ภาคผนวก ฌ
เอกสารสอบเทียบเครื่องมือ

List of Instruments Certification for Air & Noise Quality Analysis

No.	Instrument/Equipment	Parameter	Manufacturer	Model/Serial No.	Calibrator	Certification No.	Date of Calibration	Due date of Calibration	Remark
Ambient									
1	Orifice Transfer Standard Calibrator	Total Suspended Particulate (TSP) Particulate Matter < 10 µm (PM_{10})	Tisch Environmental,Inc.	TE-5025A 3393	Jiranatee Associates Co., Ltd.	CL-004-65	26 Jul 22	25 Jul 24	-
2	Orifice Transfer Standard Calibrator	Total Suspended Particulate (TSP) Particulate Matter < 10 µm (PM_{10})	Tisch Environmental,Inc.	TE-5025A 3383	Jiranatee Associates Co., Ltd.	CL-003-65	26 Jul 22	25 Jul 24	-
3	U-Tube Manometer	Total Suspended Particulate (TSP) Particulate Matter < 10 µm (PM_{10})	Dwyer	1221-36-W/M -	Technology Promotion Association (Thailand-Japan)	23P1401	9 May 23	8 May 24	-
4	Air Flow Meter	Particular Matter ($PM_{2.5}$)	Mesa Labs	DeltaCal DC1 163268	Innovative Instrument Co.,Ltd.	22-AFM-172	31 Oct 22	30 Oct 23	-
5	Air Flow Meter	Particular Matter ($PM_{2.5}$)	Mesa Labs	DeltaCal DC1 160491	Innovative Instrument Co.,Ltd.	23-AFM-204	27-Sep-23	26-Sep-24	-
6	Aneroid Barometer	Total Suspended Particulate (TSP) Particulate Matter < 10 µm (PM_{10}) Particular Matter ($PM_{2.5}$) Hydrogen Chloride Mercury Cadmium Lead	Barigo, Germany	-	Technology Promotion Association (Thailand-Japan)	23P1858	2 Jun 23	1 Jun 24	-
7	Dial Thermo-Hygrometer	Total Suspended Particulate (TSP) Particulate Matter < 10 µm (PM_{10}) Particular Matter ($PM_{2.5}$) Hydrogen Chloride Mercury Cadmium Lead	Barigo, Germany	-	Technology Promotion Association (Thailand-Japan)	23H1200	6 Jun 23	5 Jun 24	-

List of Instruments Certification for Air & Noise Quality Analysis

No.	Instrument/Equipment	Parameter	Manufacturer	Model/Serial No.	Calibrator	Certification No.	Date of Calibration	Due date of Calibration	Remark
Ambient									
8	Sound Level Calibrator (Acoustic Calibrator)	Calibrate Sound Level Meter	Larson Davis	CAL150 6457	Innovative Instrument Co.,Ltd.	23-ACT-064	12 May 23	11 May 24	-
9	Sound Level Meter	$L_{Aeq\ 24\ hours}$, L_{Amax}, L_{A90}, L_{Adn}	Larson Davis	LxT2 0005286	Sithiporn Associates Co., Ltd.	23-SLM-227	28 Jun 23	27 Jun 24	-
10	Sound Level Meter	$L_{Aeq\ 24\ hours}$, L_{Amax}, L_{A90}, L_{Adn}	Larson Davis	LxT2 0005344	Innovative Instrument Co.,Ltd.	22-ACT-248	1 Apr 22	31 Mar 24	-
11	Sound Level Meter	$L_{Aeq\ 24\ hours}$, L_{Amax}, L_{A90}, L_{Adn}	Larson Davis	LxT2 0005289	Sithiporn Associates Co., Ltd.	ACL22082	28 Jun 22	27 Jun 24	-
12	Sound Level Meter	$L_{Aeq\ 24\ hours}$, L_{Amax}, L_{A90}, L_{Adn}	Larson Davis	LxT2 0005394	Innovative Instrument Co.,Ltd.	22-ACT-034	21 Jan 22	20 Jan 24	-
13	Sound Level Meter	$L_{Aeq\ 24\ hours}$, L_{Amax}, L_{A90}, L_{Adn}	Larson Davis	LxT2 0005304	Innovative Instrument Co.,Ltd.	22-ACT-249	1 Apr 22	31 Mar 24	-
14	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 24	-
15	Sound Level Meter	$L_{Aeq\ 24\ hours}$, L_{Amax}, L_{A90}, L_{Adn}	Larson Davis	LxT2 0005396	Innovative Instrument Co.,Ltd.	22-ACT-105	11 Feb 22	10 Feb 24	-
16	Sound Level Meter	$L_{Aeq\ 24\ hours}$, L_{Amax}, L_{A90}, L_{Adn}	Larson Davis	LxT2 0006692	Larson Davis-A PCB Piezotronics Div.	2022003094	11 Mar 22	10 Mar 24	-
17	Sound Level Meter	$L_{Aeq\ 24\ hours}$, L_{Amax}, L_{A90}, L_{Adn}	Larson Davis	LxT2 5400	Innovative Instrument Co.,Ltd.	22-ACT-036	21-Jan-22	20-Jan-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									
18	Sound Level Meter	$L_{Aeq\ 24\ hours}$, L_{Amax}, L_{A90}, L_{Adn}	Larson Davis	LxT2 0006693	Larson Davis-A PCB Piezotronics Div.	2022002973	9 Mar 22	8 Mar 24	-
19	Sound Level Meter	$L_{Aeq\ 24\ hours}$, L_{Amax}, L_{A90}, L_{Adn}	Larson Davis	LxT2 0006694	Larson Davis-A PCB Piezotronics Div.	2022003098	11 Mar 22	10 Mar 24	-
20	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	21 Jan 24	-
21	Sound Level Meter	$L_{Aeq\ 24\ hours}$, L_{Amax}, L_{A90}, L_{Adn}	Larson Davis	LxT2 0006695	Larson Davis-A PCB Piezotronics Div.	2022003099	11 Mar 22	10 Mar 24	-
22	Sound Level Meter	$L_{Aeq\ 24\ hours}$, L_{Amax}, L_{A90}, L_{Adn}	Larson Davis	LxT2 5402	Innovative Instrument Co.,Ltd.	22-ACT-103	11-Feb-22	10-Feb-24	-
23	Sound Level Meter	$L_{Aeq\ 24\ hours}$, L_{Amax}, L_{A90}, L_{Adn}	Larson Davis	LxT2 5405	Innovative Instrument Co.,Ltd.	22-ACT-101	11-Feb-22	10-Feb-24	-
24	Sound Level Meter	$L_{Aeq\ 24\ hours}$, L_{Amax}, L_{A90}, L_{Adn}	Larson Davis	LxT2 5407	Innovative Instrument Co.,Ltd.	22-ACT-037	21-Jan-22	20-Jan-24	-
25	Vibration Meter	Vibration Level Acceleration Level	Instantel Inc.	Micromate UM11229	Calibration Laboratory Co.Ltd	Q22097008	23 Sep 22	22 Sep 23	-
26	Vibration Meter	Vibration Level Acceleration Level	Instantel Inc.	Micromate UM11230	Calibration Laboratory Co.Ltd hj	Q22086863	30 Aug 22	29 Aug 23	-
27	Vibration Meter	Vibration Level Acceleration Level	Instantel Inc.	Micromate UM11055	Calibration Laboratory Co.Ltd	Q23022491	1-Mar-23	28-Feb-24	-
28	Vibration Meter	Vibration Level Acceleration Level	Instantel Inc.	Micromate UM11355	Calibration Laboratory Co.Ltd	Q23019604	22 Feb 23	21 Feb 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									
29	Vibration Meter	Vibration Level Acceleration Level	Instantel Inc.	Micromate UM14106	Calibration Laboratory Co.Ltd	Q23019603	22-Feb-23	21-Feb-24	-
30	Vibration Meter	Vibration Level Acceleration Level	Instantel Inc.	Micromate UM11356	Calibration Laboratory Co.Ltd	Q22097248	23 Sep 22	22 Sep 23	-
31	Vibration Meter	Vibration Level Acceleration Level	Instantel Inc.	Micromate UM14105	Calibration Laboratory Co.Ltd	Q23022490	1-Mar-23	28-Feb-24	-
32	Vibration Meter	Vibration Level Acceleration Level	Instantel Inc.	Micromate UM12393	Calibration Laboratory Co.Ltd	Q23019601	22 Feb 23	21 Feb 24	-
33	Vibration Meter	Vibration Level Acceleration Level	Instantel Inc.	Micromate UM12394	Calibration Laboratory Co.Ltd	Q23015866	13 Feb 23	12 Feb 24	-
34	Vibration Meter	Vibration Level Acceleration Level	Instantel Inc.	Micromate UM12395	Calibration Laboratory Co.Ltd	Q23022495	1 Mar 23	28 Feb 24	-
35	Vibration Meter	Vibration Level Acceleration Level	Instantel Inc.	Micromate UM12888	Calibration Laboratory Co.Ltd	Q23022492	1 Mar 23	28 Feb 24	-
36	Vibration Meter	Vibration Level Acceleration Level	Instantel Inc.	Micromate UM12865	Calibration Laboratory Co.Ltd	Q22086865	30 Aug 22	29 Aug 23	-
37	Vibration Meter	Vibration Level Acceleration Level	Instantel Inc.	Micromate UM14547	Calibration Laboratory Co.Ltd	Q23012458	8 Feb 23	7 Feb 24	-
38	Vibration Meter	Vibration Level Acceleration Level	Instantel Inc.	Micromate UM12866	Calibration Laboratory Co.Ltd	Q22097011	23 Sep 22	22 Sep 23	-
39	Vibration Meter	Vibration Level Acceleration Level	Instantel Inc.	Micromate UM12867	Calibration Laboratory Co.Ltd	Q22064051	27 Jun 22	26 Jun 23	-
40	Vibration Meter	Vibration Level Acceleration Level	Instantel Inc.	Micromate UM11059	Calibration Laboratory Co.Ltd	Q23019602	22 Feb 23	21 Feb 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									
41	Vibration Meter	Vibration Level Acceleration Level	Instantel Inc.	Micromate UM12889	Calibration Laboratory Co.Ltd	Q22053609	31 May 22	30 May 23	-
42	Vibration Meter	Vibration Level Acceleration Level	Instantel Inc.	Micromate UM14466	Calibration Laboratory Co.Ltd	Q23019600	22 Feb 23	21 Feb 24	-
43	Vibration Meter	Vibration Level Acceleration Level	Instantel Inc.	Micromate UM12890	Calibration Laboratory Co.Ltd	Q22053608	31 May 22	30 May 23	-
44	Vibration Meter	Vibration Level Acceleration Level	Instantel Inc.	Micromate UM14468	Calibration Laboratory Co.Ltd	Q23015869	13 Feb 23	12 Feb 24	-
45	Vibration Meter	Vibration Level Acceleration Level	Instantel Inc.	Micromate UM12891	Calibration Laboratory Co.Ltd	Q22097007	23 Sep 22	22 Sep 23	-
46	Vibration Meter	Vibration Level Acceleration Level	Instantel Inc.	Micromate UM11057	Calibration Laboratory Co.Ltd	Q23022494	28 Feb 23	27 Feb 24	-
47	Vibration Meter	Vibration Level Acceleration Level	Instantel Inc.	Micromate UM13368	Calibration Laboratory Co.Ltd	Q23015868	13-Feb-23	12-Feb-24	-
48	Vibration Meter	Vibration Level Acceleration Level	Instantel Inc.	Micromate UM11056	Calibration Laboratory Co.Ltd	Q23015867	12-Feb-23	11-Feb-24	-
49	Vibration Meter	Vibration Level Acceleration Level	Instantel Inc.	Micromate UM11058	Calibration Laboratory Co.Ltd	Q23022493	1 Mar 23	28 Feb 24	-

CERTIFICATE OF CALIBRATION

เอกสารไม่ควบคุม

CERTIFICATE OF CALIBRATION

เอกสารไม่ควบคุม

เอกสารไม่ควบคุม

เอกสารไม่ควบคุม

Certificate of Calibration

เอกสารไม่ควบคุม

เอกสารไม่ควบคุม

เอกสารไม่ควบคุม

เอกสารไม่ควบคุม

Certificate of Calibration

เอกสารไม่ควบคุม

เอกสารไม่ควบคุม

Certificate of Calibration

เอกสารไม่ควบคุม

เอกสารไม่ควบคุม

Certificate of Calibration

เอกสารไม่ควบคุม

เอกสารไม่ควบคุม

Certificate of Calibration

เอกสารไม่ควบคุม

เอกสารไม่ควบคุม

Certificate of Calibration

Certificate No. :
Page : 1 of 2

Equipment :
Manufacturer : Fluke
Model :
Serial No. :
ID No. :
Condition on Receive :
Received Date :
Calibration Date :
Reference :
Ambient Temperature :
Relative Humidity :

Submitted by :

Procedure used :

Traceable to the stated calibration :

Instrument	Model	Serial No.	Certificate No.	Cal. Date

Calibrated by :
Issue Date :

Approved Signatory :
(Chanin Wisetsomsa)
(Wirakarn Vanichakit)
(Supon Vanichakit)

เอกสารไม่ควบคุม

Cert. No.
Page : 1 of 2

Result of Calibration :
Function :

Reference Temperature	Standard Humidity	UUC* Reading	Error	Uncertainty of Measurement

Result of Calibration :
Function :

Reference Temperature	Standard Humidity	UUC* Reading	Error	Uncertainty of Measurement

Result of Calibration :
Function :

Reference Temperature	UUC* Reading	Error	Uncertainty of Measurement

*UUC : Unit Under Calibration

The reported uncertainty of measurement was stated as combined uncertainty multiplied by coverage factor k = 2.00, providing a confidence level of approximately 95%.

-end-

เอกสารไม่ควบคุม

Certificate of Calibration

Customer :

Issued :
Address :

Unit Under Calibration Details :
Manufacturer :
Model :
Serial Number :
ID :

Calibration Environment and Details :
Temperature :
Humidity :
Barometric Pressure :
Received Date :
Calibration Date :
Location of Calibration :
Calibration Procedure :

Reference Standard	Model	Serial Number	Traceable	Due Calibration

Traceability :

Note :

Calibrated By :
( )
Technical Officer

Approved By :
( )
Technical Manager

Issue Date :

เอกสารไม่ควบคุม

Certificate No. :
Request No. :

Calibration Results :

Calibration Range	Without Adjustment (AB)		Adjustment (AB)		Uncertainty	Acceptance limit
	Measured	Error	Measured	Error		

Frequency of Sound pressure level :

Calibration Range	Without Adjustment		Adjustment		Uncertainty	Acceptance limit
	Measured (dB)	Range (%)	Measured (dB)	Result (%)		

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

Calibration Range	Without Adjustment	Adjustment	Uncertainty	Acceptance limit
	Measured (%)	Measured (%)		

Note :

End of Calibration

เอกสารไม่ควบคุม

เอกสารไม่ควบคุม
เอกสารไม่ควบคุม
เอกสารไม่ควบคุม
เอกสารไม่ควบคุม

เอกสารไม่ควบคุม

เอกสารไม่ควบคุม

เอกสารไม่ควบคุม

เอกสารไม่ควบคุม

เอกสารไม่ควบคุม
เอกสารไม่ควบคุม
เอกสารไม่ควบคุม
เอกสารไม่ควบคุม

SITHIPORN ASSOCIATES CO.,LTD.
CALIBRATION LABORATORY

(1) 417/7 Lumlom Rd. Bangkapi, Bangkok Bangkok 10240 Tel 0-2600-6140,
Fax 0-2600-6139 E-mail: sales@sithiporn.com http://www.sithiporn.com

Cert. No. : AC1-2202
Page : 1 of 3

Calibration Certificate

Equipment : SOUND LEVEL METER
Manufacturer : CASELLA (UK) LTD.
Model : 1-CEL-Microphone 2239A2 / Preamplifier MV261 + CEL
Serial No. : 3006258 / 3117112 / 3006258
ID No. : -

Condition As Found : GOOD

Customer : [illegible]

Location :
Ambient Temperature : (23.0 ± 2) °C
Pressure : (101.3 ± 2) kPa
Relative Humidity : (50.0 ± 20) %

Received Date : 18 APRIL 2022
Calibration Date : 20 APRIL 2022
Date of Issue : 20 APRIL 2022

Calibrated by : Sathaporn Pongsawat

Approved by : (Thanakrit Pitchaya)

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

เอกสารไม่ควบคุม

SITHIPORN ASSOCIATES CO.,LTD.
CALIBRATION LABORATORY

Continuation of Calibration Certificate

Cert. No. : AC1-2202
Job No. : 1105/61
Page : 2 of 3

Calibration Procedure : CP-AC-02

Calibration Method :
The equipment was calibrated by based on IEC 61672-3 (2013) Standard for sound level meter Class 1.
The CLH tool was a Acoustical and Electrical signal tests of Frequency weighting, Time Weighting, Overload and Reference Sensitivity Measurements.
For any results of calibration were made by comparison of UUT to reference standard and was traceable to [illegible].

Condition of the result of calibration :
1. Reference Standard Instruments :

Instrument	Model	Serial No.	Cert. No.	Due Date
Sound Level Calibrator	[illegible]	[illegible]	[illegible]	[illegible]
Sound Level Calibrator	[illegible]	[illegible]	[illegible]	[illegible]
Digital Multimeter	[illegible]	[illegible]	[illegible]	[illegible]
Digital Multimeter	[illegible]	[illegible]	[illegible]	[illegible]
Digital Multimeter	[illegible]	[illegible]	[illegible]	[illegible]
Programmable Attenuator	[illegible]	[illegible]	[illegible]	[illegible]
Condenser Microphone	[illegible]	[illegible]	[illegible]	[illegible]
Measuring Amplifier	[illegible]	[illegible]	[illegible]	[illegible]

2. The result of calibration was found accurate as shown in the acceptance of calibration for this laboratory only.
3. This certificate is traceable to the international system of unit standards of
3.1 National Institute of Metrology (Thailand)
3.2 National Institute of Scientific and Technological Research (NISTR)

เอกสารไม่ควบคุม

SITHIPORN ASSOCIATES CO.,LTD.
CALIBRATION LABORATORY

Continuation of Calibration Certificate

Cert. No. : AC1-2202
Job No. : 1105/61
Page : 3 of 3

Summary of Measurement Result :

Parameter	Pass	Fail	Uncertainty (dB)	Maximum permitted uncertainty of measurement (dB)
1. Absolute sensitivity	✓	-	0.2	N/A
2. Self-generated noise	✓	-	0.2	N/A
3. Acoustical signal test of frequency weightings				
125 Hz	✓	-	0.3	0.8
1000 Hz	✓	-	0.3	0.8
8000 Hz	✓	-	0.3	0.8
4. Electrical signal tests of frequency weightings				
For 31.5 Hz to +8 kHz	✓	-	0.3	0.8
For +8 kHz to 16 kHz	✓	-	0.3	0.8
For > 16 kHz to 20 kHz	✓	-	0.3	0.8
5. Frequency and time weightings at 1 kHz	✓	-	0.3	0.8
6. Long - term stability	✓	-	0.3	0.8
7. Level linearity on the reference level range	✓	-	0.3	0.8
8. Level linearity including the level range control	✓	-	0.3	0.8
9. Time weightings	✓	-	0.0	0.8
10. Peak C sound level	✓	-	0.0	0.71
11. Overload indication	✓	-	0.0	0.71
12. High level stability	✓	-	0.3	0.8

เอกสารไม่ควบคุม

SITHIPORN ASSOCIATES CO.,LTD.
CALIBRATION LABORATORY

Continuation of Calibration Certificate

Cert. No. : AC1-2202
Job No. : 1105/61
Page : 4 of 3

Result of calibration :

1. Absolute sensitivity

Reference Acoustic Signal (dB)	Measured Value (dB)	Deviation (dB)	Acceptance Limit (dB)
[illegible]	[illegible]	[illegible]	[illegible]

2. Self-generated noise

2.1 Normal use

Frequency Weighting	Measured value (dB)
[illegible]	[illegible]

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

Frequency Weighting	Measured value (dB)
A - weight	19.6
C - weight	19.1
Flat	19.6

3. Acoustical signal test at frequency weightings

Meter first field periodic response at a level of 94 dB

Frequency (Hz)	Deviation from nominal frequency weighting response given (dB)			
	Flat	C weight	A weight	Acceptance Limits
125	0.1	0.2	0.2	± 1.5
1000	-0.1	-0.1	0.2	± 1.5
8000	1.6	1.6	1.4	± 3.5

เอกสารไม่ควบคุม

เอกสารไม่ควบคุม

SITHIPORN SITHIPORN ASSOCIATES CO.,LTD.
CALIBRATION LABORATORY
Continuation of Calibration Certificate

เอกสารไม่ควบคุม

SITHIPORN SITHIPORN ASSOCIATES CO.,LTD.
CALIBRATION LABORATORY
Continuation of Calibration Certificate

เอกสารไม่ควบคุม

SITHIPORN SITHIPORN ASSOCIATES CO.,LTD.
CALIBRATION LABORATORY
Continuation of Calibration Certificate

เอกสารไม่ควบคุม

เอกสารไม่ควบคุม

เอกสารไม่ควบคุม

เอกสารไม่ควบคุม

เอกสารไม่ควบคุม

เอกสารไม่ควบคุม

เอกสารไม่ควบคุม

เอกสารไม่ควบคุม

เอกสารไม่ควบคุม

เอกสารไม่ควบคุม
เอกสารไม่ควบคุม
เอกสารไม่ควบคุม
เอกสารไม่ควบคุม

เอกสารไม่ควบคุม
เอกสารไม่ควบคุม
เอกสารไม่ควบคุม
เอกสารไม่ควบคุม

เอกสารไม่ควบคุม

เอกสารไม่ควบคุม

เอกสารไม่ควบคุม

เอกสารไม่ควบคุม

เอกสารไม่ควบคุม
เอกสารไม่ควบคุม
เอกสารไม่ควบคุม
เอกสารไม่ควบคุม

Calibration Certificate

LARSON DAVIS

เอกสารไม่ควบคุม

LARSON DAVIS

เอกสารไม่ควบคุม

Acoustic Signal Tests, C-weighting

Self-generated Noise

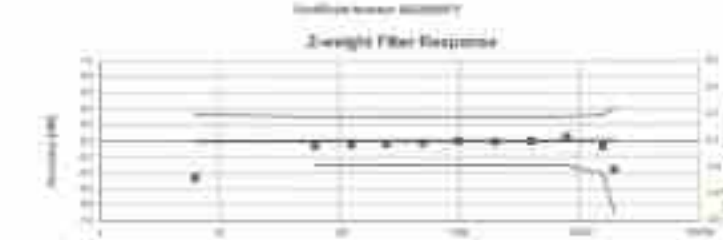
LARSON DAVIS

เอกสารไม่ควบคุม

LARSON DAVIS

เอกสารไม่ควบคุม

เอกสารไม่ควบคุม



Z-weight Filter Response

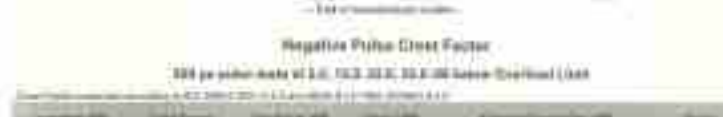
เอกสารไม่ควบคุม

A-weighted Broadband Log Linearity: 8,000.00 Hz

เอกสารไม่ควบคุม

Peak Rise Time

Positive Pulse Crest Factor



Negative Pulse Crest Factor

Gain

เอกสารไม่ควบคุม

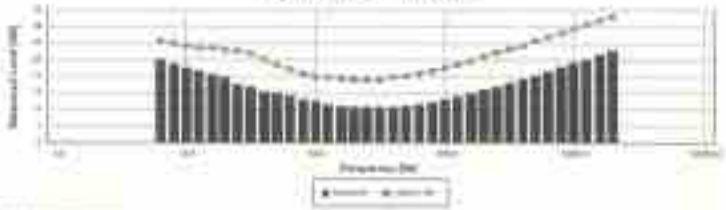
Broadband Noise Floor

Total Harmonic Distortion

LARSON DAVIS

เอกสารไม่ควบคุม

1/3-Octave Self-Generated Noise



LARSON DAVIS

เอกสารไม่ควบคุม

LARSON DAVIS

เอกสารไม่ควบคุม

Certificate of Calibration

เอกสารไม่ควบคุม

เอกสารไม่ควบคุม
เอกสารไม่ควบคุม
เอกสารไม่ควบคุม
เอกสารไม่ควบคุม

เอกสารไม่ควบคุม

Calibration Certificate

Certificate Number 2022002973

Customer:
United Analyst and Engineering Consultant Co Ltd
No. 81 Soi Udonsuk 41, Sukhumvit Road,
Bangchak, Phra Khanong,
Bangkok, 10260, Thailand

Model Number	LxT2	***Procedure Number***	D0001.8378
Serial Number	0006693	***Technician***	Jacob Cannon
Test Results	**Pass**	***Calibration Date***	9 Mar 2022
Initial Condition	As Manufactured	***Calibration Due***	
Description	SoundTrack LxT Class 2 Class 2 Sound Level Meter Firmware Revision: 2.404	***Temperature***	23.73 °C ± 0.25 °C
		Humidity	49.5 %RH ± 2.0 %RH
		Static Pressure	85.37 kPa ± 0.13 kPa

Evaluation Method Tested electrically using Larson Davis PRMLxT2C S/N 071562 and a 12.0 pF capacitor to simulate microphone capacitance. Data reported in dB re 20 µPa assuming a microphone sensitivity of 50.0 mV/Pa.

Compliance Standards Compliant to Manufacturer Specifications and the following standards when combined with Calibration Certificate from procedure D0001.8384:

IEC 60651:2001 Type 2	ANSI S1.4-2014 Class 2
IEC 60804:2000 Type 2	ANSI S1.4 (R2006) Type 2
IEC 61252:2002	ANSI S1.25 (R2007)
IEC 61672:2013 Class 2	ANSI S1.43 (R2007) Type 2
IEC 61260:2001 Class 2	ANSI S1.11 (R2009) Class 2

Issuing lab certifies that the instrument described above meets or exceeds all specifications as stated in the referenced procedure (unless otherwise noted). It has been calibrated using measurement standards traceable to the International System of Units (SI) through the National Institute of Standards and Technology (NIST), or other national measurement institutes, and meets the requirements of ISO/IEC 17025:2017. **Test points marked with a ‡ in the uncertainties column do not fall within this laboratory's scope of accreditation.**

The quality system is registered to ISO 9001:2015.

This calibration is a direct comparison of the unit under test to the listed reference standards and did not involve any sampling plans to complete. No allowance has been made for the instability of the test device due to use, time, etc. Such allowances would be made by the customer as needed.

The uncertainties were computed in accordance with the ISO Guide to the Expression of Uncertainty in Measurement (GUM). A coverage factor of approximately 2 sigma (k=2) has been applied to the standard uncertainty to express the expanded uncertainty at approximately 95% confidence level.

This report may not be reproduced, except in full, unless permission for the publication of an approved abstract is obtained in writing from the organization issuing this report.

Correction data from Larson Davis LxT Manual for SoundTrack LxT & SoundExpert Lxt, I770.01 Rev O Supporting Firmware Version 4.0.5, 2019-09-10

Calibration Check Frequency: 1000 Hz; Reference Sound Pressure Level: 114 dB re 20 µPa

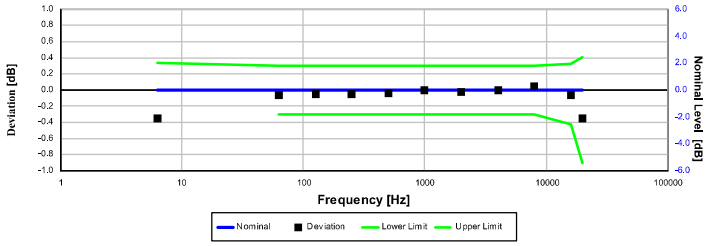
เอกสารไม่ควบคุม

Standards Used

Description	Cal Date	Cal Due	Cal Standard
Hart Scientific 2626-H Temperature Probe	2021-02-04	2022-08-04	006767
SRS DS360 Ultra Low Distortion Generator	2022-01-03	2023-01-03	007118

เอกสารไม่ควบคุม

Z-weight Filter Response



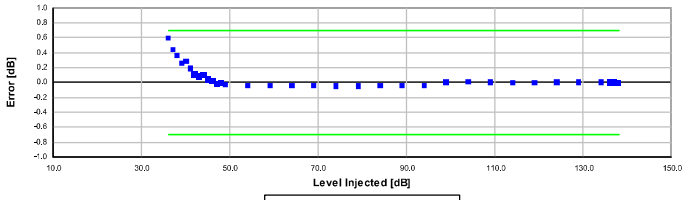
Electrical signal test of frequency weighting performed according to IEC 61672-3:2013 13 and ANSI S1.4-2014 Part 3: 13 for compliance to IEC 61672-1:2013 5.5; IEC 60651:2001 6.1 and 9.2.2; IEC 60804:2000 5; ANSI S1.4:1983 (R2006) 5.1 and 8.2.1; ANSI S1.4-2014 Part 1: 5.5

Frequency [Hz]	Test Result [dB]	Deviation [dB]	Lower limit [dB]	Upper limit [dB]	Expanded Uncertainty [dB]	Result
6.31	-0.35	-0.35	-1.11	0.33	0.15	Pass
63.10	-0.06	-0.06	-0.30	0.30	0.15	Pass
125.89	-0.05	-0.05	-0.30	0.30	0.15	Pass
251.19	-0.05	-0.05	-0.30	0.30	0.15	Pass
501.19	-0.03	-0.03	-0.30	0.30	0.15	Pass
1,000.00	0.00	0.00	-0.30	0.30	0.15	Pass
1,995.26	-0.02	-0.02	-0.30	0.30	0.15	Pass
3,981.07	-0.01	-0.01	-0.30	0.30	0.15	Pass
7,943.28	0.04	0.04	-0.30	0.30	0.15	Pass
15,848.93	-0.07	-0.07	-0.42	0.32	0.15	Pass
19,952.62	-0.35	-0.35	-0.91	0.41	0.15	Pass

-- End of measurement results--

เอกสารไม่ควบคุม

A-weighted Broadband Log Linearity: 8,000.00 Hz



Broadband level linearity performed according to IEC 61672-3:2013 16 and ANSI S1.4-2014 Part 3: 16 for compliance to IEC 61672-1:2013 5.6, IEC 60804:2000 6.2, IEC 61252:2002 8, ANSI S1.4 (R2006) 6.9, ANSI S1.4-2014 Part 1: 5.6, ANSI S1.43 (R2007) 6.2

Level [dB]	Error [dB]	Lower limit [dB]	Upper limit [dB]	Expanded Uncertainty [dB]	Result
36.00	0.60	-0.70	0.70	0.16	Pass
37.00	0.44	-0.70	0.70	0.16	Pass
38.00	0.37	-0.70	0.70	0.16	Pass
39.00	0.26	-0.70	0.70	0.16	Pass
40.00	0.28	-0.70	0.70	0.16	Pass
41.00	0.19	-0.70	0.70	0.16	Pass
42.00	0.11	-0.70	0.70	0.16	Pass
43.00	0.08	-0.70	0.70	0.17	Pass
44.00	0.10	-0.70	0.70	0.17	Pass
45.00	0.05	-0.70	0.70	0.16	Pass
46.00	0.02	-0.70	0.70	0.16	Pass
47.00	-0.01	-0.70	0.70	0.16	Pass
48.00	0.00	-0.70	0.70	0.16	Pass
49.00	-0.03	-0.70	0.70	0.16	Pass
54.00	-0.04	-0.70	0.70	0.16	Pass
59.00	-0.04	-0.70	0.70	0.16	Pass
64.00	-0.04	-0.70	0.70	0.16	Pass
69.00	-0.04	-0.70	0.70	0.16	Pass
74.00	-0.05	-0.70	0.70	0.16	Pass
79.00	-0.05	-0.70	0.70	0.16	Pass
84.00	-0.04	-0.70	0.70	0.16	Pass
89.00	-0.04	-0.70	0.70	0.16	Pass
94.00	-0.04	-0.70	0.70	0.16	Pass
99.00	0.01	-0.70	0.70	0.15	Pass
104.00	0.01	-0.70	0.70	0.15	Pass
109.00	0.01	-0.70	0.70	0.15	Pass
114.00	0.00	-0.70	0.70	0.15	Pass
119.00	0.00	-0.70	0.70	0.15	Pass
124.00	0.01	-0.70	0.70	0.15	Pass
129.00	0.01	-0.70	0.70	0.15	Pass
134.00	0.01	-0.70	0.70	0.15	Pass
136.00	0.01	-0.70	0.70	0.15	Pass
137.00	0.00	-0.70	0.70	0.15	Pass
138.00	0.00	-0.70	0.70	0.15	Pass

-- End of measurement results--

LARSON DAVIS - A PCB PIEZOTRONICS DIV.
1681 West 820 North
Provo, UT 84601, United States
716-684-0001

LARSON DAVIS
เอกสารไม่ควบคุม

Peak Rise Time

Peak rise time performed according to IEC 60651:2001 9.4.4 and ANSI S1.4:1983 (R2006) 8.4.4

Amplitude [dB]	Duration [µs]		Test Result [dB]	Lower limit [dB]	Upper limit [dB]	Expanded Uncertainty [dB]	Result
136.95	40	Negative Pulse	135.01	133.52	135.52	0.15	Pass
		Positive Pulse	134.99	133.51	135.51	0.15	Pass
	30	Negative Pulse	134.07	133.52	135.52	0.15	Pass
		Positive Pulse	134.07	133.51	135.51	0.15	Pass

-- End of measurement results--

Positive Pulse Crest Factor

200 µs pulse tests at 2.0, 12.0, 22.0, 32.0 dB below Overload Limit

Crest Factor measured according to IEC 60651:2001 9.4.2 and ANSI S1.4:1983 (R2006) 8.4.2

Amplitude [dB]	Crest Factor	Test Result [dB]	Limits [dB]	Expanded Uncertainty [dB]	Result
135.95	3	OVLD	± 1.00	0.15 ‡	Pass
	5	OVLD	± 1.00	0.15 ‡	Pass
125.95	3	-0.13	± 1.00	0.15 ‡	Pass
	5	-0.15	± 1.00	0.16 ‡	Pass
115.95	3	-0.14	± 1.00	0.15 ‡	Pass
	5	-0.14	± 1.00	0.15 ‡	Pass
105.95	3	-0.15	± 1.00	0.15 ‡	Pass
	5	-0.14	± 1.00	0.15 ‡	Pass

-- End of measurement results--

Negative Pulse Crest Factor

200 µs pulse tests at 2.0, 12.0, 22.0, 32.0 dB below Overload Limit

Crest Factor measured according to IEC 60651:2001 9.4.2 and ANSI S1.4:1983 (R2006) 8.4.2

Amplitude [dB]	Crest Factor	Test Result [dB]	Limits [dB]	Expanded Uncertainty [dB]	Result
135.95	3	OVLD	± 1.00	0.15 ‡	Pass
	5	OVLD	± 1.00	0.15 ‡	Pass
125.95	3	-0.13	± 1.00	0.15 ‡	Pass
	5	-0.11	± 1.00	0.15 ‡	Pass
115.95	3	-0.13	± 1.00	0.15 ‡	Pass
	5	-0.13	± 1.00	0.15 ‡	Pass
105.95	3	-0.14	± 1.00	0.15 ‡	Pass
	5	-0.13	± 1.00	0.15 ‡	Pass

-- End of measurement results--

Gain

Gain measured according to IEC 61672-3:2013 17.3 and 17.4 and ANSI S1.4-2014 Part 3: 17.3 and 17.4

Measurement	Test Result [dB]	Lower limit [dB]	Upper limit [dB]	Expanded Uncertainty [dB]	Result
0 dB Gain	93.96	93.92	94.12	0.15	Pass
0 dB Gain, Linearity	40.29	39.42	40.82	0.16	Pass
OBA Low Range	94.02	93.92	94.12	0.15	Pass
OBA Normal Range	94.02	93.20	94.80	0.15	Pass

-- End of measurement results--

LARSON DAVIS - A PCB PIEZOTRONICS DIV.
1681 West 820 North
Provo, UT 84601, United States
716-684-0001

LARSON DAVIS
เอกสารไม่ควบคุม

Broadband Noise Floor

Self-generated noise measured according to IEC 61672-3:2013 11.2 and ANSI S1.4-2014 Part 3: 11.2

Measurement	Test Result [dB]	Upper limit [dB]	Result
A-weight Noise Floor	27.08	36.00	Pass
C-weight Noise Floor	26.90	35.00	Pass
Z-weight Noise Floor	32.76	39.00	Pass

-- End of measurement results--

Total Harmonic Distortion

Measured using 1/3-Octave filters

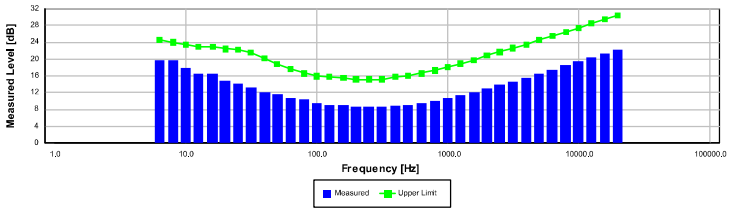
Measurement	Test Result [dB]	Lower Limit [dB]	Upper Limit [dB]	Expanded Uncertainty [dB]	Result
10 Hz Signal	135.53	134.15	135.75	0.15	Pass
THD	-67.24		-58.00	0.01 ‡	Pass
THD+N	-63.03		-58.00	0.01 ‡	Pass

-- End of measurement results--

LARSON DAVIS - A PCB PIEZOTRONICS DIV.
1681 West 820 North
Provo, UT 84601, United States
716-684-0001

LARSON DAVIS
เอกสารไม่ควบคุม

1/3-Octave Self-Generated Noise



The SLM is set to low range.

