amount (Conc.)	>= 0	79 Counts	Pass



เอกสารไม่ควบคุม

Sample ID:	ofn1pg	Operator:	TU
Instrument ID:	Braker GC/MS #1	Last Calibration:	26/11/2557 15:55
Measurement Type:	Area	Calibration Type:	External Standard
Acquisition Date:	19/5/2565 13:03	Data File:	...022\oq\ofn1pg011.xmls
Calculation Date:	19/5/2565 13:08	Method:	...ds\pm2017\fs_ptv.mth
Sample Type:	Analysis		
Inj. Sample Notes:	None		

Compound Information

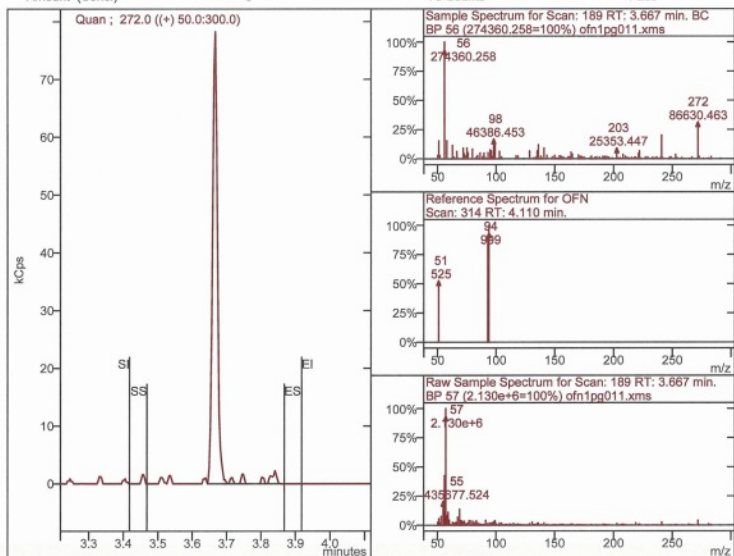
Peak Name:	OFN	Compound Number:	CAS Number:	Identified
Result Index:	1	1	None	

Identification

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

Integration and Quantitation

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



เอกสารไม่ควบคุม

Sample ID:	ofn1pg	Operator:	TU
Instrument ID:	Brucker GC/MS #1	Last Calibration:	26/11/2557 15:55
Measurement Type:	Area	Calibration Type:	External Standard
Acquisition Date:	19/5/2565 13:16	Data File:	...022loqofn1pg012.xmls
Calculation Date:	19/5/2565 13:21	Method:	...ds\pm2017fs_ptv.mth
Sample Type:	Analysis		
Inj. Sample Notes:	None		

Compound Information

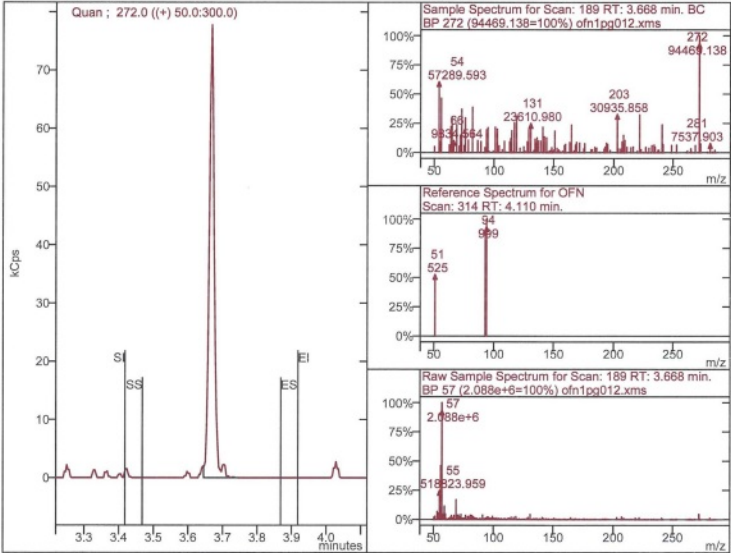
Peak Name:	OFN	Compound Number:	1	CAS Number:	None	Identified
Result Index:	1					

Identification

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

Integration and Quantitation

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



เอกสารไม่ควบคุม

Sample ID:	ofn1pg	Operator:	TU
Instrument ID:	Brucker GC/MS #1	Last Calibration:	26/11/2557 15:55
Measurement Type:	Area	Calibration Type:	External Standard
Acquisition Date:	19/5/2565 13:29	Data File:	...022loqofn1pg013.xmls
Calculation Date:	19/5/2565 13:34	Method:	...ds\pm2017fs_ptv.mth
Sample Type:	Analysis		
Inj. Sample Notes:	None		

Compound Information

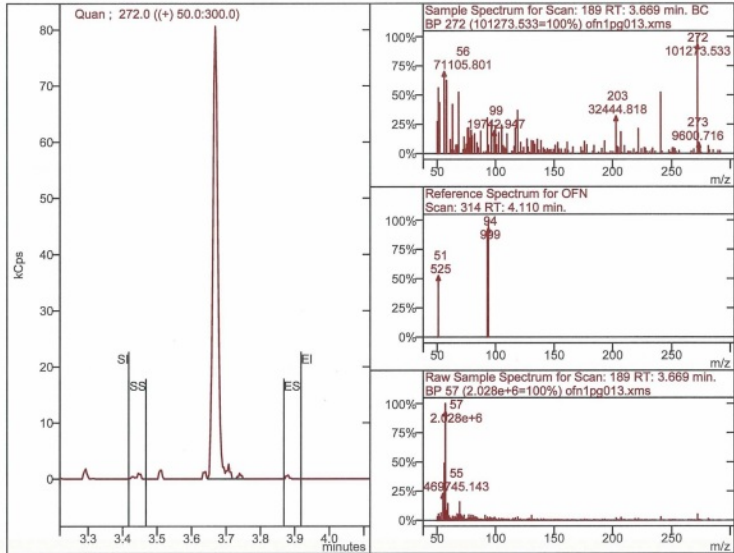
Peak Name:	OFN	Compound Number:	1	CAS Number:	None	Identified
Result Index:	1					

Identification

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

Integration and Quantitation

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



เอกสารไม่ควบคุม

Sample ID:	ofn1pg	Operator:	TU
Instrument ID:	Brucker GC/MS #1	Last Calibration:	26/11/2557 15:55
Measurement Type:	Area	Calibration Type:	External Standard
Acquisition Date:	19/5/2565 13:56	Data File:	...022loqofn1pg014.xmls
Calculation Date:	19/5/2565 14:06	Method:	...ds\pm2017fs_ptv.mth
Sample Type:	Analysis		
Inj. Sample Notes:	None		

Compound Information

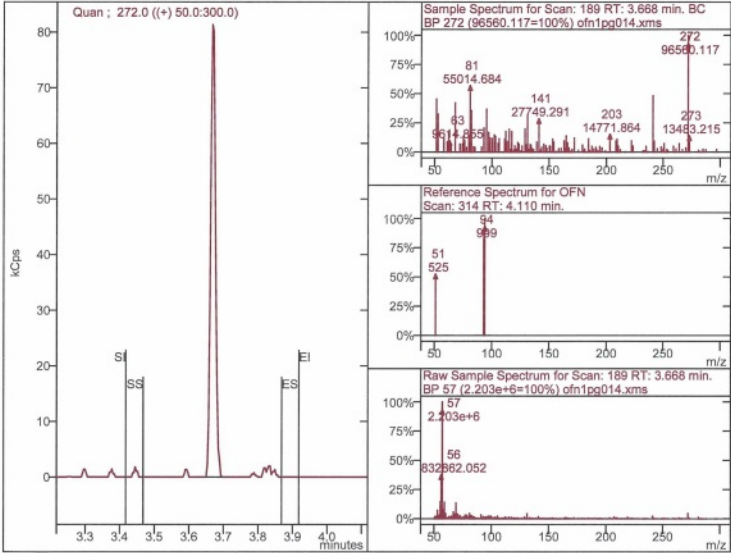
Peak Name:	OFN	Compound Number:	1	CAS Number:	None	Identified
Result Index:	1					

Identification

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

Integration and Quantitation

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



เอกสารไม่ควบคุม

Sample ID:	ofn1pg	Operator:	TU
Instrument ID:	Brucker GC/MS #1	Last Calibration:	26/11/2557 15:55
Measurement Type:	Area	Calibration Type:	External Standard
Acquisition Date:	19/5/2565 14:09	Data File:	...022loqofn1pg015.xmls
Calculation Date:	19/5/2565 14:14	Method:	...ds\pm2017fs_ptv.mth
Sample Type:	Analysis		
Inj. Sample Notes:	None		

Compound Information

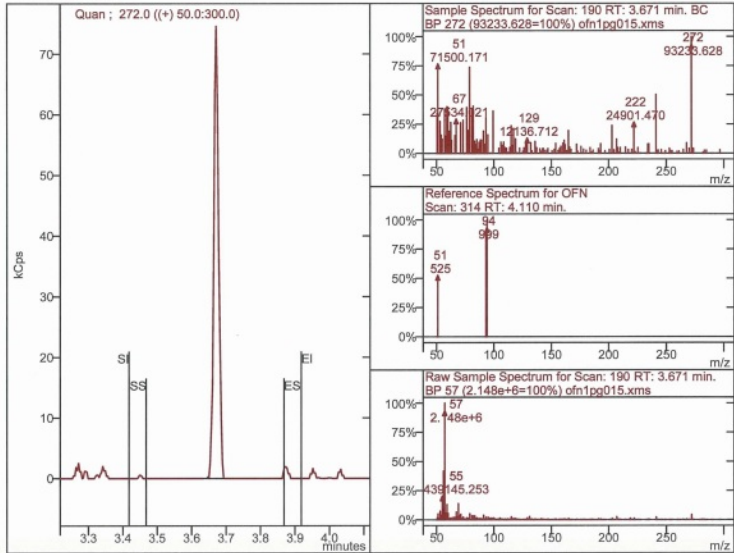
Peak Name:	OFN	Compound Number:	1	CAS Number:	None	Identified
Result Index:	1					

Identification

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

Integration and Quantitation

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



เอกสารไม่ควบคุม

Sample ID:	ofn1pg	Operator:	TU
Instrument ID:	Brucker GC/MS #1	Last Calibration:	26/11/2557 15:55
Measurement Type:	Area	Calibration Type:	External Standard
Acquisition Date:	19/5/2565 14:22	Data File:	...022\ofn1pg016.xms
Calculation Date:	19/5/2565 14:27	Method:	...ds\pm2017fs_ptv.mth
Sample Type:	Analysis		
Inj. Sample Notes:	None		

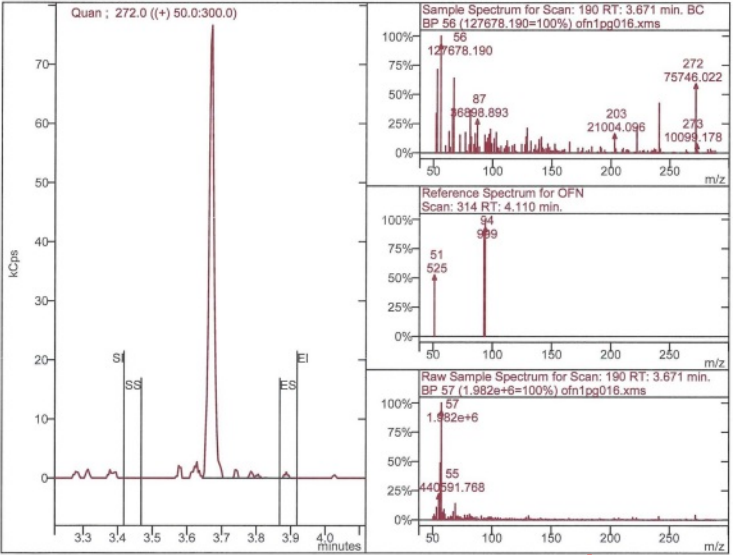
Compound Information

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

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

Integration and Quantitation

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



เอกสารไม่ควบคุม

Sample ID:	ofn1pg	Operator:	TU
Instrument ID:	Brucker GC/MS #1	Last Calibration:	26/11/2557 15:55
Measurement Type:	Area	Calibration Type:	External Standard
Acquisition Date:	19/5/2565 14:37	Data File:	...022\ofn1pg017.xms
Calculation Date:	19/5/2565 14:42	Method:	...ds\pm2017fs_ptv.mth
Sample Type:	Analysis		
Inj. Sample Notes:	None		

