

ภาคผนวก ณ  
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
<b>Ambient</b>									
1	Orifice Transfer Standard Calibrator	Total Suspended Particulate (TSP) Particulate Matter < 10 µm (PM <sub>10</sub> )	Thermo Scientific	G25A 158M	Tisch Environmental, Inc.	05072022	5 Jul 22	4 Jul 24	-
2	U-Tube Manometer	Total Suspended Particulate (TSP) Particulate Matter < 10 µm (PM <sub>10</sub> )	Dwyer	1221-36-W/M -	Technology Promotion Association (Thailand-Japan)	22P801	12 Mar 22	11 Mar 23	-
3	Flow Meter	Particular Matter (PM <sub>2.5</sub> )	Mesa Labs	DeltaCal DC1 158850	Innovative Instrument Co., Ltd.	22-AFM-116	16 Aug 22	15 Aug 23	-
4	Aneroid Barometer	Total Suspended Particulate (TSP) Particulate Matter < 10 µm (PM <sub>10</sub> ) Particular Matter (PM <sub>2.5</sub> )	Barigo, Germany	-	Technology Promotion Association (Thailand-Japan)	22P2728	22 Jul 22	21 Jul 23	-
5	Dial Thermo-Hygrometer	Total Suspended Particulate (TSP) Particulate Matter < 10 µm (PM <sub>10</sub> ) Particular Matter (PM <sub>2.5</sub> )	Barigo, Germany	-	Technology Promotion Association (Thailand-Japan)	22H1587	27 Jul 22	26 Jul 23	-
6									
7	High Volume Air Sampler	Total Suspended Particulate (TSP)	Thremo Scientific	GS2312-10105-1 2010-06	Tisch Environmental, Inc.	Ref. No.158M	5 Jul 22	4 Jul 24	-
8	High Volume Air Sampler	Total Suspended Particulate (TSP)	Thremo Scientific	GS2312-10105-1 2010-07	Tisch Environmental, Inc.	Ref. No.158M	5 Jul 22	4 Jul 24	-
9	High Volume Air Sampler	Total Suspended Particulate (TSP)	Thremo Scientific	GS2312-10105-1 2010-08	Tisch Environmental, Inc.	Ref. No.158M	5 Jul 22	4 Jul 24	-
10	High Volume Air Sampler	Total Suspended Particulate (TSP)	Thremo Scientific	GS2312-10105-1 2010-17	Tisch Environmental, Inc.	Ref. No.158M	5 Jul 22	4 Jul 24	-
11	High Volume Air Sampler	Total Suspended Particulate (TSP)	Thremo Scientific	GS2312-10105-1 2010-18	Tisch Environmental, Inc.	Ref. No.158M	5 Jul 22	4 Jul 24	-
12	High Volume Air Sampler	Total Suspended Particulate (TSP)	Thremo Scientific	GS2312-10105-1 2010-19	Tisch Environmental, Inc.	Ref. No.158M	5 Jul 22	4 Jul 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	High Volume Air Sample	Particulate Matter < 10 µm (PM <sub>10</sub> )	Thremo Scientific	IP10-1 2010-01	Tisch Environmental, Inc.	Ref. No.158M	5 Jul 22	4 Jul 24	-
14	High Volume Air Sample	Particulate Matter < 10 µm (PM <sub>10</sub> )	Thremo Scientific	IP10-1 2010-02	Tisch Environmental, Inc.	Ref. No.158M	5 Jul 22	4 Jul 24	-
15	High Volume Air Sample	Particulate Matter < 10 µm (PM <sub>10</sub> )	Thremo Scientific	IP10-1 2010-03	Tisch Environmental, Inc.	Ref. No.158M	5 Jul 22	4 Jul 24	-
16	High Volume Air Sample	Particulate Matter < 10 µm (PM <sub>10</sub> )	Thremo Scientific	IP10-1 2010-07	Tisch Environmental, Inc.	Ref. No.158M	5 Jul 22	4 Jul 24	-
17	High Volume Air Sample	Particulate Matter < 10 µm (PM <sub>10</sub> )	Thremo Scientific	IP10-1 2010-08	Tisch Environmental, Inc.	Ref. No.158M	5 Jul 22	4 Jul 24	-
18	High Volume Air Sample	Particulate Matter < 10 µm (PM <sub>10</sub> )	Thremo Scientific	IP10-1 2010-09	Tisch Environmental, Inc.	Ref. No.158M	5 Jul 22	4 Jul 24	-
19	Low Volume Air Sampler Particulate	Particular Matter (PM <sub>2.5</sub> )	Thremo Scientific	2000i 2000W 20790 1901	NIST Traceable Calibration Facility	Ref. No.158850	7 Sep 22	6 Sep 23	-
20	Low Volume Air Sampler Particulate	Particular Matter (PM <sub>2.5</sub> )	Thremo Scientific	2000i 2000W 20791 1902	NIST Traceable Calibration Facility	Ref. No.158850	7 Sep 22	6 Sep 23	-
21	Low Volume Air Sampler Particulate	Particular Matter (PM <sub>2.5</sub> )	Thremo Scientific	2000i 2000W 20792 1902	NIST Traceable Calibration Facility	Ref. No.158850	7 Sep 22	6 Sep 23	-

List of Instruments Certification for Air & Noise Quality Analysis

No.	Instrument/Equipment	Parameter	Manufacturer	Model/Serial No.	Calibrator	Certification No.	Date of Calibration	Due date of Calibration	Remark
Ambient									
22	Sound Level Calibrator (Acoustic Calibrator)	Calibrate Sound Level Meter	Larson Davis	CAL150 6307	Innovative Instrument Co.,Ltd.	22-ACT-373	8 Jun 22	7 Jun 23	-
23	Sound Level Meter	$L_{Aeq\ 24\ hours}$ , $L_{Amax}$ , $L_{A90}$ , $L_{Adn}$	Larson Davis	LxT2 0005395	Innovative Instrument Co.,Ltd.	22-ACT-247	1 Apr 22	31 Mar 23	-
24	Sound Level Meter	$L_{Aeq\ 24\ hours}$ , $L_{Amax}$ , $L_{A90}$ , $L_{Adn}$	Larson Davis	LxT2 0005398	Innovative Instrument Co.,Ltd.	22-ACT-035	21 Jan 22	20 Jan 23	-
25	Sound Level Meter	$L_{Aeq\ 24\ hours}$ , $L_{Amax}$ , $L_{A90}$ , $L_{Adn}$	Larson Davis	LxT2 0005400	Innovative Instrument Co.,Ltd.	22-ACT-036	21 Jan 22	20 Jan 23	-
26	Sound Level Meter	$L_{Aeq\ 24\ hours}$ , $L_{Amax}$ , $L_{A90}$ , $L_{Adn}$	Larson Davis	LxT2 0006616	Innovative Instrument Co.,Ltd.	22-ACT-113	15 Feb 22	14 Feb 23	-
27	Sound Level Meter	$L_{Aeq\ 24\ hours}$ , $L_{Amax}$ , $L_{A90}$ , $L_{Adn}$	Larson Davis	LxT2 0005405	Innovative Instrument Co.,Ltd.	22-ACT-101	11 Feb 22	10 Feb 23	-
28	Vibration Meter	Vibration Level Acceleration Level	Instantel Inc.	Micromate UM14471	Calibration Laboratory Co.Ltd	Q22029700	21 Mar 22	20 Mar 23	-
29	Vibration Meter	Vibration Level Acceleration Level	Instantel Inc.	Micromate UM14463	Calibration Laboratory Co.Ltd	Q22029697	21 Mar 22	20 Mar 23	-
30	Vibration Meter	Vibration Level Acceleration Level	Instantel Inc.	Micromate UM14547	Calibration Laboratory Co.Ltd	Q22012261	7 Feb 22	6 Feb 23	-
31	Vibration Meter	Vibration Level Acceleration Level	Instantel Inc.	Micromate UM14466	Calibration Laboratory Co.Ltd	Q22017948	21 Feb 22	20 Feb 23	-
32	Vibration Meter	Vibration Level Acceleration Level	Instantel Inc.	Micromate UM14544	Calibration Laboratory Co.Ltd	Q22029698	21 Mar 22	20 Mar 23	-

List of Instruments Certification for Air & Noise Quality Analysis

No.	Instrument/Equipment	Parameter	Manufacturer	Model/Serial No.	Calibrator	Certification No.	Date of Calibration	Due date of Calibration	Remark
Ambient									
33	Vibration Meter	Vibration Level Acceleration Level	Instantel Inc.	Micromate UM13204	Calibration Laboratory Co.Ltd	Q22064054	25 Jun 22	24 Jun 23	
34	Vibration Meter	Vibration Level Acceleration Level	Instantel Inc.	Micromate UM12393	Calibration Laboratory Co.Ltd	Q22012260	10 Feb 22	9 Feb 23	
35	Vibration Meter	Vibration Level Acceleration Level	Instantel Inc.	Micromate UM12392	Calibration Laboratory Co.Ltd	Q22017950	21 Feb 22	20 Feb 23	
36	Vibration Meter	Vibration Level Acceleration Level	Instantel Inc.	Micromate UM12394	Calibration Laboratory Co.Ltd	Q22005355	18 Jan 22	19 Jan 23	
37	Vibration Meter	Vibration Level Acceleration Level	Instantel Inc.	Micromate UM12867	Calibration Laboratory Co.Ltd	Q22064051	25 Jun 22	24 Jun 23	
38	Vibration Meter	Vibration Level Acceleration Level	Instantel Inc.	Micromate UM12395	Calibration Laboratory Co.Ltd	Q22012258	7 Feb 22	6 Feb 23	-
39	Vibration Meter	Vibration Level Acceleration Level	Instantel Inc.	Micromate UM12889	Calibration Laboratory Co.Ltd	Q22053609	30 May 22	29 May 23	-
40	Vibration Meter	Vibration Level Acceleration Level	Instantel Inc.	Micromate UM14468	Calibration Laboratory Co.Ltd	Q22005358	19 Jan 22	18 Jan 23	-
41	Vibration Meter	Vibration Level Acceleration Level	Instantel Inc.	Micromate UM11230	Calibration Laboratory Co.Ltd	Q22086863	30 Aug 22	29 Aug 23	-
42	Vibration Meter	Vibration Level Acceleration Level	Instantel Inc.	Micromate UM12865	Calibration Laboratory Co.Ltd	Q22086865	30 Aug 22	29 Aug 23	-
43	Vibration Meter	Vibration Level Acceleration Level	Instantel Inc.	Micromate UM12891	Calibration Laboratory Co.Ltd	Q22097007	23 Sep 22	22 Sep 23	-
44	Vibration Meter	Vibration Level Acceleration Level	Instantel Inc.	Micromate UM11356	Calibration Laboratory Co.Ltd	Q22097248	23 Sep 22	22 Sep 23	-

# Certificate of Calibration

Calibration Certification Information					
Cal. Date:	July 5, 2017	Rootmeter S/N:	435330	Temp:	28.7 °C
Operator:	Jim Tisch	Pa:	750.1		mm Hg
Calibration Model #:	G25A	Calibrator S/N:	158M		

Run	Vol. Init (m3)	Vol. Final (m3)	ΔVol. (m3)	ΔTime (min)	ΔP (mm Hg)	ΔH (in H2O)
1	1	2	1	1.3240	3.2	2.00
2	3	4	1	0.9480	6.4	4.00
3	5	6	1	0.8480	7.9	5.00
4	7	8	1	0.8060	8.7	5.50
5	9	10	1	0.6670	12.7	8.00

Data Tabulation					
Vstd (m3)	Qstd (x-axis)	$\sqrt{\Delta P \left( \frac{Pa}{Pa_0} \right) \left( \frac{T_a}{T_0} \right)}$ (y-axis)	Va (x-axis)	Qa (x-axis)	$\sqrt{\Delta P \left( \frac{Pa}{Pa_0} \right) \left( \frac{T_a}{T_0} \right)}$ (y-axis)
0.9860	0.7447	1.4073	0.9957	0.7521	0.8899
0.9818	1.0357	1.9902	0.9915	1.0459	1.2585
0.9798	1.1554	2.2251	0.9895	1.1668	1.4071
0.9788	1.2143	2.3337	0.9884	1.2263	1.4757
0.9735	1.4595	2.8146	0.9831	1.4739	1.7798
m=		1.96745	m=		1.23199
b=		-0.05315	b=		-0.03361
r=		0.99995	r=		0.99995

Calculations	
Vstd= ΔVol((Pa-ΔP)/Pstd)/((Tstd/Ta)	Va= ΔVol((Pa-ΔP)/Pa)
Qstd= Vstd/ΔTime	Qa= Va/ΔTime
For subsequent flow rate calculations:	
Qstd= $\frac{V_{std}}{\Delta t} \left( \frac{P_a}{P_{std}} \right) \left( \frac{T_{std}}{T_a} \right)$	Qa= $\frac{V_a}{\Delta t} \left( \frac{P_a}{P_{std}} \right) \left( \frac{T_{std}}{T_a} \right)$

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

RECALIBRATION	
US EPA recommends annual recalibration per 1988 40 Code of Federal Regulations Part 50 to 51, Appendix B to Part 50, Reference Method for the Determination of Suspended Particulate Matter in the Atmosphere, 9.2.17, page 30	

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

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



TECHNOLOGY PRECISION ASSOCIATION (THAILAND) PVT. LTD.  
CORPORATE SERVICES & EQUIPMENT CALIBRATION AND TESTING DIVISION  
1144 PATTAYAKARN ROAD/NO. 14, BUNBETUANG, BANGKOK 10110  
TEL: 0-2777-0000 FAX: 0-2777-9999

## Certificate of Calibration

Certificate No.: 22P001  
Page: 1 of 2

Equipment:	1) Total Moisture	This certificate may not be reproduced other than in full, along with the prior written approval of the head of Corporate Services, C. Supparat Calibration and Testing Division.
Manufacturer:	Drayco	
Model:	2211-36-WM	
Serial No.:		
SI No.:	1462-EPM-1760284	
Condition As-Received:	Used from	
Received Date:	24 March 2022	
Calibration Date:	10 March 2023	
Reference:	ISO 9100:2015	Submitted by: United Analyst and Engineering Consultant Co., Ltd.
Ambient Temperature:	23.4 ± 0.1 °C	97 Soi Nonsuwan, RT. Nonsuwan Road, Bangkok, Thailand, Bangkok 10280
Relative Humidity:	58.4 ± 0.1 %	
Atmospheric Pressure:	1013 mb	

Procedure used: The calibration was conducted by direct comparison method against Precision Measuring Instruments (Standard) according to reference calibration procedure CIPOL using "DOKUMENT" Calibration of Pressure Gauges, Edition 03/2015 " as a guideline.


### Condition of the result of calibration:

1) Reference standard instruments:

Instrument	Model	Serial No.	Certificate No.	Exp. Date
1) Pressure Calibrator	PC100P	7139	MP-0110-21	09 Aug 2022

- This result of calibration was result on requested at the point specified by customer.
- Scale and conversion factor is 1 MPa = 0.101325 bar.
- This instrument was used clean off its previous marks.
- This instrument was calibrated by loaded pressure to High-port (+) side and Low-port (-) side open to atmosphere pressure.
- This instrument was installed in vertical orientation and top of the pressure port was used as the reference level.
- This certificate is valid only to the item calibrated on date and place of calibration.
- This Calibration is traceable to the International System of Unit maintained at National Institute of Metrology (Thailand) (NIMT).

Calibrated by: Kiat, Kiatwong  
Issue Date: 10 March 2023

Approved Signature:   
1) Phatima Pratsongkarn  
1) Sam Sornwong  
1) Aijal Parnwong

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# 0282414



Certificate: 22P001  
Page: 2 of 2

Result of calibration: Vstd as indicated  
Function: Pressure Measurement  
Increasing Pressure

Reference: 0.1 MPa/0.101325 bar  
Scale Interval: 0.1 in Hg/0.131579 in H2O

U.S. Institute				
Applied Pressure (inHg)	High-port side (inHg)	Low-port side (inHg)	ΔP (inHg)	Error (inHg)
0.00	0.00	0.00	0.00	0.00
2.00	0.00	-0.04	1.93	-0.04
4.00	0.00	-1.00	0.98	-0.02
6.00	0.00	-2.00	0.98	-0.02
8.00	0.00	-3.00	0.98	-0.02
10.00	0.00	-4.00	0.98	-0.02
12.00	0.00	-5.00	11.80	-0.02
14.00	7.00	-6.00	15.80	-0.02
16.00	9.04	-7.00	16.02	0.03
18.00	9.04	-8.00	16.02	0.03
20.00	10.04	-9.00	20.02	0.03
22.00	11.00	-10.00	22.04	0.04
24.00	12.00	-12.00	24.00	0.00
26.00	13.00	-13.00	26.00	0.00
28.00	14.00	-14.00	28.00	0.00
30.00	15.00	-15.00	30.00	0.00
32.00	16.00	-16.00	32.00	0.00
34.00	17.00	-17.00	34.00	0.00
36.00	17.00	-17.00	36.00	0.00

The uncertainty of measurement was 0.011 inHg  
\*U.S. = inch 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 %.

22P001

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# 1099525



## Certificate of Calibration

Certificate No.: 22P001  
Page: 1 of 2

Customer:	UNITED STATES OF AMERICA (USA) - 101325 bar	This certificate may not be reproduced other than in full, along with the prior written approval of the head of Corporate Services, C. Supparat Calibration and Testing Division.
Manufacturer:	Drayco	
Model:	2211-36-WM	
Serial No.:		
SI No.:	1462-EPM-1760284	
Condition As-Received:	Used from	
Received Date:	24 March 2022	
Calibration Date:	10 March 2023	
Reference:	ISO 9100:2015	Submitted by: United Analyst and Engineering Consultant Co., Ltd.
Ambient Temperature:	23.4 ± 0.1 °C	97 Soi Nonsuwan, RT. Nonsuwan Road, Bangkok, Thailand, Bangkok 10280
Relative Humidity:	58.4 ± 0.1 %	
Atmospheric Pressure:	1013 mb	

U.S. Institute				
Applied Pressure (inHg)	High-port side (inHg)	Low-port side (inHg)	ΔP (inHg)	Error (inHg)
0.00	0.00	0.00	0.00	0.00
2.00	0.00	-0.04	1.93	-0.04
4.00	0.00	-1.00	0.98	-0.02
6.00	0.00	-2.00	0.98	-0.02
8.00	0.00	-3.00	0.98	-0.02
10.00	0.00	-4.00	0.98	-0.02
12.00	0.00	-5.00	11.80	-0.02
14.00	7.00	-6.00	15.80	-0.02
16.00	9.04	-7.00	16.02	0.03
18.00	9.04	-8.00	16.02	0.03
20.00	10.04	-9.00	20.02	0.03
22.00	11.00	-10.00	22.04	0.04
24.00	12.00	-12.00	24.00	0.00
26.00	13.00	-13.00	26.00	0.00
28.00	14.00	-14.00	28.00	0.00
30.00	15.00	-15.00	30.00	0.00
32.00	16.00	-16.00	32.00	0.00
34.00	17.00	-17.00	34.00	0.00
36.00	17.00	-17.00	36.00	0.00

The uncertainty of measurement was 0.011 inHg  
\*U.S. = inch 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 %.

Reference Standard	Model	Serial Number	Expiry Date	File Number
1) Pressure Calibrator	PC100P	7139	09 Aug 2022	09 Aug 2022

The uncertainty of measurement was 0.011 inHg  
\*U.S. = inch 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 %.

Calibrated by: Kiat, Kiatwong  
Issue Date: 10 March 2023

Approved Signature:   
1) Phatima Pratsongkarn  
1) Sam Sornwong  
1) Aijal Parnwong

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# 1099525







Cert. No.: 201709  
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**Result of Calibration: Without adjustment**  
**Customer: Absolute Pressure Measurement**

**Range:** 800 mPa to 1000 mPa  
**Scale Error:** ± 1 mPa (The 10% Coefficient)

Increasing Pressure									
Applied Pressure (mPa)	800.0	850.0	900.0	950.0	1000.0	1050.0	1100.0	1150.0	1200.0
GAZT Indicator (mPa)	800.0	850.0	900.0	950.0	1000.0	1050.0	1100.0	1150.0	1200.0
Scale Error	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Decreasing Pressure									
Applied Pressure (mPa)	1200.0	1150.0	1100.0	1050.0	1000.0	950.0	900.0	850.0	800.0
GAZT Indicator (mPa)	1200.0	1150.0	1100.0	1050.0	1000.0	950.0	900.0	850.0	800.0
Scale Error	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

The uncertainty of measurement was ± 0.05 mPa

\* UAC = 95% 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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# 111979



TECHNOLOGY PROMOTION ASSOCIATION (TPA) (TAA) (TAA)  
CERTIFICATE OF CALIBRATION AND VERIFICATION  
(FOR OUTSIDE LABORATORY USE ONLY)  
TEL: 02-011-0000 FAX: 02-011-0001



**Certificate of Calibration**

Certificate No.: 201709  
Page: 1 of 2

**Customer:** Dat Thana Engineering

**Manufacturer:** Sanyo

**Model:** -

**Serial No.:** -

**ID No.:** UNLAW-1234567

**Condition At Received:** Good Item

**Received Date:** 20 July 2022

**Calibration Date:** 22 July 2022

**Reference:** 10-27 July 2022

**Ambient Temperature:** (25 ± 3) °C

**Relative Humidity:** (50 ± 10) %

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

**Submitted by:** United Agency and Engineering Consultant Co., Ltd.

81 Sri Lanna Road, Samsorn Road, Bangkok,  
Prachin, Bangkok 10200

**Procedure used:** Calibration were conducted using a master calibration procedure (CP-MS) according to compliance with standard of the master sensor for humidity measurement facility and compare with standard temperature probe for temperature measurement function into facility / temperature chamber.

**Condition of this result of calibration**

1) Reference standards instruments

Instrument	Model	Serial No.	Certificate No.	Exp. Date
1) Standard Critical Mass Humidity Standard	Humidity 1	10001	10711	17 Sep 2022
2) Standard Humidity/Temperature Meter	400	1000000	1000000	19 Dec 2022

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

3) The Certificate is issued to the International System of Units (SI) as follows:

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

**Calibrated by:** Samet, Dornier  
**Issue Date:** 30 August 2022

**Approved Signature:**  
[Signature]  
1. [Signature]  
2. [Signature]  
3. [Signature]

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# 1293725



Cert. No.: 201709  
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**Result of Calibration:**

Function:	Reference Temperature (°C)	Standard Humidity (mPa)	UAC* (mPa)	Error (mPa)	Uncertainty of Measurement (mPa)
	25.0	40.1	39	-0.1	1.6
	25.0	50.0	50	0.0	1.6
	25.0	60.0	60	0.0	2.0

**Result of Calibration:**

Function:	Reference Temperature (°C)	Standard Humidity (mPa)	UAC* (mPa)	Error (mPa)	Uncertainty of Measurement (mPa)
	25.0	40.1	40	-0.1	1.6
	25.0	50.0	50	0.0	1.6
	25.0	60.0	60	0.0	2.0

**Result of Calibration:**

Function:	Reference Temperature (°C)	Standard Humidity (mPa)	UAC* (mPa)	Error (mPa)	Uncertainty of Measurement (mPa)
	25.04	30.0	30.0	0.00	0.72
	25.04	35.0	35.0	0.00	0.72
	25.04	40.0	40.0	0.00	0.72
	25.04	45.0	45.0	0.00	0.72

UAC\* - Unit Under Calibration

The reported uncertainty of measurement was based on a standard uncertainty multiplied by a coverage factor k = 2.0, providing confidence level approximately 95%.

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# 1115773

TECHNOLOGY PROMOTION ASSOCIATION (TPA) (TAA) (TAA)  
CERTIFICATE OF CALIBRATION AND VERIFICATION  
(FOR OUTSIDE LABORATORY USE ONLY)  
TEL: 02-011-0000 FAX: 02-011-0001



**Certificate of Calibration**

**Customer:**

**Name:** UNITED ANALYTICAL AND ENGINEERING CONSULTANT

**Address:**

81 Sri Lanna Road, Samsorn Road, Bangkok,

Prachin, Bangkok 10200

Certificate No.: 20-ACT-001

Request No.: Reg 00210044

**Unit Under Calibration Details**

**Manufacturer:** Agilent Calibration

**Model:** CAL-100

**Serial Number:** 1000

**ID:** 10000000000000000000

**Class:** 2

**Range:** 10, 100, 1000 Hz

**Instrument:** Used

**Calibration Environment and Details**

**Temperature:** (23 ± 2) °C

**Humidity:** (50 ± 10) %

**Pressure:** (1013 ± 0.1) kPa

**Received Date:** 01 May 2022

**Calibration Date:** 01 May 2022

**Location of Calibration:** LAB 1, Samsorn

**Calibration Procedure:** In-house, modified CP-ACT-02 based on IEC 60424-3-1 Electroacoustic - Sound calibration

Reference Standard	Model	Serial Number	Traceable	Due Calibration
Sound Calibration	SV 31A	50076	ISO	31 May 2023
ISO Calibration	2015	1000000	ISO	31 May 2023

**Traceability:** This certificate provides traceability of measurement to recognized national standards, 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:** [Signature]  
Mr. Supakorn Sungsat  
Service Calibration Engineer

**Approved by:** [Signature]  
Mr. Pong Malakorn  
Calibration Engineer Supervisor  
**Issue Date:** 01 Jun 2022

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เอกสารไม่ควบคุม  
# 1293725







Calibration No. : 20-077-000  
 Report No. : Rep-022-0000

#### 1. Calibration at the calibration check frequency

UUT Testing	Measured	Deviation	Uncertainty	Acceptance
ENV / 1.0 / 10.00	1.00	0.00	0.00	0.0
Reference testing	1.00	0.00	0.00	0.0
100 Hz, 10.00 dB	11.00	0.00	0.00	0.0

Note: Accuracy stability was confirmed by the use of Standard Calibration Check Weight 100g, Model SV 20.0, IN 2019

#### 2. Self-generated noise, Microphone installed

UUT Testing	Measured	Uncertainty	Acceptance
ENV / 174.00	174.00	0.00	0.0
Reference testing	174.00	0.00	0.0
1.0	174.00	0.00	0.0

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

UUT Testing	Measured	Uncertainty	Acceptance
ENV / 174.00	174.00	0.00	0.0
Reference testing	174.00	0.00	0.0
1.0	174.00	0.00	0.0
2.0	174.00	0.00	0.0
3.0	174.00	0.00	0.0

#### 4. Acoustic input test of frequency weighting

UUT Testing	Measured	Uncertainty	Acceptance
ENV / 174.00	174.00	0.00	0.0
Reference testing	174.00	0.00	0.0
1.0	174.00	0.00	0.0
2.0	174.00	0.00	0.0
3.0	174.00	0.00	0.0
4.0	174.00	0.00	0.0
5.0	174.00	0.00	0.0
6.0	174.00	0.00	0.0
7.0	174.00	0.00	0.0
8.0	174.00	0.00	0.0
9.0	174.00	0.00	0.0
10.0	174.00	0.00	0.0

This result complies with the requirements of the standard. The result is within the specified tolerance of 0.00, within the specified tolerance of 0.00.

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Calibration No. : 20-077-000  
 Report No. : Rep-022-0000

#### 5. Electrical input test of frequency weighting, Weighting network response with response to 1.00

UUT Testing	Measured	Uncertainty	Acceptance
ENV / 174.00	174.00	0.00	0.0
Reference testing	174.00	0.00	0.0
1.0	174.00	0.00	0.0
2.0	174.00	0.00	0.0
3.0	174.00	0.00	0.0
4.0	174.00	0.00	0.0
5.0	174.00	0.00	0.0
6.0	174.00	0.00	0.0
7.0	174.00	0.00	0.0
8.0	174.00	0.00	0.0
9.0	174.00	0.00	0.0
10.0	174.00	0.00	0.0

#### 6. Frequency test of frequency weighting at 1000

UUT Testing	Measured	Uncertainty	Acceptance
ENV / 174.00	174.00	0.00	0.0
Reference testing	174.00	0.00	0.0
1.0	174.00	0.00	0.0
2.0	174.00	0.00	0.0
3.0	174.00	0.00	0.0
4.0	174.00	0.00	0.0
5.0	174.00	0.00	0.0
6.0	174.00	0.00	0.0
7.0	174.00	0.00	0.0
8.0	174.00	0.00	0.0
9.0	174.00	0.00	0.0
10.0	174.00	0.00	0.0

UUT Testing	Measured	Uncertainty	Acceptance
ENV / 174.00	174.00	0.00	0.0
Reference testing	174.00	0.00	0.0
1.0	174.00	0.00	0.0
2.0	174.00	0.00	0.0
3.0	174.00	0.00	0.0
4.0	174.00	0.00	0.0
5.0	174.00	0.00	0.0
6.0	174.00	0.00	0.0
7.0	174.00	0.00	0.0
8.0	174.00	0.00	0.0
9.0	174.00	0.00	0.0
10.0	174.00	0.00	0.0

This result complies with the requirements of the standard. The result is within the specified tolerance of 0.00, within the specified tolerance of 0.00.

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Calibration No. : 20-077-000  
 Report No. : Rep-022-0000

#### 7. Long Term Stability

UUT Testing	Measured	Uncertainty	Acceptance
ENV / 1.0 / 10.00	1.00	0.00	0.0
Reference testing	1.00	0.00	0.0
100 Hz	11.00	0.00	0.0
1000 Hz	110.00	0.00	0.0
10000 Hz	1100.00	0.00	0.0

#### 8. Level stability on the reference level range

UUT Testing	Measured	Uncertainty	Acceptance
ENV / 1.0 / 10.00	1.00	0.00	0.0
Reference testing	1.00	0.00	0.0
1.0	1.00	0.00	0.0
2.0	1.00	0.00	0.0
3.0	1.00	0.00	0.0
4.0	1.00	0.00	0.0
5.0	1.00	0.00	0.0
6.0	1.00	0.00	0.0
7.0	1.00	0.00	0.0
8.0	1.00	0.00	0.0
9.0	1.00	0.00	0.0
10.0	1.00	0.00	0.0
11.0	1.00	0.00	0.0
12.0	1.00	0.00	0.0
13.0	1.00	0.00	0.0
14.0	1.00	0.00	0.0
15.0	1.00	0.00	0.0
16.0	1.00	0.00	0.0
17.0	1.00	0.00	0.0
18.0	1.00	0.00	0.0
19.0	1.00	0.00	0.0
20.0	1.00	0.00	0.0
21.0	1.00	0.00	0.0
22.0	1.00	0.00	0.0
23.0	1.00	0.00	0.0
24.0	1.00	0.00	0.0
25.0	1.00	0.00	0.0
26.0	1.00	0.00	0.0
27.0	1.00	0.00	0.0
28.0	1.00	0.00	0.0
29.0	1.00	0.00	0.0
30.0	1.00	0.00	0.0
31.0	1.00	0.00	0.0
32.0	1.00	0.00	0.0
33.0	1.00	0.00	0.0
34.0	1.00	0.00	0.0
35.0	1.00	0.00	0.0
36.0	1.00	0.00	0.0
37.0	1.00	0.00	0.0
38.0	1.00	0.00	0.0
39.0	1.00	0.00	0.0
40.0	1.00	0.00	0.0
41.0	1.00	0.00	0.0
42.0	1.00	0.00	0.0
43.0	1.00	0.00	0.0
44.0	1.00	0.00	0.0
45.0	1.00	0.00	0.0
46.0	1.00	0.00	0.0
47.0	1.00	0.00	0.0
48.0	1.00	0.00	0.0
49.0	1.00	0.00	0.0
50.0	1.00	0.00	0.0

This result complies with the requirements of the standard. The result is within the specified tolerance of 0.00, within the specified tolerance of 0.00.

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Calibration No. : 20-077-000  
 Report No. : Rep-022-0000

#### 9. Level stability including the level range (0.00)

UUT Testing	Measured	Uncertainty	Acceptance
ENV / 1.0 / 10.00	1.00	0.00	0.0
Reference testing	1.00	0.00	0.0
1.0	1.00	0.00	0.0
2.0	1.00	0.00	0.0
3.0	1.00	0.00	0.0
4.0	1.00	0.00	0.0
5.0	1.00	0.00	0.0
6.0	1.00	0.00	0.0
7.0	1.00	0.00	0.0
8.0	1.00	0.00	0.0
9.0	1.00	0.00	0.0
10.0	1.00	0.00	0.0

#### 10. Level stability response

UUT Testing	Measured	Uncertainty	Acceptance
ENV / 1.0 / 10.00	1.00	0.00	0.0
Reference testing	1.00	0.00	0.0
1.0	1.00	0.00	0.0
2.0	1.00	0.00	0.0
3.0	1.00	0.00	0.0
4.0	1.00	0.00	0.0
5.0	1.00	0.00	0.0
6.0	1.00	0.00	0.0
7.0	1.00	0.00	0.0
8.0	1.00	0.00	0.0
9.0	1.00	0.00	0.0
10.0	1.00	0.00	0.0
11.0	1.00	0.00	0.0
12.0	1.00	0.00	0.0
13.0	1.00	0.00	0.0
14.0	1.00	0.00	0.0
15.0	1.00	0.00	0.0
16.0	1.00	0.00	0.0
17.0	1.00	0.00	0.0
18.0	1.00	0.00	0.0
19.0	1.00	0.00	0.0
20.0	1.00	0.00	0.0
21.0	1.00	0.00	0.0
22.0	1.00	0.00	0.0
23.0	1.00	0.00	0.0
24.0	1.00	0.00	0.0
25.0	1.00	0.00	0.0
26.0	1.00	0.00	0.0
27.0	1.00	0.00	0.0
28.0	1.00	0.00	0.0
29.0	1.00	0.00	0.0
30.0	1.00	0.00	0.0
31.0	1.00	0.00	0.0
32.0	1.00	0.00	0.0
33.0	1.00	0.00	0.0
34.0	1.00	0.00	0.0
35.0	1.00	0.00	0.0
36.0	1.00	0.00	0.0
37.0	1.00	0.00	0.0
38.0	1.00	0.00	0.0
39.0	1.00	0.00	0.0
40.0	1.00	0.00	0.0
41.0	1.00	0.00	0.0
42.0	1.00	0.00	0.0
43.0	1.00	0.00	0.0
44.0	1.00	0.00	0.0
45.0	1.00	0.00	0.0
46.0	1.00	0.00	0.0
47.0	1.00	0.00	0.0
48.0	1.00	0.00	0.0
49.0	1.00	0.00	0.0
50.0	1.00	0.00	0.0

#### 11. Peak Level Stability

UUT Testing	Asymptotic	Seasonal			INTERVALITY	Asymptotic
ENV / 1.0 / 10.00	0.00	0.00	0.00	0.00	1.0000 1.0000	1.0000
UUT Testing	0.00	0.00	0.00	0.00		1.0000
Example 1.00	1.00	0.00	0.00	0.00		1.00
Example 1.00	1.00	0.00	0.00	0.00		1.00
Example 1.00	1.00	0.00	0.00	0.00	1.00	1.00
Example 1.00	1.00	0.00	0.00	0.00	1.00	1.00
Example 1.00	1.00	0.00	0.00	0.00	1.00	1.00
Example 1.00	1.00	0.00	0.00	0.00	1.00	1.00
Example 1.00	1.00	0.00	0.00	0.00	1.00	1.00
Example 1.00	1.00	0.00	0.00	0.00	1.00	1.00
Example 1.00	1.00	0.00	0.00	0.00	1.00	1.00
Example 1.00	1.00	0.00	0.00	0.00	1.00	1.00
Example 1.00	1.00	0.00	0.00	0.00	1.00	1.00
Example 1.00	1.00	0.00	0.00	0.00	1.00	1.00
Example 1.00	1.00	0.00	0.00	0.00	1.00	1.00
Example 1.00	1.00	0.00	0.00	0.00	1.00	1.00
Example 1.00	1.00	0.00	0.00	0.00	1.00	1.00
Example 1.00	1.00	0.00	0.00	0.00	1.00	1.00
Example 1.00	1.00	0.00	0.00	0.00	1.00	1.00
Example 1.00	1.00	0.00	0.00	0.00	1.00	1.00
Example 1.00	1.00	0.00	0.00	0.00	1.00	1.00
Example 1.00	1.00	0.00	0.00	0.00	1.00	1.00
Example 1.00	1.00	0.00	0.00	0.00	1.00	1.00
Example 1.00	1.00	0.00	0.00	0.00	1.00	1.00
Example 1.00	1.00	0.00	0.00	0.00	1.00	1.00
Example 1.00	1.00	0.00	0.00	0.00	1.00	1.00
Example 1.00	1.00	0.00	0.00	0.00	1.00	1.00
Example 1.00	1.00	0.00	0.00	0.00	1.00	1.00
Example 1.00	1.00	0.00	0.00	0.00	1.00	1.00
Example 1.00	1.00	0.00	0.00	0.00	1.00	1.00
Example 1.00	1.00	0.00	0.00	0.00	1.00	1.00
Example 1.00	1.00	0.00	0.00	0.00	1.00	1.00
Example 1.00	1.00	0.00	0.00	0.00	1.00	1.00
Example 1.00	1.00	0.00	0.00	0.00	1.00	1.00
Example 1.00	1.00	0.00	0.00	0.00	1.00	1.00
Example 1.00	1.00	0.00	0.00	0.00	1.00	1.00
Example 1.00	1.00	0.00	0.00	0.00	1.00	1.00
Example 1.00	1.00	0.00	0.00	0.00	1.00	1.00
Example 1.00	1.00	0.00	0.00	0.00	1.00	1.00
Example 1.00	1.00	0.00	0.00	0.00	1.00	1.00
Example 1.00	1.00	0.00	0.00	0.00	1.00	1.00
Example 1.00	1.00	0.00	0.00	0.00	1.00	1.00
Example 1.00	1.00	0.00	0.00	0.00	1.00	1.00
Example 1.00	1.00	0.00	0.00	0.00	1.00	1.00
Example 1.00	1.00	0.00	0.00	0.00	1.00	1.00
Example 1.00	1.00	0.00	0.00	0.00	1.00	1.00
Example 1.00	1.00	0.00	0.00	0.00	1.00	1.00
Example 1.00	1.00	0.00	0.00	0.00	1.00	1.00
Example 1.00	1.00	0.00	0.00	0.00	1.00	1.00
Example 1.00	1.00	0.00	0.00	0.00	1.00	1.00
Example 1.00	1.00	0.00	0.00	0.00	1.00	1.00
Example 1.00	1.00	0.00	0.00	0.00	1.00	1.00
Example 1.00	1.00	0.00	0.00	0.00	1.00	1.00
Example 1.00	1.00	0.00	0.00	0.00	1.00	1.00
Example 1.00	1.00	0.00	0.00	0.00	1.00	1.00
Example 1.00	1.00	0.00	0.00	0.00	1.00	1.00
Example 1.00	1.00	0.00	0.00	0.00	1.00	1.00
Example 1.00	1.00	0.00	0.00	0.00	1.00	1.00
Example 1.00	1.00	0.00	0.00	0.00	1.00	1.00
Example 1.00	1.00	0.00	0.00	0.00	1.00	1.00
Example 1.00	1.00	0.00	0.00	0.00	1.00	1.00
Example 1.00	1.00	0.00	0.00	0.00	1.00	1.00
Example 1.00	1.00	0.00	0.00	0.00	1.00	1.00
Example 1.00	1.00	0.00	0.00	0.00	1.00	1.00
Example 1.00	1.00	0.00	0.00	0.00	1.00	1.00
Example 1.00	1.00	0.00	0.00	0.00	1.00	1.00
Example 1.00	1.00	0.00	0.00	0.00	1.00	1.00
Example 1.00	1.00	0.00	0.00	0.00	1.00	1.00
Example 1.00	1.00	0.00	0.00	0.00	1.00	1.00
Example 1.00	1.00	0.00	0.00	0.00	1.00	1.00
Example 1.00	1.00	0.00	0.00	0.00	1.00	1.00
Example 1.00	1.00	0.00	0.00	0.00	1.00	1.00
Example 1.00	1.00	0.00	0.00	0.00	1.00	1.00
Example 1.00	1.00	0.00	0.00	0.00	1.00	1.00
Example 1.00	1.00	0.00	0.00	0.00	1.00	1.00
Example 1.00	1.00	0.00	0.00	0.00	1.00	1.00
Example 1.00	1.00	0.00	0.00	0.00	1.00	1.00
Example 1.00	1.00	0.00	0.00	0.00	1.00	1.00
Example 1.00	1.00	0.00	0.00	0.00	1.00	1.00
Example 1.00	1.00	0.00	0.00	0.00	1.00	1.00
Example 1.00	1.00	0.00	0.00	0.00	1.00	1.00
Example 1.00	1.00	0.00	0.00	0.00	1.00	1.00
Example 1.00	1.00	0.00	0.00	0.00	1.00	1.00
Example 1.00	1.00	0.00	0.00	0.00	1.00	1.00
Example 1.00	1.00	0.00	0.00	0.00	1.00	1.00
Example 1.00	1.00	0.00	0.00	0.00	1.00	1.00
Example 1.00	1.00	0.00	0.00	0.00	1.00	1.00
Example 1.00	1.00	0.00	0.00	0.00	1.00	1.00
Example 1.00	1.00	0.00	0.00	0.00	1.00	1.00
Example 1.00	1.00	0.00	0.00	0.00	1.00	1.00
Example 1.00	1.00	0.00	0.00	0.00	1.00	1.00
Example 1.00	1.00	0.00	0.00	0.00	1.00	1.00
Example 1.00	1.00	0.00	0.00	0.00	1.00	1.00
Example 1.00	1.00	0.00	0.00	0.00	1.00	1.00
Example 1.00	1.00	0.00	0.00	0.00	1.00	1.00
Example 1.00	1.00	0.00	0.00	0.00	1.00	1.00
Example 1.00	1.00	0.00	0.00	0.00	1.00	1.00
Example 1.00	1.00	0.00	0.00	0.00	1.00	1.00
Example 1.00	1.00	0.00	0.00	0.00	1.00	1.00
Example 1.00	1.00	0.00	0.00	0.00	1.00	1.00
Example 1.00	1.00	0.00	0.00	0.00	1.00	1.00
Example 1.00	1.00	0.00	0.00	0.00	1.00	1.00
Example 1.00	1.00	0.00	0.00	0.00	1.00	1.00
Example 1.00	1.00	0.00	0.00	0.00	1.00	1.00
Example 1.00	1.00	0.00	0.00	0.00	1.00	1.00
Example 1.00	1.00	0.00	0.00	0.00	1.00	1.00
Example 1.00	1.00	0.00	0.00	0.00	1.00	1.00
Example 1.00	1.00	0.00	0.00	0.00	1.00	1.00
Example 1.00	1.00	0.00	0.00	0.00	1.00	1.00
Example 1.00	1.00	0.00	0.00	0.00	1.00	1.00
Example 1.00	1.00	0.00	0.00	0.00	1.00	1.00
Example 1.00	1.00	0.00	0.00	0.00	1.00	1.00
Example 1.00	1.00	0.00	0.00	0.00	1.00	1.00
Example 1.00	1.00	0.00	0.00	0.00	1.00	1.00
Example 1.00	1.00	0.00	0.00	0.00	1.00	1.00
Example 1.00	1.00	0.00	0.00	0.00	1.00	1.00
Example 1.00	1.00	0.00	0.00	0.00	1.00	1.00
Example 1.00	1.00	0.00	0.00	0.00	1.00	1.00
Example 1.00	1.00	0.00	0.00	0.00	1.00	1.00
Example 1.00	1.00	0.00	0.00	0.00	1.00	1.00
Example 1.00	1.00	0.00	0.00	0.00	1.00	1.00
Example 1.00	1.00	0.00	0.00	0.00	1.00	1.00
Example 1.00	1.00	0.00	0			



Certificate No. : 22-AC7-193  
Report No. : Rep-002-0001

### 12. Overload Impedance

SWR Setting	Measured	UNCERTAINTY	Acceptance
SWR: 0.75:1.0	SWR	± 0.40	≤ 0.40
SWR Setting	SWR		
Resistor cap load cable	SWR		
Resistor cap load cable	SWR	± 0.5	≤ 0.5
Detected	SWR		

### 13. High Level Standing

SWR Setting	Measured	UNCERTAINTY	Acceptance
SWR: 0.75:1.0	SWR	± 0.40	≤ 0.40
SWR Setting	SWR		
Resistor	SWR		
Resistor	SWR	± 0.5	≤ 0.5
Detected	SWR		

End of Certificate

This certificate valid unless otherwise specified. The certificate shall not be reproduced except by full written authorisation of the Issuer or its authorised agent.

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### Certificate of Calibration

#### Customer

Name : UNITED ANALYST AND MEASUREMENT CONSULTANT CO., LTD.  
Address : 21/101 Sukhvithekar 11, Sukhvithekar 11 Town, Bangkok  
Tel.: 090-010-0000 / 090-010-0001

Certificate No. : 22-AC7-193  
Report No. : Rep-002-0001

#### UUT Data Calibration Details

Measurement item	Sound Level Meter	Microphone Class : 1
Manufacturer	1.00000 (N/A)	Microphone Model : 3130A
Model	1.012	Microphone SW : 3130A
Serial Number	990001	Pre-amplifier Model : P900-075
SI	1.012 (N/A) 0.0001	Pre-amplifier SW : 075000
Resolution	0.1 dB	Instrument Status : Good

#### Calibration Environment and Results


Temperature	22.5 °C ± 0.1
Humidity	30% RH ± 0.1
Barometric Pressure	1013 hPa ± 0.1
Received Date	11 January 2022
Calibrated Date	11 February 2022
Calibration Procedure	Reference method IEC 61674-2 based on IEC 61674-1:2011 (Electromagnetic sound level meter - Part 1: Portable meter)
Location of Calibration	Lab: Acoustic


#### Reference Standard

Instrument	Brand	Model	SW	Exp. calibration	Traceability
Standard Microphone	GRAS	4003	00171	11 September 2022	UKAS
Multi-frequency Calibrator	Quest	Questcal	SEA000124	14 Jan 2022	UK
Audio Generator	Sony	SW600	071	10 October 2021	UK, Europe

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. Prapachai Sompatt  
Calibration Officer

Approved By :   
Mr. Pichit Methasorn  
Calibration Engineer Supervisor  
Issue Date : 11 February 2022

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เอกสารไม่ควบคุม

Certificate No. : 22-AC7-193  
Report No. : Rep-002-0002

### 1. Indication at the calibration check frequency

SWR Setting	Measured	SWR	SWR	SWR	SWR	UNCERTAINTY	Acceptance
SWR: 0.75:1.0	SWR	SWR	SWR	SWR	SWR	± 0.40	≤ 0.40
Calibrator Setting	SWR	SWR	SWR	SWR	SWR		
SWR: 0.75:1.0	SWR	SWR	SWR	SWR	SWR		

Note: Actual uncertainty was calculated by the use of traceable standard (SWR: 0.75:1.0, Model: SWR, SWR: 0.75:1.0).