Frequency [Hz]	Test Result [dB]	Upper limit [dB]	Result
6.30	19.82	24.60	Pass
8.00	19.80	24.00	Pass
10.00	17.93	23.50	Pass
12.50	16.57	23.00	Pass
16.00	16.43	22.90	Pass
20.00	14.79	22.40	Pass
25.00	14.06	22.30	Pass
31.50	13.20	21.50	Pass
40.00	12.12	20.20	Pass
50.00	11.65	18.80	Pass
63.00	10.68	17.60	Pass
80.00	10.37	16.60	Pass
100.00	9.56	15.90	Pass
125.00	9.15	15.70	Pass
160.00	8.94	15.50	Pass
200.00	8.64	15.20	Pass
250.00	8.63	15.20	Pass
315.00	8.57	15.20	Pass
400.00	8.85	15.70	Pass
500.00	9.05	16.00	Pass
630.00	9.46	16.60	Pass
800.00	10.00	17.30	Pass
1,000.00	10.69	18.10	Pass
1,250.00	11.33	18.90	Pass
1,600.00	12.15	19.80	Pass
2,000.00	12.96	20.80	Pass
2,500.00	13.82	21.70	Pass
3,150.00	14.67	22.60	Pass
4,000.00	15.61	23.50	Pass
5,000.00	16.52	24.50	Pass
6,300.00	17.49	25.50	Pass
8,000.00	18.47	26.50	Pass
10,000.00	19.40	27.40	Pass
12,500.00	20.42	28.50	Pass
16,000.00	21.33	29.50	Pass
20,000.00	22.34	30.40	Pass

-- End of measurement results--

LARSON DAVIS - A PCB PIEZOTRONICS DIV.
1681 West 820 North
Provo, UT 84601, United States
716-684-0001

LARSON DAVIS
เอกสารไม่ควบคุม

-- End of Report--

Signatory: Jacob Cannon

LARSON DAVIS - A PCB PIEZOTRONICS DIV.
1681 West 820 North
Provo, UT 84601, United States
716-684-0001

2022-3-9T18:28:48

LARSON DAVIS
เอกสารไม่ควบคุม

Calibration Certificate

LARSON DAVIS
เอกสารไม่ควบคุม

Acoustic Calibration

Leaded Circuit Sensitivity

LARSON DAVIS
เอกสารไม่ควบคุม

Acoustic Signal Tests, C-weighting

Self-generated Noise

LARSON DAVIS
เอกสารไม่ควบคุม

Calibration Certificate

Certificate Number [illegible]
Customer:
[illegible]
[illegible]
[illegible]
[illegible]

Model Number	[illegible]	Procedure Revised	[illegible]
Serial Number	[illegible]	Technician	[illegible]
Test Results	Pass	Calibration Date	[illegible]
		Calibration Due Date	
Initial Condition	As Received	Temperature	[illegible]
Description	[illegible]	Humidity	[illegible]
		Static Pressure	[illegible]

Calibration Method: [illegible]

Acceptance Standards: [illegible]

[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

เอกสารไม่ควบคุม

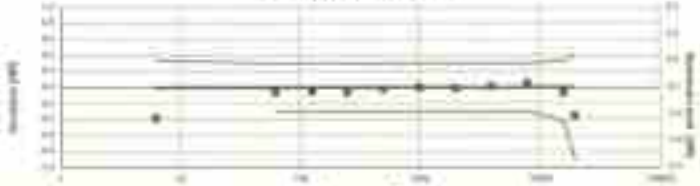
Certificate Number [illegible]

[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]

เอกสารไม่ควบคุม

Certificate Number [illegible]

Z-weight Filter Response



[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

Peak Rise Time

Positive Pulse Crest Factor

Negative Pulse Crest Factor

Gate

เอกสารไม่ควบคุม

Broadband Noise Floor

Total Harmonic Distortion

เอกสารไม่ควบคุม

1/1-Octave Self-Generated Noise

เอกสารไม่ควบคุม

เอกสารไม่ควบคุม

เอกสารไม่ควบคุม
เอกสารไม่ควบคุม
เอกสารไม่ควบคุม
เอกสารไม่ควบคุม

เอกสารไม่ควบคุม

เอกสารไม่ควบคุม

Calibration Certificate

เอกสารไม่ควบคุม

เอกสารไม่ควบคุม

Certificate Number: [redacted]

Acoustic Signal Tests, C-weighting

[redacted]

Frequency (Hz)	Nominal Level (dB)	Measured Level (dB)	Lower Limit (dB)	Upper Limit (dB)	Uncertainty (dB)	Result
125	4.41	4.29	-1.35	1.35	0.21	Pass
1000	0.10	0.09	-1.00	1.00	0.21	Pass
8000	-2.97	-3.09	-4.00	2.00	0.32	Pass

– End of measurement results –

Self-generated Noise

[redacted]

Description	Test Result (dB)
A-weighted	49.70

– End of measurement results –

– End of Report –

Approved: [redacted]

LARSON DAVIS

เอกสารไม่ควบคุม

Calibration Certificate

Certificate Number: [redacted]

Customer:

[redacted]

Model Number:	377B	Procedure Number:	[redacted]
Serial Number:	[redacted]	Technician:	[redacted]
Test Results:	Pass	Calibration Date:	[redacted]
Ambient Conditions:	[redacted]	Calibration Due:	[redacted]
Test Options:	[redacted]	Temperature:	[redacted]
		Humidity:	[redacted]
		Static Pressure:	[redacted]

Evaluation Method: [redacted]

Compliance Statement: [redacted]

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

LARSON DAVIS

เอกสารไม่ควบคุม

Certificate Number: [redacted]

[redacted]

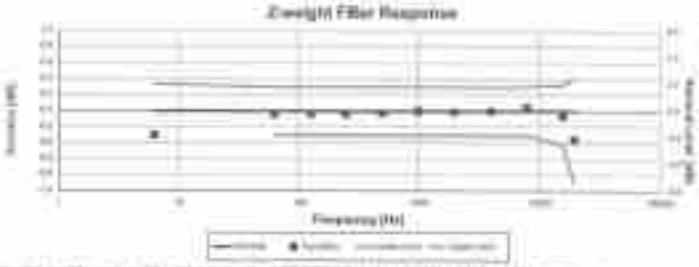
Description	Test Date	Cal Due	Cal Standard
[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]

LARSON DAVIS

เอกสารไม่ควบคุม

Certificate Number: [redacted]

Z-weight Filter Response



[redacted]

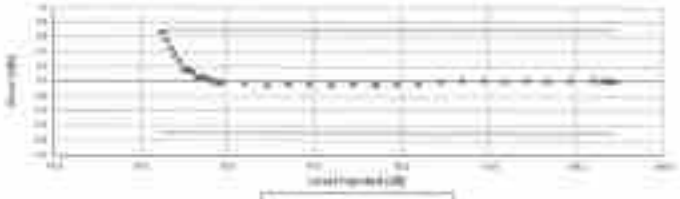
Frequency (Hz)	Test Result (dB)	Minimum (dB)	Lower Limit (dB)	Upper Limit (dB)	Uncertainty (dB)	Result
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]

– End of measurement results –

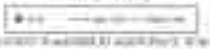
LARSON DAVIS

เอกสารไม่ควบคุม

A-weighted Broadband Lag Linearity: 8,000.00 Hz



Level Ingested (dB)



Page 5 of 9

LARSON DAVIS

เอกสารไม่ควบคุม

Peak Rise Time

Positive Pulse Crest Factor

Negative Pulse Crest Factor

Gain

LARSON DAVIS

เอกสารไม่ควบคุม

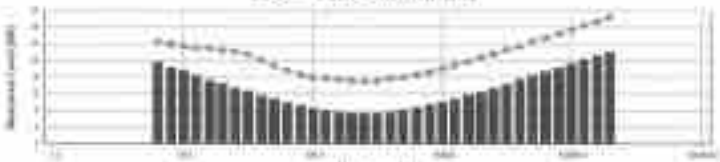
Broadband Noise Floor

Total Harmonic Distortion

LARSON DAVIS

เอกสารไม่ควบคุม

1/3 Octave Self-Generated Noise



Frequency (Hz)

LARSON DAVIS

เอกสารไม่ควบคุม

End of Report

Name: David Clemens

LARSON DAVIS

Page 4 of 4

เอกสารไม่ควบคุม

Certificate of Calibration

Customer

Item

Manufacturer

Model Number

Serial Number

Procedure

Calibration Date

Next Calibration Date

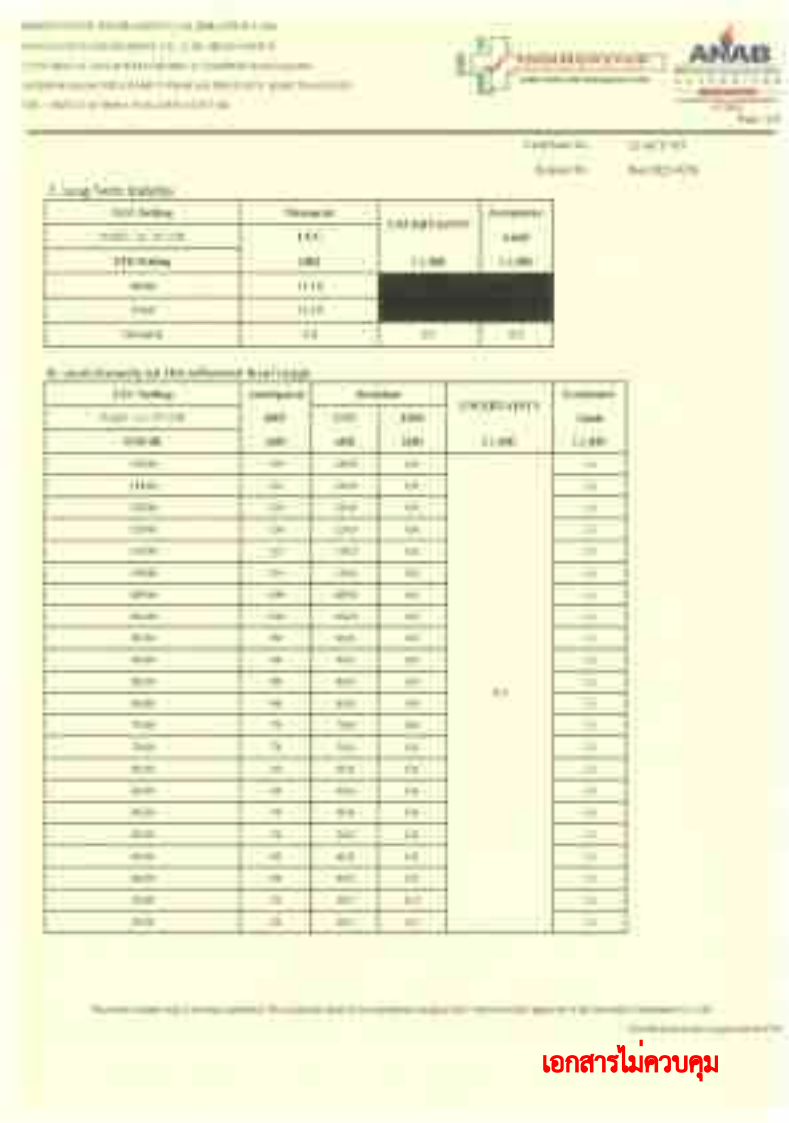
Calibrated By

Approved By

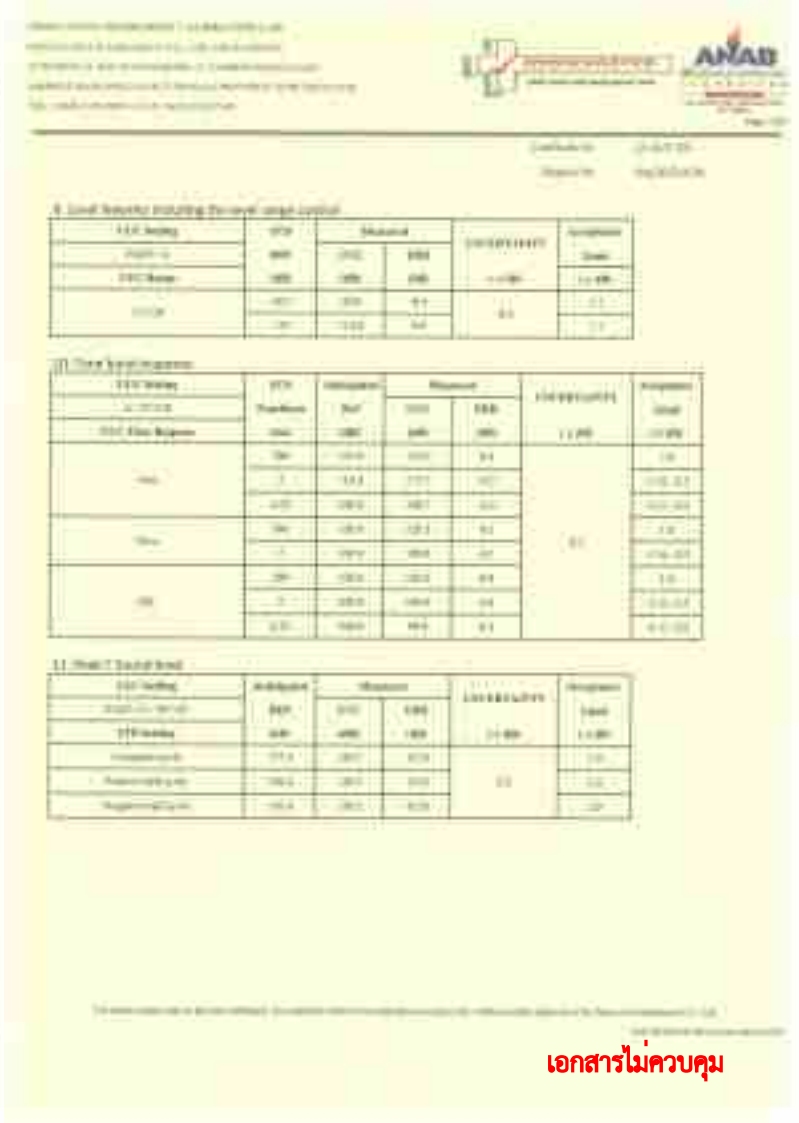
เอกสารไม่ควบคุม

เอกสารไม่ควบคุม

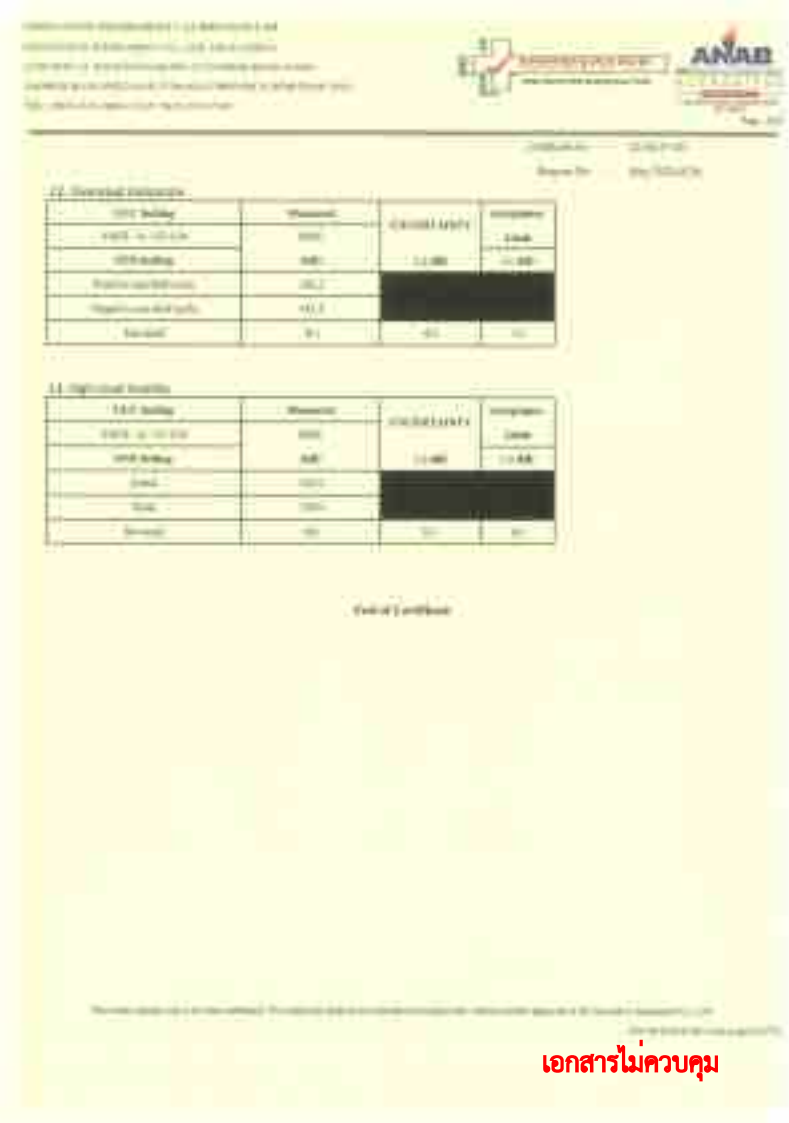
เอกสารไม่ควบคุม



เอกสารไม่ควบคุม



เอกสารไม่ควบคุม



เอกสารไม่ควบคุม

เอกสารไม่ควบคุม

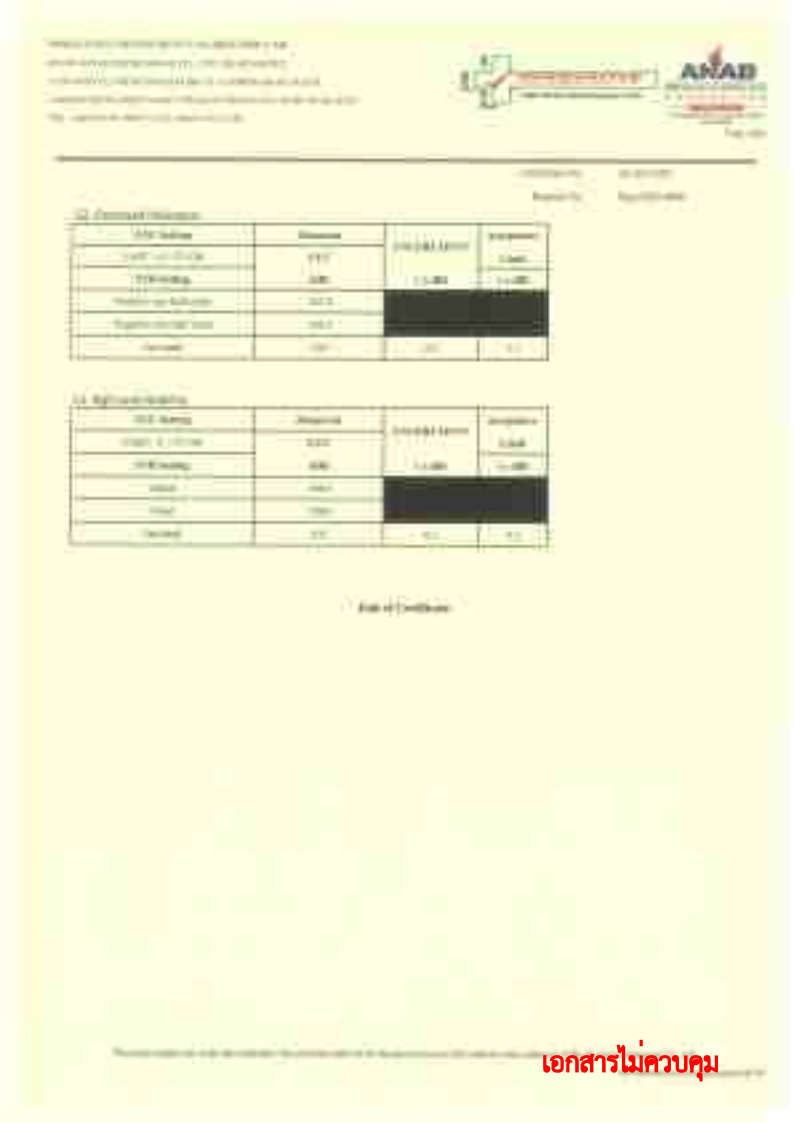
เอกสารไม่ควบคุม
เอกสารไม่ควบคุม
เอกสารไม่ควบคุม
เอกสารไม่ควบคุม

เอกสารไม่ควบคุม

เอกสารไม่ควบคุม

เอกสารไม่ควบคุม

เอกสารไม่ควบคุม



CALIBRATION LABORATORY CO., LTD.

CERTIFICATE OF CALIBRATION

FOR

Calibrated By : Sonic Piyasakulkaroon
Calibration Engineer

Approved By : Monghol Tongsomsee
Authorized Signatory
30 September 2025

เอกสารไม่ควบคุม

REPORT OF CALIBRATION

FOR

NOMENCLATURE	:	VIBRATION METER
MANUFACTURER	:	[illegible]
MODEL / TYPE	:	[illegible]
SERIAL NO	:	[illegible]
DATE OF CALIBRATION	:	23 September 2022

ENVIRONMENT CONDITION :

Temperature : [illegible] °C Relative Humidity : [illegible] %RH

PROCEDURE USED :

[illegible]

REFERENCE STANDARD USED :

[illegible]

TRACEABILITY :

[illegible]

UNCERTAINTY :

[illegible]

Certificate No. [illegible]

[illegible]

page 2 of 4

เอกสารไม่ควบคุม

CONDITION OF CALIBRATION ITEM : GOOD

MEASUREMENT RESULT : [illegible]

CALIBRATION DATA

1. ACCELERATION RESULT

Test point		Unit	UUT Reading	STD Reading	Correction	Uncertainty
[illegible]	[illegible]					
[illegible]	[illegible]					
[illegible]	[illegible]					
[illegible]	[illegible]					
[illegible]	[illegible]					
[illegible]	[illegible]					
[illegible]	[illegible]					
[illegible]	[illegible]					
[illegible]	[illegible]					
[illegible]	[illegible]					
[illegible]	[illegible]					

2. VELOCITY RESULT

Test point		Unit	UUT Reading	STD Reading	Correction	Uncertainty
[illegible]	[illegible]					
[illegible]	[illegible]					
[illegible]	[illegible]					
[illegible]	[illegible]					
[illegible]	[illegible]					
[illegible]	[illegible]					
[illegible]	[illegible]					
[illegible]	[illegible]					
[illegible]	[illegible]					
[illegible]	[illegible]					
[illegible]	[illegible]					

Certificate No. [illegible]

[illegible]

page 3 of 4

เอกสารไม่ควบคุม

CALIBRATION DATA

1. DISPLACEMENT RESULT

Test point		Unit	UUT Reading	STD Reading	Correction	Uncertainty
[illegible]	[illegible]					
[illegible]	[illegible]					
[illegible]	[illegible]					
[illegible]	[illegible]					
[illegible]	[illegible]					
[illegible]	[illegible]					
[illegible]	[illegible]					
[illegible]	[illegible]					
[illegible]	[illegible]					
[illegible]	[illegible]					

[illegible]

[illegible]

Certificate No. [illegible]

[illegible]

page 4 of 4

เอกสารไม่ควบคุม

CERTIFICATE OF CALIBRATION

FOR

NOMENCLATURE	:	VIBRATION METER
MANUFACTURER	:	[illegible]
MODEL / TYPE	:	[illegible]
SERIAL NO	:	[illegible]
CUST. NO	:	[illegible]
ITEM CONTROL NO	:	[illegible]
CUSTOMER	:	[illegible]

DATE OF RECEIVED : 20 August 2022 DATE OF ISSUE : 01 September 2022

[illegible]

Calibrated By : Name: Thongchai
Calibration Engineer

Approved By : Mongkol Chaowanon
Authorized Signatory
01 September 2022

[illegible]

Certificate No. [illegible]

[illegible]

page 1 of 4

เอกสารไม่ควบคุม

REPORT OF CALIBRATION

FOR

[illegible]	:	[illegible]
[illegible]	:	[illegible]
[illegible]	:	[illegible]
[illegible]	:	[illegible]
DATE OF CALIBRATION	:	[illegible]

ENVIRONMENT CONDITIONS :

Temperature : [illegible] Relative Humidity : [illegible]

PROCEDURE USED :

[illegible]

REFERENCE STANDARD USED :

[illegible]

TRACEABILITY :

[illegible]

UNCERTAINTY :

[illegible]

Certificate No. [illegible]

[illegible]

เอกสารไม่ควบคุม

CALIBRATION LABORATORY CO., LTD.

CALIBRATION DATA

1. ACCELERATION RESULT

Test item		Unit	UUT Reading	STD Reading	Correction	Uncertainty
[illegible]	[illegible]					
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

2. VELOCITY RESULT

Test item		Unit	UUT Reading	STD Reading	Correction	Uncertainty
[illegible]	[illegible]					
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

Certificate No. [illegible]

[illegible]

เอกสารไม่ควบคุม

CALIBRATION LABORATORY CO., LTD.

CALIBRATION DATA

1. DISPLACEMENT RESULT

Test item		Unit	UUT Reading	STD Reading	Correction	Uncertainty
[illegible]	[illegible]					
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

[illegible]

Certificate No. [illegible]

[illegible]

เอกสารไม่ควบคุม

CALIBRATION LABORATORY CO., LTD.

CERTIFICATE OF CALIBRATION

FOR

[illegible]	:	[illegible]
[illegible]	:	[illegible]
[illegible]	:	[illegible]
[illegible]	:	[illegible]
[illegible]	:	[illegible]
[illegible]	:	[illegible]

CUSTOMER : [illegible]

[illegible]

DATE OF RECEIVED : [illegible] DATE OF ISSUED : [illegible]

[illegible]

Calibrated By : [illegible]

Calibration Engineer

Approved By : [illegible]

Authorized Signatory

[illegible]

Certificate No. [illegible]

[illegible]

เอกสารไม่ควบคุม

REPORT OF CALIBRATION

FOR

NOMENCLATURE	:	VIBRATION METER
MANUFACTURER	:	[illegible]
MODEL / TYPE	:	[illegible]
SERIAL NO.	:	[illegible]
DATE OF CALIBRATION	:	10 March 2021

ENVIRONMENT CONDITION :

Temperature : [illegible] °C Relative Humidity : [illegible] %RH

PROCEDURE USED :

[illegible]

REFERENCE STANDARD USED :

1. [illegible]
2. [illegible]
3. [illegible]

TRACEABILITY :

1. [illegible]
2. [illegible]
3. [illegible]

UNCERTAINTY :

[illegible]

Certificate No. [illegible]

[illegible]

เอกสารไม่ควบคุม

CONDITION OF CALIBRATION (ON / OFF)

MEASUREMENT MADE AT : [illegible]

CALIBRATION DATA

1. ACCELERATION RESULT

Test point		Mode	ACC Reading	VEL Reading	Correction	Uncertainty
[illegible]	[illegible]					
[illegible]	[illegible]					
[illegible]	[illegible]					
[illegible]	[illegible]					
[illegible]	[illegible]					
[illegible]	[illegible]					
[illegible]	[illegible]					
[illegible]	[illegible]					
[illegible]	[illegible]					
[illegible]	[illegible]					

2. VELOCITY RESULT

Test point		Mode	ACC Reading	VEL Reading	Correction	Uncertainty
[illegible]	[illegible]					
[illegible]	[illegible]					
[illegible]	[illegible]					
[illegible]	[illegible]					
[illegible]	[illegible]					
[illegible]	[illegible]					
[illegible]	[illegible]					
[illegible]	[illegible]					
[illegible]	[illegible]					
[illegible]	[illegible]					

Certificate No. [illegible]

[illegible]

เอกสารไม่ควบคุม

CALIBRATION DATA

3. ACCELERATION RESULT

Test point		Mode	ACC Reading	VEL Reading	Correction	Uncertainty
[illegible]	[illegible]					
[illegible]	[illegible]					
[illegible]	[illegible]					
[illegible]	[illegible]					
[illegible]	[illegible]					
[illegible]	[illegible]					
[illegible]	[illegible]					
[illegible]	[illegible]					
[illegible]	[illegible]					
[illegible]	[illegible]					

[illegible]

[illegible]

เอกสารไม่ควบคุม

CERTIFICATE OF CALIBRATION

FOR

NOMENCLATURE	:	VIBRATION METER
MANUFACTURER	:	[illegible]
MODEL / TYPE	:	[illegible]
SERIAL NO.	:	[illegible]
CUST. NO.	:	[illegible]
JOB COTTROL NO.	:	[illegible]

CUSTOMER : [illegible]

DATE OF RECEIVED : 21 February 2021 DATE OF ISSUED : 26 February 2021

[illegible]

Calibrated By : Sonic Phanthaisong
Calibration Engineer

Approved By : Mongkol Yoosooree
Authorized Signatory
26 February 2021

[illegible]

Certificate No. [illegible]

[illegible]

เอกสารไม่ควบคุม

REPORT OF CALIBRATION

FOR

NOMENCLATURE	:	MEGGER INSULATION METER
MANUFACTURER	:	YOKOGAWA
MODEL / TYPE	:	2254 SERIES
SERIAL NO.	:	[illegible]
DATE OF CALIBRATION	:	21 February 2022

ENVIRONMENT CONDITION :

Temperature : 23 ± 3 °C Relative Humidity : [illegible] %RH

PROCEDURE USED :

[illegible]

REFERENCE STANDARD USED :

1. Digital Multimeter, Fluke, Model 1587 FC, [illegible]
2. High Resistance Programmable Decade Current, Hioki, Series Chroma62, [illegible]
3. Environment with Thermometer, Model [illegible]

TRACEABILITY :

1. The measurement is traceable to International System of Units (SI) through [illegible]
2. The measurement is traceable to International System of Units (SI) through [illegible]
3. The measurement is traceable to International System of Units (SI) through [illegible]

UNCERTAINTY :

[illegible]

Certificate No. [illegible]

[illegible]

เอกสารไม่ควบคุม

CONDITION OF CALIBRATION ITEM : GOOD

MEASUREMENT RESULTS (AS [illegible] / Adjustment)

CALIBRATION DATA

1. ACCURACY RESULT

Test point		Mode	UUT Reading	STD Reading	Correction	Uncertainty
[illegible]	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

2. VELOCITY RESULT

Test point		Mode	UUT Reading	STD Reading	Correction	Uncertainty
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

Certificate No. [illegible]

[illegible]

เอกสารไม่ควบคุม

CALIBRATION DATA

1. DISPLACEMENT RESULT

Test point		Mode	UUT Reading	STD Reading	Correction	Uncertainty
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

Note: * means Calibrate as found ** is [illegible] as left Certificate have been [illegible] for [illegible]

The Report is [illegible] which Certificate No. [illegible] Version/[illegible] Page [illegible] of [illegible]

This report is only for the aforesaid [illegible] only

[illegible] Certificate [illegible]

Certificate No. [illegible]

[illegible]

เอกสารไม่ควบคุม

CERTIFICATE OF CALIBRATION

FOR

NOMENCLATURE	:	MEGGER INSULATION METER
MANUFACTURER	:	YOKOGAWA
MODEL / TYPE	:	2254 SERIES
SERIAL NO.	:	[illegible]
I.D. NO.	:	[illegible]
ASSET/TOOL NO.	:	[illegible]

CUSTOMER : [illegible]

DATE OF RECEIVED : 21 February 2022 DATE OF ISSUED : 28 February 2022

Report of calibration is [illegible]

Calibrated By : [illegible]
Calibration Engineer

Approved By : [illegible]
Authorized Signatory
28 February 2022

This calibration certificate [illegible]

Certificate No. [illegible]

[illegible]

เอกสารไม่ควบคุม

REPORT OF CALIBRATION

FOR

NOMENCLATURE	:	VIBRATION METER
MANUFACTURER	:	INSTANTEL
MODEL / TYPE	:	[illegible]
SERIAL NO.	:	[illegible]
DATE OF CALIBRATION	:	23 February 2023

ENVIRONMENT CONDITIONS :

Temperature : [illegible] °C Relative Humidity : [illegible] %RH

PROCEDURE USED :

[illegible]

REFERENCE STANDARD USED :

1. [illegible]
2. [illegible]
3. [illegible]

TRACEABILITY :

1. [illegible]
2. [illegible]
3. [illegible]

UNCERTAINTY :

[illegible]

Certificate No. [illegible]

[illegible]

เอกสารไม่ควบคุม

CONDITION OF CALIBRATION ITEM : [illegible]

MEASUREMENT RESULTS : [illegible]

CALIBRATION DATA

1. ACCELERATION RESULT

Transducer (g)	Transducer (Hz)	Axis	ISO Reading (g)	ISO Reading (g)	Correction (g)	Uncertainty (k=2) (g)
[illegible]						
[illegible]						
[illegible]						
[illegible]						
[illegible]						
[illegible]						
[illegible]						
[illegible]						
[illegible]						
[illegible]						

2. VELOCITY RESULT

Transducer (mm/s)	Transducer (Hz)	Axis	ISO Reading (mm/s)	ISO Reading (mm/s)	Correction (mm/s)	Uncertainty (k=2) (mm/s)
[illegible]						
[illegible]						
[illegible]						
[illegible]						
[illegible]						
[illegible]						
[illegible]						
[illegible]						
[illegible]						
[illegible]						

Certificate No. [illegible]

[illegible]

เอกสารไม่ควบคุม

CALIBRATION DATA

3. DISPLACEMENT RESULT

Transducer (mm)	Transducer (Hz)	Axis	ISO Reading (mm)	ISO Reading (mm)	Correction (mm)	Uncertainty (k=2) (mm)
[illegible]						
[illegible]						
[illegible]						
[illegible]						
[illegible]						
[illegible]						
[illegible]						
[illegible]						
[illegible]						
[illegible]						

[illegible]

This report is valid for the environmental [illegible] only.