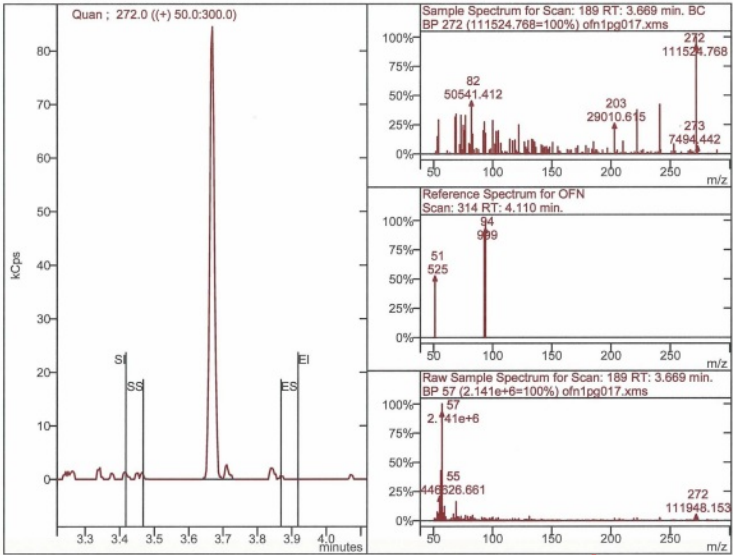
Compound Information

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

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

Integration and Quantitation

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

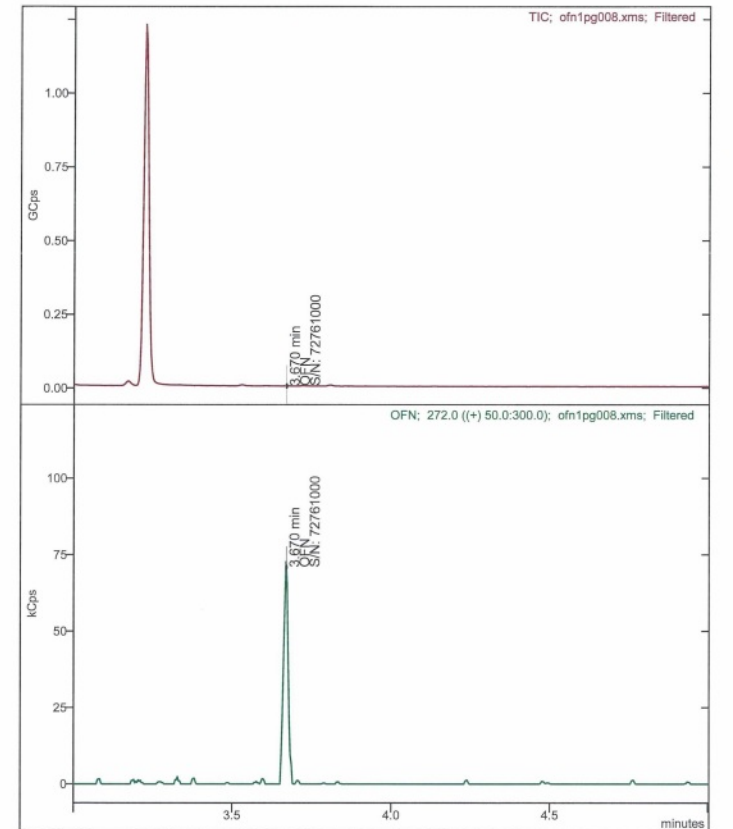


เอกสารไม่ควบคุม

Chromatogram Plots

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

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

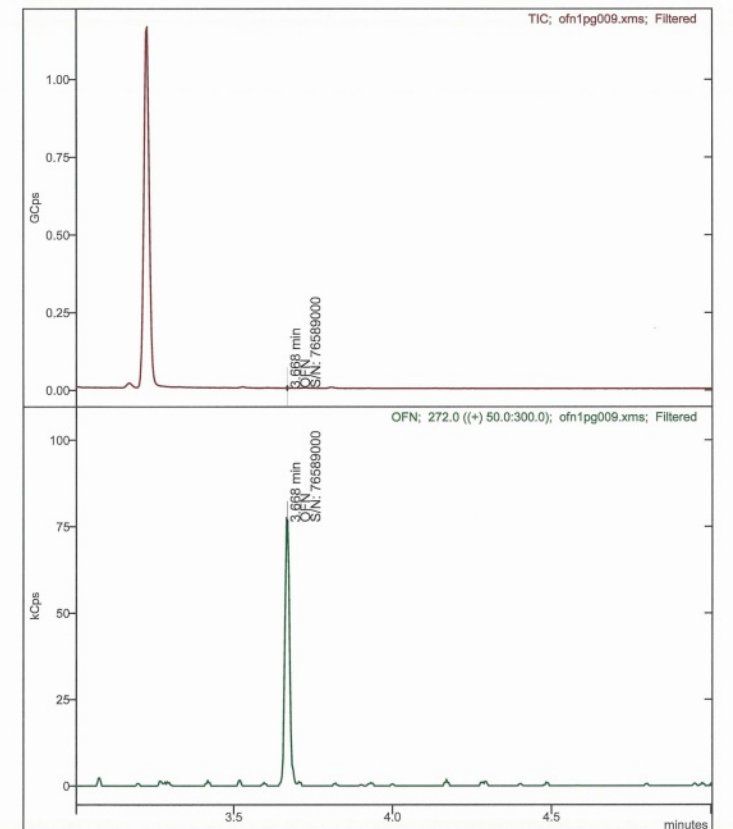


เอกสารไม่ควบคุม

Chromatogram Plots

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

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



เอกสารไม่ควบคุม

Chromatogram Plots

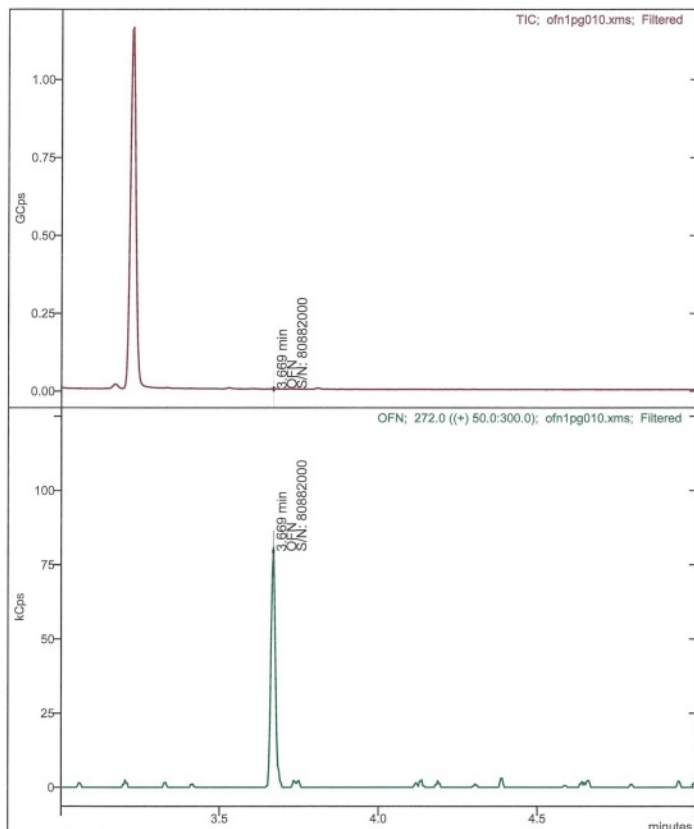
File: e:\tu\pm2022\loq\ofn1pg010.xms

Sample: ofn1pg

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

Operator: TU

Date: 19/5/2565 12:49



เอกสารไม่ควบคุม

Chromatogram Plots

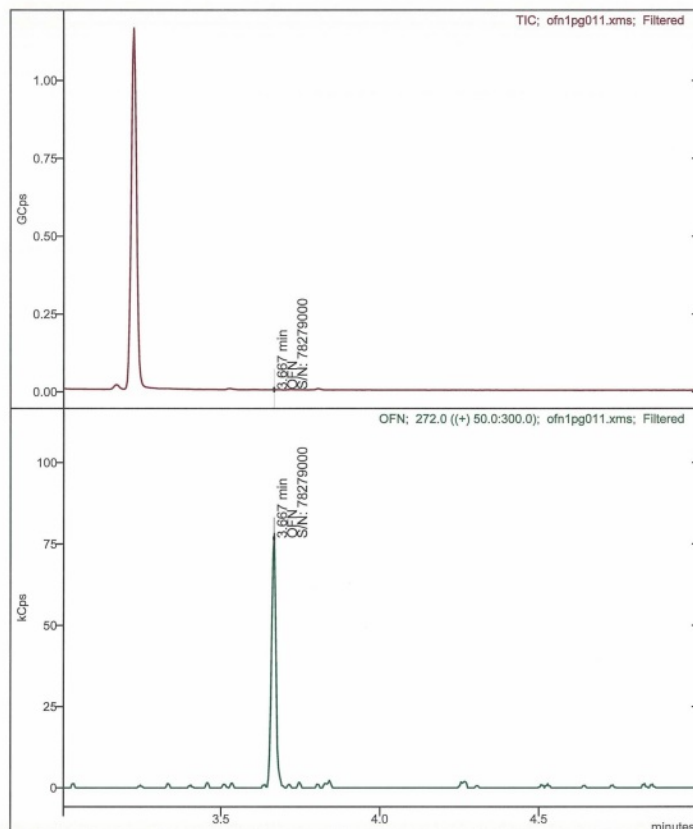
File: e:\tu\pm2022\loq\ofn1pg011.xms

Sample: ofn1pg

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

Operator: TU

Date: 19/5/2565 13:03



เอกสารไม่ควบคุม

Chromatogram Plots

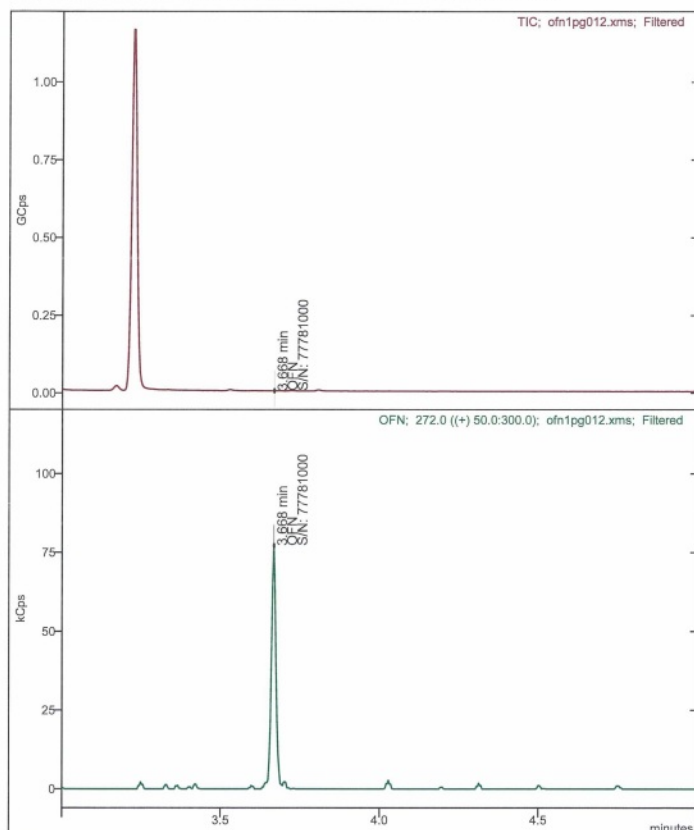
File: e:\tu\pm2022\loq\ofn1pg012.xms

Sample: ofn1pg

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

Operator: TU

Date: 19/5/2565 13:16



เอกสารไม่ควบคุม

Chromatogram Plots

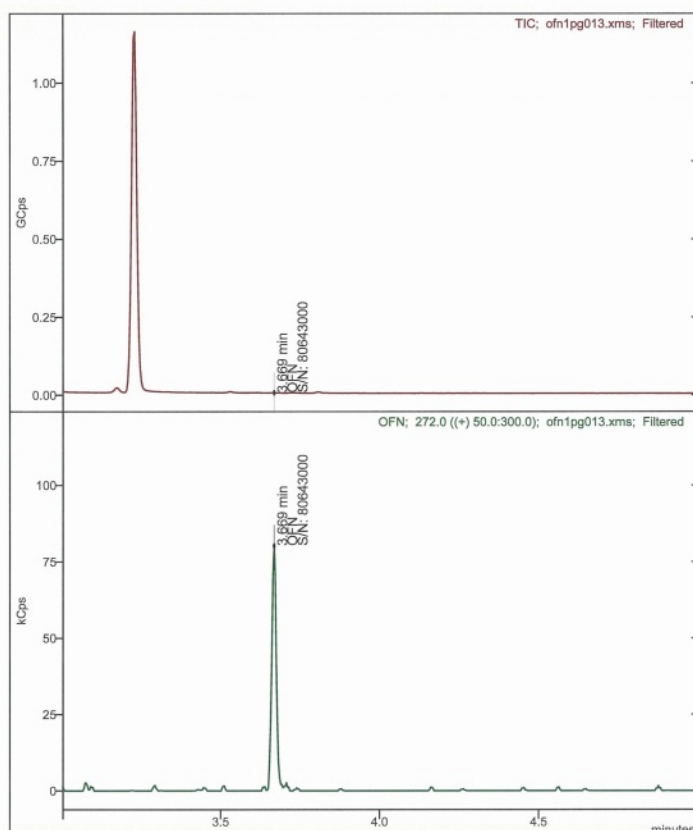
File: e:\tu\pm2022\loq\ofn1pg013.xms

Sample: ofn1pg

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

Operator: TU

Date: 19/5/2565 13:29

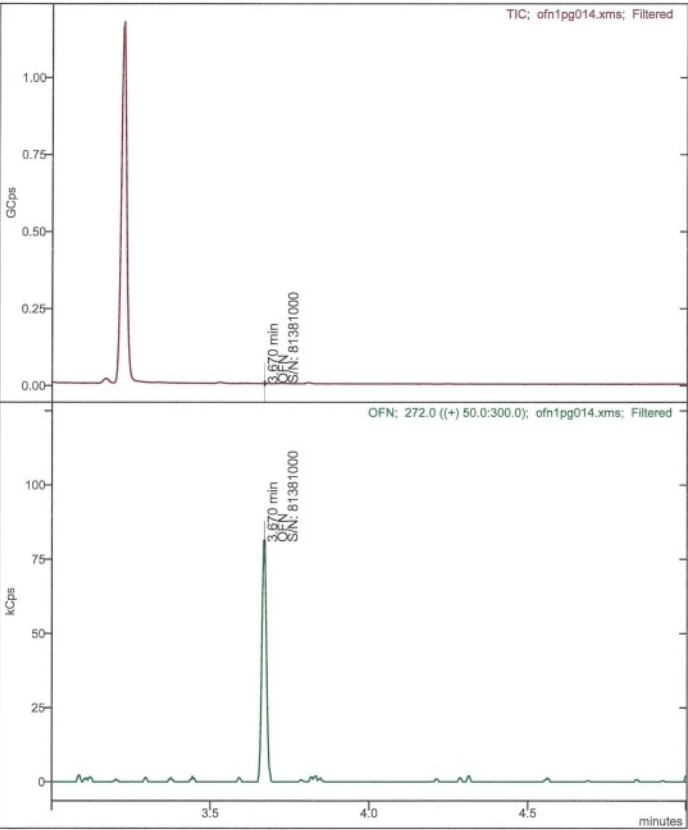


เอกสารไม่ควบคุม

Chromatogram Plots

File: e:\tu\pm2022\ioq\ofn1pg014.xms
Sample: ofn1pg
Scan Range: 1 - 565 Time Range: 3.00 - 5.00 min.

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