### 2. Self-generated noise, Microphone installed

SWR Setting	Measured	UNCERTAINTY
SWR: 0.75:1.0	SWR	± 0.40
SWR Setting	SWR	
SWR	SWR	

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

SWR Setting	Measured	UNCERTAINTY
SWR: 0.75:1.0	SWR	± 0.40
SWR Setting	SWR	
SWR	SWR	

### 4. Acoustic signal test of frequency weightings

SWR Setting	Measured	UNCERTAINTY	Acceptance
SWR: 0.75:1.0	SWR	± 0.40	≤ 0.40
SWR Setting	SWR		
SWR	SWR		

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เอกสารไม่ควบคุม

Certificate No. : 22-AC7-193  
Report No. : Rep-002-0003

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

SWR Setting	Measured	UNCERTAINTY	Acceptance
SWR: 0.75:1.0	SWR	± 0.40	≤ 0.40
SWR Setting	SWR		
SWR	SWR		

### 6. Frequency and level weightings at 1 kHz

SWR Setting	Measured	UNCERTAINTY	Acceptance
SWR: 0.75:1.0	SWR	± 0.40	≤ 0.40
SWR Setting	SWR		
SWR	SWR		

SWR Setting	Measured	UNCERTAINTY	Acceptance
SWR: 0.75:1.0	SWR	± 0.40	≤ 0.40
SWR Setting	SWR		
SWR	SWR		

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เอกสารไม่ควบคุม

Certificate No. : ID-ACF-181

Request No. : Req-2022-021

## 7. Long Term Stability

EFC Setting	Measured	UNCERTAINTY	Acceptance Limit
FAST / A / 10-100	13.1		1.000
STD Setting	13.0	1.000	1.000
Final	13.0		
Observed	0.0	0.1	0.1

## 8. Level Linearity on the reference level range

EFC Setting	Anticipated	Measured	UNCERTAINTY	Acceptance Limit
FAST / A / 10-100	100	100	1.000	1.000
STD Setting	100	100	1.000	1.000
Final	100	100	1.000	1.000
Observed	0.0	0.0	0.1	0.1

The results obtained are in line with the anticipated. The certificate shall not be superseded except by ANAB without written approval of the International Bureau of Standards (BIPM).

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เอกสารไม่ควบคุม

Certificate No. : ID-ACF-181

Request No. : Req-2022-021

## 9. Level Linearity including the level range control

EFC Setting	Anticipated	Measured	UNCERTAINTY	Acceptance Limit
FAST / A	100	100	1.000	1.000
STD Setting	100	100	1.000	1.000
Final	100	100	1.000	1.000
Observed	0.0	0.0	0.1	0.1

## 10. Time based response

EFC Setting	Anticipated	Measured	UNCERTAINTY	Acceptance Limit
FAST / A / 10-100	100	100	1.000	1.000
STD Setting	100	100	1.000	1.000
Final	100	100	1.000	1.000
Observed	0.0	0.0	0.1	0.1

## 11. Peak C Sound level

EFC Setting	Anticipated	Measured	UNCERTAINTY	Acceptance Limit
FAST / A / 10-100	100	100	1.000	1.000
STD Setting	100	100	1.000	1.000
Final	100	100	1.000	1.000
Observed	0.0	0.0	0.1	0.1

The results obtained are in line with the anticipated. The certificate shall not be superseded except by ANAB without written approval of the International Bureau of Standards (BIPM).

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เอกสารไม่ควบคุม

Certificate No. : ID-ACF-181

Request No. : Req-2022-021

## 12. Overall calibration

EFC Setting	Measured	UNCERTAINTY	Acceptance Limit
FAST / A / 10-100	100	1.000	1.000
STD Setting	100	1.000	1.000
Final	100	1.000	1.000
Observed	0.0	0.1	0.1

## 13. High level stability

EFC Setting	Measured	UNCERTAINTY	Acceptance Limit
FAST / A / 10-100	100	1.000	1.000
STD Setting	100	1.000	1.000
Final	100	1.000	1.000
Observed	0.0	0.1	0.1

End of Certificate

The results obtained are in line with the anticipated. The certificate shall not be superseded except by ANAB without written approval of the International Bureau of Standards (BIPM).

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เอกสารไม่ควบคุม

## Certificate of Calibration

Customer : INNOVATIVE INSTRUMENT CALIBRATION LTD. (INCORPORATED)  
Address : 1150 Mouldside Drive, Northampton, LE19 4RQ, United Kingdom  
Request No. : ID-ACF-181

### Lab Scope Calibration Details

Measurement item : Sound Level Meter  
Measurement : 100dB (A) (100)  
Model : 100  
Serial Number : 1000000  
Reference : 1000000 (1000000)  
Reference : 1000000 (1000000)

### Calibration Performance and Results

Temperature : 20.0 ± 0.5 °C  
Humidity : 50.0 ± 5.0 %  
Measurement : 100dB (A) (100)  
Reference : 1000000 (1000000)  
Reference : 1000000 (1000000)  
Reference : 1000000 (1000000)  
Reference : 1000000 (1000000)

Item	Value	Unit	Uncertainty	Acceptance Limit
Sound Level Meter	100.0	dB(A)	1.000	1.000
Sound Level Meter	100.0	dB(A)	1.000	1.000
Sound Level Meter	100.0	dB(A)	1.000	1.000

Note

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

Authorized By :  
By: [Signature]  
Calibration Officer

Approved By :  
By: [Signature]  
Calibration Officer  
Date: 11 February 2022

The results obtained are in line with the anticipated. The certificate shall not be superseded except by ANAB without written approval of the International Bureau of Standards (BIPM).

เอกสารไม่ควบคุม

Certificate No: 20-07-111  
 Report No: Rep-020-0001

1. Indication of the calibration check frequency

UUT Testing	Measured	Deviation	Uncertainty	Acceptance
UUT 1: 10-100	100	100	100	100
UUT 2: 10-100	100	100	100	100
UUT 3: 10-100	100	100	100	100

Note: The above results are for the calibration check frequency of 100%.

2. Self-generated noise, Measurement included

UUT Testing	Measured	Uncertainty
UUT 1: 10-100	100	100
UUT 2: 10-100	100	100
UUT 3: 10-100	100	100

3. Self-generated noise, Measurement replaced by the external input signal device

UUT Testing	Measured	Uncertainty
UUT 1: 10-100	100	100
UUT 2: 10-100	100	100
UUT 3: 10-100	100	100

4. Acoustic signal test of frequency weighting (without weighting)

UUT Testing	Measured	Uncertainty	Acceptance
UUT 1: 10-100	100	100	100
UUT 2: 10-100	100	100	100
UUT 3: 10-100	100	100	100

The above results are for the calibration check frequency of 100%.

เอกสารไม่ควบคุม

Certificate No: 20-07-111  
 Report No: Rep-020-0001

5. Electrical signal test of frequency weighting, Weighting response with relative to 1 kHz

UUT Testing	Measured	Uncertainty	Acceptance
UUT 1: 10-100	100	100	100
UUT 2: 10-100	100	100	100
UUT 3: 10-100	100	100	100

6. Frequency and time weighting at 1 kHz

UUT Testing	Measured	Uncertainty	Acceptance
UUT 1: 10-100	100	100	100
UUT 2: 10-100	100	100	100
UUT 3: 10-100	100	100	100

The above results are for the calibration check frequency of 100%.

เอกสารไม่ควบคุม

Certificate No: 20-07-111  
 Report No: Rep-020-0001

7. Long Term Stability

UUT Testing	Measured	Uncertainty	Acceptance
UUT 1: 10-100	100	100	100
UUT 2: 10-100	100	100	100
UUT 3: 10-100	100	100	100

8. Level Uncertainty for the reference level range

UUT Testing	Measured	Uncertainty	Acceptance
UUT 1: 10-100	100	100	100
UUT 2: 10-100	100	100	100
UUT 3: 10-100	100	100	100

The above results are for the calibration check frequency of 100%.

เอกสารไม่ควบคุม

Certificate No: 20-07-111  
 Report No: Rep-020-0001

9. Level Uncertainty for the level range covered

UUT Testing	Measured	Uncertainty	Acceptance
UUT 1: 10-100	100	100	100
UUT 2: 10-100	100	100	100
UUT 3: 10-100	100	100	100

10. Time based response

UUT Testing	Measured	Uncertainty	Acceptance
UUT 1: 10-100	100	100	100
UUT 2: 10-100	100	100	100
UUT 3: 10-100	100	100	100

11. Peak C-Sound level

UUT Testing	Measured	Uncertainty	Acceptance
UUT 1: 10-100	100	100	100
UUT 2: 10-100	100	100	100
UUT 3: 10-100	100	100	100

The above results are for the calibration check frequency of 100%.

เอกสารไม่ควบคุม









## REPORT OF CALIBRATION

### FOR

NOMENCLATURE : VIBRATION METER  
 MANUFACTURER : INSTANTEL  
 MODEL / TYPE : 721A266/721A201  
 SERIAL NO. : UN14547/UN14547  
 DATE OF CALIBRATION : 08 February 2022

#### ENVIRONMENT CONDITIONS :

Temperature :  $(27 \pm 0.5)^\circ\text{C}$  Humidity :  $(55 \pm 0.5)\%$  RH

#### PROCEDURE USED :

This instrument was calibrated under procedure No. CLC-CP01-05 based on ISO 10012-21, as calibration position.  
 The calibration was performed by using Digital Multimeter, Universal Counter and Portable Vibration Calibrator which equipped by the Calibration Laboratory Co., Ltd.

#### REFERENCE STANDARD USED :

1. Digital Multimeter, Wavetek Model 1201-501, 2012B.
2. Universal Counter, Etekco Packed Model 6315A, 2014/10/12.
3. Portable Vibration Calibrator, The Model Shop Model 91101, 2014.

#### TRACEABILITY :

1. The measurement are traceable to International System of Units (SI), through Automatic Ratio of Thailand Ltd. Certificate No. 01-010101, Date 31 May 2021.
2. The measurement are traceable to International System of Units (SI), through Automatic Ratio of Thailand Ltd. Certificate No. 01-007321, Date 14 May 2022.
3. The measurement are traceable to International System of Units (SI), through The Model Shop, Inc. Certificate No. 2019-01, Date 10 November 2022.

#### UNCERTAINTY :

The reported standard uncertainty of measurement is stated in the standard uncertainty of measurement multiplied by the coverage factor  $k=2.00$  which for a normal distribution corresponds to a coverage probability of approximately 95%.  
 It has been evaluated according to the "Evaluation of the Uncertainty of Measurement in Calibration" (EA-402, 2021P).

Certificate No. Q1212201  
 05-01-0401-12

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เอกสารไม่ควบคุม



#### CONDITION OF CALIBRATION ITEM : GOOD

#### MEASUREMENT RESULTS : (X) without adjustment ( ) adjustment

#### CALIBRATION DATA

##### 1. ACCELERATION RESULT

Test point		Mode	STD Reading (g)	DOC Reading (g)	Correction (g)	Uncertainty $\pm 1\%$ of $a_{g1}$
(g)	(Frequency)					
0.2	30 Hz	peak	0.198	0.204	-0.006	1.9
0.4	30 Hz		0.400	0.407	-0.007	1.9
0.6	30 Hz		0.598	0.606	-0.008	1.9
0.8	30 Hz		0.800	0.811	-0.011	1.9
0.7	30 Hz		0.700	0.714	-0.014	1.9
0.5	300 Hz	peak	0.498	0.505	-0.007	1.9
0.8	300 Hz		0.800	0.807	-0.007	1.9
0.8	300 Hz		0.798	0.810	-0.012	1.9
0.6	300 Hz		0.600	0.615	-0.015	1.9
0.7	300 Hz		0.700	0.710	-0.010	1.9

##### 2. VELOCITY RESULT

Test point		Mode	STD Reading (mm/s)	DOC Reading (mm/s)	Correction (mm/s)	Uncertainty $\pm 1\%$ of $a_{g1}$
(mm/s)	(Frequency)					
3	30 Hz	peak	3.000	3.015	-0.015	1.9
4	30 Hz		4.000	4.014	-0.014	1.9
5	30 Hz		5.000	5.020	-0.020	1.9
6	30 Hz		6.000	6.019	-0.019	1.9
7	30 Hz		7.000	7.038	-0.038	1.9
3	300 Hz	peak	3.000	3.016	-0.016	1.9
4	300 Hz		4.000	4.019	-0.019	1.9
5	300 Hz		5.000	5.014	-0.014	1.9
6	300 Hz		6.000	6.022	-0.022	1.9
7	300 Hz		7.000	7.003	-0.003	1.9

Certificate No. Q1212201  
 05-01-0401-12

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เอกสารไม่ควบคุม



#### CALIBRATION DATA

##### \*3. DISPLACEMENT RESULT

Test point		Mode	STD Reading (mm)	DOC Reading (mm)	Correction (mm)	Uncertainty $\pm 1\%$ of $a_{g1}$
(mm)	(Frequency)					
0.03	30 Hz	peak	0.030	0.030	0.000	2.1
0.04	30 Hz		0.040	0.040	0.000	1.7
0.05	30 Hz		0.050	0.051	-0.001	1.9
0.06	30 Hz		0.060	0.061	-0.001	1.9
0.07	30 Hz		0.070	0.071	-0.001	1.2
0.03	180 Hz	peak	0.030	0.030	0.000	2.1
0.04	180 Hz		0.040	0.040	0.000	1.7
0.05	180 Hz		0.050	0.050	0.000	1.9
0.06	180 Hz		0.060	0.061	-0.001	1.9
0.07	180 Hz		0.070	0.071	-0.001	1.2

Note: \* Issued Calibration method "Not-Avail Auto-Stor" is the Certificate have been included for completeness.

The Scope of Accredited ANAB Certificate No. A2204-2014 Version 008 Page 1 of 10

This report is valid for the above stated instruments only.

007 End of Certificate 008

Certificate No. Q1212201  
 05-01-0401-12

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เอกสารไม่ควบคุม



## CERTIFICATE OF CALIBRATION

### FOR

NOMENCLATURE : VIBRATION METER  
 MANUFACTURER : INSTANTEL  
 MODEL / TYPE : 721A266/721A201  
 SERIAL NO. : UN14466/UN14466  
 CLID NO. : 252006953  
 JOB CONTROL NO. : 21822017948

UNITED ANALYST AND ENGINEERING CONSULTANT CO., LTD.  
 81 SOUTHMOOR RD, NORTHVIEW ROAD,  
 BANGKOK, PHRAKHAMONG, BANGKOK 10150

DATE OF RECEIVED : 21 February 2022

DATE OF ISSUED : 24 February 2022

Report of calibration covering instrument is taken in input. Except comply. Without the approval of the Calibration Laboratory Co., Ltd.

Calibrated By : Sontai Phasacharabong  
 Calibration Engineer

Approved By : Mengkhal Yimsamont  
 Authorized Signatory  
 24 February 2022



This Calibration Certificate documents the responsibility to national standards, which underlies the work of measurement according to the International System of Units (SI).

Certificate No. Q1217948  
 05-01-0401-12

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เอกสารไม่ควบคุม



## เอกสารไม่ควบคุม





## REPORT OF CALIBRATION

FOR

NOMENCLATURE : VIBRATION METER  
 MANUFACTURER : INSTANTEIL  
 MODEL / TYPE : 721A2601/721A2601  
 SERIAL NO. : UM14463/UM14463  
 DATE OF CALIBRATION : 22 March 2022

### ENVIRONMENT CONDITIONS :

Temperature :  $(25 \pm 2)^\circ\text{C}$  Relative Humidity :  $(55 \pm 15)\%$  RH

### PROCEDURE USED :

This instrument was calibrated under procedure No. CLC-CPE008 based on ISO 10012:2013 as calibration procedure.  
 The calibration was performed by using Digital Multimeter, Universal Counter and Portable Frequency Calibrator which maintained by the Calibration Laboratory Co., Ltd.

### REFERENCE STANDARD USED :

- Digital Multimeter, Fluke Model 101 & 2000
- Universal Counter, Hewlett Packard Model 3313A, 670, 3100A, 3300A
- Portable Frequency Calibrator, The Model Shop Model 1100 & N-1100A

### TRACEABILITY :

- The measurements are traceable to International System of Units (SI), through Automatic Scale of Thailand Ltd. Certificate No. 01-007121, Due Date: 31 May 2023
- The measurements are traceable to International System of Units (SI), through Automatic Scale of Thailand Ltd. Certificate No. 01-007121, Due Date: 31 May 2023
- The measurements are traceable to International System of Units (SI), through The Model Shop, Inc. Certificate No. 204910, Due Date: 31 November 2022

### UNCERTAINTY :

The reported expanded uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor  $k = 2.00$  which for a normal distribution corresponds to a coverage probability of approximately 95%. It has been evaluated according to the "Guideline of the University of Measurement in Calibration (EA-402:03/01)".

Certificate No. Q2202607  
 02-025-9200-12

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เอกสารไม่ควบคุม



### CONDITION OF CALIBRATION ITEM : GOOD

MEASUREMENT RESULT : (X) without adjustment ( ) adjustment

### CALIBRATION DATA

#### 1. ACCELERATION RESULT

Test point		Mode	STD Reading	DUV Reading	Correction	Uncertainty
(g)	(Frequency)		(g)	(g)	(g)	(% of ref. g)
0.3	10 Hz	peak	0.300	0.300	-0.001	1.0
0.4	10 Hz		0.400	0.411	-0.011	1.0
0.5	10 Hz		0.500	0.511	-0.011	1.0
0.6	10 Hz		0.600	0.610	-0.010	1.0
0.7	10 Hz		0.700	0.710	-0.010	1.0
0.3	100 Hz	peak	0.300	0.300	-0.001	1.0
0.4	100 Hz		0.400	0.410	-0.010	1.0
0.5	100 Hz		0.500	0.511	-0.011	1.0
0.6	100 Hz		0.600	0.611	-0.011	1.0
0.7	100 Hz		0.700	0.711	-0.011	1.0

#### 2. VELOCITY RESULT

Test point		Mode	STD Reading	DUV Reading	Correction	Uncertainty
(mm/s)	(Frequency)		(mm/s)	(mm/s)	(mm/s)	(% of ref. mm/s)
3	10 Hz	peak	3.000	3.000	-0.010	1.0
4	10 Hz		4.000	4.011	-0.011	1.0
5	10 Hz		5.000	5.000	-0.008	1.0
6	10 Hz		6.000	6.001	-0.001	1.0
7	10 Hz		7.000	7.100	-0.100	1.0
3	100 Hz	peak	3.000	3.010	-0.010	1.0
4	100 Hz		4.000	4.001	-0.001	1.0
5	100 Hz		5.000	5.100	-0.100	1.0
6	100 Hz		6.000	6.100	-0.100	1.0
7	100 Hz		7.000	7.100	-0.100	1.0

Certificate No. Q2202607  
 02-025-9200-12

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### CALIBRATION DATA

#### \*1. DISPLACEMENT RESULT

Test point		Mode	STD Reading	DUV Reading	Correction	Uncertainty
(mm)	(Frequency)		(mm)	(mm)	(mm)	(% of ref. mm)
0.00	10 Hz	peak	0.000	0.000	0.000	2.3
0.04	10 Hz		0.040	0.040	0.000	1.7
0.08	10 Hz		0.080	0.080	0.000	1.0
0.16	10 Hz		0.160	0.160	-0.001	1.3
0.32	10 Hz		0.320	0.321	-0.001	1.2
0.60	100 Hz	peak	0.600	0.600	0.000	2.2
0.04	100 Hz		0.040	0.040	0.000	1.7
0.08	100 Hz		0.080	0.081	-0.001	1.8
0.16	100 Hz		0.160	0.160	-0.001	1.3
0.32	100 Hz		0.320	0.321	-0.001	1.2

Note: \* means Calibration marked "Not ANAB Accredited" in this Certificate have been included for comparison.

The Scope of Accredited: ANAB Certificate No. A22012017 Version 001 Page 1 of 20

This report is valid for the above stated instrument only.

499 End of Certificate 999

Certificate No. Q2202607  
 02-025-9200-12

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เอกสารไม่ควบคุม



## CERTIFICATE OF CALIBRATION

FOR

NOMENCLATURE : VIBRATION METER  
 MANUFACTURER : INSTANTEIL  
 MODEL / TYPE : 721A2601/721A2601  
 SERIAL NO. : UM14464/UM14464  
 CLID NO. : 202000040  
 JOB CONTROL NO. : 2202302509

CUSTOMER : UNITED ANALYST AND ENGINEERING CONSULTANT CO., LTD.  
 81 BUILDING 4, SUKHUMVIT ROAD,  
 BANGCHAK, PHRAKHAONG, BANGKOK 10260

DATE OF RECEIVED : 21 March 2022

DATE OF DATED : 24 March 2022

Pages of calibration certificate were sent by e-mail in pdf. through computer. Without the approval of the Calibration Laboratory Co., Ltd.

Calibrated By :

Sunee Phrasaengseng  
 Calibration Engineer

Approved By :

Mangkol Yimsomran  
 Authorized Signatory  
 24 March 2022



This Calibration Certificate documents the traceability to national standards, which (within the scope of measurement) according to the International System of Units (SI).

Certificate No. Q2202608  
 02-025-9200-12

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เอกสารไม่ควบคุม





## REPORT OF CALIBRATION

### FOR

NOMENCLATURE : VIBRATION METER  
MANUFACTURER : INSTANTEEL  
MODEL / TYPE : 721A360/721A360  
SERIAL NO. : 136143441/13614544  
DATE OF CALIBRATION : 22 March 2022

#### ENVIRONMENT CONDITIONS :

Temperature :  $(27 \pm 1) ^\circ\text{C}$  Relative Humidity :  $48 \pm 20\%$  RH

#### PROCEDURE USED :

This instrument was calibrated under procedure No. CLC-CPEE-08 based on ISO 10012:01 as calibration procedure.  
The calibration was performed by using Digital Multimeter, Universal Counter and Portable Vibration Calibrator which maintained by the Calibration Laboratory Co., Ltd.

#### REFERENCE STANDARD USED :

1. Digital Multimeter, Vortex Model 124-10C 2019B
2. Universal Counter, Syntech Parked Model 5715A 2019 2440A194G
3. Portable Vibration Calibrator, The Model Shop Model 91100 5/N 11412

#### TRACEABILITY :

1. The measurements are traceable to International System of Units (SI), through International Scale of Thailand (L1) Certificate No. 39-8237101, Due Date 31 May 2023
2. The measurements are traceable to International System of Units (SI), through International Scale of Thailand (L2) Certificate No. 87-8073701, Due Date 31 May 2023
3. The measurements are traceable to International System of Units (SI), through The Model Shop, Inc. Certificate No. 204101, Due Date 30 November 2022

#### UNCERTAINTY :

The reported expanded uncertainty of measurement is based on the standard uncertainty of measurement multiplied by the coverage factor  $k = 2.00$  which for a normal distribution corresponds to a coverage probability of approximately 95%. It has been evaluated according to the "Evaluation of the Uncertainty of Measurement in Calibration (EA-4) 047811"

Certificate No. Q1201908

03-011-0001-02

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เอกสารไม่ควบคุม



#### CONDITION OF CALIBRATION ITEM : GOOD

MEASUREMENT RESULTS : ( X ) without adjustment ( ) adjustment

#### CALIBRATION DATA

##### 1. ACCELERATION RESULT

Test point	Mode	STD Reading ( g )	DUC Reading ( g )	Correction ( g )	Uncertainty $\pm$ ( % of avg. )
( g )	( frequency )				
0.5	30 Hz	0.500	0.502	-0.002	1.0
0.0	30 Hz	0.000	0.002	-0.002	1.0
0.2	30 Hz	0.200	0.203	-0.003	1.0
0.0	30 Hz	0.000	0.007	-0.007	1.0
0.7	30 Hz	0.700	0.704	-0.004	1.0
0.3	100 Hz	0.300	0.298	+0.002	1.0
0.0	100 Hz	0.000	0.001	-0.001	1.0
0.5	100 Hz	0.500	0.498	+0.002	1.0
0.0	100 Hz	0.000	0.001	-0.001	1.0
0.7	100 Hz	0.700	0.692	+0.008	1.0

##### 2. VELOCITY RESULT

Test point	Mode	STD Reading ( mm/s )	DUC Reading ( mm/s )	Correction ( mm/s )	Uncertainty $\pm$ ( % of avg. )
( mm/s )	( frequency )				
0	30 Hz	0.000	0.000	-0.000	1.0
0	30 Hz	0.000	0.000	-0.000	1.0
0	30 Hz	0.000	0.001	-0.001	1.0
0	30 Hz	0.000	0.001	-0.001	1.0
7	30 Hz	7.000	6.928	+0.072	1.0
0	100 Hz	0.000	0.017	-0.017	1.0
0	100 Hz	0.000	0.022	-0.022	1.0
0	100 Hz	0.000	0.013	-0.013	1.0
0	100 Hz	0.000	0.019	-0.019	1.0
7	100 Hz	7.000	7.000	-0.000	1.0

Certificate No. Q1201908

03-011-0001-02

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#### CALIBRATION DATA

##### 1.1 DISPLACEMENT RESULT

Test point	Mode	STD Reading ( mm )	DUC Reading ( mm )	Correction ( mm )	Uncertainty $\pm$ ( % of avg. )
( mm )	( frequency )				
0.01	30 Hz	0.001	0.000	0.000	1.1
0.04	30 Hz	0.040	0.040	0.000	1.7
0.07	30 Hz	0.070	0.070	0.000	1.0
0.04	30 Hz	0.040	0.039	+0.001	1.0
0.07	30 Hz	0.070	0.069	+0.001	1.0
0.01	100 Hz	0.001	0.000	0.000	1.1
0.04	100 Hz	0.040	0.040	0.000	1.7
0.07	100 Hz	0.070	0.070	0.000	1.0
0.04	100 Hz	0.040	0.040	0.000	1.0
0.07	100 Hz	0.070	0.070	0.000	1.0

Note : \* please Calibration realized " 1st XNAB Accredited " in 30a Certificate have been included for completeness

The Scope of Accredited ANAB Certificate No. ACDM-2014 Version 09 Page 1 of 18

This report is valid for the above stated instrument only.

006 End of Certificate 006

Certificate No. Q1201908

03-011-0001-02

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## CERTIFICATE OF CALIBRATION

### FOR

NOMENCLATURE : VIBRATION METER  
MANUFACTURER : INSTANTEEL  
MODEL / TYPE : 721A360/721A360  
SERIAL NO. : 136143441/13614544  
CLID. NO. : 25300002  
JOB CONTROL NO. : 2103101700

CUSTOMER : UNITED ANALYST AND ENGINEERING CONSULTANT CO., LTD.  
81 RUE DINDOK AL SAKHRIYEH ROAD,  
BANGCHAI, PHRAKHAMONG, BANGKOK 10100

DATE OF RECEIVED : 21 March 2022

DATE OF ISSUE : 24 March 2022

Scope of calibration covering instrument is shown in page 2, scope complete. Without the approval of the Calibration Laboratory Co., Ltd.

Calibrated By :

Santi Phuanbunrong  
Calibration Engineer

Approved By :

Mongkol Yimsaenon  
Authorized Signatory  
24 March 2022



This Calibration Certificate demonstrates the traceability to national standards, which enables the use of measurement according to the International System of Units (SI)

Certificate No. Q1201908

03-011-0001-02

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## REPORT OF CALIBRATION

FOR

NOMENCLATURE : VIBRATION METER  
 MANUFACTURER : INSTANTEL  
 MODEL / TYPE : T21A250/T21A250I  
 SERIAL NO. : UM12294/UM12394  
 DATE OF CALIBRATION : 19 January 2022

### ENVIRONMENT CONDITIONS :

Temperature :  $20 \pm 0.5^\circ\text{C}$  Relative Humidity :  $45 \pm 10\%$  RH

### PROCEDURE USED :

This instrument was calibrated under procedure No. CLC-CPEE-08 based on ISO 10012-01 as calibration guidelines.  
 The calibration was performed by using Digital Multimeter, Universal Counter and Portable Vibration Calibrator which maintained by the Calibration Laboratory Co., Ltd.

### REFERENCE STANDARD USED :

- Digital Multimeter, Wavetek Model D21 S/N 20303
- Universal Counter, Horvut, Packard Model D312A S/N 2446A12642
- Portable Vibration Calibrator, The Model Shop Model V100 S/N 11433

### TRACEABILITY :

- The measurement is traceable to International System of Units (SI), through Accredited RoCo of Thailand Ltd. Certificate No. 09-037572, (Due Date 31 May 2022).
- The measurement is traceable to International System of Units (SI), through Accredited RoCo of Thailand Ltd. Certificate No. 01-007321, (Due Date 14 May 2022).
- The measurement is traceable to International System of Units (SI), through The Model Shop, Inc. Certificate No. 264081, (Due Date 18 November 2021).

### UNCERTAINTY :

The reported expanded uncertainty of measurement is stated as the combined uncertainty of measurement multiplied by the coverage factor  $k = 2.00$  which for a normal distribution corresponds to a coverage probability of approximately 95%. It has been evaluated according to the "Evaluation of the Uncertainty of Measurement in Calibration (EA-403:2018)".

Certificate No. Q22012108

03-011-0001-12

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เอกสารไม่ควบคุม



CONDITION OF CALIBRATION ITEM : GOOD

MEASUREMENT RESULTS : (X) without adjustment ( ) adjustment

### CALIBRATION DATA

#### 1. ACCELERATION RESULT

Test point		Mode	STD Reading (g)	DCC Reading (g)	Correction (g)	Uncertainty ( $\pm 1\%$ of $M_{95}$ )
(g)	(Frequency)					
0.5	10 Hz	peak	0.500	0.289	-0.001	1.0
0.8	10 Hz		0.800	0.396	-0.004	1.0
0.9	10 Hz		0.900	0.407	-0.003	1.0
0.8	10 Hz		0.900	0.396	-0.006	1.0
0.7	10 Hz		0.700	0.400	-0.007	1.0
0.2	100 Hz	peak	0.200	0.382	-0.002	1.0
0.4	100 Hz		0.400	0.403	-0.001	1.0
0.8	100 Hz		0.700	0.394	-0.001	1.0
0.6	100 Hz		0.600	0.407	-0.007	1.0
0.7	100 Hz		0.700	0.398	-0.008	1.0

#### 2. VELOCITY RESULT

Test point		Mode	STD Reading (mm/s)	DCC Reading (mm/s)	Correction (mm/s)	Uncertainty ( $\pm 1\%$ of $M_{95}$ )
(mm/s)	(Frequency)					
3	10 Hz	peak	3.000	2.841	-0.011	1.0
4	10 Hz		4.000	4.819	-0.021	1.0
5	10 Hz		5.000	5.870	-0.070	1.0
6	10 Hz		6.000	6.801	-0.001	1.0
7	10 Hz		7.000	7.805	0.001	1.0
3	100 Hz	peak	3.000	3.831	-0.071	1.0
4	100 Hz		4.000	4.842	-0.042	1.0
5	100 Hz		5.000	5.870	0.000	1.0
6	100 Hz		6.000	6.877	-0.077	1.0
7	100 Hz		7.000	7.803	-0.001	1.0

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03-011-0001-12

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### CALIBRATION DATA

#### 1A. DISPLACEMENT RESULT

Test point		Mode	STD Reading (mm)	DCC Reading (mm)	Correction (mm)	Uncertainty ( $\pm 1\%$ of $M_{95}$ )
(mm)	(Frequency)					
0.02	10 Hz	peak	0.020	0.020	0.000	1.0
0.04	10 Hz		0.040	0.040	0.000	1.0
0.05	10 Hz		0.050	0.049	-0.000	1.0
0.06	10 Hz		0.060	0.058	-0.002	1.0
0.07	10 Hz		0.070	0.069	-0.001	1.0
0.02	100 Hz	peak	0.020	0.020	0.000	1.0
0.04	100 Hz		0.040	0.040	0.000	1.0
0.05	100 Hz		0.050	0.051	0.001	1.0
0.06	100 Hz		0.060	0.063	0.003	1.0
0.07	100 Hz		0.070	0.071	0.001	1.0

Note: \* means Calibration marked "Not ANAB Accredited" in this Certificate from here to (b) (c) for completeness.

The Scope of Accredited: ANAB Certificate No. MC00-0218 Version 001 Page 1 of 18

This report is valid for the above stated instrument(s) only.

End of Certificate 001

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## CERTIFICATE OF CALIBRATION

FOR

NOMENCLATURE : VIBRATION METER  
 MANUFACTURER : INSTANTEL  
 MODEL / TYPE : T21A250/T21A250I  
 SERIAL NO. : UM12294/UM12394  
 CLID. NO. : 251001230  
 JOB CONTROL NO. : 220307912250

CUSTOMER : UNITED ANALYST AND ENGINEERING CONSULTANT CO., LTD.  
 85 MOO 10, ROAD 41, SECURITY ROAD,  
 BANGCHAK, PHRAKHAMONG, BANGKOK 10260

DATE OF RECEIVED : 07 February 2022

DATE OF ISSUE : 10 February 2022

Report of calibration covering stated test for future use. Report complete. Without the approval of the Calibration Laboratory Co., Ltd.

Calibrated By :

Sorak Phairatwong  
 Calibration Engineer

Approved By :

Mongkol Yonvong  
 Authorized Signatory  
 10 February 2022



This Calibration Certificate documents the traceability to national standards, which makes the units of measurement according to the International System of Units (SI).

Certificate No. Q22012108

03-011-0001-12

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เอกสารไม่ควบคุม







## REPORT OF CALIBRATION

### FOR

NOMENCLATURE : VIBRATION METER  
 MANUFACTURER : INSTANTEL  
 MODEL / TYPE : 721A2801/721A2801  
 SERIAL NO. : CM123055H12385  
 DATE OF CALIBRATION : 01 February 2022

#### ENVIRONMENT CONDITIONS :

Temperature :  $(23 \pm 2)^\circ\text{C}$  Relative Humidity :  $(60 \pm 10)\%$

#### PROCEDURE USED :

This instrument was calibrated under procedure No. CLC-CPRE-08 based on ISO 10012-1 in calibration position.  
 The calibration was performed by using Digital Multimeter, Universal Counter and Portable Vibration Calibrator which maintained by the Calibration Laboratory Co., Ltd.

#### REFERENCE STANDARD USED :

1. Digital Multimeter, Wavetek Model 1301 5 1/2 20110
2. Universal Counter, Rytek/Packard 38680 3 1/2 244013102
3. Portable Vibration Calibrator, The Model Shop Model 91 RD-50 11424

#### TRACEABILITY :

1. The measurements are traceable to International System of Units (SI), through Accredited Bodies of Thailand Ltd. Certificate No. 01-000731, Date Due 31 May 2023.
2. The measurements are traceable to International System of Units (SI), through Accredited Bodies of Thailand Ltd. Certificate No. 05-007321, Date Due 31 May 2022.
3. The measurements are traceable to International System of Units (SI), through The World Shop, Inc. Certificate No. 264981, Date Due 16 November 2022.

#### UNCERTAINTY :

The reported expanded uncertainty of measurement is stated in the standard uncertainty of measurement multiplied by the coverage factor  $k = 2.00$  which for a normal distribution corresponds to a coverage probability of approximately 95 %.  
 It has been evaluated according to the "Evaluation of the Uncertainty of Measurement in Calibration (JG-400 94.2) 13"

Certificate No. Q2201209

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#### CONDITION OF CALIBRATION ITEM : GOOD

MEASUREMENT RESULTS : (X) without adjustment ( ) adjustment

#### CALIBRATION DATA

##### 1. ACCELERATION RESULT

Test point		Mode	STD Reading	10°C Reading	Correction	Uncertainty
(g)	(Frequency)		(g)	(g)	(g)	(% of ref. g)
0.2	10 Hz	peak	0.200	0.200	-0.001	1.0
0.4	10 Hz		0.400	0.400	-0.001	1.0
0.7	10 Hz		0.700	0.700	-0.006	1.3
0.9	10 Hz		0.900	0.900	-0.006	1.3
0.1	10 Hz		0.100	0.100	-0.001	1.3
0.2	100 Hz	peak	0.200	0.201	-0.001	1.0
0.4	100 Hz		0.400	0.404	-0.004	1.0
0.7	100 Hz		0.700	0.706	-0.006	1.3
0.9	100 Hz		0.900	0.907	-0.007	1.3
0.1	100 Hz		0.100	0.106	-0.006	1.3

##### 2. VELOCITY RESULT

Test point		Mode	STD Reading	10°C Reading	Correction	Uncertainty
(mm/s)	(Frequency)		(mm/s)	(mm/s)	(mm/s)	(% of ref. g)
0	10 Hz	peak	1.000	1.001	-0.001	0.5
4	10 Hz		4.000	4.000	-0.000	0.5
9	10 Hz		9.000	9.001	-0.001	0.5
4	10 Hz		4.000	4.004	-0.004	0.5
1	10 Hz		1.000	1.002	-0.002	0.5
1	100 Hz	peak	1.000	1.000	-0.000	0.5
4	100 Hz		4.000	4.002	-0.002	0.5
9	100 Hz		9.000	9.003	-0.003	0.5
4	100 Hz		4.000	4.005	-0.005	0.5
1	100 Hz		1.000	1.005	-0.005	0.5

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#### CALIBRATION DATA

##### \*5. DISPLACEMENT RESULT

Test point		Mode	STD Reading	10°C Reading	Correction	Uncertainty
(mm)	(Frequency)		(mm)	(mm)	(mm)	(% of ref. g)
0.02	10 Hz	peak	0.020	0.020	0.000	0.1
0.04	10 Hz		0.040	0.040	0.000	1.3
0.07	10 Hz		0.070	0.070	0.000	1.3
0.09	10 Hz		0.090	0.090	0.000	1.3
0.01	10 Hz		0.010	0.010	0.000	1.3
0.02	100 Hz	peak	0.020	0.020	0.000	0.1
0.04	100 Hz		0.040	0.040	0.000	1.3
0.07	100 Hz		0.070	0.070	0.000	1.3
0.09	100 Hz		0.090	0.090	0.000	1.3
0.01	100 Hz		0.010	0.010	0.000	1.3

Note: \* means Calibration included \* Not ANAB Accredited \* In this Certificate have been included for comparison.

The Scope of Accredited: ANAB Certificate No. ACDM 2014 Version 008 Page 1 of 30

This report is valid for the above stated instruments only.

200 End of Certificate 000

Certificate No. Q2201209

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## CERTIFICATE OF CALIBRATION

### FOR

NOMENCLATURE : VIBRATION METER  
 MANUFACTURER : INSTANTEL  
 MODEL / TYPE : 721A2801/721A2801  
 SERIAL NO. : CM123055H12385  
 CLID. NO. : 25190351  
 JOB CONTROL NO. : 210201209

CERTIFICATION : UNITED ANALYST AND ENGINEERING CONSULTANT CO., LTD.  
 81 RUK THUMPHI 21, KIRKHAMPT ROAD,  
 BANACHAN, PHRACHANONG, RANGKON 10100

DATE OF RECEIVED : 07 February 2022

DATE OF ISSUED : 10 February 2022

Report of calibration is valid only for the above stated instruments only. Without the approval of the Calibration Laboratory Co., Ltd.

Calibrated By :

Sutin Phasuchabong  
 Calibration Engineer

Approved By :

Mangkol Yotornatam  
 Authorized Signatory  
 10 February 2022



This Calibration Certificate documents the traceability to national standards, which reflect the value of measurement according to the International System of Units (SI).

Certificate No. Q2201209

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## เอกสารไม่ความคืบ



## REPORT OF CALIBRATION

### FOR

NOMENCLATURE : VIBRATION METER  
MANUFACTURER : INSTANTEL  
MODEL / TYPE : T31A290/T31A290I  
SERIAL NO. : UM12913UM12912  
DATE OF CALIBRATION : 21 February 2021

#### ENVIRONMENT CONDITIONS :

Temperature :  $(23 \pm 2)^\circ\text{C}$  Relative Humidity :  $(58 \pm 10)\%$

#### PROCEDURE USED :

This instrument was calibrated under provision for CLC-OPER-08 based on ISO 10012-1 in calibration guidelines.  
The calibration was performed by using Digital Multimeter, Universal Calibrator and Portable Vibration Calibrator  
which maintained by the Calibration Laboratory Co., Ltd.

#### REFERENCE STANDARD USED :

1. Digital Multimeter, Wyse Model 1301 9/9, 2020.
2. Universal Calibrator, Hewlett Packard Model 3322A S/N: 248612042.
3. Portable Vibration Calibrator, The Model Shop Model 9500 301, 12424.

#### TRACEABILITY :

1. The measurement is traceable to International System of Units (SI), through National Bureau of Thailand Ltd.  
Certificate No. 03-000711, Due Date 31 May 2021.
2. The measurement is traceable to International System of Units (SI), through National Bureau of Thailand Ltd.  
Certificate No. 03-000712, Due Date 31 May 2021.
3. The measurement is traceable to International System of Units (SI), through The Model Shop, Inc.  
Certificate No. 284911, Due Date 16 November 2021.

#### UNCERTAINTY :

The reported expanded uncertainty of measurement is stated in the standard uncertainty of measurement multiplied  
by the coverage factor  $k=2$  which for a normal distribution corresponds to a coverage probability of approximately 95 %.  
It has been evaluated according to the "Guidelines of the Uncertainty of Measurement in Calibration (EA-402:01/2011)".

Certificate No. Q2007990

21-011-0001-12

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เอกสารไม่ควบคุม



#### CONDITION OF CALIBRATION ITEM : GOOD

MEASUREMENT RESULTS : (X) without adjustment ( ) adjustment

#### CALIBRATION DATA

##### 1. ACCELERATION RESULT

Test point		Mode	STD Reading	DOC Reading	Correction	Uncertainty
(g)	(Frequency)		(g)	(g)	(g)	$\pm$ (% of rdg.)
0.2	10 Hz	peak	0.190	0.190	-0.001	1.8
0.4	10 Hz		0.380	0.380	-0.001	1.8
0.8	10 Hz		0.760	0.760	-0.001	1.2
0.8	10 Hz		0.800	0.807	-0.007	1.3
0.7	10 Hz		0.700	0.700	-0.000	1.3
0.2	100 Hz	peak	0.190	0.192	-0.002	1.8
0.4	100 Hz		0.380	0.380	-0.001	1.8
0.8	100 Hz		0.760	0.760	-0.001	1.2
0.8	100 Hz		0.800	0.800	-0.000	1.2
0.7	100 Hz		0.700	0.700	-0.000	1.8

##### 2. VELOCITY RESULT

Test point		Mode	STD Reading	DOC Reading	Correction	Uncertainty
(mm/s)	(Frequency)		(mm/s)	(mm/s)	(mm/s)	$\pm$ (% of rdg.)
0	10 Hz	peak	1.000	1.000	-0.001	1.8
4	10 Hz		4.000	4.000	-0.001	1.8
8	10 Hz		8.000	8.073	-0.073	1.8
8	10 Hz		8.000	8.080	-0.080	1.8
7	10 Hz		7.000	7.000	-0.001	1.8
2	100 Hz	peak	1.000	1.007	-0.007	1.8
4	100 Hz		4.000	4.000	-0.000	1.8
8	100 Hz		8.000	8.070	-0.070	1.8
8	100 Hz		8.000	8.000	-0.000	1.8
7	100 Hz		7.000	7.000	-0.001	1.8

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#### CALIBRATION DATA

##### \*A. DISPLACEMENT RESULT

Test point		Mode	STD Reading	DOC Reading	Correction	Uncertainty
(mm)	(Frequency)		(mm)	(mm)	(mm)	$\pm$ (% of rdg.)
0.03	10 Hz	peak	0.030	0.030	0.000	2.1
0.04	10 Hz		0.040	0.040	0.000	1.2
0.05	10 Hz		0.050	0.050	0.000	1.2
0.05	10 Hz		0.050	0.050	0.000	1.8
0.07	10 Hz		0.070	0.071	-0.001	1.2
0.03	100 Hz	peak	0.030	0.030	0.000	2.1
0.04	100 Hz		0.040	0.040	0.000	1.2
0.05	100 Hz		0.050	0.050	0.000	1.2
0.05	100 Hz		0.050	0.050	0.000	1.8
0.07	100 Hz		0.070	0.071	-0.001	1.2

Note: \* Issues Calibration result of "Not a Full Accredited" in this Certificate have been included for completeness.

The Scope of Accredited ANAB Certificate No. ACDM 2014 Version 09 Page 1 of 31

This report is valid for the above stated instrument's only.

END End of Certificate 000

Certificate No. Q2007990

21-011-0001-12

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เอกสารไม่ควบคุม



## CERTIFICATE OF CALIBRATION

### FOR

NOMENCLATURE : VIBRATION METER  
MANUFACTURER : INSTANTEL  
MODEL / TYPE : T31A290/T31A290I  
SERIAL NO. : UM12913UM12912  
CLID NO. : 20180101  
JOB CONTROL NO. : 22062804001

CUSTOMER : UNITED ANALYST AND ENGINEERING CONSULTANT CO., LTD.  
81 SOI EDONGK 41, BANGKOK ROAD,  
BANGCHAK, PHRAKHAMING, BANGKOK 10260

DATE OF RECEIVED : 25 June 2021

DATE OF ISSUED : 28 June 2021

Report of calibration is not required for adjustment. Report complete. Without the approval of the Calibration Laboratory Co., Ltd.

Calibrated By :

Somchai Phairatrasong  
Calibration Engineer

Approved By :

Mongkol Vongsomman  
Authorized Signatory  
28 June 2021



This Calibration Certificate documents the responsibility to national standards, which include the trace of measurement according to  
the International System of Units (SI)

Certificate No. Q2007990

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## REPORT OF CALIBRATION

### FOR

NOMENCLATURE : VIBRATION METER  
 MANUFACTURER : INSTANTEL  
 MODEL / TYPE : T21A200/T21A200  
 SERIAL NO. : 13012047/UNIT2047  
 DATE OF CALIBRATION : 27 June 2022

#### ENVIRONMENT CONDITIONS :

Temperature :  $27 \pm 0.1^\circ\text{C}$  Relative Humidity :  $58 \pm 10\%$  RH

#### PROCEDURE USED :

This instrument was calibrated under procedure No. CLC-CP01-01 based on ISO 10012-2:2013 calibration guidelines.  
 The calibration was performed by using Digital Multimeter, High Resolution Programmable Function Generator and Portable Vibration Calibrator which maintained by the Calibration Laboratory Co., Ltd.

#### REFERENCE STANDARD USED :

1. Digital Multimeter, Fluke Model 121 5TH, 2018.
2. High Resolution Programmable Function Generator, Philips Model PM6088 5TH, 2005/01/04.
3. Portable Vibration Calibrator, The Model Shop Model 9130 3TH, 13424.

#### TRACEABILITY :

1. The measurements are traceable to International System of Units (SI), through Association of Banks of Thailand Ltd. Certificate No. 00-000711, Issue Date 31 May 2021.
2. The measurements are traceable to International System of Units (SI), through Association of Banks of Thailand Ltd. Certificate No. 01-000112, Issue Date 22 February 2021.
3. The measurements are traceable to International System of Units (SI), through The Model Shop, Inc. Certificate No. 3449141, Issue Date 16 November 2022.