[illegible]

Certificate No. [illegible]

[illegible]

เอกสารไม่ควบคุม

CERTIFICATE OF CALIBRATION

FOR

NOMENCLATURE	:	VIBRATION METER
MANUFACTURER	:	INSTANTEL
MODEL / TYPE	:	[illegible]
SERIAL NO.	:	[illegible]
CLIC NO.	:	[illegible]
ISSUED FOR	:	[illegible]

CUSTOMER : [illegible]

DATE OF RECEIVED : 21 September 2022 DATE OF ISSUED : 24 September 2022

[illegible]

Calibrated By : Sonic Phantusuwong
Calibration Engineer

Approved By : Bhagdee Umnuaysuk
Authorized Signatory
24 September 2022

[illegible]

Certificate No. [illegible]

[illegible]

เอกสารไม่ควบคุม

REPORT OF CALIBRATION

FOR

NOMENCLATURE	:	VIBRATED METER
MANUFACTURER	:	[illegible]
MODEL / TYPE	:	[illegible]
SERIAL NO.	:	[illegible]
DATE OF CALIBRATION	:	23 September 2022

ENVIRONMENT CONDITION :

Temperature : [illegible] °C Relative Humidity : [illegible] %

PROCEDURE USED :

[illegible]

REFERENCE STANDARD USED :

1. [illegible]
2. [illegible]
3. [illegible]

TRACEABILITY :

1. The measurements are traceable to [illegible]
2. The measurements are traceable to [illegible]
3. The measurements are traceable to [illegible]

UNCERTAINTY :

[illegible]

Certificate No. [illegible]

[illegible]

เอกสารไม่ควบคุม

CONDITION OF CALIBRATION ITEM : GOOD

MEASUREMENT RESULTS : (X) without adjustment ( ) adjustment

CALIBRATION DATA

1. ACCELERATION RESULT

Excitation		Meter	[illegible] Reading	[illegible] Reading	Conversion	Uncertainty
[illegible]	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

2. VELOCITY RESULT

Excitation		Meter	[illegible] Reading	[illegible] Reading	Conversion	Uncertainty
[illegible]	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

Certificate No. [illegible]

[illegible]

เอกสารไม่ควบคุม

CALIBRATION DATA

1. ACCELERATION RESULT

Excitation		Meter	[illegible] Reading	[illegible] Reading	Conversion	Uncertainty
[illegible]	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

[illegible]

[illegible]

Certificate No. [illegible]

[illegible]

เอกสารไม่ควบคุม

CERTIFICATE OF CALIBRATION

FOR

NOMENCLATURE	:	[illegible]
MANUFACTURER	:	[illegible]
MODEL / TYPE	:	[illegible]
SERIAL NO.	:	[illegible]
CUST. No.	:	[illegible]
JOB CONTROL NO.	:	[illegible]

CUSTOMER : [illegible]

DATE OF RECEIVED : 28 February 2022 DATE OF ISSUE : 02 March 2022

Calibrated By : Sanit Phumlerdtong
Calibration Engineer

Approved By : Mongkol Yimyaem
Authorized Signatory
02 March 2022

Certificate No. [illegible]

[illegible]

เอกสารไม่ควบคุม

REPORT OF CALIBRATION

FOR

[illegible]	:	VIBRATION METER
[illegible]	:	[illegible]
[illegible]	:	[illegible]
[illegible]	:	[illegible]
[illegible]	:	[illegible]

ENVIRONMENT CONDITION :

Temperature : [illegible] °C Relative Humidity : [illegible] %RH

PROCEDURE USED :

[illegible]

REFERENCE STANDARD USED :

[illegible]

TRACEABILITY :

[illegible]

UNCERTAINTY :

[illegible]

เอกสารไม่ควบคุม

CONDITION OF CALIBRATION ITEM : GOOD

[illegible]

CALIBRATION DATA

1. ACCELERATION RESULT

Equipment		Mode	UUT Reading	SMT Reading	Uncertainty	Uncertainty
[illegible]	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

2. VELOCITY RESULT

Equipment		Mode	UUT Reading	SMT Reading	Uncertainty	Uncertainty
[illegible]	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

เอกสารไม่ควบคุม

CALIBRATION DATA

1. DISPLACEMENT RESULT

Equipment		Mode	UUT Reading	SMT Reading	Uncertainty	Uncertainty
[illegible]	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

[illegible]

[illegible]

[illegible]

เอกสารไม่ควบคุม

CERTIFICATE OF CALIBRATION

FOR

[illegible]	:	VIBRATION METER
[illegible]	:	[illegible]
[illegible]	:	[illegible]
[illegible]	:	[illegible]
[illegible]	:	[illegible]
[illegible]	:	[illegible]

Customer : [illegible]

[illegible]

DATE OF RECEIVED : 21 February 2023 DATE OF ISSUED : 28 February 2023

[illegible]

Calibrated By : Sirote Phonkhaodeng
Calibration Engineer

Approved By : Rungkiat Tumwasorn
Authorized Signatory
28 February 2023

[illegible]

เอกสารไม่ควบคุม

REPORT OF CALIBRATION

FOR

[illegible]	:	VIBRATION METER
[illegible]	:	[illegible]
[illegible]	:	[illegible]
[illegible]	:	[illegible]
DATE OF CALIBRATION	:	25 February 2025

ENVIRONMENT CONDITIONS :

Temperature : [illegible] °C Relative Humidity : [illegible] %RH

PROCEDURE USED :

[illegible]

REFERENCE STANDARDS USED :

1. [illegible]
2. [illegible]
3. [illegible]

TRACEABILITY :

1. [illegible]
2. [illegible]
3. [illegible]

UNCERTAINTY :

[illegible]

Certificate No. [illegible]

Page 1 of 3

เอกสารไม่ควบคุม

CONDITION OF CALIBRATION ITEM : GOOD

MEASUREMENT RESULTS : [illegible]

CALIBRATION DATA

1. CALIBRATION RESULT

Frequency		Unit	UUT Reading	STD Reading	Correction	Uncertainty
(Hz)	(Nominal)		(g)	(g)	(g)	(k=2) (+/-g)
[illegible]						

2. SENSITIVITY RESULT

Test point		Unit	UUT Reading	STD Reading	Correction	Uncertainty
(mm/s)	(Nominal)		(mm/s)	(mm/s)	(mm/s)	(k=2) (+/-g)
[illegible]						

Certificate No. [illegible]

Page 2 of 3

เอกสารไม่ควบคุม

CALIBRATION DATA

2. DISPLACEMENT RESULT

Frequency		Unit	STD Reading	UUT Reading	Correction	Uncertainty
(mm)	(Nominal)		(mm)	(mm)	(mm)	(k=2) (+/-g)
[illegible]						

Note: * means Calibration is out of * but [illegible] is still in Calibration limit and is considered to be satisfactory.

This Report Is Issued By [illegible] Page 2 of 3

This report is valid for the above mentioned item only.

[illegible]

Certificate No. [illegible]

Page 3 of 3

เอกสารไม่ควบคุม

CERTIFICATE OF CALIBRATION

FOR

[illegible]	:	VIBRATION METER
[illegible]	:	[illegible]
[illegible]	:	[illegible]
[illegible]	:	[illegible]
[illegible]	:	[illegible]
[illegible]	:	[illegible]
CUSTOMER	:	[illegible]

DATE OF RECEIVED : 25 February 2025 DATE OF ISSUED : 25 February 2025

Calibrated By :

[illegible]

Approved By :

[illegible]

25 February 2025

Certificate No. [illegible]

Page 1 of 3

เอกสารไม่ควบคุม

REPORT OF CALIBRATION

FOR

[illegible]	:	VIBRATION METER
MANUFACTURER	:	[illegible]
MODEL / TYPE	:	[illegible]
SERIAL NO.	:	[illegible]
DATE OF CALIBRATION	:	11 February 2025

ENVIRONMENT CONDITION :

Temperature : [illegible] °C Relative Humidity : [illegible] %

PROCEDURE USED :

[illegible]

REFERENCE STANDARD USED :

1. [illegible]
2. [illegible]
3. [illegible]

TRACEABILITY :

1. [illegible]
2. [illegible]
3. [illegible]

UNCERTAINTY :

[illegible]

Certificate No. [illegible]

[illegible]

เอกสารไม่ควบคุม

CALIBRATION LABORATORY CO., LTD.

CONDITION OF CALIBRATION ITEM : GOOD

MEASUREMENT RESULTS : ( ) without adjustment ( ) adjustment

CALIBRATION DATA

1. ACCELERATION RESULT

Test point		Units	Uncertainty	DUT Reading	Correction	Uncertainty
Set	Unit		(±)	(±)	(±)	(± k = 2)
0.5	[illegible]	m/s²	[illegible]	[illegible]	[illegible]	[illegible]
1.0	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]
2.0	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]
5.0	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]
10.0	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]
0.5	[illegible]	g	[illegible]	[illegible]	[illegible]	[illegible]
1.0	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]
2.0	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]
5.0	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]
10.0	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]

2. VELOCITY RESULT

Test point		Units	Uncertainty	DUT Reading	Correction	Uncertainty
Level 1	1/3 Octave 1		(dB)	(dB)	(dB)	(± k = 2) dB
1	[illegible]	mm/s	[illegible]	[illegible]	[illegible]	[illegible]
2	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]
3	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]
4	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]
5	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]
1	[illegible]	in/s	[illegible]	[illegible]	[illegible]	[illegible]
2	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]
3	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]
4	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]
5	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]

Certificate No. [illegible]

[illegible]

เอกสารไม่ควบคุม

CALIBRATION LABORATORY CO., LTD.

CALIBRATION DATA

3. SHOCK ACCELERATION RESULT

Test point		Units	DUT Reading	DUT Reading	Correction	Uncertainty
Level 1	1/3 Octave 1		(dB)	(dB)	(dB)	(± k = 2) dB
1	[illegible]	mm/s	[illegible]	[illegible]	[illegible]	[illegible]
2	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]
3	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]
4	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]
5	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]
1	[illegible]	in/s	[illegible]	[illegible]	[illegible]	[illegible]
2	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]
3	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]
4	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]
5	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]

Certificate No. [illegible]

[illegible]

เอกสารไม่ควบคุม

CALIBRATION LABORATORY CO., LTD.

CERTIFICATE OF CALIBRATION

FOR

[illegible]	:	VIBRATION METER
MANUFACTURER	:	[illegible]
MODEL / TYPE	:	[illegible]
SERIAL NO.	:	[illegible]
CLIENT NO.	:	[illegible]
ISSUE CONTROL NO.	:	[illegible]

CUSTOMER : [illegible]

DATE OF RECEIVED : 28 February 2025 DATE OF ISSUED : 02 March 2025

Calibrated By : Sarun Phuadraodong
Calibration Engineer

Approved By : Wongkot Yawanarak
Authorized Signatory
02 March 2025

Certificate No. [illegible]

[illegible]

เอกสารไม่ควบคุม

REPORT OF CALIBRATION

FOR

[illegible]	:	VIBRATION METER
MANUFACTURER	:	[illegible]
MODEL / TYPE	:	[illegible]
SERIAL NO.	:	[illegible]
DATE OF CALIBRATION	:	31 March 2021

ENVIRONMENT CONDITIONS :

Temperature : [illegible] °C Relative Humidity : [illegible] %RH

PROCEDURE USED :

[illegible]

REFERENCE STANDARDS USED :

1. [illegible]
2. [illegible]
3. [illegible]

TRACEABILITY :

1. The measurement is traceable to International System of Units (SI), through Accredited Quality of Thailand Ltd. Certificate No. [illegible] Date Issued 11 May 2021
2. The measurement is traceable to International System of Units (SI), through Accredited Quality of Thailand Ltd. Certificate No. [illegible] Date Issued 17 July 2020
3. The measurement is traceable to the International System of Units (SI), through National Institute of Metrology (Thailand) Certificate No. [illegible] Date Issued 15 June 2020

UNCERTAINTY :

The uncertainty included uncertainty of measurement in relation to the calculation of measurement multiplied by the coverage factor k = 2.28 which is a normal distribution corresponds to a coverage probability of approximately 95%. The uncertainty was calculated according to the "Evaluation of the Uncertainty of Measurement in Calibration (LAB-GUIDE02)"

Certificate No. [illegible]

[illegible]

page 2 of 3

เอกสารไม่ควบคุม

CONDITION OF CALIBRATION ITEM : GOOD

MEASUREMENT RESULTS : [illegible] adjustment / [illegible] adjustment

CALIBRATION DATA

1. ACCELERATION RESULT

Test point		Mode	UUT Reading	STD Reading	Correction	Uncertainty
[illegible]	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

2. VELOCITY RESULT

Test point		Mode	STD Reading	UUT Reading	Correction	Uncertainty
[illegible]	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

Certificate No. [illegible]

[illegible]

page 3 of 3

เอกสารไม่ควบคุม

CALIBRATION DATA

3. DISPLACEMENT RESULT

Test point		Mode	STD Reading	UUT Reading	Correction	Uncertainty
[illegible]	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

Note: * Means Calibration applied / The ISCIE Accredited / Unit is Centimeter/second/meter and gravity

The Degree of Accredited, Model Certificate No. [illegible] Revision [illegible] Page [illegible] of [illegible]

[illegible]

[illegible]

Certificate No. [illegible]

[illegible]

page 4 of 5

เอกสารไม่ควบคุม

CERTIFICATE OF CALIBRATION

FOR

[illegible]	:	VIBRATION METER
MANUFACTURER	:	[illegible]
MODEL / TYPE	:	[illegible]
SERIAL NO.	:	[illegible]
CLIB. NO.	:	[illegible]
JOB CONTROL NO.	:	[illegible]

CUSTOMER : [illegible]

[illegible]

DATE OF RECEIVED : [illegible] 2021 DATE OF ISSUE : 31 March 2021

Rights of calibration are strictly reserved. Without the approval of the Calibration Laboratory Co., Ltd.

Calibrated By : [illegible]
Calibration Engineer

Approved By : [illegible]
Authorized Signatory
31 March 2021

This Calibration Certificate shall not be reproduced, except in full, without written approval of the Calibration Laboratory Co., Ltd.

Certificate No. [illegible]

[illegible]

page 1 of 3

เอกสารไม่ควบคุม

REPORT OF CALIBRATION

FOR

NOMENCLATURE	:	VIBRATION METER
MANUFACTURER	:	[illegible]
MODEL / TYPE	:	[illegible]
SERIAL NO.	:	[illegible]
DATE OF CALIBRATION	:	31 March 2022

ENVIRONMENT CONDITION :

Temperature : [illegible] °C Relative Humidity : [illegible] %RH

PROCEDURE USED :

[illegible]

REFERENCE STANDARD USED :

1. [illegible]
2. [illegible]
3. [illegible]

TRACEABILITY :

1. [illegible]
2. [illegible]
3. [illegible]

UNCERTAINTY :

[illegible]

Certificate No. [illegible]

[illegible]

เอกสารไม่ควบคุม

CONDITION OF CALIBRATION ITEM : GOOD

ARRANGEMENT : REMOTE (X) without adjustment ( ) adjustment

CALIBRATION DATA :

A. ACCELERATION MODULE

Test point		Mode	UUT Reading	STANDARD Reading	Correction	Uncertainty
(g)	(frequency)		(g)	(g)	(g)	(k = 2 , 95 %)
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

B. VELOCITY RESULT :

Test point		Mode	UUT Reading	STANDARD Reading	Correction	Uncertainty
(mm/s)	(frequency)		(mm/s)	(mm/s)	(mm/s)	(k = 2 , 95 %)
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

Certificate No. [illegible]

[illegible]

เอกสารไม่ควบคุม

CALIBRATION DATA

A. ACCELERATION RESULT

Test point		Mode	UUT Reading	STANDARD Reading	Correction	Uncertainty
(mm/s)	(frequency)		(mm/s)	(mm/s)	(mm/s)	(k = 2 , 95 %)
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

[illegible]

[illegible]

[illegible]

เอกสารไม่ควบคุม

CERTIFICATE OF CALIBRATION

FOR

NOMENCLATURE	:	VIBRATION METER
MANUFACTURER	:	[illegible]
MODEL / TYPE	:	[illegible]
SERIAL NO.	:	[illegible]
CLIENT NO.	:	[illegible]
IDENTIFICATION NO.	:	[illegible]

CUSTOMER : [illegible]

DATE OF RECEIVED : 29 August 2022 DATE OF ISSUED : 01 September 2022

[illegible]

Calibrated By : Sarin Thongdee
Calibration Engineer

Approved By : Hongkot Yoosamutsin
Authorized Signatory
01 September 2022

[illegible]

Certificate No. [illegible]

[illegible]

เอกสารไม่ควบคุม

REPORT OF CALIBRATION

FOR

NOMENCLATURE	:	VIBRATION METER
MANUFACTURER	:	[illegible]
MODEL / TYPE	:	[illegible]
SERIAL NO.	:	[illegible]
DATE OF CALIBRATION	:	30 August 2021

ENVIRONMENT CONDITION :

Temperature : [illegible] °C Relative Humidity : [illegible] %

PROCEDURE USED :

REFERENCE STANDARD USED :

TRACEABILITY :

UNCERTAINTY :

เอกสารไม่ควบคุม

CALIBRATION LABORATORY CO.,LTD.

CALIBRATION DATA

1. ACCELERATION MODULE

Test point		Result	ACC Reading	VCC Reading	Uncertainty	Tolerance
[illegible]	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

2. VELOCITY MODULE

Test point		Result	VCC Reading	VCC Reading	Uncertainty	Tolerance
[illegible]	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

เอกสารไม่ควบคุม

CALIBRATION LABORATORY CO.,LTD.

CALIBRATION DATA

1. DISPLACEMENT MODULE

Test point		Result	VCC Reading	VCC Reading	Uncertainty	Tolerance
[illegible]	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

เอกสารไม่ควบคุม

CALIBRATION LABORATORY CO.,LTD.

CERTIFICATE OF CALIBRATION

FOR

NOMENCLATURE	:	VIBRATION METER
MANUFACTURER	:	[illegible]
MODEL / TYPE	:	[illegible]
SERIAL NO.	:	[illegible]
CLIENT	:	[illegible]
JOB CONTROL NO.	:	[illegible]

Customer : [illegible]

Calibrated By : Surat Phanthuang
Calibration Engineer

Approved By : Manphol Tonsomsuk
Authorized Signatory
[illegible] February 2021

เอกสารไม่ควบคุม

REPORT OF CALIBRATION

FOR

NOMENCLATURE	:	VIBRATION METER
MANUFACTURER	:	[illegible]
MODEL / TYPE	:	[illegible]
SERIAL NO.	:	[illegible]
DATE OF CALIBRATION	:	06 [illegible] 2021

ENVIRONMENT CONDITIONS :

Temperature : [illegible] °C Relative Humidity : [illegible] %RH

TRACEABILITY :

1. The measurement is traceable to International System of Units (SI) through International Body of [illegible]

2. The measurement is traceable to International System of Units (SI) through International Body of [illegible]

3. The measurement is traceable to International System of Units (SI) through National Institute of Metrology (Thailand)

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 %.

[illegible]

Certificate No. [illegible]

[illegible]

เอกสารไม่ควบคุม

CONDITION OF CALIBRATION (GOOD / [illegible])

MEASUREMENT RESULTS ([illegible] / without adjustment / [illegible])

CALIBRATION DATA

1. ACCELERATION RESULT

Nominal		Unit	UUT Reading	STD Reading	Correction	Uncertainty
[illegible]	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

2. VELOCITY RESULT

Nominal		Unit	UUT Reading	STD Reading	Correction	Uncertainty
[illegible]	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

Certificate No. [illegible]

[illegible]

เอกสารไม่ควบคุม

CALIBRATION DATA

1. DISPLACEMENT RESULT

Nominal		Unit	UUT Reading	STD Reading	Correction	Uncertainty
[illegible]	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

Note: * means Calibration method "[illegible]" in this Certificate have been included in measurement.

[illegible]

[illegible]

Certificate No. [illegible]

[illegible]

เอกสารไม่ควบคุม

CERTIFICATE OF CALIBRATION

FOR

NOMENCLATURE	:	VIBRATION METER
MANUFACTURER	:	[illegible]
MODEL / TYPE	:	[illegible]
SERIAL NO.	:	[illegible]
I.D. No.	:	[illegible]
ACCESSORIES	:	[illegible]

CUSTOMER : [illegible]

DATE OF RECEIVED : 22 September 2021 DATE OF CALIBRATION : 30 September 2021

Remarks : [illegible]

Calibrated By : Sasin Phasakdeedang
Calibration Engineer

Approved By : Nongkhit Yoosuanma
Authorized Signatory
30 September 2021

[illegible]

Certificate No. [illegible]

[illegible]

เอกสารไม่ควบคุม

REPORT OF CALIBRATION

FOR

NOMENCLATURE	:	VIBRATION METER
MANUFACTURER	:	[illegible]
MODEL / TYPE	:	[illegible]
SERIAL NO.	:	[illegible]
DATE OF CALIBRATION	:	21 September 2022

ENVIRONMENT CONDITION :

Temperature : [illegible] °C Relative Humidity : [illegible] %

PROCEDURE USED :

[illegible]

REFERENCE STANDARD USED :

1. [illegible]
2. [illegible]
3. [illegible]

TRACEABILITY :

1. The measurements are traceable to International System of Units (SI) through [illegible]
2. The measurements are traceable to International System of Units (SI) through [illegible]
3. The measurements are traceable to International System of Units (SI) through [illegible]

UNCERTAINTY :

[illegible]

Certificate No. [illegible]

[illegible]

เอกสารไม่ควบคุม

CALIBRATION LABORATORY CO., LTD.

CORRECTION OF CALIBRATION CHART

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

CALIBRATION DATA

1. ACCELERATION SENSOR

Nominal		Scale	UUT Reading	STD Reading	Correction	Uncertainty
(g)	(Frequency)		(g)	(g)	(g)	(%) (k = 2)
0.1	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
0.2	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
0.3	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
0.4	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
0.5	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
0.6	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
0.7	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
0.8	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
0.9	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1.0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

2. VELOCITY SENSOR

Nominal		Scale	UUT Reading	STD Reading	Correction	Uncertainty
(mm/s)	(Frequency)		(mm/s)	(mm/s)	(mm/s)	(%) (k = 2)
1	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
2	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
3	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
4	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
5	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
6	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
7	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
8	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
9	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
10	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

Certificate No. [illegible]

[illegible]

เอกสารไม่ควบคุม

CALIBRATION LABORATORY CO., LTD.

CALIBRATION DATA

1. DISPLACEMENT RESULT

Nominal		Scale	UUT Reading	STD Reading	Correction	Uncertainty
(mm)	(Frequency)		(mm)	(mm)	(mm)	(%) (k = 2)
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

Note * Values in bold are nominal Unit: 1 G = 9.80665 m/s² ** Unit: 1 inch/s = 25.4 mm/s *** Unit: 1 mil = 0.0254 mm

This report of calibration [illegible]

[illegible]

Certificate No. [illegible]

[illegible]

เอกสารไม่ควบคุม

CALIBRATION LABORATORY CO., LTD.

CERTIFICATE OF CALIBRATION

FOR

NOMENCLATURE	:	VIBRATION METER
MANUFACTURER	:	[illegible]
MODEL / TYPE	:	[illegible]
SERIAL NO.	:	[illegible]
CUSTOMER	:	[illegible]
ADDRESS	:	[illegible]

CUSTOMER : [illegible]

DATE OF RECEIVED : 21 June 2022 DATE OF TEST : 20 June 2022

Based on calibration system and traceable to [illegible]

Calibrated By : [illegible]
Calibration Engineer

Approved By : [illegible]
Authorized Signatory
20 June 2022

This calibration certificate [illegible]

Certificate No. [illegible]

[illegible]

เอกสารไม่ควบคุม

CALIBRATION LABORATORY CO., LTD.

REPORT OF CALIBRATION

FOR

NOMENCLATURE	:	VIBRATION METER
MANUFACTURER	:	INSTANTEL
MODEL / TYPE	:	[illegible]
SERIAL NO.	:	[illegible]
DATE OF CALIBRATION	:	27 June 2022

ENVIRONMENT CONDITIONS :

Temperature : [illegible] °C Relative Humidity : [illegible] %RH

PROCEDURE USED :

[illegible]

REFERENCE STANDARD USED :

1. Digital Multimeter, Fluke model 233, S/N. 8438
2. Digital Acceleration Programmable Transducer, Philips series 4 model 8316, S/N 0111
3. Portable Vibration Calibrator, Bruel & Kjaer model 4294, S/N 1101

TRACEABILITY :

1. The measurement is traceable to International System of Units (SI) through Asia Metrology (Thailand) Co.,Ltd. Certificate No. 66-0001/21, Date 20 January 2021
2. The measurement is traceable to International System of Units (SI) through Asia Metrology (Thailand) Co.,Ltd. Certificate No. 65-0002/21, Date 20 January 2021
3. The measurement is traceable to International System of Units (SI) through Tri Tool Co., Ltd. Certificate No. 20-0101, Date 5 November 2020

UNCERTAINTY :

The reported expanded uncertainty of measurement is stated as the combined standard uncertainty of measurement multiplied by the coverage factor k = 2.01 which at a confidence probability is in coverage probability of approximately 95%. Value have evaluated according to the "Guidelines of the Uncertainty of Measurement in Calibration (LAC-G-002)"

Certificate No. [illegible]

[illegible]

page 1 of 3

เอกสารไม่ควบคุม

CALIBRATION LABORATORY CO., LTD.

CONDITION OF CALIBRATION ITEM : GOOD

MEASUREMENT MODE (X) without adjustment ( ) adjustment

CALIBRATION DATA

1. ACCELERATION RESULT

Test point		Mode	UUT Reading	STD Reading	Uncertainty	Uncertainty
(g)	(Frequency)		(g)	(g)	(g)	(% k=2 cvg.)
0.2	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]
0.5	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]
1.0	[illegible]	peak	[illegible]	[illegible]	[illegible]	[illegible]
2.0	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]
5.0	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]
0.7	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]
1.5	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]
3.5	[illegible]	peak	[illegible]	[illegible]	[illegible]	[illegible]
7.0	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]

2. VELOCITY RESULT

Test point		Mode	UUT Reading	STD Reading	Uncertainty	Uncertainty
(mm/s)	(frequency)		(mm/s)	(mm/s)	(mm/s)	(% k=2 cvg.)
5	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]
8	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]
15	[illegible]	peak	[illegible]	[illegible]	[illegible]	[illegible]
30	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]
50	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]
5	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]
8	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]
15	[illegible]	peak	[illegible]	[illegible]	[illegible]	[illegible]
30	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]
50	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]

Certificate No. [illegible]

[illegible]

page 2 of 3

เอกสารไม่ควบคุม

CALIBRATION LABORATORY CO., LTD.

CALIBRATION DATA

3. DISPLACEMENT RESULT

Test point		Mode	UUT Reading	STD Reading	Uncertainty	Uncertainty
(mm/s)	(frequency)		(mm/s)	(mm/s)	(mm/s)	(% k=2 cvg.)
[illegible]	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	peak	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	peak	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]

Note: * Grade C (Marginal) or Grade F (Not Acceptable) results shall not be used for calibration.

The Reference Standard used is traceable to [illegible]

This report is valid for the above tested instrument only.

[illegible]

Certificate No. [illegible]

[illegible]

page 3 of 3

เอกสารไม่ควบคุม

CALIBRATION LABORATORY CO., LTD.

CERTIFICATE OF CALIBRATION

FOR

NOMENCLATURE	:	VIBRATION METER
MANUFACTURER	:	INSTANTEL
MODEL / TYPE	:	[illegible]
SERIAL NO.	:	[illegible]
CUST. NO.	:	[illegible]
JOB CONTROL NO.	:	[illegible]

CUSTOMER : [illegible]

DATE OF RECEIVED : 21 February 2022 DATE OF ISSUED : 24 February 2022

This is to certify that the above mentioned instrument was calibrated in our laboratory.

Calibrated By : Sunti Phasathaudeng
Calibration Engineer

Approved By : Manphol Tanyaroon
Authorized Signatory
24 February 2022

The Calibration Certificate without signature and company's seal is not valid. Results are only valid for the items calibrated.

Certificate No. [illegible]

[illegible]

page 1 of 3

เอกสารไม่ควบคุม

REPORT OF CALIBRATION

FOR

NOMENCLATURE	:	VIBRATION METER
MANUFACTURER	:	[illegible]
MODEL / TYPE	:	[illegible]
SERIAL NO.	:	[illegible]
DATE OF CALIBRATION	:	21 February 2022

ENVIRONMENT CONDITION :

Temperature : [illegible] °C Relative Humidity : [illegible] %RH

PROCEDURE USED :

[illegible]

REFERENCE STANDARD USE :

[illegible]

TRACEABILITY :

[illegible]

UNCERTAINTY :

[illegible]

Certificate No. [illegible]

[illegible]

เอกสารไม่ควบคุม

CONDITION OF CALIBRATION TYPE : [illegible]

MEASUREMENT RESULTS : (X) without adjustment ( ) adjustment

CALIBRATION DATA

1. ACCELERATION RESULT

Test point		Mode	ATE Reading	UUC Reading	Correction	Uncertainty
(g)	(Frequency)		(g)	(g)	(g)	% (k=2 at 95%)
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

2. VELOCITY RESULT

Test point		Mode	ATE Reading	UUC Reading	Correction	Uncertainty
(mm/s)	(Frequency)		(mm/s)	(mm/s)	(mm/s)	% (k=2 at 95%)
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

[illegible]

เอกสารไม่ควบคุม

CALIBRATION DATA

1. DISPLACEMENT RESULT

Test point		Mode	ATE Reading	UUC Reading	Correction	Uncertainty
(mm/s)	(Frequency)		(mm/s)	(mm/s)	(mm/s)	% (k=2 at 95%)
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

[illegible]

This report is valid for the same standard instrument only.