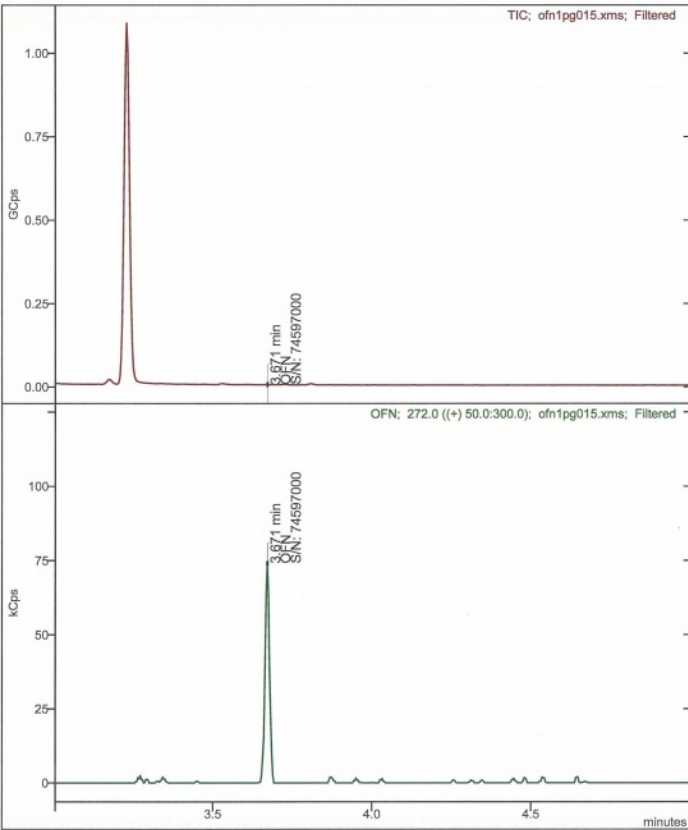


เอกสารไม่ควบคุม

Chromatogram Plots

File: e:\tu\pm2022\ioq\ofn1pg015.xms
Sample: ofn1pg
Scan Range: 1 - 566 Time Range: 3.00 - 5.00 min.

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

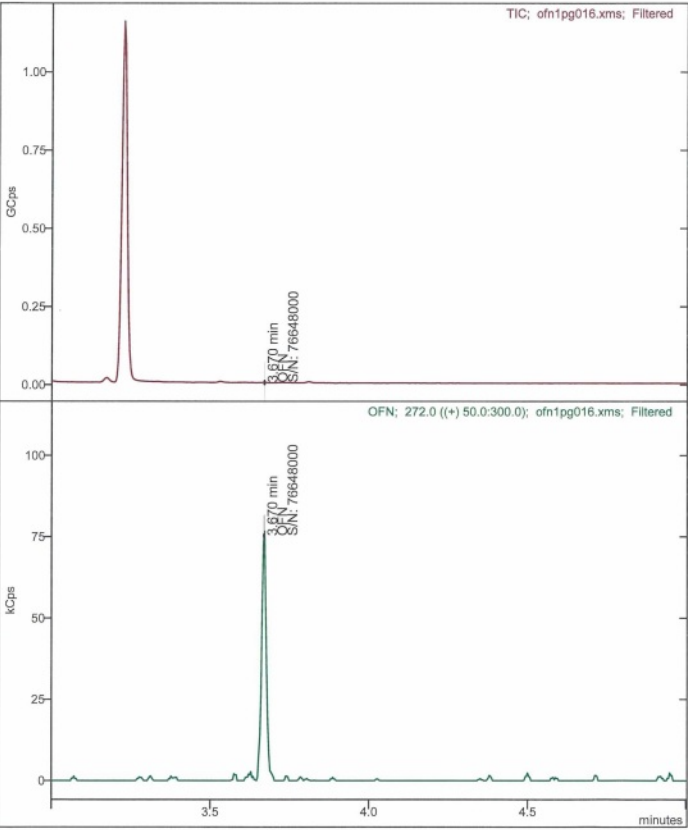


เอกสารไม่ควบคุม

Chromatogram Plots

File: e:\tu\pm2022\ioq\ofn1pg016.xms
Sample: ofn1pg
Scan Range: 1 - 566 Time Range: 3.00 - 5.00 min.

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

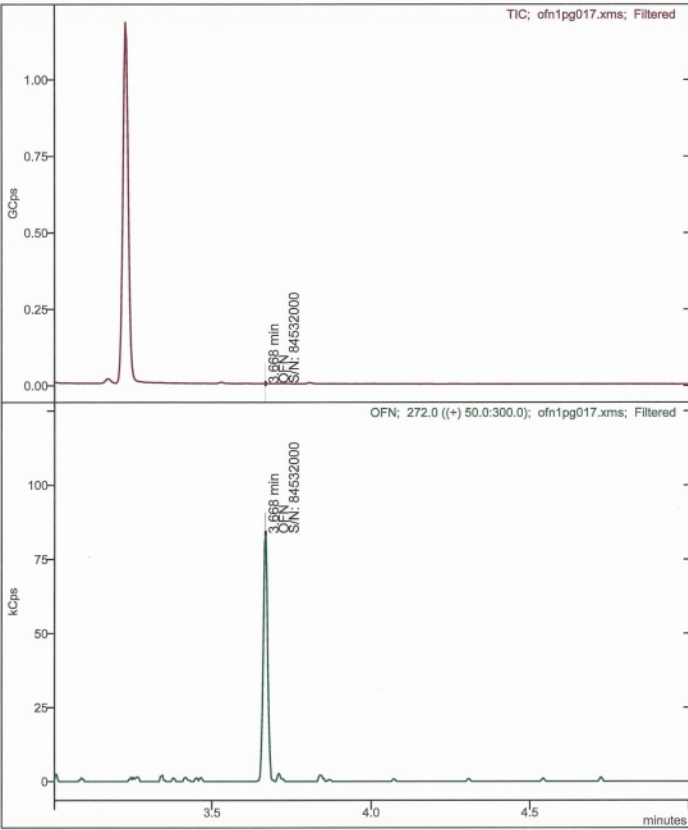


เอกสารไม่ควบคุม

Chromatogram Plots

File: e:\tu\pm2022\ioq\ofn1pg017.xms
Sample: ofn1pg
Scan Range: 1 - 565 Time Range: 3.00 - 5.00 min.

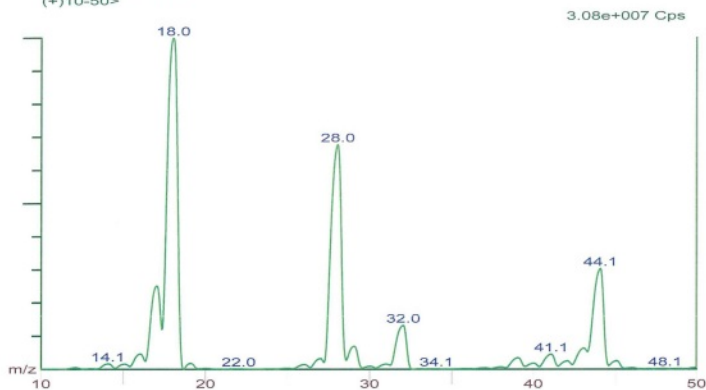
Operator: TU
Date: 19/5/2565 14:37



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

Date:19 MAY 22 9:17 AM



28 absolute size (cps)

- Normal < 9.0e7
- Measured 2.12e7

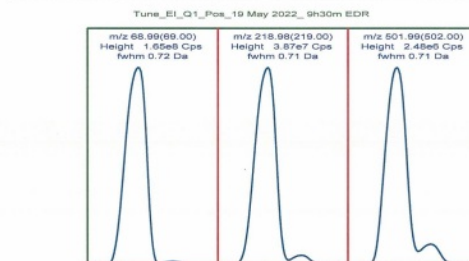
28/32 Ratio

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

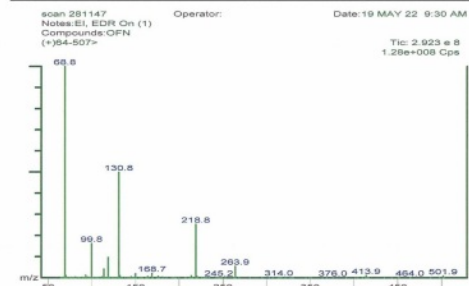
28/18 Ratio

- Normal <2.0:1
- Measured 0.7:1

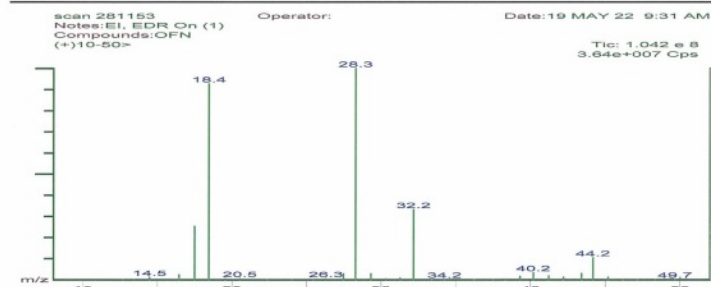
เอกสารไม่ควบคุม



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



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



เอกสารไม่ควบคุม

SCION Operational Qualification Protocol

Addendum Procedure: A. Certificate Page Number: _____

SCION Operational Qualification Protocol

Operational Qualification Protocol Certification

for

SCION

with the serial number

GQS1203F21

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

Scion Certified Engineer

SOMCHAI ROTHONGSKAM

Name (please print)

Somchai P. 19 MAY 22

Signature

Date

Authorized Customer Representative

Name / Function (please print)

Signature

Date

Customer Address

United Analyst and Engineering Consultant Co., Ltd.