#### UNCERTAINTY :

The reported expanded uncertainty of measurement is stated in the standard uncertainty of measurement multiplied by the coverage factor  $k=2.00$  which for a normal distribution corresponds to a coverage probability of approximately 95%.  
 It has been estimated according to the "Evaluation of the Uncertainty of Measurement in Calibration (GUM 1992)".

Certificate No. Q1204-011

17-011-0401-12

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เอกสารไม่ควบคุม



#### CONDITION OF CALIBRATION ITEM : GOOD

MEASUREMENT RESULTS : (X) without adjustment ( ) adjustment

#### CALIBRATION DATA

##### 1. ACCELERATION RESULT

Test point		Mode	STD Reading	DVC Reading	Correction	Uncertainty
(g)	(Frequency)		(g)	(g)	(g)	$\pm 1\%$ of std. 1
0.5	10 Hz	peak	0.500	0.500	+0.000	1.0
0.6	20 Hz		0.600	0.600	+0.000	1.0
0.7	30 Hz		0.700	0.699	+0.001	1.0
0.8	40 Hz		0.800	0.800	+0.000	1.0
0.7	50 Hz		0.700	0.699	+0.001	1.0
0.5	100 Hz	peak	0.500	0.500	+0.000	1.0
0.6	100 Hz		0.600	0.600	+0.000	1.0
0.7	100 Hz		0.700	0.699	+0.001	1.0
0.8	100 Hz		0.800	0.800	+0.000	1.0
0.7	100 Hz		0.700	0.699	+0.001	1.0

##### 2. VELOCITY RESULT

Test point		Mode	STD Reading	DVC Reading	Correction	Uncertainty
(mm/s)	(Frequency)		(mm/s)	(mm/s)	(mm/s)	$\pm 1\%$ of std. 1
1	10 Hz	peak	1.000	1.000	+0.000	1.0
1	20 Hz		1.000	1.001	-0.001	1.0
1	30 Hz		1.000	1.002	-0.002	1.0
1	40 Hz		1.000	1.001	-0.001	1.0
1	50 Hz		1.000	1.000	+0.000	1.0
1	100 Hz	peak	1.000	1.000	+0.000	1.0
1	100 Hz		1.000	1.000	+0.000	1.0
1	100 Hz		1.000	1.000	+0.000	1.0
1	100 Hz		1.000	1.000	+0.000	1.0
1	100 Hz		1.000	1.000	+0.000	1.0

Certificate No. Q1204-011

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#### CALIBRATION DATA

##### 3. DISPLACEMENT RESULT

Test point		Mode	STD Reading	DVC Reading	Correction	Uncertainty
(mm)	(Frequency)		(mm)	(mm)	(mm)	$\pm 1\%$ of std. 1
0.01	10 Hz	peak	0.010	0.010	+0.000	1.0
0.01	20 Hz		0.010	0.010	+0.000	1.0
0.01	30 Hz		0.010	0.010	+0.000	1.0
0.01	40 Hz		0.010	0.010	+0.000	1.0
0.01	50 Hz		0.010	0.010	+0.000	1.0
0.01	100 Hz	peak	0.010	0.010	+0.000	1.0
0.01	100 Hz		0.010	0.010	+0.000	1.0
0.01	100 Hz		0.010	0.010	+0.000	1.0
0.01	100 Hz		0.010	0.010	+0.000	1.0
0.01	100 Hz		0.010	0.010	+0.000	1.0

Note: "Process Calibration method" (Not ANAB Approved) in this Certificate have been included for completeness.

The Scope of Accredited APAD Certificate No. ACCM 2014 Version 001 Page 1 of 10

This report is valid for the above stated measurement only.

001 End of Certificate 001

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## CERTIFICATE OF CALIBRATION

### FOR

NOMENCLATURE : VIBRATION METER  
 MANUFACTURER : INSTANTEL  
 MODEL / TYPE : T21A200/T21A200  
 SERIAL NO. : UNIT2047/UNIT2047  
 CLID NO. : 252000774  
 JOB CONTROL NO. : 11062904004

CUSTOMER : UNITED ANALYST AND ENGINEERING CONSULTANT CO., LTD.  
 11 SOI SUKUMVIT 11, SUKUMVIT ROAD,  
 BANGCHAL, PHRAKHAENG, BANGKOK 10110

DATE OF RECEIVED : 25 June 2022

DATE OF ISSUED : 28 June 2022

Report of calibration covering measurement traceability to national standards, which calibrates the scale of measurement according to the International System of Units (SI).

Calibrated By :

Savit Pannachanabong  
 Calibration Engineer

Approved By :

Mongkol Yontacharn  
 Authorized Signatory  
 28 June 2022



This Calibration Certificate documents the traceability to national standards, which calibrates the scale of measurement according to the International System of Units (SI).

Certificate No. Q1204-011

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## REPORT OF CALIBRATION

FOR

NOMENCLATURE : VIBRATION METER  
MANUFACTURER : INSTANTEEL  
MODEL / TYPE : 721A2001/721A2001  
SERIAL NO. : UM10448/UM10448  
DATE OF CALIBRATION : 30 January 2022

### ENVIRONMENT CONDITIONS :

Temperature :  $(25 \pm 0.5)^\circ\text{C}$  Relative Humidity :  $(50 \pm 10)\%$  RH

### PROCEDURE USED :

This instrument was calibrated under procedure No. CLC-CPEB-00 based on ISO 10012-2:2013 as calibration procedure.  
The calibration was performed by using Digital Multimeter, Servoed Counter and Portable Vibration Calibrator which installed by the Calibration Laboratory Co., Ltd.

### REFERENCE STANDARD USED :

- Digital Multimeter, Wavem Model 1221 S/N. 20208
- Servowed Counter, Hovick Pocket Model 5015A S/N. 2448A10942
- Portable Vibration Calibrator, The Model Shy Model 91102 S/N. 11454

### TRACEABILITY :

- The measurement are traceable to International System of Units (SI) through International Ratio of Thailand Ltd. Certificate No. 05-020701, Due Date 31 May 2022.
- The measurement are traceable to International System of Units (SI) through International Ratio of Thailand Ltd. Certificate No. 07-007001, Due Date 31 May 2022.
- The measurement are traceable to International System of Units (SI) through The Model Shy, Inc. Certificate No. 204451, Due Date 14 November 2022.

### UNCERTAINTY :

The reported expanded uncertainty of measurement is stated in the standard uncertainty of measurement multiplied by the coverage factor  $k = 2.00$  which for a normal distribution corresponds to a coverage probability of approximately 95%. It has been evaluated according to the "Expression of the Uncertainty of Measurement in Calibration (EA-4) 1:2017".

Certificate No. Q1200599

05-01-0400-12

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## REPORT OF CALIBRATION

### FOR

NOMENCLATURE : VIBRATION METER  
 MANUFACTURER : INSTANTEL  
 MODEL / TYPE : 721A200/721A200  
 SERIAL NO. : UM12006/UM12006  
 DATE OF CALIBRATION : 31 May 2022

#### ENVIRONMENT CONDITIONS :

Temperature :  $25 \pm 0.5^\circ\text{C}$  Relative Humidity :  $50 \pm 10\%$

#### PROCEDURE USED :

This instrument was calibrated under procedure No. CLC-CPD-08 based on ISO 10607:21 as reference procedure.  
 The calibration was performed by using Digital Multimeter, High Resolution Programmable Time Counter  
 and Portable Vibration Calibrator which maintained by the Calibration Laboratory Co., Ltd.

#### REFERENCE STANDARD USED :

1. Digital Multimeter, Wavetek Model D31 5/10/30/50.
2. High Resolution Programmable Time Counter, Philips Model PM4000 01 - 04/07/21.
3. Portable Vibration Calibrator, The Model Shop Model V100 5/10/30/50.

#### TRACEABILITY :

1. The measurements are traceable to International System of Units (SI), through Association of Banks of Thailand Ltd. Certificate No. 07/03/21, Due Date 31 May 2022.
2. The measurements are traceable to International System of Units (SI), through Association of Banks of Thailand Ltd. Certificate No. 07/06/22, Due Date 22 February 2023.
3. The measurements are traceable to International System of Units (SI), through The Model Shop, Inc. Certificate No. 2009-01, Due Date 10 November 2022.

#### UNCERTAINTY :

The reported expanded uncertainty of measurement is stated in the standard uncertainty of measurement multiplied by the coverage factor  $k = 2.00$  which for a normal distribution corresponds to a coverage probability of approximately 95%. It has been evaluated according to the "Evaluation of the Uncertainty of Measurement to Calibration (EA-4/02:03/01)".

Certificate No. Q1200004

09-01-04/01-02

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#### CONDITION OF CALIBRATION ITEM : GOOD

MEASUREMENT RESULTS : ( X ) without adjustment ( ) adjustment

#### CALIBRATION DATA

##### 1. ACCELERATION RESULT

Test point		Mode	STD Reading (g)	DPC Reading (g)	Correction (g)	Uncertainty $\pm 1\%$ of Mag.
(mm/s)	(Frequency)					
0.5	10 Hz	peak	0.300	0.300	-0.000	0.9
0.8	20 Hz		0.400	0.400	-0.000	0.9
2.7	30 Hz		0.800	0.800	-0.000	1.1
5.0	10 Hz		0.800	0.800	-0.000	1.1
2.7	10 Hz		0.700	0.700	-0.000	1.1
5.7	100 Hz	peak	0.300	0.300	-0.000	0.9
0.8	100 Hz		0.400	0.400	-0.000	0.9
0.7	100 Hz		0.300	0.300	-0.000	1.1
5.0	100 Hz		0.800	0.800	-0.000	1.1
0.7	100 Hz		0.700	0.700	-0.000	1.1

##### 2. VELOCITY RESULT

Test point		Mode	STD Reading (mm/s)	DPC Reading (mm/s)	Correction (mm/s)	Uncertainty $\pm 1\%$ of Mag.
(mm/s)	(Frequency)					
1	10 Hz	peak	1.000	1.000	-0.000	0.9
1	10 Hz		1.000	1.000	-0.000	0.9
0	10 Hz		1.000	1.000	-0.000	0.9
0	20 Hz		0.800	0.800	-0.000	0.9
7	10 Hz		1.000	1.000	-0.000	0.9
1	100 Hz	peak	1.000	1.000	-0.000	0.9
1	100 Hz		1.000	1.000	-0.000	0.9
0	100 Hz		1.000	1.000	-0.000	0.9
0	100 Hz		1.000	1.000	-0.000	0.9
7	100 Hz		1.000	1.000	-0.000	0.9

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#### CALIBRATION DATA

##### 3. DISPLACEMENT RESULT

Test point		Mode	STD Reading (mm)	DPC Reading (mm)	Correction (mm)	Uncertainty $\pm 1\%$ of Mag.
(mm)	(Frequency)					
0.02	10 Hz	peak	0.020	0.020	0.000	2.1
0.04	20 Hz		0.040	0.040	0.000	1.7
0.05	50 Hz		0.050	0.050	0.000	1.3
0.08	10 Hz		0.080	0.080	-0.001	1.3
0.07	10 Hz		0.070	0.070	0.001	1.3
0.03	100 Hz	peak	0.030	0.030	0.000	2.1
0.04	100 Hz		0.040	0.040	0.000	1.7
0.05	100 Hz		0.050	0.050	0.000	1.3
0.08	100 Hz		0.080	0.080	-0.001	1.3
0.07	100 Hz		0.070	0.070	0.001	1.3

Note: \* means Calibration method \*\* see ANAB Accredited \* as this Calibration trace trace included for compliance.

The Scope of Accredited: ANAB Certificate No. NC104-0011 Version 001 Page 1 of 20

This report is valid for the above stated instrument only.

END End of Certificate 000

Certificate No. Q1200004

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## CERTIFICATE OF CALIBRATION

### FOR

NOMENCLATURE : VIBRATION METER  
 MANUFACTURER : INSTANTEL  
 MODEL / TYPE : 721A200/721A200  
 SERIAL NO. : UM12006/UM12006  
 CLUB NO. : 25701313  
 JIB CONTROL NO. : 21001000003

CUSTOMER : UNITED ANALYST AND ENGINEERING CONSULTANT CO., LTD.  
 6100 CHONGKRI 41, SUDHIVIT ROAD,  
 BANGKOK, THAILAND 10110

DATE OF RECEIVED : 29 August 2022

DATE OF ISSUE : 01 September 2022

Report of results when receiving point per the below is valid. It is not complete. It follows the approval of the Calibration Laboratory Co., Ltd.

Calibrated By : Sorn Thongtong  
 Calibration Engineer

Approved By : Mangkorn Yodsomwong  
 Authorized Signatory  
 01 September 2022



This Calibration is done according to the uncertainty in accordance with the ISO 17025:2017 standard. The scope of Accredited: ANAB Certificate No. NC104-0011

Certificate No. Q1200004

09-01-04/01-02

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เอกสารไม่ควบคุม







## REPORT OF CALIBRATION

FOR

NOMENCLATURE : VIBRATION METER  
MANUFACTURER : INSTANTEL  
MODEL / TYPE : T21A2000/T21A2001  
SERIAL NO. : C0112065101238  
DATE OF CALIBRATION : 28 August 2022

### ENVIRONMENT CONDITIONS :

Temperature :  $23 \pm 1$  °C Relative Humidity :  $50 \pm 10$  %RH

### PROCEDURE USED :

This instrument was calibrated using procedures for CLC-CPEE-09 based on ISO 10012-2 as calibration practice.  
The calibration was performed by using Digital Multimeter, High Resolution Programmable TaperCutter,  
Accelerometer and Shimmering Amplifier which maintained by the Calibration Laboratory Co., Ltd.

### REFERENCE STANDARD USED :

1. Digital Multimeter, Vibration Model: D30 500, 20121
2. High Resolution Programmable TaperCutter, Philips Model: PTH9000 370, 134607191
3. Accelerometer with Shimmering Amplifier, Iteal & Rigel Model: K201, 2112 505, 107910, 3439980

### TRACEABILITY :

1. The measurement is traceable to International System of Units (SI), through National Institute of Thailand Ltd. (Certificate No. 61-606721, Date from 11 May 2021).
2. The measurement is traceable to International System of Units (SI), through National Institute of Thailand Ltd. (Certificate No. 27-606712, Date from 22 February 2021).
3. The measurement is traceable to International System of Units (SI), through National Institute of Metrology (Thailand) (Certificate No. AY-0009-02, Date from 17 June 2021).

### UNCERTAINTY :

The stated expanded uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor  $k = 2.00$  which for a normal distribution corresponds to a coverage probability of approximately 95%. (This has been evaluated according to the "Evaluation of the Uncertainty of Measurement in Calibration" ISO 17025:2017)

Certificate No. Q12000001

05-01-04-01-01

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เอกสารไม่ควบคุม

CONDITION OF CALIBRATION ITEM : GOOD

MEASUREMENT RESULTS : (X) without adjustment ( ) adjustment

### CALIBRATION DATA

#### 1. ACCELERATION RESULT

Test point		Mode	STD Reading	UNC Reading	Correction	Uncertainty
(g)	(Frequency)		(g)	(g)	(g)	( $\pm 1\%$ of rdg.)
0.1	10 Hz	peak	0.080	0.080	-0.001	1.0
0.2	10 Hz		0.080	0.080	-0.001	1.0
0.5	10 Hz		0.280	0.280	-0.006	1.0
0.6	10 Hz		0.480	0.480	-0.006	1.2
0.7	10 Hz		0.780	0.780	-0.007	1.2
0.1	100 Hz	peak	0.180	0.180	-0.004	1.0
0.2	100 Hz		0.380	0.380	-0.005	1.0
0.5	100 Hz		0.780	0.780	-0.006	1.2
0.6	100 Hz		0.980	0.980	-0.007	1.2
0.7	100 Hz		0.780	0.780	-0.006	1.2

#### 2. VELOCITY RESULT

Test point		Mode	STD Reading	UNC Reading	Correction	Uncertainty
(mm/s)	(Frequency)		(mm/s)	(mm/s)	(mm/s)	( $\pm 1\%$ of rdg.)
1	10 Hz	peak	2.000	2.000	-0.001	1.0
2	10 Hz		4.000	4.000	-0.007	1.0
3	10 Hz		5.000	5.000	-0.007	1.0
4	10 Hz		6.000	6.000	-0.006	1.0
5	10 Hz		7.000	7.000	-0.006	1.0
1	100 Hz	peak	3.000	3.000	-0.006	1.0
2	100 Hz		4.000	4.000	-0.006	1.0
3	100 Hz		5.000	5.000	-0.006	1.0
4	100 Hz		6.000	6.000	-0.006	1.0
5	100 Hz		7.000	7.000	-0.006	1.0

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### CALIBRATION DATA

#### 1. REPLACEMENT RESULT

Test point		Mode	STD Reading	UNC Reading	Correction	Uncertainty
(mm/s)	(Frequency)		(mm/s)	(mm/s)	(mm/s)	( $\pm 1\%$ of rdg.)
0.01	10 Hz	peak	0.010	0.010	0.000	2.3
0.02	10 Hz		0.020	0.020	0.000	1.7
0.03	10 Hz		0.030	0.030	0.000	2.0
0.04	10 Hz		0.040	0.040	-0.001	1.2
0.05	10 Hz		0.050	0.050	-0.001	1.2
0.01	100 Hz	peak	0.010	0.010	0.000	2.3
0.02	100 Hz		0.020	0.020	0.000	1.7
0.03	100 Hz		0.030	0.030	0.000	1.5
0.04	100 Hz		0.040	0.040	-0.001	1.2
0.05	100 Hz		0.050	0.050	-0.001	1.2

Note: "Uncertainty Calculated in this Report" in this Calibration has been included for comparison.

This copy of Accepted ANAB Certificate No. ACT04 (2014 Version) Page 1 of 09

This report is valid for the above stated instrument(s) only.

001 End of Certificate

Certificate No. Q12000001

05-01-04-01-01

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## CERTIFICATE OF CALIBRATION

FOR

NOMENCLATURE : VIBRATION METER  
MANUFACTURER : INSTANTEL  
MODEL / TYPE : T21A2000/T21A2001  
SERIAL NO. : C01120651012505  
CLC NO. : 251001702  
JOB CONTROL NO. : 23062000005

CUSTOMER : UNITED ANALYST AND ENGINEERING CONSULTANT CO., LTD.  
88 HONGDORNGA, SUBHEMINT ROAD,  
BANGKOK, PHRAKANTUNG, BANGKOK 10110

DATE OF RECEIVED : 28 August 2022

DATE OF ISSUE : 01 September 2022

Report of calibration covering work can be found at page 1. For any enquiries, please refer to page 1 of the Calibration Laboratory Co., Ltd.

Calibrated By :

Sutira Thongtarn  
Calibration Engineer

Approved By :

Mangkol Yamsamran  
Authorized Signatory  
01 September 2022



This Calibration Certificate demonstrates the capability to perform work, which confirms the state of measurement according to the International System of Units (SI).

Certificate No. Q12000001

05-01-04-01-01

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## REPORT OF CALIBRATION

### FOR

NOMENCLATURE : VIBRATION METER  
MANUFACTURER : INSTANTEL  
MODEL / TYPE : T25A2501/25A2500  
SERIAL NO. : UN1265UCM1895  
DATE OF CALIBRATION : 26 August 2022

#### ENVIRONMENT CONDITIONS :

Temperature :  $20 \pm 0.5^\circ\text{C}$  Relative Humidity :  $45 \pm 15\%$

#### PROCEDURE USED :

The instrument was calibrated using procedure No. CLC-CPED-08 based on ISO 10012-1 and its revision guidelines.  
The calibration was performed by using Digital Microscope, High Resolution Programmable Force Control,  
Displacement and Measuring Amplifier which maintained by the Calibration Laboratory Co., Ltd.

#### REFERENCE STANDARD USED :

1. Digital Microscope, Wykoze Model 120, 5/1/2022
2. High Resolution Programmable Force Control, Philtec Model PFM000-001, 9/MAR/22
3. Accelerometer with Measuring Amplifier, Head & Base Model 0301, 2022 001, 07/04/22, 24/04/22

#### TRACEABILITY :

1. The measurements are traceable to International System of Units (SI) through National Scale of Thailand at Calibration No. 49-4125/21, Due Date 31 May 2023.
2. The measurements are traceable to International System of Units (SI) through National Scale of Thailand at Calibration No. 49-4125/21, Due Date 31 February 2023.
3. The measurements are traceable to International System of Units (SI) through National Scale of Thailand at Calibration No. 49-4125/21, Due Date 31 June 2023.

#### UNCERTAINTY :

The reported expanded uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor  $k = 2.00$  which for a normal distribution corresponds to a coverage probability of approximately 95%. It has been evaluated according to the "Guidelines of the Evaluation of Measurement Data" (GUM 1992:1992).

Certificate No. Q2208040

23-411-0401-12

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#### CONDITION OF CALIBRATION ITEM : GOOD

#### MEASUREMENT RESULTS : (X) without adjustment (Y) adjustment

#### CALIBRATION DATA

##### 1. ACCELERATION RESULT

Test point		Mode	970 Reading		970 Reading		Correction	Uncertainty
(mm/s)	(Frequency)		(mm/s)	(mm/s)	(mm/s)	(mm/s)		
0.1	30 Hz	push	0.000	0.000	+0.000	0.0	0.0	0.1
0.2	30 Hz		0.000	0.000	+0.000	0.0		
0.3	30 Hz		0.000	0.000	+0.000	0.0		
0.4	30 Hz		0.000	0.000	+0.000	0.0		
0.5	30 Hz		0.000	0.000	+0.000	0.0		
0.1	100 Hz	push	0.000	0.000	+0.000	0.0	0.0	0.1
0.2	100 Hz		0.000	0.000	+0.000	0.0		
0.3	100 Hz		0.000	0.000	+0.000	0.0		
0.4	100 Hz		0.000	0.000	+0.000	0.0		
0.5	100 Hz		0.000	0.000	+0.000	0.0		

##### 2. VELOCITY RESULT

Test point		Mode	970 Reading		970 Reading		Correction	Uncertainty
(mm/s)	(Frequency)		(mm/s)	(mm/s)	(mm/s)	(mm/s)		
1	50 Hz	push	0.000	0.000	+0.000	0.0	0.0	0.1
2	50 Hz		0.000	0.000	+0.000	0.0		
3	50 Hz		0.000	0.000	+0.000	0.0		
4	50 Hz		0.000	0.000	+0.000	0.0		
5	50 Hz		0.000	0.000	+0.000	0.0		
1	100 Hz	push	0.000	0.000	+0.000	0.0	0.0	0.1
2	100 Hz		0.000	0.000	+0.000	0.0		
3	100 Hz		0.000	0.000	+0.000	0.0		
4	100 Hz		0.000	0.000	+0.000	0.0		
5	100 Hz		0.000	0.000	+0.000	0.0		

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#### CALIBRATION DATA

##### 1. DISPLACEMENT RESULT

Test point		Mode	970 Reading		970 Reading		Correction	Uncertainty
(mm)	(Frequency)		(mm)	(mm)	(mm)	(mm)		
0.01	30 Hz	push	0.000	0.000	0.000	0.0	0.0	0.1
0.02	30 Hz		0.000	0.000	0.000	0.0		
0.03	30 Hz		0.000	0.000	0.000	0.0		
0.04	30 Hz		0.000	0.000	0.000	0.0		
0.05	30 Hz		0.000	0.000	0.000	0.0		
0.01	100 Hz	push	0.000	0.000	0.000	0.0	0.0	0.1
0.02	100 Hz		0.000	0.000	0.000	0.0		
0.03	100 Hz		0.000	0.000	0.000	0.0		
0.04	100 Hz		0.000	0.000	0.000	0.0		
0.05	100 Hz		0.000	0.000	0.000	0.0		

Note: \* Actual Calibration result \*\* Not ANAB Accredited \*\* No data Calibration have been included for comparison.

The Scope of Accredited: ANAB Calibration No. 42104-014 Version 008 Page 1 of 38

This report is valid for the above stated measurement only.

Doc. Ref. of Calibration 008

Certificate No. Q2208040

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## CERTIFICATE OF CALIBRATION

### FOR

NOMENCLATURE : VIBRATION METER  
MANUFACTURER : INSTANTEL  
MODEL / TYPE : T25A2501/25A2500  
SERIAL NO. : UN1265UCM1895  
CLC NO. : 20200004  
JOB CONTROL NO. : 12002507007

CUSTOMER : UNITED ANALYST AND ENGINEERING CONSULTANT CO., LTD.  
85/8 JONGSENAK, SURKHYIT ROAD,  
BANGKOK, THAILAND 10100

DATE OF RECEIVED : 22 September 2022

DATE OF ISSUED : 26 September 2022

Signatures of calibration according to the ISO 17025:2017, Clause 7.1.5.1. The approval of the Calibration Laboratory Co., Ltd.

Calibrated By :

Savit Phrasamrangsak  
Calibration Engineer

Approved By :

Mongkol Yonsamran  
Authorized Signatory  
26 September 2022



This Calibration Certificate documents the conformity to national standards, which confirm the traceability of measurement according to the International System of Units (SI).

Certificate No. Q2208040

23-411-0401-12

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## REPORT OF CALIBRATION

### FOR

NO. OF CALIBRATION : VIBRATION METER  
MANUFACTURER : INSTANTEL  
MODEL / TYPE : T1A200/21A200  
SERIAL NO. : DM135615H1296  
DATE OF CALIBRATION : 27 September 2022

#### ENVIRONMENT CONDITIONS :

Temperature :  $25 \pm 0.5^\circ\text{C}$  Relative Humidity :  $(48 \pm 0.1)\%$

#### PROCEDURE USED :

This instrument was calibrated using procedure No. CLC-CPEE-08 based on ISO 16067-21 as calibration procedure.  
The calibration was performed by using Rigol's Multimeter, High Precision Programmable Power Source,  
Accelerometer and Measurement Amplifier, which are maintained by the Calibration Laboratory Co., Ltd.

#### REFERENCE STANDARD USED :

1. Signal Multimeter, Wincor Model 1501 SN. 20526
2. High Resolution Programmable Power Source, Philips Model PM5000 SN. 50007101
3. Accelerometer with Measurement Amplifier, Briel & Kjaer Model 8006, 2017 SN. 307010, 307000

#### TRACEABILITY :

1. The measurement are traceable to International System of Units (SI), through International Bureau of Standards Ltd. (Certificate No. 01-020721, Valid Date 31 May 2022)
2. The measurement are traceable to International System of Units (SI), through International Bureau of Standards Ltd. (Certificate No. 01-004132, Valid Date 22 February 2022)
3. The measurement are traceable to International System of Units (SI), through National Institute of Metrology (Thailand) (Certificate No. 01/000012, Valid Date 22 June 2021)

#### UNCERTAINTY :

The reported expanded uncertainty of measurement is stated as the combined uncertainty of measurement resulting from the following factors  $k = 2.00$  which for a normal distribution corresponds to a coverage probability of approximately 95%.  
It has been evaluated according to the "Guidelines of the International Union of Pure and Applied Chemistry (IUPAC) 2017"

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#### CONDITION OF CALIBRATION ITEM : GOOD

MEASUREMENT RESULTS : (C) without adjustment ( ) adjustment  
CALIBRATION DATA

##### 1. ACCELERATION RESULT

Test point		Mode	STD Reading	DIC Reading	Correction	Uncertainty
1 g	Frequency 1		1 g	1 g	1 g	$\pm 1\%$ of reg. 1
0.1	10 Hz	peak	0.000	0.000	+0.000	1.0
0.4	20 Hz		0.000	0.000	+0.000	1.0
0.2	30 Hz		0.000	0.000	+0.000	1.0
0.8	50 Hz		0.000	0.000	+0.000	1.0
0.7	80 Hz		0.000	0.000	+0.000	1.0
0.3	100 Hz	peak	0.000	0.000	+0.000	1.0
0.4	150 Hz		0.000	0.000	+0.000	1.0
0.7	200 Hz		0.000	0.000	+0.000	1.0
0.8	300 Hz		0.000	0.000	+0.000	1.0
0.7	500 Hz		0.000	0.000	+0.000	1.0

##### 2. VELOCITY RESULT

Test point		Mode	STD Reading	DIC Reading	Correction	Uncertainty
1 mm/s	Frequency 1		1 mm/s	1 mm/s	1 mm/s	$\pm 1\%$ of reg. 1
1	10 Hz	peak	2.000	2.000	+0.000	1.0
4	20 Hz		4.000	4.000	+0.000	1.0
5	30 Hz		5.000	5.000	+0.000	1.0
6	50 Hz		6.000	6.000	+0.000	1.0
7	80 Hz		7.000	7.000	+0.000	1.0
3	100 Hz	peak	3.000	3.000	+0.000	1.0
4	150 Hz		4.000	4.000	+0.000	1.0
6	200 Hz		6.000	6.000	+0.000	1.0
8	300 Hz		8.000	8.000	+0.000	1.0
7	500 Hz		7.000	7.000	+0.000	1.0

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#### CALIBRATION DATA

##### 3. DISPLACEMENT RESULT

Test point		Mode	STD Reading	DIC Reading	Correction	Uncertainty
1 mm	Frequency 1		1 mm	1 mm	1 mm	$\pm 1\%$ of reg. 1
0.1	10 Hz	peak	0.000	0.000	+0.000	1.0
0.4	20 Hz		0.000	0.000	+0.000	1.0
0.2	30 Hz		0.000	0.000	+0.000	1.0
0.8	50 Hz		0.000	0.000	+0.000	1.0
0.7	80 Hz		0.000	0.000	+0.000	1.0
0.3	100 Hz	peak	0.000	0.000	+0.000	1.0
0.4	150 Hz		0.000	0.000	+0.000	1.0
0.7	200 Hz		0.000	0.000	+0.000	1.0
0.8	300 Hz		0.000	0.000	+0.000	1.0
0.7	500 Hz		0.000	0.000	+0.000	1.0

Note: "Accuracy Calibration method" has ANAB Accredited" in this Certificate have been included for your information.

The Scope of Accredited: ANAB Certificate No. ACDA 2014 Version 004 Page 1 of 10

This report is valid for the above stated instruments only.

END End of Certificate 000

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Certificate Laboratory Instrument/Equipment for Air Quality Analysis.

No.	Instrument/Equipment	Parameter	Manufacturer	Model/Serial No.	Calibrator	Certification No.	Date of Calibration	Due date of Calibration*	Remark
Laboratory Instrument/Equipments.									
1	Analytical Balance (Readability 0.1 mg)	TSP	Mettler-Toledo	AB204-S / 1128312528	Mettler-Toledo (Thailand) Ltd.	TH2058-097-040722- ACC-TH	7 Apr 22	6 Apr 23	-
		PM-10							
2	Analytical Balance (Readability 0.1 mg)		Mettler-Toledo	AB204-S/FACT / B108115858	Mettler-Toledo (Thailand) Ltd.	TH2058-098-040722- ACC-TH	7 Apr 22	6 Apr 23	-
3	Analytical Balance (Readability 0.001 mg)	PM 2.5	Mettler-Toledo	XP6 / B322373893	Mettler-Toledo (Thailand) Ltd.	TH2058-099-040722- ACC-TH	7 Apr 22	6 Apr 23	-

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



Mettler Toledo (Thailand) Ltd.  
840th - 840th, Ladda Rd., Bangkok 10110  
Bangkok, Thailand 10110  
+66 2021 0382  
OT-Thailand@mettler.com



## Accuracy Calibration Certificate

### Customer

Company: Laxmi Agency and Engineering Consultant Co., Ltd.  
Address: 21st Floor, Sukhvit, Sathorn Rd., Bangkok  
City: Bangkok  
State / Province: Bangkok  
Order Number: 10000000000000000000

### Weighing Device

Manufacturer: Mettler Toledo  
Model: AS204 R  
Serial No.: 1100010000  
Building: 100  
Floor: 1  
Room: 10000000000000000000  
Instrument Type: Analytical Instrument  
Rated Capacity: 200 g  
Tare Capacity: 0.0001 g  
Readability: 0.0001 g

### Procedure

Calibration Guidelines: BUREAU 12-15, 12/1/2013  
Mettler Toledo User Instruction: 0000000000  
This calibration certificate compares measurements for As Found calibration for As Left calibration was performed because the device was not modified after As Found calibration. Therefore, ready for As Left calibration was performed.  
The sensitivity of the weighing instrument was adjusted before calibration with a known weight.  
In accordance with BUREAU 12-15, the test load was selected to reflect the specific use of the weighing device or to accommodate specific calibration conditions.

As Found Calibration Date: 01 Jan 2022  
As Left Calibration Date: 01 Jan 2022  
Issue Date: 01 Jan 2022  
Approved Signature: [Signature]  
Checked Signature: [Signature]  
Calibration Technician: [Signature]  
Test Engineer: [Signature]  
Calibration Technician: [Signature]  
Test Engineer: [Signature]

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## Measurement Results

### Repeatability

Test Load: 100 g	As Found	As Left
1	100.0000 g	100.0000 g
2	100.0000 g	100.0000 g
3	100.0000 g	100.0000 g
4	100.0000 g	100.0000 g
5	100.0000 g	100.0000 g
6	100.0000 g	100.0000 g
7	100.0000 g	100.0000 g
8	100.0000 g	100.0000 g
9	100.0000 g	100.0000 g
10	100.0000 g	100.0000 g
Standard Deviation	0.0000 g	0.0000 g



The 10 sigma graph represents the repeatability of the measurement in which the test was performed.  
The results of the test are shown in the graph above the mean value.

### Stability

Test Load: 100 g	As Found	As Left
1	100.0000 g	100.0000 g
2	100.0000 g	100.0000 g
3	100.0000 g	100.0000 g
4	100.0000 g	100.0000 g
5	100.0000 g	100.0000 g
Standard Deviation	0.0000 g	0.0000 g

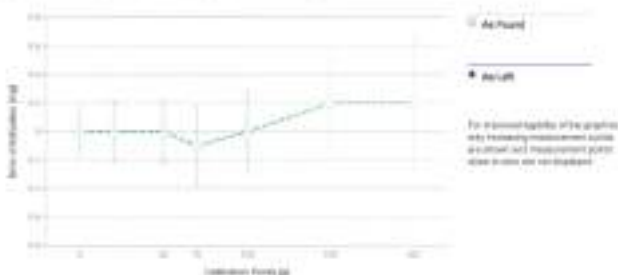


The 10 sigma graph represents the repeatability of the measurement in which the test was performed.

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### Error of Indication

As Found	Reference Value	Indication	Error of Indication	Extended Uncertainty	k
1	0.0000 g	0.0000 g	0.0000 g	0.10 mg	2
2	0.0000 g	0.0000 g	0.0000 g	0.10 mg	2
3	0.0000 g	0.0000 g	0.0000 g	0.10 mg	2
4	0.0000 g	0.0000 g	0.0000 g	0.10 mg	2
5	0.0000 g	0.0000 g	0.0000 g	0.10 mg	2
6	0.0000 g	0.0000 g	0.0000 g	0.10 mg	2
7	0.0000 g	0.0000 g	0.0000 g	0.10 mg	2
8	0.0000 g	0.0000 g	0.0000 g	0.10 mg	2
9	0.0000 g	0.0000 g	0.0000 g	0.10 mg	2
10	0.0000 g	0.0000 g	0.0000 g	0.10 mg	2
11	0.0000 g	0.0000 g	0.0000 g	0.10 mg	2



The uncertainty stated is the expanded uncertainty of calibration obtained by multiplying the standard combined uncertainty by the coverage factor k=2, which can be larger than 2 according to BUREAU 12-15. The value of the measurement is within the assigned range of values with a probability of approximately 95%.

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

### Test Equipment

All weights used for non-destructive testing are traceable to national or international standards. The weights were calibrated and certified by an accredited calibration laboratory.  
Weight set to: OIML R110  
Weight Set No.: 10000000000000000000  
Certificate Number: 10000000000000000000  
Thermo-Regulator: 10000000000000000000  
Equipment No.: 10000000000000000000  
Certificate Number: 10000000000000000000

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### Remarks

Equipment condition: Good  
Next calibration according to customer procedure  
Calibration Date: Not decided by calibration laboratory  
Test weight by NIST: 1 g = 0.0001 g, 2 g = 0.0001 g, 5 g = 0.0001 g  
End of Accredited Section

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

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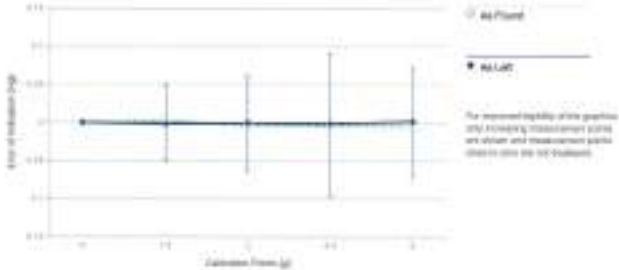


Error of Indication

As Found	Reference Value	Indication	Error of Indication	Expanded Uncertainty	k
1	0.00000 g	0.00000 g	0.00000 g	0.0000 mg	2
2	0.00005 g	0.00000 g	-0.00005 g	0.0004 mg	2
3	0.00010 g	0.00000 g	-0.00010 g	0.0011 mg	2
4	0.00015 g	0.00000 g	-0.00015 g	0.0015 mg	2
5	0.00020 g	0.00000 g	-0.00020 g	0.0019 mg	2
6	0.00025 g	0.00000 g	-0.00025 g	0.0023 mg	2
7	0.00030 g	0.00000 g	-0.00030 g	0.0027 mg	2
8	0.00035 g	0.00000 g	-0.00035 g	0.0031 mg	2
9	0.00040 g	0.00000 g	-0.00040 g	0.0035 mg	2
10	0.00045 g	0.00000 g	-0.00045 g	0.0039 mg	2
11	0.00050 g	0.00000 g	-0.00050 g	0.0043 mg	2

As Left	Reference Value	Indication	Error of Indication	Expanded Uncertainty	k
12	0.00055 g	0.00000 g	-0.00055 g	0.0047 mg	2
13	0.00060 g	0.00000 g	-0.00060 g	0.0051 mg	2
14	0.00065 g	0.00000 g	-0.00065 g	0.0055 mg	2
15	0.00070 g	0.00000 g	-0.00070 g	0.0059 mg	2
16	0.00075 g	0.00000 g	-0.00075 g	0.0063 mg	2
17	0.00080 g	0.00000 g	-0.00080 g	0.0067 mg	2
18	0.00085 g	0.00000 g	-0.00085 g	0.0071 mg	2
19	0.00090 g	0.00000 g	-0.00090 g	0.0075 mg	2
20	0.00095 g	0.00000 g	-0.00095 g	0.0079 mg	2
21	0.00100 g	0.00000 g	-0.00100 g	0.0083 mg	2

The indication uncertainty was calculated by the GNC Calibration and Measurement Capabilities value database for the associated uncertainty and smaller than the 0.001 g value.



The uncertainty stated in the expanded uncertainty of calibration obtained by multiplying the standard combined uncertainty by the coverage factor  $k=2$ —which can be higher than 2 according to GUM Annex G. The value of the coverage factor within the assigned range of values with a probability of approximately 95%.

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

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Test Equipment

All weights used for metrological testing were under continuous or increasing inspection. The weights were calibrated and verified to an accredited calibration laboratory.

Weight Set N: OIML R110

Weight Set No.:	2000	Date of Issue:	20-Feb-2025
Calibration Period:	2025081021	Calibration Due Date:	11-Aug-2026
Thema Hygionist			
Equipment No.:	9000	Date of Issue:	14-Jun-2021
Calibration Number:	2119-028	Calibration Due Date:	01-Jun-2022

Remarks

- INMET adjustment functionality verified
- Value of the GUM  $k$  weight adjusted
- Equipment condition: Good
- Test calibration according to customer's procedure
- Calibration data not directly by calibration laboratory
- Test weight for Mass:  $0.000000 \text{ g} \pm 0.000000 \text{ g}$ ,  $0.000002 \text{ g} \pm 0.000001 \text{ g}$

End of Accredited Section

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

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Measurement Uncertainty of the Weighing Instrument in Use

Based on the expanded uncertainty with  $k=2$  is used. The formula shall be used for the estimation of the overall being under consideration of the error of indication. The value  $P$  represents the normal distribution in the case of measure at the device.

Temperature coefficient for the evaluation of the measurement uncertainty in use	$1.0 \times 10^{-6} / ^\circ\text{C}$
Temperature range on site for the evaluation of the measurement uncertainty in use	$23.0^\circ\text{C}$

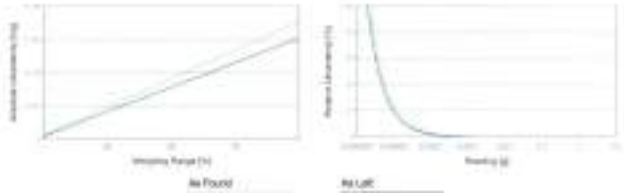
Uncertainty of Uncertainty Equation

Range	Mass	As Found	As Left
0.000000 g - 0.1 g	0.1 g	$u_c = 0.000000 \text{ mg} \pm 0.000000 \text{ mg}$ - R	$u_c = 0.000000 \text{ mg} \pm 0.000000 \text{ mg}$ - R

To optimize the quality of the forecast, besides of the zero load only increasing measurement points with a load load of 25% of the measurement range or larger are added for the calculation of the basic equation.

Absolute and Relative Measurement Uncertainty in Use for Various Test Indications (Example)

Test Indication	As Found	As Left
0.000000 g	0.0000 mg	0.0000 mg
0.000005 g	0.0000 mg	0.0000 mg
0.000010 g	0.0000 mg	0.0000 mg
0.000015 g	0.0000 mg	0.0000 mg
0.000020 g	0.0000 mg	0.0000 mg
0.000025 g	0.0000 mg	0.0000 mg
0.000030 g	0.0000 mg	0.0000 mg
0.000035 g	0.0000 mg	0.0000 mg
0.000040 g	0.0000 mg	0.0000 mg
0.000045 g	0.0000 mg	0.0000 mg
0.000050 g	0.0000 mg	0.0000 mg



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รายการใบรับรองสอบเทียบ/ทวนสอบ เครื่องมือหลักประจำห้องปฏิบัติการ สำหรับวิเคราะห์คุณภาพน้ำผิวดิน น้ำใต้ดิน และน้ำทิ้ง

No.	Instrument/Equipment	Parameter	Manufacturer	Model/Serial No.	Calibrator	Certification No.	Date of Calibration	Due date of Calibration*	Remark
Laboratory Instrument/Equipment.									
1	pH Meter	pH Temperature	Mettler-Toledo	Seven Easy S20 / 1230525212	National Food Institute, Ministry of Industry, Thailand	2202093-001-01	16 Mar 22	15 Mar 23	-
2	pH Meter		Hanna Instrument	HI2020-02 / C0051107	National Food Institute, Ministry of Industry, Thailand	2203135-001-01	8 Jun 22	7 Jun 23	-
3	Conductivity Meter	Electrical Conductivity	Si Analytics	Lab955 / 16300356	SPC Calibration Center Co.,Ltd.	C24220084	22 Mar 22	21 Mar 23	-
4	Analytical Balance (Readability 0.01 mg)	Total Solids Total Dissolved Solids	Mettler-Toledo	XSR205DUJ / C009071872	Technology Promotion Association (Thailand-Japan)	22MM210	26 Apr 22	25 Apr 23	-
5	Hot Air Oven	Total Suspended Solids	Memmert	UF55 / B216.1666	Technology Promotion Association (Thailand-Japan)	22TM1490	19 Oct 22	18 Oct 23	-
6	BOD Incubator	Biochemical Oxygen Demand	Arco	UC4-1320 / (UAE.LAB.015/2561)	Technology Promotion Association (Thailand-Japan)	22TM90	17 Feb 22	16 Feb 23	-
7	BOD Incubator		Arco	UR-1320 / (UAE.WAO.018/2551)	Technology Promotion Association (Thailand-Japan)	22TM305	7 Apr 22	6 Apr 23	-
8	Analytical Balance (Readability 0.1 mg)	Fat Oil And Grease	Mettler-Toledo	AB-204S/FACT / 1129361010	National Food Institute, Ministry of Industry, Thailand	2203120-001-01	1 Jun 22	31 May 23	-
9	Incubator	Total Coliform Bacteria Faecal Coliform Bacteria	Memmert	IPP 260 / V615.0187	Technology Promotion Association (Thailand-Japan)	22TM563	7 Apr 22	6 Apr 23	-
10	Incubator		Memmert	IPP 260 / V618.0033	Technology Promotion Association (Thailand-Japan)	22TM503	3 May 22	2 May 23	-



รายการใบรับรองสอบเทียบ/ทวนสอบ เครื่องมือหลักประจำห้องปฏิบัติการ สำหรับวิเคราะห์คุณภาพน้ำผิวดิน น้ำใต้ดิน และน้ำทิ้ง

No.	Instrument/Equipment	Parameter	Manufacturer	Model/Serial No.	Calibrator	Certification No.	Date of Calibration	Due date of Calibration*	Remark
Laboratory Instrument/Equipment.									
11	Water Bath		Memmert	WNE 14 / L414.1407	Technology Promotion Association (Thailand-Japan)	22TM565	7 Apr 22	6 Apr 23	-
12	Water Bath	Total Coliform Bacteria Faecal Coliform Bacteria	Memmert	WNE 14 / L416.0606	Technology Promotion Association (Thailand-Japan)	22TM333	17 Feb 22	16 Feb 23	-
13	Analytical Balance		Mettler-Toledo	MS603S / B0070110311	Mettler-Toledo (Thailand) Ltd.	H2058-096-040722-ACC-T	7 Apr 22	6 Apr 23	-
14	Auto Clave		ALP	CL-40L / 802664	Technology Promotion Association (Thailand-Japan)	22TM89	17 Feb 22	16 Feb 23	-
15	Atomic Absorption Spectrophotometer (AAS)	Iron, Titanium, Arsenic, Cadmium, Manganese, Chromium, Copper, Barium, Lead, Mercury, Nickel, Selenium, Chromium Trivalent, Chromium Hexalent, Zinc Titanium, Chromium	Agilent Technologies	System ID:G8432A AA240F5 / MY13160001	Thailand Institute Of Science And Technological Research (TISTR)	MTC.ACL. No. 486/65	7 Mar 22	6 Mar 23	-
16	Inductively Coupled Plasma (ICP)		Agilent Technologies	System ID:G8015A G8015AA / MY18030001	Agilent Technologies (Thailand) Co.,Ltd.	Preventive Maintenance Checklist	30 Nov 22	29 Nov 23	-
17	UV-VIS Spectrophotometer	Phosphate, Ammonia-Nitrogen Sulphate, Cyanide	Agilent Technologies	Cary60 G6860A / MY15410009	DQE Services Co.,Ltd.	SP22-016	31 May 22	30 May 23	-
18	UV-VIS Spectrophotometer	Nitrate Nitrogen, Phenols, Colour, Chromium Hexalent, Total Nitrogen	Hitachi	U-1900 / 2021-064	DQE Services Co.,Ltd.	SP22-007	20 Jan 22	19 Jan 23	-
19	UV-VIS Spectrophotometer	Chemical Oxygen Demand Formaldehyde, Cyanide As HCN	Hitachi	U-2900 / 21E22-009	DQE Services Co.,Ltd.	SP22-008	20 Jan 22	19 Jan 23	-

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No.	Instrument/Equipment	Parameter	Manufacturer	Model/Serial No.	Calibrator	Certification No.	Date of Calibration	Due date of Calibration*	Remark
Laboratory Instrument/Equipment.									
20	COD Reactor (Heating Block)	Chemical Oxygen Demand	Hanna	HI839800-02 / H018500I	Technology Promotion Association (Thailand-Japan)	HIT-2209-0184	1 Mar 22	1 Mar 23	-
21	Digester Unit	Total Kjeldahl Nitrogen (TKN)	FOSS TECATOR	2520auto / 91794469	National Food Institute, Ministry of Industry, Thailand	2202361-001-01	4 Apr 22	3 Apr 23	-
22	Distillation Unit (Kjeldahl Method)	Ammonia-Nitrogen Total Kjeldahl Nitrogen (TKN)	FOSS TECATOR	KT8100 / 91889052	FOSS South East Asia	6623	25 Jul 22	24 Jul 23	-
23	Gas Chromatography (GC)	Organochlorine Pesticides, 2,4-D, Benzo (a) Pyrene,	Agilent Technologies	System ID:CN11021007 7890 / CN11021007	Agilent Technologies (Thailand) Co.,Ltd.	Certificate of System Qualification GC-OQ	11 Feb 22	10 Feb 23	-
24	Gas Chromatography (GC)	PCBs, Pentachlorophenol Atrazine	Agilent Technologies	System ID:CN13113001 7890 / CN13113001	Agilent Technologies (Thailand) Co.,Ltd.	Certificate of System Qualification GC-OQ	22 Apr 22	21 Apr 23	-
25	Gas Chromatography / Mass Spectrometry (GC-MS)	Benzene, Carbon Tetrachloride, 1,2-Dichloroethane, Styrene, 1,1-Dichloroethylene, Toluene, cis-1,2-Dichloroethylene, trans-1,2-Dichloroethylene, Dichloromethane, Total Xylenes, Ethylbenzene, Tetrachloroethylene, Trichloroethylene, 1,1,1-Trichloroethane, 1,1,2-Trichloroethane	Agilent Technologies	System ID: US2009M037 8890 (G3542A) / CN1945A066 5977B / US2009M037	Agilent Technologies (Thailand) Co.,Ltd.	Preventive Maintenance Checklist	13 Jun 22	12 Jun 23	-

รายการใบรับรองสอบเทียบ/ทวนสอบ เครื่องมือหลักประจำห้องปฏิบัติการ สำหรับวิเคราะห์คุณภาพน้ำผิวดิน น้ำใต้ดิน และน้ำทิ้ง

No.	Instrument/Equipment	Parameter	Manufacturer	Model/Serial No.	Calibrator	Certification No.	Date of Calibration	Due date of Calibration*	Remark
Laboratory Instrument/Equipment.									
26	Turbidity Meter	Turbidity	Oakton	T100IR / 1120501017	Technology Promotion Association (Thailand-Japan)	22CH1184	5 Sep 22	4 Sep 23	-

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

## Calibration Certificate

Certificate No.: 220203-001-01  
Client name: UNITED ANALYST AND ENGINEERING CONSULTANT CO., LTD.  
Address: 2-50 Udonrak 41, Sukhumvit Road,  
Bangkok, Prathung, Bangkok 10250

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Equipment: pH Meter  
Manufacturer: METTLER TOLEDO  
Model: SevenEasy pH  
Serial No.: 123813212  
ID No.: LME-VAS-202302  
Order No.: 220203  
Operation No.: 220203-001  
Date of Receipt: 11 March 2022  
Date of Calibration: 16 March 2022

Calibrated by: N. Kham, Somchai  
Approved by: (Signature)  
Manager, Division of Calibration Laboratory  
Responsible for the Technical Management, Force

This certificate is for a calibration accuracy of approximately 0.01.