[illegible]

[illegible]

เอกสารไม่ควบคุม

CERTIFICATE OF CALIBRATION

FOR

NOMENCLATURE	:	VIBRATION METER
MANUFACTURER	:	[illegible]
MODEL / TYPE	:	[illegible]
SERIAL NO.	:	[illegible]
CUID. NO.	:	[illegible]
[illegible]	:	[illegible]

CUSTOMER : [illegible]

[illegible]

[illegible]

Calibrated By : Suree Phoonthoodtong
Calibration Engineer

Approved By : Mongkol Yoosomsiri
Authorized Signatory
02 June 2022

[illegible]

[illegible]

เอกสารไม่ควบคุม

REPORT OF CALIBRATION

FOR

NOMENCLATURE	:	VIBRATION METER
MANUFACTURER	:	INSTANTEL
MODEL / TYPE	:	[illegible]
SERIAL NO.	:	[illegible]
DATE OF CALIBRATION	:	31 May 2022

ENVIRONMENT CONDITIONS :

Temperature : [illegible] °C Relative Humidity : [illegible] %RH

PROCEDURE USED :

[illegible]

REFERENCE STANDARD USED :

1. [illegible]
2. [illegible]
3. [illegible]

TRACEABILITY :

1. The measurements are traceable to International System of Units (SI) through [illegible]
2. The measurements are traceable to International System of Units (SI) through [illegible]
3. The measurements are traceable to International System of Units (SI) through The Metal Shop Inc.

UNCERTAINTY :

[illegible]

เอกสารไม่ควบคุม

CONDITION OF CALIBRATION : GOOD

MEASUREMENT RESULTS : [illegible]

CALIBRATION DATA

1. ACCELERATION RESULT

Test point		Scale	UUT Reading	STD Reading	Correction	Uncertainty
[illegible]	[illegible]					
0.1	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]
0.2	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]
0.3	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]
0.4	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]
0.5	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]
0.6	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]
0.7	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]
0.8	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]
0.9	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]
1.0	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]

2. VELOCITY RESULT

Test point		Scale	UUT Reading	STD Reading	Correction	Uncertainty
[illegible]	[illegible]					
1	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]
2	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]
3	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]
4	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]
5	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]
6	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]
7	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]
8	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]
9	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]
10	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]

เอกสารไม่ควบคุม

CALIBRATION DATA

3. DISPLACEMENT RESULT

Test point		Scale	UUT Reading	STD Reading	Correction	Uncertainty
[illegible]	[illegible]					
[illegible]	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]

[illegible]

[illegible]

[illegible]

เอกสารไม่ควบคุม

CERTIFICATE OF CALIBRATION

FOR

NOMENCLATURE	:	VIBRATION METER
MANUFACTURER	:	INSTANTEL
MODEL / TYPE	:	[illegible]
SERIAL NO.	:	[illegible]
CUS. NO.	:	[illegible]
CALIBRATION NO.	:	[illegible]

CUSTOMER : [illegible]

DATE OF RECEIVED : 21 February 2022 DATE OF ISSUED : 24 February 2022

[illegible]

Calibrated By : [illegible]
Calibration Engineer

Approved By : [illegible]
Authorized Signatory
25 February 2022

[illegible]

เอกสารไม่ควบคุม

REPORT OF CALIBRATION

FOR

NOMENCLATURE	:	VIBRATION METER
MODEL+CITIZEN	:	SVAN 979
SERIAL / TYPE	:	72118827/SVAN 979
SERIAL No.	:	23[illegible]/SVAN
DATE OF CALIBRATION	:	22 February 2022

ENVIRONMENT CONDITIONS :

Temperature : 23 ± 3 °C Relative Humidity : 60 ± 10 %RH

PROCEDURE USED :

This instrument was calibrated in accordance to ASTM E 1005-00 Section 6 and ISO 16063-21 recommended practices. The calibration was performed by using Digital Multimeter, High Resolution Programmable Power Source, accelerometer and Measuring amplifier which traceable to the Calibration Laboratory Co., Ltd.

REFERENCE STANDARD USED :

1. Digital Multimeter, Keysight Model 3458A S/N: [illegible]
2. High Resolution Programmable Power Source, Fluke Model 9500B S/N: [illegible]
3. Accelerometer with Measuring Amplifier, Bruel & Kjaer Model 8305 S/N: [illegible]

TRACEABILITY :

1. The measurements are traceable to International Standard Unit (SI) through measurement Reference Laboratory Certificate No. [illegible] dated [illegible]
2. The measurements are traceable to International Standard Unit (SI) through measurement Reference Laboratory Certificate No. [illegible] dated [illegible]
3. The measurements are traceable to International Standard Unit (SI) through National Institute of Metrology (Thailand) Certificate No. [illegible] dated [illegible]

UNCERTAINTY :

The results of acquisition and error of measurement are stated as the standard uncertainty of measurement multiplied by the coverage factor k = 2.26 which is corresponding to a coverage probability of approximately 95%. Uncertainty evaluation according to the ISO Publication of the Uncertainty in Measurement in Calibration (ISO GUM, 1995:2008)

Certificate No. [illegible]

[illegible] page 2 of 3

เอกสารไม่ควบคุม

CONDITION OF CALIBRATION ITEM : GOOD

MEASUREMENT RESULTS : [X] without adjustment [ ] adjustment

CALIBRATION DATA

1. ACCELERATION RESULT

Indicated		Mode	STD Reading	DUT Reading	Correction	Uncertainty
(g)	(frequency)		(g)	(g)	(g)	± (% of rdg)
0.5	79.6Hz		0.499	0.500	0.001	3.0
1.0	79.6Hz		0.999	1.002	0.003	1.5
2.0	79.6Hz	peak	2.004	2.010	0.006	1.2
5.0	79.6Hz		5.000	5.027	0.027	1.2
9.9	79.6Hz		9.900	9.956	0.056	1.2
0.5	3.98 Hz		0.500	0.490	-0.010	3.0
1.0	3.98 Hz		0.999	0.985	-0.014	1.5
2.0	3.98 Hz	peak	2.000	1.985	-0.015	1.2
5.0	3.98 Hz		5.000	4.985	-0.015	1.2
9.9	3.98 Hz		9.900	9.887	-0.013	1.2

2. VELOCITY RESULT

Indicated		Mode	STD Reading	DUT Reading	Correction	Uncertainty
(mm/s)	(frequency)		(mm/s)	(mm/s)	(mm/s)	± (% of rdg)
5	79.6Hz		5.000	5.000	0.000	3.0
10	79.6Hz		9.999	9.993	-0.006	1.5
20	79.6Hz	peak	19.999	19.991	-0.008	1.5
50	79.6Hz		50.000	49.985	-0.015	1.2
99	79.6Hz		99.000	98.970	-0.030	1.2
5	3.98 Hz		5.000	4.997	-0.003	3.0
10	3.98 Hz		9.999	9.990	-0.009	1.5
20	3.98 Hz	rms	19.999	19.990	-0.009	1.5
50	3.98 Hz		50.000	49.986	-0.014	1.2
99	3.98 Hz		99.000	98.972	-0.028	1.2

Certificate No. [illegible]

[illegible] page 3 of 3

เอกสารไม่ควบคุม

CALIBRATION DATA

1. ACCELERATION RESULT

Indicated		Mode	STD Reading	DUT Reading	Correction	Uncertainty
(g)	(frequency)		(g)	(g)	(g)	± (% of rdg)
0.5	79.6Hz		0.499	0.500	0.001	3.0
1.0	79.6Hz		0.999	1.002	0.003	1.5
2.0	79.6Hz	peak	2.004	2.010	0.006	1.2
5.0	79.6Hz		5.000	5.027	0.027	1.2
9.9	79.6Hz		9.900	9.956	0.056	1.2
0.5	3.98 Hz		0.500	0.490	-0.010	3.0
1.0	3.98 Hz		0.999	0.985	-0.014	1.5
2.0	3.98 Hz	peak	2.000	1.985	-0.015	1.2
5.0	3.98 Hz		5.000	4.985	-0.015	1.2
9.9	3.98 Hz		9.900	9.887	-0.013	1.2

Certificate No. [illegible]

[illegible] page 3 of 3

เอกสารไม่ควบคุม

CERTIFICATE OF CALIBRATION

FOR

NOMENCLATURE	:	VIBRATION METER
MODEL+CITIZEN	:	SVAN 979
MODEL / TYPE	:	72118827/SVAN 979
SERIAL No.	:	23[illegible]/SVAN
CUST. No.	:	[illegible]
REQUESTOR	:	[illegible]

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

[illegible]

[illegible]

Date of Calibration : 24 May 2022 Date of Issue : 25 May 2022

Calibrated By : Somsri Phanthawatthong
Calibration Engineer

Approved By : Monghol Yimwimon
Authorized Signatory
01 June 2022

[illegible]

Certificate No. [illegible]

[illegible] page 1 of 3

เอกสารไม่ควบคุม

REPORT OF CALIBRATION

FOR

NOMENCLATURE	:	VIBRATION METER
MANUFACTURER	:	[illegible]
MODEL / TYPE	:	[illegible]
SERIAL NO.	:	[illegible]
DATE OF CALIBRATION	:	11 Nov 2022

ENVIRONMENT CONDITIONS :

Temperature : [illegible] °C Relative Humidity : [illegible] %RH

PROCEDURE USED :

[illegible]

REFERENCE STANDARD USED :

1. [illegible]
2. [illegible]
3. [illegible]

TRACEABILITY :

1. [illegible]
2. [illegible]
3. [illegible]

UNCERTAINTY :

[illegible]

Calibrated by: [illegible]

[illegible]

เอกสารไม่ควบคุม

[illegible] OF CALIBRATION ITEM : [illegible]

MEASUREMENT RESULTS ([illegible]) [illegible]

CALIBRATION DATA

1. ACCELERATION RESULT

Transducer		Range	UUT Reading	STD Reading	Correction	Uncertainty
[illegible]	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

2. VELOCITY RESULT

Transducer		Range	UUT Reading	STD Reading	Correction	Uncertainty
[illegible]	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

Certificate No. [illegible]

[illegible]

เอกสารไม่ควบคุม

CALIBRATION DATA

2. SHOCK ACCELERATION RESULT

Transducer		Range	UUT Reading	STD Reading	Correction	Uncertainty
[illegible]	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

Note: [illegible]

[illegible]

[illegible]

[illegible]

Certificate No. [illegible]

[illegible]

เอกสารไม่ควบคุม

CERTIFICATE OF CALIBRATION

FOR

NOMENCLATURE	:	VIBRATION METER
MANUFACTURER	:	[illegible]
MODEL / TYPE	:	[illegible]
SERIAL NO.	:	[illegible]
CUS. NO.	:	[illegible]
[illegible]	:	[illegible]

[illegible] : [illegible]

[illegible]

[illegible]

[illegible]

Calibrated By : [illegible]

Calibration Engineer

Approved By : [illegible]

Authorized Signatory

11 February 2023

[illegible]

Certificate No. [illegible]

[illegible]

เอกสารไม่ควบคุม

REPORT OF CALIBRATION

FOR

	:	
	:	
	:	
	:	
	:	

ENVIRONMENT CONDITION :

PROCEDURE USED :

REFERENCE STANDARD USED :

TRACEABILITY :

UNCERTAINTY :

เอกสารไม่ควบคุม

CALIBRATION LABORATORY CO.,LTD.

CALIBRATION DATA

1. ACCELERATION MODULE

2. VELOCITY MODULE

เอกสารไม่ควบคุม

CALIBRATION LABORATORY CO.,LTD.

CALIBRATION DATA

1. DISPLACEMENT MODULE

เอกสารไม่ควบคุม

CALIBRATION LABORATORY CO.,LTD.

CERTIFICATE OF CALIBRATION

FOR

	:	
	:	
	:	
	:	
	:	
	:	

CUSTOMER :

DATE OF RECEIVED : 13 September 2022 DATE OF ISSUED : 20 September 2022

Calibrated By : Name: Phanthitsilong
Calibration Engineer

Approved By : Mongkol Yoosuwan
Authorized Signatory
20 September 2022

เอกสารไม่ควบคุม

REPORT OF CALIBRATION

FOR

NOMENCLATURE	:	VIBRATION METER
MANUFACTURER	:	[illegible]
MODEL / TYPE	:	[illegible]
SERIAL NO.	:	[illegible]
DATE OF CALIBRATION	:	23 September 2022

ENVIRONMENT CONDITIONS :

Temperature : [illegible] °C Relative Humidity : [illegible] %RH

TRACEABILITY :

1. The measurements are traceable to International Standards of Weight and Measures and National Standards of Weight and Measures.
2. The measurements are traceable to International Standards of Weight and Measures and National Standards of Weight and Measures.
3. The measurements are traceable to International Standards of Weight and Measures and National Standards of Weight and Measures.

UNCERTAINTY :

The reported expanded uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor k = 2, which for a normal distribution corresponds to a coverage probability of approximately 95%. The uncertainty was determined according to the Publication of the International Bureau of Weights and Measures (BIPM).

Certificate No. [illegible]

[illegible]

เอกสารไม่ควบคุม

CONDITION OF CALIBRATION ITEM : Good

MECHANICAL RESULTS : ( ) Without Adjustment ( ) Adjustment

CALIBRATION DATA :

1. ACCELERATION RESULT

Frequency		Mode	UUT Reading	STD Reading	Deviation	Uncertainty
[illegible]	[illegible]					
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

2. VELOCITY RESULT

Frequency		Mode	UUT Reading	STD Reading	Deviation	Uncertainty
[illegible]	[illegible]					
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

Certificate No. [illegible]

[illegible]

เอกสารไม่ควบคุม

CALIBRATION DATA

3. DISPLACEMENT RESULT

Frequency		Mode	UUT Reading	STD Reading	Deviation	Uncertainty
[illegible]	[illegible]					
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

[illegible]

[illegible]

เอกสารไม่ควบคุม

CERTIFICATE OF CALIBRATION

FOR

NOMENCLATURE	:	VIBRATION METER
MANUFACTURER	:	[illegible]
MODEL / TYPE	:	[illegible]
SERIAL NO.	:	[illegible]
CAL. NO.	:	[illegible]
JOB CONTROL NO.	:	[illegible]

CUSTOMER : [illegible]

[illegible]

DATE OF CALIBRATION : 28 February 2022 DATE OF ISSUE : 01 March 2022

[illegible]

Calibrated By : Sonic Phoonbanchong
Calibration Engineer

Approved By : Mongkol Tonsomsuk
Authorized Signatory
02 March 2022

[illegible]

Certificate No. [illegible]

[illegible]

เอกสารไม่ควบคุม

REPORT OF CALIBRATION

FOR

[illegible]	:	VIBRATION METER
[illegible]	:	[illegible]
[illegible]	:	[illegible]
[illegible]	:	[illegible]
[illegible]	:	[illegible]

ENVIRONMENT CONDITION :

Temperature : [illegible] °C Relative Humidity : [illegible] %RH

PROCEDURE USED :

[illegible]

REFERENCE STANDARD USED :

1. [illegible]
2. [illegible]
3. [illegible]

TRACEABILITY :

1. The measurements are traceable to International System of Units (SI) through [illegible]
2. The measurements are traceable to International System of Units (SI) through [illegible]
3. The measurements are traceable to International System of Units (SI) through [illegible]

UNCERTAINTY :

[illegible]

Certificate No. [illegible]

[illegible]

เอกสารไม่ควบคุม

CALIBRATION LABORATORY CO.,LTD.

CONDITION OF CALIBRATION / [illegible]

MEASUREMENT [illegible]

CALIBRATION DATA

1. ACCELERATION RESULT

Frequency		Unit	ACO Reading	PCB Reading	Deviation	Uncertainty
(Hz)	(Rad/sec)		(g's)	(g's)	(%)	(U k=2 ,conf.p)
2.5	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
4.0	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]
5.0	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]
6.3	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]
8.0	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]
9.5	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]
10.0	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]
12.5	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]
15.0	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]
16.0	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]

2. VELOCITY RESULT

Frequency		Unit	ACO Reading	PCB Reading	Deviation	Uncertainty
(Hertz)	(Rad/sec)		(mm/s)	(mm/s)	(mm/s)	(U k=2 ,conf.p)
5	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
6	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]
7	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]
8	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]
9	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]
10	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]
11	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]
12	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]
13	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]
14	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]

Certificate No. [illegible]

[illegible]

เอกสารไม่ควบคุม

CALIBRATION LABORATORY CO.,LTD.

CALIBRATION DATA

1. DISPLACEMENT RESULT

Frequency		Unit	ACO Reading	PCB Reading	Deviation	Uncertainty
(Hz)	(Rad/sec)		(mm)	(mm)	(mm)	(U k=2 ,conf.p)
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]

[illegible]

[illegible]

Certificate No. [illegible]

[illegible]

เอกสารไม่ควบคุม

CALIBRATION LABORATORY CO.,LTD.

CERTIFICATE OF CALIBRATION

FOR

[illegible]	:	VIBRATION METER
[illegible]	:	[illegible]
[illegible]	:	[illegible]
[illegible]	:	[illegible]
CUST. NO.	:	[illegible]
[illegible]	:	[illegible]

CUSTOMER : [illegible]

[illegible]

[illegible]

Calibrated By : Ivory Phanthavong
Calibration Engineer

Approved By : [illegible]
Technical Signatory
[illegible]

Certificate No. [illegible]

[illegible]

เอกสารไม่ควบคุม

REPORT OF CALIBRATION

FOR

[illegible]	:	VIBRATION METER
[illegible]	:	[illegible]
[illegible]	:	[illegible]
[illegible]	:	[illegible]
DATE OF CALIBRATION	:	11 February 2025

ENVIRONMENT CONDITION :

Temperature : 23 ± 3 °C Relative Humidity : 60 ± 10 %RH

PROCEDURE USED :

[illegible]

REFERENCE STANDARD USED :

1. [illegible]
2. [illegible]
3. [illegible]

TRACEABILITY :

1. The equipment is traceable to International System of Units (SI) through Accredited Bodies of Thailand [illegible]
2. The equipment is traceable to International System of Units (SI) through Accredited Bodies of Thailand [illegible]
3. The equipment is traceable to International System of Units (SI) through National Metrology Institute of Germany (PTB) [illegible]

UNCERTAINTY :

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

The uncertainty budget is according to the "Evaluation of the Uncertainty of Measurement for Calibration" [illegible]

Certificate No. [illegible]

[illegible]

เอกสารไม่ควบคุม

CONDITION OF CALIBRATION : OOOR

MEASUREMENT RESULTS ([illegible]) : [illegible]

CALIBRATION DATA

1. ACCELERATION RESULT

Transducer		Range	STD Reading	DUT Reading	Correction	Uncertainty
[illegible]	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

2. VELOCITY RESULT

Transducer		Range	STD Reading	DUT Reading	Correction	Uncertainty
[illegible]	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

Certificate No. [illegible]

[illegible]

เอกสารไม่ควบคุม

CALIBRATION DATA

3. DISPLACEMENT RESULT

Transducer		Range	STD Reading	DUT Reading	Correction	Uncertainty
[illegible]	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

Note: * [illegible]

[illegible]

[illegible]

Certificate No. [illegible]

[illegible]

เอกสารไม่ควบคุม

CERTIFICATE OF CALIBRATION

FOR

[illegible]	:	VIBRATION METER
[illegible]	:	[illegible]
[illegible]	:	[illegible]
[illegible]	:	[illegible]
[illegible]	:	[illegible]
[illegible]	:	[illegible]
[illegible]	:	[illegible]

[illegible]

DATE OF CALIBRATION : 11 February 2025 DATE OF ISSUE : 16 February 2025

[illegible]

Calibrated By : [illegible]

Calibration Engineer

Approved By : [illegible]

Authorized Signatory

16 February 2025

[illegible]

Certificate No. [illegible]

[illegible]

เอกสารไม่ควบคุม

REPORT OF CALIBRATION

FOR

[illegible]	:	VIBRATION METER
[illegible]	:	[illegible]
[illegible]	:	[illegible]
[illegible]	:	[illegible]
[illegible]	:	[illegible]

ENVIRONMENT CONDITIONS :

PROCEDURE USED :

REFERENCE STANDARD USED :

TRACEABILITY :

UNCERTAINTY :

เอกสารไม่ควบคุม

CALIBRATION LABORATORY CO., LTD.

CONDITION OF CALIBRATION ITEM : GOOD

MEASUREMENT RESULTS :

CALIBRATION DATA

1. ACCELERATION RESULT

Operator		Unit	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]					
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

2. VELOCITY RESULT

Operator		Unit	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]					
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

เอกสารไม่ควบคุม

CALIBRATION LABORATORY CO., LTD.

CALIBRATION DATA

1. SHOCK ACCELERATION RESULT

Test Item		Limit	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]					
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

[illegible]

[illegible]

เอกสารไม่ควบคุม

CALIBRATION LABORATORY CO., LTD.

CERTIFICATE OF CALIBRATION

FOR

[illegible]	:	VIBRATION METER
[illegible]	:	[illegible]
[illegible]	:	[illegible]
[illegible]	:	[illegible]
[illegible]	:	[illegible]
[illegible]	:	[illegible]

CUSTOMER : [illegible]

DATE OF RECEIVED : 28 February 2023 DATE OF ISSUED : 02 March 2023

[illegible]

Calibrated By : Saro Phanthawong
Calibration Engineer

Approved By : Ekaphol Yoocoonin
Authorized Signatory
02 March 2023

[illegible]

เอกสารไม่ควบคุม

REPORT OF CALIBRATION

FOR

NOMENCLATURE	:	VIBRATION METER
MANUFACTURER	:	[illegible]
MODEL / TYPE	:	[illegible]
SERIAL NO.	:	[illegible]
DATE OF CALIBRATION	:	31 March 2022

ENVIRONMENTAL CONDITIONS :

Temperature : [illegible] °C Relative Humidity : [illegible] %RH

PROCEDURE USED :

[illegible]

REFERENCE STANDARD USED :

1. [illegible]
2. [illegible]
3. [illegible]

TRACEABILITY :

1. The measurement are traceable to laboratory of Union [illegible] through international Bodies of National Lab Certificate No. [illegible] Date Due [illegible]
2. The measurement are traceable to laboratory of Union [illegible] through international Bodies of National Lab Certificate No. [illegible] Date Due [illegible]
3. The measurement are traceable to laboratory of Union [illegible] through National standard of Metrology of Thailand Certificate No. [illegible] Dated [illegible]

UNCERTAINTY :

[illegible]

Certificate No. [illegible]

[illegible]

เอกสารไม่ควบคุม

CONDITION OF CALIBRATION ITEM : GOOD

MEASUREMENT RESULTS (AS [illegible] / adjustment) : [illegible]

CALIBRATION DATA

1. ACCELERATION RESULT

Test point		Mode	STD Reading	DUT Reading	Correction	Uncertainty
[illegible]	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

2. VELOCITY RESULT

Test point		Mode	STD Reading	DUT Reading	Correction	Uncertainty
[illegible]	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

Certificate No. [illegible]

[illegible]

เอกสารไม่ควบคุม

CALIBRATION DATA

3. DISPLACEMENT RESULT

Test point		Mode	STD Reading	DUT Reading	Correction	Uncertainty
[illegible]	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

Note: [illegible]

[illegible]

[illegible]

Certificate No. [illegible]

[illegible]

เอกสารไม่ควบคุม

แผนงานติดตามตรวจสอบคุณภาพอากาศในบรรยากาศ
บริษัท ทีพีไอ โพลีน จำกัด (มหาชน) สระบุรี

รายการใบรับรองสอบเทียบ/ทวนสอบ เครื่องมือหลักประจำห้องปฏิบัติการวิเคราะห์ สำหรับวิเคราะห์คุณภาพสิ่งแวดล้อม

No.	Instrument/Equipment	Parameter	Manufacturer	Model/Serial No.	Calibrator	Certification No.	Date of Calibration	Due date of Calibration*	Remark
เครื่องมือหลักประจำห้องปฏิบัติการวิเคราะห์คุณภาพอากาศ									
1	Analytical Balance (Readability 0.1 mg)	TSP PM10 PM 2.5	Mettler-Toledo	AB204-S / 1128312528	Technology Promotion Association (Thailand-Japan)	23MM331	7 Apr 23	5 Apr 24	-
2	Analytical Balance (Readability 0.1 mg)		Mettler-Toledo	AB204-S/FACT / B108115858	Technology Promotion Association (Thailand-Japan)	23MM332	7 Apr 23	5 Apr 24	-
3	Analytical Balance (Readability 0.001 mg)		Mettler-Toledo	XP6 / B322373893	Technology Promotion Association (Thailand-Japan)	23MM333	7 Apr 23	5 Apr 24	-
4	Ion Chromatrography (IC)	HCl, Chlorine, HF, H_2SO_4	Dionex	DX-120 / 03010223	Archemica Lab Co.Ltd.	Qualification Report Anion (ID#042)	9 Dec 22	8 Dec 23	-
5	Atomic Absorption Spectrophotometer (AAS)	Hg, Cd, Pb, Ar, Cr, Cu, Mn, Ni, Va, Co Antimony, Berylium	Perkin Elmer	PinAAcle 900F / PFBS20031902	Perkin Elmer Co.,Ltd.	PM Service No. WO-02273773	26 Jun 23	24 Jun 24	-
6	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	-
7	Atomic Absorption Spectrophotometer (AAS)		Agilent Technologies	System ID:G8432A AA240FS / MY13160001	Thailand Institute of Scientific and Technological Research(TISTR)	MTC. ACL. No. 387/66	2 Feb 23	1 Feb 24	-
8	UV-VIS Spectrophotometer	Nox	Agilent Technologies	Cary60 G6860A / MY15410009	DQE Services Co.,Ltd.	SP23-021	20 May 23	18 May 24	-
9	UV-VIS Spectrophotometer		Hitachi	U-1900 / 2021-064	DQE Services Co.,Ltd.	SP23-007	5 Jan 23	4 Jan 24	-

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

Certificate of Calibration

Equipment :
Manufacturer :
Model :
Serial No. :
ID No. :
Submitted by :
Location :
Received date :
Calibration Date :
Ambient Temperature :
Relative Humidity :
Calibrated by :
Approved by :
Issue Date :

Uncontrolled Document

Equipment :
Condition As Received :
Reference :
Procedure used :
Condition of the result of calibration :
Result of calibration :
Before Adjustment :
After Adjustment :

Applied Weight (g)	Balance Reading (g)	Correction (g)	Measurement Uncertainty (±mg)	Coverage Factor (k)

Uncertainty of the standard deviation of weighing method

Applied Weight (g)	Standard Deviation of Reading (g)

Uncontrolled Document

Equipment :
Condition As Received :
Reference :
Result of calibration :

2. Effect of off center loading

Position 1 (g) | Position 2 (g) | Position 3 (g) | Position 4 (g) | Position 5 (g) | Maximum difference between off-center and center loading (g)

3. Repeatability test several runs

Applied Weight (g)	Balance Reading (g)	Correction (g)	Measurement Uncertainty (±mg)	Coverage Factor (k)

Uncontrolled Document

Certificate of Calibration

Equipment :
Manufacturer :
Model :
Serial No. :
ID No. :
Submitted by :
Location :
Received date :
Calibration Date :
Ambient Temperature :
Relative Humidity :
Calibrated by :
Approved by :
Issue Date :

Uncontrolled Document

Equipment :
Condition As-Received :
Reference :
Procedure used :

Cert No. :
Page : 1 of 3

Calibration were conducted using in-house calibration procedure CP-0001 according to direct measurement method against standard weight.

Condition of the result of calibration

1. Reference standard instrument :

Instruments	Model	Serial No.	ID No.	Test report No.	Due date
1) Standard Weight Set (E2)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

2. This certificate is valid only for the item calibrated on date and place of calibration.
3. The result of calibration was made on requested at the point specified by customer.
4. This certificate is not certified for any commercial transaction.
5. This certification is traceable to the International System of Unit.

Result of calibration : [ ] Without Adjustment [ ] After Adjustment by Internal Calibration

Range capacity : [illegible] g to [illegible] g Resolution [illegible] g

Before Adjustment :

Applied Weight (g)	Balance Reading (g)	Correction (g)	Measurement Uncertainty (+/-mg)	Coverage Factor (k)
100	[illegible]	[illegible]	0.21	2.00
200	[illegible]	[illegible]	0.29	2.00

After Adjustment :

1. Determination of the standard deviation of weighing machine (n = 10)

Applied Weight (g)	Standard Deviation of Reading (g)
100	[illegible]
200	[illegible]

Uncontrolled Document

Equipment :
Condition As-Received :
Reference :
Procedure used :

Cert No. :
Page : 2 of 3

Result of calibration

1. Effect of off-center loading

A mass of 100 g was placed in various position on the pan.
The weighing machine reading is not affected as given in the table.

Position 1 (g)	Position 2 (g)	Position 3 (g)	Position 4 (g)	Position 5 (g)	Maximum difference between off-center and central loading (g)
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

2. Departure from standard value

Applied Weight (g)	Balance Reading (g)	Correction (g)	Measurement Uncertainty (+/-mg)	Coverage Factor (k)
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

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 %.

Uncontrolled Document

Equipment :
Condition As-Received :
Reference :
Procedure used :

Cert No. :
Page : 3 of 3

Calibration were conducted using in-house calibration procedure CP-0001 according to direct measurement method against standard weight.

Condition of the result of calibration

1. Reference standard instrument :

Instruments	Model	Serial No.	ID No.	Test report No.	Due date
1) Standard Weight Set (E2)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

2. This certificate is valid only for the item calibrated on date and place of calibration.
3. The result of calibration was made on requested at the point specified by customer.
4. This certificate is not certified for any commercial transaction.
5. This certification is traceable to the International System of Unit.

Result of calibration : [ ] Without Adjustment [ ] After Adjustment by Internal Calibration

Range capacity : [illegible] g to [illegible] g Resolution [illegible] g

Before Adjustment :

Applied Weight (g)	Balance Reading (g)	Correction (g)	Measurement Uncertainty (+/-mg)	Coverage Factor (k)
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

After Adjustment :

1. Determination of the standard deviation of weighing machine (n = 10)

Applied Weight (g)	Standard Deviation of Reading (g)
[illegible]	[illegible]

Uncontrolled Document

[illegible]

Certificate of Calibration

Cert No. : [illegible]
Page : 1 of 3

Equipment :	Electronic Balance
Manufacturer :	Mettler Toledo
Model :	[illegible]
Serial No. :	[illegible]
ID No. :	[illegible]
Submitted by :	United Surgical and Engineering Corporation Co. Ltd. 3 Soi Lasalle 41, Sukhumvit Road, Bangchak, Phrakhanong, Bangkok 10260
Location :	Balance Room 3
Received date :	07 April 2020
Calibration Date :	07 April 2020
Ambient Temperature :	20 °C to 40 °C
Relative Humidity :	30 % to 80 %
Calibrated by :	Surat Inpo
Approved by :	Approved Signatory
	(Hardhipan Tanmpanit) (Mallas Sukkasan)
Issue Date :	10 April 2020

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

[illegible]

Uncontrolled Document

Uncontrolled Document

Certificate of Calibration

DX-120 : (Anion System ID#042)

for

UAE Consultant Co.,Ltd.

เอกสารไม่ควบคุม

Qualification Report

PM_Checklist : CM_OQ and PQ
DX-120 (ID#042)

For
UAE Consultant Co.,Ltd.
(2nd Contract)

Preventive Maintenance

Check List

เอกสารไม่ควบคุม

เอกสารไม่ควบคุม

Preventive Maintenance Checklist

Dionex Ion Chromatography
Preventive Maintenance Report

Customer Organization	Service Organization
Lab / Area Name	Software
Engineer Name	Date
Mr. Chanchanog Khaosoot	Service Visit

Instrument Detail

Instrument Model	Application
ICS-1100(DNP)	Anion
Instrument Configuration	Serial Number
ICS-1100	1001XXX

Consumable Detail

Consumable	Required Consumable	Part Number	Recommended	Qty
Anion	Anion	079870 (4mm) 079779		

Remarks

Performed By
Mr.Chanchanog Khaosoot

Engineer's Signature & Date

Customer

Customer's Signature & Date

เอกสารไม่ควบคุม

Preventive Maintenance Checklist

General Inspection Checklist

Item	Description	Result: Pass	Result: Fail	Action Taken	N.A.
1	Power line (ON line)	☐	☐	Checked	☐
2	Electronic Unit	☐	☐	Checked	☐
3	Pressure Guage (0~40 psi)	☐	☐	Checked	☐
4	Backup filling and line filling	☐	☐	Checked	☐
5	Compare and checked cutting	☐	☐	Checked	☐
6	Preventive Valve For Leak	☐	☐	Checked	☐
7	Sticker name for leak	☐	☐		☐
8	Inspect Inlet	☐	☐		☐
9	Inspect port hole	☐	☐		☐
10	Inspect cooling unit	☐	☐		☐
11	Inspect filling and line tab	☐	☐	Checked	☐
12	Suppressor for leak	☐	☐	Checked	☐
13	Cell for leak	☐	☐	Checked	☐
14	Electronic valve connector	☐	☐	Checked	☐
15	Check waterproof valve for leak	☐	☐		☐
16	Inspect air filling and line	☐	☐	Checked	☐
17	Eluent Generator	☐	☐	Checked	☐
18	Inspect cap O-ring	☐	☐	Checked	☐
19	Inspect on for leak	☐	☐	Checked	☐
20	Power supply has been replaced	☐	☐	Checked	☐
21	Backup lithium has been replaced	☐	☐	Checked	☐
22	Rotary connector	☐	☐	Checked	☐
23	Power panel set	☐	☐		☐
24	Leak limit valve	☐	☐	Checked	☐
25	Inlet valve	☐	☐	Checked	☐
26	Capillary electric set 10mm T.E	☐	☐	Checked	☐
27	Check valve for suppressor set to be complete	☐	☐	Checked	☐
28	Check circuit	☐	☐	Checked	☐
29	Check suppressor	☐	☐	Checked	☐
30	Check pump	☐	☐	Checked	☐
31	Check set	☐	☐	Checked	☐
32	Check fan motor	☐	☐	Checked	☐
33	Rotor set	☐	☐	Checked	☐
34	System pressure	☐	☐	Checked	☐
35	Detector Setting to 0	☐	☐	Checked	☐

เอกสารไม่ควบคุม

Chromeleon Operational Qualification (CM_OQ)

เอกสารไม่ควบคุม

DIONEX

Chromeleon Operational Qualification

General Information

Computer Name (Server)	
Computer Name (Client)	
Version Number	
Operator	

General System Suitability Test

Comparison Formats

เอกสารไม่ควบคุม

DIONEX

Chromeleon Operational Qualification, Part 1

Verification of Selected Results

Calibration Type	LOP
Integration Type	Area
Standard Method	External
Calibration Mode	Total
Auto Recalibrate	ON

Report Variable	Peak Name	Status
Offset (nA)		
Mean (nA)		
Calibration Coeff.		
Variance		
Std. Deviation		
Rel. Std. Dev.		
Variance Coeff.		