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

เอกสารไม่ควบคุม

เอกสารไม่ควบคุม

Agilent 5110 and 5100 ICP-OES Preventive Maintenance Checklist

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

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

Customer Information

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

Service Engineer's Responsibilities

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

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Agilent 5110 and 5100 ICP-OES Preventive Maintenance Checklist

System Information

Instrument system name and ID	ICP-OES 5100 VDV
Instrument system site and location	UAE Consultant
List system component product numbers	List the serial numbers of each component
1. 83015A	1. MY 19030001
2.	2.
3.	3.
4.	4.
5.	5.
6.	6.
7.	7.
8.	8.
9.	9.
10.	10.

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

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Agilent 5110 and 5100 ICP-OES Preventive Maintenance Checklist

General Preparation

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

Inspect and clean the system

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

Agilent Water Recirculator

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

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Agilent 5110 and 5100 ICP-OES Preventive Maintenance Checklist

SPS 3 Auto Sampler

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

SPS 4 Auto Sampler

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

AVS 4, 6, 7

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

Instrument Adjustment

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

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

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

Instrument Performance Test Results Table

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

	Pre PM Sensitivity Check		Post PM Sensitivity Check	
	Radial	Axial *	Radial	Axial*
Zn 213.857 nm SRBR	4092.3	7954.1	4192.8	7920.7
Mn 257.610 nm SRBR	11415.2	30894.7	11493.6	34460.9
Al 396.152 nm SBR	7.8	15.7	8.7	13.5
K 766.491 nm SBR	5.3	39.9	5.7	44.6

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

Instrument Test Results Table

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

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

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เอกสารไม่ควบคุม

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

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

Measurement	Standby Mode	Plasma On
Mains Voltage	115.717 VAC	194.510 VAC
Mains Current	0.219 A	3.233 A
Instrument Temperature	23.4 °C	23.5 °C
RF Air Flow (sensor speed)	14.0 Hz	19.0 Hz
Plasma Exhaust Temperature	No measurement	65.0 °C
Water Flow Oscillator	No measurement	2.03 L/min
Water Flow Detector	0.00 L/min	1.37 L/min
Water Inlet Temperature	19.2 °C	12.8 °C
Polychromator Temperature	35.0 °C	35.0 °C
CCD Temperature	26.9 °C	-39.7 °C
Thermal Stabilizer	35.0 °C	35.0 °C
Argon Supply Pressure	614.25 kPa	629.97 kPa
Purge Gas Supply Pressure*1	641.74 kPa	654.67 kPa
Option Gas Supply Pressure*1	- kPa	- kPa
Nebulizer Flow	No measurement	0.90 L/min
Nebulizer Back Pressure	No measurement	163.05 kPa
Plasma Gas Flow	No measurement	15.00 L/min
Auxiliary Gas Flow	No measurement	1.20 L/min
RF Power	No measurement	1207.1 W
RF Supply Current	No measurement	3.233 A
RF Supply Voltage	No measurement	194.510 V

*1 If option installed

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

Part description	Part Number	Product /Model # where used	Quantity Consumed
Axial Pre-Optic Window	G8010-68014	G8010A, G8011A, G8014A/G8015A	1
Radial Pre-Optic Window	G8010-68015	All	1
Polyclear Plus Cooling Fluid	G3292-80012	Agilent Water Recirculator	-
Purge Gas Filter	G8010-60136	All	1
Air inlet filter	G8000-68002	All	1
High Capacity Air Filter	G8010-60189	Optional	-
Rotor seal for 6-7 port valve for AVS6/7	G8494-60002	G8494A/G8495	-
Rotor seal for 4 port valve for AVS4	G8493-60002	G8493A	-
Rinse solution to rinse station 2.5mm id x 1m	G8410-80123	SPS 4	-
Barb connector 2.5mm-1.5mm ID	G8410-80124	SPS 4	-
PVC waste tubing, 8mm od x 5mm id, 2m	G8410-80122	SPS 4	-
Additional Parts may be required from engineers stock:			
X axis drive belt	5410047500	SPS 3	-
Z axis drive belt	5410047400	SPS 3	-
Peristaltic pump tubing, PVC SolvaFlex, 3 bridged,	3710049000	SPS 4	-

Restore system

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

Leave system in an idle state: on and purging.

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

Service Review

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

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

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

Service Engineer Comments (optional)

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

Other Important Customer Web Links

How to get information on your product:

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

Service Completion

Service request number 600439717 Date service completed 09/12/21

Agilent signature Nelson L. Customer signature Aphorn Onkong

Document part number: G8014-90075

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เอกสารไม่ควบคุม

Report Summary	
Instrument Model	Agilent 5100/5110 VDV ICP-OES
Instrument ID	G8011A/G8015A
Instrument Serial Number	MY18030001
Software Version	7.3.1.9507
Firmware Version	3442
Tested By	Nukoon L.
Test Completed On	12/9/2021 9:14:59 AM
Result Summary	
Subsystem Communications Test	Skipped
Air Flow Test	Skipped
Water Flow Test	Skipped
Gas Flows Test	Skipped
RF Generator Test	Skipped
Camera Test	Skipped
Optics Test	Skipped
Advanced Valve System Test	Skipped
Resolution Test	Pass
Sensitivity Test	Pass
Precision Test	Pass

เอกสารไม่ควบคุม

Resolution Test			Pass
Element Wavelength	Specification	Width	
N (174.213 nm)	≤ 9.40	7.27	
As (188.980 nm)	≤ 8.20	8.23	
C (193.027 nm)	≤ 11.50	8.26	
Mo (202.032 nm)	≤ 8.20	6.42	
Cr (206.158 nm)	≤ 13.40	9.27	
Zn (213.857 nm)	≤ 8.70	6.77	
Pb (220.353 nm)	≤ 9.50	7.12	
Co (228.615 nm)	≤ 17.20	11.88	
Ba (230.424 nm)	≤ 9.40	7.36	
Mn (257.610 nm)	≤ 13.30	9.52	
Mn (260.568 nm)	≤ 20.30	14.30	
Cr (267.716 nm)	≤ 11.00	7.99	
Cu (324.754 nm)	≤ 25.00	19.06	
Cu (327.395 nm)	≤ 14.20	11.32	
Sr (338.071 nm)	≤ 33.50	24.39	
Ba (455.403 nm)	≤ 44.00	33.86	
Sr (460.733 nm)	≤ 36.00	17.38	
Ba (493.408 nm)	≤ 36.00	25.53	
Ba (614.171 nm)	≤ 42.00	24.99	
Ar (675.283 nm)	≤ 74.00	59.49	
K (766.491 nm)	≤ 80.00	65.27	

เอกสารไม่ควบคุม

Sensitivity Test			Pass		
Radial					
Element Wavelength	Specification	Method	Ratio	Standard	Blank
As (188.980 nm)	≥ 46.0	SRBR	167.2	1131.3	42.4
Se (196.026 nm)	≥ 41.0	SRBR	119.1	1177.1	84.2
Zn (213.857 nm)	≥ 1421.0	SRBR	4082.3	49908.2	148.6
Pb (220.353 nm)	≥ 46.0	SRBR	191.1	2682.8	172.6
Mn (257.610 nm)	≥ 3518.0	SRBR	11415.2	265002.2	536.8
Al (396.152 nm)	≥ 3.4	SBR	7.8	49838.0	5676.5
Ba (493.408 nm)	≥ 34.0	SBR	116.1	1999041.4	17066.5
K (766.491 nm)	≥ 1.8	SBR	5.3	101078.4	16104.6
Axial					
Element Wavelength	Specification	Method	Ratio	Standard	Blank
As (188.980 nm)	≥ 208.0	SRBR	252.9	3214.2	147.0
Se (196.026 nm)	≥ 159.0	SRBR	216.2	3839.7	272.2
Zn (206.200 nm)	≥ 234.0	SRBR	1203.3	14046.1	133.7
Zn (213.857 nm)	≥ 1743.0	SRBR	7856.1	171323.1	472.9
Cd (214.439 nm)	≥ 4227.0	SRBR	7054.9	129539.3	335.4
Pb (220.353 nm)	≥ 320.0	SRBR	531.7	13218.2	566.2
Mn (257.610 nm)	≥ 10625.0	SRBR	30884.7	1314844.0	1807.4
Cr (267.716 nm)	≥ 1048.0	SRBR	4442.1	174420.3	1515.1
Cu (324.754 nm)	≥ 19.0	SBR	50.7	374603.6	7249.0
Al (396.152 nm)	≥ 6.0	SBR	15.7	279915.3	16790.4
Ba (493.408 nm)	≥ 60.0	SBR	209.7	10899956.6	51728.3
K (766.491 nm)	≥ 24.0	SBR	38.9	1983197.5	49746.6

เอกสารไม่ควบคุม

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

เอกสารไม่ควบคุม

Report Summary

Instrument Model	Agilent 5100/5110 VDV ICP-OES
Instrument ID	G8011A/G8015A
Instrument Serial Number	MY18030001
Software Version	7.3.1.9507
Firmware Version	3442
Tested By	Nukoon L.
Test Completed On	12/9/2021 12:55:49 PM

Result Summary

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

Optics Test

Pass

	Radial	Axial
Intensity	5296135	5755042
Wavelength	737.212	737.212

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เอกสารไม่ควบคุม

Resolution Test

Pass

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

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Sensitivity Test

Pass

Radial	Element Wavelength	Specification	Method	Ratio	Standard	Blank
	As (188.980 nm)	≥ 46.0	SRBR	154.8	1242.3	58.5
	Se (196.026 nm)	≥ 41.0	SRBR	117.4	1259.6	97.9
	Zn (213.857 nm)	≥ 1421.0	SRBR	4192.8	52402.6	155.3
	Pb (220.353 nm)	≥ 46.0	SRBR	196.4	2814.2	179.9
	Mn (257.610 nm)	≥ 3518.0	SRBR	11993.6	281210.1	547.6
	Al (396.152 nm)	≥ 3.4	SBR	8.7	55103.6	5662.9
	Ba (493.408 nm)	≥ 34.0	SBR	125.4	2152916.9	17032.2
	K (766.491 nm)	≥ 1.8	SBR	5.7	107906.7	16079.8

Axial

Element Wavelength	Specification	Method	Ratio	Standard	Blank
As (188.980 nm)	≥ 208.0	SRBR	297.5	4054.8	170.4
Se (196.026 nm)	≥ 159.0	SRBR	260.2	4794.9	298.5
Zn (206.200 nm)	≥ 234.0	SRBR	1305.9	16162.3	150.3
Zn (213.857 nm)	≥ 1743.0	SRBR	8920.7	200915.6	504.7
Cd (214.439 nm)	≥ 4227.0	SRBR	7958.3	149327.5	350.4
Pb (220.353 nm)	≥ 320.0	SRBR	606.7	15244.5	584.0
Mn (257.610 nm)	≥ 10625.0	SRBR	34460.9	1493092.8	1872.5
Cr (267.716 nm)	≥ 1048.0	SRBR	5018.6	198000.6	1532.6
Cu (324.754 nm)	≥ 19.0	SBR	57.5	423683.7	7248.6
Al (396.152 nm)	≥ 6.0	SBR	18.5	320004.9	16441.4
Ba (493.408 nm)	≥ 60.0	SBR	233.3	11882915.4	50714.5
K (766.491 nm)	≥ 24.0	SBR	44.6	2218974.4	48657.9

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Precision Test

Pass

Radial	Element Wavelength	Specification	Measured Value % RSD
	As (188.980 nm)	≤ 2.60	1.38
	Se (196.026 nm)	≤ 2.60	0.91
	Zn (213.857 nm)	≤ 1.50	0.38
	Pb (220.353 nm)	≤ 2.60	0.44
	Mn (257.610 nm)	≤ 1.50	0.43
	Al (396.152 nm)	≤ 1.50	0.38
	Ba (493.408 nm)	≤ 1.50	0.66
	K (766.491 nm)	≤ 1.50	0.36

Axial

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

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

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

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เอกสารไม่ควบคุม



Agilent 55 240 280 Series Atomic Absorption Spectroscopy Systems

Preventive Maintenance Checklist

Agilent Preventive Maintenance provides factory recommended service for your analytical systems to assure reliable operation and the accuracy of your results.