The Certificate is issued in accordance with the conditions of membership under the Technical Management System which has obtained the measurement capability of the laboratory with its capability to measure national standards and to the units of measurement based on the corresponding national standards. This certificate may not be reproduced without the prior written approval of the National Food Institute.

PCH-02 Revision: 02 Date: 14-12-02

เอกสารไม่ควบคุม

## Calibration Report

Certificate No.: 220203-001-01  
Equipment: pH Meter  
Manufacturer: METTLER TOLEDO  
Model: SevenEasy pH  
Serial No.: 123813212  
ID No.: LME-VAS-202302

Date of Calibration: 16 March 2022 Page 2 of 5

Location: Central Calibration Laboratory, National Food Institute  
Environment Condition: Ambient Temperature:  $(20 \pm 1.0) ^\circ\text{C}$  Relative Humidity:  $(45 \pm 1) \%$   
Condition of Equipment: Good Condition

Condition of this results of Calibration:

1. Calibration Method: In-house method (NFI-02-02) based on their measurement using standard buffer solution and certified reference material (CRM).

2. Reference Standard: 1 Certified Reference Material

Instrument	Serial No.	Manufacturer	Certificate No.	Exp. Date
2.1 100 ml buffer solution	2700001	Fluka	011-011-0001	31 June 2022
2.2 Digital Thermometer	2700001	Fluka	011-011-0001	31 June 2022
2.3 High-purity water	011-011-00001	Fluka	011-011-0001	31 June 2022

Instrument	Serial No.	Manufacturer	Model	Exp. Date
2.4 pH buffer 4.00 (Primary pH buffer Solution)	70001	Chromat	PH01.1A	31 November 2022
2.5 pH buffer 7.00 (Primary pH buffer Solution)	70001	Chromat	PH01.1A	31 November 2022
2.6 pH buffer 10.01 (Primary pH buffer Solution)	70001	Chromat	PH01.1A	31 November 2022
2.7 pH buffer 1.68 (Secondary pH buffer Solution)	70001	Chromat	PH01.1A	31 November 2022

3. The calibration is made up to the technical system of LME-02 (0.01)

3.1 Instrument No. 2.1 Through NFI-02-02 Laboratory Standard of Calibration (0.01)

3.2 Instrument No. 2.2 Through NFI-02-02 Laboratory Standard of Calibration (0.01)

3.3 Instrument No. 2.3 Through NFI-02-02 Laboratory Standard of Calibration (0.01)

3.4 Calibration is made up to the technical system of LME-02 (0.01)

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## Calibration Report

**Certificate No.:** 220115-001-01  
**Equipment:** Digital Thermometer with RTD (2nd Model)  
**Resolution:** 0.1 °C **Model:** SevenEasy pH  
**Serial No.:** 11000011 **Q No.:** 04E/NA01000001  
**Manufacturer:** METTLER TOLEDO  
**Date of Calibration:** 15 March 2022 **Page 5 of 6**

**Calibration point:** 10.0, 20.0 and 30.0 °C  
**Calibration result:**

The point was measured in liquid medium with a minimum depth of 100 mm.  
 Description of probe: Model: P4, Size: P4  
 Dimensions of probe: Diameter: 10 mm, Length: 140 mm.  
 Sheath material: Stainless Steel

DOF Reading (°C)	Standard Temperature (°C)	Correction Value (°C)	Uncertainty (°C)
10.2	10.00	-0.2	0.005
20.2	20.00	-0.2	0.005
30.2	30.00	-0.2	0.005

Note: 1. DOF: 1st Order 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%.

**Signature:**   
**PC-012 Revision 01 Date: 14-12-01**

เอกสารไม่ควบคุม

## Calibration Certificate

**Certificate No.:** 220115-001-01  
**Client name:** UNITED ANALYST AND ENGINEERING CONSULTANT CO., LTD.  
**Address:** 9 Soi Udomsak 41, Sukhumvit Road, Bangkok, Prachinong, Bangkok 10250

**Equipment:** pH Meter  
**Manufacturer:** HANNA HD15M00115  
**Model:** HD15P-02  
**Serial No.:** 0081107  
**ID No.:** 338 WAO BAO 0001  
**Order No.:** 220115  
**Operation No.:** 220115-001  
**Date of Receipt:** 1 June 2022  
**Date of Calibration:** 8 June 2022

**Calibrated by:** Mr. Manee Samak  
**Approved by:**   
 (Mr. Phongsak Tungsri)  
 Manager, Division of Calibration Laboratory  
 Responsible for the Technical Management Team  
**Date of Issue:** 15 June 2022

The uncertainty can be a confidence probability of approximately 95%.  
 This Certificate is issued in accordance with the conditions of accreditation granted to the Thai Laboratory Accreditation Centre which has granted its membership capacity in the laboratory and its capability to recognize national standards and to the work of national standards in the laboratory. The certificate may not be reproduced other than in full, except with the prior written consent of the National Food Institute.

PC-001 Revision 01 Date: 12-01-01

เอกสารไม่ควบคุม

## Calibration Report

**Certificate No.:** 220115-001-01  
**Equipment:** pH Meter  
**Resolution:** 0.01 pH **Q No.:** 04E/NA01000001  
**Manufacturer:** HANNA HD15M00115  
**Model:** HD15P-02  
**Serial No.:** 0081107  
**ID No.:** 338 WAO BAO 0001  
**Date of Calibration:** 8 June 2022 **Page 6 of 6**

**Location:** Division of Calibration Laboratory, National Food Institute  
**Environment Condition:** Ambient Temperature: (20.0 ± 1.0) °C **Relative Humidity:** (45 ± 5) %  
**Condition of Equipment:** Good Condition

**Condition of this Result of Calibration**

1. Calibration Method: In-house method (NFI) based on direct measurement by using standard buffer solution and certified reference material (CRM).

2. Reference Standards: 1. Certified Reference Material

Lot/Serial No.	Manufacturer	Certificate No.	Exp. Date
2-1 0.1 M Hydrochloric Acid	Merck	001-010001	30 June 2022
2-2 0.1 M Sodium Hydroxide	Merck	001-010002	30 June 2022
2-3 0.1 M Potassium Hydroxide	Merck	001-010003	30 June 2022

3. Certified Reference Material

Lot/Serial No.	Manufacturer	Ref. No.	Expiry Date
2-4 0.1 M Hydrochloric Acid (Primary standard solution)	Merck	001-010001	31 April 2024
2-5 0.1 M Sodium Hydroxide (Primary standard solution)	Merck	001-010002	31 April 2024
2-6 0.1 M Potassium Hydroxide (Primary standard solution)	Merck	001-010003	31 April 2024
2-7 0.1 M Sodium Hydroxide (Primary standard solution)	Merck	001-010004	31 April 2024

4. This calibration is suitable for the international system of units (SI).

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## Calibration Report

**Certificate No.:** 220115-001-01  
**Equipment:** pH Meter  
**Resolution:** 0.01 pH **Q No.:** 04E/NA01000001  
**Manufacturer:** HANNA HD15M00115  
**Model:** HD15P-02  
**Serial No.:** 0081107  
**ID No.:** 338 WAO BAO 0001  
**Date of Calibration:** 8 June 2022 **Page 6 of 6**

**Calibration Result:**

1. Calibration of pH Meter (Manual Temperature Compensation at 20 °C)

Standard pH	DC Voltage Reading (mV)	Average Indicator Reading		Uncertainty (mV)	Coverage Factor (k=2)
		mV	pH		
0	114.17	114.17	0.00	0.005	0.00
0	114.17	114.17	0.00	0.005	0.00
4	171.40	171.40	0.00	0.005	0.00
5	181.40	181.40	0.00	0.005	0.00
7	214.17	214.17	0.00	0.005	0.00
8	224.17	224.17	0.00	0.005	0.00
10	257.17	257.17	0.00	0.005	0.00
11	267.17	267.17	0.00	0.005	0.00
12	277.17	277.17	0.00	0.005	0.00

2. Calibration of pH Meter with Electrode (Manual Temperature Compensation at 20 °C)

**Equipment:** pH Electrode **Type:** Combined Electrode

**Manufacturer:** HANNA HD15M00115 **Model:** HD15P-02

**Serial No.:** 0081107 **ID No.:** 338 WAO BAO 0001

**Performance of Electrode system:** (Check Point Calibration at pH 7 and pH 4)

Calibration value (pH)	Average Indicator Reading		Uncertainty (pH)	Coverage Factor (k=2)
	pH	mV		
7.00	7.01	114.17	0.01	0.005
4.00	4.01	171.40	0.01	0.005
0.00	0.01	114.17	0.01	0.005
0.00	0.01	114.17	0.01	0.005
0.00	0.01	114.17	0.01	0.005

PC-012 Revision 01 Date: 12-01-01

PC-012 Revision 01 Date: 12-01-01

เอกสารไม่ควบคุม

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## Calibration Report

**Certificate No.:** 000100-001-01  
**Equipment:** Digital Thermometer with RTD (pt1000)  
**Resolution:** 0.1 °C  
**Model:** HI91410  
**Serial No.:** 0001101  
**CN:** LMS-PNC-000007  
**Manufacturer:** HANNA HI91410-01  
**Date of Calibration:** 6 June 2022 Page 4 of 4

**Location:** On-site Calibration Laboratory, National Food Institute  
**Environmental Condition:** Ambient Temperature: 23.9 ± 1.0 °C  
Relative Humidity: 51 ± 3.1 %

### Condition of this result of Calibration:

1. Calibration Method:
  - In house method HI 91410 by comparison with standard thermometer
  - The Calibration is determined by comparing with the known temperature
  - Test is performed in accordance with standard
  - The temperature scale is valid for the purpose of the measurement
  - Temperature range of 100 (170.00)

### 2. Reference Standard instrument

Instrument	Model	Serial No.	Certificate No.	Exp. Date	Through
Standard Reference Thermometer (SRT)	1001	2119 101	PL-7 001 01	24-Jun-22	1070

Support Equipment: Low Temperature Bath (SRT-20-A) Model: Europe A Free Range, 844, 307 0000

3. This certificate is traceable to international system of units (SI units)
4. This certificate was verified only for the instrument as indicated
5. This result of calibration was found accurate as determined and phase of calibration only
6. Condition of calibrated item:
 

☒ A. Without adjustment
 ☐ B. After adjustment
7. Result of Evaluation:
 

☒ A. Without adjustment
 ☐ B. After adjustment

ISO-9001 Registered: 21 Jan 2019-2024

เอกสารไม่ควบคุม

## Calibration Report

**Certificate No.:** 000100-001-01  
**Equipment:** Digital Thermometer with RTD (pt1000)  
**Resolution:** 0.1 °C  
**Model:** HI91410  
**Serial No.:** 0001101  
**CN:** LMS-PNC-000007  
**Manufacturer:** HANNA HI91410-01  
**Date of Calibration:** 6 June 2022 Page 4 of 4

**Calibration point:** 23.9, 25.0 and 25.0 °C  
**Calibration result:**

- The probe was immersed in liquid bath at the bath temperature 23.9 ± 1.0 °C
- Description of probe model: HI91410, SN: 0001101
- Dimension of probe: Diameter: 12 mm, Length: 130 mm
- Material: Steel

UNC Reading (°C)	Standard Temperature (°C)	Correction Value (°C)	Uncertainty ± (°C)
23.9	23.901	-0.1	0.009
25.0	25.000	-0.1	0.009
25.0	25.000	-0.1	0.009

ISO 1:2007, 1:2008 Calibration

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

ISO-9001 Registered: 21 Jan 2019-2024

เอกสารไม่ควบคุม

SPC Calibration Center

**SERT**  
Part of DSG Group

## Certificate of Calibration

**Equipment:** CONDUCTIVITY METER  
**Model:** LUT98  
**Serial No. (or ID):** 9000390  
**Manufacturer:** SI Analytics  
**Electrode Serial No.:** 1607067  
**Condition:** In Condition  
**Certificate No.:** C04220064  
**Issued Date:** 22 March 2022  
**Job No.:** 9SP16220207  
**Page:** 1 of 2  
**Model:** LP413T  
**Brand:** SI Analytics

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

**Environmental Condition:** Temperature: 23 °C ± 2 °C  
Humidity: 50 %RH ± 10 %RH

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

**Calibration By:** Mr. Wasan Nuchnabed  
**Calibration Date:** 22 March 2022  
**The Method used:** In house method, SPCC-95-49, based on ASTM D 1125-14 and D 5385-16  
**Traceability:** This certificate is traceable to the SI Units maintained by CRM of NIST (SRM) through CPA Chem Co., Ltd. (ISO/IEC 17030) Certificate No. 794135, 794136, 772024

**(Mr. Wasan Nuchnabed)**  
Person in charge  
**(Mr. Daming Boonopon)**  
Authorized signatory

This certificate is based on the unity of measurement according to the International System of Units (SI). It provides a level of confidence of measurement to international or national standard or other recognized national standard laboratory.  
The measurement uncertainty stated in this report is the standard 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 before and after the last tested, calibration or sample. The report shall not be reproduced except in full without approval of SPC RT Co., Ltd.

SPC Calibration Center

**SERT**  
Part of DSG Group

Certificate No.: C04220064 Page: 2 of 2

### Calibration Results:

#### Before Adjustment

Standard Conductivity Solution	Unit Under Calibration Reading	Correction	Coverage Factor (k)	Uncertainty (±)
25.000 µS/cm	25.0 µS/cm	-0.000 µS/cm	2.00	0.22 µS/cm
1413.0 µS/cm	1448 µS/cm	-35.0 µS/cm	2.00	8.8 µS/cm
111.3 µS/cm	107.8 µS/cm	3.48 µS/cm	2.00	0.80 µS/cm

#### After Adjustment: at 1413 µS/cm

Standard Conductivity Solution	Unit Under Calibration Reading	Correction	Coverage Factor (k)	Uncertainty (±)
25.000 µS/cm	25.0 µS/cm	0.000 µS/cm	2.00	0.22 µS/cm
1413.0 µS/cm	1413.0 µS/cm	0.0 µS/cm	2.00	8.8 µS/cm
111.3 µS/cm	107.2 µS/cm	4.10 µS/cm	2.00	0.80 µS/cm

The End of Certificate

## ใบตรวจสอบสภาพเครื่องวัดสิ่งแวดล้อม

เลขที่ใบงาน: KSPR230328T

ชื่อเครื่องวัด: CONDUCTIVITY METER

รุ่น: Lab655

หมายเลขเครื่อง: 18190389

ตรวจสอบ (g)		ตรวจสอบ (g)	หมายเหตุ
22 Mar 2022			
ผ่าน	ไม่ผ่าน	ผ่าน	ไม่ผ่าน
General			
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
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Specifications			
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
pH Meter and Conductivity Meter			
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Refractometer			
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Automatic Diluter			
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

อุณหภูมิ: Electrode Temperature 24.9 °C Tap Control Water at 23.2 ± 0.1 °C

Mr. Wasan Nuchabun

Service Engineer

เอกสารไม่ควบคุม

SFC-CP-01-02-23 Rev. 2020


 THE ASSOCIATION OF CALIBRATION ENGINEERS (THAILAND) (A.C.E.)  
 CORPORATE SERVICES, EQUIPMENT CALIBRATION AND TESTING SERVICES  
 (THE ASSOCIATION OF CALIBRATION ENGINEERS (THAILAND) (A.C.E.))  
 101, 102, 103, 104, 105, 106, 107, 108, 109, 110, 111, 112, 113, 114, 115, 116, 117, 118, 119, 120, 121, 122, 123, 124, 125, 126, 127, 128, 129, 130, 131, 132, 133, 134, 135, 136, 137, 138, 139, 140, 141, 142, 143, 144, 145, 146, 147, 148, 149, 150, 151, 152, 153, 154, 155, 156, 157, 158, 159, 160, 161, 162, 163, 164, 165, 166, 167, 168, 169, 170, 171, 172, 173, 174, 175, 176, 177, 178, 179, 180, 181, 182, 183, 184, 185, 186, 187, 188, 189, 190, 191, 192, 193, 194, 195, 196, 197, 198, 199, 200, 201, 202, 203, 204, 205, 206, 207, 208, 209, 210, 211, 212, 213, 214, 215, 216, 217, 218, 219, 220, 221, 222, 223, 224, 225, 226, 227, 228, 229, 230, 231, 232, 233, 234, 235, 236, 237, 238, 239, 240, 241, 242, 243, 244, 245, 246, 247, 248, 249, 250, 251, 252, 253, 254, 255, 256, 257, 258, 259, 260, 261, 262, 263, 264, 265, 266, 267, 268, 269, 270, 271, 272, 273, 274, 275, 276, 277, 278, 279, 280, 281, 282, 283, 284, 285, 286, 287, 288, 289, 290, 291, 292, 293, 294, 295, 296, 297, 298, 299, 300, 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501, 502, 503, 504, 505, 506, 507, 508, 509, 510, 511, 512, 513, 514, 515, 516, 517, 518, 519, 520, 521, 522, 523, 524, 525, 526, 527, 528, 529, 530, 531, 532, 533, 534, 535, 536, 537, 538, 539, 540, 541, 542, 543, 544, 545, 546, 547, 548, 549, 550, 551, 552, 553, 554, 555, 556, 557, 558, 559, 560, 561, 562, 563, 564, 565, 566, 567, 568, 569, 570, 571, 572, 573, 574, 575, 576, 577, 578, 579, 580, 581, 582, 583, 584, 585, 586, 587, 588, 589, 590, 591, 592, 593, 594, 595, 596, 597, 598, 599, 600, 601, 602, 603, 604, 605, 606, 607, 608, 609, 610, 611, 612, 613, 614, 615, 616, 617, 618, 619, 620, 621, 622, 623, 624, 625, 626, 627, 628, 629, 630, 631, 632, 633, 634, 635, 636, 637, 638, 639, 640, 641, 642, 643, 644, 645, 646, 647, 648, 649, 650, 651, 652, 653, 654, 655, 656, 657, 658, 659, 660, 661, 662, 663, 664, 665, 666, 667, 668, 669, 670, 671, 672, 673, 674, 675, 676, 677, 678, 679, 680, 681, 682, 683, 684, 685, 686, 687, 688, 689, 690, 691, 692, 693, 694, 695, 696, 697, 698, 699, 700, 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1582, 1583, 1584, 1585, 1586, 1587, 1588, 1589, 1590, 1591, 1592, 1593, 1594, 1595, 1596, 1597, 1598, 1599, 1600, 1601, 1602, 1603, 1604, 1605, 1606, 1607, 1608, 1609, 1610, 1611, 1612, 1613, 1614, 1615, 1616, 1617, 1618, 1619, 1620, 1621, 1622, 1623, 1624, 1625, 1626, 1627, 1628, 1629, 1630, 1631, 1632, 1633, 1634, 1635, 1636, 1637, 1638, 1639, 1640, 1641, 1642, 1643, 1644, 1645, 1646, 1647, 1648, 1649, 1650, 1651, 1652, 1653, 1654, 1655, 1656, 1657, 1658, 1659, 1660, 1661, 1662, 1663, 1664, 1665, 1666, 1667, 1668, 1669, 1670, 1671, 1672, 1673, 1674, 1675, 1676, 1677, 1678, 1679, 1680, 1681, 1682, 1683, 1684, 1685, 1686, 1687, 1688, 1689, 1690, 1691, 1692, 1693, 1694, 1695, 1696, 1697, 1698, 1699, 1700, 1701, 1702, 1703, 1704, 1705, 1706, 1707, 1708, 1709, 1710, 1711, 1712, 1713, 1714, 1715, 1716, 1717, 1718, 1719, 1720, 1721, 1722, 1723, 1724, 1725, 1726, 1727, 1728, 1729, 1730, 1731, 1732, 1733, 1734, 1735, 1736, 1737, 1738, 1739, 1740, 1741, 1742, 1743, 1744, 1745, 1746, 1747, 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1914, 1915, 1916, 1917, 1









Equipment : BOD Incubator  
Condition As-Received : Used Item  
Reference : 2202-0415DC-1  
Procedure Used :-

Cert. No.: 22TMM9  
Page: 2 of 3

Calibration were conducted using calibration procedure CP-0702 according to direct measurement method with Data Acquisition which connected with Resistance Temperature Detector (RTD).  
The temperature scale used was based on ITS-90.

#### Condition of this result of calibration

##### 1. Reference standard instrument:-

Instrument Model Serial No. Cert. No. Due Date  
1) Data Acquisition 34970A 19410217 21UM30 23 Dec 2022

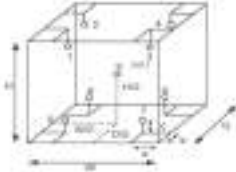
2. This certificate is valid only to the item calibrated on date and place of calibration.

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

Result of Calibration :- ( ° ) Without Adjustment

Function of UUC :- Temperature Source

Fresh air setting : Not Available



Probe Installation Details : Dimension of Chamber :  
a = 30 cm D = 0.02 m  
b = 30 cm W = 1.2 m  
c = 30 cm H = 1.2 m  
Capacity = 0.88 m<sup>3</sup>

Environment during calibration		
	Beginning	Finished
Temp. ( °C )	25	25
REL Humid. ( % )	68	75
AC Supply ( Volt )	220	220

Position :	Ref. Std. ID No.:
1	18-10RTD-01
2	18-10RTD-02
3	18-10RTD-03
4	18-10RTD-04
5	18-10RTD-05
6	22-10RTD-13
7	18-10RTD-07
8	18-10RTD-08
9 (ref.)	18-10RTD-09

Valu

เอกสารไม่ควบคุม  
# 10960-1



Equipment : BOD Incubator  
Condition As-Received : Used Item  
Reference : 2202-0415DC-1  
Result of Calibration :- ( ° ) Without Adjustment  
Function of UUC :- Temperature Source  
Fresh air setting : Not Available

Cert. No.: 22TMM9  
Page: 3 of 3

Calibration Point ( °C )	UUC <sup>1</sup> Setting ( °C )	UUC <sup>1</sup> Reading ( °C )	Temperature stability ( ± °C )	Temperature uniformity ( °C )	Overall Variation ( °C )	Uncertainty ( ± °C )	Coverage Factor
25.0	19.5	19.4	0.30	0.58	1.5	0.50	2

Calibration Point ( °C )	Measured Temperature ( °C )								
	1	2	3	4	5	6	7	8	9 (ref.)
25.0	25.104	25.013	25.236	25.020	24.834	25.701	25.017	25.024	25.027

Average<sup>1</sup> : The average of 30 values in each position.

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

Temperature uniformity : The maximum difference of measured temperature of 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<sup>1</sup> : Unit Under Calibration

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

<00>

Valu

เอกสารไม่ควบคุม  
# 10960-1



TECHNOLOGY PROMOTION AGENCY (TIPA), AND JAPAN  
CORPORATE AGENCY & EQUIPMENT CALIBRATION AND TESTING LABORATORY  
1114 FUCHIYAMA ROAD, SUITE 101, FUCHIYAMA, TAMA-KU, TOKYO 206-8508, JAPAN  
TEL: 03-3340-0001 FAX: 03-3340-0002



Cert. No.: 22TMM35  
Page: 1 of 3

## Certificate of Calibration

Equipment : BOD Incubator  
Manufacturer : ARCO  
Model : UR-1320  
Serial No. :  
ID No. : UAEWAO3182551  
Submitted by : United Analytical and Engineering Consultants Co., Ltd.  
3 Soi Utomak N1, Sukhumvit Road,  
Bangkok, Phrasitong,  
Bangkok 10250  
Location : Lab Floor 2  
Received Order : 7 April 2022  
Calibration Date : 7 April 2022  
Ambient Temperature : ( 24 ± 10 ) °C  
Relative Humidity : ( 10 ± 30 ) %  
Calibrated by : Natt Patsara/englab@uac.com

Approved by :   
Approved Signature

( ) Pongsak Tanwattana  
( ) Natt Patsara  
( ) Suttatong

Issue Date : 19 April 2022

The Uncertainty are for a confidence probability of approximately 95%

This certificate may not be reproduced without the prior written consent of the issuing authority.

Approved by the National Institute of Standards and Technology (NIST) and the National Institute of Standards and Technology (NIST).

# 1040246

เอกสารไม่ควบคุม



Equipment : BOD Incubator  
Condition As-Received : Used Item  
Reference : 2204-0415DC-2  
Procedure Used :-

Cert. No.: 22TMM35  
Page: 2 of 3

Calibration were conducted using calibration procedure CP-0702 according to direct measurement method with Data Acquisition which connected with Resistance Temperature Detector (RTD).  
The temperature scale used was based on ITS-90.

#### Condition of this result of calibration

##### 1. Reference standard instrument:-

Instrument Model Serial No. Cert. No. Due Date  
1) Data Acquisition 34970A 19410217 21UM30 10 Jan 2023

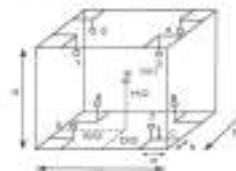
2. This certificate is valid only to the item calibrated on date and place of calibration.

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

Result of Calibration :- ( ° ) Without Adjustment

Function of UUC :- Temperature Source

Fresh air setting : Not Available



Probe Installation Details : Dimension of Chamber :  
a = 16 cm D = 0.02 m  
b = 16 cm W = 1.2 m  
c = 16 cm H = 1.2 m  
Capacity = 0.88 m<sup>3</sup>

Environment during calibration		
	Beginning	Finished
Temp. ( °C )	27	27
REL Humid. ( % )	58	58
AC Supply ( Volt )	220	220

Position :	Ref. Std. ID No.:
1	18-04RTD-01
2	18-04RTD-02
3	18-04RTD-03
4	18-04RTD-04
5	18-04RTD-05
6	18-04RTD-06
7	18-04RTD-07
8	18-04RTD-08
9 (ref.)	18-04RTD-09

Valu

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# 1104314



Equipment: BCO Incubator  
Condition As-Received: Used Item  
Reference: 2009-001600-2  
Result of Calibration: [ ] Without Adjustment  
Function of UUC: Temperature Source  
Fresh air setting: Not Available

Cert. No.: 2203120  
Page: 1 of 2

Calibration Point (°C)	UUC Setting (°C)	UUC Reading (°C)	Temperature stability (± °C)	Temperature uniformity (°C)	Overall Variation (°C)	Uncertainty (± °C)	Coverage Factor
20.0	20.0	20.0	0.00	0.44	1.1	0.04	1
20.0	20.0	20.0	0.00	0.44	1.1	0.04	1

Average: The average of 30 values in each position.  
Temperature stability: One-half of the greatest absolute difference of measured temperature at any one sensor.  
Temperature uniformity: The maximum difference of measured temperature at any sensors and the measured temperature of 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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2203120



Foundation for Industrial Development National Fluid Institute  
Practical Laboratory Service Center



## Calibration Certificate

Certificate No.: 2203120-001-01  
Client name: UNITED ANALYST AND ENGINEERING CONSULTANT CO., LTD.  
Address: 3 Set Idomruet 41, Sukhumvit Road,  
Bangchak, Phraeklong, Bangkok 10260

Page 1 of 2

Equipment: Electronic Balance  
Manufacturer: METTLER TOLEDO  
Model: AB304-S/FACT  
Serial No.: 1129081018  
ED No.: UMLW55.692/2002  
Order No.: 2203120  
Operation No.: 2203120-001  
Date of Receipt: 1 June 2022  
Date of Calibration: 1 June 2022

Calibrated by: Mr. Tawarak Saeber  
Scientist  
Approved by: (Mr. Phrasitai Tangthai)  
Manager, Division of Calibration Laboratory  
Responsible for the Technical Management Team  
Date of Issue: 7 June 2022

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 is the only of measurement related at the corresponding national standards laboratory. This certificate may not be reproduced other than in full except with the prior written approval of the National Fluid Institute.

FCI-021 Revision: 04 Date: 20-04-01

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Foundation for Industrial Development National Fluid Institute  
Practical Laboratory Service Center



## Calibration Report

Certificate No.: 2203120-001-01  
Equipment: Electronic Balance  
Manufacturer: METTLER TOLEDO  
Model: AB304-S/FACT  
Serial No.: 1129081018  
ED No.: UMLW55.692/2002  
Capacity: 320 g  
Date of Calibration: 1 June 2022  
Page 2 of 2

Environment Conditions: Ambient Temperature: 27.7 ± 0.2 °C, Relative Humidity: 49 ± 1.2 %  
Place of Calibration: 301, 302, 303, 304, 305, 306, 307, 308, 309, 310, 311, 312, 313, 314, 315, 316, 317, 318, 319, 320, 321, 322, 323, 324, 325, 326, 327, 328, 329, 330, 331, 332, 333, 334, 335, 336, 337, 338, 339, 340, 341, 342, 343, 344, 345, 346, 347, 348, 349, 350, 351, 352, 353, 354, 355, 356, 357, 358, 359, 360, 361, 362, 363, 364, 365, 366, 367, 368, 369, 370, 371, 372, 373, 374, 375, 376, 377, 378, 379, 380, 381, 382, 383, 384, 385, 386, 387, 388, 389, 390, 391, 392, 393, 394, 395, 396, 397, 398, 399, 400, 401, 402, 403, 404, 405, 406, 407, 408, 409, 410, 411, 412, 413, 414, 415, 416, 417, 418, 419, 420, 421, 422, 423, 424, 425, 426, 427, 428, 429, 430, 431, 432, 433, 434, 435, 436, 437, 438, 439, 440, 441, 442, 443, 444, 445, 446, 447, 448, 449, 450, 451, 452, 453, 454, 455, 456, 457, 458, 459, 460, 461, 462, 463, 464, 465, 466, 467, 468, 469, 470, 471, 472, 473, 474, 475, 476, 477, 478, 479, 480, 481, 482, 483, 484, 485, 486, 487, 488, 489, 490, 491, 492, 493, 494, 495, 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1910, 1911, 1912, 1913, 1914, 1915, 1916, 1917, 1918, 1919, 1920, 1921, 1922, 1923, 1924, 1925, 1926, 1927, 1928, 1929, 1930, 1931, 1932, 1933, 1934, 1935, 1936, 1937, 1938, 1939, 1940, 1941, 1942, 1943, 1944, 1945, 1946, 1947, 1948, 1949, 1950, 1951, 1952, 1953, 1954, 1955, 1956, 1957, 1958, 1959, 1960, 1961, 1962, 1963, 1964, 1965, 1966, 1967, 1968, 1969, 1970, 1971, 1972, 1973, 1974, 1975, 1976, 1977, 1978, 1979, 1980, 1981, 1982, 1983, 1984, 1985, 1986, 1987, 1988, 1989, 1990, 1991, 1992, 1993, 1994, 1995, 1996, 1997, 1998, 1999, 2000, 2001, 2002, 2003, 2004, 2005, 2006, 2007, 2008, 2009, 2010, 2011, 2012, 2013, 2014, 2015, 2016, 2017, 2018, 2019, 2020, 2021, 2022, 2023, 2024, 2025, 2026, 2027, 2028, 2029, 2030, 2031, 2032, 2033, 2034, 2035, 2036, 2037, 2038, 2039, 2040, 2041, 2042, 2043, 2044, 2045, 2046, 2047, 2048, 2049, 2050, 2051, 2052, 2053, 2054, 2055, 2056, 2057, 2058, 2059, 2060, 2061, 2062, 2063, 2064, 2065, 2066, 2067, 2068, 2069, 2070, 2071, 2072, 2073, 2074, 2075, 2076, 2077, 2078, 2079, 2080, 2081, 2082, 2083, 2084, 2085, 2086, 2087, 2088, 2089, 2090, 2091, 2092, 2093, 2094, 2095, 2096, 2097, 2098, 2099, 2100, 2101, 2102, 2103, 2104, 2105, 2106, 2107, 2108, 2109, 2110, 2111, 2112, 2113, 2114, 2115, 2116, 2117, 2118, 2119, 2120, 2121, 2122, 2123, 2124, 2125, 2126, 2127, 2128, 2129, 2130, 2131, 2132, 2133



Cert. No.: 22TM002  
Page: 1 of 3

## Certificate of Calibration

Equipment : Incubator  
Manufacturer : Memmert  
Model : PP 280  
Serial No. : V050387  
ID No. : UAE-MC-0030260  
Submitted by : United Analytical and Engineering Consultant Co., Ltd.  
3 Soi Udomsak 41, Sukhumvit Road,  
Bangkok, Phrakhanong,  
Bangkok 10260  
Location : Microbiology Laboratory  
Received Order : 7 April 2022  
Calibration Date : 7 April 2022  
Ambient Temperature :  $(20 \pm 1) ^\circ\text{C}$   
Relative Humidity :  $(51 \pm 3) \%$   
Calibrated by : Preeti Sridharan  
Approved by :  
Pontripa Tameykal  
Maha Sukrua  
Sueh Inga  
Issue Date : 19 April 2022

The Uncertainty are for a confidence probability of approximately 95%  
This certificate has not to be reported unless the full, correct and complete  
Approved by the Board of Engineers (Thailand) - Engineering Calibration and Testing Services

เอกสารไม่ควบคุม

A 1040248



Equipment : Incubator  
Condition As-Received : Used Item  
Reference : 2204-051600-1  
Procedure Used :

Cert. No.: 22TM003  
Page: 2 of 3

Calibration was conducted using calibration procedure CP-0102 according to direct measurement method with Data Acquisition which connected with Resistance Temperature Detector (RTD).  
The temperature scale used was based on ITS-90.

### Condition of this result of calibration

1. Reference standard (reference):

1) Data Acquisition Model: 34570A Serial No.: M14007817 Cert. No.: 21LMV0 Due Date: 20 Jul 2022

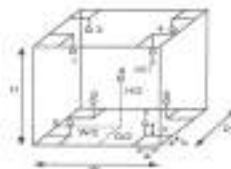
2. This certificate is valid only to the item calibrated on date and place of calibration.

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

Result of Calibration :  $(^\circ\text{C})$  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

Dimensions of Chamber :

D = 0.38 m  
W = 0.64 m  
H = 0.60 m  
Capacity = 0.28 m<sup>3</sup>

Environment during calibration		
	Beginning	Finished
Temp. ( $^\circ\text{C}$ )	28	28
REL. Humid. (%)	62	62
AC Supply (V <sub>eff</sub> )	220	220

Position	Ref. Std. ID No.
1	15RTD211
2	15RTD212
3	15RTD213
4	15RTD214
5	15RTD215
6	15RTD216
7	15RTD217
8	15RTD218
9 (ref.)	15RTD219

เอกสารไม่ควบคุม

B 1104310



Equipment : Incubator  
Condition As-Received : Used Item  
Reference : 2204-051600-1  
Result of Calibration :  $(^\circ\text{C})$  Without Adjustment  
Function of UUC : Temperature Source  
Fresh air setting : Close

Cert. No.: 22TM003  
Page: 3 of 3

Calibration Point ( $^\circ\text{C}$ )	UUC Setting ( $^\circ\text{C}$ )	UUC Reading ( $^\circ\text{C}$ )	Temperature stability ( $\pm ^\circ\text{C}$ )	Temperature uniformity ( $^\circ\text{C}$ )	Overall Variation ( $^\circ\text{C}$ )	Uncertainty ( $^\circ\text{C}$ )	Coverage Factor
35.0	35.0	35.2	0.12	0.05	0.70	0.30	2

Average : The average of 30 values in each position.  
Temperature stability : One-half of the greatest maximum difference of measured temperature at any one 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%.

ฉบับ

เอกสารไม่ควบคุม

B 1104309



Cert. No.: 22TM003  
Page: 1 of 3

## Certificate of Calibration

Equipment : Incubator  
Manufacturer : Memmert  
Model : PP 280  
Serial No. : V050387  
ID No. : UAE-MC-0030260  
Submitted by : United Analytical and Engineering Consultant Co., Ltd.  
3 Soi Udomsak 41, Sukhumvit Road,  
Bangkok, Phrakhanong,  
Bangkok 10260  
Location : Microbiology Laboratory (362)  
Received Order : 3 May 2022  
Calibration Date : 3 May 2022  
Ambient Temperature :  $(28 \pm 1) ^\circ\text{C}$   
Relative Humidity :  $(51 \pm 3) \%$   
Calibrated by : Winda Mula  
Approved by :  
Pontripa Tameykal  
Maha Sukrua  
Sueh Inga  
Issue Date : 19 May 2022

The Uncertainty are for a confidence probability of approximately 95%  
This certificate has not to be reported unless the full, correct and complete  
Approved by the Board of Engineers (Thailand) - Engineering Calibration and Testing Services

เอกสารไม่ควบคุม



## เอกสารไม่ควบคุม





Equipment : Water Bath  
 Condition As-Received : Used Item  
 Reference : 2004-0190C-4  
 Result of Calibration : ( ° ) Without Adjustment  
 Function of UUC : Temperature Source

Cert. No.: 22TM005  
 Page.: 2 of 2

Calibration point ( °C )	UUC <sup>1</sup> Setting ( °C )	UUC <sup>1</sup> Reading ( °C )	Average <sup>2</sup> Standard Reading ( °C )				
			Position				
			1	2	3	4	5 (ref.)
44.5	44.5	44.5	44.426	44.439	44.479	44.470	44.581

Calibration point ( °C )	Uniformity ( °C )	Stability ( ± °C )	Uncertainty ( ± °C )	Coverage Factor k
44.5	0.22	0.008	0.75	2

Average<sup>2</sup> : 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<sup>1</sup> : 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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THAI CALIBRATION ASSOCIATION (THAILAND-JAPAN)  
 COMPARE SERVICE IN 3 EQUIPMENT CALIBRATION AND TESTING LABORATORY  
 104 PATTANABONGKOR ROAD 15, 20/201 CHANG CHUANG ROAD BANGKOK 10200  
 TEL. 0-2557-5867-7 FAX. 0-2557-5868



Cert. No.: 22TM032  
 Page.: 1 of 3

## Certificate of Calibration

Equipment : Water Bath  
 Manufacturer : Minomoto  
 Model : WNE-14  
 Serial No. : L4760814  
 ID No. : UAC-MC-0352081  
 Submitted by : United Analyst and Engineering Consultant Co., Ltd.  
 3-59 Udonrui 41, Sukhumvit Road,  
 Bangkok, Phrakhanong,  
 Bangkok 10200  
 Location : Microbiology Laboratory  
 Received Order : 17 February 2022  
 Calibration Date : 17 February 2022  
 Ambient Temperature : ( 20 ± 10 ) °C  
 Relative Humidity : ( 20 ± 20 ) %  
 Calibrated by : Sudt Injai  
 Approved by :   
 ( ) Pongthapa Tanasap  
 ( ) Malee Subruan

Issue Date : 22 February 2022

The Uncertainty are for a confidence probability of approximately 95 %

This certificate is valid for equipment when used in the way and under the same conditions.

Approved on behalf of the Calibration Service :

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A 0350096



Equipment : Water Bath  
 Condition As-Received : Used Item  
 Reference : 2003-0440C-2  
 Procedure Used :

Cert. No.: 22TM032  
 Page.: 2 of 3

Calibration was conducted using in-house calibration procedure CP-OT01 according to direct measurement method with Data Acquisition which connected with Industrial Precision Resistance Thermometer ( IPTS ).

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	34870A	MF4087617	2118110	28 Jul 2022

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

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

Result of Calibration : ( ° ) Without Adjustment

Function of UUC : Temperature Source

	Environmental		AC Voltage Supply
	( °C )	( %RH )	( Volt )
Beginning of Calibration	21	66	229
Finished of Calibration	22	66	230



Foot :

Position :	Ref. Std. ID No.
1	ZORC143
2	ZORC144
3	ZORC145
4	ZORC146
5 (ref.)	ZORC147



Equipment : Water Bath  
 Condition As-Received : Used Item  
 Reference : 2003-0440C-2  
 Result of Calibration : ( ° ) Without Adjustment  
 Function of UUC : Temperature Source

Cert. No.: 22TM032  
 Page.: 2 of 3

Calibration point ( °C )	UUC <sup>1</sup> Setting ( °C )	UUC <sup>1</sup> Reading ( °C )	Average <sup>2</sup> Standard Reading ( °C )				
			Position				
			1	2	3	4	5 (ref.)
44.5	44.5	44.5	44.540	44.517	44.513	44.527	44.578
60.0	60.0	60.0	60.080	60.091	60.036	60.061	60.090

Calibration point ( °C )	Uniformity ( °C )	Stability ( ± °C )	Uncertainty ( ± °C )	Coverage Factor k
44.5	0.10	0.043	0.15	2
60.0	0.11	0.042	0.15	2

Average<sup>2</sup> : 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<sup>1</sup> : 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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A 1096053

เอกสารไม่ควบคุม

A 1096052

Mettler Toledo (Thailand) Ltd.  
4th Fl., 34/35 Ladda Rd., Bangna 1st Sub-Station  
Bangna District, Bangkok 10260  
+66 2123 1382  
M-T: thailandsales@mt.com



## Accuracy Calibration Certificate

### Customer

Company: Jintan Medical and Engineering Standard Co., Ltd.  
Address: 256 Ladda Station, Suburban Rd., Bang Chue  
City: Phra Prachin  
Country: Thailand  
Zip / Postal: 10200  
State / Province: Bangkok  
Order Number:

### Weighing Device

Manufacturer: Mettler Toledo  
Model: XPR105  
Serial No.: 30578 0001  
Building: 104  
Floor: 2  
Room: Research Room (200)

Instrument Type: Analytical Instrument  
Model Number: XPR105  
Terminal Model: XPR  
Terminal Serial No.: 105

Range	Max. Capacity	Readability (g)
1	100 g	0.001 g

### Procedure

Calibration Guidelines: EURAMET 100-1, 4.0.2 (10/01/10)  
METTLER TOLEDO Weighing Instructions: 010000000

This calibration certificate provides measurements for As Found calibration. The 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 of the weighing instrument was adjusted before calibration within its built-in range.  
In accordance with EURAMET 100-1 (1.0.2.4), the test loads were selected to reflect the capacity range of the weighing device up to approximately 90% of calibration conditions.

As Found	Room	Temp.	Humidity
As Found	Room 22.8 °C	Room 33.0 °C	Room 60.4 %

As Found Calibration Date: 01 Apr 2022  
As Left Calibration Date: N/A  
Issue Date: 06 Apr 2022

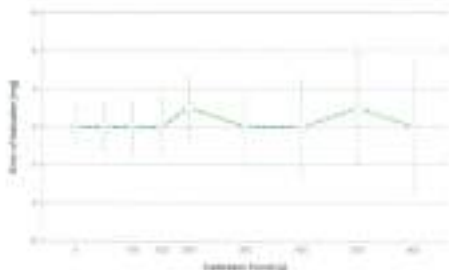
Calibrator:   
Special Operator:   
Approved Signatory:

☒ Equipment Transferred  
☐ Rent, Storage  
☐ Service Subline

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### Error of Indication

As Found	Reference Value	Indication	Error of Indication	Expected Uncertainty	U
1	0.000 g	0.000 g	0.000 g	1.0 mg	2
2	0.000 g	0.000 g	0.000 g	1.0 mg	2
3	1.000 g	1.000 g	0.000 g	1.0 mg	2
4	10.000 g	10.000 g	0.000 g	1.0 mg	2
5	100.000 g	100.000 g	0.000 g	1.0 mg	2
6	100.000 g	100.000 g	0.000 g	1.0 mg	2
7	100.000 g	100.001 g	0.001 g	1.0 mg	2
8	100.004 g	100.001 g	0.003 g	1.0 mg	2
9	100.004 g	100.001 g	0.003 g	1.0 mg	2
10	100.004 g	100.002 g	0.002 g	1.0 mg	2
11	100.004 g	100.001 g	0.003 g	1.0 mg	2



As Found  
As Left

The improved legibility of the graphical only (weighting-measurement points are shown and individual points have been set and displayed).