เอกสารไม่ควบคุม

DIONEX

Chromeleon Operational Qualification, Part 1

Verification of Selected Results

Report Variable	Peak Name	Status
Calibration Point 6		
Calibration Point 5		
Amount (ng)		
Resolution (EP)		
Resolution (USP)		
Peak Asymmetry (EP/USP)		
Peak Asymmetry (USP)		

เอกสารไม่ควบคุม

DIONEX

Chromeleon Operational Qualification, Part 1

Verification of Selected Results

Report Variable	Peak Name	Status
Theoretical Plates (EP)		
Theoretical Plates (USP)		
Theoretical Plates (JP)		

Test Result: Passed

เอกสารไม่ควบคุม

DIONEX

Chromeleon Operational Qualification, Part 2

Most Frequently Used Parameters: Comparison with Expected Results

Calibration Type	LOP
Integration Type	Area
Standard Method	External
Calibration Mode	Total
Auto Recalibrate	ON

Variable Category	Report Variable	Peak Name	Status
Sample	No.		
	Name		
	Sample Type		
	Position		
	Status		
	Inj.Vol.		
	Dil.Fac.		
	Weight		
	Amount		
	Program		
	Quantitation Method		
Chromatogram	Channel		
	No. of Points		
	Start Time		
	Signal Min.		
	Signal Max.		
	Signal Dimension		
	Noise 2.1-2.3		
Peak Results	No.	Methylparaben	
	No.	Ethylparaben	
	No.	Propylparaben	
	Peak Name	Methylparaben	
	Peak Name	Ethylparaben	
	Peak Name	Propylparaben	
	Rel.Time	Methylparaben	
	Rel.Time	Ethylparaben	
	Rel.Time	Propylparaben	

เอกสารไม่ควบคุม

DIONEX

Chromeleon Operational Qualification, Part 2

Most Frequently Used Parameters: Comparison with Expected Results

Variable Category	Report Variable	Peak Name	Status
Peak Results	Ret.Dev (abs)	Methylparaben	ok
	Ret.Dev (abs)	Ethylparaben	ok
	Ret.Dev (abs)	Propylparaben	ok
	Ret.Dev (rel)	Methylparaben	ok
	Ret.Dev (rel)	Ethylparaben	ok
	Ret.Dev (rel)	Propylparaben	ok
	Area	Methylparaben	ok
	Area	Ethylparaben	ok
	Area	Propylparaben	ok
	Rel.Area (Total)	Methylparaben	ok
	Rel.Area (Total)	Ethylparaben	ok
	Rel.Area (Total)	Propylparaben	ok
	Height	Methylparaben	ok
	Height	Ethylparaben	ok
	Height	Propylparaben	ok
	Rel.Height (Total)	Methylparaben	ok
	Rel.Height (Total)	Ethylparaben	ok
	Rel.Height (Total)	Propylparaben	ok
	Amount	Methylparaben	ok
	Amount	Ethylparaben	ok
	Amount	Propylparaben	ok
	Concentration	Methylparaben	ok
	Concentration	Ethylparaben	ok
	Concentration	Propylparaben	ok
	Rel.Amount	Methylparaben	ok
	Rel.Amount	Ethylparaben	ok
	Rel.Amount	Propylparaben	ok
	Peak Width (0%)	Methylparaben	ok
	Peak Width (0%)	Ethylparaben	ok
	Peak Width (0%)	Propylparaben	ok
	Peak Width (8%)	Methylparaben	ok
	Peak Width (8%)	Ethylparaben	ok
	Peak Width (8%)	Propylparaben	ok
	Peak Width (19%)	Methylparaben	ok
	Peak Width (19%)	Ethylparaben	ok
	Peak Width (19%)	Propylparaben	ok

เอกสารไม่ควบคุม

DIONEX

Chromeleon Operational Qualification, Part 2

Most Frequently Used Parameters: Comparison with Expected Results

Variable Category	Report Variable	Peak Name	Status
Peak Results	Peak Width (50%)	Methylparaben	ok
	Peak Width (50%)	Ethylparaben	ok
	Peak Width (50%)	Propylparaben	ok
	Left Width (0%)	Methylparaben	ok
	Left Width (0%)	Ethylparaben	ok
	Left Width (0%)	Propylparaben	ok
	Right Width (0%)	Methylparaben	ok
	Right Width (8%)	Ethylparaben	ok
	Right Width (8%)	Propylparaben	ok
	Peak Start	Methylparaben	ok
	Peak Start	Ethylparaben	ok
	Peak Start	Propylparaben	ok
	Peak Stop	Methylparaben	ok
	Peak Stop	Ethylparaben	ok
	Peak Stop	Propylparaben	ok
	Peak Start Value	Methylparaben	ok
	Peak Start Value	Ethylparaben	ok
	Peak Start Value	Propylparaben	ok
	Peak Stop Value	Methylparaben	ok
	Peak Stop Value	Ethylparaben	ok
	Peak Stop Value	Propylparaben	ok
	SL-Value Peak Start	Methylparaben	ok
	SL-Value Peak Start	Ethylparaben	ok
	SL-Value Peak Start	Propylparaben	ok
	SL-Value Peak Stop	Methylparaben	ok
	SL-Value Peak Stop	Ethylparaben	ok
	SL-Value Peak Stop	Propylparaben	ok
	Type	Methylparaben	ok
	Type	Ethylparaben	ok
	Type	Propylparaben	ok
	Resolution(EP)	Methylparaben	ok
	Resolution(EP)	Ethylparaben	ok
	Resolution(USP)	Methylparaben	ok
	Resolution(USP)	Ethylparaben	ok
	Asymmetry(EP)	Methylparaben	ok
	Asymmetry(EP)	Ethylparaben	ok
	Asymmetry(EP)	Propylparaben	ok

เอกสารไม่ควบคุม

DIONEX

Chromeleon Operational Qualification, Part 2

Most Frequently Used Parameters: Comparison with Expected Results

Variable Category	Report Variable	Peak Name	Status
Peak Results	Asymmetry(USP)	Methylparaben	ok
	Asymmetry(USP)	Ethylparaben	ok
	Asymmetry(USP)	Propylparaben	ok
	Theoretical Plates(EP)	Methylparaben	ok
	Theoretical Plates(EP)	Ethylparaben	ok
	Theoretical Plates(EP)	Propylparaben	ok
	Theoretical Plates(USP)	Methylparaben	ok
	Theoretical Plates(USP)	Ethylparaben	ok
	Theoretical Plates(USP)	Propylparaben	ok
	Theoretical Plates(P)	Methylparaben	ok
	Theoretical Plates(P)	Ethylparaben	ok
	Theoretical Plates(P)	Propylparaben	ok
Peak Calibration	Cal.Mode	Methylparaben	ok
	Cal.Mode	Ethylparaben	ok
	Cal.Mode	Propylparaben	ok
	Auto.Recal.	Methylparaben	ok
	Auto.Recal.	Ethylparaben	ok
	Auto.Recal.	Propylparaben	ok
	Cal.Type	Methylparaben	ok
	Cal.Type	Ethylparaben	ok
	Cal.Type	Propylparaben	ok
	Weights	Methylparaben	ok
	Weights	Ethylparaben	ok
	Weights	Propylparaben	ok
	Offset	Methylparaben	ok
	Offset	Ethylparaben	ok
	Offset	Propylparaben	ok
	Slope	Methylparaben	ok
	Slope	Ethylparaben	ok
	Slope	Propylparaben	ok
	RF-Value	Methylparaben	ok
	RF-Value	Ethylparaben	ok
	RF-Value	Propylparaben	ok
	No. of Points	Methylparaben	ok
	No. of Points	Ethylparaben	ok

เอกสารไม่ควบคุม

DIONEX

Chromeleon Operational Qualification, Part 2

Most Frequently Used Parameters: Comparison with Expected Results

Variable Category	Report Variable	Peak Name	Status
Peak Calibration	No. of Points	Propylparaben	ok
	No. of Points(residual)	Methylparaben	ok
	No. of Points(residual)	Ethylparaben	ok
	No. of Points(residual)	Propylparaben	ok
	Reference	Methylparaben	ok
	Reference	Ethylparaben	ok
	Reference	Propylparaben	ok
	Fit Coeff	Methylparaben	ok
	Fit Coeff	Ethylparaben	ok
	Fit Coeff	Propylparaben	ok
	Std.Dev.	Methylparaben	ok
	Std.Dev.	Ethylparaben	ok
	Std.Dev.	Propylparaben	ok
	Rel.Std.Dev.	Methylparaben	ok
	Rel.Std.Dev.	Ethylparaben	ok
	Rel.Std.Dev.	Propylparaben	ok
	Corr.Coeff.	Methylparaben	ok
	Corr.Coeff.	Ethylparaben	ok
	Corr.Coeff.	Propylparaben	ok
	Coeff.Det.	Methylparaben	ok
	Coeff.Det.	Ethylparaben	ok
	Coeff.Det.	Propylparaben	ok
	Adj. Coeff.Det.	Methylparaben	ok
	Adj. Coeff.Det.	Ethylparaben	ok
	Adj. Coeff.Det.	Propylparaben	ok
	X	Methylparaben	ok
	X	Ethylparaben	ok
	X	Propylparaben	ok
	Y	Methylparaben	ok
	Y	Ethylparaben	ok
	Y	Propylparaben	ok
	W	Methylparaben	ok
	W	Ethylparaben	ok
	W	Propylparaben	ok
	F(X)	Methylparaben	ok
	F(X)	Ethylparaben	ok
	F(X)	Propylparaben	ok

เอกสารไม่ควบคุม

DIONEX

Chromeleon Operational Qualification, Part 2

Most Frequently Used Parameters: Comparison with Expected Results

Variable Category	Report Variable	Peak Name	Status
Peak Calibration	Residual for Cal Point 0	Methylparaben	ok
	Residual for Cal Point 1	Propylparaben	ok
	Residual for Cal Point 2	Propylparaben	ok
	Calibration Point Status	Methylparaben	ok
	Calibration Point Status	Ethylparaben	ok
	Calibration Point Status	Propylparaben	ok
	Amount	Methylparaben	ok
	Amount	Ethylparaben	ok
	Amount	Propylparaben	ok
Peak Table	Peak Tab. Cal Type	Methylparaben	ok
	Peak Tab. Peak Type	Methylparaben	ok
	Peak Tab. Left Limit	Methylparaben	ok
	Peak Tab. Right Limit	Methylparaben	ok
	Peak Tab. Group	Methylparaben	ok
	Peak Tab. Resp.Factor	Methylparaben	ok
	Peak Tab. Amount	Methylparaben	ok
	Peak Tab. Amnt.Unit	Methylparaben	ok

เอกสารไม่ควบคุม

DIONEX

Chromeleon Operational Qualification, Part 2

Most Frequently Used Parameters: Comparison with Expected Results

Variable Category	Report Variable	Peak Name	Status
Peak Purity	PH1	Methylparaben	ok
	PH2	Ethylparaben	ok
	PH3	Propylparaben	ok
	[432] PH1	Methylparaben	ok
	[432] PH2	Ethylparaben	ok
	[432] PH3	Propylparaben	ok
	Match	Methylparaben	ok
	Match	Ethylparaben	ok
	Match	Propylparaben	ok
	[432] Match	Methylparaben	Deviation
	[432] Match	Ethylparaben	Deviation
	[432] Match	Propylparaben	Deviation
	Not Met at	Methylparaben	ok
	Not Met at	Ethylparaben	ok
	Not Met at	Propylparaben	ok

Test Result: Failed

เอกสารไม่ควบคุม

DIONEX

Chromeleon Operational Qualification, Part 3

Peak Acquisition Steps: Comparison with Expected Results

Calibration Type:	ESTD
Integration Type:	Area
Standard Method:	External
Calibration Mode:	Final
Auto Recalibrate:	Off

Channel Name	Report Variable	Peak Name	Status
Extract UV Channel:			
EX1320NM	Area	Methylparaben	ok
	Area	Ethylparaben	ok
	Area	Propylparaben	ok
	Height	Methylparaben	ok
	Height	Ethylparaben	ok
	Height	Propylparaben	ok
	Base Peak Width	Methylparaben	ok
	Base Peak Width	Ethylparaben	ok
	Base Peak Width	Propylparaben	ok
EX1260NM	Area	Methylparaben	ok
	Area	Ethylparaben	ok
	Area	Propylparaben	ok
	Height	Methylparaben	ok
	Height	Ethylparaben	ok
	Height	Propylparaben	ok
	Base Peak Width	Methylparaben	ok
	Base Peak Width	Ethylparaben	ok
	Base Peak Width	Propylparaben	ok
Smooth Data:			
UV_VIS_1_MA_WR_001	Noise (1.8-2.4 min)		ok
UV_VIS_1_01_181_001	Noise (1.8-2.4 min)		ok
EX1260NM_BG_WR_010	Noise (1.8-2.4 min)		ok

เอกสารไม่ควบคุม

DIONEX

Chromeleon Operational Qualification, Part 3

Peak Acquisition Steps: Comparison with Expected Results

Channel Name	Report Variable	Peak Name	Status
Extract UV Channel:			
WR_UV_VIS_1_UV_VIS_1	Area	Methylparaben	ok
WR_UV_VIS_1_UV_VIS_1	Area	Ethylparaben	ok
WR_UV_VIS_1_UV_VIS_1	Area	Propylparaben	ok
WR_UV_VIS_1_UV_VIS_1	Area	Methylparaben	ok
WR_UV_VIS_1_UV_VIS_1	Area	Ethylparaben	ok
WR_UV_VIS_1_UV_VIS_1	Area	Propylparaben	ok

Test Result: Passed

เอกสารไม่ควบคุม

DIONEX

Chromeleon Operational Qualification, Part 4

System Suitability Test: Comparison with Expected Results

Test Result: Passed

เอกสารไม่ควบคุม

DIONEX

Chromeleon Operational Qualification, Part 5

Fraction Collection: Comparison with Expected Results

Test Result: Passed

เอกสารไม่ควบคุม

Performance Qualification (PQ)

เอกสารไม่ควบคุม

DIONEX

Performance Qualification

Instruments

Pump				
Detector				
Autosampler				
Column Compartment				
Chromatography				

Accessories

เอกสารไม่ควบคุม

Limits:

Test	Customer Limits	Dionex Recommended Limits
CD10 Conductivity Noise (nS)	2	2
CD10 Conductivity Drift (nS/hr)	20	20
Inject Precision (Peak Area)	1.0	1.0
Typical Carry Over (Area %)	0.1	0.1
EP CD Detector Linearity (Corr.)	0.990	0.999
EX CD Detector Linearity (%RSD)	5	5

Additional Information:

Customer Company:	IVAX Sandoz(Thailand) Co.,Ltd.	Date:	6-Dec-2022
Qualification Executor:	Mr.Chanakarn Kotkaew	Last Instrument Qualification:	11 months
		Next Qualification:	Dec-2023

Customer Signature | Qualification Executor | Date

เอกสารไม่ควบคุม

DIONEX

Performance Qualification

Detector Noise and Drift

Instruments:

Instrument Name	Model	Properties	Serial Number	Manufacturer Identifier
Pump	DX-500	Gradient	99999999	0-00
Detector	DX-500	Detector	01010101	0-01
Autosampler	AS50 (P. Kon)	Detector	n.a.	0-02
Column Compartment	n.a.	Detector	n.a.	0-03

Accessories

Name	Description
Backpressure Tubing	0.13 mm x 0.25 m, 10 PEEK, 10 x 10 UT
Guard	Guard

Additional Information

Customer Company:	IVAX Sandoz(Thailand) Co.,Ltd.	Date:	6-Dec-2022
Qualification Executor:	Mr.Chanakarn Kotkaew	Next Qualification:	Dec-2023

Test Results Summary

Test	Result
CD10 Conductivity Noise (nS)	PASS
CD10 Conductivity Drift (nS/hr)	PASS

Customer Signature | Qualification Executor | Date

เอกสารไม่ควบคุม

Data for detector noise

Segment number	Noise, nS
1	0.172
2	0.071
3	1.331
4	1.036
5	0.597
6	0.403
7	1.424
8	0.797
9	0.726
10	0.877
11	0.570
12	1.205
13	0.997
14	1.135
15	0.938
16	0.955
17	1.440
18	1.230
19	1.054
20	0.915
Average, nS	0.997
Limit, nS	2
Result	PASS

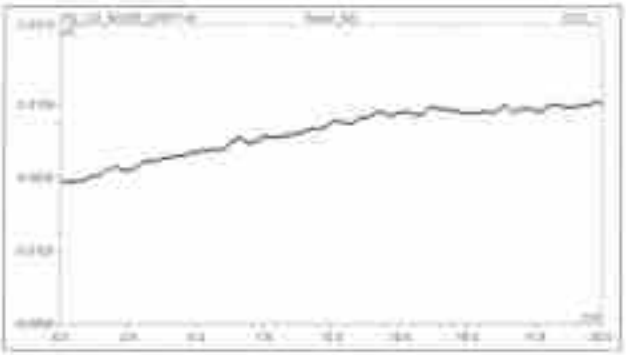
Data for detector drift

10 Minute drift, nS	Drift, nS/hr	Limit, nS/hr	Result
0.083	1.661	15.000	PASS

Customer Signature | Qualification Executor | Date

เอกสารไม่ควบคุม

Chromatogram of Detector Noise and Drift



Customer Signature | Qualification Executor | Date

เอกสารไม่ควบคุม

DIONEX

Performance Qualification

Injector Precision

Instruments

Instrument Name	Model	Supplier	Serial Number	Module/Software Version
Pump	[illegible]	Dionex	[illegible]	[illegible]
Detector	[illegible]	Dionex	[illegible]	[illegible]
Autosampler	[illegible]	Dionex	n.a.	[illegible]
Smart Software	n.a.	Dionex	n.a.	[illegible]

Accessories

Name	Description
Backpressure Tubing	[illegible]
Sample 1	[illegible]
Blank	Water

Additional Information

Customer Company	[illegible]	Date	[illegible]
Qualification Executor	Mr Dasaporn/ [illegible]	Next Qualification	[illegible]

Test Results Summary

Test	Result
Injector Precision (n=6) [illegible]	PASS

Customer Signature | Qualification Executor | Date

เอกสารไม่ควบคุม

เอกสารไม่ควบคุม

Data for Injector Precision test

Name	Area [illegible]
Inj. Precision_1	[illegible]
Inj. Precision_2	[illegible]
Inj. Precision_3	[illegible]
Inj. Precision_4	[illegible]
Inj. Precision_5	[illegible]
Inj. Precision_6	[illegible]
Inj. Precision_7	[illegible]
Inj. Precision_8	[illegible]
Inj. Precision_9	[illegible]
Inj. Precision_10	[illegible]
Average	[illegible]
Std. Dev.	[illegible]
% RSD	[illegible] %
Limit	[illegible] %
Result	PASS

Customer Signature | Qualification Executor | Date

เอกสารไม่ควบคุม

DIONEX

Performance Qualification

Injector Carry Over

Instruments

Instrument Name	Model	Supplier	Serial Number	Module/Software Version
Pump	[illegible]	Dionex	[illegible]	[illegible]
Detector	[illegible]	Dionex	[illegible]	[illegible]
Autosampler	[illegible]	Dionex	n.a.	[illegible]
Smart Software	n.a.	Dionex	n.a.	[illegible]

Accessories

Name	Description
Backpressure Tubing	[illegible]
Sample 1	[illegible]
Blank	Water
Eluent	Water

Additional Information

Customer Company	[illegible]	Date	[illegible]
Qualification Executor	Mr Dasaporn/ [illegible]	Next Qualification	[illegible]

Test Results Summary

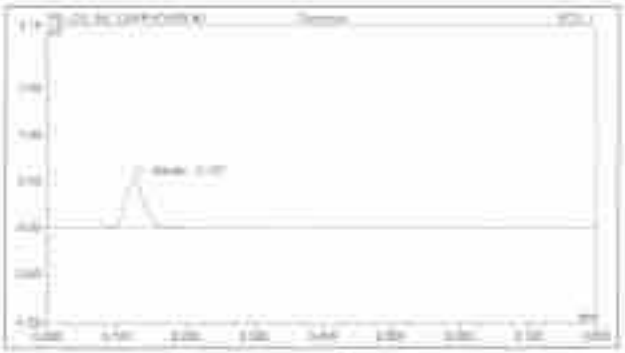
Test	Result
Injector Carry Over (n=xx) [illegible]	PASS

Customer Signature | Qualification Executor | Date

เอกสารไม่ควบคุม

เอกสารไม่ควบคุม

Chromatogram for Carry Over test



Data for Carry Over test

Name	Ret Time (minutes)	Area
	Amt	µS*min
	Units	Areas
	ECD_1	ECD_1
High Level		
Carryover		
Blank		
Purity level		
Limit		
Result		

Customer Signature | Qualification Executor | Date

เอกสารไม่ควบคุม

DIONEX

Performance Qualification

Detector Linearity

Instruments

Instrument Name	Model	Supplier	Serial Number	Manufacturer Version
Pump		Dionex		
Detector		Dionex		
Autosampler		Dionex		
Chiller/Oven	n.a.	Dionex	n.a.	

Accessories

Name	Description

Additional Information

Customer Company	UAE Consultant Co. LLC	Date	5-Dec-2020
Qualification Protocol	IQ Chromeleon 7 Performance	Next Qualification	Date (MM/DD/YYYY)

Test Results Summary

Test	Result
IQ OQ Detector Linearity Cell 1	PASS
IQ OQ Detector Linearity Cell 2	PASS

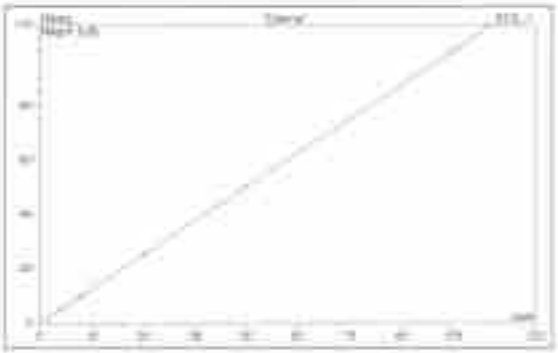
Customer Signature | Qualification Executor | Date

เอกสารไม่ควบคุม

Data for Detector Linearity

Name	Amount (ppm)	Height (uS)
	Areas	Areas
	ECD_1	ECD_1
Detector linearity_1		
Detector linearity_2		
Detector linearity_3		
Detector linearity_4		
Detector linearity_5		

Linearity Plot



Calibration Type	Number Of Points	Offset	Slope

	Correlation Coefficient	% RSD
Linearity		
Limit		
Result	PASS	PASS

Customer Signature | Qualification Executor | Date

เอกสารไม่ควบคุม

CERTIFICATE

เอกสารไม่ควบคุม

เอกสารไม่ควบคุม

เอกสารไม่ควบคุม

PerkinElmer
For the Better

PinAAcle 900F
Preventive Maintenance Report

Company Name: UNITED ANALYST AND ENGINEERING

Instrument Location: BANGCHAK, PRAKHANONG

BANGKOK, 10260

Instrument Serial No.: PFBS20031902

Date: 26-Jun-2023

เอกสารไม่ควบคุม

PinAAcle 900F Preventive Maintenance (PM)			
Company Name:	UNITED ANALYST AND ENGINEERING		
Address (Instrument Location):	BANGCHAK, PRAKHANONG, BANGKOK, 10260		
Serial Number:	PFBS20031902	**PM Number:**	2/2
Customer Name (if applicable):	K. SATIDA	**Telephone Number:**	095-558-0049
Customer Support Engineer Name:	K. DUANG	**Service Order Number:**	WO-02273773
Date PM Performed: (DD-MMM-YYYY)	Jun 26, 2023	**Next PM Due Date:** (DD-MMM-YYYY)	Dec 30, 2023
Standard Labor Hours to Complete PM :		**5 hours**	

Part Number	Release	Publication Date
09370145 Rev.9	A	January 2018

Scope
The purpose of this PM is to ensure the continued functionality of the PinAAcle 900F by inspecting and replacing any worn or damaged parts. This service should only be performed by a trained representative of PerkinElmer.
The customer should save their method before the PM begins.

General Instructions:
The customer must provide the engineer operational data to demonstrate recent instrument performance prior to starting the PM.
Always check with the customer before making any changes that may affect the customer's analysis or calibration, including a current back-up of system software and/or data files.
The completed document should be signed by an authorized PerkinElmer and customer representative and left with the customer.
Update the PM sticker and instrument logbook as required.

Copyright Information
This document contains proprietary information that is protected by copyright. All rights are reserved.
No part of this publication may be reproduced in any form whatsoever or translated into any language without the prior, written permission of PerkinElmer, Inc.
Copyright © 2013 PerkinElmer, Inc.

Trademarks
Registered names, trademarks, etc. used in this document, even when not specifically marked as such, are protected by law. PerkinElmer is a registered trademark of PerkinElmer, Inc. All other trademarks and registered trademarks not owned by PerkinElmer, Inc. or its subsidiaries that are depicted herein are the property of their respective owners.
Except as specifically set forth in its terms and conditions of sale, PerkinElmer makes no Warranty of any kind with regard to this document, including, but not limited to, the implied warranties of merchantability and fitness for a particular purpose.
PerkinElmer shall not be liable for incidental or consequential damages in connection with the furnishing or use of this document.

เอกสารไม่ควบคุม

Component List

Component / Specific Model	Serial #	Configuration Notes

Parts Lists

Parts Included with the PM		
Part Number (if applicable)	**Description**	**Quantity**
B0501696	Fan Filters	N/A
N3160156	O-Ring Kits for Sampling Introduction (Stainless Steels Nebulizer)	N/A
N3160157	O-Ring Kits for Sampling Introduction (Plastic Nebulizer)	N/A
N9301714	Replacement Acetylene Filter Cartridge	N/A
TH001022	Replacement Air Filter Cartridge	N/A

Additional Reagents and Standards Required for PM				
Part Number (if applicable)	**Description**	**Quality**	**Batch/Lot #**	**Expired Date (MM/YY)**
N9300183	1000 mg/L Copper Standard	AR	26-87CUY1	30-Jan-2024

Additional Reagents and Standards Required for PM (Customer Support Solution)				
Part Number (if applicable)	**Description**	**Quantity**	**Batch/Lot #**	**Expiration Date (MM/YY)**
N/A	DI Water	250 ml.	AR	AR
N/A	0.5% $HN0_3$	250 ml.	AR	AR

เอกสารไม่ควบคุม

Additional Tools Required for PM			
Part Number (if applicable)	**Description**	**Quantity**	**Serial #**
N1013000	0.2A Neutral density filter	1	MG0-252
N1013002	1.0A Neutral density filter	1	MG0-358
03030997	System 2 EDL Driver	1	03030997
N3050605	As System 2 EDL	1	16148
N3050121	Cu Lumina HCL	1	092216-010130
N3050109	Ba Lumina HCL	1	102416-040160
N3050139	K Lumina HCL	1	110716-010060
N3050152	Ni Lumina HCL	1	100516-030190

เอกสารไม่ควบคุม

Procedure Checklist

Use (✓) to check off those steps in the checklist that have been completed.

1. **General:**
   - ☑ Review the instrument performance with the customer and document any recent problems.
   - ☑ Inspect the customer log book and make any appropriate PM entries.
   - ☑ Perform general inspection of system for cleanliness.
2. **PC Instrument Software:**
   - ☑ Instrument Software user files/databases archived, packed, and/or deleted as needed.
3. **Mechanical:**
   - ☑ Inspect and clean all fans and filters. Replace filters if necessary
   - ☑ Inspect all gas lines for leaks and/or wear. Replace if needed.
   - ☑ Clean exterior of the instrument.
   - ☑ Inspect the burner head, burner chamber, and nebulizer. Clean if needed as stated in the Hardware Guide.
   - ☑ Check burner head dimensions with the feeler gauge as stated in the Hardware Guide in the Maintenance chapter section on cleaning the burner head and checking sloth width. Replace if out of specification
   - ☑ Check the condition of the end cap, burner head, and nebulizer O-rings. Replace if necessary.
   - ☑ Check the drain system for signs of wear. Replace worn or damaged parts.
   - ☑ Visually check for proper flame conditions when igniting the Air-C2H2 and N20-C2H2 flames (if applicable).
4. **Electrical:**
   - ☑ Inspect PC boards. Clean if necessary.
   - ☑ Carefully check all internal and external cable connections.
   - ☑ Check instrument firmware revisions upgrade to current levels (if necessary)
   - ☑ Run Diagnostics Test within the Advanced function of the Spectrometer page. Check the results in the service log folder in the Spectrometer BM Log Viewer.
5. **Optics:**
   - ☑ Inspect and clean the sample compartment windows, if needed.
   - ☑ Inspect optics. Clean or replace if necessary,
6. **Gasses:**
   - ☑ Verify that the Gasses supplied to the instrument are within the pressure and purity specifications found in the PinAAcle 900 Series Pre-installation Checklist SDB.
   - ☑ Verify that the acetylene filter and air filter element is dry. Replace if necessary.

เอกสารไม่ควบคุม

7. **Flame Interlock Check:**

   Description: Check to ensure that all safety interlocks are closed.

Parameter	Specification	Test Results	Pass/Fail
Flame Sensor	Air/C_2H_2 Flame correctly shuts down	Active	Passed
Drain Sensor	Air/C_2H_2 Flame correctly shuts down	Active	Passed
Nebulizer Sensor	Air/C_2H_2 Flame correctly shuts down	Active	Passed
C_2H_2 Pressure Sensor	Air/C_2H_2 Flame correctly shuts down	Active	Passed
Air Pressure Sensor	Air/C_2H_2 Flame correctly shuts down	Active	Passed
Burner Head Sensor	Choosing Nitrous Oxide as the oxidant should trigger an interlock shuts down	Active	Passed

8. **After PM Performance tests:**

   8.1 Detector Linearity with Barium

   Description: Ensures that the detector is linear in the Visible Range.

Parameter	Specification	Certificate Value at 553.6 nm (Abs.)	Test Results	Pass/Fail
1.0 A ND Filter	± 5% from Cert.	0.9798	0.9890	Passed
0.2 A ND Filter	± 5% from Cert.	0.2042	0.1975	Passed

   8.2 Baseline Noise at 1.0 Absorbance with Barium

   Description: Ensures that a high absorbance will not produce excessive noise.

Parameter	Specification	Results	Pass/Fail
Standard Deviation	≤ 0.010	0.0009	Passed

   8.3 AA Baseline Noise with Copper

   Description: Check baseline noise.

Parameter	Specification	Results	Pass/Fail
Standard Deviation	≤ 0.001	0.0002	Passed

เอกสารไม่ควบคุม

8.4 D_2 Background Compensation with Copper

Description: Verifies the instruments ability to compensate for Background absorption.

Parameter	Specification	Results	Pass/Fail
Standard Deviation	≤ 0.010	-0.0062	Passed

8.5 AA-BG Baseline Noise with Copper

Description: Ensures that background correction does not produce excessive noise.

Parameter	Specification	Results	Pass/Fail
Standard Deviation	≤ 0.005	0.0002	Passed

8.6 AA-BG Baseline Noise with Arsenic

Description: Ensures that background correction does not produce excessive noise at a low wavelength.

Parameter	Specification	Results	Pass/Fail
Standard Deviation	≤ 0.005	0.0014	Passed

8.7 Flame Sensitivity

Description: Instrument Sensitivity checked against Copper standard.

Standard Copper Sensitivity	Specification	Results (Abs.)	Pass/Fail
5 mg/L Sensitivity SS Neb (if applicable)	> 0.250 Abs.	NA	Not Applicable
2 mg/L Sensitivity HS Neb (if applicable)	> 0.250 Abs.	0.3467	Passed

10. Review:

☑ Review with the customer PM work performed.
☑ Review with the customer routine maintenance procedures.
☑ Discuss recommended customer supplied materials to have on hand.
☑ Attach PM sticker.

เอกสารไม่ควบคุม

Additional Comments

Additional Comments Regarding the PM

Review

The preventive maintenance checks and if applicable performance tests for PinAAcle 900F have been completed.

This PinAAcle 900F Passes ☑ Fails ☐ the preventive maintenance.