Delivered by highly trained and certified service engineers using genuine Agilent parts and supplies, Agilent Preventive Maintenance provides everything you need to reduce unplanned downtime and keep your systems operating at their peak. This checklist will be completed at the end of the service and provided to you as a record of the installation.

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

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

Introduction

Customer Information

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



Instrument Preventive Maintenance Checklist

Important Customer Web Links

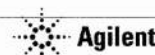
- For more information about Agilent Technologies services, please visit our website using the following URL: <http://www.agilent.com/en-us/products/crosslab-instrument-services/service-repair>
- To access Agilent University, visit <http://www.agilent.com/crosslab/university/> to learn about training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

Service Engineer's Responsibilities

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



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Instrument Maintenance

System Information

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

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

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

Preparation, Safe operation and Initial performance checks

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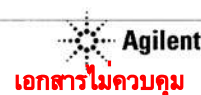
- ☐ Agilent AA safe operation flow chart inspections (to determine if the PM can be performed).

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

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

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Preventive Maintenance Procedures

FLAME SYSTEM section

- ☐ Section not applicable

Electronic components

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

Mechanical components

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

Optics components

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

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Sample Introduction and Atomization

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

Gas handling components and safety interlocks

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

Analytical performance for Flame systems

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

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FURNACE SYSTEM section

☒ Section not applicable**Electronic components**

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

Mechanical components

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

Optics components

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

Gas handling, water system and workhead component checks

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

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- ☐ Tube
- ☐ Electrodes
- ☐ Shroud

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

Analytical performance for Furnace systems

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

PSD autosampler accessory for Furnace systems

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

Sample introduction pump system (SIPS) accessory

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

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

Sample preparation system (SPS 4) accessory☒ Section NOT Applicable

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

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

- ☐ Cleaning the spill tray, rack location mat, end frames and chassis accessories with a damp soft cloth and diluted mild detergent.
- ☐ Cleaning the autosampler cover panels with domestic window cleaner.
- ☐ Checking the X- axis and Z- axis drive belts for cracks, splits, damaged teeth, excessive fraying, color changes or degradation from fumes.
- ☐ Check the X- axis, Theta- axis and Z- axis FFC cables for cracks, incorrect positioning, damaged edge or damaged connectors.

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

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

Sample preparation system (SPS 3) accessory☒ Section NOT Applicable

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

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**Vapor generation accessory VGA (hydride generator)**

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

UltraAA lamp accessory (external)

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

Restore System

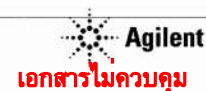
- ☐ If you have altered the customer's instrumentation during the course of PM, restore to the original status to allow the customer to conduct their normal activities (e.g., reload the customer's method.)

Guidance

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

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Signature Page

Service Review

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

Test Results

Test Description	Expected Test Result	Actual Test Result
Flame optics PMT Gain test		
For copper at 324.8 nm, 4 mA, 0.5 nm slit width	< 55 %	42 %
Flame performance test with 5 ppm copper sample		
Air /acetylene, mixing paddle removed	Abs value > 0.5	0.5963
Air /acetylene, mixing paddle installed, 10 replicates	%RSD < 1.0	0.4
Deuterium furnace optics PMT Gain test		
For copper at 324.8 nm, 4 mA, 0.5 nm slit width	< 55 %	
Deuterium furnace performance test with 25 ppb copper sample (327.4 nm)		
Precision %RSD	≤ 4.0 %	-
Abs value	≥ 0.15	-
Zeeman furnace analytical performance: 25 ppb copper sample (327.4 nm)		
Precision %RSD	≤ 4.0 %	-
Abs value	≥ 0.10	-
MSR%	≥ 70 %	-
As VGA-77 test Abs.	0.2 Abs	0.2156 Abs

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AA consumable and parts list table

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

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

Items classified as PM supplied in the above table are included in the standard PM Those classified as consumable should be provided by the customer or charged to the customer if supplied by the Agilent service engineer.

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SVD Results Report



Report ID: Diagnostic Start Time: 28/01/2022 8:48:57 AM Diagnostic End Time: 28/01/2022 9:51:21 AM
Customer: UAE Service Engineer: Kanyakorn S.
Address: Contact Details: 026376363#1

Instrument Configuration

Configuration:

Serial Number: MY13160001 Turret Type: Automatic
Instrument Model: Varian AA140/240/280 Number Of Lamps: 4
Flame Instrument: True Mono Type: Automatic
Furnace Instrument: True Gasbox Type: Y Gas Box
Zeeman Present: False Auto Burner Adjuster: False
Internal Zeeman: False Mains Frequency: 50
Internal UltraAA: False Firmware Version: 2.11
Optics Type: Double Beam Photomultiplier Type: Normal(900nm)
D2 BG Correction Fitted: True PWB Version: 45
Boot Block Version: 1.09

EEPROM Data:

Instrument Run Hours: 48968.684 D2 Run Hours: 38036.500
Zero Wavelength Offset: 30.071 D2 Serial Number: not set
Mono Correction: 0.755 D2 Install Date: 01/01/1970
Flame Hours: 23619.166 D2 Original Intensity: 1.000
D2 Last Intensity: 475.000

Frequency:

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

Result: **Passed**

Service Engineer Comments (optional)

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

Service Completion

Service request number: 6004901032 Date service completed: 28 Jan 2022
Agilent signature: Kanyakorn S. Customer signature: Chomthanan A.
Total number of pages in this document: 13

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Power Supply:

Averaging Period: 30.0
Datapoint Count: 20

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

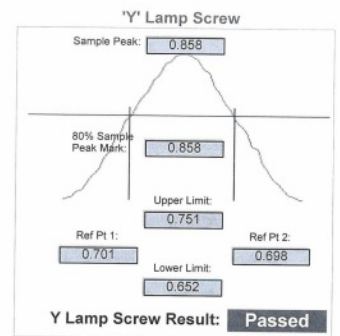
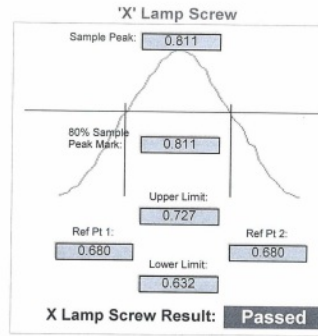
Optics

Beam Balance:

Lamp Type: Copper
Lamp Socket Used: 3

Peak Selected: 324.80

Lamp Alignment: **Performed**



Grating Squareness:

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

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

Wavelength Repeatability:

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

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

Mean: 324.821
Standard Deviation: 0.002

Result: **Passed**

Mechanical

Wavelength Drive:

Passed

Slit Drive:

Passed

Turret Drive:

Passed

Auto Burner Adjuster Drive:

Untested

Miscellaneous

Signal Processing Linearity:

Calculate Mode: New Calc Mode

	Lower Limit	Actual	Upper Limit	Result:
S0	114	260	297	Passed
S1	156	164	191	Passed
S2	271	295	332	Passed
S3	474	505	579	Passed
S4	825	913	1008	Passed
S5	1435	1519	1754	Passed
S6	2498	2753	3053	Passed
S7	4347	4724	5313	Passed

Interlocks:

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

Auto Lamp Recognition:

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

Result: **Passed**

GTA Temperature Monitoring:

Not Performed

Notes:

Signatures:

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

Sequential by time report

28/01/2022 11:03 AM
Page 1 of 1

SpectrAA

Analyst
Date Started 28/01/2022 9:56 AM GMT: 28/01/2022 2:56 AM
Worksheet PM 28-01-2022 01-Send/ly test
Comment
Methods Cu
Computer name HEM-212
Serial Number: MY13160001

Method: Cu (Flame)

Sample ID	Exp Abs	%RSD	Mean Abs			
Cu 5 ppm	0.500	0.4	0.5004			
Readings						
	0.5042	0.5002	0.4979	0.5006	0.5021	0.4980
	0.5019	0.5004	0.4988	0.4996	28/01/2022	

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

6

SVD Results Report
เอกสารไม่ควบคุม

Sequential by time report

28/01/2022 12:22 PM
Page 1 of 1

SpectrAA

Analyst
Date Started 28/01/2022 11:04 AM GMT: 28/01/2022 4:04 AM
Worksheet As Hydride
Comment
Methods As
Computer name HEM-212
Serial Number: MY13160001

Method: As (Vapor)

Sample ID	Exp Abs	%RSD	Mean Abs			
As 10 ppb	0.22	1.1	0.2156			
Readings						
	0.2188	0.2171	0.2150	0.2145	0.2125	28/01/2022

SPC Calibration Center

SERT
Part of DKSH Group

Certificate of Calibration

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

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

Environment Condition: Temperature 23 °C ± 2 °C
Humidity 50 %RH ± 15 %RH

Calibration Place: Environment Laboratory, SPC RT Co., Ltd.
1194 Soi Wachirathamsathit 57, Sukhumvit 101/1 Rd.,
Bangchak, Prakanong, Bangkok 10260 Thailand

Calibration By: Mr.Imron Ama
Calibration Date: 29 March 2021
The Method used: In house method, SPCC-WI-49, base on ASTM D 1125-14 and D 5391-14
Traceability: This certificate is traceable to the CRM maintained by DAKKS/DKD calibration laboratory through Radiometer Analytical Co., Ltd. Certificate No. 1561, 1515, 1377

(Mr. Imron Ama)
Person in charge

บริษัท เอสพีซี อาร์ที จำกัด
SPC RT Co., Ltd.

(Mr. Dumrong Boonsopon)
Authorized signatory

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

Calibration Results:

Before Adjustment

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

After Adjustment ; at 1408.3 μS/cm

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

The End of Certificate

Calibration Certificate

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

Page 1 of 5

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

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

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

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

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

เอกสารไม่ควบคุม

Calibration Report

Certificate No.: 2201793-001-01
Equipment: pH Meter
Resolution: 0.01 pH : 1 mV
Manufacturer: METTLER TOLEDO
Model: SevenEasy pH
Serial No.: 1231155210
Type: Bench top
ID No.: UAE.WAT.010/2553
Date of Calibration: 1 March 2022 Page 2 of 5
Location: Chemical Calibration Laboratory, NATIONAL FOOD INSTITUTE
Environment Condition: Ambient Temperature: (23.5 ± 1.5) °C Relative Humidity: (53 ± 5) %
Condition of Equipment: Good Condition
Condition of this Results of Calibration
1. Calibration Method
In house method ; W-CC-002 based on direct measurement by using standard voltage calibrator and certified reference material (CRM)
2. Reference Standards / Certified Reference Material
Instruments Serial / ID No. Manufacturer Certificate No. Due Date
2.1 DC Voltage Calibrator 2709007 Fluke SCL-21F-0687 24 June 2022
2.2 Digital Thermometer 2709007 Fluke CG-640599-01 30 October 2022
2.3 Thermo-Hygro Meter NFI.BTH004/18 PONPE QR22-0195 27 January 2023
Certified Reference Material Lot No. Manufacturer Ref N Expire Date
2.4 pH buffer 4.008 (Primary pH buffer Solution) 741339 CPAchem PH216.L5 19 April 2023
2.5 pH buffer 6.865 (Primary pH buffer Solution) 741340 CPAchem PH217.L5 19 April 2023
2.6 pH buffer 10.01 (Primary pH buffer Solution) 741342 CPAchem PH220.L5 19 April 2022
2.7 pH buffer 7.00 (Standard pH buffer Solution) 735836 CPAchem PH107.L5 16 March 2022
3. This certification is traceable to The International System of Unit (SI Unit)
3.1 Instruments No.2.1 through NSC-TIS-TIS 17025 Laboratory Accreditation of Calibration No.0075
3.2 Instruments No.2.2 through NSC-TIS-TIS 17025 Laboratory Accreditation of Calibration No.0061
3.3 Instruments No.2.3 through NSC-TIS-TIS 17025 Laboratory Accreditation of Calibration No.0292
3.4 Certified Reference Material No. 2.4 to 2.6 traceable to Primary measurement method- Hamed call using calibrated thermometer, barometer, and nanopvometer. The Standard Solution preparation and certified by CPAchem Ltd is accredited to ISO 17034 and ISO/IEC 17025
3.5 Certified Reference Material No. 2.7 traceable to BIM RefN HI-7 LotN 30.04.2020; BIM RefN HI-9 LotN 28.05.2020; BIM RefN HI-8 LotN 30.04.2020; BIM RefN HI-10 LotN 28.05.2020. The Standard Solution preparation and certified by CPAchem Ltd is accredited to ISO 17034 and ISO/IEC 17025
4. This certificate was certified only for the instrument we calibrated.
5. This result of calibration was found accurate as shown on date and place of calibration only.