The uncertainty stated in the expected uncertainty at calibration laboratory is multiplied by the standard combined uncertainty by the coverage factor k = 2, which can be larger than 2 according to EURAMET 100-1. The value of the measured item with the assigned range of values with a probability of approximately 95%.

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

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## Measurement Results

### Repeatability

Temp Load: 200 g	As Found	As Left	As Found	As Left
1	200.000 g	199.999 g	199.999 g	199.999 g
2	200.000 g	199.999 g	199.999 g	199.999 g
3	200.000 g	199.999 g	199.999 g	199.999 g
4	200.000 g	199.999 g	199.999 g	199.999 g
5	200.000 g	199.999 g	199.999 g	199.999 g
6	200.000 g	199.999 g	199.999 g	199.999 g
7	200.000 g	199.999 g	199.999 g	199.999 g
8	200.000 g	199.999 g	199.999 g	199.999 g
9	200.000 g	199.999 g	199.999 g	199.999 g
10	200.000 g	199.999 g	199.999 g	199.999 g
Standard Deviation	0.0004 g	199.999 g		

The 10 of the graph represents the repeatability of the measurement in absolute values and is performed.  
The results of the graph are based upon the standard values of the different function measurement.

### Evenity

Test Load: 200 g	Position	As Found	As Left
1	100.001 g	199.999 g	199.999 g
2	100.001 g	199.999 g	199.999 g
3	100.001 g	199.999 g	199.999 g
4	100.001 g	199.999 g	199.999 g
5	100.001 g	199.999 g	199.999 g
Maximum Deviation	0.001 g	199.999 g	

The 10 of the graph represents the repeatability of the measurement in which the results are performed.

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### 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.	00001	Date of Issue	06 Jul 2021
Certificate Number	00001-001-001	Calibration Date	07 Jul 2021
Weight Set 2 - OIML E2			
Weight Set No.	00001	Date of Issue	06 Jul 2021
Certificate Number	00001-001-001	Calibration Date	07 Jul 2021
Thermo Regressor			
Equipment No.	00001	Date of Issue	16 Jun 2021
Certificate Number	00001-001-001	Calibration Date	07 Jul 2021

### Remarks

FACT adjustment functionality activated  
Equipment condition: Good  
Test calibration according to manufacturer's procedure  
Calibration was not done by calibration laboratory

### End of Assessment Section

The information below and any adjustments to this calibration certificate are not part of the assessment calibration.

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Request No. 25-65 / 0398

MTC. ACL No. 486 / 65

## CALIBRATION CERTIFICATE

NOMENCLATURE : 1. Atomic Absorption Spectrophotometer "Agilent Technologies"

Model AA2000, Serial No. MY13180001

2. Working standard solution "Inorganic Ventures"

Multi Analyte Custom Grade Solution, Lot No. PS ME9075616

SUBMITTED BY : (Name) Analyst and Engineering Consultant Co., Ltd.

123 Sukhumvit 111, Sukhumvit Road, Bangkok, Thailand 10110

CALIBRATION PROCEDURE : 1. Performance verification of Atomic Absorption Spectrophotometer (AA2000-02-30)

2. Information Uncertainty of Measurement in Analytical Chemistry (IP-011)

REFERENCE MATERIAL : Traceable to NIST "Agilent Technologies", "Data Base"

Cadmium Lot No. 31684706L, Chromium Lot No. 31681818S, Copper Lot No. 31680803S, Lead Lot No. 31680776L

Lead Lot No. 31681247S, Manganese Lot No. 31682856, Nickel Lot No. 31680784L, Zinc Lot No. 31680722T

CALIBRATION RANGE : 0.000300.00330.00370 mg/L at 228.8 nm Cd, 0.000200.00230.00270 mg/L at 327.3 nm Cr,

0.000100.00030.00070 mg/L at 324.7 nm Cu, 0.000100.00030.00070 mg/L at 244.7 nm Fe, 0.000100.00030.00070 mg/L at 217.0 nm Pb,

0.000100.00030.00070 mg/L at 279.5 nm Mn, 0.000100.00030.00070 mg/L at 232.0 nm Ni,

0.000100.00030.00070 mg/L at 213.9 nm Zn

AMBIENT CONDITIONS : Temperature: 22 °C, Relative humidity: 60 %

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

Calibrated by : (Signature)  
(Mr. Daniel Srikongkum)Approved by : (Signature)  
Director of Analytical Chemistry Laboratory  
Ref. 202506300500020001  
Calibration Date : 3 February 2022

This result valid only for the item described/checked in above request.

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IMTC-ACC-001 Rev.4

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Request No. 25-65 / 0398

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MTC. ACL No. 486 / 65

## 3. Precision

Element	Conc. (mg/L)	Absorbance										File No.	SD	Repeatability
Cd	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003
	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003
	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003
Cr	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002
	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002
	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002
Cu	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
Fe	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
Pb	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
Mn	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
Ni	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
Zn	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001

Continue : 3 / 5

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Request No. 25-65 / 0398

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MTC. ACL No. 486 / 65

## CALIBRATION DATA

## 1. Noise Level in term of standard deviation

Element	Cd	Cr	Cu	Fe	Pb	Mn	Ni	Zn
Absorbance	0.0003	0.0002	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
	0.0003	0.0002	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
	0.0003	0.0002	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
	0.0003	0.0002	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
	0.0003	0.0002	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
	0.0003	0.0002	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
	0.0003	0.0002	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
	0.0003	0.0002	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
	0.0003	0.0002	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
	0.0003	0.0002	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
Average Absorbance	0.0003	0.0002	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
	0.0003	0.0002	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
	0.0003	0.0002	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
	0.0003	0.0002	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
	0.0003	0.0002	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
	0.0003	0.0002	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
	0.0003	0.0002	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
	0.0003	0.0002	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
	0.0003	0.0002	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
	0.0003	0.0002	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
Standard Deviation	0.0003	0.0002	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001

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Request No. 25-65 / 0398

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MTC, ACL No. 486 / 65

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

Element	Standard Value of Fe (mg/L)	Reading (mg/L)	Error of Measurement (mg/L)	Error of Measurement (%)	Uncertainty (mg/L)
Fe	3.123	0.276	0.008	5.69	$\pm 0.028$
	2.5813	0.522	0.021	4.09	$\pm 0.017$
	1.0338	0.999	-0.035	1.00	$\pm 0.030$

## 3.5 Reading on wavelength- Lead (Pb) at 210.0 nm.

Element	Standard Value of Pb (mg/L)	Reading (mg/L)	Error of Measurement (mg/L)	Error of Measurement (%)	Uncertainty (mg/L)
Pb	0.1386	0.197	0.002	0.91	$\pm 0.014$
	0.8258	0.730	0.028	3.77	$\pm 0.022$
	1.4612	1.483	-0.028	1.78	$\pm 0.040$

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

Element	Standard Value of Mn (mg/L)	Reading (mg/L)	Error of Measurement (mg/L)	Error of Measurement (%)	Uncertainty (mg/L)
Mn	0.04958	0.059	0.008	9.95	$\pm 0.004$
	0.20736	0.317	0.019	9.85	$\pm 0.006$
	0.60033	0.682	0.017	1.50	$\pm 0.013$

Continue 5 / 5

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This report is only for the item described or value delivered.  
Underlying the Report/Results and validity of the results stated is full and permitted unless written permission is obtained from the provider of TSCS.

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E-mail: [service@tscs.co.th](mailto:service@tscs.co.th)

Office/Laboratory  
No. 12, Bangyong Industrial Estate, Bangyong Road,  
Bangyong District, Bangkok 10140, Thailand  
Tel: 081-0107-8888  
Fax: 081-0107-8888  
E-mail: [service@tscs.co.th](mailto:service@tscs.co.th)

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Request No. 25-65 / 0398

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MTC, ACL No. 486 / 65

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

Element	Standard Value of Ni (mg/L)	Reading (mg/L)	Error of Measurement (mg/L)	Error of Measurement (%)	Uncertainty (mg/L)
Ni	0.099	0.100	0.003	3.03	$\pm 0.007$
	0.495	0.589	-0.008	1.21	$\pm 0.015$
	0.990	0.970	-0.015	1.52	$\pm 0.025$

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

Element	Standard Value of Zn (mg/L)	Reading (mg/L)	Error of Measurement (mg/L)	Error of Measurement (%)	Uncertainty (mg/L)
Zn	0.099	0.028	0.000	0.00	$\pm 0.002$
	0.380	0.307	0.007	1.33	$\pm 0.011$
	0.760	0.683	0.048	5.21	$\pm 0.015$

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

Calibrated by:   
(Mr. Danai Sritongkum)

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

INDUSTRIAL METROLOGY AND TESTING SERVICE CENTRE

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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 service please visit our web site using the following URL: <http://www.agilent.com/service/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 List 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 table 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 5100 v04
Instrument system site and location	UAE / 3rd Floor Laboratory
List system component product numbers	List the serial numbers of each component
1. 5100A	1. 9116070001
2. 5100B	2. 9116070002
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
Neaturation Type	Inductively Coupled Plasma (ICP) or other
Spray Chamber	Cylindrical Single Pass (CSP) or Cylindrical Double Pass (CDP) or other
Neat	Inductively Coupled Plasma (ICP) or other
Injector Diameter	2.0mm (1.5mm) 1.0mm (0.8mm) or other
Injector Material	Quartz (Ceramic) or 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 HP application systems, if standard sample introduction system was not installed, ask the customer to install it. <sup>1</sup>
- ☑ 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 polycondensate purge filter.
- ☑ Replace the radial pre-optics window.
- ☑ Replace the radial pre-optics window for SMDV and VDV instruments.
- ☑ Check exhaust flow for the correct positive extraction at the exhaust duct to ensure they meet minimum specifications.
- ☑ Replace air inlet dust filter.
- ☑ Replace high capacity air inlet dust filter element if installed. <sup>1</sup>
- ☑ Remove and clean instrument water inlet filter.

**G8481A Cooling water system**

- ☑ **Section NOT Applicable**
- ☑ Drain cooling fluid and remove any particles from the chiller reservoir.
- ☑ Remove, clean and reinstall water inlet metal mesh filter.
- ☑ Re fill with Polyolene cooling fluid.
- ☑ Clean the cooling system Air filter and the condenser by compressed air or vacuum cleaner.

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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 as 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 raise port, ensure that the probe is approximately centered in the vial.

**SPS 4 Auto Sampler**

- ☑ **Section NOT Applicable**
- ☑ Clean the spill tray, catch 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 PPU cables for cracks, incorrect positioning, damaged edges or damaged connectors.
- ☑ Pump Tubing Replacement. Replace peristaltic pump tubing. Replace all tubing that goes from the three station to the pump and from the pump to the waste/rins bottles.

**AVS 4, 5, 7**

- ☑ **Section NOT Applicable**
- ☑ Replace valve seat 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.
  - ☑ Solvent 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	
	Realt	Axial *	Realt	Axial *
50.013.007 nm SRH	420.6	2364.0	4375.0	2420.8
30.227.010 nm SRH	17064.7	3849.1	18201.7	30946.2
Al 308.252 nm SRH	7.5	16.9	9.5	16.9
K 766.481 nm SRH	5.1	36.8	6.4	35.7

\* Axial result is not applicable for G8015AA, G8015AA 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
Solvent Communications Test	Pass
Air Flow	Pass
Water Flow	Pass
Gas Flows	Pass
RF Generator	Pass
Camera Test	Pass
Optics Test	Pass
Nebulizer Test	Pass

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

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

Measurement	Steady State	Flames (s)
Main Voltage	214.5AC	VAC
Main Current	2.304	A
Instrument Temperature	22.2	°C
RF Air Flow (waste open)	15.0	L/min
Flame Exhaust Temperature	No measurement	26.7
Water Flow Oscillator	No measurement	1.44
Water Flow Detector	1.02	L/min
Water Inlet Temperature	18.0	°C
Polycondensate Temperature	25.8	°C
ICD Temperature	-29.8	°C
Thermal Shielding	25.0	°C
Argon Supply Pressure	271.54	kPa
Purge Gas Supply Pressure <sup>1</sup>	274.50	kPa
Optics Gas Supply Pressure <sup>1</sup>	274.50	kPa
Nebulizer Flow	No measurement	0.70
Nebulizer Back Pressure	No measurement	168.63
Flame Gas Flow	No measurement	1.52
Auxiliary Gas Flow	No measurement	1.00
RF Power	No measurement	1200
RF Supply Current	No measurement	8.663
RF Supply Voltage	No measurement	184.61

<sup>1</sup> 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 Comment
Aspirator Pre-Optic Window	08010-80014	08010A, 08011A, 08014A, 08012A	1
Radial Pre-Optic Window	08010-80015		All
Polyester Coating Fluid	02020-50010	08010A	1
Purge Gas Filter	08010-80130	All	1
Air Inlet Filter	08010-80001	All	1
High Capacity Air Filter	08010-80130	Optional	
Motor seal for 6-7 port valve for AS30/7	08014-00001	08014A, 08010	
Motor seal for 4 port valve for AS34	08010-00001	08010A	
Flow solution to flow station 22mm id x 0.8	08010-80120	SPS 4	
Barb connector 2.5mm-1.5mm ID	08010-80124	SPS 4	
PVC waste tubing 1/2" x 1/2" x 1/2" x 1/2"	08010-80122	SPS 4	
<b>Additional Parts may be required from engineers stock</b>			
X axis drive belt	14100-07000	SPS 1	
Z axis drive belt	14100-07000	SPS 1	
Peristaltic pump tubing, PVC 3/16" x 1/8" x 1/8"	07100-09000	SPS 4	

**Restore system**

For ICP 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 check.

**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  
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- ☒ 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 issues 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/resources/products/literature/literaturesearch/5110.asp>
- ☒ Need to know more? - <http://www.agilent.com/chem/analytical>
- ☒ Need technical support, FAQs? - <http://www.agilent.com/chem/support/technicalsupport>
- ☒ Need supplier? - <http://www.agilent.com/chem/supplier>

**Service Completion**

Service request number: 08010-50017 Date service completed: 30 Nov 2017

Agilent signature: Vincent T. Customer signature: [Signature]

Document part number: 08014-00078

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**Report Summary**

Instrument Model: Agilent 5100/5110 VPP ICP-OES  
Instrument ID: 08011A/08011A  
Instrument Serial Number: MY1000001  
Software Version: 7.3.1.0507  
Firmware Version: 3442  
Tested By: Test Before PM  
Test Completed On: 11/30/2017 9:08:32 AM

**Result Summary**

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

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**Resolution Test**

Element Wavelength	Specification	Width
H (174.213 nm)	± 9.40	0.02
As (196.080 nm)	± 9.20	0.20
C (196.027 nm)	± 11.80	0.35
Mo (202.032 nm)	± 8.20	0.41
Cr (208.186 nm)	± 13.40	0.04
Zn (213.857 nm)	± 5.75	0.60
Pb (223.363 nm)	± 9.00	1.19
Co (229.615 nm)	± 17.20	11.75
Ba (229.424 nm)	± 9.40	7.21
Mn (257.610 nm)	± 10.30	9.90
Mn (259.688 nm)	± 20.30	14.35
Cr (267.716 nm)	± 11.00	8.14
Cu (324.754 nm)	± 25.90	18.99
Cu (327.389 nm)	± 14.20	11.24
Br (338.271 nm)	± 32.50	24.47
Ba (455.403 nm)	± 44.00	33.08
Sr (407.773 nm)	± 36.00	17.22
Ba (482.408 nm)	± 39.00	25.48
Ba (514.171 nm)	± 42.00	25.47
Ar (675.263 nm)	± 74.00	64.82
K (766.491 nm)	± 82.00	64.94

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Sensitivity Test		Pass			
Result					
Element Wavelength	Specification	Method	Ratio	Standard	Blank
As (198.880 nm)	≤ 40.0	SRBR	147.7	1108.1	95.8
Se (196.029 nm)	≤ 41.0	SRBR	111.1	1198.3	97.7
Zn (213.857 nm)	≤ 140.0	SRBR	4700.6	51958.5	158.8
Pb (225.353 nm)	≤ 48.8	SRBR	192.1	2689.6	195.7
Mn (257.610 nm)	≤ 3536.0	SRBR	11684.7	254188.0	547.5
As (286.152 nm)	≤ 3.4	SRBR	7.1	48047.2	5770.6
Sa (483.408 nm)	≤ 34.0	SRBR	167.4	1857710.2	17407.5
K (766.491 nm)	≤ 1.8	SRBR	0.1	108906.8	9606.4
Actual					
Element Wavelength	Specification	Method	Ratio	Standard	Blank
As (198.880 nm)	≤ 330.0	SRBR	234.9	3066.4	192.8
Se (196.029 nm)	≤ 189.0	SRBR	218.1	2895.1	271.6
Zn (213.857 nm)	≤ 234.0	SRBR	1386.5	16860.4	144.9
Pb (225.353 nm)	≤ 1745.0	SRBR	8394.8	183007.8	470.4
Mn (257.610 nm)	≤ 4227.0	SRBR	7716.0	143040.2	542.8
As (286.152 nm)	≤ 320.0	SRBR	578.3	14405.2	680.4
Sa (483.408 nm)	≤ 19625.0	SRBR	31842.1	1811257.3	1858.9
K (766.491 nm)	≤ 1848.0	SRBR	4460.1	183110.6	1642.2
Ca (393.754 nm)	≤ 16.0	SRBR	46.2	371487.1	7082.9
Al (396.152 nm)	≤ 6.0	SRBR	14.9	278447.4	17582.0
Na (589.438 nm)	≤ 60.0	SRBR	100.6	10081607.3	52518.8
K (766.491 nm)	≤ 24.0	SRBR	95.8	1822953.4	9689.1

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Precision Test		Pass
Result		
Element Wavelength	Specification	Measured Value % RSD
As (198.880 nm)	≤ 2.80	0.82
Se (196.029 nm)	≤ 2.80	0.71
Zn (213.857 nm)	≤ 1.80	0.43
Pb (225.353 nm)	≤ 2.60	0.78
Mn (257.610 nm)	≤ 1.58	0.60
As (286.152 nm)	≤ 1.90	0.46
Sa (483.408 nm)	≤ 1.90	0.89
K (766.491 nm)	≤ 1.84	0.42
Actual		
Element Wavelength	Specification	Measured Value % RSD
As (198.880 nm)	≤ 1.80	0.57
Se (196.029 nm)	≤ 1.84	0.78
Zn (213.857 nm)	≤ 1.58	0.91
Pb (225.353 nm)	≤ 1.90	0.81
Mn (257.610 nm)	≤ 1.50	0.66
Pb (225.353 nm)	≤ 1.84	0.52
Mn (257.610 nm)	≤ 1.58	0.64
Cr (267.716 nm)	≤ 1.80	0.84
Ca (393.754 nm)	≤ 1.80	0.69
Al (396.152 nm)	≤ 1.39	0.61
Na (589.438 nm)	≤ 1.00	0.86
K (766.491 nm)	≤ 1.80	1.23

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Report Summary	
Instrument Model	Agilent 5100B/110 VCV ICP-OES
Instrument ID	04811AG0015A
Instrument Serial Number	MF19030081
Software Version	7.3.1.8507
Firmware Version	3442
Tested By	PM Functional Test
Test Completed On	11/30/2022 11:43:35 AM
Result Summary	
Subsystems Communications Test	Pass
Air Flow Test	Pass
Water Flow Test	Pass
Gas Flow Test	Pass
RF Generator Test	Pass
Camera Test	Pass
Optics Test	Skipped
Advanced Valve System Test	Skipped
Reactor Test	Skipped
Sensitivity Test	Skipped
Precision Test	Skipped
Subsystem Communications Test	
Pass	
Air Flow Test	
Pass	
20% Air Flow (relative speed)	75% Air Flow (relative speed)
14.00	19.00
Water Flow Test	
Pass	
RF Water Flow (L/min)	Camera Water Flow (L/min)
1.44	1.55
	Water Inlet Temperature (°C)
	18.81

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Gas Flow Test			Pass		
Nebulizer Target Flow	Actual Flow	Back Pressure	Auxiliary Target Flow	Actual Flow	Back Pressure
0.70	0.70	953.27	2.08	1.89	100.48
Mistup Target Flow	Actual Flow	Back Pressure	Plasma Target Flow	Actual Flow	Back Pressure
2.00	2.00	112.85	18.00	17.81	23.46
RF Generator Test			Pass		
RF Power Supply Test			Passed		
RF Power Supply (V)			147.437		
RF Oscillator Test			Passed		
RF Oscillator Frequency (MHz)			3.900		
Wave Coil Current (A)			45.968		
RF Power Supply Current (A)			1.987		
Camera Test			Pass		
	Integration Time (ms)	Standard Deviation	Status		
Electronic Offset Test	1000	5.839	Passed		
Dark Current Test	6000	0.976	Passed		
Anti Test	5	0.004	Passed		
Linearity Test		0.118	Passed		

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Report Summary	
Instrument Model	Agilent 5100/5110 VDV ICP-OES
Instrument ID	08011A/G8015A
Instrument Serial Number	8918030001
Software Version	1.3.1.0607
Firmware Version	3442
Tested By	PM Performance Test
Test Completed On	11/30/2025 12:10:42 PM
Result Summary	
Subsystem Communications Test	Skipped
Air Flow Test	Skipped
Water Flow Test	Skipped
Gas Flow Test	Skipped
RF Generator Test	Skipped
Camera Test	Skipped
Optics Test	Pass
Advanced Valve System Test	Skipped
Resolution Test	Pass
Sensitivity Test	Pass
Precision Test	Pass
Optics Test	
Intensity	Radial: 5074935 Axial: 5823470
Wavelength	737.212

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Resolution Test			Pass
Element Wavelength	Specification	Width	
N (174.213 nm)	≤ 9.40	6.79	
As (188.880 nm)	≤ 8.20	6.09	
C (193.827 nm)	≤ 11.50	8.20	
Pb (205.230 nm)	≤ 8.20	6.30	
Cr (205.168 nm)	≤ 15.45	8.25	
Zn (213.857 nm)	≤ 8.70	6.77	
Pb (220.353 nm)	≤ 9.55	7.82	
Co (228.815 nm)	≤ 17.20	11.67	
Ba (230.404 nm)	≤ 9.45	7.39	
Mn (257.610 nm)	≤ 13.30	9.48	
Mn (260.568 nm)	≤ 25.39	14.25	
Cr (267.716 nm)	≤ 11.00	7.94	
Cu (324.754 nm)	≤ 25.08	18.89	
Cu (327.385 nm)	≤ 14.20	11.33	
Fe (338.871 nm)	≤ 33.56	24.44	
Ba (455.408 nm)	≤ 44.05	33.06	
Bi (485.733 nm)	≤ 36.00	17.51	
Ba (485.408 nm)	≤ 36.00	35.50	
Ba (514.171 nm)	≤ 42.30	24.96	
Ar (575.283 nm)	≤ 74.90	69.30	
K (766.491 nm)	≤ 85.30	69.60	

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Sensitivity Test							Pass
Radial							
Element Wavelength	Specification	Method	Ratio	Standard	Blank		
As (188.880 nm)	≤ 40.0	SPSR	147.8	1145.3	94.8		
Se (196.026 nm)	≤ 41.0	SPSR	111.6	1222.8	101.8		
Zn (213.857 nm)	≤ 1421.0	SPSR	4375.0	52592.3	143.7		
Pb (205.230 nm)	≤ 48.9	SPSR	199.8	2144.4	199.8		
Mn (257.610 nm)	≤ 3816.0	SPSR	12821.7	268891.3	486.0		
Al (308.152 nm)	≤ 3.4	SPSR	9.8	32685.5	4873.8		
Ba (455.408 nm)	≤ 34.0	SPSR	154.5	2267201.2	14998.1		
K (766.491 nm)	≤ 1.8	SPSR	6.4	195771.9	14250.0		
Axial							
Element Wavelength	Specification	Method	Ratio	Standard	Blank		
As (188.880 nm)	≤ 208.8	SPSR	242.4	3175.1	164.9		
Se (196.026 nm)	≤ 159.0	SPSR	220.1	4134.3	289.3		
Zn (213.857 nm)	≤ 234.0	SPSR	1126.8	13762.8	148.8		
Zn (213.857 nm)	≤ 1743.0	SPSR	8400.0	177188.8	442.5		
Cr (205.168 nm)	≤ 4227.0	SPSR	7081.9	125804.2	321.8		
Pb (220.353 nm)	≤ 583.0	SPSR	636.3	32987.0	632.6		
Mn (257.610 nm)	≤ 13925.8	SPSR	30945.2	1267668.0	1736.6		
Cr (267.716 nm)	≤ 1040.0	SPSR	4368.8	187330.0	1424.4		
Cu (324.754 nm)	≤ 19.0	SPSR	52.1	373680.7	7033.1		
Al (308.152 nm)	≤ 6.0	SPSR	16.8	268357.7	19112.4		
Ba (455.408 nm)	≤ 85.0	SPSR	225.2	10173441.5	44971.7		
K (766.491 nm)	≤ 24.0	SPSR	98.7	1874138.2	48655.7		

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Precision Test				Pass
Radial				
Element Wavelength	Specification	Measured Value % RSD		
As (188.880 nm)	≤ 2.88	0.83		
Se (196.026 nm)	≤ 2.68	0.64		
Zn (213.857 nm)	≤ 1.90	0.28		
Pb (205.230 nm)	≤ 2.60	0.66		
Mn (257.610 nm)	≤ 1.54	0.25		
Al (308.152 nm)	≤ 1.55	0.28		
Ba (455.408 nm)	≤ 1.50	0.59		
K (766.491 nm)	≤ 1.50	0.23		
Axial				
Element Wavelength	Specification	Measured Value % RSD		
As (188.880 nm)	≤ 1.58	0.71		
Se (196.026 nm)	≤ 1.55	0.43		
Zn (205.230 nm)	≤ 1.50	0.46		
Zn (213.857 nm)	≤ 1.50	0.37		
Cr (214.439 nm)	≤ 1.50	0.48		
Pb (220.353 nm)	≤ 1.50	0.48		
Mn (257.610 nm)	≤ 1.54	0.74		
Cr (267.716 nm)	≤ 1.50	0.26		
Cu (324.754 nm)	≤ 1.50	0.31		
Al (308.152 nm)	≤ 1.50	0.45		
Ba (455.408 nm)	≤ 1.50	0.81		
K (766.491 nm)	≤ 1.50	0.84		

Page 4 of 4

เอกสารไม่ควบคุม



# **CERTIFICATE OF CALIBRATION**

Certificate No. : SP22-018

Page 1 of 5

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

Address : 3 Soi Uthawak 41, Sukhumvit Road, Bangkok, Phrakhanong,

Bangkok 10260

Location of calibration : Laboratory 315

Equipment : UV-Vis Spectrophotometer

Manufacturer : Agilent Technologies

Model : Cary 60

Serial No. : MY1540009

ID No. : N/A

Received Date : 23 May 2022

Calibration Date : 25 May 2022

Issue Date : 26 May 2022

Condition Instrument : Good

Calibrated by :   
(Mr. Theeraporn Rittichai)

Approved by :   
(Ms. Chantida Sangsri)

Technician Manager

Quality Manager

This calibration result is applied only to the items calibrated date and time based on issue on the issue date and place of calibration only.

The measurement capability of the laboratory and its traceability is recognized national standards and in the scope of measurement included in the corresponding without certificate. This certificate may be reproduced other than in full except with the prior written approval of the DQE Service Co., Ltd.

เอกสารไม่ควบคุม

156706-02-001 1/1/2021



# **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	25750	89928	22 October 2023
Absorbance Standard set	25757	89929	22 October 2023
Wavelength Standard set	25806	89930	22 October 2023
Wavelength Standard set	25758	89931	22 October 2023

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

(Institute of Standards and Technology (NIST) through Sigma 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

156706-02-001 1/1/2021



# **REPORT OF CALIBRATION**

Certificate No. : SP22-016

Page 3 of 5

Calibration Results : Without adjustment

Photometric Accuracy :

Wavelength (nm.)	CRM Value (Abs)	UUC Reading (Abs)	Correction (Abs)	Uncertainty (Abs)	Coverage factor
420	0.0000	0.0000	0.0000	0.0028	2.00
	0.5787	0.5755	0.0032	0.0031	2.00
	1.0490	1.0438	0.0052	0.0029	2.00
	2.1000	2.1847	0.0847	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
	1.0347	1.0332	0.0015	0.0035	2.00
	2.1229	2.1211	0.0018	0.0062	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
	0.5181	0.5171	0.0010	0.0031	2.00
	1.0003	0.9984	0.0019	0.0035	2.00
	1.9867	1.9848	0.0041	0.0084	2.00
596	0.0000	0.0000	0.0000	0.0028	2.00
	0.5523	0.5509	0.0014	0.0030	2.00
	1.0808	1.0791	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
	0.5661	0.5584	0.0077	0.0031	2.00
	1.0512	1.0498	0.0014	0.0029	2.00
	1.9234	1.9265	0.0029	0.0082	2.00

เอกสารไม่ควบคุม

156706-02-001 1/1/2021



# **REPORT OF CALIBRATION**

Certificate No. : SP22-016

Page 4 of 5

Photometric Accuracy :

Wavelength (nm.)	CRM Value (Abs)	UUC Reading (Abs)	Correction (Abs)	Uncertainty (Abs)	Coverage factor
735	0.0000	0.0001	-0.0001	0.0050	2.00
	0.7478	0.7421	0.0057	0.0056	2.00
757	0.0000	0.0000	0.0000	0.0030	2.00
	0.8686	0.8619	0.0067	0.0059	2.00
813	0.0000	0.0000	0.0000	0.0030	2.00
	0.2912	0.2896	0.0016	0.0051	2.00
859	0.0000	0.0000	0.0000	0.0030	2.00
	0.6448	0.6403	0.0045	0.0053	2.00

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156706-02-001 1/1/2021



## REPORT OF CALIBRATION

Certificate No. : SP22-016

Page 2 of 3

## Wavelength Accuracy :

CRM Value (nm)	UVC Reading (nm)	Correction (nm)	Uncertainty (nm)	Coverage Factor k
365.73	362.9	-0.28	0.18	2.00
375.01	373.2	-0.08	0.18	2.00
387.81	387.5	0.31	0.18	2.00
394.06	393.5	0.56	0.18	2.00
399.53	399.2	0.43	0.18	2.00
408.79	408.0	0.29	0.18	2.00
445.94	445.4	0.34	0.18	2.00
453.68	453.2	0.46	0.18	2.00
480.02	479.7	0.32	0.18	2.00
536.29	536.2	0.09	0.18	2.00
637.88	636.9	-0.33	0.18	2.00
431.39	431.8	0.35	0.18	2.00
473.29	473.5	0.80	0.18	2.00
513.47	513.5	-0.03	0.18	2.00
528.89	528.5	0.39	0.18	2.00
573.27	573.8	0.17	0.18	2.00
589.35	589.8	0.35	0.20	2.00
694.40	694.7	-0.36	0.18	2.00
746.72	746.8	-0.08	0.20	2.00
748.53	748.5	0.01	0.18	2.00
807.83	807.3	-0.29	0.18	2.00
878.28	878.9	0.28	0.18	2.00

Remarks : - UVC = Cuvette Calibration

- N/A = Not Available

- The stated reported uncertainty of measurement is based on the expanded uncertainty of measurement multiplied by the coverage factor k.

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

- \*\* Indication and TIR specified

- End of Certificate -

PHE 196-02-001 1/1/2021

เอกสารไม่ควบคุม



## CERTIFICATE OF CALIBRATION

Certificate No. : SP22-007

Page 1 of 5

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

Address : 3 Soi Udonnakh 41, Sukhumvit Road, Bangkok, Phrakong, Bangkok 10260

Location of calibration : Laboratory 517

Equipment : UV-Vis Spectrophotometer

Manufacturer : Hitachi

Model : U-1900

Serial No. : 2021-064

ID No. : UAE.WAS.006/2552

Received Date : 28 January 2022

Calibration Date : 28 January 2022

Issue Date : 24 January 2022

Condition Instrument : Good

Calibrated by :   
(Jit Teerarat, Analyst)Approved by :   
(Chaiyaporn Sangsri, Quality Manager)

This calibration result is valid only in the item calibrated item and non-related parameter reference item and place of calibration only.

The measurement capability of the laboratory and its compliance is designed based on the use of measurement indicated in the corresponding national standards laboratory. This certification can be guaranteed when it is in line with the prior written approval of the DQE Service Co., Ltd.

PHE 196-02-001 1/1/2021

เอกสารไม่ควบคุม



## REPORT OF CALIBRATION

Certificate No. : SP22-007

Page 2 of 5

Environment Condition : Ambient Temperature 23 ± 1 °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	89915	22 October 2023
Absorbance Standard set	25757	89928	22 October 2023
Wavelength Standard set	21806	89918	22 October 2023
Wavelength Standard set	25758	89919	22 October 2023

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

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

Spectral Band Width of UVC : 4.0 nm

Scan Speed of UVC : 200 nm/min

Scan Interval of UVC : 0.1 nm

Resolution of UVC : Photometric : 0.001 Abs.

Wavelength 0.1 nm

PHE 196-02-001 1/1/2021

เอกสารไม่ควบคุม



## REPORT OF CALIBRATION

Certificate No. : SP22-007

Page 3 of 5

Calibration Result : Without adjustment

## Photometric Accuracy :

Wavelength (nm)	CRM Value (Abs)	UVC Reading (Abs)	Correction (Abs)	Uncertainty (Abs)	Coverage factor k
420	0.0090	0.009	0.0000	0.0028	2.00
	0.1787	0.177	0.0017	0.0031	2.00
	1.0490	1.050	-0.0010	0.0029	2.00
	2.1890	2.183	0.0070	0.0008	2.00
440	0.0090	0.009	0.0000	0.0028	2.00
	0.1607	0.160	0.0007	0.0034	2.00
	1.0347	1.025	0.0017	0.0035	2.00
	2.1229	2.118	0.0049	0.0078	2.00
460	0.0090	0.009	0.0000	0.0028	2.00
	0.1258	0.121	0.0026	0.0030	2.00
	0.9434	0.943	0.0004	0.0029	2.00
	1.9780	1.974	0.0023	0.0059	2.00
546.1	0.0090	0.009	0.0000	0.0028	2.00
	0.1191	0.118	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	0.0090	0.009	0.0000	0.0028	2.00
	0.1523	0.152	0.0003	0.0030	2.00
	1.0009	1.002	-0.0013	0.0030	2.00
	2.0391	2.033	0.0061	0.0079	2.00
635	0.0090	0.009	0.0000	0.0028	2.00
	0.1601	0.162	-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

PHE 196-02-001 1/1/2021

เอกสารไม่ควบคุม

DGE Services Co., Ltd.  
31 Soi Ladprao/Wongthong 25, Ladprao/Wongthong Rd., Ladprao, Ladprao, Bangkok 10250  
Phone : +66 (0)2 214 2034, Email : dge@vsnoradigital.com

**REPORT OF CALIBRATION**

Certificate No.: SP22-037 Page 4 of 3

**Photometric Accuracy :**

Wavelength	CRM Value	UVC Reading	Correction	Uncertainty	Coverage factor
(nm)	(Abs)	(Abs)	(Abs)	(Abs)	K
225	0.9000	0.900	0.0000	0.0050	2.00
	0.7478	0.746	0.0018	0.0057	2.00
227	0.9000	0.900	0.0000	0.0050	2.00
	0.9000	0.891	0.0070	0.0059	2.00
313	0.0000	0.000	0.0000	0.0050	2.00
	0.2912	0.291	0.0000	0.0051	2.00
350	0.0000	0.000	0.0000	0.0050	2.00
	0.0448	0.038	0.0068	0.0055	2.00

SP22-037-001-01.0.2021

เอกสารไม่ควบคุม

DGE Services Co., Ltd.  
31 Soi Ladprao/Wongthong 25, Ladprao/Wongthong Rd., Ladprao, Ladprao, Bangkok 10250  
Phone : +66 (0)2 214 2034, Email : dge@vsnoradigital.com

**REPORT OF CALIBRATION**

Certificate No.: SP22-037 Page 3 of 3

**Wavelength Accuracy :**

CRM Value	UVC Reading	Correction	Uncertainty	Coverage factor
(nm)	(nm)	(nm)	(nm)	K
241.54	240.8	0.74	0.10	2.00
278.40	278.1	0.30	0.10	2.00
288.79	288.0	0.79	0.10	2.00
314.22	313.1	0.70	0.10	2.00
360.20	360.3	0.70	0.10	2.00
410.40	410.0	0.40	0.10	2.00
440.70	440.0	0.70	0.10	2.00
451.20	451.0	0.20	0.10	2.00
460.00	459.5	0.50	0.10	2.00
510.00	510.0	0.00	0.10	2.00
517.94	517.2	0.74	0.10	2.00
440.74	440.0	0.74	0.10	2.00
412.12	411.6	0.60	0.10	2.00
515.70	515.0	0.70	0.10	2.00
526.72	526.6	0.12	0.10	2.00
510.40	511.8	0.80	0.10	2.00
585.40	584.6	0.80	0.10	2.00
584.65	584.0	0.65	0.10	2.00
580.27	580.0	0.27	0.10	2.00
745.20	747.8	0.40	0.10	2.00
807.10	805.4	0.70	0.10	2.00
870.10	870.8	0.80	0.10	2.00

Remark : UVC is used under optimum

UVC = the average

The most expanded uncertainty of measurement (U) is shown in the stated uncertainty of measurement multiplied by the coverage factor (K).

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

\* Indicates non TSI corrected

- End of Certificate -

SP22-037-001-01.0.2021

เอกสารไม่ควบคุม

DGE Services Co., Ltd.  
31 Soi Ladprao/Wongthong 25, Ladprao/Wongthong Rd., Ladprao, Ladprao, Bangkok 10250  
Phone : +66 (0)2 214 2034, Email : dge@vsnoradigital.com

**CERTIFICATE OF CALIBRATION**

Certificate No.: SP22-038 Page 1 of 3

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

Address : 31 Soi 11/Novak 41, Sukhumvit Road, Bangkok, Phrasang, Bangkok 10260

Location of calibration : Laboratory 213

Equipment : UV-Vis Spectrophotometer

Manufacturer : Hitachi

Model : U-2900

Serial No. : Z1822-089

ID No. : UAE.WAT.001/2564

Received Date : 20 January 2022

Calibration Date : 20 January 2022

Issue Date : 24 January 2022

Condition Instrument : Good

Calibrated by :  Approved by :   
(Mr. Tawarat Kittichak) (Ms. Chuchittha Sangsri) Technical Manager Quality Manager

This calibration is valid only in the stated calibration item and not for use in other items or other place of calibration only.

The measurement capability of the laboratory and its traceability to international standards and the state of measurement realized on the corresponding national standards laboratory. This certification can be reproduced when used in full compliance with the prior written approval of the DGE Services Co., Ltd.

SP22-038-001-01.0.2021

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DGE Services Co., Ltd.  
31 Soi Ladprao/Wongthong 25, Ladprao/Wongthong Rd., Ladprao, Ladprao, Bangkok 10250  
Phone : +66 (0)2 214 2034, Email : dge@vsnoradigital.com

**REPORT OF CALIBRATION**

Certificate No.: SP22-038 Page 2 of 3

Environment Condition : Ambient Temperature  $20 \pm 1$  °C

Relative humidity :  $55 \pm 20$  %RH

Calibration method : Reference method CR-01 Based on ASTM E274-08

Certified Reference Materials :

Material	Serial No.	Certificate No.	Due date
Absorbance Standard set	25700	99935	22 October 2023
Absorbance Standard set	25757	99939	22 October 2023
Wavelength Standard set	25908	99916	22 October 2023
Wavelength Standard set	25758	99913	22 October 2023

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

Spectral Band Width of UVC : 1.2 nm.

Scan Speed of UVC : 200 nm/min

Scan Interval of UVC : 0.1 nm.


Resolution of UVC : Photometric 0.001 Abs.

Wavelength 8.1 nm.


SP22-038-001-01.0.2021

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DGE Services Co., Ltd.  
12 Soi Ladprao-Wongthong 15, Ladprao-Wongthong Rd., Ladprao, Ladprao, Bangkok 10240  
Phone : +66-02-538 2054, Email : dge@vsnl.co.th@gmail.com



REPORT OF CALIBRATION

Certificate No. :SP22-088

Page 3 of 5


Calibration Results : Without adjustment

Photometric Accuracy :


Wavelength (nm.)	CBM Value (nm)	UV-Reading (nm)	Correction (nm)	Uncertainty (nm)	Coverage factor k
420	0.0001	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	1.022	0.0027	0.0025	2.00
	2.1226	2.116	0.0066	0.0079	2.00
465	0.0000	0.000	0.0000	0.0028	2.00
	0.5258	0.523	0.0028	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	0.0023	2.00
	1.9887	1.982	0.0067	0.0084	2.00
580	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
	2.0341	2.031	0.0031	0.0079	2.00
625	0.0000	0.000	0.0000	0.0028	2.00
	0.5621	0.560	0.0021	0.0031	2.00
	1.0932	1.092	0.0012	0.0030	2.00
	1.9294	1.922	0.0074	0.0079	2.00

SPR-0002-001-01-0000

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DGE Services Co., Ltd.  
12 Soi Ladprao-Wongthong 15, Ladprao-Wongthong Rd., Ladprao, Ladprao, Bangkok 10240  
Phone : +66-02-538 2054, Email : dge@vsnl.co.th@gmail.com



REPORT OF CALIBRATION

Certificate No. : SP22-088


Page 4 of 5

Photometric Accuracy :


Wavelength (nm.)	CBM Value (nm)	UV-Reading (nm)	Correction (nm)	Uncertainty (nm)	Coverage factor k
215	0.0001	0.000	0.0000	0.0030	2.00
	0.7478	0.747	0.0008	0.0017	2.00
257	0.0001	0.000	0.0000	0.0030	2.00
	0.8886	0.885	0.0036	0.0019	2.00
313	0.0000	0.000	0.0000	0.0030	2.00
	0.2912	0.290	0.0012	0.0021	2.00
350	0.0000	0.000	0.0000	0.0030	2.00
	0.6448	0.640	0.0048	0.0025	2.00

SPR-0002-001-01-0000

เอกสารไม่ควบคุม



DGE Services Co., Ltd.  
12 Soi Ladprao-Wongthong 15, Ladprao-Wongthong Rd., Ladprao, Ladprao, Bangkok 10240  
Phone : +66-02-538 2054, Email : dge@vsnl.co.th@gmail.com



REPORT OF CALIBRATION

Certificate No. : SP22-088

Page 5 of 5

Wavelength Accuracy :

CBM Value (nm.)	UV-Reading (nm.)	Correction (nm.)	Uncertainty (nm.)	Coverage factor k
240.72	240.0	0.72	0.10	2.00
279.81	279.0	0.81	0.10	2.00
287.81	287.0	0.81	0.10	2.00
334.06	333.1	0.96	0.10	2.00
368.93	368.0	0.93	0.10	2.00
418.59	418.0	0.59	0.10	2.00
445.94	445.5	0.44	0.10	2.00
473.69	473.0	0.69	0.10	2.00
489.02	489.2	0.18	0.10	2.00
536.59	536.0	0.59	0.10	2.00
577.98	577.5	0.48	0.10	2.00
611.38	611.0	0.38	0.10	2.00
672.56	672.0	0.56	0.10	2.00
672.47	672.8	0.47	0.10	2.00
726.88	726.1	0.78	0.10	2.00
771.17	771.0	0.17	0.10	2.00
785.33	785.8	0.47	0.10	2.00
864.45	864.2	0.25	0.10	2.00
940.72	940.3	0.42	0.10	2.00
945.17	945.1	0.07	0.10	2.00
987.05	987.8	0.75	0.10	2.00
979.10	979.3	0.20	0.10	2.00

Remark : UV-Test Tube Calibration

UV-Test Tube

The reported uncertainty of measurement (U) is based on the standard uncertainty of measurement multiplied by the coverage factor (k).

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

\* Reference test TM recorded

- End of Certificate -

SPR-0002-001-01-0000

เอกสารไม่ควบคุม

		<b>Hanna Instruments (Thailand) Ltd.</b> 41/657-68 Soi Ratchabongk 24, Ratchabongk Rd., Samutprakan, Bangkok, Bangkok 10130 Tel. 0-2541-6199 Fax. 0-2541-6198	
		Certificate No. : HT-2204-0304 Page : 1 of 1	
<b>CERTIFICATE OF CALIBRATION</b>			
Equipment :	COD Test Tube Heater		
Model :	HR2880-02	Serial No. :	00000000
Manufacturer :	Hanna Instruments		
Model :	Banana		
Condition As-Received :	Used Product		
Reference :	HET20254		
Customer name :	United Analytical and Engineering Consultant Co., Ltd. 2 Soi Uthorn 41, Sukhumvit Rd., Bangkok, Phra Prachin, Bangkok 10250		
Received date :	21 February 2022		
Calibrate date :	1 March 2022		
Issue date :	2 March 2022		
Ambient Temperature :	(25 ± 2) °C		
Relative Humidity :	(50 ± 15) % RH		
Calibrated Location :	Hanna Instruments (Thailand) Ltd.		
Calibrated by :	 Mr. Pichet Pong Calibration Engineer		
Approved by :	 Mr. Anon Sornchanchai Authorized Signatory 		
This certificate was verified only for the instrument was calibrated. The result of calibration was based on data on date and place of calibration only.			
** This certificate may not be reproduced other than in full, except with the prior written approval of the head of Hanna Instruments (Thailand)			

เอกสารไม่ควบคุม

เอกสารไม่ควบคุม







## Kjeltec™ 8100 Distillation Unit

This IQ applies to Kjeltec™ 8100 Distillation Unit manufactured by FOSS Analytical. The installation is performed by FOSS trained service personnel.

### 1 Intended Use

Kjeltec 8100 is intended for laboratory use analyzing parameters as specified in FOSS Analytical AB's Application Notes.

### 2 Purpose

This Installation Qualification is designed to ensure that:

- The Kjeltec instrument is received complete, with all required parts in good condition.
- The location of the instrument is environmentally and ergonomically suitable.
- The instrument is assembled and configured correctly.
- Stable electricity and water are supplied to the instrument, see table 2 for requirements.

### 3 Identification

Description	Serial Number
Kjeltec 8100 Distillation Unit	918 67001

#### Dedicated Analytical Solutions

FOSS Analytical AB  
40 Strömsholmen  
SE-1900 Jönköping  
Sweden

Tel: +46 30 930 12 00  
Fax: +46 30 930 12 01  
E-mail: support@foss.se  
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FOSS Analytical AB  
Box 10  
SE-201 21 Ängelholm  
Sweden

Tel: +46 40 33 77 00  
Fax: +46 40 33 77 00  
E-mail: support@foss.se  
Web: www.foss.se

Customer Support: 800 7344 7344

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## 4 Control of Received Equipment

### 4.1 Verify that the correct instrument type and accessory kit items are received and in proper condition

The packing list (shipped with the instrument) specifies all the items. The installer will verify that all items are received as shipped on the packing list. For each item listed, verify that the acceptance criteria are met. If so, write "Y" in the right column of the table immediately following.