Review of Preventive Maintenance:		
Authorized PerkinElmer Representative:	Date: 26-Jun-2023 (DD-MMM-YYYY)
Authorized Customer Representative:	Date: 26-Jun-2023 (DD-MMM-YYYY)

เอกสารไม่ควบคุม

Agilent Technologies

Agilent 5110 and 5100 ICP-OES
Preventive Maintenance Checklist

Agilent Preventive Maintenance provides factory recommended service for your analytical system 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.

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

Customer Information

- Customer should provide all necessary operating supplies upon request of the engineer.
- For customers using ISP 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 the 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 such as gases for the maintenance service, then Client must be notified in advance, which may incur additional

Service Engineer's Responsibilities

- Only complete relevant 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 the applicable checklists to indicate services just performed, as needed
- Complete the PM service in the order of the tasks listed
- Complete the Service System section together with the customer

เอกสารไม่ควบคุม

Agilent Technologies

Agilent 5110 and 5100 ICP-OES
Preventive Maintenance Checklist

System Information

Instrument system name and ID	
Instrument system site and location	
Sub-system component product numbers	Sub-system component serial numbers
1.	1.
2.	2.
3.	3.
4.	4.
5.	5.
6.	6.
7.	7.
8.	8.
9.	9.
10.	10.

ICP-OES Configuration Item	Enter the type or write in the type if other
Nebulizer Type	
Spray Chamber	
Torch	
Injector Diameter	
Injector Material	

เอกสารไม่ควบคุม

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, accessories
- ☑ Check for required firmware/software updates and verify with customer if they would like it installed
- ☑ For IP application systems, if standard sample introduction system was not installed, ask the customer to install it. n/a
- ☑ Run Instrument Performance test and record results in Instrument Performance Test Results Table - Pre-PM

Inspect and clean the system

- ☑ Look for any obvious external damage or problems
- ☑ Inspect water cooling hoses, gas lines and power cord for excessive wear or damage.
- ☑ Perform a general (external) inspection of the system for excessive dust accumulation, clean if necessary
- ☑ Inspect sample introduction components and record any required maintenance in the Service Diagnostic Components and verify the customer is the required actions required.
- ☑ Record the instrument operating conditions in the ICP-OES Status Results Table
- ☑ Replace the polychromator purge filter
- ☑ Replace the radial pre-optics window
- ☑ Replace the axial pre-optics window for PVIN and VDE instruments
- ☑ Check radiator fan for the correct position relative to the external fan to ensure they meet minimum specifications
- ☑ Replace air inlet dust filter
- ☑ Replace high capacity air inlet dust filter element if installed n/a
- ☐ Remove and clean instrument water inlet filter

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 Polyalkene cooling fluid
- ☑ Clean the cooling system Air filter and the condenser to compressed air or vacuum cleaner

เอกสารไม่ควบคุม

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 Z and X axis slide shafts
- ☑ Using instrument's cache and the Agilent software move the sample probe to the 4 outermost corners and close port, ensure that the probe is approximately centered in the cell

SPS 4 Auto Sampler

- ☑ Section NOT Applicable
- ☑ Clean the split rear rack locations (rear, and frames and rinse with a damp soft cloth and diluted mild detergent
- ☑ Clean the auto sampler cover panels, if cover lid is installed, with deionized window cleaner
- ☑ Check the X-axis and Z-axis drive belts for cracks, splits, damaged teeth, excessive fraying, color changes or degradation from fumes
- ☑ Check the X-axis, Theta-axis and Z-axis FFC cables for cracks, excessive processing, damaged edges or damaged connectors
- ☑ Pump Tubing Replacement: Replace peristaltic pump tubing. Replace all tubing that goes from the rinse station to the pump and from the pump to the waste/rinse bottles

AVS 4, 6, 7

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

Instrument Adjustments

- ☑ Check position of Zy zero, 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 7.2 and above run the following functions and record the result in the Instrument Test Results Table:
  - ☑ Subsystem Communication Test
  - ☑ Argon Flow

เอกสารไม่ควบคุม

- ☑ 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 Reference Check		Post-PM Sensitivity Check	
	Radial	Axial *	Radial	Axial *
In [illegible] use [illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

* Axial result is not applicable for SH110A1, SH110A Radial View instruments

Instrument Test Results Table

Note: The instrument Test results are for systems using ICP Expert version 7.2 and above only.

Instrument Test	Result
Subsystem Communication Test	[illegible]
Ar Flow	[illegible]
Aux Flow	[illegible]
Gas Flows	[illegible]
RF Generator	[illegible]
Camera Test	[illegible]
Optics Test	[illegible]
Nebulizer test	[illegible]

เอกสารไม่ควบคุม

ICP-OES Status Results Table

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

Measurement	Standard Mode		Plasma Hi	
Mains Voltage	[illegible]	VAC	[illegible]	VAC
Mains Current	[illegible]	A	[illegible]	A
Instrument Temperature	[illegible]	°C	[illegible]	°C
RF Gen Plate (actual speed)	[illegible]	Hz	[illegible]	Hz
Plasma Exhaust Temperature	No measurement		[illegible]	°C
Water Flow Software	No measurement		[illegible]	L/min
Water Flow Internal	[illegible]	L/min	[illegible]	L/min
Water Inlet Temperature	[illegible]	°C	[illegible]	°C
Nebulizer Temperature	[illegible]	°C	[illegible]	°C
CCD Temperature	[illegible]	°C	[illegible]	°C
Internal Pressure	[illegible]	°C	[illegible]	°C
Main Supply Pressure	[illegible]	kPa	[illegible]	kPa
Pump Gas Supply Pressure*1	[illegible]	kPa	[illegible]	kPa
Option Gas Supply Pressure*1	[illegible]	kPa	n/a	kPa
Nebulizer Flow	No measurement		[illegible]	L/min
Nebulizer Back Pressure	No measurement		[illegible]	kPa
Plasma Gas Flow	No measurement		[illegible]	L/min
Auxiliary Gas Flow	No measurement		[illegible]	L/min
RF Power	No measurement		[illegible]	W
RF Reflected Power	No measurement		[illegible]	W
RF Supply Voltage	No measurement		[illegible]	V

*1 If option installed

เอกสารไม่ควบคุม

ICP-OES Parts List Table

Part description	Part Number	Product Model & Serial (opt)	Quantity Consumed
Solid Sample Nebulizer	[illegible]	[illegible]	1
Radial Torch Spec Washer	[illegible]	x4	1
Injection Tube/Shaft	[illegible]	[illegible]	
Pump Tube Pillow	[illegible]	x4	1
Torch Inlet Elbow	[illegible]	x4	1
High Capacity Ion Filter	[illegible]	Optional	
Rubber seal dip 4.5 port valve for SPS4	[illegible]	[illegible]	
Rubber seal for 3 port valve for ASX	[illegible]	[illegible]	
Tubing assembly, peristaltic pump 2 Drive 11 x 14	[illegible]	qty x	
Spectrometer Cleaner Drive Kit	[illegible]	qty x	
PTFE tubing assembly 1/4 x 25mm id, 2m	[illegible]	qty x	
Additional Parts may be required from engineer stock			
5 axis drive belt	[illegible]	qty x	
5 axis drive belt	[illegible]	qty x	
Peristaltic pump tubing, PVC duraflex, 3 tubes	[illegible]	qty x	

Restore system

For HF applications, set the customer to connect their sample introduction system.

Leave system in as idle state as you prefer.

Guidance: If the PM service is performed prior to a qualification service, then use the qualification procedure as a guide for final performance verification checkout.

Service Review

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

เอกสารไม่ควบคุม

Agilent Technologies

Agilent 5110 and 5100 ICP-OES
Preventive Maintenance Checklist

1. Review the service and any key results with the customer.
2. If the replacement 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 want to make as part of performing the installation or other items of interest for the customer, please write in the box.

Other Important Customer Web Links

Tips to get information on your product

- Literature Library - [illegible]
- Need to know more? - [illegible]
- Need technical support Today? - [illegible]
- Need supplies? - [illegible]

Service Completion

Service support position: [illegible] Date service completed: [illegible]

Agilent signature: [illegible] Customer signature: [illegible]

Document part number: [illegible]

เอกสารไม่ควบคุม

Report Summary

Instrument Model	Agilent [illegible] ICP-OES
Instrument ID	[illegible]
Instrument Serial Number	[illegible]
Software Version	2.1.1.827
Firmware Version	3HC
Tested By	[illegible]
Test Completed On	[illegible]

Result Summary

Nebulizer Characteristics Test	Skipped
Air Flow Test	Skipped
Make Flow Test	Skipped
Gas Flows Test	Skipped
RF Generator Test	Skipped
Camera Test	Skipped
Torch Test	Skipped
Advanced Valve System Test	Skipped
Resolution Test	Pass
Sensitivity Test	Pass
Precision Test	Pass

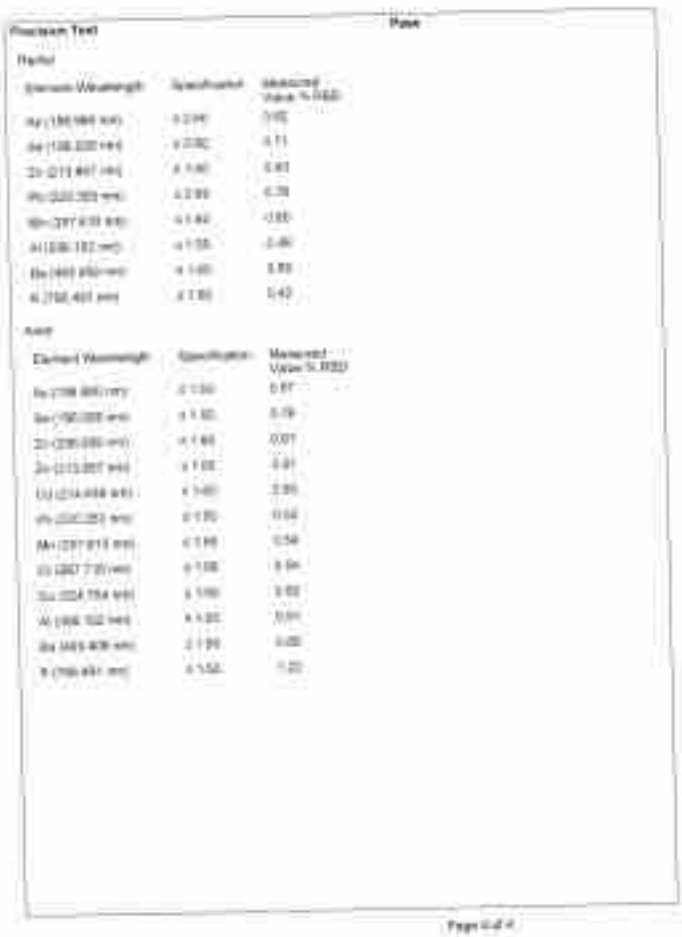
เอกสารไม่ควบคุม

Resolution Test — **Pass**

Element Wavelength	Specification	Width
Al (167.022 nm)	≤ 0.04	0.02
As (188.980 nm)	≤ 0.20	0.10
B (249.677 nm)	≤ 0.20	0.10
Ba (455.403 nm)	≤ 0.20	0.11
Be (313.042 nm)	≤ 0.10	0.04
Ca (317.933 nm)	≤ 0.15	0.06
Cd (214.438 nm)	≤ 0.15	0.06
Co (228.616 nm)	≤ 0.15	0.06
Cr (267.716 nm)	≤ 0.20	0.10
Cu (324.754 nm)	≤ 0.20	0.10
Fe (238.204 nm)	≤ 0.20	0.10
K (766.491 nm)	≤ 0.30	0.15
Li (670.784 nm)	≤ 0.20	0.10
Mg (279.553 nm)	≤ 0.15	0.06
Mn (257.610 nm)	≤ 0.15	0.06
Mo (202.030 nm)	≤ 0.20	0.10
Na (589.592 nm)	≤ 0.30	0.15
Ni (231.604 nm)	≤ 0.20	0.10
P (213.618 nm)	≤ 0.20	0.10
Pb (220.353 nm)	≤ 0.20	0.10
Sb (206.833 nm)	≤ 0.20	0.10
Se (196.026 nm)	≤ 0.20	0.10
Si (251.611 nm)	≤ 0.15	0.06
Sn (189.989 nm)	≤ 0.20	0.10
Sr (407.771 nm)	≤ 0.15	0.06
Ti (334.941 nm)	≤ 0.15	0.06
V (292.402 nm)	≤ 0.15	0.06
Zn (213.856 nm)	≤ 0.15	0.06

เอกสารไม่ควบคุม

เอกสารไม่ควบคุม



เอกสารไม่ควบคุม

เอกสารไม่ควบคุม

เอกสารไม่ควบคุม

Result Summary

Result Summary

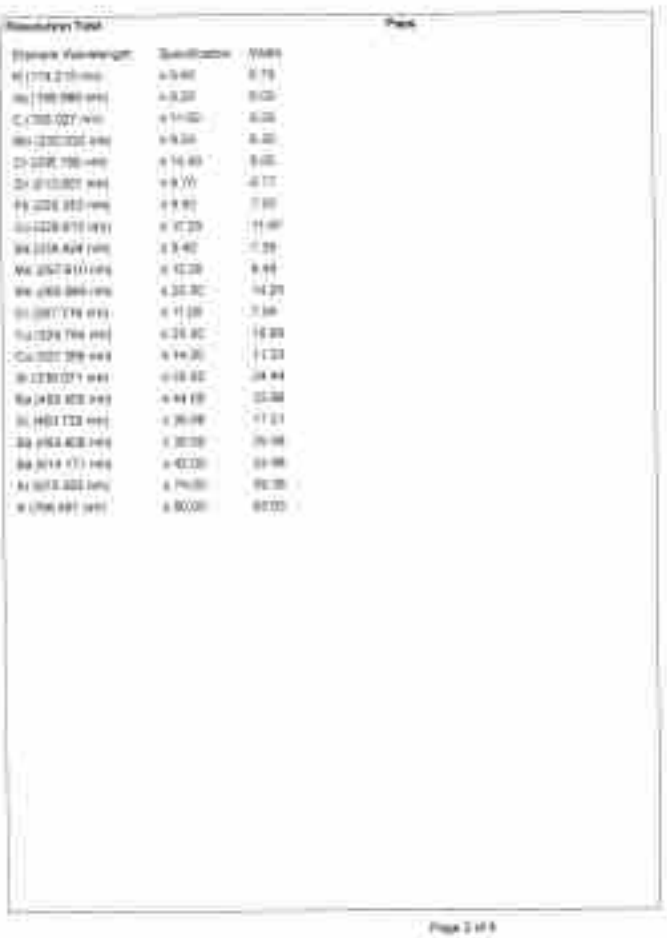
Subsystem Communications Test — Passed
Air Flow Test — Skipped
Water Flow Test — Skipped
Gas Flows Test — Passed
RF Generator Test — Skipped
Camera Test — Skipped
Optics Test — Pass
Advanced Valve System Test — Skipped
Resolution Test — Pass
Sensitivity Test — Pass
Precision Test — Pass

Optics Test — Pass

	Result	Limit
Intensity	8818650	5000000
Wavelength	737.210	737.210

Page 1 of 4

เอกสารไม่ควบคุม

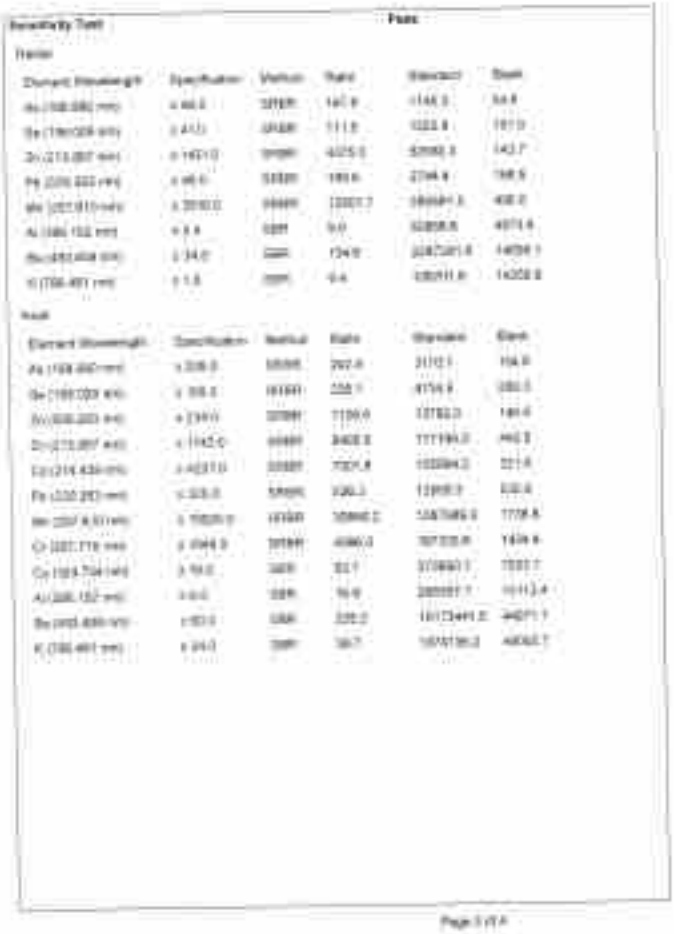


Resolution Test — Pass

Element Wavelength	Specification	Result
Al (176.210 nm)	≤ 0.40	0.19
As (189.980 nm)	≤ 0.20	0.03
C (193.027 nm)	≤ 1.00	0.26
Mn (257.610 nm)	≤ 0.20	0.10
Zn (206.200 nm)	≤ 0.40	0.05
Zn (213.857 nm)	≤ 0.30	0.11
Pb (220.353 nm)	≤ 0.40	0.20
Cu (224.700 nm)	≤ 0.20	0.07
Ca (317.933 nm)	≤ 0.20	0.09
Ba (455.403 nm)	≤ 0.20	0.08
Ni (231.604 nm)	≤ 0.20	0.06
Ba (455.403 nm)	≤ 0.20	0.08
Ba (614.171 nm)	≤ 0.20	0.07
Ni (231.604 nm)	≤ 0.20	0.06
Al (396.152 nm)	≤ 0.20	0.09

Page 2 of 4

เอกสารไม่ควบคุม



Sensitivity Test — Pass

Noise

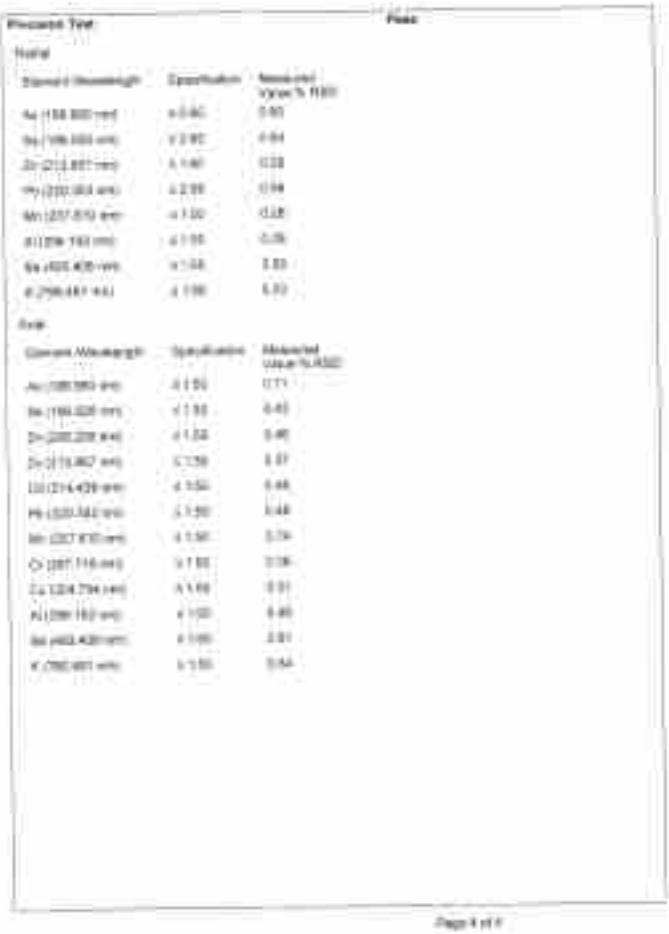
Element Wavelength	Specification	Method	Right	Standard	Blank
As (188.980 nm)	≤ 40.0	SPEP	141.9	1144.3	54.8
Se (196.026 nm)	≥ 41.0	SPEP	111.8	1222.8	151.0
Zn (213.857 nm)	≤ 140.0	SPEP	4275.0	52592.3	142.7
Pb (220.353 nm)	≤ 46.0	SPEP	189.6	2744.4	168.5
Mn (257.610 nm)	≤ 20.0	SPEP	12001.7	186841.3	408.0
Al (396.152 nm)	≤ 8.8	SPEP	9.0	52858.8	4974.6
Ba (455.404 nm)	≤ 34.0	SPEP	134.9	2267281.8	14838.1
K (766.491 nm)	≤ 1.0	SPEP	0.4	135911.9	14258.8

Peak

Element Wavelength	Specification	Method	Right	Standard	Blank
As (188.980 nm)	≤ 208.0	SPEP	262.8	2112.1	154.8
Se (196.026 nm)	≤ 205.0	SPEP	258.1	4174.8	250.0
Zn (206.200 nm)	≤ 234.0	SPEP	7139.0	137852.0	184.0
Zn (213.857 nm)	≤ 1142.0	SPEP	8402.8	777199.0	442.8
Cd (214.439 nm)	≤ 4237.0	SPEP	7021.8	103994.0	221.8
Pb (220.353 nm)	≤ 223.0	SPEP	336.3	13958.0	230.6
Mn (257.610 nm)	≤ 10020.0	SPEP	16940.0	1347686.0	7728.8
Cr (267.716 nm)	≤ 3944.0	SPEP	4080.0	307335.8	1434.8
Cu (324.754 nm)	≤ 19.0	SPEP	33.1	370863.1	7332.7
Al (396.152 nm)	≤ 8.8	SPEP	9.0	285557.1	1011.4
Ba (455.404 nm)	≤ 83.0	SPEP	335.0	1613441.0	44071.1
K (766.491 nm)	≤ 24.0	SPEP	39.7	1574136.0	46062.7

Page 3 of 4

เอกสารไม่ควบคุม



Precision Test — Pass

Noise

Element Wavelength	Specification	Measured Value % RSD
As (188.980 nm)	≤ 0.40	0.30
Se (196.026 nm)	≤ 2.00	0.64
Zn (213.857 nm)	≤ 1.00	0.08
Pb (220.353 nm)	≤ 2.00	0.04
Mn (257.610 nm)	≤ 1.00	0.08
Al (396.152 nm)	≤ 1.00	0.06
Ba (455.404 nm)	≤ 1.00	0.33
K (766.491 nm)	≤ 1.00	0.30

Peak

Element Wavelength	Specification	Measured Value % RSD
As (188.980 nm)	≤ 1.00	0.71
Se (196.026 nm)	≤ 1.00	0.40
Zn (206.200 nm)	≤ 1.00	0.46
Zn (213.857 nm)	≤ 1.00	0.37
Cd (214.439 nm)	≤ 1.00	0.48
Pb (220.353 nm)	≤ 1.00	0.48
Mn (257.610 nm)	≤ 1.00	0.74
Cr (267.716 nm)	≤ 1.00	0.36
Cu (324.754 nm)	≤ 1.00	0.31
Al (396.152 nm)	≤ 1.00	0.46
Ba (455.404 nm)	≤ 1.00	0.81
K (766.491 nm)	≤ 1.00	0.54

Page 4 of 4

เอกสารไม่ควบคุม

Request No. 25-03 / 0268 MTC. ACL No. 888 / 65

CALIBRATION CERTIFICATE

NOMENCLATURE : 1. Atomic Absorption Spectrophotometer, "Optima Technologies"
Model AA500FG, Serial No. 111233001
2. Working standard solution, "Inorganic standard"
Multi Element Calibration Solution, Lot No. 19-0008-0015

SUBMITTED BY : Global Analytical Engineering Consultant Co., Ltd.
9, 1st Intersection, Laboratory Road, Bangchak, Phrakanong, Bangkok, 10260

CALIBRATION PROCEDURE : 1. Performing Verification of Atomic Absorption Spectrophotometer (SA-SOP-AS-02)
2. Calibration Uncertainty of Measurement in Analytical Chemistry (QP-015)

REFERENCE MATERIAL : "Standards by NIST Traceable Technologies", "Earth Star"
Cadmium Lot No. 0-0004756, Certificate Lot No. 19-0014-18, Expired Lot No. 31-12/04/2025, Iron Lot No. 0-0004-0001, Lot No. 19-0008-0015, Manganese Lot No. 7-0002-0004, Nickel Lot No. 19-0018-0004, Zinc Lot No. 19-0018-0001

CALIBRATION RANGE : 0.00-5.00 mg/L at 228.8 nm, 0.00-5.00 mg/L at 357.9 nm, 0.00-5.00 mg/L at 324.7 nm, 0.00-5.00 mg/L at 248.3 nm, 0.00-5.00 mg/L at 213.9 nm, 0.00-5.00 mg/L at 283.3 nm, 0.00-5.00 mg/L at 232.0 nm, 0.00-5.00 mg/L at 217.0 nm, 0.00-5.00 mg/L at 422.7 nm, 0.00-5.00 mg/L at 279.5 nm, 0.00-5.00 mg/L at 202.5 nm, 0.00-5.00 mg/L at 324.8 nm, 0.00-5.00 mg/L at 249.8 nm, 0.00-5.00 mg/L at 231.6 nm, 0.00-5.00 mg/L at 196.0 nm, 0.00-5.00 mg/L at 371.9 nm, 0.00-5.00 mg/L at 213.8 nm, 0.00-5.00 mg/L at 766.5 nm, 0.00-5.00 mg/L at 324.8 nm, 0.00-5.00 mg/L at 589.0 nm, 0.00-5.00 mg/L at 285.2 nm, 0.00-5.00 mg/L at 766.5 nm, 0.00-5.00 mg/L at 324.8 nm, 0.00-5.00 mg/L at 589.0 nm, 0.00-5.00 mg/L at 285.2 nm

AMBIENT CONDITIONS : Temperature 22 °C, Relative Humidity 50 %

The Atomic Absorption Spectrophotometer set This item calibrated against Reference Material traceable to National Institute of Standards and Technology (NIST) by The Analytical Calibration Laboratory. The results are attached herewith.

Calibrated By : _____
(Mr. Danai Wiriyangkun)

Approved By : _____
(Dr. [illegible])
Technical Manager
The Analytical Calibration Laboratory

Ref. 2025/03/0268/CERT.pdf
Calibration Date : 3 February 2025

This report shall not be reproduced except in full, without written approval of the laboratory.
Unauthorized alteration, forgery or falsification of this report is illegal and offenders may be subject to prosecution to the fullest extent of the law.

Head Office
[illegible]

Office Laboratory
[illegible]

Office
[illegible]

เอกสารไม่ควบคุม

Request No. 25-03 / 0268 1 / 3 MTC. ACL No. 888 / 65

CALIBRATION DATA

1. Fluoride Level, in terms of standard deviation

Element	[illegible]							
Aluminium	[illegible]							

Continue 2 / 3

เอกสารไม่ควบคุม

Request No. 25-03 / 0268 2 / 3 MTC. ACL No. 888 / 65

2. Precision

Parameter	Conc. (mg/L)	Precision											Avg (mg/L)	%RSD	MDL (mg/L)
Cd	0.50	0.4974	0.5003	0.5060	0.4918	0.5070	0.4948	0.5171	0.4955	0.5041	0.5002	0.4977	0.5014	1.19	0.0059
	1.00	0.9952	1.0000	0.9941	0.9902	1.0002	0.9818	1.0000	0.9970	0.9946	0.9902	0.9977	0.9944	0.60	0.0059
	2.50	2.5021	2.5180	2.5019	2.4998	2.4999	2.5111	2.5179	2.5012	2.5054	2.4974	2.5176	2.5061	0.33	0.0059
Cr	1.00	1.0056	1.0098	1.0047	0.9976	1.0100	1.0007	1.0098	1.0054	1.0111	0.9974	1.0127	1.0054	0.62	0.0059
	2.50	2.5009	2.5082	2.5064	2.5113	2.5087	2.5009	2.5008	2.5091	2.5078	2.5091	2.5078	2.5067	0.20	0.0059
	5.00	5.0029	5.0082	5.0080	5.0058	5.0091	5.0052	5.0058	5.0084	5.0079	5.0058	5.0079	5.0069	0.11	0.0059
Cu	0.50	0.4994	0.4979	0.5078	0.5078	0.5021	0.4980	0.4994	0.5007	0.5013	0.5007	0.5013	0.5007	0.54	0.0059
	1.00	0.9951	0.9918	0.9922	0.9922	0.9922	0.9922	0.9922	0.9961	0.9922	0.9922	0.9922	0.9926	0.13	0.0059
	2.50	2.5009	2.5000	2.5000	2.5000	2.5000	2.5000	2.5000	2.5000	2.5000	2.5000	2.5000	2.5000	0.00	0.0059
Fe	0.50	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.00	0.0059
	1.00	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	0.00	0.0059
	2.50	2.5000	2.5000	2.5000	2.5000	2.5000	2.5000	2.5000	2.5000	2.5000	2.5000	2.5000	2.5000	0.00	0.0059
Mn	0.50	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.00	0.0059
	1.00	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	0.00	0.0059
	2.50	2.5000	2.5000	2.5000	2.5000	2.5000	2.5000	2.5000	2.5000	2.5000	2.5000	2.5000	2.5000	0.00	0.0059
Ni	0.50	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.00	0.0059
	1.00	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	0.00	0.0059
	2.50	2.5000	2.5000	2.5000	2.5000	2.5000	2.5000	2.5000	2.5000	2.5000	2.5000	2.5000	2.5000	0.00	0.0059
Pb	0.50	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.00	0.0059
	1.00	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	0.00	0.0059
	2.50	2.5000	2.5000	2.5000	2.5000	2.5000	2.5000	2.5000	2.5000	2.5000	2.5000	2.5000	2.5000	0.00	0.0059
Zn	0.50	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.00	0.0059
	1.00	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	0.00	0.0059
	2.50	2.5000	2.5000	2.5000	2.5000	2.5000	2.5000	2.5000	2.5000	2.5000	2.5000	2.5000	2.5000	0.00	0.0059

Continue 3 / 3

เอกสารไม่ควบคุม

Request No. 25-03 / 0268 3 / 3 MTC. ACL No. 888 / 65

3. Traceability

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

Element	Standard Value of Std. (mg/L)	Reading (mg/L)	Error of Measurement (mg/L)	Error of Measurement (%)	Uncertainty (mg/L)
Cd	0.0004	0.0003	0.0001	0.01	± 0.0001
	2.5000	2.5001	0.0001	0.01	± 0.0001
	5.0000	5.0001	0.0001	0.01	± 0.0001

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

Element	Standard Value of Std. (mg/L)	Reading (mg/L)	Error of Measurement (mg/L)	Error of Measurement (%)	Uncertainty (mg/L)
Cr	0.0002	0.0001	0.0001	0.01	± 0.0001
	2.5000	2.5000	0.0000	0.00	± 0.0000
	5.0000	5.0000	0.0000	0.00	± 0.0000

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

Element	Standard Value of Std. (mg/L)	Reading (mg/L)	Error of Measurement (mg/L)	Error of Measurement (%)	Uncertainty (mg/L)
Cu	0.0002	0.0001	0.0001	0.01	± 0.0001
	2.5000	2.5000	0.0000	0.00	± 0.0000
	5.0000	5.0000	0.0000	0.00	± 0.0000

Continue 4 / 3

เอกสารไม่ควบคุม

เอกสารไม่ควบคุม

เอกสารไม่ควบคุม

CERTIFICATE OF CALIBRATION

Certificate No. : SP23-016 Page 1 of 3

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

Address : 7 Soi Udomsuk 43, Sukhumvit Road, Bangchak, Phrakhanong,

Bangkok 10260

Location of calibration : Laboratory XXX

Equipment : UV-Vis Spectrophotometer

Manufacturer : Agilent Technologies

Model : Cary 60

Serial No. : MY19410009

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. Natawat Wiriyakul)
Technical Manager

Approved by : (Ms. Chanikarn Anggarun)
Quality Manager

Uncontrolled Document

REPORT OF CALIBRATION

Certificate No. : SP23-016 Page 2 of 3

Environment Condition : Ambient Temperature 22 ± 3 °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
Holmium Perchlorate	25760	16924	22 October 2023
Holmium Oxide	25767	16929	22 October 2023
Wavelength Standard set	25906	16916	22 October 2023
Wavelength Standard set	25758	16911	22 October 2023

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

Spectral Band Width of UUC : 1.5 nm.

Scan Speed of UUC : 80 nm/min

Scan Interval of UUC : 0.15 nm.

Resolution of UUC : Photometric 0.0001 Abs.

Wavelength 0.1 nm.