P. Jenghambit
1 March 2022

เอกสารไม่ควบคุม

Calibration Report

Certificate No.: 2201793-001-01
Equipment: pH Meter
Resolution: 0.01 pH : 1 mV
Manufacturer: METTLER TOLEDO
Model: SevenEasy pH
Serial No.: 1231155210
Type: Bench top
ID No.: UAE.WAT.010/2553
Date of Calibration: 1 March 2022 Page 3 of 5
Calibration Results:
1. Calibration of pH Meter (Manual Temperature Compensation at 25 °C)
Nominal pH DC Voltage Standard (mV) Average Indicator Reading Uncertainty (±mV) Coverage Factor (k)
mV pH
0.00 414.117 414 0.00 0.58 2.00
2.00 295.811 296 2.00 0.58 2.00
4.00 177.462 178 4.00 0.58 2.00
6.00 59.159 59 6.00 0.58 2.00
7.00 -0.001 0 7.00 0.58 2.00
8.00 -59.159 -59 8.00 0.58 2.00
10.00 -177.463 -177 10.00 0.58 2.00
12.00 -295.812 -296 12.00 0.58 2.00
14.00 -414.119 -414 14.00 0.58 2.00
2. Calibration of pH Meter with Electrode (Manual Temperature Compensation at 25 °C)
Equipment: pH Electrode Type: Combined Electrode
Manufacturer: METTLER TOLEDO Model: InLabSolds
Serial No.: 1156882 ID.No. N/A
Performance of Electrode system (Three-Point Calibration at pH4, pH7 and pH10)
Certified Value @25 °C (pH) Average Indicator Reading Relative Slope (%) Uncertainty (± pH) Coverage Factor (k)
pH mV
4.008 4.00 180 96.25 0.0076 2.00
6.866 6.88 16 - 0.0079 2.00
10.012 10.01 -162 96.13 0.0094 2.00
6.865 7.00 9 - 0.0097 2.00

P. Jenghambit
1 March 2022

เอกสารไม่ควบคุม

Calibration Report

Certificate No.: 2201793-001-01
Equipment: Digital Thermometer with RTD (pH Meter)
Resolution: 0.1 °C Model: SevenEasy pH
Serial No.: 1231155210 ID No.: UAE.WAT.010/2553
Manufacturer: METTLER TOLEDO
Date of Calibration: 1 March 2022 Page 4 of 5

Location: Chemical Calibration Laboratory, NATIONAL FOOD INSTITUTE
Environment Condition: Ambient Temperature 24 °C ± 1 °C
Relative Humidity 53 % ± 2 %

Condition of this results of Calibration:

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

2. Reference Standard Instrument :

Instrument	Model	Serial No.	Certificate No.	Due Date	Through
HANDHELD THERMOMETER	1523	2118154	PSL-T 0851/64	03-Jun-22	TISTR
Platinum Resistance Thermometer (PRT)	5627A	877332			

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

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

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

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

6. Condition of Calibrated item :

Good

7. Result of Calibration :

☒ X

Without adjustment

☐

After adjustment

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

เอกสารไม่ควบคุม

Calibration Report

Certificate No.: 2201793-001-01
Equipment: Digital Thermometer with RTD (pH Meter)
Resolution: 0.1 °C Model: SevenEasy pH
Serial No.: 1231155210 ID No.: UAE.WAT.010/2553
Manufacturer: METTLER TOLEDO
Date of Calibration: 1 March 2022 Page 5 of 5

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

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

UUC* Reading (°C)	Standard Temperature (°C)	Correction Value (°C)	Uncertainty ± (°C)
15.1	15.006	-0.1	0.099
25.1	25.004	-0.1	0.099
35.1	35.003	-0.1	0.099

Note

* UUC* : Unit Under Calibration

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

----- End -----

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

เอกสารไม่ควบคุม

Calibration Certificate

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

Page 1 of 5

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

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

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

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

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

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

เอกสารไม่ควบคุม

Calibration Report

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

Date of Calibration: 16 March 2022 Page 2 of 5

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

Condition of this Results of Calibration

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

Instruments	Serial / ID No.	Manufacturer	Certificate No.	Due Date
2.1 DC Voltage Calibrator	2709007	Fluke	SCL-21F-0687	24 June 2022
2.2 Digital Thermometer	2709007	Fluke	CC-640599-01	30 October 2022
2.3 Thermo-Hygro Meter	ana.kh.BTH 005/58	PONPE	QR21-2787	15 November 2022

Certified Reference Material	Lot No.	Manufacturer	Ref N	Expiry Date
2.4 pH buffer 4.008 (Primary pH buffer Solution)	780012	CPAchem	PH216.L5	21 November 2023
2.5 pH buffer 6.865 (Primary pH buffer Solution)	780013	CPAchem	PH217.L5	21 November 2023
2.6 pH buffer 10.01 (Primary pH buffer Solution)	780015	CPAchem	PH220.L5	21 November 2022
2.7 pH buffer 7.00 (Standard pH buffer Solution)	776840	CPAchem	PH107.L5	8 November 2022

- This certificate is traceable to The International System of Unit (SI Unit)
 - Instruments No.2.1 through NSC-TISI-TIS 17025 Laboratory Accreditation of Calibration No.0075
 - Instruments No.2.2 through NSC-TISI-TIS 17025 Laboratory Accreditation of Calibration No.0061
 - Instruments No.2.3 through NSC-TISI-TIS 17025 Laboratory Accreditation of Calibration No.0292
 - Certified Reference Material No. 2.4 to 2.6 traceable to Primary measurement method- Harned cell using calibrated thermometer, barometer, and nanovoltmeter. The Standard Solution preparation and certified by CPAchem Ltd is accredited to ISO 17034 and ISO/IEC 17025
 - Certified Reference Material No. 2.7 traceable to BIM RefN HI-7 LotN 30.04.2020; BIM RefN HI-9 LotN 28.05.2020; BIM RefN HI-8 LotN 30.04.2020; BIM RefN HI-10 LotN 28.05.2020. The Standard Solution preparation and certified by CPAchem Ltd is accredited to ISO 17034 and ISO/IEC 17025

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

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

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

เอกสารไม่ควบคุม

Calibration Report

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

Date of Calibration: 16 March 2022 Page 3 of 5

Calibration Results:

1. Calibration of pH Meter

(Manual Temperature Compensation at 25 °C)

Nominal pH	DC Voltage Standard (mV)	Average Indicator Reading		Uncertainty (mV)	Coverage Factor (k)
		mV	pH		
0	414.117	414	0.00	0.58	2.00
2	295.811	295.7	2.00	0.063	2.00
4	177.462	177.4	4.00	0.063	2.00
6	59.159	59.2	6.00	0.063	2.00
7	-0.001	0.1	7.00	0.063	2.00
8	-59.159	-59.1	8.00	0.063	2.00
10	-177.463	-177.3	10.00	0.063	2.00
12	-295.812	-295.6	12.00	0.063	2.00
14	-414.119	-414	14.00	0.58	2.00

2. Calibration of pH Meter with Electrode

Equipment: pH Electrode Type: Combined Electrode
Manufacturer: METTLER TOLEDO Model: LE420
Serial No.: 1142802 ID No.: N/A

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

Certified Value (25 °C (pH))	Average Indicator Reading		Relative Slope (%)	Uncertainty (± pH)	Coverage Factor (k)
	pH	mV			
4.008	4.01	180.5	99.3	0.0071	2.00
6.866	6.87	12.5	-	0.0074	2.00
10.015	10.01	-171.5	99.1	0.0090	2.00
6.983	6.98	5.2	-	0.0092	2.00

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

เอกสารไม่ควบคุม

Calibration Report

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

Date of Calibration: 16 March 2022 Page 4 of 5

Location: Chemical Calibration Laboratory, National Food Institute.

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

Condition of this results of Calibration:

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

Instrument	Model	Serial No.	Certificate No.	Due Date	Through
HANDHELD THERMOMETER	1523	2118154	PSL-T 8851/64	24-Jun-22	TISTR
Platinum Resistance Thermometer (PRT)	5627A	877332			

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

- This certificate is traceable to International System of Units (SI Units).
- This certificate was certified only for the instrument we calibrated.
- This result of calibration was found accurate as shown on date and place of calibration only.
- Condition of Calibrated item : Good
5. Result of Calibration : ☒ Without adjustment ☐ After adjustment

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

เอกสารไม่ควบคุม

Calibration Report

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

Date of Calibration: 16 March 2022 Page 5 of 5

Calibration point: 15.0, 25.0 and 35.0 °C

Calibration result:

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

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

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

Sheath material : Stainless Steel

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

Note : - UUC* : Unit Under Calibration

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

----- End -----

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

เอกสารไม่ควบคุม

Calibration Certificate

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

Page 1 of 3

Equipment: Electronic Balance

Manufacturer: METTLER TOLEDO

Model: AB204-S/FACT

Serial No.: 1129361010

ID No.: UAE.WAS.002/2552

Order No.: 2203120

Operation No.: 2203120-001

Date of Receipt: 1 June 2022

Date of Calibration: 1 June 2022

Calibrated by Mr.Taveesak Sellee
Scientist

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

The uncertainties are for a confidence probability of approximately 95%

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

F-CS-009 Revision: 01 Date: 20-04-65

เอกสารไม่ควบคุม

Calibration Report

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

Date of Calibration: 1 June 2022 Page 2 of 3

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

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

Condition of Equipment: Good Condition

Condition of This Results of Calibration:

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

2. Reference Standards:

Reference Standard	Model	Serial No.	Calibrated By	Certificate No.	Due Date
Standard Weight Class E2	1-500mg	B308068554	TCS	M2010205	6 January 2023
Standard Weight Class E2	1-500g	B308068128	TCS	M2010215	6 January 2023

Instrument	Model	Serial No.	Calibrated By	Certificate No.	Due Date
Thermo-Hygro Meter	PONPE 490	NFI.BTH 010/18	Quality Reborn	QR22-0350	18 February 2023

3. This certification is traceable to SI UNIT

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

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

Calibration Results:

1. Repeatability of Reading:

Nominal Value (g)	Standard Deviation of Reading (g)
100	0.000048
200	0.000052

2. Off-Center Error:

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

The balance reading obtained is given in the table.

ading obtained is given in the table.