Packing List Item	Acceptance Criteria	Pass (Y/N)
Kjeltec 8100 Distillation Unit	No visible damage, received in undamaged FOSS Analytical's standard shipping container	Y
Accessory kit, according to packing list	Included, no visible damage, received in undamaged FOSS Analytical's standard shipping container	Y
Handling device for digestion tube	Included, no visible damage	Y
Tools with level sensor for Waste, Alkali and Water	Included, no visible damage	Y
Receiver Test	Included, no visible damage	Y
One digestion tube 250ml	Included, no visible damage	Y
One digestion tube 100ml	Included, no visible damage	Y
Tube adapter	Included, no visible damage	Y
User manual	Kjeltec 8100 Distillation Unit	Y
Owner's guide	Kjeltec 8100 Distillation Unit	Y
Quick guide	Kjeltec 8100 Distillation Unit	Y
Spare parts manual	Kjeltec 8100 Distillation Unit	Y
Application notes	AM 300 included AM 303 included	Y

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## 5 Installation

### 5.1 The equipment must be installed in a suitable location with power, water and draining available

Verify that the instrument installation site meets the acceptance criteria given in the table below. If so, write "Y" in the right column of the table immediately following.

Location Requirements	Acceptance Criteria	Pass (Y/N)
Adequate space for instrument	Dimensions 48x56x93 cm	Y
AC supply available for instrument	200-240 V 50/60Hz	Y
Current	12 A	Y
Cold water supply available	2 Liter at 20°C	Y
Drain	For cooling water and waste (depending on local waste disposal legislation)	Y
Ambient temperature	Max. 40°C	Y
Ambient humidity	Max. 80% relative	Y
Internal fans	T10A AH	Y

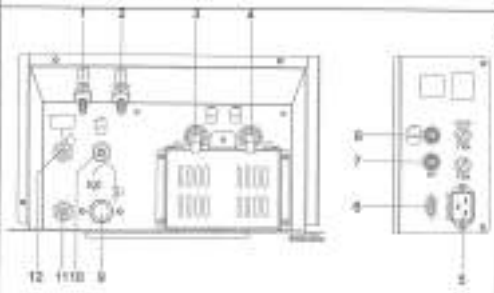
Customer Support: 800 7344 7344

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### 5.2 The instrument must be assembled correctly

Verify that all tubes are correct connected. If so, write "Y" in the right column of the table immediately following.

Instrument Tubing Connections	Acceptance Criteria	Pass (Y/N)
	Visual verification by installer	Y

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### 5.3 The instrument should be assembled and powered up

Connect the distilling unit to the power supply. Perform the start-up procedure and check that the expected response is obtained. If so, write "Y" in the right column of the table immediately following.

Action	Expected Response	Pass (Y/N)
Switch on the power	The instruments start up and the self test will run. The sample counter shows the number of analysed samples since first power and the Software Version shows the version of the instruments software.	Y
	After start-up, Program 1 is loaded and the Analyse menu is displayed.	Y
Turn on the cold water tap	No visible reaction	Y
Press the "Manual" view	The Manual menu is opened	Y
Open the door with the handle, place the test tube and recover liquid in position. Close the door.		Y
Select Dilution and press Start	Water is added to the tube	Y
Select Alkali and press Start	Alkali is added to the tube	Y
Select Steam and press start	After heating up, steam is entering the tube	Y
Select Drain and press Start	The liquid is drained	Y

### 6 Summary of Deviations/Comments

Deviations from above requirements are specified below and any corrective actions are noted.

Deviation	Action	Comment

### 7 IQ Documentation

Upon successful completion and recording of all instructions above, sign and date this sheet below. If required by customer, leave one signed copy with instrument.

If customer's internal procedures require further reporting or substantiating of results, execute those procedures as required.

Installed By: Prasanna Srinivasan  
 Company: Exide SEA  
 Customer Name: United Analytical and Engineering  
 Company: United Analytical and Engineering  
 Date completed: July 28, 2022



### Kjeltec™ 8100 Distillation Unit

This OQ applies to Kjeltec 8100 Distillation Unit manufactured by FOSS Analytical. The operation qualification is performed by FOSS trained service personnel.

#### 1 Intended Use

Kjeltec 8100 is intended for laboratory use analysing parameters as specified in FOSS Analytical Application Notes.

#### 2 Purpose

This procedure is designed to test the function of the instrument according to factory test specifications:

- Alkali volume
- Distillation Accuracy
- Distillation Reproducibility

#### 3 Identification

Description	Serial Number
Kjeltec 8100 Distillation Unit, 230-240 V 50/60 Hz	413 757252

### 4 Performance

#### 4.1 Verify the dispensed volumes of reagents

Note: To verify the dispensed volumes of reagents a triple test should be done to be statistically correct. Then calculate a mean value.

1. Choose "Manual" in the menu. (When starting up the instrument Program 1 is loaded)
2. Open the safety door by pressing Open and place a tube in the instrument. Close the safety door.

##### Water

1. Press Dilution and then press Start. 80 ml of water will be filled into the tube.
2. Measure the collected water in a graduated measuring glass and note the result in table 1 below.
3. Check acceptance criteria in the table and make the judgement if passed or not.

Note! If the water volume needs to be calibrated, go to 4.8.5 Distillation Pump Calibration in the User Manual.

##### Alkali

1. Press Alkali and then press Start. 50 ml of alkali will be filled into the tube.
2. Measure the collected alkali in a graduated measuring glass and note the result in table 1 below.
3. Check acceptance criteria in the table and make the judgement if passed or not.

Table 1 Volume control

Test	Result	Expected result	Passed (Y/N)
Water volume	$\frac{75}{77}$ ml $\frac{77}{79}$ ml $\frac{77}{79}$ ml Mean $\frac{75+77+79}{3}$ ml	75-84 ml	Y
Alkali volume	$\frac{47}{49}$ ml $\frac{49}{51}$ ml $\frac{49}{51}$ ml Mean $\frac{47+49+51}{3}$ ml	47-54 ml	Y

## 4.2 Verify the distillation procedure, accuracy and precision

The distillation principle is to convert ammonium ( $\text{NH}_4^+$ ) into ammonia ( $\text{NH}_3$ ) by using an alkali ( $\text{NaOH}$ ) and thereafter steam distill it into a receiver flask containing boric acid and titrate with standard acid solution using colorimetric end-point detection. Ammonium sulphate, a substance with known ammonia content, can be used to check the accuracy of the distillation. The recovery is calculated from obtained result.

The way to perform this test will be described in the following:

### Chemical Check

Use ammonium sulphate ( $(\text{NH}_4)_2\text{SO}_4$ , purity > 99.5 % \*)

Mol. weight = 132.14 g/mol, Nitrogen content in ammonium sulphate (98.3 %) = 21.06% \*)

### Analysis conditions according to AN 300

Water	80 ml
Alkali	50 ml NaOH (30% w/w)
Receiver solution	10 ml boric acid (4%)
Distillation time	5 minutes
SALT	5 seconds
Titrant	0.2N HCl

For reagent preparation see Appendix A

- Start the test series and run two blanks without chemicals according to above analysis conditions, distill into a receiver flask containing boric acid. Titrate with a standard acid solution using colorimetric end-point detection. If the blanks are less than 0.2 ml continue with the recovery test.
- Weigh 0.15 g ammonium sulphate into a tube. Prepare 6 samples (tubes).
- Run the six samples according to above analysis conditions. Titrate with a standard acid solution using colorimetric end-point detection.
- Calculate the recovery according to below equations. Expected results of recovery should be 100% ± 1%.

Recovery test	Result	Expected result	Passed (Y/N)
Blank value (water blank)	1. 0.05 ml 2. 0.10 ml	0.05-0.20 ml	Y
Recovery	1. 100.12 % 2. 100.12 % 3. 100.13 % 4. 99.97 % 5. 99.97 % 6. 100.11 %		
Accuracy	Mean Value: 100.04	99-101%	Y
Precision	SD: 0.05 %	SD < 1%	Y

Customer Support: 8002 7000 / Fax: 0

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## 5 Summary of Deviations/Comments

Deviations from above requirements are specified below and any corrective actions are noted.

Deviation	Action	Comment

## 6 OQ Documentation

Upon successful completion of tests above, sign and date this sheet below. If required by customer, leave one signed copy with instrument.

If customer's internal procedures require further reporting or witnessing of results, execute those procedures as required.

Performed By: \_\_\_\_\_  
Company: \_\_\_\_\_  
Customer Name: \_\_\_\_\_  
Company: \_\_\_\_\_  
Date completed: \_\_\_\_\_

Customer Support: 8002 7000 / Fax: 0

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\*) Note! Please also note that the below calculations must be adjusted if other purity levels of ammonium salts are used. A certificate for the chemical supplier should be available.

Purity	Nitrogen content
99.5%	21.05%
99.6%	21.12%
99.7%	21.19%
99.8%	21.26%
99.9%	21.33%

$$\% \text{ Nitrogen} = \frac{(\text{ml}_{\text{sample}} - \text{ml}_{\text{blank}}) \times N \times 14.007 \times 100}{\text{WE}_{\text{sample}}} \quad 2.1.1$$

N = Normality of titrant to 4 places of decimal.

$$\% \text{ Accuracy} = \frac{\% \text{ Nitrogen}}{21.09} \times 100$$

$$\text{mg Nitrogen} = \frac{\text{mg sample} \times \% \text{ Nitrogen}}{100}$$

Customer Support: 8002 7000 / Fax: 0

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## 7 Appendix A

### 7.1 Preparation of Reagents

#### 7.1.1 Alkali

To convert ammonium into ammonia an excess of sodium hydroxide is necessary.

Use 400 g NaOH per litre of solution. Commercially available in concentrations up to 50 %. Do not use concentrations above 40 % as this will lead to crystal formation impairing the function of the pumps. If you can only buy concentrations > 40 %, dilute it before use.

#### 7.1.2 Titrant acid, determination of concentration

To be able to achieve accurate nitrogen / protein results, one must be quite sure that the HCl (hydrochloric acid) concentration is what it is supposed to be. A titration against a predetermined solution of sodium carbonate as described below is thus necessary. Incorrect HCl concentration can otherwise cause substantial errors.

#### Standard substance

Weigh approx. 10 g of anhydrous sodium carbonate ( $\text{Na}_2\text{CO}_3$ ). Use a mortar to make a fine powder. Dry it for 1 h at 265 °C or 2 h at 280 °C. After cooling in a desiccator, transfer the sodium carbonate to a beaker with a tight lid. Store it in a desiccator.

#### Indicator solution

Dissolve 0.1 g methyl red in 100 ml methanol. Dissolve 0.1 g bromocresol green in 100 ml methanol.

#### Procedure

Weigh approx. 0.4 g of the standard substance, using an analytical balance, note the weight ( $W_1$ ). Transfer the sodium carbonate to a receiver flask and add 40 ml of  $\text{H}_2\text{O}$  (distilled or deionized). Add 8 drops from each of the indicator solutions. Titrate to pink. Note the amount in ml used ( $A_1$ ). Boil this solution for a few minutes. The solution will turn green. Cool rapidly to room temperature under running water. Continue the titration until the next pink colour change occurs. Note also this volume.

( $A_2$ ) Boil the solution for a few minutes. Cool rapidly to room temperature under running water. Continue the titration until the next pink colour occurs. Note also this volume ( $A_3$ ).

Note! Temperature changes will influence the volume and the concentration of the titrant solution. The working temperature of the titrant should approximate that of its temperature during standardization. If temperature corrections are necessary, sufficient accuracy may be obtained by use of a correction table (AOAC 940.25).

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## 7.2 Calculation

$$\text{Molarity (M)} = \frac{14.0070 \times F_1}{(V_1 + V_2 + V_3)}$$

Note: Concentration must be accurate to four digits, i.e. 0.0068 M.

Note: The colour change of this official procedure (AOAC 990.15) may be difficult to see, therefore a pH meter or a mixed indicator (e.g. 0.1 g Methyl red and 0.1 g Bromocresol green in 100 ml methanol) will make it much easier to perform.

## 7.3 Receiver Solution

Boric acid 4 % with bromocresol green / methyl red indicator solution

In order to obtain accurate results the receiver solution is adjusted so that a small (0.05–0.20 ml) positive blank is obtained when running a blank sample. The 4 % boric acid receiver solution is prepared by dissolving 400 g of boric acid in about 5–6 l very hot deionized water. Mix and add more hot deionized water to a volume of about 9 l. Cool the solution to room temperature and add 100 ml of bromocresol green solution (100 mg in 100 ml methanol) and 70 ml of methyl red solution (100 mg in 100 ml of methanol). Dilute to 10 l with deionized water and mix carefully.

Note: The addition of alkali is to achieve a positive blank value. This should, however, be kept between 0.05 – 0.20 ml titrant, to obtain good repeatability when testing blanks.

Adjustment of the boric acid is made by the following procedure:

- Transfer 25 ml boric acid solution to a receiver flask and add 100 ml of distilled water. If the solution in the flask is still red, titrate with 0.1 M sodium hydroxide solution until a neutral grey colour is obtained. Calculate the amount of sodium hydroxide solution necessary to adjust the boric acid solution in the 10 l flask with the formula: ml 1.0 M alkali = ml titrant  $\times$  40.
- Add the calculated amount of 1.0 M alkali solution to the boric acid solution. Mix.
- To check proceed as follows using 25 ml of the boric acid solution. Run a blank. If the value of this blank is high (0.5 ml of 0.2 M HCl) the boric acid is incorrectly adjusted. This might ensure irregular blanks. For correction add HCl directly into the boric acid tank, mix it carefully and repeat until a reading of 0.05 – 0.20 ml HCl is obtained. If a positive blank is not achieved, add further small quantities of 1 M NaOH and repeat the check until a satisfactory value is achieved.

## Kjeltec™ 8100 Distillation Unit Tecator™ 2508/2520 Digestor

### 1 Scope

This PQ applies to the Digestion system 2508/2520 (including exhaust and scrubber unit) and Kjeltec 8100 Distillation Unit manufactured by FOSS Analytical. The user of the instrument performs the PQ.

### 2 Intended Use

The Digestion system (including exhaust and scrubber) and Kjeltec 8100 Distillation Unit are intended for laboratory use analyzing parameters as specified in FOSS Application Notes.

### 3 Purpose

The guidelines are intended to assist the user in successfully developing Performance Qualifications for the specific application(s) to which the instrument is applied.

The Performance Qualification (PQ) includes the process of demonstrating that the Digestion system 2508/2520 (including exhaust and scrubber unit) and the Kjeltec 8100 Distillation unit consistently perform according to a specification appropriate for its routine use. Main activities in the PQ phase are:

- Preventive maintenance
- On-going verification runs

This document suggests routines to fulfill the requirements for an acceptable PQ but the final procedure should be adapted to local routines for similar equipment.

### 4 Definition of Test Procedures

#### 4.1 Preventive Maintenance

Maintenance of the Kjeltec 8100 should be performed according to the instructions in manual, see User Manual Kjeltec 8100/8200 Distillation Unit, chapter 5: Maintenance. A yearly service is recommended (service agreement).

Maintenance of the Digestion block (including exhaust and scrubber) should be performed according to instruction in the user manual, see User Manual Tecator Digestor, chapter 1: Maintenance.

#### Dedicated Analytical Solutions

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## 4.2 Ongoing Qualification Tests

### Block Temperature

The temperature for the digestion is limited by the boiling point for the sulphuric acid, this can be increased by adding a salt ( $K_2SO_4$ ) to the digestion mixture. It's important that the optimal ratio between acid and salt is kept; please follow recommendation in AN 200 or suggested procedures for a specific kind of sample material.

The block temperature itself can be controlled external by inserting a temperature probe in the standard hole in the aluminium block (front row of holes).

Use the reagents and method procedure specified in AN 200. Use only reagents of recognized analytical grade, unless otherwise specified and distilled or deionized water of water of equivalent purity.

Suggested standard material for internal quality control:

Ammonium sulphate  $[(NH_4)_2SO_4]$ , min. 99.5 % (mass fraction), with certified purity.

Note: The above chemical is usually readily available with a certificate specifying the purity.

Alternatively ammonium iron(II) sulphate,  $(NH_4)_2 Fe(SO_4)_2 \cdot 6 H_2O$ , with certified purity may be used.

Tryptophan  $(C_{11}H_{12}N_2O_2)$ , minimum assay 99 % (mass fraction). Nitrogen content 177.2 g/kg. Do not dry in an oven before use.

Acetanilide  $(C_8H_9NO)$ , minimum assay 99 % (mass fraction). Nitrogen content 101.6 g/kg. Do not dry in an oven before use.

Sucrose,  $(C_{12}H_{22}O_{11})$ , with a nitrogen content of not more than 0.002 % (mass fraction). Do not dry in an oven before use.

### Blank Tests

Carry out a blank test following the currently used procedure for digestion, distillation and titration taking 2 ml of water and about 0.7 g of sucrose instead of the test portion. Keep a record of blank values. If blank values change, identify the cause.

Note: The amount of titrant used in the blank test should always be greater than 0.5 ml. Blanks within the same laboratory should be consistent across time.

## 4.3 Recovery Tests

Regularly run recovery studies to check the accuracy of procedure and equipment:

- Nitrogen loss: Use 0.12 g ammonium sulphate and 0.87 g increase per flask weighed to the nearest 0.1 mg. Add all other reagents as stated in the method currently used (Kjeltec,  $H_2SO_4$ , etc). Digest and distill under same conditions as for sample. Recoveries shall be >99 %.
- Digestion efficiency: Use a test portion of minimum 0.15 g of tryptophan or acetanilide and 0.87 g increase per flask weighed to the nearest 0.1 mg. Determine the nitrogen content according to the current procedure in use. The recovery of nitrogen shall be >98.5 %, the recoveries of acetanilide shall be >99.2 %.
- Distillation and Absorption efficiency: Distill 0.10 – 0.12 g  $\pm$  0.0005 g ammonium sulphate, omitting the digestion step. The recovery should be >99.5 %.

Note: Results less than 98.5 % or more than 101.5 % in either of the recovery tests indicate failures in the procedure and/or inaccurate concentration of the standard volumetric hydrochloric acid solution (should be adjusted to four decimal accuracy according to procedure in AN 200)

## External Quality Control Program

It is recommended to participate in an external quality control program, such a proficiency program or ring test, with equivalent sample material as analyzed within the laboratory.

## Calculation and Expression of Results

$$N, \% = \frac{14.0070 \times F_1 \times 100\%}{W}$$

Where:

$W$  is the nitrogen content of the sample, expressed as a percentage by mass.

$F_1$  is the numerical value of the volume of the hydrochloric acid standard volumetric solution used in the sample test, in milliliters, expressed to the nearest 0.05 ml.

$F_2$  is the numerical value of the volume of the hydrochloric acid standard volumetric solution used in the blank test, in milliliters, expressed to the nearest 0.05 ml.

$N$  is the numerical value of the exact normality of the hydrochloric acid standard volumetric solution, expressed to four decimal places.

$W$  is the numerical value of the mass of the test portion, in milligrams, expressed to the nearest 1 mg for sample weights >1 g or to the nearest 0.1 mg for sample weights <1 g.

## 5 Maintenance

### 5.1 Maintenance Kjeltec™ 8100

See instructions in User Manual - Kjeltec 8100/8200, chapter 5: Maintenance.

### 5.2 Maintenance Tecator™ Digestor

See instructions in User Manual - Tecator Digestor, chapter 5: Maintenance.

## 6 The Maintenance Record Charts

This record charts are provided to assist you in keeping your system in good working order. Please make copies and use them regularly as they can often help us to help you in the unlikely event a system malfunction.







## Certificate of System Qualification

GC-02

System ID: CH11021007  
Organization Name: UAE Consultant Co. Ltd.  
Organization Location: 3 Bui Vien Street 41, Khatuwan Rd., Bangkok, Phrakong, Bangkok 10200.

Date: February 10, 2021 10:00:27 AM  
COP Name: AgilentRecommended  
COP Revision: GC-02.51  
Overall Qualification Status: Pass

## System Inspection and Basic Safety and Operation

Name: T890  
Setup/Status: Pass

Overall System Inspection and Basic Safety and Operation Test Status  
Pass

## Inlet Pressure Decay

Name: T890  
Flow: Front SS.  
Setup/Status: Pass  
Pressure: 25.9 psi  
Pressure Change: -0.1 psi 5 minutes  
Agilent Recommended:  $\pm 0.2$  psi

## Overall Inlet Pressure Decay Test Status

Pass

## Inlet Pressure Accuracy

Name: T890  
Flow: Front SS.

Date: February 10, 2021 10:00:27 AM  
System ID: CH11021007

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Setup/Status: Pass  
Inlet Pressure: 25.9 psi  
Accuracy: 0.3 psi  
Agilent Recommended:  $\pm 1.2$  psi

## Overall Inlet Pressure Accuracy Test Status

Pass

## Detector Flow Accuracy

Name: T890  
Flow: Back FID  
Setup/Status: Pass  
Flow Type: Front  
Setup: 20.0 mL/min Measured Flow: 20.9 mL/min  
Accuracy: 0.1 mL/min  
Agilent Recommended:  $\pm 10.0$  % setpoint ( 0.8 mL/min )  
Limit is percentage of setpoint or 0.5 minutes, whichever is largest.

Setup/Status: Pass  
Flow Type: On/Off  
Setup: 400.0 mL/min Measured Flow: 397.3 mL/min  
Accuracy: 0.7 mL/min  
Agilent Recommended:  $\pm 10.0$  % setpoint ( 40.0 mL/min )  
Limit is percentage of setpoint or 0.5 minutes, whichever is largest.

Setup/Status: Pass  
Flow Type: Back/Off  
Setup: 25.2 mL/min Measured Flow: 24.8 mL/min  
Accuracy: 0.4 mL/min  
Agilent Recommended:  $\pm 10.0$  % setpoint ( 2.5 mL/min )  
Limit is percentage of setpoint or 0.5 minutes, whichever is largest.

Date: February 10, 2021 10:00:27 AM  
System ID: CH11021007

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## Overall Detector Flow Accuracy Test Status

Pass

## Detector Flow Accuracy

Name: T890  
Flow: Front UCCD  
Setup/Status: Pass  
Flow Type: Makeup  
Setup: 20.0 mL/min Measured Flow: 24.7 mL/min  
Accuracy: 0.3 mL/min  
Agilent Recommended:  $\pm 10.0$  % setpoint ( 2.5 mL/min )  
Limit is percentage of setpoint or 0.5 minutes, whichever is largest.

## Overall Detector Flow Accuracy Test Status

Pass

## GC Oven Temperature Accuracy

Name: T890  
Setup/Status: Pass  
Zone: Oven  
Setup/Actual: 220.0 219.6 °C  
Accuracy: 0.4 °C  
Agilent Recommended:  $\pm 1.2$  °C ( 0.8 °C )  
 $\pm 1.0$  °C ( 0.8 °C )

Setup/Status: Pass  
Zone: Oven  
Setup/Actual: 100.0 99.8 °C  
Accuracy: 0.2 °C  
Agilent Recommended:  $\pm 1.2$  °C ( 0.7 °C )  
 $\pm 1.0$  °C ( 0.7 °C )

Date: February 10, 2021 10:00:27 AM  
System ID: CH11021007

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## Overall GC Oven Temperature Accuracy Test Status

Pass

## GC Oven Temperature Stability

Name: T890  
Setup/Status: Pass  
Temperature: 100.0 99.8333 °C  
Stability: 0.2 °C  
Agilent Recommended:  $\pm 0.5$  °C

## Overall GC Oven Temperature Stability Test Status

Pass

## Scouting Run

Tested Combination: Front SS. / Back FID  
Injection Volume: 1.0 µL  
Name: T890  
Setup/Status: Completed  
Injection Volume on Column: 1.0 µL

## Overall Scouting Run Status

Completed

## Notes and Shift

Tested Combination: Front SS. / Back FID  
Name: T890

Date: February 10, 2021 10:00:27 AM  
System ID: CH11021007

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Setuppoint Status: **Pass**

Base Signal: 11.7  pH

ASTM Noise	Drift
<input type="text"/> pH	<input type="text"/> pH/yr
0.03	1.44
Agilent Recommended: ±0.10	Agilent Recommended: ±0.20

Agilent Recommended Status: **Pass**

## Overall Noise and Drift Test Status

**Pass**

## Injection Precision

Tested Combination: Front SSIL / Back PSD

Name: T5638

Setuppoint Status: **Pass**

Injection Volume on Column: 1.0  µL

Area RSD: 1.08 % Retention Time RSD: 0.10 %

Agilent Recommended: ±1.00 ±1.20

This test's 3 comment(s) and 1 deviation(s) are available in the Attachments section.

## Overall Injection Precision Test Status

**Pass**

## Signal to Noise

Tested Combination: Front SSIL / Back PSD

Name: T5638

Injection Tower

Setuppoint Status: **Pass**

Signal to Noise: 958194

Agilent Recommended: ±300000

## Overall Signal to Noise Test Status

**Pass**Date: February 16, 2021 10:46:07 AM  
System ID: CN11021007

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## Scheduling Run

Tested Combination: Front SSIL / Front USCD

Name: Manual Injection

Setuppoint Status: **Completed**

Injection Volume on Column: 1.0  µL

## Overall Scheduling Run Status

**Completed**

## Water and Drift

Tested Combination: Front SSIL / Front USCD

Name: T5638

Setuppoint Status: **Pass**

Base Signal: 126  pH

ASTM Noise	Drift
<input type="text"/> pH	<input type="text"/> pH/yr
1.87	1.71
Agilent Recommended: ±3.00	Agilent Recommended: ±15.00

This test's 3 comment(s) and 1 deviation(s) are available in the Attachments section.

## Overall Noise and Drift Test Status

**Pass**

## Signal to Noise

Tested Combination: Front SSIL / Front USCD

Name: Manual Injection

Tested Combination: Front SSIL / Front USCD

Name: T5638

Date: February 16, 2021 10:46:07 AM  
System ID: CN11021007

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Setuppoint Status: **Pass**

Signal to Noise: 8304

Agilent Recommended: ±1000

Overall Signal to Noise Test Status: **Pass**

Date: February 16, 2021 10:46:07 AM  
System ID: CN11021007

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## Instrument Details

## Purpose

This section describes the as found system configuration.

## Details

System	CN11021007
System ID	CN11021007
Manufacturer	Agilent Technologies
Name	T5638
Flow Data Input	Manual Data
Temperature Data Input	Manual Data or Other Data Logging
Tested Combination	Injection Tower
Injection Technique	Injection Tower
Inlet	Front
Detector	Back
LTM Included?	No
Tested Combination	Manual Injection
Injection Technique	Manual Injection
Inlet	Front
Detector	Front
LTM Included?	No
Sampler	Agilent Technologies
Manufacturer	Agilent Technologies
Type	Injection Tower
Name	T5638
Model Number	G2013A
Serial Number	CN82149436
Firmware Revision	A.11.03
Usage	Sample Injection
Location	Front
Syringe Volume (µL)	50

Date: February 16, 2021 10:46:07 AM  
System ID: CN11021007

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Sample 2	
Manufacturer	Agilent Technologies
Type	Trap
Name	TR03A
Model Number	Q2616A
Serial Number	QW0246767
Firmware Revision	A.02.01

Sample 3	
Manufacturer	Agilent Technologies
Type	Manual Injection
Usage	Sample Injection
Syringe Volume (µL)	10

Manifold 1	
Manufacturer	Agilent Technologies
Name	TR00
Model Number	Q2440A
Serial Number	QW11021007
Firmware Revision	A.01.11
Oven Type	Standard

Inlet 1	
Manufacturer	Agilent Technologies
Name	TR00
Type	SSL
Location	Front
Carrier Gas	Helium
Control Type	Electronic Pressure Control (EPC)
Purged Inlet	Yes

Date: February 16, 2021 10:56:27 AM  
System ID: QW11021007

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เอกสารไม่ควบคุม

Detector 1	
Manufacturer	Agilent Technologies
Name	TR00
Type	USCD
Serial Number	U10086
Adapter	Capillary
Control Type	Electronic Pressure Control (EPC)
Location	Front
Makeup Gas	Nitrogen

Detector 2	
Manufacturer	Agilent Technologies
Name	TR00
Type	FID
Adapter	Capillary
Control Type	Electronic Pressure Control (EPC)
Location	Back
Makeup Gas	Nitrogen

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System ID: QW11021007

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## Electronic Signature

### Purpose

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

### Details

Full Name of Signer	Rasameekul Supawattakul
Logged On User Name	Rasameekul.Supawattakul@nan.agilent.com
Signature Creation Date	February 16, 2021
Reason for Signature	Generated protocol and published this original version of document

### Regulatory Disclaimer

This document provides a protocol for verify and record instrument configuration and acceptance of proper operation. It has been prepared from our interpretation of applicable regulations as well as industry best practices. This document is designed to provide an important component of a complete compliance package. Validation depends upon many factors and use of this protocol alone does not assure compliance. Agilent Technologies makes no promises or representations as to its sufficiency for any specific regulatory program.

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เอกสารไม่ควบคุม

User Name: Rasameekul Supawattakul Username: JAFFSP-0700000 System ID: QW11021007 Print Date: February 16, 2021 10:56:27 AM				
iOrder_Canonical_Soft_Presentation Log				
Date	Transaction Date	Activity Performed	Type of Presentation	Optional Information
February 9, 2021 11:44:40 AM	Auto	Instrument Setup	Session	None
February 9, 2021 11:44:40 AM	Auto	Configuration	Session	None
February 9, 2021 11:44:40 AM	Auto	Validation	Session	User is responsible and does not represent any other code
February 9, 2021 11:44:40 AM	Auto	Sign-off	Session	PDF results for primary technique (201-1100000) (Prepared Protocol Configuration loaded at 10:56:27 AM) (ACE File Name: QW11021007_ACE_001.html) (DigitalSignature:None)
February 9, 2021 10:56:27 AM	Auto	Configuration	Session	None
February 9, 2021 10:56:27 AM	Auto	Configuration	Session	None
February 9, 2021 10:56:27 AM	Auto	Configuration	Session	System Installation and Setup, Safety and Operation, and Troubleshooting - All applicable procedures
February 9, 2021 10:56:27 AM	Auto	Configuration	Session	None
February 9, 2021 10:56:27 AM	Auto	Reporting	Session	None
February 9, 2021 10:56:27 AM	Auto	Reporting	Session	None
February 9, 2021 10:56:27 AM	Auto	Configuration	Session	None

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Date: February 16, 2021 10:56:27 AM  
System ID: QW11021007

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เอกสารไม่ควบคุม



[illegible]

## เอกสารไม่ควบคุม

Time	Transcript Date	Activity Reported	Type of Transcription	Optional Information
February 5, 2011 12:00:40	Real FM	Continues	Standard-Flow Accidents - Real	None FD - Type - Collision - 0 - 0000 00.000 - 1 - 00.000 - 00.000
February 5, 2011 12:00:43	Auto FM	Open	Standard-Flow Accidents - Real	Motorist/Driver Only FD - Type - Collision - 0 - 0000 00.000 - 1 - 00.000 - 00.000
February 5, 2011 12:00:54	Auto FM	Cancelled	Auto/Driver Accidents - Real	Real Count - 0 FD - Type - Collision - 0 - 0000 00.000 - 1 - 00.000 - 00.000
February 5, 2011 12:00:55	Real FM	Continues	Inspector-Flow Accidents - Real	None FD - Type - Collision - 0 - 0000 00.000 - 1 - 00.000 - 00.000
February 5, 2011 12:00:56	Auto FM	Open	Inspector-Flow Accidents - Real	Motorist/Driver Only FD - Type - Collision - 0 - 0000 00.000 - 1 - 00.000 - 00.000
February 5, 2011 12:00:57	Real FM	Continues	Inspector-Flow Accidents - Real	Real Count - 0 FD - Type - Collision - 0 - 0000 00.000 - 1 - 00.000 - 00.000
February 5, 2011 12:00:57	Real FM	Continues	Inspector-Flow Accidents - Real	None FD - Type - Collision - 0 - 0000 00.000 - 1 - 00.000 - 00.000
February 5, 2011 12:00:57	Auto FM	Open	Inspector-Flow Accidents - Real	Motorist/Driver Only FD - Type - Collision - 0 - 0000 00.000 - 1 - 00.000 - 00.000
February 5, 2011 12:00:57	Auto FM	Continues	Inspector-Flow Accidents - Real	Real Count - 0 FD - Type - Collision - 0 - 0000 00.000 - 1 - 00.000 - 00.000

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## เอกสารไม่ควบคุม

[illegible]

## เอกสารไม่ควบคุม

User Name: Administrator  
Address: LAFTON-000010

System: CM Master  
Platform: February 16, 2011 10:30:11 AM

Listing: Get Items - Job Transferring

Item	Transaction Date	Activity (Highlighted)	Type of Transaction	Original Information
February 9, 2011 11:14 AM	Auto	Acquisition	Success	None
February 9, 2011 11:16 AM	Auto	Acquisition	Success	None
February 9, 2011 11:18 AM	Auto	Acquisition	Success	None
February 9, 2011 11:19 AM	Auto	Qualification	Success	NR
February 9, 2011 11:21 AM	Auto	Transfer	DC Qualifying Run - Operation Transfer From GLS, Base F10 - Partial System Preparation. No data acquisition	None
February 9, 2011 11:49 AM	Auto	Data	DC Qualifying Run - Operation Transfer From GLS, Base F10 - Partial System Preparation. No data acquisition	Data Box Path : S:\QCP\MSD_Get report\j_sch\GLS_Schedule
February 9, 2011 11:51 AM	Auto	Transfer	DC Qualifying Run - Operation Transfer From GLS, Base F10 - Partial System Preparation. No data acquisition	Real Clock: 0
February 9, 2011 11:52 AM	Auto	Transfer	None and TSD - Spill F10 - Transfer F10 - L, Status == 0 - Data, L, Quality == 2.5% (Failure)	None
February 9, 2011 11:53 AM	Auto	Data	None and TSD - Spill F10 - Transfer F10 - L, Status == 0 - Data, L, Quality == 2.5% (Failure)	Data Box Path : S:\QCP\MSD_Get report\j_sch\GLS_Schedule
February 9, 2011 11:54 AM	Auto	Transfer	None and TSD - Spill F10 - Transfer F10 - L, Status == 0 - Data, L, Quality == 2.5% (Failure)	Real Clock: 0

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## เอกสารไม่ควบคม

Query Name: [Advanced Search](#)  
 Dimensions: [LAPTOP-1506276](#)

Updated: 10/10/2019  
 First Date: February 10, 2017 10:36:11 AM

[Export to CSV](#) [Export to Excel](#) [Export to PDF](#)

Time	Transaction Date	Activity	Type of Transaction	Optional Information
February 6, 2017 11:47 AM	Start	Connection	Regular Payment - Apportion	None
			Issue: Term:03, Rate: FID: (2) : 1, (Comp) => 1.0000 - 1 (Plan: Term) => 1.0000	
February 6, 2017 11:50 AM	Appl.	Close	Regular Payment - Apportion	End End Term: S:03P203 / 13 FID 103
			Issue: Term:03, Rate: FID: (2) : 1, (Comp) => 1.0000 - 1 (Plan: Term) => 1.0000	S:03P / FID:03FID03ub
February 6, 2017 11:50 AM	Appl.	Close	Regular Payment - Apportion	End End Term: S:03P203 / 13 FID 103
			Issue: Term:03, Rate: FID: (2) : 1, (Comp) => 1.0000 - 1 (Plan: Term) => 1.0000	S:03P / FID:03FID03ub
February 6, 2017 11:50 AM	Appl.	Close	Regular Payment - Apportion	End End Term: S:03P203 / 13 FID 103
			Issue: Term:03, Rate: FID: (2) : 1, (Comp) => 1.0000 - 1 (Plan: Term) => 1.0000	S:03P / FID:03FID03ub
February 6, 2017 11:50 AM	Appl.	Close	Regular Payment - Apportion	End End Term: S:03P203 / 13 FID 103
			Issue: Term:03, Rate: FID: (2) : 1, (Comp) => 1.0000 - 1 (Plan: Term) => 1.0000	S:03P / FID:03FID03ub
February 6, 2017 11:50 AM	Appl.	Close	Regular Payment - Apportion	End End Term: S:03P203 / 13 FID 103
			Issue: Term:03, Rate: FID: (2) : 1, (Comp) => 1.0000 - 1 (Plan: Term) => 1.0000	S:03P / FID:03FID03ub
February 6, 2017 11:50 AM	Appl.	Close	Regular Payment - Apportion	End End Term: S:03P203 / 13 FID 103
			Issue: Term:03, Rate: FID: (2) : 1, (Comp) => 1.0000 - 1 (Plan: Term) => 1.0000	S:03P / FID:03FID03ub
February 6, 2017 11:50 AM	Appl.	Close	Regular Payment - Apportion	End End Term: S:03P203 / 13 FID 103
			Issue: Term:03, Rate: FID: (2) : 1, (Comp) => 1.0000 - 1 (Plan: Term) => 1.0000	S:03P / FID:03FID03ub
February 6, 2017 11:50 AM	Appl.	Close	Regular Payment - Apportion	End End Term: S:03P203 / 13 FID 103
			Issue: Term:03, Rate: FID: (2) : 1, (Comp) => 1.0000 - 1 (Plan: Term) => 1.0000	S:03P / FID:03FID03ub
February 6, 2017 11:50 AM	Appl.	Close	Regular Payment - Apportion	End End Term: S:03P203 / 13 FID 103
			Issue: Term:03, Rate: FID: (2) : 1, (Comp) => 1.0000 - 1 (Plan: Term) => 1.0000	S:03P / FID:03FID03ub
February 6, 2017 11:50 AM	Appl.	Close	Regular Payment - Apportion	End End Term: S:03P203 / 13 FID 103
			Issue: Term:03, Rate: FID: (2) : 1, (Comp) => 1.0000 - 1 (Plan: Term) => 1.0000	S:03P / FID:03FID03ub
February 6, 2017 11:50 AM	Appl.	Close	Regular Payment - Apportion	End End Term: S:03P203 / 13 FID 103
			Issue: Term:03, Rate: FID: (2) : 1, (Comp) => 1.0000 - 1 (Plan: Term) => 1.0000	S:03P / FID:03FID03ub
February 6, 2017 11:50 AM	Appl.	Close	Regular Payment - Apportion	End End Term: S:03P203 / 13 FID 103
			Issue: Term:03, Rate: FID: (2) : 1, (Comp) => 1.0000 - 1 (Plan: Term) => 1.0000	S:03P / FID:03FID03ub
February 6, 2017 11:50 AM	Appl.	Close	Regular Payment - Apportion	End End Term: S:03P203 / 13 FID 103
			Issue: Term:03, Rate: FID: (2) : 1, (Comp) => 1.0000 - 1 (Plan: Term) => 1.0000	S:03P / FID:03FID03ub
February 6, 2017 11:50 AM	Appl.	Close	Regular Payment - Apportion	End End Term: S:03P203 / 13 FID 103
			Issue: Term:03, Rate: FID: (2) : 1, (Comp) => 1.0000 - 1 (Plan: Term) => 1.0000	S:03P / FID:03FID03ub
February 6, 2017 11:50 AM	Appl.	Close	Regular Payment - Apportion	End End Term: S:03P203 / 13 FID 103
			Issue: Term:03, Rate: FID: (2) : 1, (Comp) => 1.0000 - 1 (Plan: Term) => 1.0000	S:03P / FID:03FID03ub
February 6, 2017 11:50 AM	Appl.	Close	Regular Payment - Apportion	End End Term: S:03P203 / 13 FID 103
			Issue: Term:03, Rate: FID: (2) : 1, (Comp) => 1.0000 - 1 (Plan: Term) => 1.0000	S:03P / FID:03FID03ub
February 6, 2017 11:50 AM	Appl.	Close	Regular Payment - Apportion	End End Term: S:03P203 / 13 FID 103
			Issue: Term:03, Rate: FID: (2) : 1, (Comp) => 1.0000 - 1 (Plan: Term) => 1.0000	S:03P / FID:03FID03ub
February 6, 2017 11:50 AM	Appl.	Close	Regular Payment - Apportion	End End Term: S:03P203 / 13 FID 103
			Issue: Term:03, Rate: FID: (2) : 1, (Comp) => 1.0000 - 1 (Plan: Term) => 1.0000	S:03P / FID:03FID03ub
February 6, 2017 11:50 AM	Appl.	Close	Regular Payment - Apportion	End End Term: S:03P203 / 13 FID 103
			Issue: Term:03, Rate: FID: (2) : 1, (Comp) => 1.0000 - 1 (Plan: Term) => 1.0000	S:03P / FID:03FID03ub
February 6, 2017 11:50 AM	Appl.	Close	Regular Payment - Apportion	End End Term: S:03P203 / 13 FID 103
			Issue: Term:03, Rate: FID: (2) : 1, (Comp) => 1.0000 - 1 (Plan: Term) => 1.0000	S:03P / FID:03FID03ub
February 6, 2017 11:50 AM	Appl.	Close	Regular Payment - Apportion	End End Term: S:03P203 / 13 FID 103
			Issue: Term:03, Rate: FID: (2) : 1, (Comp) => 1.0000 - 1 (Plan: Term) => 1.0000	S:03P / FID:03FID03ub
February 6, 2017 11:50 AM	Appl.	Close	Regular Payment - Apportion	End End Term: S:03P203 / 13 FID 103
			Issue: Term:03, Rate: FID: (2) : 1, (Comp) => 1.0000 - 1 (Plan: Term) => 1.0000	S:03P / FID:03FID03ub
February 6, 2017 11:50 AM	Appl.	Close	Regular Payment - Apportion	End End Term: S:03P203 / 13 FID 103
			Issue: Term:03, Rate: FID: (2) : 1, (Comp) => 1.0000 - 1 (Plan: Term) => 1.0000	S:03P / FID:03FID03ub
February 6, 2017 11:50 AM	Appl.	Close	Regular Payment - Apportion	End End Term: S:03P203 / 13 FID 103
			Issue: Term:03, Rate: FID: (2) : 1, (Comp) => 1.0000 - 1 (Plan: Term) => 1.0000	S:03P / FID:03FID03ub
February 6, 2017 11:50 AM	Appl.	Close	Regular Payment - Apportion	End End Term: S:03P203 / 13 FID 103
			Issue: Term:03, Rate: FID: (2) : 1, (Comp) => 1.0000 - 1 (Plan: Term) => 1.0000	S:03P / FID:03FID03ub
February 6, 2017 11:50 AM	Appl.	Close	Regular Payment - Apportion	End End Term: S:03P203 / 13 FID 103
			Issue: Term:03, Rate: FID: (2) : 1, (Comp) => 1.0000 - 1 (Plan: Term) => 1.0000	S:03P / FID:03FID03ub
February 6, 2017 11:50 AM	Appl.	Close	Regular Payment - Apportion	End End Term: S:03P203 / 13 FID 103
			Issue: Term:03, Rate: FID: (2) : 1, (Comp) => 1.0000 - 1 (Plan: Term) => 1.0000	S:03P / FID:03FID03ub
February 6, 2017 11:50 AM	Appl.	Close	Regular Payment - Apportion	End End Term: S:03P203 / 13 FID 103
			Issue: Term:03, Rate: FID: (2) : 1, (Comp) => 1.0000 - 1 (Plan: Term) => 1.0000	S:03P / FID:03FID03ub
February 6, 2017 11:50 AM	Appl.	Close	Regular Payment - Apportion	End End Term: S:03P203 / 13 FID 103
			Issue: Term:03, Rate: FID: (2) : 1, (Comp) => 1.0000 - 1 (Plan: Term) => 1.0000	S:03P / FID:03FID03ub
February 6, 2017 11:50 AM	Appl.	Close	Regular Payment - Apportion	End End Term: S:03P203 / 13 FID 103
			Issue: Term:03, Rate: FID: (2) : 1, (Comp) => 1.0000 - 1 (Plan: Term) => 1.0000	S:03P / FID:03FID03ub
February 6, 2017 11:50 AM	Appl.	Close	Regular Payment - Apportion	End End Term: S:03P203 / 13 FID 103
			Issue: Term:03, Rate: FID: (2) : 1, (Comp) => 1.0000 - 1 (Plan: Term) => 1.0000	S:03P / FID:03FID03ub
February 6, 2017 11:50 AM	Appl.	Close	Regular Payment - Apportion	End End Term: S:03P203 / 13 FID 103
			Issue: Term:03, Rate: FID: (2) : 1, (Comp) => 1.0000 - 1 (Plan: Term) => 1.0000	S:03P / FID:03FID03ub
February 6, 2017 11:50 AM	Appl.	Close	Regular Payment - Apportion	End End Term: S:03P203 / 13 FID 103
			Issue: Term:03, Rate: FID: (2) : 1, (Comp) => 1.0000 - 1 (Plan: Term) => 1.0000	S:03P / FID:03FID03ub
February 6, 2017 11:50 AM	Appl.	Close	Regular Payment - Apportion	End End Term: S:03P203 / 13 FID 103
			Issue: Term:03, Rate: FID: (2) : 1, (Comp) => 1.0000 - 1 (Plan: Term) => 1.0000	S:03P / FID:03FID03ub
February 6, 2017 11:50 AM	Appl.	Close	Regular Payment - Apportion	End End Term: S:03P203 / 13 FID 103
			Issue: Term:03, Rate: FID: (2) : 1, (Comp) => 1.0000 - 1 (Plan: Term) => 1.0000	S:03P / FID:03FID03ub
February 6, 2017 11:50 AM	Appl.	Close	Regular Payment - Apportion	End End Term: S:03P203 / 13 FID 103
			Issue: Term:03, Rate: FID: (2) : 1, (Comp) => 1.0000 - 1 (Plan: Term) => 1.0000	S:03P / FID:03FID03ub
February 6, 2017 11:50 AM	Appl.	Close	Regular Payment - Apportion	End End Term: S:03P203 / 13 FID 103
			Issue: Term:03, Rate: FID: (2) : 1, (Comp) => 1.0000 - 1 (Plan: Term) => 1.0000	S:03P / FID:03FID03ub
February 6, 2017 11:50 AM	Appl.	Close	Regular Payment - Apportion	End End Term: S:03P203 / 13 FID 103
			Issue: Term:03, Rate: FID: (2) : 1, (Comp) => 1.0000 - 1 (Plan: Term) => 1.0000	S:03P / FID:03FID03ub
February 6, 2017 11:50 AM	Appl.	Close	Regular Payment - Apportion	End End Term: S:03P203 / 13 FID 103
			Issue: Term:03, Rate: FID: (2) : 1, (Comp) => 1.0000 - 1 (Plan: Term) => 1.0000	S:03P / FID:03FID03ub
February 6, 2017 11:50 AM	Appl.	Close	Regular Payment - Apportion	End End Term: S:03P203 / 13 FID 103
			Issue: Term:03, Rate: FID: (2) : 1, (Comp) => 1.0000 - 1 (Plan: Term) => 1.0000	S:03P / FID:03FID03ub
February 6, 2017 11:50 AM	Appl.	Close	Regular Payment - Apportion	End End Term: S:03P203 / 13 FID 103
			Issue: Term:03, Rate: FID: (2) : 1, (Comp) => 1.0000 - 1 (Plan: Term) => 1.0000	S:03P / FID:03FID03ub
February 6, 2017 11:50 AM	Appl.	Close	Regular Payment - Apportion	End End Term: S:03P203 / 13 FID 103
			Issue: Term:03, Rate: FID: (2) : 1, (Comp) => 1.0000 - 1 (Plan: Term) => 1.0000	S:03P / FID:03FID03ub
February 6, 2017 11:50 AM	Appl.	Close	Regular Payment - Apportion	End End Term: S:03P203 / 13 FID 103
			Issue: Term:03, Rate: FID: (2) : 1, (Comp) => 1.0000 - 1 (Plan: Term) => 1.0000	S:03P / FID:03FID03ub
February 6, 2017 11:50 AM	Appl.	Close	Regular Payment - Apportion	End End Term: S:03P203 / 13 FID 103
			Issue: Term:03, Rate: FID: (2) : 1, (Comp) => 1.0000 - 1 (Plan: Term) => 1.0000	S:03P / FID:03FID03ub
February 6, 2017 11:50 AM	Appl.	Close	Regular Payment - Apportion	End End Term: S:03P203 / 13 FID 103
			Issue: Term:03, Rate: FID: (2) : 1, (Comp) => 1.0000 - 1 (Plan: Term) => 1.0000	S:03P / FID:03FID03ub
February 6, 2017 11:50 AM	Appl.	Close	Regular Payment - Apportion	End End Term: S:03P203 / 13 FID 103
			Issue: Term:03, Rate: FID: (2) : 1, (Comp) => 1.0000 - 1 (Plan: Term) => 1.0000	S:03P / FID:03FID03ub
February 6, 2017 11:50 AM	Appl.	Close	Regular Payment - Apportion	End End Term: S:03P203 / 13 FID 103
			Issue: Term:03, Rate: FID: (2) : 1, (Comp) => 1.0000 - 1 (Plan: Term) => 1.0000	S:03P / FID:03FID03ub
February 6, 2017 11:50 AM	Appl.	Close	Regular Payment - Apportion	End End Term: S:03P203 / 13 FID 103
			Issue: Term:03, Rate: FID: (2) : 1, (Comp) => 1.0000 - 1 (Plan: Term) => 1.0000	S:03P / FID:03FID03ub
February 6, 2017 11:50 AM	Appl.	Close	Regular Payment - Apportion	End End Term: S:03P203 / 13 FID 103
			Issue: Term:03, Rate: FID: (2) : 1, (Comp) => 1.0000 - 1 (Plan: Term) => 1.0000	S:03P / FID:03FID03ub
February 6, 2017 11:50 AM	Appl.	Close	Regular Payment - Apportion	End End Term: S:03P203 / 13 FID 103
			Issue: Term:03, Rate: FID: (2) : 1, (Comp) => 1.0000 - 1 (Plan: Term) => 1.0000	S:03P / FID:03FID03ub
February 6, 2017 11:50 AM	Appl.	Close	Regular Payment - Apportion	End End Term: S:03P203 / 13 FID 103
			Issue: Term:03, Rate: FID: (2) : 1, (Comp) => 1.0000 - 1 (Plan: Term) => 1.0000	S:03P / FID:03FID03ub
February 6, 2017 11:50 AM	Appl.	Close	Regular Payment - Apportion	End End Term: S:03P203 / 13 FID 103
			Issue: Term:03, Rate: FID: (2) : 1, (Comp) => 1.0000 - 1 (Plan: Term) => 1.0000	S:03P / FID:03FID03ub
February 6, 2017 11:50 AM	Appl.	Close	Regular Payment - Apportion	End End Term: S:03P203 / 13 FID 103
			Issue: Term:03, Rate: FID: (2) : 1, (Comp) => 1.0000 - 1 (Plan: Term) => 1.0000	S:03P / FID:03FID03ub
February 6, 2017 11:50 AM	Appl.	Close	Regular Payment - Apportion	End End Term: S:03P203 / 13 FID 103
			Issue: Term:03, Rate: FID: (2) : 1, (Comp) => 1.0000 - 1 (Plan: Term) => 1.0000	S:03P / FID:03FID03ub
February 6, 2017 11:50 AM	Appl.	Close	Regular Payment - Apportion	End End Term: S:03P203 / 13 FID 103
			Issue: Term:03, Rate: FID: (2) : 1, (Comp) => 1.0000 - 1 (Plan: Term) => 1.0000	S:03P / FID:03FID03ub
February 6, 2017 11:50 AM	Appl.	Close	Regular Payment - Apportion	End End Term: S:03P203 / 13 FID 103
			Issue: Term:03, Rate: FID: (2) : 1, (Comp) => 1.0000 - 1 (Plan: Term) => 1.0000	S:03P / FID:03FID03ub
February 6, 2017 11:50 AM	Appl.	Close	Regular Payment - Apportion	End End Term: S:03P203 / 13 FID 103
			Issue: Term:03, Rate: FID: (2) : 1, (Comp) => 1.0000 - 1 (Plan: Term) => 1.0000	S:03P / FID:03FID03ub
February 6, 2017 11:50 AM	Appl.	Close	Regular Payment - Apportion	End End Term: S:03P203 / 13 FID 103
			Issue: Term:03, Rate: FID: (2) : 1, (Comp) => 1.0000 - 1 (Plan: Term) => 1.0000	S:03P / FID:03FID03ub
February 6, 2017 11:50 AM	Appl.	Close	Regular Payment - Apportion	End End Term: S:03P203 / 13 FID 103
			Issue: Term:03, Rate: FID: (2) : 1, (Comp) => 1.0000 - 1 (Plan: Term) => 1.0000	S:03P / FID:03FID03ub
February 6, 2017 11:50 AM	Appl.	Close	Regular Payment - Apportion	End End Term: S:03P203 / 13 FID 103
			Issue: Term:03, Rate: FID: (2) : 1, (Comp) => 1.0000 - 1 (Plan: Term) => 1.0000	S:03P / FID:03FID03ub
February 6, 2017 11:50 AM	Appl.	Close	Regular Payment - Apportion	End End Term: S:03P203 / 13 FID 103
			Issue: Term:03, Rate: FID: (2) : 1, (Comp) => 1.0000 - 1 (Plan: Term) => 1.0000	S:03P / FID:03FID03ub
February 6, 2017 11:50 AM	Appl.	Close	Regular Payment - Apportion	End End Term: S:03P203 / 13 FID 103
			Issue: Term:03, Rate: FID: (2) : 1, (Comp) => 1.0000 - 1 (Plan: Term) => 1.0000	S:03P / FID:03FID03ub
February 6, 2017 11:50 AM	Appl.	Close	Regular Payment - Apportion	End End Term: S:03P203 / 13 FID 103
			Issue: Term:03, Rate: FID: (2) : 1, (Comp) => 1.0000 - 1 (Plan: Term) => 1.0000	S:03P / FID:03FID03ub
February 6, 2017 11:50 AM	Appl.	Close	Regular Payment - Apportion	End End Term: S:03P203 / 13 FID 103
			Issue: Term:03, Rate: FID: (2) : 1, (Comp) => 1.0000 - 1 (Plan: Term) => 1.0000	S:03P / FID:03FID03ub
February 6, 2017 11:50 AM	Appl.	Close	Regular Payment - Apportion	End End Term: S:03P203 / 13 FID 103
			Issue: Term:03, Rate: FID: (2) : 1, (Comp) => 1.0000 - 1 (Plan: Term) => 1.0000	S:03P / FID:03FID03ub
February 6, 2017 11:50 AM	Appl.	Close	Regular Payment - Apportion	End End Term: S:03P203 / 13 FID 103
			Issue: Term:03, Rate: FID: (2) : 1, (Comp) => 1.0000 - 1 (Plan: Term) => 1.0000	S:03P / FID:03FID03ub
February 6, 2017 11:50 AM	Appl.	Close	Regular Payment - Apportion	End End Term: S:03P203 / 13 FID 103
			Issue: Term:03, Rate: FID: (2) : 1, (Comp) => 1.0000 - 1 (Plan: Term) => 1.0000	S:03P / FID:03FID03ub
February 6, 2017 11:50 AM	Appl.	Close	Regular Payment - Apportion	End End Term: S:03P203 / 13 FID 103
			Issue: Term:03, Rate: FID: (2) : 1, (Comp) => 1.0000 - 1 (Plan: Term) => 1.0000	S:03P / FID:03FID03ub