Uncontrolled Document

REPORT OF CALIBRATION

Certificate No. (SPT2-010) Page 3 of 3

Calibration Results : Without adjustment

Photometric Accuracy :

Wavelength (nm)	CRMs Values (Abs)	UUC Reading (Abs)	Correction (Abs)	Uncertainty (Abs)	Coverage factor (k)
420	0.0000	0.0000	0.0000	0.0020	2.00
	0.3737	0.3733	0.0032	0.0011	2.00
	1.0440	1.0436	0.0054	0.0020	2.00
	2.1900	2.1847	0.0053	0.0037	2.00
440	0.0000	0.0000	0.0000	0.0020	2.00
	0.5602	0.5589	0.0019	0.0016	2.00
	1.1247	1.1232	0.0015	0.0035	2.00
	2.1126	2.1111	0.0015	0.0082	2.00
465	0.0000	0.0000	0.0000	0.0020	2.00
	0.5239	0.5197	0.0034	0.0029	2.00
	0.9634	0.9621	0.0004	0.0030	2.00
	1.9765	1.9752	0.0011	0.0075	2.00
546.1	0.0000	0.0000	0.0000	0.0020	2.00
	0.5101	0.5173	0.0020	0.0011	2.00
	1.0000	0.9984	0.0019	0.0033	2.00
	2.0987	1.9946	0.0041	0.0064	2.00
590	0.0000	0.0000	0.0000	0.0020	2.00
	0.5721	0.5709	0.0014	0.0030	2.00
	1.0809	1.0799	0.0016	0.0029	2.00
	2.1030	2.0939	0.0082	0.0080	2.00
635	0.0000	0.0000	0.0000	0.0020	2.00
	0.5401	0.5384	0.0017	0.0031	2.00
	1.0923	1.0898	0.0014	0.0029	2.00
	2.1054	2.0965	0.0059	0.0082	2.00

Uncontrolled Document

REPORT OF CALIBRATION

Certificate No. (SPT2-010) Page 4 of 5

Photometric Accuracy :

Wavelength (nm)	CRMs Values (Abs)	UUC Reading (Abs)	Correction (Abs)	Uncertainty (Abs)	Coverage factor (k)
235	0.0000	0.0001	-0.0001	0.0020	2.00
	0.7478	0.7421	0.0057	0.0050	2.00
257	0.0000	0.0000	0.0000	0.0020	2.00
	0.9484	0.9419	0.0067	0.0039	2.00
313	0.0000	0.0000	0.0000	0.0020	2.00
	0.8412	0.2994	0.0018	0.0072	2.00
350	0.0000	0.0000	0.0000	0.0020	2.00
	0.6448	0.6405	0.0043	0.0025	2.00

Uncontrolled Document

REPORT OF CALIBRATION

Certificate No. (SPT2-010) Page 5 of 5

Wavelength Accuracy :

CRMs Value (nm)	UUC Reading (nm)	Correction (nm)	Uncertainty (nm)	Coverage factor (k)
241.93	241.4	-0.20	0.15	2.00
279.80	279.5	0.07	0.15	2.00
287.09	287.9	0.31	0.15	2.00
333.66	333.9	0.46	0.15	2.00
361.50	361.3	0.41	0.15	2.00
416.39	415.9	0.29	0.15	2.00
467.94	467.9	0.34	0.15	2.00
486.06	485.9	0.46	0.15	2.00
546.23	545.7	0.23	0.20	2.00
587.79	587.5	0.19	0.20	2.00
637.58	638.0	0.11	0.20	2.00
912.59	911.9	0.59	0.20	2.00
972.54	972.9	0.06	0.20	2.00
1014.67	1015.1	0.03	0.20	2.00
1128.66	1128.7	0.16	0.20	2.00
1775.17	1775.8	0.17	0.20	2.00
1931.21	1931.9	0.19	0.20	2.00
1969.89	1969.1	0.29	0.20	2.00
2362.72	2362.6	0.09	0.20	2.00
2487.35	2486.7	0.05	0.20	2.00
2537.85	2537.3	0.27	0.20	2.00
2728.20	2728.6	0.19	0.20	2.00

End of Certificate

Uncontrolled Document

CERTIFICATE OF CALIBRATION

Certificate No. : (SPT2-007) Page 1 of 5

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

Address : 2 Soi Chaiyodsak 41, Sukhumvit Road, Bangchak, Phrakhanong, Bangkok 10260

Location of calibration : Laboratory 105

Equipment : UV-Vis Spectrophotometer

Manufacturer : Hitachi

Model : U-1900

Serial No. : 2N2-0001

ID No. : UAE-S-ACAB-2102

Received Date : 4 January 2023

Calibration Date : 4 January 2023

Issue Date : 05 January 2023

Condition (received) : Used

Calibrated by : (Mr.Sarawut Kaikaew) Technical Manager

Approved by : (Mrs.Chonnikarn Tadpigeon) Quality Manager

This calibration result is applicable only to the above calibrated item and is not to be used as an endorsement of any kind of product.

The recommended period of this instrument is not to exceed 1 year or upon special agreement and in case of equipment is used in the out-measuring range stated in inventory. This certificate may not be reproduced except in full, except with the prior written approval of the UAE Services Co., Ltd.

เอกสารไม่ควบคุม

DGE Services

REPORT OF CALIBRATION

Certificate No. : 0721-007 Page 2 of 3

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	22760	93410	22 October 2021
Absorbance Standard set	22757	93420	22 October 2021
Wavelength Standard set	22846	93510	22 October 2021
Wavelength Standard set	22798	93511	22 October 2021

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

Spectral Band Width of UUC : 0.5 nm.

Scan Speed of UUC : 220 nm/min

Scan Interval of UUC : 0.1 nm.

Resolution of UUC : Photometric 0.001 Abs.

Wavelength 0.1 nm.

เอกสารไม่ควบคุม

DGE Services

REPORT OF CALIBRATION

Certificate No. : 0721-007 Page 3 of 3

Calibration Result : Without adjustment

Photometric Accuracy :

Wavelength (nm)	CRMs Value (Abs)	UUC Reading (Abs)	Correction (Abs)	Uncertainty (Abs)	Coverage factor k
420	0.0000	0.000	0.0000	0.0028	2.00
	0.3787	0.373	0.0057	0.0031	2.04
	1.0498	1.044	0.0058	0.0029	2.00
	2.1900	2.181	0.0090	0.0060	2.04
440	0.0000	0.000	0.0000	0.0028	2.00
	0.3607	0.356	0.0047	0.0034	2.00
	1.0245	1.020	0.0057	0.0035	2.00
	2.1229	2.115	0.0079	0.0083	2.00
465	0.0000	0.000	0.0000	0.0028	2.00
	0.3258	0.320	0.0056	0.0030	2.00
	0.9634	0.963	0.0024	0.0029	2.00
	1.9793	1.968	0.0081	0.0070	2.00
590.1	0.0000	0.000	0.0000	0.0028	2.00
	0.3195	0.314	0.0051	0.0031	2.00
	1.0001	1.000	0.0001	0.0051	2.00
	2.0997	2.092	0.0077	0.0064	2.00
596	0.0000	0.000	0.0000	0.0028	2.00
	0.3727	0.372	0.0003	0.0030	2.00
	1.0836	1.092	-0.0011	0.0030	2.00
	2.2561	2.261	-0.0043	0.0049	2.00
670	0.0000	0.000	0.0000	0.0028	2.00
	0.3660	0.362	0.0038	0.0032	2.00
	1.0313	1.035	-0.0036	0.0030	2.00
	2.0286	1.977	0.0514	0.0078	2.00

เอกสารไม่ควบคุม

DGE Services

REPORT OF CALIBRATION

Certificate No. : 0721-007 Page 4 of 5

Photometric Accuracy :

Wavelength (nm)	CRMs Value (Abs)	UUC Reading (Abs)	Correction (Abs)	Uncertainty (Abs)	Coverage factor k
235	0.0000	0.000	0.0000	0.0028	2.00
	0.7478	0.745	0.0028	0.0037	2.00
257	0.0000	0.000	0.0000	0.0028	2.00
	0.6698	0.661	0.0078	0.0059	2.00
313	0.0000	0.000	0.0000	0.0028	2.00
	0.2912	0.291	0.0002	0.0031	2.00
350	0.0000	0.000	0.0000	0.0028	2.00
	0.0000	0.000	0.0000	0.0028	2.00

เอกสารไม่ควบคุม

DGE Services

REPORT OF CALIBRATION

Certificate No. : 0721-007 Page 5 of 5

Wavelength Accuracy :

CRMs Value (nm)	UUC Reading (nm)	Correction (nm)	Uncertainty (nm)	Coverage factor k
361.33	361.0	0.33	0.18	2.00
474.44	474.7	-0.26	0.18	2.00
486.01	486.0	0.01	0.18	2.00
536.51	536.3	0.21	0.18	2.00
546.08	546.1	-0.02	0.18	2.00
576.96	577.0	-0.04	0.18	2.00
579.07	579.1	-0.03	0.18	2.00
640.75	640.8	-0.05	0.18	2.00
652.95	653.0	-0.05	0.18	2.00
703.24	703.2	0.04	0.18	2.00
738.48	738.5	-0.02	0.18	2.00
748.37	748.4	-0.03	0.18	2.00
794.82	794.8	0.02	0.18	2.00
811.54	811.5	0.04	0.18	2.00

Remark : UUC = Unit Under Calibration

N/A = Not Available

This result represents only the item(s) calibrated. It should not be used to claim product certification, approval, or endorsement by DGE Services Co.,Ltd.

Unless otherwise specified, uncertainty is evaluated with a confidence probability of approximately 95%

* Measurement Uncertainty

- End of Certificate -

เอกสารไม่ควบคุม

การติดตามตรวจสอบคุณภาพสิ่งแวดล้อม

บริษัท ทีพีไอ โพลีน จำกัด (มหาชน) จังหวัดสระบุรี

ระหว่างเดือนกรกฎาคม ถึง เดือนธันวาคม พ.ศ. 2566

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	2302181-001-01	24 Mar 23	22 Mar 24	-
2	pH Meter		Mettler-Toledo	Seven Compact S220 / C113432421	National Food Institute, Ministry of Industry, Thailand	2303560-001-01	22 Jun 23	21 Jun 24	-
3	Conductivity Meter	Electrical Conductivity	SI Analytics	Lab955 / 16300356	DKSH Technology Limited	C24230059	16 Mar 23	14 Mar 24	-
4	Analytical Balance (Readability 0.01 mg)	Total Solids Total Dissolved Solids Total Suspended Solids	Mettler-Toledo	AB204-S/FACT 1129361010	National Food Institute, Ministry of Industry, Thailand	2303074-001-01	26 May 23	2 May 24	-
5	Hot Air Oven		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.WAO.015/2561)	Technology Promotion Association (Thailand-Japan)	23TM249	15 Feb 23	14 Feb 24	-
7	BOD Incubator		Arco	UR-1320 / (UAE.WAO.018/2551)	Technology Promotion Association (Thailand-Japan)	23TM375	12 Apr 23	10 Apr 24	-
8	Analytical Balance (Readability 0.1 mg)	Fat Oil And Grease	Mettler-Toledo	XSR204/ C117635043	National Food Institute, Ministry of Industry, Thailand	2302827-001-01	10 May 23	9 May 24	-
9	Incubator	Total Coliform Bacteria Faecal Coliform Bacteria	Memmert	IPP 260 / V615.0187	Technology Promotion Association (Thailand-Japan)	23TM378	12 Apr 23	10 Apr 24	-
10	Incubator		Memmert	IPP 260 / V618.0033	Technology Promotion Association (Thailand-Japan)	23TM729	27 Apr 23	26 Apr 24	-
11	Water Bath		Memmert	WNE 14 / L416.0606	Technology Promotion Association (Thailand-Japan)	23TM193	15 Feb 23	14 Feb 24	-

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.									
12	Water Bath	Total Coliform Bacteria Faecal Coliform Bacteria	Memmert	WNE 14 / L416.0612	Technology Promotion Association (Thailand-Japan)	23TM194	15 Feb 23	14 Feb 24	-
13	Analytical Balance		OHAUS	PX623 / C236754745	DKSH (Thailand) Ltd.	C01223732	9 Dec 22	8 Dec 23	-
14	Auto Clave		ALP	CL-40L / 810010	DKSH (Thailand) Ltd.	C11230106	9 Jun 23	8 Jun 24	-
15	Atomic Absorption Spectrophotometer (AAS)	Iron, Titanium, Arsenic, Cadmium, Manganese, Chromium, Copper, Barium, Lead, Mercury, Nickel,	Agilent Technologies	System ID:G8432A AA240FS / MY13160001	Thailand Institute of Scientific and Technological Research(TISTR)	MTC.ACL.No. 387/66	2 Feb 23	1 Feb 24	-
16	Inductively Coupled Plasma (ICP)	Selenium, Chromium Trivalent, Chromium Hexalent, Zinc Titanium, Chromium	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 / MY15410009	DQE Services Co.,Ltd.	SP23-021	20 May 23	19 May 24	-
18	UV-VIS Spectrophotometer	Nitrate Nitrogen, Phenols, Colour, Chromium Hexalent,Total Nitrogen	Hitachi	U-1900 / 2021-064	DQE Services Co.,Ltd.	SP23-007	6 Jan 23	5 Jan 24	-
19	UV-VIS Spectrophotometer	Chemical Oxygen Demand Formaldehyde, Cyanide As HCN	Hitachi	U-2900 / 21E22-009	DQE Services Co.,Ltd.	SP23-008	6 Jan 23	5 Jan 24	-
20	COD Reactor (Heating Block)	Chemical Oxygen Demand	Hanna	HI839800-02 / H018500I	Hanna Instruments (Thailand) Ltd.	HIT-2312-0342	10 Mar 23	9 Mar 24	-
21	Digestor Unit	Total Kjeldahl Nitrogen (TKN)	FOSS TECATOR	2520auto / 91794469	National Food Institute, Ministry of Industry, Thailand	2302413-001-01	30 Mar 23	28 Mar 24	-

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.									
22	Distillation Unit (Kjeldahl Method)	Ammonia-Nitrogen Total Kjeldahl Nitrogen (TKN)	FOSS TECATOR	KT200 / 91790524	FOSS South East Asia	7824	17 Jan 23	16 Jan 24	-
23	Gas Chromatrography (GC)	Organochlorine Pesticides, 2,4-D, Benzo (a) Pyrene, PCBs, Pentachlorophenol Atrazine	Agilent Technologies	System ID:CN11021007 7890 / CN11021007	Agilent Technologies (Thailand) Co.,Ltd.	Certificate of System Qualification GC-OQ	23 Feb 23	22 Feb 24	-
24	Gas Chromatrography (GC)		Agilent Technologies	System ID:CN13113001 7890 / CN13113001	Agilent Technologies (Thailand) Co.,Ltd.	Certificate of System Qualification GC-OQ	19 Apr 23	17 Apr 24	-
25	Gas Chromatrography / 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	G7077B/ US2009M037	Agilent Technologies (Thailand) Co.,Ltd.	Preventive Maintenance Checklist	14 Jun 23	13 Jun 24	-
26	Turbidity Meter	Turbidity	Oakton	T100IR / 1120501017	Technology Promotion Association (Thailand-Japan)	23CH1148	14 Sep 23	13 Sep 24	-

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

Calibration Certificate

Certificate No.:
Client name:
Address:

Equipment: pH Meter
Manufacturer: METTLER TOLEDO
Model:
Serial No.:
ID No.:
Order No.:
Operation No.:
Date of Receipt:
Date of Calibration:

Calibrated by
Approved by

Date of Issue:

เอกสารไม่ควบคุม

Calibration Report

Certificate No.:
Equipment:
Date of Calibration:
Location:
Environmental Condition:
Condition of Equipment:
Condition of the Results of Calibration:

เอกสารไม่ควบคุม

Calibration Report

Certificate No.:
Equipment:
Date of Calibration:

เอกสารไม่ควบคุม

Calibration Report

Certificate No.:
Equipment:
Date of Calibration:
Location:
Environment Condition:

Condition of the results of Calibration:

1. Calibration Method :
2. Reference Standard Instrument :

Instrument	Model	Serial No.	Certificate No.	Due Date	Through
HANDHELD THERMOMETER					
Platinum Resistance Thermometer (PRT)					

3. This certificate is invalidated if not allowed System of Units (SI Units).
4. This certificate was verified only for the input power as calibrated.
5. The result of calibration was found accurate as shown on date and place of calibration only.
6. Condition of calibrated item : Good
7. Result of Calibration : [x] Without adjustment [ ] After adjustment

เอกสารไม่ควบคุม

Calibration Report

Certificate No.:
Equipment:
Date of Calibration:

Calibration point:
Calibration result:

IAC* Reading (°C)	Standard Temperature (°C)	Correction Value (°C)	Uncertainty ± (°C)
11.0	10.999	0.1	0.12
20.1	19.999	0.1	0.12
30.1	29.999	0.1	0.12

Note
- IAC* : Unit Under Calibration

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

---End---

เอกสารไม่ควบคุม

Calibration Certificate

Certificate No.:
Client name:
Address:

Equipment: pH Meter
Manufacturer:
Model:
Serial No.:
ID No.:
Order No.:
Operation No.:
Date of Receipt:
Date of Calibration:

Calibrated by
Approved by
Date of Issue: 27 June 2023

เอกสารไม่ควบคุม

Calibration Report

Certificate No.:
Equipment:
Date of Calibration:
Location:
Environmental Condition:
Condition of Equipment:
Condition and/or Method of Calibration:

1. Reference Standards

Instrument	Serial / ID No.	Manufacturer	Certificate No.	Due Date
1.1				
1.2				
1.3				

Certified Reference Material	Lot No.	Manufacturer	Set #	Expiry Date
1.4				
1.5				
1.6				
1.7				

2. The certificate is issued on the basis of a Report in attachment

2.1	through	
2.2	through	
2.3	through	
2.4		
2.5		

3.
4.

เอกสารไม่ควบคุม

Calibration Report

Certificate No.:
Equipment:
Date of Calibration:
Calibration Results

Nominal pH	Standard Solution (°C)	Average Indication Reading		Uncertainty (± pH)	Coverage Factor (k)
		pH	pH		

Equipment:
Manufacturer:
Serial No.:
Performance of Reconciliation:

Certified Value (pH) @ °C (pH)	Average Indication Reading		Relative Error (%)	Uncertainty (± pH)	Coverage Factor (k)
	pH	mV			

27 June

เอกสารไม่ควบคุม

Calibration Report

เอกสารไม่ควบคุม

Calibration Report

เอกสารไม่ควบคุม

DKSH

Certificate of Calibration

Equipment:	CONDUCTIVITY METER	Certificate No.:	CH230008
Model:	Lab 862	Issued Date:	16 March 2023
Serial No. (s/ 81):	1600286	Job No.:	66PR23M470
Manufacturer:	SI Analytics	Page:	1 of 2
Electrode Serial No:	1647/287	Model: LF413T	Brand: SI Analytics
Condition:	In Condition		

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

Environment Condition: Temperature 23 °C ± 1 °C
Humidity 50 %RH ± 10 %RH

Calibration Place: Environment Laboratory, DKSH Technology Limited
2535 Sukhumvit Road, Bangchak,
Prakhanong, Bangkok 10260 Thailand

Calibration By: Mr.Akachai Ngamcharoen
Calibration Date: 16 March 2023
The Method used: In-house method, CAL-WI-46, base on ASTM D 1125-14 and D 5391-15
Traceability: This certificate is traceable to the SI Units maintained by OMN of NIST/SRM through OMN others Co., Ltd. (ISO/IEC 17034) Certificate No. 836712, 836713, 836719

(Mr. Akachai Ngamcharoen)
Person in charge

(Mr.Wilson Sithasoth)
Authorized signatory

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

เอกสารไม่ควบคุม

DKSH

Calibration Results:

Before Adjustment

Standard Conductivity Solution	Unit Under Calibration Reading	Correction	Coverage Factor (k)	Uncertainty (±)
80,000 µS/cm	84.0 µS/cm	0.304 µS/cm	2.00	6.21 µS/cm
1413.0 µS/cm	1408 µS/cm	10.0 µS/cm	2.00	8.0 µS/cm
111.3 mS/cm	108.8 mS/cm	2.80 mS/cm	2.00	0.81 mS/cm

After Adjustment (at 1413 µS/cm)

Standard Conductivity Solution	Unit Under Calibration Reading	Correction	Coverage Factor (k)	Uncertainty (±)
80,000 µS/cm	84.8 µS/cm	0.304 µS/cm	2.00	6.21 µS/cm
1413.0 µS/cm	1410 µS/cm	0.0 µS/cm	2.00	8.0 µS/cm
111.3 mS/cm	108.8 mS/cm	2.80 mS/cm	2.00	0.81 mS/cm

The End of Certificate

เอกสารไม่ควบคุม

DKSH

ใบตรวจสอบสภาพเครื่องวัดสิ่งแวดล้อม

ผลที่ตรวจ: สมบูรณ์ปกติ

ชนิดเครื่องมือ: CONDUCTIVITY METER No. Lot: 005 หมายเลขเครื่อง: 15303008

ตรวจสอบ (วันที่ 19 Mar 2020)		การตรวจสอบ	ตรวจสอบ (วันที่ 19 Mar 2020)		หมายเหตุ
ปกติ	ไม่ปกติ		ปกติ	ไม่ปกติ	
		General			
☒	☐	1. สภาพทั่วไปของเครื่อง	☒	☐	
☒	☐	2. สายต่างๆ (สายไฟ/สัญญาณ, การเชื่อมต่อเครื่อง)	☒	☐	
☒	☐	3. ตัวเครื่อง – ปุ่มกด/สวิตช์ (On/Off Switch)	☒	☐	
☒	☐	4. ปุ่มกด (Keypad)	☒	☐	
☒	☐	5. หน้าจอ (Display Screen Contrast)	☒	☐	
		Electrolyte/Electrode			
☐	☐	6. แบตเตอรี่สำรอง (Battery Backup >= 2.5 VDC	☐	☐	
☐	☐	7. ปุ่มปรับค่าความเข้มข้น (Wavelength Control)	☐	☐	
☐	☐	8. การตั้งค่าเครื่อง (Monochrom Check)	☐	☐	
☐	☐	9. แสงสว่างหลอด (UV > 3,000 hour)	☐	☐	
☐	☐	10. แสงสว่างหลอด (Visible > 5,000 hour)	☐	☐	
☐	☐	11. ตัวเก็บหลอดหลอด (Carousel Module)	☐	☐	
		pH Meter and Conductivity Meter			
☒	☐	12. อิเล็กโทรด (Electrode and Connector Cable)	☒	☐	
☐	☐	13. หลอดแสงของโต๊ะ Electrode (Level KCl)	☐	☐	
☐	☐	14. ปลั๊กอิเล็กโทรด Electrode (Dual Protective Head)	☐	☐	
☐	☐	15. ตัวเก็บอิเล็กโทรด (Stand)	☐	☐	
		Turbidimeter			
☐	☐	16. หลอดแหล่งกำเนิดแสง (Air Bubble)	☐	☐	
☐	☐	17. หลอดการตรวจสอบแสงของเครื่อง (>= 2.5 Volts)	☐	☐	
		Automatic Titrator			
☐	☐	18. ตรวจ Point (Sensitive)	☐	☐	
☐	☐	19. Function Rinsing and Dosing	☐	☐	
☐	☐	20. หลอดแสงสว่างของเครื่อง(Ventilation)	☐	☐	

หมายเหตุ: Electrode ใช้งานอยู่ที่ 25 °C/ Tes Control Standard ที่ 25.0 ±0.1°C

Mr.Akachai Rujkrichanut
Service Engineer

เอกสารไม่ควบคุม

---

nfi

Calibration Certificate

Certificate No.: CERT074-001-01
Client name: UNITED ANALYST AND ENGINEERING CONSULTANT CO.,LTD.
Address: 8 Soi Udomsuk 41, Sukhumvit Road, Bangchak, Prakkanong, Bangkok 10260

Page 1 of 5

Equipment: Electronic Balance
Manufacturer: METTLER TOLEDO
Model: AB204-S/FACT
Serial No.: 1129341018
ID No.: UAE-AWS-002/2012
Order No.: 2383974
Operation No.: 2383974-001
Date of Receipt: 28 May 2020
Date of Calibration: 29 May 2020

Calibrated by Mr.Phongphon Thongto, Technician
Approved by (Miss Pattiyaporn Bunsiperm)
Vice President, Department of Laboratory Services
Responsible for the Technical Management Team

Date of Issue: 29 May 2020

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 this laboratory and its traceability to recognized national standards and to the units of measurement realized at the corresponding national standards laboratories. This certificate may not be reproduced other than in full, except with the prior written approval of the National Food Institute.

F-CL-005 Revision: 01 Date: 20-04-60

เอกสารไม่ควบคุม

---

nfi

Calibration Report

Certificate No.: 2383974-001-01
Equipment: Electronic Balance **Manufacturer:** METTLER TOLEDO
Model: AB204-S/FACT **Resolution:** 0.0001 g
Serial No.: 1129341018 **ID No.:** UAE-AWS-002/2012
Capacity: 220 g

Date of Calibration: 29 May 2020 Page 2 of 5
Environmental Condition: Ambient Temperature 22.7 ± 0.1 °C Relative Humidity 41 ± 2.5 %
Place of Calibration: Room 208 Balance Room at UNITED ANALYST AND ENGINEERING CONSULTANT CO.,LTD.
Condition of Equipment: Good Condition
Condition of The Results of Calibration

1. Calibration Method: MA-Method-M-008-001 (Based on OIML Rec 76-1 (2013))
2. Reference Standard:

Reference Standard	Model	Serial No.	Calibrated By	Certificate No.	Due Date
Standard Weight Class E2	1mg to 200g	M1003070	TISI	0104/2019	8 April 2020

Instrument	Model	Serial No.	Calibrated By	Certificate No.	Due Date
Electronic Balance	AB204-S	B415143425	Calibration Section	0037/2020	14 February 2021

3. This certificate is issued in 5 page(s).
4. This certificate may not be used for the calibration of other devices.
5. This result of calibrated shall be kept at least 3 years, or other time period as specified by user.

Calibration Results:
1. Repeatability of Reading:

Nominal Value (g)	Maximum Deviation of Reading (g)
100	0.0004
200	0.0004

2. Off-Center Error:

Error at 100 g was found and it used for without applied corrections.
The Maximum reading difference is equal to 0.0004 g.

Position of Load	Indication (g)	Error (g)
Front Left	100.0000	0.0000
Front Right	100.0000	0.0000
Back Left	100.0000	0.0000
Back Right	100.0000	0.0000
Center	100.0000	0.0000
Maximum Difference		0.0000

29 May 2020

F-CL-011 Revision: 01 Date: 20-04-60

เอกสารไม่ควบคุม

---

nfi

Calibration Report

Certificate No.: 2383974-001-01
Equipment: Electronic Balance **Manufacturer:** METTLER TOLEDO
Model: AB204-S/FACT **Resolution:** 0.0001 g
Serial No.: 1129341018 **ID No.:** UAE-AWS-002/2012
Capacity: 220 g

Date of Calibration: 29 May 2020 Page 3 of 5
Calibration Results: (Continued)
Calibration Range: 0.200 g
Calibration Adjustment: Internal Calibration
2. Departure from Nominal Value:

Nominal Value (g)	Standard Value (g)	Average Reading (g)	Correction (g)	Uncertainty (g)	Coverage Factor k
Initial	0.00000	0.0001	0.0000	0.00009	2.00
0.01	0.00999	0.0100	0.0000	0.00009	2.00
0.02	0.01999	0.0200	0.0000	0.00009	2.00
0.05	0.04999	0.0500	0.0000	0.00009	2.00
0.1	0.09999	0.1000	0.0000	0.00009	2.00
0.2	0.19998	0.2000	0.0000	0.00009	2.00
0.5	0.49996	0.5000	0.0000	0.00009	2.00
1	0.99993	1.0000	0.0000	0.00009	2.00
2	1.99986	2.0000	0.0000	0.00009	2.00
5	4.99965	5.0000	0.0000	0.00009	2.00
10	9.99930	10.0000	0.0000	0.00009	2.00
20	19.99860	20.0000	0.0000	0.00009	2.00
50	49.99650	50.0000	0.0000	0.00009	2.00
100	99.99300	100.0000	0.0000	0.00009	2.00
150	149.98950	150.0000	0.0000	0.00009	2.00
200	199.98600	200.0000	0.0000	0.00009	2.00

29 May 2020

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

End

F-CL-011 Revision: 01 Date: 20-04-60

เอกสารไม่ควบคุม

Certificate of Calibration

Equipment :
Manufacturer :
Model :
Serial No. :
ID No. :
Submitted by :
Location :
Received Date :
Calibration Date :
Ambient Temperature :
Relative Humidity :
Calibrated by :
Approved by :
Approved Signatory
Issue Date :

เอกสารไม่ควบคุม

เอกสารไม่ควบคุม

Equipment :
Condition As Received :
Reference :
Procedure Used :

Condition of the result of calibration

Instrument	Model	Serial No.	Cert. No.	Due Date
1.) Data Acquisition				

Result of Calibration :
Position of UUC :
Fixed on ceiling :

Environment during calibration

	Beginning	Finished

Position	Calibration Points	
1		
2		
3		
4		
5		
6		
7		
8		
9 (Ctr.)		

Probe installation Depths

Dimension of Chamber

เอกสารไม่ควบคุม

Equipment :
Condition As Received :
Reference :
Result of Calibration :
Position of UUC* :
Fixed on ceiling :

Calibration Point	24HR* Setting	24HR* Reading	Temperature stability	Temperature uniformity	Overall Variation	Uncertainty	Coverage Factor

Calibration Point	Measured Temperature (°C)								
	Position								
	1	2	3	4	5	6	7	8	9 (Ctr.)

Average* : The average of 30 values in each position.
Temperature stability : One half of the greatest maximum difference of measured temperature at any one sensor from the mean temperature over the duration of the test.
Temperature uniformity : The maximum difference of measured temperatures at any sensors and the measured temperature at the reference location, which are observed at the same time or at an observation time as near 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 stabilization.
UUC* : Unit Under Calibration.
Note : The reported uncertainty of measurement was computed stability and non-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 %.

เอกสารไม่ควบคุม

กำหนดจุดห้ามใช้งาน

References Certificate Number. : 22TM1490

Equipment : Hot Air Oven

Model : UF55

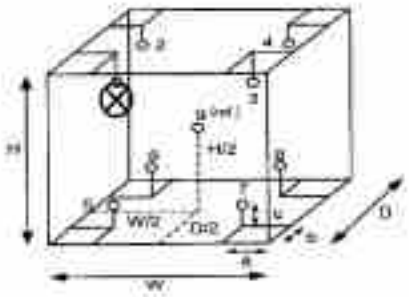
Serial No. : B216.1666

ID No. : UAE.WAO.027/2559

Manufacturer : Memmert

Calibration Point : 140.0 °C

Unit Under Calibration Setting : 140.0°C



รูปภาพเครื่องมือ แสดงจุดที่ใช้วัดการสอบเทียบ และสัญลักษณ์ ⊗ แสดงจุดห้ามใช้งาน

กำหนดจุดห้ามใช้งานตำแหน่งที่ 1

เอกสารไม่ควบคุม

กำหนดจุดห้ามใช้งาน

References Certificate Number. : 22TM1490

Equipment : Hot Air Oven

Model : UF55

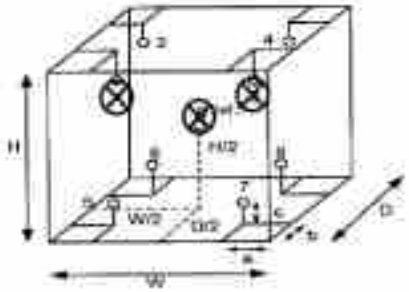
Serial No. : B216.1666

ID No. : UAE.WAO.027/2559

Manufacturer : Memmert

Calibration Point : 180.0 °C

Unit Under Calibration Setting : 180.0°C



รูปภาพเครื่องมือ แสดงจุดที่ใช้วัดการสอบเทียบ และสัญลักษณ์ ⊗ แสดงจุดห้ามใช้งาน

กำหนดจุดห้ามใช้งานตำแหน่งที่ 1,3,9

เอกสารไม่ควบคุม

Certificate of Calibration

เอกสารไม่ควบคุม

เอกสารไม่ควบคุม

เอกสารไม่ควบคุม

Uncontrolled Document

Certificate of Calibration

Uncontrolled Document

Uncontrolled Document

Calibration Certificate

Certificate No.: 2202827-001-01
Client name: UNITED ANALYST AND ENGINEERING CONSULTANT CO., LTD.
Address: 3 Soi Udomsuk 42, Sukhumvit Road,
Bangchak, Phrakhanong, Bangkok 10260

Equipment: Electronic Balance

Manufacturer: METTLER TOLEDO

Model: XS204

Serial No.: C117620843

ID No.: UAE.WAS.011.2564

Order No.: 2202827

Operation No.: 2202827-001

Date of Receipt: 10 May 2022

Date of Calibration: 10 May 2022

Calibrated by Mr.Pisnan Somsak
Specialist

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

Date of Issue: 10 May 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 Bureau which has assessed the measurement capability of this laboratory and its traceability to recognized national standards and to the units of measurement realized at the corresponding national standards laboratory. This certificate may not be reproduced other than in full, except with the prior written approval of the issuing laboratory.

Uncontrolled Document

Calibration Report

Certificate No.: 2202827-001-01
Equipment:
Model:
Serial No.:
Capacity:
Manufacturer:
Resolution:
ID No.:

Date of Calibration:
Environment Condition:
Place of Calibration:
Condition of Equipment:
Condition of The Results of Calibration:

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

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

Calibration Results

1. Repeatability of Reading:

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

2. Off-Center Error:

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

Uncontrolled Document

Calibration Report

Certificate No.: 2202827-001-01
Equipment:
Model:
Serial No.:
Capacity:
Manufacturer:
Resolution:
ID No.:

Date of Calibration:
Calibration Results: (Continued)
Calibration Range:
Calibration Adjustment:
3. Departure from Nominal Value:

Nominal Value (g)	Standard Value (g)	Average Reading (g)	Correction (g)	Uncertainty (± g)	Coverage Factor (k)

Uncontrolled Document

Calibration Report

Certificate No.: 2202827-001-01
Equipment:
Model:
Serial No.:
Capacity:
Manufacturer:
Resolution:
ID No.:

Date of Calibration:
Calibration Results: (Continued)
Calibration Range: 0 - 200 g
Calibration Adjustment: Internal Calibration
3. Departure from Nominal Value:

Nominal Value (g)	Standard Value (g)	Average Reading (g)	Correction (g)	Uncertainty (± g)	Coverage Factor (k)

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

End

Uncontrolled Document

Certificate of Calibration

Equipment :

Manufacturer :

Model :

Serial No. :

ID No. :

Submitted by :

Location :

Received Date :
Calibration Date :
Ambient Temperature :
Relative Humidity :

Calibrated by :

Approved by :

Approved Signatory

( ) Pornthipan Tonnayaka
( ) Nitiwit Sukmuse
( ) Duwit Inlar

Issue Date :

The Calibration are for a confidence probability of approximately 95%

Uncontrolled Document

Equipment :
Condition As-Received :
Reference :
Procedure Used :

Cert. No. :
Page :

Calibration were conducted using calibration procedure (QP-CAL) 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 the result of calibration

1. Reference standard instrument :

Instrument	Model	Serial No.	Cert. No.	Due Date
( ) Data Acquisition				

2. This certificate is valid only for the item mentioned on date and place of calibration.
3. This certification is traceable to the International System of Unit.