☐

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

F-C5-012 Revision: 01 Date: 20-04-65

เอกสารไม่ควบคุม

Calibration Report

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

Date of Calibration: 1 June 2022 Page 3 of 3

Calibration Results: (Continued)

Calibration Range: 0 - 200 g

Calibration Adjustment: Internal Calibration

3. Departure from Nominal Value:

Nominal Value (g)	Standard Value (g)	Average Reading (g)	Correction (g)	Uncertainty (g)	Coverage Factor
Unload	0.00000	0.0000	0.0000	0.000088	2.00
0.01	0.01000	0.0100	0.0000	0.000088	2.00
0.05	0.05000	0.0499	0.0001	0.000088	2.00
0.1	0.10000	0.1000	0.0000	0.000088	2.00
0.2	0.20000	0.2000	0.0000	0.000088	2.00
0.5	0.50000	0.5000	0.0000	0.000088	2.00
1	1.00000	0.9999	0.0001	0.000088	2.00
2	2.00000	1.9999	0.0001	0.000089	2.00
5	5.00000	5.0000	0.0000	0.000089	2.00
10	9.99998	9.9999	0.0001	0.000092	2.00
20	19.99999	19.9999	0.0001	0.000094	2.00
50	49.99990	49.9999	0.0000	0.00012	2.00
70	69.99989	69.9998	0.0001	0.00014	2.00
100	100.00001	99.9999	0.0001	0.00017	2.00
150	149.99991	149.9997	0.0002	0.00022	2.00
200	200.00007	199.9998	0.0003	0.00030	2.00

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

----- End -----

F-C5-012 Revision: 01 Date: 20-04-65

เอกสารไม่ควบคุม

Calibration Certificate

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

Page 1 of 4

Equipment: Electronic Balance

Manufacturer: METTLER TOLEDO

Model: AX 105 DR

Serial No.: 1122100406

ID No.: UAE.WAO.004/2546

Order No.: 2200708

Operation No.: 2200708-001

Date of Receipt: 24 November 2021

Date of Calibration: 24 November 2021

Calibrated by Mr.Worapob Sooktong
Scientist

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

Date of Issue: 30 November 2021

The uncertainties are for a confidence probability of approximately 95%

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

F-C5-009 Revision: 00 Date: 14-12-61

เอกสารไม่ควบคุม

Calibration Report

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

Date of Calibration: 24 November 2021 Page 2 of 4

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

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

Condition of Equipment: Good Condition

Condition of This Results of Calibration:

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

2. Reference Standards:

Reference Standard	Model	Serial No.	Calibrated By	Certificate No.	Due Date
Standard Weight Class E2	1-500mg	15880	TCS	M20111955	28 November 2021
Standard Weight Class E2	1-500g	15882	TCS	M20111965	28 November 2021

Instrument	Model	Serial No.	Calibrated By	Certificate No.	Due Date
Thermo-Hygro Meter	11A1	aw.jh, BTH 003/55	Quality Reborn	QR21-0297	15 February 2022

3. This certification is traceable to SI UNIT

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

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

Calibration Results:

1. Repeatability of Reading:


Nominal Value (g)	Standard Deviation of Reading (g)
15	0.000057
30	0.000084
50	0.000053
100	0.000048

2. Off-Center Error:


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

The balance reading obtained is given in the table.


loading obtained is given in the table.



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

F-C5-012 Revision: 00 Date: 14-12-61

เอกสารไม่ควบคุม

Calibration Report

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

Date of Calibration: 24 November 2021 **Page 3 of 4**

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

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

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

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

เอกสารไม่ควบคุม

Calibration Report

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

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

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

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

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

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

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

เอกสารไม่ควบคุม



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES
5344 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG BANGKOK 10250
TEL. 0-2717-3000-27 FAX. 0-2719-9484



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

Certificate of Calibration

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

Issue Date: 4 November 2021

The Uncertainties are for a confidence probability of approximately 95%

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



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

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

Procedure Used :-

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

The temperature scale used was based on ITS-90.

Condition of this result of calibration

1. Reference standard instrument:-

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

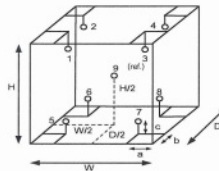
2. This certificate is valid only to the item calibrated on date and place of calibration.

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

Result of Calibration :- (*) Without Adjustment

Function of UUC* : Temperature Source

Fresh air setting : Close



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

Environment during calibration		
	Beginning	Finished
Temp. (°C)	28	28
REL.Humid. (%)	56	55
AC Supply (Volt)	230	230

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

เอกสารไม่ควบคุม

เอกสารไม่ควบคุม



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

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

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

Calibration Point (°C)	Measured Temperature (°C)								
	Position								
	1	2	3	4	5	6	7	8	9 (ref.)
104.0	103.852	103.978	104.382	104.323	103.776	104.015	104.312	104.196	103.907
140.0	140.309	140.730	140.426	140.270	139.531	139.666	140.067	139.895	139.750
180.0	180.598	180.339	180.755	180.619	179.716	179.829	180.204	180.365	179.975

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

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

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

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

UUC* : Unit Under Calibration

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

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

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เอกสารไม่ควบคุม

DQE Services Co.,Ltd.

DQE Services

32 Soi Ladprao-Wanghin 55, Ladprao-Wanghin Rd., Ladprao, Bangkok 10230

Phone : +66 (0)2 538 2054, Email : dqeservicesinfo@gmail.com



CERTIFICATE OF CALIBRATION

Certificate No. : SP22-016

Page 1 of 5

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

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

Bangkok 10260

Location of calibration : Laboratory 315

Equipment : UV-Vis Spectrophotometer

Manufacturer : Agilent Technologies

Model : Cary 60

Serial No. : MY15410009

ID No. : N/A

Received Date : 23 May 2022

Calibration Date : 23 May 2022

Issue Date : 26 May 2022

Condition Instrument : Good

Calibrated by : ปณณ
 (Mr.Tanawat Rittidach)

Technical Manager

Approved by : ชลจิชา
 (Ms. Chonthicha Sangngern)

Quality Manager

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

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

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FM-708-02 R01 1/11/2021

DQE Services Co.,Ltd.

DQE Services

32 Soi Ladprao-Wanghin 55, Ladprao-Wanghin Rd., Ladprao, Bangkok 10230

Phone : +66 (0)2 538 2054, Email : dqeservicesinfo@gmail.com



REPORT OF CALIBRATION

Certificate No. : SP22-016

Page 2 of 5

Environment Condition : Ambient Temperature 25 ± 5 °C

Relative humidity 55 ± 20 %RH

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

Certified Reference Materials :

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

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

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

Spectral Band Width of UUC : 1.5 nm.

Scan Speed of UUC : 90 nm/min

Scan Interval of UUC : 0.15 nm.

Resolution of UUC : Photometric 0.0001 Abs.

Wavelength 0.1 nm.

เอกสารไม่ควบคุม

FM-708-02 R01 1/11/2021

DQE Services Co.,Ltd.

DQE Services

32 Soi Ladprao-Wanghin 55, Ladprao-Wanghin Rd., Ladprao, Bangkok 10230

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REPORT OF CALIBRATION

Certificate No. : SP22-016

Page 3 of 5

Calibration Results : Without adjustment

Photometric Accuracy :

Wavelength (nm.)	CRMs Values (Abs)	UUC Reading (Abs)	Correction (Abs)	Uncertainty (Abs)	Coverage factor k
420	0.0000	0.0000	0.0000	0.0028	2.00
	0.5787	0.5755	0.0032	0.0031	2.00
	1.0490	1.0436	0.0054	0.0029	2.00
	2.1900	2.1847	0.0053	0.0075	2.00
440	0.0000	0.0000	0.0000	0.0028	2.00
	0.5607	0.5588	0.0019	0.0034	2.00
	1.0247	1.0232	0.0015	0.0035	2.00
	2.1229	2.1211	0.0018	0.0082	2.00
465	0.0000	0.0000	0.0000	0.0028	2.00
	0.5236	0.5197	0.0039	0.0029	2.00
	0.9634	0.9625	0.0009	0.0028	2.00
	1.9763	1.9752	0.0011	0.0070	2.00
546.1	0.0000	-0.0001	0.0001	0.0028	2.00
	0.5191	0.5171	0.0020	0.0031	2.00
	1.0003	0.9984	0.0019	0.0033	2.00
	1.9987	1.9946	0.0041	0.0084	2.00
590	0.0000	0.0000	0.0000	0.0028	2.00
	0.5523	0.5509	0.0014	0.0030	2.00
	1.0809	1.0799	0.0010	0.0029	2.00
	2.0391	2.0329	0.0062	0.0080	2.00
635	0.0000	0.0000	0.0000	0.0028	2.00
	0.5601	0.5584	0.0017	0.0031	2.00
	1.0512	1.0498	0.0014	0.0029	2.00
	1.9294	1.9265	0.0029	0.0082	2.00

เอกสารไม่ควบคุม

FM-708-02 R01 1/11/2021



REPORT OF CALIBRATION

Certificate No. : SP22-016

Page 4 of 5

Photometric Accuracy :

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



REPORT OF CALIBRATION

Certificate No. : SP22-016

Page 5 of 5

Wavelength Accuracy :

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

Remark : - UUC = Unit Under Calibration

- N/A = Not Available

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

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

- * Indicates non TISI accredited

- End of Certificate -

เอกสารไม่ควบคุม

FM-708-02 R01 1/11/2021

เอกสารไม่ควบคุม

FM-708-02 R01 1/11/2021



CERTIFICATE OF CALIBRATION

Certificate No. : SP22-007

Page 1 of 5

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

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

Bangkok 10260

Location of calibration : Laboratory 315

Equipment : UV-Vis Spectrophotometer

Manufacturer : Hitachi

Model : U-1900

Serial No. : 2021-064

ID No. : UAE.WAS.006/2552

Received Date : 20 January 2022

Calibration Date : 20 January 2022

Issue Date : 24 January 2022

Condition Instrument : Good

Calibrated by :

(Mr. Tanawut Rittidach)

Technical Manager

Approved by :

(Ms. Chonthicha Sangern)

Quality Manager

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

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



REPORT OF CALIBRATION

Certificate No. : SP22-007

Page 2 of 5

Environment Condition : Ambient Temperature 25 ± 5 °CRelative humidity 55 ± 20 %RH

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

Certified Reference Materials :

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

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

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

Spectral Band Width of UUC : 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.

เอกสารไม่ควบคุม

เอกสารไม่ควบคุม

DQE Services Co.,Ltd.
32 Soi Ladprao-Wanghin 55, Ladprao-Wanghin Rd., Ladprao, Bangkok 10230
Phone : +66 (0)2 538 2054, Email : dqeservicesinfo@gmail.com

REPORT OF CALIBRATION

Certificate No. : SP22-007 Page 3 of 5

Calibration Results : Without adjustment

Photometric Accuracy :

Wavelength (nm.)	CRMs Values (Abs)	UUC Reading (Abs)	Correction (Abs)	Uncertainty (Abs)	Coverage factor k
420	0.0000	0.000	0.0000	0.0028	2.00
	0.5787	0.577	0.0017	0.0031	2.00
	1.0490	1.050	-0.0010	0.0029	2.00
	2.1900	2.183	0.0070	0.0080	2.00
440	0.0000	0.000	0.0000	0.0028	2.00
	0.5607	0.560	0.0007	0.0034	2.00
	1.0247	1.023	0.0017	0.0035	2.00
	2.1229	2.118	0.0049	0.0079	2.00
465	0.0000	0.000	0.0000	0.0028	2.00
	0.5236	0.521	0.0026	0.0030	2.00
	0.9634	0.963	0.0004	0.0029	2.00
	1.9763	1.974	0.0023	0.0070	2.00
546.1	0.0000	0.000	0.0000	0.0028	2.00
	0.5191	0.518	0.0011	0.0031	2.00
	1.0003	1.000	0.0003	0.0033	2.00
	1.9987	1.996	0.0027	0.0084	2.00
590	0.0000	0.000	0.0000	0.0028	2.00
	0.5523	0.552	0.0003	0.0030	2.00
	1.0809	1.082	-0.0011	0.0030	2.00
	2.0391	2.033	0.0061	0.0079	2.00
635	0.0000	0.000	0.0000	0.0028	2.00
	0.5601	0.562	-0.0019	0.0031	2.00
	1.0512	1.052	-0.0008	0.0030	2.00
	1.9294	1.925	0.0044	0.0079	2.00

FM-708-02 R01 1/11/2021

เอกสารไม่ควบคุม

DQE Services Co.,Ltd.
32 Soi Ladprao-Wanghin 55, Ladprao-Wanghin Rd., Ladprao, Bangkok 10230
Phone : +66 (0)2 538 2054, Email : dqeservicesinfo@gmail.com

REPORT OF CALIBRATION

Certificate No. : SP22-007 Page 4 of 5

Photometric Accuracy :

Wavelength (nm.)	CRMs Values (Abs)	UUC Reading (Abs)	Correction (Abs)	Uncertainty (Abs)	Coverage factor k
235	0.0000	0.000	0.0000	0.0050	2.00
	0.7478	0.746	0.0018	0.0057	2.00
257	0.0000	0.000	0.0000	0.0050	2.00
	0.8686	0.861	0.0076	0.0059	2.00
313	0.0000	0.000	0.0000	0.0050	2.00
	0.2912	0.291	0.0002	0.0051	2.00
350	0.0000	0.000	0.0000	0.0050	2.00
	0.6448	0.638	0.0068	0.0055	2.00