Host Name: bruce@comcast.net	System ID: 00000000			
Hostname: LAPTOP-108076	Print Date: February 10, 2017 16:34:21 AM			
Migrate_20170209_0401-Transaction-log				
Time	Transaction Module	Activity Performed	System/Information	
February 9, 2017 10:29 PM	SQL	Completed	Signal to/From - Injection Trans: From SQL, Back TO: Database: FID - L - = 20000	None
February 9, 2017 10:30 PM	SQL	Completed	Signal to/From - Injection Trans: From SQL, Back TO: Database: FID - L - = 20000	None
February 9, 2017 10:30 PM	SQL	Data	Signal to/From - Injection Trans: From SQL, Back TO: Database: FID - L - = 20000	Backfile Path: C:\ProgramData\LAN Watch\SQL\20090909_FID-040000-01
February 9, 2017 10:30 PM	SQL	Completed	Signal to/From - Injection Trans: From SQL, Back TO: Database: FID - L - = 20000	Run Count - 1
February 9, 2017 11:04 AM	SQL	Task/Blocked	Injection Process - Injection Trans: From SQL, Back TO: OS - L (Verba: -- 1.0.0.0 - L (File: Sleep -- 1.0.0.0)	Backfile Path for Run Count - 1
February 9, 2017 11:04 PM	SQL	Completed	Injection Process - Injection Trans: From SQL, Back TO: OS - L (Verba: -- 1.0.0.0 - L (File: Sleep -- 1.0.0.0)	None
February 9, 2017 11:30 AM	SQL	DBI	Injection Process - Injection Trans: From SQL, Back TO: OS - L (Verba: -- 1.0.0.0 - L (File: Sleep -- 1.0.0.0)	Backfile Path: C:\ProgramData\LAN Watch\SQL\20090909_FID-040000-01
February 9, 2017 11:30 AM	SQL	DBI	Injection Process - Injection Trans: From SQL, Back TO: OS - L (Verba: -- 1.0.0.0 - L (File: Sleep -- 1.0.0.0)	Backfile Path: C:\ProgramData\LAN Watch\SQL\20090909_FID-040000-01
February 9, 2017 11:30 AM	SQL	DBI	Injection Process - Injection Trans: From SQL, Back TO: OS - L (Verba: -- 1.0.0.0 - L (File: Sleep -- 1.0.0.0)	Backfile Path: C:\ProgramData\LAN Watch\SQL\20090909_FID-040000-01

## เอกสารไม่ควบคุม

## เอกสารไม่ควบคุม

[illegible][illegible]

## เอกสารไม่ควบคุม

## เอกสารไม่ควมคม

[illegible]

User Name: Isadora.Miranda@usda.gov  
Accession: LPTOP-102876

Session ID: 03108799  
Print Date: February 15, 2017 9:34:30 AM

EXPENSE\_TRACKING\_USER Transaction Log

Time	Transaction Date	Activity Performed	Type of Transaction	Appropriation/Allocation
February 15, 2017 10:00:31 AM jml		Execution	Release and OMB - From USDO - October: USDO - 1 (Release) -> January: 1 (Study) -> USDO 101040	Non-Disb - J
February 15, 2017 10:00:31 AM jml		Confirmation	Release	DO
February 15, 2017 10:00:47 AM jml		Reporting	Release	None
February 15, 2017 10:00:49 AM jml		Reporting	Release	Report Generated - Contribution

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## เอกสารไม่ควบคุม

## เอกสารไม่ควบคุม

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Topics of Curiosity	
Answer	Page
Religion and Spirituality	
Is there a God? How many gods? One, God	10
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Can God be proven? Can God be disproven?	11
Yes, I think so. No, I don't. (See Note 1 on 10)	
What?	
See Answer 1 on 10	
Can you tell if others might be a god or a demon?	
No, I don't	
Demons and Exorcism	
Exorcism?	
What is Exorcism? How does it work?	
Exorcism? Exorcism?	
Exorcism? No.	

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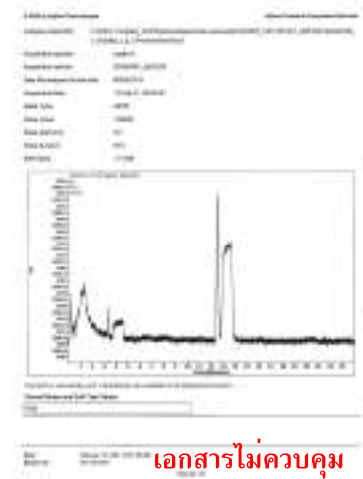
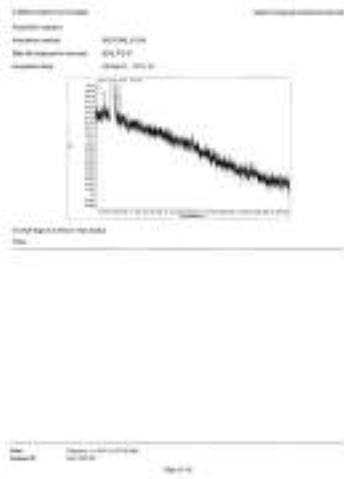
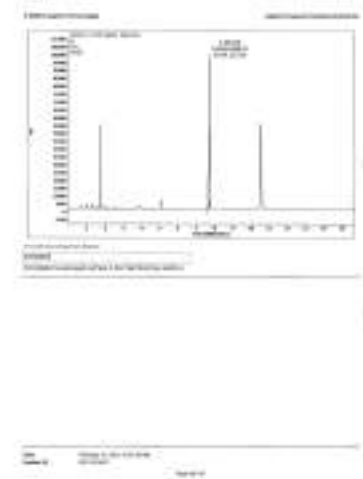
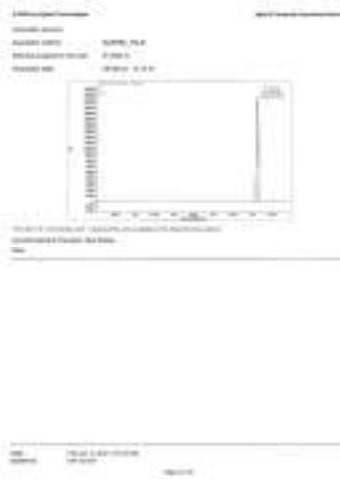
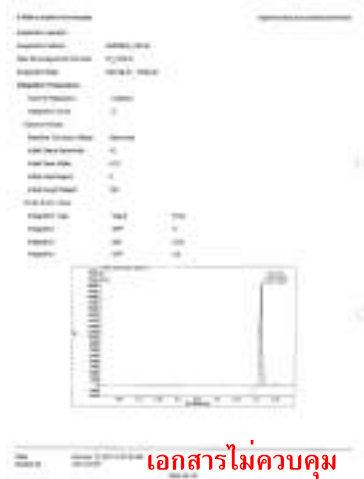
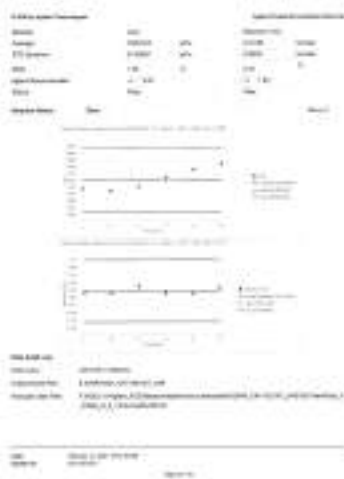
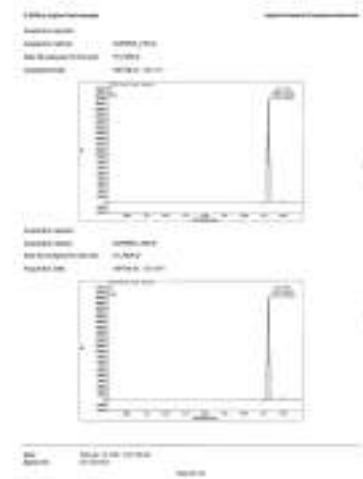
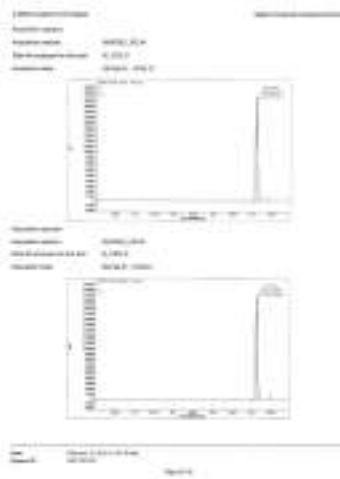
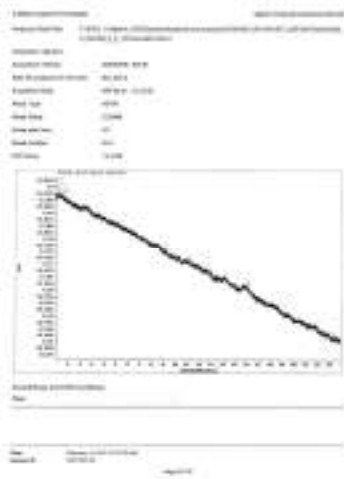
1. Basic information		2. Basic information	
Company		Company	Company
Address		Address	Address
City		City	City
State		State	State
Country		Country	Country
Phone		Phone	Phone
Fax		Fax	Fax
E-mail		E-mail	E-mail
Website		Website	Website
Business		Business	Business
Product		Product	Product
Service		Service	Service
Other		Other	Other

## เอกสารไม่ควบคุม

## เอกสารไม่ควบคุม









[illegible]

DOI: 10.1002/for

[illegible]

DOI: 10.1002/for

2. **Erklären Sie, weshalb die folgenden Aussagen falsch sind:**

a) **Die Gewinnfunktion eines Monopolisten ist eine Parabel, die nach unten geöffnet ist.**  
 b) **Die Gewinnfunktion eines Monopolisten ist eine Parabel, die nach oben geöffnet ist.**  
 c) **Die Gewinnfunktion eines Monopolisten ist eine Parabel, die nach unten geöffnet ist.**  
 d) **Die Gewinnfunktion eines Monopolisten ist eine Parabel, die nach oben geöffnet ist.**  
 e) **Die Gewinnfunktion eines Monopolisten ist eine Parabel, die nach unten geöffnet ist.**  
 f) **Die Gewinnfunktion eines Monopolisten ist eine Parabel, die nach oben geöffnet ist.**  
 g) **Die Gewinnfunktion eines Monopolisten ist eine Parabel, die nach unten geöffnet ist.**  
 h) **Die Gewinnfunktion eines Monopolisten ist eine Parabel, die nach oben geöffnet ist.**  
 i) **Die Gewinnfunktion eines Monopolisten ist eine Parabel, die nach unten geöffnet ist.**  
 j) **Die Gewinnfunktion eines Monopolisten ist eine Parabel, die nach oben geöffnet ist.**  
 k) **Die Gewinnfunktion eines Monopolisten ist eine Parabel, die nach unten geöffnet ist.**  
 l) **Die Gewinnfunktion eines Monopolisten ist eine Parabel, die nach oben geöffnet ist.**  
 m) **Die Gewinnfunktion eines Monopolisten ist eine Parabel, die nach unten geöffnet ist.**  
 n) **Die Gewinnfunktion eines Monopolisten ist eine Parabel, die nach oben geöffnet ist.**  
 o) **Die Gewinnfunktion eines Monopolisten ist eine Parabel, die nach unten geöffnet ist.**  
 p) **Die Gewinnfunktion eines Monopolisten ist eine Parabel, die nach oben geöffnet ist.**  
 q) **Die Gewinnfunktion eines Monopolisten ist eine Parabel, die nach unten geöffnet ist.**  
 r) **Die Gewinnfunktion eines Monopolisten ist eine Parabel, die nach oben geöffnet ist.**  
 s) **Die Gewinnfunktion eines Monopolisten ist eine Parabel, die nach unten geöffnet ist.**  
 t) **Die Gewinnfunktion eines Monopolisten ist eine Parabel, die nach oben geöffnet ist.**  
 u) **Die Gewinnfunktion eines Monopolisten ist eine Parabel, die nach unten geöffnet ist.**  
 v) **Die Gewinnfunktion eines Monopolisten ist eine Parabel, die nach oben geöffnet ist.**  
 w) **Die Gewinnfunktion eines Monopolisten ist eine Parabel, die nach unten geöffnet ist.**  
 x) **Die Gewinnfunktion eines Monopolisten ist eine Parabel, die nach oben geöffnet ist.**  
 y) **Die Gewinnfunktion eines Monopolisten ist eine Parabel, die nach unten geöffnet ist.**  
 z) **Die Gewinnfunktion eines Monopolisten ist eine Parabel, die nach oben geöffnet ist.**

Name: 
 Address: 
 City: 
 State: 
 Zip:

[illegible]

Age	20-29	30-39	40-49	50-59	60-69	70-79	80-89	90-99
Gender	Male	Female	Male	Female	Male	Female	Male	Female

[illegible]

Year	Volume of fish caught	Number of fish
1990	1000	1000
1991	1000	1000
1992	1000	1000
1993	1000	1000
1994	1000	1000
1995	1000	1000
1996	1000	1000
1997	1000	1000
1998	1000	1000
1999	1000	1000
2000	1000	1000
2001	1000	1000
2002	1000	1000
2003	1000	1000
2004	1000	1000
2005	1000	1000
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2092	1000	1000
2093	1000	1000
2094	1000	1000
2095	1000	1000
2096	1000	1000
2097	1000	1000
2098	1000	1000
2099		

[illegible]

เอกสารไม่ควบคุม

1. **Informations personnelles** : Nom et Prénom : \_\_\_\_\_ Adresse : \_\_\_\_\_

2. **Informations académiques** : Niveau d'étude : \_\_\_\_\_ Matière : \_\_\_\_\_

3. **Informations de contact** : Téléphone : \_\_\_\_\_ E-mail : \_\_\_\_\_

4. **Informations de suivi** : Date de naissance : \_\_\_\_\_ Sexe : \_\_\_\_\_

5. **Informations de paiement** : Montant payé : \_\_\_\_\_

6. **Informations de signature** : Signature : \_\_\_\_\_

7. **Informations de validation** : Date de validation : \_\_\_\_\_

8. **Informations de remarque** : \_\_\_\_\_

NAME	DATE
ADDRESS	

**Formulario de Registro de Asistencia**

Nombre y Apellido: Juan Carlos  
 Fecha: 15/05/2015  
 Hora: 10:00  
 Lugar: Sala de Clase

Nombre y Apellido	Presencia	Ausencia	Faltas	Retrasos	Otras
Juan Carlos	Presencia				
Maria Elena	Presencia				
Carlos	Presencia				
Ana	Presencia				
Diego	Presencia				
Lucia	Presencia				
Roberto	Presencia				
Sofia	Presencia				
Diego	Presencia				
Lucia	Presencia				
Roberto	Presencia				
Sofia	Presencia				
Diego	Presencia				
Lucia	Presencia				
Roberto	Presencia				
Sofia	Presencia				
Diego	Presencia				
Lucia	Presencia				
Roberto	Presencia				
Sofia	Presencia				
Diego	Presencia				
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Roberto	Presencia				
Sofia	Presencia				
Diego	Presencia				
Lucia	Presencia				
Roberto	Presencia				
Sofia	Presencia				
Diego	Presencia				
Lucia	Presencia				
Roberto	Presencia				
Sofia	Presencia				
Diego	Presencia				
Lucia	Presencia				
Roberto	Presencia				
Sofia	Presencia				
Diego	Presencia				
Lucia	Presencia				
Roberto	Presencia				
Sofia	Presencia				
Diego	Presencia				
Lucia	Presencia				
Roberto	Presencia				
Sofia	Presencia				
Diego	Presencia				
Lucia	Presencia				
Roberto	Presencia				
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Diego	Presencia				
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Roberto	Presencia				
Sofia	Presencia				
Diego	Presencia				
Lucia	Presencia				
Roberto	Presencia				
Sofia	Presencia				
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Lucia	Presencia				
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Lucia	Presencia				
Roberto	Presencia				
Sofia	Presencia				
Diego	Presencia				
Lucia	Presencia				
Roberto	Presencia				
Sofia	Presencia				
Diego	Presencia				
Lucia	Presencia				
Roberto	Presencia				
Sofia	Presencia				
Diego	Presencia				
Lucia	Presencia				
Roberto	Presencia				
Sofia					

## เอกสารไม่ควบคม

4. <b>Other representative</b>		5. <b>Other representative</b>	
6. <b>Other representative</b>		7. <b>Other representative</b>	
<div style="border: 1px solid black; height: 200px; margin-top: 10px;"></div>			
<div style="text-align: right; margin-top: 10px;">             8. <b>Other representative</b> </div>			

Year	Number of cases	Percentage of cases
1990	10	10.0
1991	15	15.0
1992	20	20.0
1993	25	25.0
1994	30	30.0
1995	35	35.0
1996	40	40.0
1997	45	45.0
1998	50	50.0
1999	55	55.0
2000	60	60.0
2001	65	65.0
2002	70	70.0
2003	75	75.0
2004	80	80.0
2005	85	85.0
2006	90	90.0
2007	95	95.0
2008	100	100.0
2009	105	105.0
2010	110	110.0
2011	115	115.0
2012	120	120.0
2013	125	125.0
2014	130	130.0
2015	135	135.0
2016	140	140.0
2017	145	145.0
2018	150	150.0
2019	155	155.0
2020	160	160.0
2021	165	165.0
2022	170	170.0
2023	175	175.0
2024	180	180.0
2025	185	185.0
2026	190	190.0
2027	195	195.0
2028	200	200.0
2029	205	205.0
2030	210	210.0
2031	215	215.0
2032	220	220.0
2033	225	225.0
2034	230	230.0
2035	235	235.0
2036	240	240.0
2037	245	245.0
2038	250	250.0
2039	255	255.0
2040	260	260.0
2041	265	265.0
2042	270	270.0
2043	275	275.0
2044	280	280.0
2045	285	285.0
2046	290	290.0
2047	295	295.0
2048	300	300.0
2049	305	305.0
2050	310	310.0
2051	315	315.0
2052	320	320.0
2053	325	325.0
2054	330	330.0
2055	335	335.0
2056	340	340.0
2057	345	345.0
2058	350	350.0
2059	355	355.0
2060	360	360.0
2061	365	365.0
2062	370	370.0
2063	375	375.0
2064	380	380.0
2065	385	385.0
2066	390	390.0
2067	395	395.0
2068	400	400.0
2069	405	405.0
2070	410	410.0
2071	415	415.0
2072	420	420.0
2073	425	425.0
2074	430	430.0
2075	435	435.0
2076	440	440.0
2077	445	445.0
2078	450	450.0
2079	455	455.0
2080	460	460.0
2081	465	465.0
2082	470	470.0
2083	475	475.0
2084	480	480.0
2085	485	485.0
2086	490	490.0
2087	495	495.0
2088	500	500.0
2089	505	505.0
2090	510	510.0
2091	515	515.0
2092	520	520.0
2093	525	525.0
2094	530	530.0
2095	535	535.0
2096	540	540.0
2097	545	545.0
2098	550	550.0
2099	555	555.0
2100		

[illegible]

DOI: 10.1002/for

[illegible]

1999	100.0	100.0	100.0
2000	100.0	100.0	100.0
2001	100.0	100.0	100.0
2002	100.0	100.0	100.0
2003	100.0	100.0	100.0
2004	100.0	100.0	100.0
2005	100.0	100.0	100.0
2006	100.0	100.0	100.0
2007	100.0	100.0	100.0
2008	100.0	100.0	100.0
2009	100.0	100.0	100.0
2010	100.0	100.0	100.0
2011	100.0	100.0	100.0
2012	100.0	100.0	100.0
2013	100.0	100.0	100.0
2014	100.0	100.0	100.0
2015	100.0	100.0	100.0
2016	100.0	100.0	100.0
2017	100.0	100.0	100.0
2018	100.0	100.0	100.0
2019	100.0	100.0	100.0
2020	100.0	100.0	100.0
2021	100.0	100.0	100.0
2022	100.0	100.0	100.0
2023	100.0	100.0	100.0
2024	100.0	100.0	100.0
2025	100.0	100.0	100.0
2026	100.0	100.0	100.0
2027	100.0	100.0	100.0
2028	100.0	100.0	100.0
2029	100.0	100.0	100.0
2030	100.0	100.0	100.0
2031	100.0	100.0	100.0
2032	100.0	100.0	100.0
2033	100.0	100.0	100.0
2034	100.0	100.0	100.0
2035	100.0	100.0	100.0
2036	100.0	100.0	100.0
2037	100.0	100.0	100.0
2038	100.0	100.0	100.0
2039	100.0	100.0	100.0
2040	100.0	100.0	100.0
2041	100.0	100.0	100.0
2042	100.0	100.0	100.0
2043	100.0	100.0	100.0
2044	100.0	100.0	100.0
2045	100.0	100.0	100.0
2046	100.0	100.0	100.0
2047	100.0	100.0	100.0
2048	100.0	100.0	100.0
2049	100.0	100.0	100.0
2050	100.0	100.0	100.0
2051	100.0	100.0	100.0
2052	100.0	100.0	100.0
2053	100.0	100.0	100.0
2054	100.0	100.0	100.0
2055	100.0	100.0	100.0
2056	100.0	100.0	100.0
2057	100.0	100.0	100.0
2058	100.0	100.0	100.0
2059	100.0	100.0	100.0
2060	100.0	100.0	100.0
2061	100.0	100.0	100.0
2062	100.0	100.0	100.0
2063	100.0	100.0	100.0
2064	100.0	100.0	100.0
2065	100.0	100.0	100.0
2066	100.0	100.0	100.0
2067	100.0	100.0	100.0
2068	100.0	100.0	100.0
2069	100.0	100.0	100.0
2070	100.0	100.0	100.0
2071	100.0	100.0	100.0
2072	100.0	100.0	100.0
2073	100.0	100.0	100.0
2074	100.0	100.0	100.0
2075	100.0	100.0	100.0
2076	100.0	100.0	100.0
2077	100.0	100.0	100.0
2078	100.0	100.0	100.0
2079	100.0	100.0	100.0
2080	100.0	100.0	100

**Form 1041-ES (2004)**

**Estimated Tax for Individuals**

**Department of the Treasury**

**Internal Revenue Service**

**1041-ES**

**2004**

**John Doe**

**123 Main Street**

**Anytown, NY 10001**

**SSN: 123-45-6789**

**Married**

**2004 Adjusted Gross Income: \$10,000**

**Estimated Tax: \$1,000**

**Payments: \$1,000**

**Refund: \$1,000**

**1/15/05**

**IRS**

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Journal of Internal Medicine 255: 103–110

1. The authors acknowledge that the data collection for the study was conducted in a relatively short period of time, which may have limited the generalizability of the findings. However, the authors believe that the data collected are representative of the population of interest, and the findings are consistent with previous research on the topic.
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5. The authors acknowledge that the data collection for the study was conducted in a relatively short period of time, which may have limited the generalizability of the findings. However, the authors believe that the data collected are representative of the population of interest, and the findings are consistent with previous research on the topic.

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1993	25	25.0
1994	30	30.0
1995	35	35.0
1996	40	40.0
1997	45	45.0
1998	50	50.0
1999	55	55.0
2000	60	60.0
2001	65	65.0
2002	70	70.0
2003	75	75.0
2004	80	80.0
2005	85	85.0
2006	90	90.0
2007	95	95.0
2008	100	100.0
2009	105	105.0
2010	110	110.0
2011	115	115.0
2012	120	120.0
2013	125	125.0
2014	130	130.0
2015	135	135.0
2016	140	140.0
2017	145	145.0
2018	150	150.0
2019	155	155.0
2020	160	160.0
2021	165	165.0
2022	170	170.0
2023	175	175.0
2024	180	180.0
2025	185	185.0
2026	190	190.0
2027	195	195.0
2028	200	200.0
2029	205	205.0
2030	210	210.0
2031	215	215.0
2032	220	220.0
2033	225	225.0
2034	230	230.0
2035	235	235.0
2036	240	240.0
2037	245	245.0
2038	250	250.0
2039	255	255.0
2040	260	260.0
2041	265	265.0
2042	270	270.0
2043	275	275.0
2044	280	280.0
2045	285	285.0
2046	290	290.0
2047	295	295.0
2048	300	300.0
2049	305	305.0
2050	310	310.0
2051	315	315.0
2052	320	320.0
2053	325	325.0
2054	330	330.0
2055	335	335.0
2056	340	340.0
2057	345	345.0
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2059	355	355.0
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2061	365	365.0
2062	370	370.0
2063	375	375.0
2064	380	380.0
2065	385	385.0
2066	390	390.0
2067	395	395.0
2068	400	400.0
2069	405	405.0
2070	410	410.0
2071	415	415.0
2072	420	420.0
2073	425	425.0
2074	430	430.0
2075	435	435.0
2076	440	440.0
2077	445	445.0
2078	450	450.0
2079	455	455.0
2080	460	460.0
2081	465	465.0
2082	470	470.0
2083	475	475.0
2084	480	480.0
2085	485	485.0
2086	490	490.0
2087	495	495.0
2088	500	500.0
2089	505	505.0
2090	510	510.0
2091	515	515.0
2092	520	520.0
2093	525	525.0
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2097	545	545.0
2098	550	550.0
2099	555	555.0
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2250-2251

2251-2252

2252-2253

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2254-2255

2255-2256

2256-2257

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## เอกสารไม่ควบคุม

L'Espresso	L'Espresso	L'Espresso
Nome e Cognome	Indirizzo e Città	Cap e Prov.
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Year	Number of cases	Percentage of cases
1990	10	10.0
1991	15	15.0
1992	20	20.0
1993	25	25.0
1994	30	30.0
1995	35	35.0
1996	40	40.0
1997	45	45.0
1998	50	50.0
1999	55	55.0
2000	60	60.0
2001	65	65.0
2002	70	70.0
2003	75	75.0
2004	80	80.0
2005	85	85.0
2006	90	90.0
2007	95	95.0
2008	100	100.0
2009	105	105.0
2010	110	110.0
2011	115	115.0
2012	120	120.0
2013	125	125.0
2014	130	130.0
2015	135	135.0
2016	140	140.0
2017	145	145.0
2018	150	150.0
2019	155	155.0
2020	160	160.0
2021	165	165.0
2022	170	170.0
2023	175	175.0
2024	180	180.0
2025	185	185.0
2026	190	190.0
2027	195	195.0
2028	200	200.0
2029	205	205.0
2030	210	210.0
2031	215	215.0
2032	220	220.0
2033	225	225.0
2034	230	230.0
2035	235	235.0
2036	240	240.0
2037	245	245.0
2038	250	250.0
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2045	285	285.0
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2047	295	295.0
2048	300	300.0
2049	305	305.0
2050	310	310.0
2051	315	315.0
2052	320	320.0
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2093	525	525.0
2094	530	530.0
2095	535	535.0
2096	540	540.0
2097	545	545.0
2098	550	550.0
2099	555	555.0
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## เอกสารไม่ควบคุม

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เอกสารไม่ควบคุม

เอกสารไม่ควบคุม

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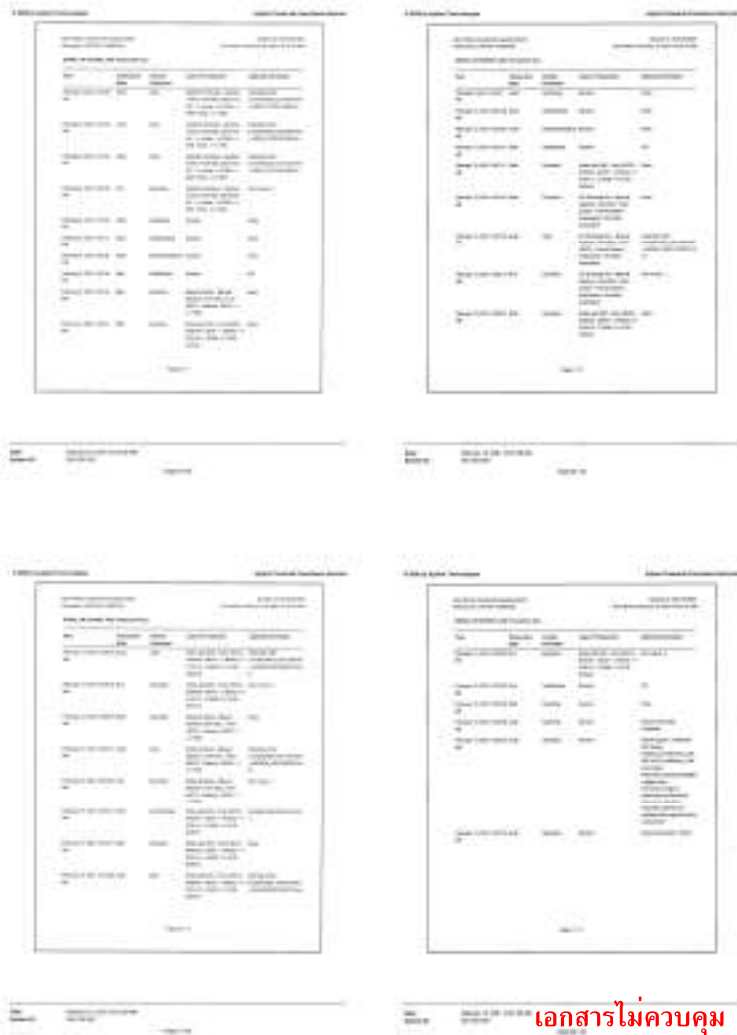
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เอกสารไม่ควบคุม

เอกสารไม่ควบคุม





## Certificate of System Qualification

GC-00

System ID: 0413115001  
Organization Name: United Analytical Engineering Consultant  
Organization Location: 3 Soi Udomsak 41 Sukhumvit Road, Bangkok, Phrahanang, Bangkok, 10250

Date: April 22, 2022 2:32:18 PM  
OSP Name: AgilentRecommended  
OSP Revision: 0C10.01  
Overall Qualification Status: Pass

## System Inspection and Basic Safety and Operation

Name: 7000  
Setuppoint Status: Pass

## Overall System Inspection and Basic Safety and Operation Test Status

Pass

## Inlet Pressure Density

Name: 7000  
Front: 00L

Setuppoint Status: Pass

Pressure: 25.0 psi

Pressure Change: -0.1 psi / 5 seconds

Agilent Recommended: <= -2.0 and <= 0.5

## Overall Inlet Pressure Density Test Status

Pass

## Inlet Pressure Accuracy

Name: 7000  
Front: 00L

Date: April 22, 2022 2:32:18 PM  
System ID: 0413115001

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เอกสารไม่ควบคุม

เอกสารไม่ควบคุม

Setuppoint Status: Pass

Setpoint: 30.0 psi Actual: 28.0 psi

Accuracy: 0.0 psi

Agilent Recommended: <= 1.2

## Overall Inlet Pressure Accuracy Test Status

Pass

## Detector Flow Accuracy

Name: 7000  
Back: PPD+

Setuppoint Status: Pass

Flow Type: Fuel

Setpoint: 80.0 mL/min Measured Flow: 80.2 mL/min

Accuracy: 0.2 mL/min

Agilent Recommended: <= 18.0 % setpoint | 0.5 mL/min |

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

Setuppoint Status: Pass

Flow Type: Gasless

Setpoint: 80.0 mL/min Measured Flow: 79.1 mL/min

Accuracy: 0.1 mL/min

Agilent Recommended: <= 18.0 % setpoint | 0.5 mL/min |

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

Setuppoint Status: Pass

Flow Type: Inlet/Out

Setpoint: 80.0 mL/min Measured Flow: 80.0 mL/min

Purge Offset: 20 % setpoint

Adjusted Setpoint: 72.00 mL/min

Accuracy: 7.7 mL/min

Agilent Recommended: <= 18.0 % setpoint | 1.2 mL/min |

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

## Overall Detector Flow Accuracy Test Status

Pass

## Detector Flow Accuracy

Name: 7000  
Front: PPD-

Setuppoint Status: Pass

Flow Type: Fuel

Setpoint: 30.0 mL/min Measured Flow: 30.2 mL/min

Accuracy: 0.2 mL/min

Agilent Recommended: <= 18.0 % setpoint | 0.5 mL/min |

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

Setuppoint Status: Pass

Flow Type: Gasless

Setpoint: 80.0 mL/min Measured Flow: 80.2 mL/min

Accuracy: 0.2 mL/min

Agilent Recommended: <= 18.0 % setpoint | 0.5 mL/min |

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

เอกสารไม่ควบคุม

เอกสารไม่ควบคุม

Setpoint Status: **Pass**

Flow Type: **MS-SPD**

Setpoint: **25.0 mL/min** Measured Flow: **24.8 mL/min**

Accuracy: **0.9 mL/min**

Agilent Recommended: **±1.0 % setpoint** ( **2.5 mL/min** )

Limit is percentage of setpoint or 0.5 mL/min, whichever is larger.

#### Overall Selector Flow Accuracy Test Status

**Pass**

#### GC Oven Temperature Accuracy

Name: **7608**

Setpoint Status: **Pass**

Zone: **Over**

Setpoint/Actual: **230.0 / 230.8 °C**

Temperature: **230.8 °C**

Accuracy: **0.8 °C**

Agilent Recommended: **±1.0 % setpoint or 1.0 °C** ( **2.3 °C** )

Setpoint Status: **Pass**

Zone: **Over**

Setpoint/Actual: **100.0 / 100.4 °C**

Temperature: **100.4 °C**

Accuracy: **0.4 °C**

Agilent Recommended: **±1.0 % setpoint or 1.0 °C** ( **1.0 °C** )

#### Overall GC Oven Temperature Accuracy Test Status

**Pass**

#### GC Oven Temperature Stability

Name: **7608**

Date: **April 23, 2021 2:02:16 PM**

System ID: **0N1313001**

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เอกสารไม่ควบคุม

Setpoint Status: **Pass**

Substrate/Average: **180.0 / 100.4303 °C**

Temperature: **180.0 °C**

Stability: **0.1 °C**

Agilent Recommended: **±0.5 °C**

#### Overall GC Oven Temperature Stability Test Status

**Pass**

#### Scouting Run

Tested Combination1: **Front** **SQL** **/ Back** **FID+**

Name: **7603A**

Setpoint Status: **Completed**

Injection Volume on Column: **1.0 µL**

Mode: **Pulsate**

#### Overall Scouting Run Status

**Completed**

#### Noise and Drift

Tested Combination1: **Front** **SQL** **/ Back** **FID+**

Name: **7608**

Setpoint Status: **Pass**

Mode: **P-Mode**

Base Signal: **12.0 150 pA**

ASTM Noise: **0.9** **0.92** **0.92** **0.92**

Agilent Recommended: **±0.30** **±0.30** **±0.30** **±0.30**

Status: **Pass** **Pass** **Pass** **Pass**

Date: **April 23, 2021 2:02:16 PM**

System ID: **0N1313001**

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เอกสารไม่ควบคุม

#### Overall Noise and Drift Test Status

**Pass**

#### Injection Precision

Tested Combination1: **Front** **SQL** **/ Back** **FID+**

Name: **7603A**

Setpoint Status: **Pass**

Injection Volume on Column: **1.0 µL**

Mode: **Pulsate**

Area RSD: **0.01 %** Retention Time RSD: **0.01 %**

Agilent Recommended: **±0.05** **±0.05**

#### Overall Injection Precision Test Status

**Pass**

#### Signal to Noise

Tested Combination1: **Front** **SQL** **/ Back** **FID+**

Name: **7608**

Mode: **P-Mode**

Setpoint Status: **Pass**

Signal to Noise: **11028**

Agilent Recommended: **±2400**

#### Overall Signal to Noise Test Status

**Pass**

#### Scouting Run

Tested Combination2: **Front** **SQL** **/ Front** **FID**

Name: **7603A**

Date: **April 23, 2021 2:02:16 PM**

System ID: **0N1313001**

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Setpoint Status: **Completed**

Injection Volume on Column: **1.0 µL**

#### Overall Scouting Run Status

**Completed**

#### Noise and Drift

Tested Combination2: **Front** **SQL** **/ Front** **FID**

Name: **7608**

Setpoint Status: **Pass**

Base Signal: **21.2 pA**

ASTM Noise: **0.9** **0.92** **0.92** **0.92**

Agilent Recommended: **±0.15** **±0.15** **±0.15** **±0.15**

Status: **Pass** **Pass** **Pass** **Pass**

#### Overall Noise and Drift Test Status

**Pass**

#### Injection Precision

Tested Combination2: **Front** **SQL** **/ Front** **FID**

Name: **7603A**

Setpoint Status: **Pass**

Injection Volume on Column: **1.0 µL**

Area RSD: **0.44 %** Retention Time RSD: **0.04 %**

Agilent Recommended: **±0.05** **±0.05**

#### Overall Injection Precision Test Status

**Pass**

#### Signal to Noise

Date: **April 23, 2021 2:02:16 PM**

System ID: **0N1313001**

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Tested Combination2	Front	ISL	/ Front	FID
Injection Tower				
Name	T98C			
Subject Station	Pass			
Signets to Station	52945			
Agilent Recommended	== 30000			
Control Signal to Motor Test Station				
Pass				

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## Instrument Details

## Purpose

This section describes the air flow system configuration.

## Details

## System

System ID	CH13113001
Manufacturer	Agilent Technologies
Name	T98C
Flow Gps Input	Manual Data
Temperature Data Input	Manual Data or Other Data Logging

## Front Combination1

Injection Technique	Injection Tower
Inlet	Front
Detector	Back
ITM Included?	No

## Tested Combination2

Injection Technique	Injection Tower
Inlet	Front
Detector	Front
ITM Included?	No

## Sample 1

Manufacturer	Agilent Technologies
Type	Injection Tower
Name	T98CA
Model Number	G4513A
Serial Number	CH12080010
Firmware Revision	4.10.00
Usage	Sample Injection
Location	Front
Syringe Volume (µL)	10

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Sample 2	
Manufacturer	Agilent Technologies
Type	Trap
Name	T980A
Model Number	G4514A
Serial Number	CH1230180
Firmware Revision	4.10.10
Valve Heater	Not Installed
Sample 1	
Manufacturer	Agilent Technologies
Name	T980
Model Number	G3440B
Serial Number	CH13113001
Firmware Revision	8.02.03.2
Column Type	Standard
Front 1	
Manufacturer	Agilent Technologies
Name	T980
Type	ISL
Location	Front
Control Gas	Helium
Control Type	Electronic Pressure Control (EPC)
Purge Gas	Yes
Detector 1	
Manufacturer	Agilent Technologies
Name	T980
Type	FID
Adapter	Capillary
Control Type	Electronic Pressure Control (EPC)
Location	Front
Makeup Gas	Nitrogen

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## Detector 2

Manufacturer	Agilent Technologies
Name	T980
Type	FID+
Adapter	Capillary
Control Type	Electronic Pressure Control (EPC)
Location	Back
Makeup Gas	Nitrogen
Flow Filter Tested	Pass

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**Electronic Signature**

**Purchase**

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Full Name of Signer:	Sangeetha Tosa
Logged On User Name:	sangeetha.tosa@wms.apicel.com
Signature Creation Date:	April 22, 2023
Reason for Signature:	Reviewed protocol and published the original version of document

## Regulatory Disclosure

This document provides a protocol to verify and record instrument configuration and evidence of proper operation. It has been prepared from our interpretation of applicable regulations and as an industry best practice. The document is designed to provide an important component of a complete compliance package. Instrument dealers only have many factors and use of the protocol along does not assure compliance. iSight Technologies makes no warranty or representation as to the sufficiency for any specific regulatory purposes.