FM-708-02 R01 1/11/2021

เอกสารไม่ควบคุม

DQE Services Co.,Ltd.
32 Soi Ladprao-Wanghin 55, Ladprao-Wanghin Rd., Ladprao, Bangkok 10230
Phone : +66 (0)2 538 2054, Email : dqeservicesinfo@gmail.com

REPORT OF CALIBRATION

Certificate No. : SP22-007 Page 5 of 5

Wavelength Accuracy :

CRMs Values (nm.)	UUC Reading (nm.)	Correction (nm.)	Uncertainty (nm.)	Coverage factor 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	418.0	0.48	0.18	2.00
446.70	446.0	0.70	0.18	2.00
453.20	453.0	0.20	0.18	2.00
460.06	459.5	0.56	0.18	2.00
536.90	536.0	0.90	0.18	2.00
637.94	637.2	0.74	0.18	2.00
440.74	440.0	0.74	0.18	2.00
472.22	471.6	0.62	0.18	2.00
513.70	513.0	0.70	0.18	2.00
528.72	528.0	0.72	0.18	2.00
574.60	573.8	0.80	0.18	2.00
585.48	584.6	0.88	0.20	2.00
684.63	684.0	0.63	0.18	2.00
740.27	739.8	0.47	0.20	2.00
748.28	747.8	0.48	0.18	2.00
807.16	806.4	0.76	0.18	2.00
879.70	878.8	0.90	0.18	2.00

Remark : - UUC = Unit Under Calibration

- N/A = Not Available

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

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

- * Indicates non TISI accredited

- End of Certificate -

FM-708-02 R01 1/11/2021

เอกสารไม่ควบคุม

DQE Services Co.,Ltd.
32 Soi Ladprao-Wanghin 55, Ladprao-Wanghin Rd., Ladprao, Bangkok 10230
Phone : +66 (0)2 538 2054, Email : dqeservicesinfo@gmail.com

CERTIFICATE OF CALIBRATION

Certificate No. : SP22-008 Page 1 of 5

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

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

Location of calibration : Laboratory 213

Equipment : UV-Vis Spectrophotometer

Manufacturer : Hitachi

Model : U-2900

Serial No. : 21E22-009


ID No. : UAE.WAT.051/2564


Received Date : 20 January 2022

Calibration Date : 20 January 2022

Issue Date : 24 January 2022

Condition Instrument : Good

Calibrated by :  (Mr. Tanawat Rittidach)
Technical Manager

Approved by :  (Ms. Chonthicha Sangngern)
Quality Manager

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

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

FM-708-02 R01 1/11/2021

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DQE Services Co.,Ltd.
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REPORT OF CALIBRATION

Certificate No. : SP22-008 Page 2 of 5

Environment Condition : Ambient Temperature 25 ± 5 °C
Relative humidity 55 ± 20 %RH

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

Certified Reference Materials :

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

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

Spectral Band Width of UUC : 1.5 nm.

Scan Speed of UUC : 200 nm/min

Scan Interval of UUC : 0.1 nm.

Resolution of UUC : Photometric 0.001 Abs.
Wavelength 0.1 nm.

FM-708-02 R01 1/11/2021

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REPORT OF CALIBRATION

Certificate No. : SP22-008 Page 3 of 5

Calibration Results : Without adjustment

Photometric Accuracy :

Wavelength (nm.)	CRMs Values (Abs)	UUC Reading (Abs)	Correction (Abs)	Uncertainty (Abs)	Coverage factor k
420	0.0000	0.000	0.0000	0.0028	2.00
	0.5787	0.576	0.0027	0.0031	2.00
	1.0490	1.046	0.0030	0.0029	2.00
	2.1900	2.182	0.0080	0.0075	2.00
440	0.0000	0.000	0.0000	0.0028	2.00
	0.5607	0.559	0.0017	0.0034	2.00
	1.0247	1.023	0.0017	0.0035	2.00
	2.1229	2.116	0.0069	0.0079	2.00
465	0.0000	0.000	0.0000	0.0028	2.00
	0.5236	0.521	0.0026	0.0030	2.00
	0.9634	0.962	0.0014	0.0029	2.00
	1.9763	1.970	0.0063	0.0070	2.00
546.1	0.0000	0.000	0.0000	0.0028	2.00
	0.5191	0.519	0.0001	0.0031	2.00
	1.0003	0.999	0.0013	0.0033	2.00
	1.9987	1.992	0.0067	0.0084	2.00
590	0.0000	0.000	0.0000	0.0028	2.00
	0.5523	0.552	0.0003	0.0030	2.00
	1.0809	1.080	0.0009	0.0030	2.00
	2.0391	2.031	0.0081	0.0079	2.00
635	0.0000	0.000	0.0000	0.0028	2.00
	0.5601	0.560	0.0001	0.0031	2.00
	1.0512	1.052	-0.0008	0.0030	2.00
	1.9294	1.922	0.0074	0.0079	2.00

FM-708-02 R01 1/11/2021

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REPORT OF CALIBRATION

Certificate No. : SP22-008 Page 4 of 5

Photometric Accuracy :

Wavelength (nm.)	CRMs Values (Abs)	UUC Reading (Abs)	Correction (Abs)	Uncertainty (Abs)	Coverage factor k
235	0.0000	0.000	0.0000	0.0050	2.00
	0.7478	0.747	0.0008	0.0057	2.00
257	0.0000	0.000	0.0000	0.0050	2.00
	0.8686	0.865	0.0036	0.0059	2.00
313	0.0000	0.000	0.0000	0.0050	2.00
	0.2912	0.290	0.0012	0.0051	2.00
350	0.0000	0.000	0.0000	0.0050	2.00
	0.6448	0.640	0.0048	0.0055	2.00

FM-708-02 R01 1/11/2021

เอกสารไม่ควบคุม

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Phone : +66 (0)2 538 2054, Email : dqeservicesinfo@gmail.com

REPORT OF CALIBRATION

Certificate No. : SP22-008 Page 5 of 5

Wavelength Accuracy :

CRMs Values (nm.)	UUC Reading (nm.)	Correction (nm.)	Uncertainty (nm.)	Coverage factor k
241.72	241.0	0.72	0.18	2.00
279.45	279.0	0.45	0.18	2.00
287.81	287.0	0.81	0.18	2.00
334.06	333.5	0.56	0.18	2.00
360.93	360.0	0.93	0.18	2.00
418.59	418.0	0.59	0.18	2.00
445.94	445.5	0.44	0.18	2.00
453.66	453.0	0.66	0.18	2.00
460.02	459.5	0.52	0.18	2.00
536.59	536.0	0.59	0.18	2.00
637.98	637.5	0.48	0.18	2.00
431.38	431.0	0.38	0.18	2.00
472.50	472.0	0.50	0.18	2.00
513.47	513.0	0.47	0.18	2.00
528.88	528.5	0.38	0.18	2.00
573.17	573.0	0.17	0.18	2.00
585.35	585.0	0.35	0.20	2.00
684.40	684.0	0.40	0.18	2.00
740.72	740.5	0.22	0.20	2.00
748.55	748.5	0.05	0.18	2.00
807.03	807.0	0.03	0.18	2.00
879.28	879.5	-0.22	0.18	2.00

Remark : - UUC = Unit Under Calibration

- N/A = Not Available

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

- * Indicates non TISI accredited

- End of Certificate -

FM-708-02 R01 1/11/2021

เอกสารไม่ควบคุม



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

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

Calibration point (°C)	UUC* Setting (°C)	UUC* Reading (°C)	Average* Standard Reading (°C)				
			Position				
			1	2	3	4	5 (ref.)
44.5	44.5	44.5	44.498	44.481	44.482	44.518	44.534

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

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

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

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

UUC* : Unit Under Calibration

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

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

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เอกสารไม่ควบคุม



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



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

Certificate of Calibration

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

Approved by : 
 Approved Signatory

() Ponthippa Tameyakul
 (/) Malee Butkruea

Issue Date : 22 February 2022

The Uncertainties are for a confidence probability of approximately 95%

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

เอกสารไม่ควบคุม

A 0038095



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

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

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

The temperature scale used was based on ITS-90.

Condition of this result of calibration

1. Reference standard instrument:-

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

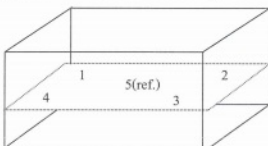
2. This certificate is valid only to the item calibrated on date and place of calibration.

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

Result of Calibration :- (*) Without Adjustment

Function of UUC* : Temperature Source

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



Front

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

เอกสารไม่ควบคุม

a 1096055



Equipment : Water Bath
 Condition As-Received : Used Item
 Reference : 2202-0444OC-4
 Result of Calibration :- (*) Without Adjustment
 Function of UUC* : Temperature Source

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

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

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

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

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

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

UUC* : Unit Under Calibration

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

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

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เอกสารไม่ควบคุม

a 1096054

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



Accuracy Calibration Certificate

Customer

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

Weighing Device

Manufacturer: Mettler Toledo Instrument Type: Weighing Instrument
Model: M5603S/01 Asset Number: UAE.MIC.008/2553
Serial No.: 8007010311 Terminal Model: N/A
Building: N/A Terminal Serial No.: N/A
Floor: 2 Terminal Asset No.: N/A
Room: Balance Room (206)

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

Procedure

Calibration Guideline: EURAMET cg-18 v. 4.0 (11/2015)
METTLER TOLEDO Work Instruction: CP/W002/20
This calibration certificate contains measurements for As Found calibration. No As Left calibration was performed because the device was not modified after As Found calibration. Therefore, results for As Left correspond to As Found.
The sensitivity/span of the weighing instrument was adjusted before calibration with a built-in weight.
In accordance with EURAMET cg-18 (11/2015), the test loads were selected to reflect the specific use of the weighing device or to accommodate specific calibration conditions.

As Found	Temperature	Humidity
As Found	Start: 22.8 °C End: 23.0 °C	Start: 49.9 % End: 58.3 %

As Found Calibration Date: 07-Apr-2022 Calibrator: 
As Left Calibration Date: N/A
Issue Date: 08-Apr-2022 Approved Signatory: 
☒ Kassakorn Tassanachaisakul
☐ Santi Jitniyom
☐ Sursachet Sukkate

Measurement Results

Repeatability

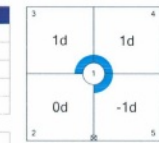
Test Load: 200 g		
	As Found	As Left
1	200.001 g	N/A
2	200.001 g	N/A
3	200.001 g	N/A
4	200.001 g	N/A
5	200.001 g	N/A
6	200.000 g	N/A
7	200.001 g	N/A
8	200.001 g	N/A
9	200.000 g	N/A
10	200.001 g	N/A
Standard Deviation	0.0004 g	N/A



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

Eccentricity

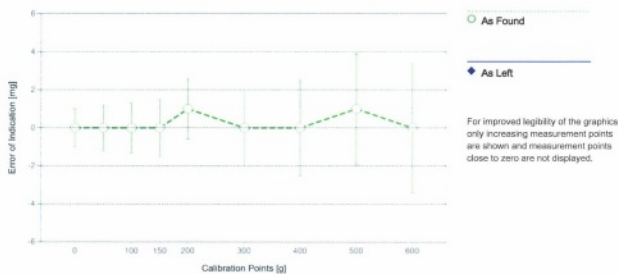
Test Load: 200 g		
Position	As Found	As Left
1	200.001 g	N/A
2	200.001 g	N/A
3	200.002 g	N/A
4	200.002 g	N/A
5	200.000 g	N/A
Maximum Deviation	0.001 g	N/A



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

Error of Indication

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



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

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

Test Equipment

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

Weight Set 1: OIML F1

Weight Set No.: WS55 Date of Issue: 06-Jul-2021
Certificate Number: CCM-0137-21-C Calibration Due Date: 07-Jul-2022

Weight Set 2: OIML E2

Weight Set No.: WS60 Date of Issue: 23-Feb-2022
Certificate Number: C206581631 Calibration Due Date: 14-Aug-2023

Thermo Hygrometer

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

Remarks

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

End of Accredited Section

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