**Abstract**

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Date Rec'd - Interpretive Level		Session ID - Date/Time		
Programme - LAPTIP-CG200303		From 0000 - April 02, 2003 10:00 AM		
ENR110007 - Presentation Log				
Time	Transmission Status	Activity Performed	Type of Transmission	Signal or Information
April 02, 2003 09:18:20 AM	Audio	Transmission	Station	None
April 02, 2003 09:18:20 AM	Audio	CG20030300	Station	None
April 02, 2003 09:18:20 AM	Audio	Continued	Learning	Use of Interpreting and Note and Signaling in written mode
April 02, 2003 09:18:40 AM	Audio	High Level	Station	CGP details for various information plus: Personalized feedback on writing skills (CGP 110007, CGP 110008, CGP 110009, CGP 110010, CGP 110011, CGP 110012, CGP 110013, CGP 110014, CGP 110015, CGP 110016, CGP 110017, CGP 110018, CGP 110019, CGP 110020, CGP 110021, CGP 110022, CGP 110023, CGP 110024, CGP 110025, CGP 110026, CGP 110027, CGP 110028, CGP 110029, CGP 110030, CGP 110031, CGP 110032, CGP 110033, CGP 110034, CGP 110035, CGP 110036, CGP 110037, CGP 110038, CGP 110039, CGP 110040, CGP 110041, CGP 110042, CGP 110043, CGP 110044, CGP 110045, CGP 110046, CGP 110047, CGP 110048, CGP 110049, CGP 110050, CGP 110051, CGP 110052, CGP 110053, CGP 110054, CGP 110055, CGP 110056, CGP 110057, CGP 110058, CGP 110059, CGP 110060, CGP 110061, CGP 110062, CGP 110063, CGP 110064, CGP 110065, CGP 110066, CGP 110067, CGP 110068, CGP 110069, CGP 110070, CGP 110071, CGP 110072, CGP 110073, CGP 110074, CGP 110075, CGP 110076, CGP 110077, CGP 110078, CGP 110079, CGP 110080, CGP 110081, CGP 110082, CGP 110083, CGP 110084, CGP 110085, CGP 110086, CGP 110087, CGP 110088, CGP 110089, CGP 110090, CGP 110091, CGP 110092, CGP 110093, CGP 110094, CGP 110095, CGP 110096, CGP 110097, CGP 110098, CGP 110099, CGP 110100, CGP 110101, CGP 110102, CGP 110103, CGP 110104, CGP 110105, CGP 110106, CGP 110107, CGP 110108, CGP 110109, CGP 110110, CGP 110111, CGP 110112, CGP 110113, CGP 110114, CGP 110115, CGP 110116, CGP 110117, CGP 110118, CGP 110119, CGP 110120, CGP 110121, CGP 110122, CGP 110123, CGP 110124, CGP 110125, CGP 110126, CGP 110127, CGP 110128, CGP 110129, CGP 110130, CGP 110131, CGP 110132, CGP 110133, CGP 110134, CGP 110135, CGP 110136, CGP 110137, CGP 110138, CGP 110139, CGP 110140, CGP 110141, CGP 110142, CGP 110143, CGP 110144, CGP 110145, CGP 110146, CGP 110147, CGP 110148, CGP 110149, CGP 110150, CGP 110151, CGP 110152, CGP 110153, CGP 110154, CGP 110155, CGP 110156, CGP 110157, CGP 110158, CGP 110159, CGP 110160, CGP 110161, CGP 110162, CGP 110163, CGP 110164, CGP 110165, CGP 110166, CGP 110167, CGP 110168, CGP 110169, CGP 110170, CGP 110171, CGP 110172, CGP 110173, CGP 110174, CGP 110175, CGP 110176, CGP 110177, CGP 110178, CGP 110179, CGP 110180, CGP 110181, CGP 110182, CGP 110183, CGP 110184, CGP 110185, CGP 110186, CGP 110187, CGP 110188, CGP 110189, CGP 110190, CGP 110191, CGP 110192, CGP 110193, CGP 110194, CGP 110195, CGP 110196, CGP 110197, CGP 110198, CGP 110199, CGP 110200, CGP 110201, CGP 110202, CGP 110203, CGP 110204, CGP 110205, CGP 110206, CGP 110207, CGP 110208, CGP 110209, CGP 110210, CGP 110211, CGP 110212, CGP 110213, CGP 110214, CGP 110215, CGP 110216, CGP 110217, CGP 110218, CGP 110219, CGP 110220, CGP 110221, CGP 110222, CGP 110223, CGP 110224, CGP 110225, CGP 110226, CGP 110227, CGP 110228, CGP 110229, CGP 110230, CGP 110231, CGP 110232, CGP 110233, CGP 110234, CGP 110235, CGP 110236, CGP 110237, CGP 110238, CGP 110239, CGP 110240, CGP 110241, CGP 110242, CGP 110243, CGP 110244, CGP 110245, CGP 110246, CGP 110247, CGP 110248, CGP 110249, CGP 110250, CGP 110251, CGP 110252, CGP 110253, CGP 110254, CGP 110255, CGP 110256, CGP 110257, CGP 110258, CGP 110259, CGP 110260, CGP 110261, CGP 110262, CGP 110263, CGP 110264, CGP 110265, CGP 110266, CGP 110267, CGP 110268, CGP 110269, CGP 110270, CGP 110271, CGP 110272, CGP 110273, CGP 110274, CGP 110275, CGP 110276, CGP 110277, CGP 110278, CGP 110279, CGP 110280, CGP 110281, CGP 110282, CGP 110283, CGP 110284, CGP 110285, CGP 110286, CGP 110287, CGP 110288, CGP 110289, CGP 110290, CGP 110291, CGP 110292, CGP 110293, CGP 110294, CGP 110295, CGP 110296, CGP 110297, CGP 110298, CGP 110299, CGP 110300, CGP 110301, CGP 110302, CGP 110303, CGP 110304, CGP 110305, CGP 110306, CGP 110307, CGP 110308, CGP 110309, CGP 110310, CGP 110311, CGP 110312, CGP 110313, CGP 110314, CGP 110315, CGP 110316, CGP 110317, CGP 110318, CGP 110319, CGP 110320, CGP 110321, CGP 110322, CGP 110323, CGP 110324, CGP 110325, CGP 110326, CGP 110327, CGP 110328, CGP 110329, CGP 110330, CGP 110331, CGP 110332, CGP 110333, CGP 110334, CGP 110335, CGP 110336, CGP 110337, CGP 110338, CGP 110339, CGP 110340, CGP 110341, CGP 110342, CGP 110343, CGP 110344, CGP 110345, CGP 110346, CGP 110347, CGP 110348, CGP 110349, CGP 110350, CGP 110351, CGP 110352, CGP 110353, CGP 110354, CGP 110355, CGP 110356, CGP 110357, CGP 110358, CGP 110359, CGP 110360, CGP 110361, CGP 110362, CGP 110363, CGP 110364, CGP 110365, CGP 110366, CGP 110367, CGP 110368, CGP 110369, CGP

[illegible]

Type Name: <a href="#">Inventory Item</a> Home: <a href="#">LAMPON-CLINICAL</a>			System: <a href="#">2013-1-2013</a> Print Date: <a href="#">April 22, 2013 10:47 AM</a>	
<a href="#">Go</a>   <a href="#">Filter</a>   <a href="#">Export</a>   <a href="#">Print</a>				
Title	Transaction Date	Account (Reference)	Type of Transaction	Optional Information
April 22, 2013 10:23 AM	April	Bank	Debitum Post-Inventory - Bank FEB - Type: <a href="#">Inventory -</a> BOL: <a href="#">BOL</a> - L: <a href="#">11-0025</a> <a href="#">edit</a>	Manual Entry (1)
April 22, 2013 10:40 AM	April	Expense	Debitum Post-Inventory - Bank FEB - Type: <a href="#">Inventory -</a> BOL: <a href="#">BOL</a> - L: <a href="#">11-0025</a> <a href="#">edit</a>	Bank Check - 1
April 22, 2013 10:43 AM	April	Expense	Expense Sales - Expense Sales: <a href="#">Inventory</a> , Bank: <a href="#">BOL</a> - L: <a href="#">11-0025</a> <a href="#">edit</a>	None
April 22, 2013 10:50:23 AM	April	Expense	Expense Sales - Expense Sales: <a href="#">Inventory</a> , Bank: <a href="#">BOL</a> - L: <a href="#">11-0025</a> <a href="#">edit</a>	None
April 22, 2013 10:50:43 AM	April	Expense	Debitum Post-Inventory - Asset FEB - Type: <a href="#">FEB</a> - B: <a href="#">BOL</a> - L: <a href="#">11-0025</a> <a href="#">edit</a>	Manual Entry (1)
April 22, 2013 10:50:59 AM	April	Bank	Debitum Post-Inventory - Asset FEB - Type: <a href="#">FEB</a> - B: <a href="#">BOL</a> - L: <a href="#">11-0025</a> <a href="#">edit</a>	Manual Entry (1)
April 22, 2013 10:51:09 AM	April	Expense	Debitum Post-Inventory - Asset FEB - Type: <a href="#">FEB</a> - B: <a href="#">BOL</a> - L: <a href="#">11-0025</a> <a href="#">edit</a>	Bank Check - 1
April 22, 2013 10:51:23 AM	April	Expense	Debitum Post-Inventory - Asset FEB - Type: <a href="#">FEB</a> - B: <a href="#">BOL</a> - L: <a href="#">11-0025</a> <a href="#">edit</a>	Bank
April 22, 2013 10:51:43 AM	April	Bank	Debitum Post-Inventory - Asset FEB - Type: <a href="#">FEB</a> - B: <a href="#">BOL</a> - L: <a href="#">11-0025</a> <a href="#">edit</a>	Manual Entry (1)
April 22, 2013 10:51:53 AM	April	Expense	Debitum Post-Inventory - Asset FEB - Type: <a href="#">FEB</a> - B: <a href="#">BOL</a> - L: <a href="#">11-0025</a> <a href="#">edit</a>	Bank Check - 1
April 22, 2013 10:52:03 AM	April	Expense	Debitum Post-Inventory - Asset FEB - Type: <a href="#">FEB</a> - B: <a href="#">BOL</a> - L: <a href="#">11-0025</a> <a href="#">edit</a>	Bank
April 22, 2013 10:52:13 AM	April	Bank	Debitum Post-Inventory - Asset FEB - Type: <a href="#">FEB</a> - B: <a href="#">BOL</a> - L: <a href="#">11-0025</a> <a href="#">edit</a>	Manual Entry (1)
April 22, 2013 10:52:23 AM	April	Expense	Debitum Post-Inventory - Asset FEB - Type: <a href="#">FEB</a> - B: <a href="#">BOL</a> - L: <a href="#">11-0025</a> <a href="#">edit</a>	Bank Check - 1
April 22, 2013 10:52:33 AM	April	Expense	Debitum Post-Inventory - Asset FEB - Type: <a href="#">FEB</a> - B: <a href="#">BOL</a> - L: <a href="#">11-0025</a> <a href="#">edit</a>	Bank
April 22, 2013 10:52:43 AM	April	Bank	Debitum Post-Inventory - Asset FEB - Type: <a href="#">FEB</a> - B: <a href="#">BOL</a> - L: <a href="#">11-0025</a> <a href="#">edit</a>	Manual Entry (1)
April 22, 2013 10:52:53 AM	April	Expense	Debitum Post-Inventory - Asset FEB - Type: <a href="#">FEB</a> - B: <a href="#">BOL</a> - L: <a href="#">11-0025</a> <a href="#">edit</a>	Bank Check - 1
April 22, 2013 10:53:03 AM	April	Expense	Debitum Post-Inventory - Asset FEB - Type: <a href="#">FEB</a> - B: <a href="#">BOL</a> - L: <a href="#">11-0025</a> <a href="#">edit</a>	Bank
April 22, 2013 10:53:13 AM	April	Bank	Debitum Post-Inventory - Asset FEB - Type: <a href="#">FEB</a> - B: <a href="#">BOL</a> - L: <a href="#">11-0025</a> <a href="#">edit</a>	Manual Entry (1)
April 22, 2013 10:53:23 AM	April	Expense	Debitum Post-Inventory - Asset FEB - Type: <a href="#">FEB</a> - B: <a href="#">BOL</a> - L: <a href="#">11-0025</a> <a href="#">edit</a>	Bank Check - 1
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April 22, 2013 10:53:43 AM	April	Bank	Debitum Post-Inventory - Asset FEB - Type: <a href="#">FEB</a> - B: <a href="#">BOL</a> - L: <a href="#">11-0025</a> <a href="#">edit</a>	Manual Entry (1)
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April 22, 2013 10:54:03 AM	April	Expense	Debitum Post-Inventory - Asset FEB - Type: <a href="#">FEB</a> - B: <a href="#">BOL</a> - L: <a href="#">11-0025</a> <a href="#">edit</a>	Bank
April 22, 2013 10:54:13 AM	April	Bank	Debitum Post-Inventory - Asset FEB - Type: <a href="#">FEB</a> - B: <a href="#">BOL</a> - L: <a href="#">11-0025</a> <a href="#">edit</a>	Manual Entry (1)
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April 22, 2013 10:54:43 AM	April	Bank	Debitum Post-Inventory - Asset FEB - Type: <a href="#">FEB</a> - B: <a href="#">BOL</a> - L: <a href="#">11-0025</a> <a href="#">edit</a>	Manual Entry (1)
April 22, 2013 10:54:53 AM	April	Expense	Debitum Post-Inventory - Asset FEB - Type: <a href="#">FEB</a> - B: <a href="#">BOL</a> - L: <a href="#">11-0025</a> <a href="#">edit</a>	Bank Check - 1
April 22, 2013 10:55:03 AM	April	Expense	Debitum Post-Inventory - Asset FEB - Type: <a href="#">FEB</a> - B: <a href="#">BOL</a> - L: <a href="#">11-0025</a> <a href="#">edit</a>	Bank
April 22, 2013 10:55:13 AM	April	Bank	Debitum Post-Inventory - Asset FEB - Type: <a href="#">FEB</a> - B: <a href="#">BOL</a> - L: <a href="#">11-0025</a> <a href="#">edit</a>	Manual Entry (1)
April 22, 2013 10:55:23 AM	April	Expense	Debitum Post-Inventory - Asset FEB - Type: <a href="#">FEB</a> - B: <a href="#">BOL</a> - L: <a href="#">11-0025</a> <a href="#">edit</a>	Bank Check - 1
April 22, 2013 10:55:33 AM	April	Expense	Debitum Post-Inventory - Asset FEB - Type: <a href="#">FEB</a> - B: <a href="#">BOL</a> - L: <a href="#">11-0025</a> <a href="#">edit</a>	Bank

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เอกสารไม่ควบคุม

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เอกสารไม่ควบคุม

Section Header	Content Area
Introduction	<p>This report provides a comprehensive overview of the project's objectives, scope, and methodology. It details the research process, data collection methods, and the analysis techniques used to derive the findings.</p> <p>The report is structured as follows:</p> <ul style="list-style-type: none"> <li>Introduction</li> <li>Methodology</li> <li>Results</li> <li>Discussion</li> <li>Conclusion</li> <li>References</li> <li>Appendices</li> </ul>

Section Header	Content Area
Report and Delivery Options	<p>This section outlines the various options available for the report, including different formats, languages, and delivery methods. It also provides information on the pricing and ordering process.</p> <p>Options include:</p> <ul style="list-style-type: none"> <li>PDF Report</li> <li>Printed Report</li> <li>Online Report</li> <li>Customized Report</li> </ul>

Section Header	Content Area
Product Details	<p>This section provides detailed information about the product, including its features, benefits, and specifications. It also includes a list of the product's components and a description of its intended use.</p> <p>Key features include:</p> <ul style="list-style-type: none"> <li>High performance</li> <li>Reliable operation</li> <li>Easy installation</li> <li>Low maintenance</li> </ul>

Section Header	Content Area
<div>   </div> <div> <h3>GROUP ASSIGNMENT REPORT (2024)</h3> <p>Submitted by: [Name]</p> <p>Submitted to: [Name]</p> <p>Submitted on: [Date]</p> <p>Submitted at: [Location]</p> <p>Submitted for: [Course]</p> <p>Submitted by: [Name]</p> <p>Submitted to: [Name]</p> <p>Submitted on: [Date]</p> <p>Submitted at: [Location]</p> <p>Submitted for: [Course]</p> </div>	
<div> <p>Table of Contents</p> <p>Page 1 of 1</p> </div>	

Section Header	Content Area
Abstract/Summary	<p>This section provides a brief overview of the report, highlighting the key findings and conclusions. It also includes a list of the report's components and a description of its intended use.</p> <p>Key findings include:</p> <ul style="list-style-type: none"> <li>High performance</li> <li>Reliable operation</li> <li>Easy installation</li> <li>Low maintenance</li> </ul>

Section Header	Content Area
Legal Notice	<p>This section contains the legal notice for the report, including the terms and conditions of use. It also includes a list of the report's components and a description of its intended use.</p> <p>Key findings include:</p> <ul style="list-style-type: none"> <li>High performance</li> <li>Reliable operation</li> <li>Easy installation</li> <li>Low maintenance</li> </ul>

เอกสารไม่ควบคุม

Section Header	Content Area
Table of Contents	<p>This section provides a detailed list of the report's contents, including the page numbers for each section. It also includes a list of the report's components and a description of its intended use.</p> <p>Key findings include:</p> <ul style="list-style-type: none"> <li>High performance</li> <li>Reliable operation</li> <li>Easy installation</li> <li>Low maintenance</li> </ul>

Section Header	Content Area
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เอกสารไม่ควบคุม

Section Header	Content Area
Table Summary	<p>This section provides a summary of the data presented in the report, including the key findings and conclusions. It also includes a list of the report's components and a description of its intended use.</p> <p>Key findings include:</p> <ul style="list-style-type: none"> <li>High performance</li> <li>Reliable operation</li> <li>Easy installation</li> <li>Low maintenance</li> </ul>

Section Header	Content Area
Table Details	<p>This section provides a detailed overview of the data presented in the report, including the key findings and conclusions. It also includes a list of the report's components and a description of its intended use.</p> <p>Key findings include:</p> <ul style="list-style-type: none"> <li>High performance</li> <li>Reliable operation</li> <li>Easy installation</li> <li>Low maintenance</li> </ul>

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เอกสารไม่ควบคุม

Section Header	Content Area
Table Details	<p>This section provides a detailed overview of the data presented in the report, including the key findings and conclusions. It also includes a list of the report's components and a description of its intended use.</p> <p>Key findings include:</p> <ul style="list-style-type: none"> <li>High performance</li> <li>Reliable operation</li> <li>Easy installation</li> <li>Low maintenance</li> </ul>

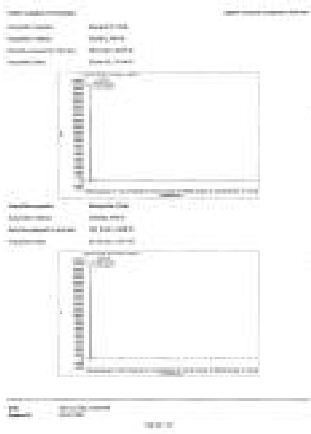
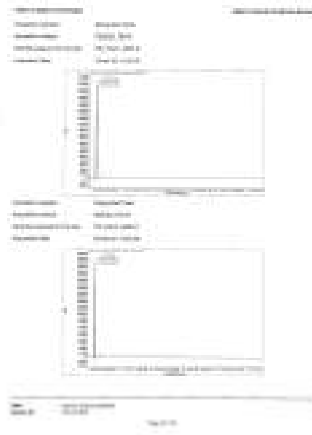
Section Header	Content Area
Table Details	<p>This section provides a detailed overview of the data presented in the report, including the key findings and conclusions. It also includes a list of the report's components and a description of its intended use.</p> <p>Key findings include:</p> <ul style="list-style-type: none"> <li>High performance</li> <li>Reliable operation</li> <li>Easy installation</li> <li>Low maintenance</li> </ul>

เอกสารไม่ควบคุม

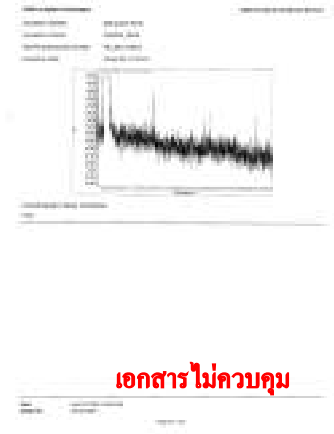








เอกสารไม่ควบคุม



เอกสารไม่ควบคุม



เอกสารไม่ควบคุม



เอกสารไม่ควบคุม

The image shows a single page from a lined notebook. The page has horizontal ruling lines and a vertical margin line on the left side. The word "Trescal" is written in a large, stylized, cursive font across the middle of the page. The handwriting is dark and appears to be done with a pen or marker. The background of the page is white, and the lines are light gray or blue.

[illegible][illegible]

The image shows a sample of a completed Form 990-EZ for the year 2002. The form is for "The School" and shows a total revenue of \$100,000 and a total expense of \$100,000, resulting in a net income of \$0. The form includes sections for revenue, expenses, and net income, with various sub-sections and line items.

เอกสารไม่ควบคุม

**Lecture 10 - The Role of the Teacher**

**Introduction**

The role of the teacher is a complex and multifaceted one. It is a role that has evolved over time and across cultures. In this lecture, we will explore the various roles that teachers play in the classroom and how these roles have changed over the years.

**The Role of the Teacher**

Teachers play a variety of roles in the classroom. Some of the most common roles include:

- Facilitator:** Teachers act as facilitators, helping students to learn and understand the material. They provide guidance and support, and they create a safe and supportive learning environment.
- Assessor:** Teachers assess student learning and provide feedback. They use a variety of assessment tools, including tests, quizzes, and assignments, to measure student progress.
- Manager:** Teachers manage the classroom and ensure that all students are engaged and on task. They establish rules and routines, and they use a variety of strategies to manage behavior.
- Collaborator:** Teachers collaborate with students and colleagues. They work with students to solve problems and learn from their mistakes. They also work with colleagues to share best practices and improve their teaching.

**Table 1: The Role of the Teacher**

Role	Description	Impact
Facilitator	Helps students learn and understand the material.	Increases student engagement and learning.
Assessor	Assesses student learning and provides feedback.	Improves student performance and learning.
Manager	Manages the classroom and ensures that all students are engaged and on task.	Creates a safe and supportive learning environment.
Collaborator	Collaborates with students and colleagues.	Improves teaching and learning outcomes.

**Table 2: The Role of the Teacher**

Role	Description	Impact
Facilitator	Helps students learn and understand the material.	Increases student engagement and learning.
Assessor	Assesses student learning and provides feedback.	Improves student performance and learning.
Manager	Manages the classroom and ensures that all students are engaged and on task.	Creates a safe and supportive learning environment.
Collaborator	Collaborates with students and colleagues.	Improves teaching and learning outcomes.

**Conclusion**

The role of the teacher is a complex and multifaceted one. It is a role that has evolved over time and across cultures. In this lecture, we have explored the various roles that teachers play in the classroom and how these roles have changed over the years. We have seen that teachers are not just teachers, but also facilitators, assessors, managers, and collaborators. They play a vital role in the lives of their students and the future of our society.

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[illegible]

Date: \_\_\_\_\_

### Question 1: Algebra (10 marks)

1. (10 marks) Solve the system of linear equations for  $x$  and  $y$  using the elimination method:

$$\begin{cases} 2x + 3y = 12 \\ x - y = 4 \end{cases}$$

2. (10 marks) Simplify the expression and solve for  $x$  if the expression equals zero:

$$x^2 - 5x + 6 = 0$$

3. (10 marks) A rectangular garden has a perimeter of 60 meters. If the length is 4 meters more than the width, find the dimensions of the garden.

4. (10 marks) Find the value of  $x$  that satisfies the equation:

$$\frac{2}{x-1} + \frac{3}{x+2} = \frac{5}{x}$$

5. (10 marks) A car starts from rest and accelerates uniformly to a speed of 60 km/h in 10 seconds. Calculate the acceleration of the car.

6. (10 marks) A ball is thrown vertically upwards from the ground with an initial velocity of 20 m/s. Calculate the maximum height reached by the ball.

7. (10 marks) A train starts from rest and accelerates uniformly to a speed of 100 km/h in 20 seconds. Calculate the distance traveled by the train during this time.

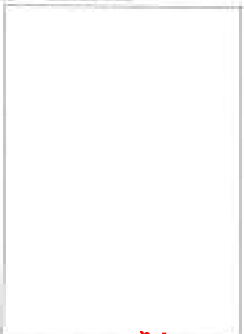
8. (10 marks) A car starts from rest and accelerates uniformly to a speed of 80 km/h in 15 seconds. Calculate the distance traveled by the car during this time.

9. (10 marks) A ball is thrown vertically upwards from the ground with an initial velocity of 15 m/s. Calculate the time taken for the ball to reach its maximum height.

10. (10 marks) A train starts from rest and accelerates uniformly to a speed of 120 km/h in 30 seconds. Calculate the distance traveled by the train during this time.

J. Smith  
 1234 Main St.  
 City, State, Zip  
 Date of Birth: 01/01/1950  
 Gender: Male  
 Medical History: Hypertension, Diabetes, Asthma  
 Signature: [Signature]  
 Date: 01/01/2000

Figure 1: A schematic diagram of a 12-lead ECG recording system. It shows a patient connected to a 12-lead ECG machine. The machine has a control panel with buttons for '12 LEAD ECG', 'PRINT', and 'STOP'. Below the control panel is a display screen showing a 12-lead ECG trace. The trace is labeled '12 LEAD ECG' and shows a standard 12-lead ECG waveform. The patient is lying on a bed, and the ECG machine is positioned next to them. The diagram is labeled 'Figure 1' at the bottom.



**เอกสารไม่ควบคุม**

**ISOLAR**  
SOLAR PANELS

**TECHNICAL SPECIFICATIONS**

Model	ISOLAR 1000W
Power (W)	1000
Voltage (V)	18
Current (A)	55.56
Dimensions (mm)	1650 x 990 x 35
Weight (kg)	12.5
Material	Monocrystalline Silicon
Efficiency (%)	20.5
Temperature Coefficient (1/°C)	-0.45
Operating Temperature (°C)	-40 to +85
Storage Temperature (°C)	-40 to +125
Humidity (%)	95
IP Rating	IP67
Warranty (Years)	10

**Output Terminals:**

- POSITIVE (+) - Red Wire
- NEGATIVE (-) - Black Wire

**ISOLAR**



Form 1: General Information and Project Details. Includes fields for Project Name, Location, and a table for Project Details.

Item	Quantity	Unit	Remarks
1	1	kg	
2	1	kg	
3	1	kg	
4	1	kg	
5	1	kg	
6	1	kg	
7	1	kg	
8	1	kg	
9	1	kg	
10	1	kg	

Form 2: Blank page for additional information or notes.

Form 3: General Information and Project Details. Includes fields for Project Name, Location, and a table for Project Details.

Item	Quantity	Unit	Remarks
1	1	kg	
2	1	kg	
3	1	kg	
4	1	kg	
5	1	kg	
6	1	kg	
7	1	kg	
8	1	kg	
9	1	kg	
10	1	kg	

Form 4: Blank page for additional information or notes.

Form 5: General Information and Project Details. Includes fields for Project Name, Location, and a table for Project Details.

Item	Quantity	Unit	Remarks
1	1	kg	
2	1	kg	
3	1	kg	
4	1	kg	
5	1	kg	
6	1	kg	
7	1	kg	
8	1	kg	
9	1	kg	
10	1	kg	

Form 6: Blank page for additional information or notes.

Form 7: General Information and Project Details. Includes fields for Project Name, Location, and a table for Project Details.

Item	Quantity	Unit	Remarks
1	1	kg	
2	1	kg	
3	1	kg	
4	1	kg	
5	1	kg	
6	1	kg	
7	1	kg	
8	1	kg	
9	1	kg	
10	1	kg	

Form 8: Blank page for additional information or notes.

Form 9: General Information and Project Details. Includes fields for Project Name, Location, and a table for Project Details.

Item	Quantity	Unit	Remarks
1	1	kg	
2	1	kg	
3	1	kg	
4	1	kg	
5	1	kg	
6	1	kg	
7	1	kg	
8	1	kg	
9	1	kg	
10	1	kg	

Form 10: Blank page for additional information or notes.

Form 11: General Information and Project Details. Includes fields for Project Name, Location, and a table for Project Details.

Item	Quantity	Unit	Remarks
1	1	kg	
2	1	kg	
3	1	kg	
4	1	kg	
5	1	kg	
6	1	kg	
7	1	kg	
8	1	kg	
9	1	kg	
10	1	kg	

Form 12: Blank page for additional information or notes.

Form 13: General Information and Project Details. Includes fields for Project Name, Location, and a table for Project Details.

Item	Quantity	Unit	Remarks
1	1	kg	
2	1	kg	
3	1	kg	
4	1	kg	
5	1	kg	
6	1	kg	
7	1	kg	
8	1	kg	
9	1	kg	
10	1	kg	

Form 14: Blank page for additional information or notes.

Form 15: General Information and Project Details. Includes fields for Project Name, Location, and a table for Project Details.

Item	Quantity	Unit	Remarks
1	1	kg	
2	1	kg	
3	1	kg	
4	1	kg	
5	1	kg	
6	1	kg	
7	1	kg	
8	1	kg	
9	1	kg	
10	1	kg	

Form 16: Blank page for additional information or notes.

## เอกสารไม่ควบคุม

## เอกสารไม่ควบคุม

## เอกสารไม่ควบคุม

## เอกสารไม่ควบคุม



## Agilent 8890 Gas Chromatograph Preventive Maintenance Checklist

Agilent Preventive Maintenance provides factory recommended service for your analytical instruments to assure reliable operation and the accuracy of your results. Delivered by highly trained and certified service engineers using genuine Agilent parts and supplies, Agilent Preventive Maintenance provides everything you need to reduce unplanned downtime and keep your systems operating at their peak. This check-out will be completed at the end of the service and provided to you as a record of the installation.

## Customer Information

- \* Customer's 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, two fees must be ordered separately and charged as a work, which may incur additional costs.

Important Customer Web Links

- For more information about **Agilent Technology** services, please visit our website using the following URL: <http://www.agilent.com/chem/products/instrumentation/services/serviceindex>
- To access **Agilent University**, visit <http://www.agilent.com/chem/edu/university/> to learn about training options, which include online, classroom and on-site delivery. A training sponsor/cost can vary directly with you to help determine your best option.
- A useful **Agilent Resource Center** web page is available, which includes short videos on maintenance, quick facts of consumables for new instruments, and other valuable information. Check out the Resource Page here: <http://www.agilent.com/chem/na/agilentresources>
- Need technical support? FAQs, supplies\* – visit our **Support Home** page <http://www.agilent.com/chem/techsupport>



## Service Engineer's Responsibilities

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

## Additional Instruction Notes

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

เอกสารไม่ควบคุม

## System Information

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

Instrument system name and ID	GC 9600
Instrument system site and location	UPE
List system component product numbers	List the serial numbers of each component
1. G 7561A	1. CNY1925A0000
2.	2.
3.	3.
4.	4.
5.	5.
6.	6.
7.	7.
8.	8.
9.	9.
10.	10.

## Preparation

- ☑ Discuss any specific issues with the customer before starting.
- ☑ Review the instrument logbook for recorded problems and comments.
- ☑ Save instrument control settings before starting the procedure.
- ☑ Perform a general inspection of the system for cleanliness.
- ☑ Check for proper installation of parts, assemblies, sensors etc.
- ☑ Check system for required installation of components, settings as defined by current Service Notes.
- ☑ Check for required firmware updates and verify with customers if they would like them installed.
- ☑ Before starting the following procedures, record the Detector Signal Output(s) in the results table. If the GC is turned OFF or in a service mode, containing the detector outputs before and after the service is not possible.

เอกสารไม่ควบคุม

## PM Procedure

### Clean and inspect GC

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

### Inlet and detector consumable replacement

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

### Zero Sensors and Leak test

- ☑ Zero all pressure sensors using the Touchscreen User Interface.
- ☑ Perform inlet pressure decay test(s) from the diagnostics screen on either the Touchscreen or Browser User Interface. Record if test passed or failed in the results table.
- ☑ Note: If the PM is done in preparation for an Operational Qualification, then the pressure decay test defined within that protocol can be used for the PM.

เอกสารไม่ควบคุม

## ALS/Maintenance

- ☑ Section NOT applicable
- ☑ Check all cabling and configuration settings between GC, Inlet, and Injectors.
- ☑ Vacuum or remove any dust, especially around fans.
- ☑ Check operation of all fans.
- ☑ Check syringe for smooth plunger operation.
- ☑ Check for smooth operation of the needle support - clean if necessary.

### Restore instrument

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

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

## Service Review

- ☑ Attach available reports/photos 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 this change in the Service Engineer's Comments box or if necessary, in the customer's IG records.
- ☑ Please ask the customer if they would like to have Smart Alerts installed on their computer.

เอกสารไม่ควบคุม

Test description	Before PM Service	After PM Service
Front detector output	$N / \beta$	$N / \beta$
Rear detector output	$N / \beta$	$N / \beta$
AUX 1 detector output	$N / \beta$	$N / \beta$
AUX 2 detector output	$N / \beta$	$N / \beta$
Test description	Expected test result	Actual test result
Leak and Restriction Test after front inlet reconnection	Pass	
Leak and Restriction Test after back inlet reconnection	Pass	$N / \beta$
Leak and Restriction Test after front inlet Split Vent Trap installation	Pass	
Leak and Restriction Test after back inlet Split Vent Trap installation	Pass	$N / \beta$
Front inlet pressure decay test	Pass	
Back inlet pressure decay test	Pass	$N / \beta$

*Note:* The following kits are recommended for capillary and purge/probed leaks. If this is a general PM and the customer has a dedicated set of consumables, you may use the customer's consumables.

Part description	Part number	Product or model where used	Quantity assembled
SS2, Capillary Inlet PM Inlet, Splitless	5188-0487	8890 GC	1
SS2, Capillary Inlet PM Inlet, Split	5188-0486	8890 GC	1
SS2, Capillary Ultra Inert Inlet Gold Seal with Washer	5193-0144	8890 GC	—
SS2, Capillary Ultra Inert Inlet Splitless Liner - Single Inlet with Glass Inlet	5149-2263	8890 GC	—
SS2, Capillary Ultra Inert Inlet Low Pressure Drop Split Liner - with Glass Inlet	5106-2268	8890 GC	—

## เอกสารไม่ควบคุม

Part description	Part number	Product or model where used	Quantity consumed
200 Watt PM Kit	5180-6430	8890 GC	--
Split vent trap PM kit, single cartridge (for 100L, PTV & XL)	5180-6435	8890 GC	--
NMI Cleaning Kit	03319-05833	8890 GC	--
PTV Septumless Head Rebuild Kit	5182-0747	8890 GC	--
PTV Septumless Head Teflon Guide	5182-0748	8890 GC	--
Ignitor (glow plug) assembly with O-ring	18233-80882	8890 GC	--
ED Collector Rebuild/Cleaning Kit	01521-07806	8890 GC	--
ED Collector Replacement Kit	01521-07801	8890 GC	--
Standard OTC Jack, 100 Lbs	04981-00018	8890 GC	--

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

Device request number 1805300152 Date service completed 12 Jun 2018  
Agent signature Adrian E. Customer signature \_\_\_\_\_  
Total number of pages in this document 7

## เอกสารไม่ควบคุม

This page is only relevant for Agilent source documents for document control purposes and is NOT intended for customer viewing. Refer to the ERM checklist Auditing Guide for more information.

#### Revision Log

Revision	Date	Reason for update
Add revision number of document here	Date of issuance	Author to describe main features/changes made for this specific revision
1.00	00-Jan-2019	Initial Release

## Approval Logo

Revision	Approver	Title of approver
Add revision number	Add approver name here	Add approver's function or title here
1.01	Sanjetha Toppireddy	CC and CCMS Product Support Manager

## เอกสารไม่ควบคุม

## Agilent GC/MS Preventive Maintenance Checklist

Agilent Preventive Maintenance provides factory recommended service for your analytical systems to ensure 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.

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

- |  |         |
|--|---------|
| <input type="checkbox"/> Indirect Periodic Maintenance | 5 weeks |
| <input type="checkbox"/> Major Periodic Maintenance    | Four    |

**This checklist covers the following model(s):**

Type	Model
SO	WFS Series MS0
SO	WFS Series MS2
SO	WFS Series MS3
TS	7000 Series MS1-100
TS	7010 Series MS1-100
STP	7000 Series STP0
STP	7000 Series STP0

Definition of the Task/Recommended items within the document

Task		Recommended			
Yes	No	Interim/Aspx/No needed			
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Yes selected means that the task was done or the part was required.
<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	No selected means that the task was not done or the part was required.
<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Means that this task is recommended to be done <b>at 5-month</b> intervals.
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Means that this task is recommended to be done <b>yearly</b> , if the customer would like a service to be done at the 5-month interval that the service could be purchased.
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	An <b>as needed</b> means that the task was done or the part was used as needed. Could be less than 50 times could be used and fly was the one which was selected.

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

## เอกสารไม่ควบคุม



## Agilent GC/MS Preventive Maintenance Checklist

### 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 listed in the Parts table section of this document are not included in the scope of this service.
- If a system requires the use of additional or special procedures and/or parts for the instrument service, these items must be ordered separately and charged as a repair, which may incur additional costs.

### Service Engineer Responsibilities

- Print out all pages of the document and complete sections that relate to the system being installed.
- Complete empty fields with the relevant information.
- Complete the relevant checkboxes in the checklist using X or tick mark ✓ in the checkboxes.
- Check the Not Applicable check boxes or specify N/A (where appropriate) to indicate optional services not delivered.
- Complete the Service Review and Service Completion sections together with the customer.

### Additional Instruction Notes

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

Issued: 14 Feb 2018  
Rev: 0.01.00

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## Agilent GC/MS Preventive Maintenance Checklist

### System Information

System Name and ID	System Site and Location
MSB 54775	U-41

### System Components

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

List system component product numbers	List the serial numbers of each component
1. G 74730	1. MS10007533
2.	2.
3.	3.
4.	4.
5.	5.
6.	6.
7.	7.
8.	8.
9.	9.
10.	10.

### Preparation

- Discuss any specific issues with the customer prior to starting.
- Review the instrument logbook.
- Save instrument control settings before starting the procedure.
- Perform general inspection of system for cleanliness.
- Check for proper installation of safety-related parts, assemblies, sensors etc.
- Check for required firmware updates and verify with customer if they would like it installed.

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Rev: 0.01.00

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## Agilent GC/MS Preventive Maintenance Checklist

### Preventive Maintenance for MSs

#### Customer Responsibilities

Customers should ensure that all necessary operating supplies, consumables and image dependent items such as gases, fluids, reagents, calibration reference and solvents required for the successful preventive maintenance are available. A customer representative should be available while the preventive maintenance procedure is being performed.

#### Important notice for customers

The customer should complete the following before the Support Provider arrives on site:  
☒ Perform on-site and review the printed base report just prior to the start of the PM to verify performance of the equipment.

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

Issued: 14 Feb 2018  
Rev: 0.01.00

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## Agilent GC/MS Preventive Maintenance Checklist

### Parts – Included and as needed as part of the preventive maintenance

#### Common MS Maintenance Supplies

Yes/No	Interim/Major/As needed	Description	Part number
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Aluminum paper, 30 um	1001-1006
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Aluminum powder	00191021
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Clarks, clean (package of 11)	0000-0001
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Cotton, cleaning (package of 30)	001-0005
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Cotton swabs (package of 100)	1000-1000
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Gloves, clean, large	100-0000
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Gloves, clean, small	000-0000
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Station, Agilent L, high vacuum	1042-1000

#### Common MS Filters and Seals – 8870/8875/8877/8880/8881/8886/8888 Series

Yes/No	Interim/Major/As needed	Description	Part number
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Injection gas filter – if required	0010-1001
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Transfer gas filter – if required	0010-1002
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Flow detector, 5 um, 1/8 in. Swagelok – if required	0010-1003
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Gas Station Carrier Gas Kit for 8870 for Nitrogen or Helium (includes Manual and Filter) – if required	2711000
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Gas Station Filter kit 001-MS 1/8 in. Swagelok – if required	2710000
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Gas Station 001-MS Filter – if required	2710001
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Chemical Injection Gas Purifier (2 systems) – if required	1100-1001
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Transfer Pump, 0.1, 1000 ml	1042-1000

#### MS Maintenance Supplies for 8870/8875/8877

Yes/No	Interim/Major/As needed	Description	Part number
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Injection pump (with Station Pump Mount)	1001-1001, 1001-1002
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	GC/MS, 1/8 in. Swagelok (1/8 in. Swagelok)	1001-1001
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	GC/MS, 1/8 in. Swagelok (1/8 in. Swagelok)	1001-1001
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	GC/MS, 1/8 in. Swagelok (1/8 in. Swagelok)	1001-1001

#### MS Maintenance Supplies for 7000/7200

Yes/No	Interim/Major/As needed	Description	Part number
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Injection gas filter	0010-1001
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	GC/MS, 1/8 in. Swagelok	1001-1001

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MS Maintenance Supplies for 7200/7204

Yes/No	Interval	Major/As needed	Description	Part number
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Sample gas filter	9500-0002
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	MS Pump Maintenance Kit (7200 Series only)	9500-0010
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	MS Pump Maintenance Kit (7204 Series only)	9500-0011
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	MS Pump Maintenance Kit (7200/7204 Series)	9500-0012
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	MS Pump Maintenance Kit (7200/7204 Series)	9500-0013
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	MS Pump Maintenance Kit (7200/7204 Series)	9500-0014

MS Maintenance Supplies for 7200/7204

Yes/No	Interval	Major/As needed	Description	Part number
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	MS Pump Maintenance Kit (7200 Series only)	9500-0010
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	MS Pump Maintenance Kit (7204 Series only)	9500-0011

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Parts – Needs be purchased if found defective or worn out

Common MSD Maintenance Supplies 8071/8075/8077/8090/8091/7200/7204

Yes/No	Interval	Major/As needed	Description	Part number
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	MS Pump Maintenance Kit (7200 Series only)	9500-0010
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	MS Pump Maintenance Kit (7204 Series only)	9500-0011
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	MS Pump Maintenance Kit (7200/7204 Series)	9500-0012
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	MS Pump Maintenance Kit (7200/7204 Series)	9500-0013
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	MS Pump Maintenance Kit (7200/7204 Series)	9500-0014

MS Maintenance Supplies for 8071/8075/8077

Yes/No	Interval	Major/As needed	Description	Part number
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	MS Pump Maintenance Kit (7200 Series only)	9500-0010
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	MS Pump Maintenance Kit (7204 Series only)	9500-0011
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	MS Pump Maintenance Kit (7200/7204 Series)	9500-0012
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	MS Pump Maintenance Kit (7200/7204 Series)	9500-0013
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	MS Pump Maintenance Kit (7200/7204 Series)	9500-0014

MS Maintenance Supplies for 7200/7204

Yes/No	Interval	Major/As needed	Description	Part number
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	MS Pump Maintenance Kit (7200 Series only)	9500-0010
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	MS Pump Maintenance Kit (7204 Series only)	9500-0011
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	MS Pump Maintenance Kit (7200/7204 Series)	9500-0012
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	MS Pump Maintenance Kit (7200/7204 Series)	9500-0013
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	MS Pump Maintenance Kit (7200/7204 Series)	9500-0014

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MS Maintenance Supplies for 7200

Yes/No	Interval	Major/As needed	Description	Part number
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	MS Pump Maintenance Kit (7200 Series only)	9500-0010
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	MS Pump Maintenance Kit (7204 Series only)	9500-0011
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	MS Pump Maintenance Kit (7200/7204 Series)	9500-0012
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	MS Pump Maintenance Kit (7200/7204 Series)	9500-0013
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	MS Pump Maintenance Kit (7200/7204 Series)	9500-0014

MS Maintenance Supplies for 7200

Yes/No	Interval	Major/As needed	Description	Part number
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	MS Pump Maintenance Kit (7200 Series only)	9500-0010
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	MS Pump Maintenance Kit (7204 Series only)	9500-0011
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	MS Pump Maintenance Kit (7200/7204 Series)	9500-0012
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	MS Pump Maintenance Kit (7200/7204 Series)	9500-0013
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	MS Pump Maintenance Kit (7200/7204 Series)	9500-0014

MS Maintenance Supplies for future 9000 MS Systems

Yes/No	Interval	Major/As needed	Description	Part number
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	MS Pump Maintenance Kit (7200 Series only)	9500-0010
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	MS Pump Maintenance Kit (7204 Series only)	9500-0011

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Agilent GC/MS Preventive Maintenance Checklist

Preventive Maintenance Checklist:

Yes/No	Interval	Major/As needed	Description
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Perform general inspection of system for cleanliness.
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Inspect and replace the calibration gas, if found with the instrument.
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Review customer maintenance records and evaluate maintenance on recently serviced items.
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Review the most recent software reports. This will give a starting point for evaluating spectral peaks, baseline noise, peak shape, mass assignments and resolution.

Yes/No	Interval	Major/As needed	Description
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Record instrument serial no. <u>G 70775</u>
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Record instrument serial no. <u>1152000003</u>
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Record Pump Vacuum <u>---</u>
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Record Mass Filter Vacuum <u>---</u>
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Type of Column installed <u>DB-5, 60m</u>

Yes/No	Interval	Major/As needed	Description
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Check manually that you have calibration points.
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Verify the instrument.
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Inspect instrument, pump, solvent inlet and power supply for excessive noise.
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Visually inspect the calibration results – PTRMS, PRTD (if applicable), RM (if applicable), RM (if applicable).
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Look for any obvious spectral changes or problems.
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Check the instrument. Consider (event) may need to be reviewed.
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Verify system line voltage meets instrument specifications. Yes <input type="checkbox"/> No <input type="checkbox"/>

Yes/No	Interval	Major/As needed	Description
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Check for evidence of oil leakage. Check pump seals for leakage.
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Check and replace solvent pump oil.
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Replace Oil filter if applicable.
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Discuss with customer the need for more frequent oil changes if the oil is dirty.
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Demolish the filter, if requested.
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Anti-static test.

Yes/No	Interval	Major/As needed	Description
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Check for evidence of poor vacuum – Turbomolecular Pump, poor manifold vacuum, etc.
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	If necessary, replace the manifold pump.
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Anti-static test.

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