Result of Calibration : ( ) Without Adjustment
Function of UUC* :
Fresh air setting :

Temperature Sensor

Environment during calibration

	Beginning	Finished
Temp. (°C)		
Rel. Humidity (%)		
Air Supply (VAC)		

Position	Ref. Std. ID No. :
1	
2	
3	
4	
5	
6	
7	
8	
9 (ref.)	

Probe Installation Depths :

x =	0.0	cm
y =	0.0	cm
z =	0.0	cm

Dimension of Chamber

D =	0.00	m
W =	0.00	m
H =	0.00	m
Capacity =	0.00	m³

Uncontrolled Document

Equipment :
Condition As-Received :
Reference :
Result of Calibration : ( ) Without Adjustment
Function of UUC* :
Fresh air setting :

Cert. No. :
Page :

Calibration Point	UUC* Setting	UUC* Reading	Temperature stability	Temperature uniformity	Overall Variation	Coverage Factor
(°C)	(°C)	(°C)	(± °C)	(°C)	(°C)	k
30.0	30.0	30.0	0.053	0.19	0.60	3

Calibration Point	Measured Temperature (°C) Position									Uncertainty
(°C)	1	2	3	4	5	6	7	8	9 (ref.)	(± °C)
30.0	30.000	29.746	30.017	29.744	30.000	30.023	30.113	29.980	30.000	0.30

Average* : the average of 30 values in each position

Temperature stability : Over-all of the greatest maximum difference of measured temperatures at any one position

Temperature uniformity : The maximum difference of measured temperatures at any positions and the measured temperature at the reference location, which are observed at the same time on all six sides an empty chamber time as possible to determine the temperature pattern or nonuniformity within the chamber under steady state conditions

Overall Variation : The difference of the maximum and minimum measured temperatures from given observations

UUC* : unit under Calibration

Note : The operation uncertainty of measurement was included stability and workload 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 %

Uncontrolled Document

Certificate of Calibration

Cert. No. :
Page :

Equipment :

Manufacturer :

Model :

Serial No. :

ID No. :

Submitted by :

Location :

Received Date :
Calibration Date :
Ambient Temperature :
Relative Humidity :

Calibrated by :

Approved by :

Approved Signatory

( ) Pornthipan Tonnayaka
( ) Nitiwit Sukmuse
( ) Duwit Inlar

Issue Date :

The Calibration are for a confidence probability of approximately 95%

Uncontrolled Document

Equipment : Incubator
Condition As-Received : Used Item
Reference : 2304.040100-7
Procedure Used :-

Calibration were conducted using calibration procedure CD-07102 according to direct measurement method with Data Acquisition which connected with Platinum Temperature Detector (RTD).

The temperature scale used was based on ITS-90.

Condition of the result of calibration

1. Reference standard instrument:-

Instrument	Model	Serial No.	Cert. No.	Due Date
1) Data Acquisition	34970A	MY51512711	22L1663	02 Jul 2023

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

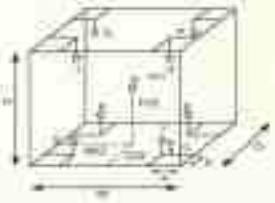
3. This certificate is traceable to the International System of Unit

Result of Calibration : [*] Without Adjustment

Function of UUC* : Temperature Stores

Fresh air setting : Close

Environment during calibration	Beginning	Finished
Temp. (°C)	20	21
REL Humid. (%)	70	71
AC Source (Volt)	230	231



Position	Ref. Std. ID No.
1	19-SRTD-041
2	19-SRTD-029
3	19-SRTD-025
4	19-SRTD-034
5	19-SRTD-045
6	19-SRTD-019
7	19-SRTD-027
8	20-SRTD-005
9 (Mid.)	19-SRTD-036

Probe Installation Details :

a =	10	cm.
b =	10	cm.
c =	10	cm.

Dimension of Chamber

H =	0.55	m.
W =	0.54	m.
D =	0.60	m.
Capacity =	220	cu.ft.

Uncontrolled Document

Equipment : Incubator
Condition As-Received : Used Item
Reference : 2304.040100-7
Result of Calibration : [*] Without Adjustment
Function of UUC* : Temperature Stores
Fresh air setting : Close

Calibration Point (°C)	UUC* Setting (°C)	UUC* Reading (°C)	Temperature stability (± °C)	Temperature uniformity (°C)	Uncert. Value (°C)	Coverage Factor
33.0	33.0	33.0	0.000	0.15	0.19	2
44.0	44.0	44.0	0.000	0.80	0.87	2

Calibration Point (°C)	Measure Temperature (°C) Position								Average (°C)	Uncertainty (± °C)
	1	2	3	4	5	6	7	8		
33.0	32.999	32.728	31.971	33.003	33.304	32.930	31.941	31.959	32.753	0.30
44.0	44.000	44.447	43.200	44.224	43.808	43.089	43.027	43.043	44.085	0.91

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

Temperature stability : Example of the greatest maximum difference of measured temperature at any one sensor.

Temperature uniformity : The maximum difference in measured temperature at any sensors and the measured temperature on the reference sensor, which are observed at the same time or at as close as a predetermined time as possible to determine the temperature pattern or homogeneity within the chamber under steady-state conditions.

Stored 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 %.

-xxx-

Uncontrolled Document

Certificate of Calibration

Sert. No. :
Page :

Equipment : Water Bath
Manufacturer :
Model :
Serial No. :
ID No. :
Submitted by : United Analyte and Engineering Consultant Co.,Ltd.
2 Soi Udomsuk 41, Sukhumvit Road,
Bangkok, Phrakhanong,
Bangkok 10260
Location : Microbiology Laboratory
Received Date : 15 February 2023
Calibration Date : 15 February 2023
Ambient Temperature : (20 ± 4) °C
Relative Humidity : (60 ± 30) %
Calibrated by : Anon Aoja
Approved by :
Approved Signatory
[ ] Penetgrade Tomsakhol
[ ] Wanee Bulbroan
Issue Date : 16 February 2023

This Calibration are for a confidence probability of approximately 95 %

เอกสารไม่ควบคุม

Equipment : Water Bath
Condition As-Received : Used Item
Reference :
Procedure Used :-

Calibration were conducted using in-house calibration procedure CP-07104 according to direct measurement method with Data Acquisition which connected with Industrial Platinum Resistance Thermometer (IPRT).

The temperature scale used was based on ITS-90.

Condition of the result of calibration

1. Reference standard instrument:-

Instrument	Model	Serial No.	Cert. No.	Due Date
*) Data Acquisition	34970A	MY50030417	22L0160	08 Nov 2023

2. This certificate is valid only on 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 Stores

	Environment (°C)	(%R.H.)	AC Voltage Supply (Volt)
Beginning of Calibration	23	68	231
Finished of Calibration	23	67	231

Position	Ref. Std. ID No.
1	
2	
3	
4	
5 (Mid.)	

Stored

เอกสารไม่ควบคุม

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

Calibration point (°C)	UUC* Setting (°C)	UUC* Reading (°C)	Average* Deviation Reading (°C)				
			Position				
			1	2	3	4	5 (ctr)
44.0	44.0	44.0	44.033	44.037	44.033	44.077	44.037

Calibration point (°C)	Uniformity (°C)	Stability (± °C)	Uncertainty (± °C)	Coverage Factor k
44.0	0.078	0.030	0.10	2

Average* : The average of 30 values in each position.
Uniformity : The maximum difference of measured temperatures at any sensors and the measured temperature at the reference location, which are observed at the same time or at as close an observation time as possible to determine the temperature pattern or homogeneity within the chamber under steady-state conditions.
Stability : One-half of the greatest maximum difference of measured temperatures at any one probe.
UUC* : Unit Under Calibration
Note : The reported uncertainty of measurement was stated as standard uncertainty multiplied by a coverage factor k, providing a level of confidence of approximately 95 %.

-ends-

เอกสารไม่ควบคุม

Doc No.: QP-CTM-F-01
Rev. No.: 00
Effective Date: 01 Jan 2021

Doc No.: [illegible]
Page : 1 of 2

Certificate of Calibration

Equipment : Water Bath
Manufacturer : Memmert
Model : WNE 14
Serial No. : [illegible]
ID No. : [illegible]
Submitted by : United Analyst and Engineering Consultant Co. Ltd.
2 Soi Udomsuk 41, Sukhumvit Road,
Bangchak, Phrakhanong,
Bangkok 10260
Location : Microbiology Laboratory
Received Date : 13 February 2023
Calibration Date : 13 February 2023
Ambient Temperature : [illegible]
Relative Humidity : [illegible]
Calibrated by : Suwit Inap
Approved by : Vut
Approver Signatory
( ) Printhipara Tamsaiku
( ) Wanee Sutthong
Issue Date : 20 February 2023

This Calibration is for a confidence probability of approximately 95%.
The uncertainty of the measurement has been calculated in accordance with the EA-4/02 document and is documented in the calibration report.
Reference Standard Traceable to National / International Standards of Measurement.

เอกสารไม่ควบคุม

Equipment : Water Bath
Condition As Received : Used Item
Reference :
Procedure Used :
Calibration were conducted using a Fluke calibrator processor CP-07UK according to client measurement method with Data Acquisition which connected with Industrial Platinum Resistance Thermometer (PRT).
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	2638A	9970/810671	22-0619	30 Nov 2023

2. This certificate is valid only in the item calibrated for date and levels 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	%R.H.	Volt
Beginning of Calibration	23	61	231
Finished of Calibration	23	61	230

Position	Ref. Std. ID No.
1	[illegible]
2	[illegible]
3	[illegible]
4	[illegible]
5(ctr)	[illegible]

Front

เอกสารไม่ควบคุม

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

Calibration point (°C)	UUC* Setting (°C)	UUC* Reading (°C)	Average* Deviation Reading (°C)				
			Position				
			1	2	3	4	5 (ctr)
44.0	44.0	44.0	44.033	44.030	44.030	44.030	44.033

Calibration point (°C)	Uniformity (°C)	Stability (± °C)	Uncertainty (± °C)	Coverage Factor k
44.0	0.067	0.057	0.10	2

Average* : The average of 30 values in each position.
Uniformity : The maximum difference of measured temperatures at any sensors and the measured temperature at the reference location, which are observed at the same time or at as close an observation time as possible to determine the temperature pattern or homogeneity within the chamber under steady-state conditions.
Stability : One-half of the greatest maximum difference of measured temperatures at any one probe.
UUC* : Unit Under Calibration
Note : The reported uncertainty of measurement was stated as standard uncertainty multiplied by a coverage factor k, providing a level of confidence of approximately 95 %.

-ends-

เอกสารไม่ควบคุม

DKSH

Certificate of Calibration

Equipment:	Balance	Certificate No.:	[illegible]
Model:	[illegible]	Issued Date:	09 December 2022
Serial No. (or ID.):	[illegible]	Job No.:	[illegible]
Manufacturer:	[illegible]	Page:	1 of 3
Condition:	New		

Customer: [illegible]

Environmental Condition: Temperature [illegible] °C ± 0.5 °C
Humidity [illegible] %RH ± 2.0 %RH

Calibration Place: [illegible]

Calibration By: Mr. Adisak Makron

Calibration Date: 09 December 2022

The Method used: In-house method, CAL-WI-47, based on OIML Lab 14

Traceability: This certificate is traceable to the SI Units maintained by National Institute of Metrology [NIMT], Thailand through DKSH Technology Co., Ltd. Certificate No. [illegible]

(Mr. Adisak Makron)
Person in charge

(Mr. Rungroj Jaroltraikulchai)
Authorized signatory

[illegible]

เอกสารไม่ควบคุม

[illegible]

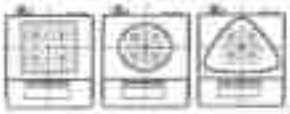
DKSH

Certificate No.: [illegible] Page: 2 of 3

Calibration Results

Without Adjustment

Repeatedly Bend, Weight is Set 1/3 or 1/2 of Maximum capacity, taken from the center of the pan as a zero reference.



Nominal Test Value	[illegible]	[illegible]
Reference Points [g]		
A	B	C	D	E
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

Repeatability: Determination of the standard deviation of weighing instrument. Repeatability [illegible] [illegible]

Nominal test value (g)	Standard Deviation
[illegible]	[illegible]
[illegible]	[illegible]

Error of indication from nominal or conventional mass value., Readability [illegible] [illegible]

Nominal Value [illegible]	Conventional Mass [illegible]	Displayed Value [illegible]	Error of Indication [illegible]	Uncertainty [illegible]	k
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

The End of Certificate

[illegible]

เอกสารไม่ควบคุม

[illegible]

DKSH

Refer to Certificate No.: [illegible] Page: 1 of 3

Statements of conformity:

This statement certifies the conformity of the following statements of conformity based on the measurement results of corresponding calibration certificate.

The error of indication determined during calibration and under given measurement and environmental conditions and considering the expanded measurement uncertainty (coverage probability 95%) within the specification. The given measurement uncertainty is stated, without other calculations by according to the standard method, OIML Lab14. Therefore, those parameters have not been considered traceability.

Tolerance and Decision rules:

Assessment of the conformity of the measurement device was done based on direct comparison of the relevant measurement results with the tolerances and standard rule are prescribed by the customer.

Decision rule : ☐ Choice A Binary Statement in Simple Acceptance Rule (w = 0, Specific Risk = 50% PFA)

☐ Choice B Non-binary statement with guard band (w = 1 U), Fixed or Full Specific Risk = 2.5% PFA and Conditional Pass or Conditional Fail Specific Risk = 50% PFA.

☐ Choice C Customer defines Customer may define statutory multiple of U to have applied for guard band (w = k x U)

(PFA = Probability of False Acceptance)

(Mr. Rungroj Jaroltraikulchai)
Authorized signatory

[illegible]

เอกสารไม่ควบคุม

[illegible]

DKSH

Refer to Certificate No.: [illegible] Page: 2 of 3

Statements of conformity:

Without Adjustment

Readability: [illegible] g

Nominal Value g	Error of Indication g	Guard band (w) g	Tolerance (U) g	Conformity
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

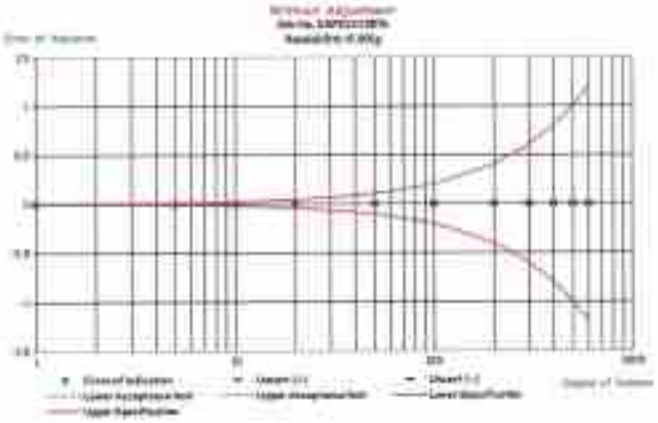
The validity of the statements of conformity cannot be guaranteed for different places of use, environmental conditions or intervals and

The End of Statements of conformity

[illegible]

เอกสารไม่ควบคุม

[illegible]



DKSH

Certificate of Calibration

Equipment:	Autoclave	Certificate No. :	C1120318
Model:	GL-40L	Issued Date:	11 June 2020
Serial No. (or ID.) :	810010	Job No.:	KSP0230070
Manufacturer:	ALP	Page:	1 of 4
Condition:	In Condition		

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

Environment Condition:

Temperature:	22 °C	±	0.8 °C
Humidity:	58 %RH	±	4.0 %RH
Voltage:	229 VAC	±	1.5 VAC

Calibration Place: United Analyst and Engineering Consultant Company Limited. (301 Room)
3 Soi Udomsuk 41 Sukhumvit Road,
Bangkok, Prakanong, Bangkok 10260 Thailand.

Calibrator By: Mr. Arkomthep Phumpho

Calibration Date: 08 June 2020

The Method used: In house method, CAL-W-18, based on BS 3646 : Part 3

Traceability: This certificate is traceable to the SI Units maintained by National Institute of Metrology (NIMT), Thailand through Quality reform Co., Ltd.
Certificate no.QR23-2008

(Mr. Arkomthep Phumpho)
Person in charge

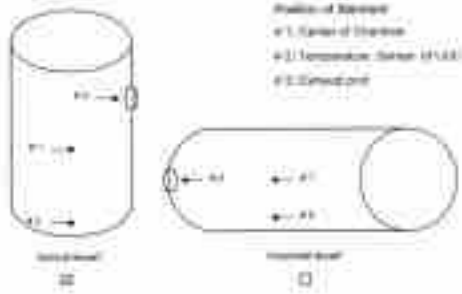
(Mr. Utain Sinthanid)
Authorized signatory

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

UNITED Analyst and Engineering Consultant Co., Ltd.
DKSH Technology Limited
3 Soi Udomsuk 41 Sukhumvit Road, Prakanong, Bangkok 10260
Phone: +66 2026 7000 Email: info.uecthailand@dksh.com Website: www.dksh.com/uecthailand

เอกสารไม่ควบคุม
Uncontrolled Document

Position of Standard
- P1 Center of Chamber
- P2 Temperature Sensor (TI-01)
- P3 Exhaust port



Standard Installation Locations:

Standard Location (P1): Geometric center of the chamber

Standard Location (P2): Distance from temperature sensor of (TI-01) 2 (cm.)

Standard Location (P3): Distance from the wall 5 (cm.)

Position of Mid	P1	P2	P3
Channel of Logger	4	5	6

Definitions:

Indicating Temperature: The average reading of indicating sensor which forms the integral part of the autoclave.

Measured Temperature: The average reading of standards at any positions or location.

Measured Stability: The one-half of greatest maximum difference of measurement temperatures at any one points.

UNITED Analyst and Engineering Consultant Co., Ltd.
DKSH Technology Limited
3 Soi Udomsuk 41 Sukhumvit Road, Prakanong, Bangkok 10260
Phone: +66 2026 7000 Email: info.uecthailand@dksh.com Website: www.dksh.com/uecthailand
Delivering Growth – In Asia and Beyond

Uncontrolled Document

Calibration Results:

Without adjustment

Measurement Temperature at Spread Locations, Indicating of Unit Under Calibration: 114.0 °C

Locations	Measured Temperature (°C)	Correction of UUC. (°C)	Uncertainty (± °C)
#1	113.34	0.34	0.59
#2	113.40	0.40	0.59
#3	113.45	0.45	0.59

Temperature Distribution:

Temperature			Pressure	Measured Temperature at Spread Locations			Uncertainty
Desired	Setting	Indicating	Indicating	#1	#2	#3	
(°C)	(°C)	(°C)	Mpa	(°C)	(°C)	(°C)	(± °C)*
115	115	115.0	0.08	115.34	115.40	115.45	0.59

Chamber Characteristics:

Indicating Temperature	Indicating Pressure	Measured Stability
(°C)	Mpa	(± °C)
115.0	0.08	0.15

Note: * Maximum uncertainty of the each position

Record every 10 seconds after reaching steady state or after one achieved complete cycle.

UNITED Analyst and Engineering Consultant Co., Ltd.
DKSH Technology Limited
3 Soi Udomsuk 41 Sukhumvit Road, Prakanong, Bangkok 10260
Phone: +66 2026 7000 Email: info.uecthailand@dksh.com Website: www.dksh.com/uecthailand
Delivering Growth – In Asia and Beyond

Uncontrolled Document

DKSH

Certificate No. 01100199 Page 4 of 4

Without adjustment

Measurement Temperature at Spread Locations, Indicating at Uniformity Calibration 121.0 °C

Locations	Measured Temperature (°C)	Deviation of MAC (°C)	Uncertainty (± °C)
#1	121.34	0.34	0.09
#2	121.40	0.40	0.09
#3	121.26	0.26	0.09

Temperature Distribution

Temperature			Pressure	Measured Temperature at Spread Locations			Uncertainty
Desired (°C)	Setting (°C)	Indicating (°C)	Indicating Mpa	#1 (°C)	#2 (°C)	#3 (°C)	(± °C)*
121	121	121.2	0.12	121.34	121.40	121.26	0.09

Chamber Characteristics

Indicating Temperature (°C)	Indicating Pressure Mpa	Measured Stability (± °C)
121.2	0.12	0.07

Note: * Maximum uncertainty of the each position

Record every 10 seconds after reaching stability state or after one sterilization complete cycle.

The End of Certificate

Uncontrolled Document

เอกสารไม่ควบคุม

Request No. 25-65 / 0268 NITC ACL No. 888 / 65

CALIBRATION CERTIFICATE

NOMENCLATURE : A Volume Measuring Type Graduated Cylinder "Highland Technologies"

SUBMITTED BY : Grand Analytic and Engineering Consultant Co., Ltd.

CALIBRATION PROCEDURE : A Performance Verification of Volume Measuring Type Graduated Cylinder

REFERENCE MATERIAL : "Traceable to NIST "Highland Technologies", "Class A/Ser".

CALIBRATION RANGE : 5.0000 ml to 25.0000 ml

AMBIENT CONDITIONS : Temperature 22 °C ; Relative Humidity 60 %

The volume measuring cylinder was 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 : (Mr. Somjai Sirimongkhon)

Approved by : (Mrs. Thanyaporn Kongsuwan)
Director of Analytical Chemistry Laboratory
Ref. 2565000000000000
Calibration Date : 3 February 2022

Head Office: 1 Sukhumvit Rd., Klong Toey, Bangkok 10110, Thailand. Tel. +66 2 667 0000. Fax. +66 2 667 0001. Email: info@grandanalytic.co.th

Branch Office: 88 Moo 5, Bangna-Trad Km. 23, Bangsaothong, Samutprakan 10540, Thailand. Tel. +66 2 312 3000. Fax. +66 2 312 3001.

Office: 99 Moo 9, Chaengwattana Rd., Pakkret, Nonthaburi 11120, Thailand. Tel. +66 2 583 9999. Fax. +66 2 583 9998.

เอกสารไม่ควบคุม

Request No. 25-67 / 0268 1 / 3 NITC ACL No. 890 / 65

CALIBRATION DATA

1. Value Level, in term of standard deviation

Standard	X1	X2	X3	X4	X5	X6	X7	X8
Repeatability								
Standard Deviation								
Tolerance Coefficient								

Continue 2 / 3

INDUSTRIAL METROLOGY AND TESTING SERVICE CENTER

เอกสารไม่ควบคุม

Request No. 25-65 / 0268 2 / 3 NITC ACL No. 464 / 65

2. Precision

Parameter	Conc. (mg/l)	Absorbance										Std. Dev. (Sx)	CV	Result
Cd	0.10	0.0016	0.0021	0.0019	0.0022	0.0018	0.0020	0.0017	0.0021	0.0019	0.0020	0.0002	0.14	
	0.20	0.0041	0.0045	0.0043	0.0047	0.0044	0.0046	0.0043	0.0045	0.0044	0.0045	0.0002	0.05	
	0.30	0.0063	0.0068	0.0065	0.0069	0.0066	0.0067	0.0064	0.0068	0.0065	0.0066	0.0002	0.03	
Cr	0.10	0.0046	0.0051	0.0048	0.0052	0.0049	0.0050	0.0047	0.0051	0.0048	0.0049	0.0002	0.04	
	0.20	0.0091	0.0096	0.0093	0.0097	0.0094	0.0095	0.0092	0.0096	0.0093	0.0094	0.0002	0.02	
	0.30	0.0136	0.0141	0.0138	0.0142	0.0139	0.0140	0.0137	0.0141	0.0138	0.0139	0.0002	0.01	
Cu	0.10	0.0031	0.0036	0.0033	0.0037	0.0034	0.0035	0.0032	0.0036	0.0033	0.0034	0.0002	0.06	
	0.20	0.0061	0.0066	0.0063	0.0067	0.0064	0.0065	0.0062	0.0066	0.0063	0.0064	0.0002	0.03	
	0.30	0.0091	0.0096	0.0093	0.0097	0.0094	0.0095	0.0092	0.0096	0.0093	0.0094	0.0002	0.02	
Pb	0.10	0.0011	0.0016	0.0013	0.0017	0.0014	0.0015	0.0012	0.0016	0.0013	0.0014	0.0002	0.14	
	0.20	0.0021	0.0026	0.0023	0.0027	0.0024	0.0025	0.0022	0.0026	0.0023	0.0024	0.0002	0.08	
	0.30	0.0031	0.0036	0.0033	0.0037	0.0034	0.0035	0.0032	0.0036	0.0033	0.0034	0.0002	0.06	
Mn	0.10	0.0026	0.0031	0.0028	0.0032	0.0029	0.0030	0.0027	0.0031	0.0028	0.0029	0.0002	0.07	
	0.20	0.0051	0.0056	0.0053	0.0057	0.0054	0.0055	0.0052	0.0056	0.0053	0.0054	0.0002	0.04	
	0.30	0.0076	0.0081	0.0078	0.0082	0.0079	0.0080	0.0077	0.0081	0.0078	0.0079	0.0002	0.03	
Ni	0.10	0.0021	0.0026	0.0023	0.0027	0.0024	0.0025	0.0022	0.0026	0.0023	0.0024	0.0002	0.08	
	0.20	0.0041	0.0046	0.0043	0.0047	0.0044	0.0045	0.0042	0.0046	0.0043	0.0044	0.0002	0.04	
	0.30	0.0061	0.0066	0.0063	0.0067	0.0064	0.0065	0.0062	0.0066	0.0063	0.0064	0.0002	0.03	
Zn	0.10	0.0006	0.0011	0.0008	0.0012	0.0009	0.0010	0.0007	0.0011	0.0008	0.0009	0.0002	0.22	
	0.20	0.0011	0.0016	0.0013	0.0017	0.0014	0.0015	0.0012	0.0016	0.0013	0.0014	0.0002	0.14	
	0.30	0.0016	0.0021	0.0018	0.0022	0.0019	0.0020	0.0017	0.0021	0.0018	0.0019	0.0002	0.10	

Continue 3 / 5

INDUSTRIAL METROLOGY AND TESTING SERVICE CENTER

เอกสารไม่ควบคุม

เอกสารไม่ควบคุม

เอกสารไม่ควบคุม

เอกสารไม่ควบคุม

Agilent Technologies

Agilent 5110 and 5100 ICP-OES
Preventive Maintenance Checklist

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

For more information about Agilent Technologies services please visit our web site using the following URL: http://www.agilent.com/chem/service-and-maintenance-services

Customer Information

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

Service Engineer's Responsibilities

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

Copyright © 2017
Agilent Technologies

System Information

Instrument system name and ID	[illegible]
Instrument system site and location	[illegible]

Use mouse computer system numbers	Use the serial numbers of the components
1. [illegible]	1. [illegible]
2. [illegible]	2. [illegible]
3	3
4	4
5	5
6	6
7	7
8	8
9	9
10	10

5110/5100 Configuration value	Circle the type or write in the type if other
Nebulizer Type	Sturgeon (Inert) other
Spray Chamber	Cyclonic Single Pass (Cyclonic Double Pass) other
Torch	Radial (Axial 1500) other
Injector Diameter	1.8mm (2.4mm) 3.0mm (4.0mm) other
Injector Material	Quartz (Ceramic) other

เอกสารไม่ควบคุม

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, screws etc.
- ☐ Check for required firmware/software updates and verify with customer if they would like it installed.
- ☑ For HF application systems, if standard sample introduction system was not installed, ask the customer to install it.
- ☑ Run Instrument Performance test and record results in Instrument Performance Test Results Table. Print PIC.

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 (severe) inspection of the system for excessive dust accumulation, clean if necessary.
- ☑ Inspect sample introduction components and record any required maintenance in the Instrument Diagnostic Comments and verify the customer as the required actions required.
- ☐ Record the instruments operating conditions in the ICP-OES Status Results Table.
- ☑ Replace the polychromator purge filter.
- ☑ Replace the radial pre optics window.
- ☑ Replace the axial pre optics window for 5110VDV and 5100 instruments.
- ☑ Check exhaust flow for the correct positive extraction at the exhaust duct to ensure they were maintain specifications.
- ☑ Replace air inlet dust filter.
- ☑ Replace high capacity air inlet dust filter element if installed. N/A
- ☑ Remove and clean instrument water inlet filter.

GH491A Cooling water system

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

เอกสารไม่ควบคุม

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 tube and the Agilent software move the sample probe to the 6 calibration cleaner and verify visually that the probe is approximately centered in the slot.

SPS 4 Auto Sampler

- ☑ Section NOT Applicable
- ☑ Clean the spill tray, rack location slot, and frames and cleaner 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 for 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 PTFE bushes for cracks, excessive permanent, damaged edges or damaged connectors.
- ☑ Pump Tubing Replacement. Perform peristaltic pump tubing. Replace all tubing that goes from the rinse station to the pump and from the pump to the nebulizer/mixer/waste.

AVS 4, 6, 7

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

Instrument Adjustments

- ☑ Check position of Dz peak, adjust if required.
- ☑ Check Argon Stabs, adjust to specified value if required.
- ☑ Perform Intensity Calibration.
- ☑ Perform Instrument Calibration.
- ☑ Run Instrument Performance Test and record results in Instrument Performance Test Results Table. Print PIC.
- ☑ For systems using ICP Expert version 7.3 and above run the following Instrument tests and record the result in the Instrument Test Results Table.
  - ☑ Subsystem Communications Test
  - ☑ Air Flow

เอกสารไม่ควบคุม

- ☑ Water Flow
- ☑ Gas Flows
- ☑ RF Generator
- ☑ Camera Test
- ☑ Optics Test
- ☑ Peristaltic Test

Instrument Performance Test Results Table

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

	Dz (Pd Sensitivity Check		Fwd Pd Sensitivity Check	
	Radial	Axial*	Radial	Axial*
Ar 211.595 nm 10000	[illegible]	[illegible]	[illegible]	[illegible]
Mn 257.610 nm 10000	[illegible]	[illegible]	[illegible]	[illegible]
Ar 696.543 nm 4000	[illegible]	[illegible]	[illegible]	[illegible]
Ar 706.567 nm 4000	[illegible]	[illegible]	[illegible]	[illegible]

* Axial result is not applicable for 5100 SVDV, 5100 DVDV Radial View instruments.

Instrument Test Results Table

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

Instrument Test	Result
Subsystem Communications Test	[illegible]
Air Flow	[illegible]
Water Flow	[illegible]
Gas Flows	[illegible]
RF Generator	[illegible]
Camera Test	[illegible]
Optics Test	[illegible]
Subsystem test	[illegible]

เอกสารไม่ควบคุม

ICP-OES Status Results Table

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

Measurement	Nominal Value		Factory Set	
Mains Voltage	[illegible]	Vac	[illegible]	Vac
Mains Current	[illegible]	A	[illegible]	A
Instrument Temperature	[illegible]	°C	[illegible]	°C
RF Air Flow (sweep speed)	[illegible]	l/s	[illegible]	l/s
Plasma Exhaust Temperature	No measurement		[illegible]	°C
Water Flow Switches	No measurement		[illegible]	L/min
Water Flow Detector	[illegible]	L/min	[illegible]	L/min
Water Inlet Temperature	[illegible]	°C	[illegible]	°C
Polychromator Temperature	[illegible]	°C	[illegible]	°C
CCD Temperature	[illegible]	°C	[illegible]	°C
Thermal Enclosure	[illegible]	°C	[illegible]	°C
Power Supply Firmware	[illegible]	mVa	[illegible]	mVa
Purge Gas Supply Pressure*	[illegible]	mPa	[illegible]	mPa
Optical Gas Supply Pressure*	[illegible]	mPa	[illegible]	mPa
Nebulizer Flow	No measurement		[illegible]	L/min
Nebulizer Back Pressure	No measurement		[illegible]	mPa
Plasma Gas Flow	No measurement		[illegible]	L/min
Auxiliary Gas Flow	No measurement		[illegible]	L/min
RF Power	No measurement		[illegible]	W
RF Reflect Current	No measurement		[illegible]	A
RF Anode Voltage	No measurement		[illegible]	V

*If option installed

เอกสารไม่ควบคุม

Agilent Technologies

Agilent 5110 and 5100 ICP-OES
Preventive Maintenance Checklist

ICP-OES Parts List Table

Part Description	Part Number	Product Model # where used	Quantity Consumed
Solid Pre-Spec Window	[illegible]	[illegible]	[illegible]
Radial Pre-Spec Window	[illegible]	All	[illegible]
Polymer Cooling Fluid	[illegible]	[illegible]	
Purge Gas Filter	[illegible]	All	[illegible]
Air Inlet Filter	[illegible]	All	[illegible]
Slit Cassette Air Filter	[illegible]	[illegible]	
Robot end for 8 Vial carousel, product T	[illegible]	[illegible]	
Robot end for 4 port vitra for ICPMS	[illegible]	[illegible]	
Spare insertion tube assembly 1.0mm ID x 3m	[illegible]	[illegible]	
Torch injector 2.0mm I.Dmm ID	[illegible]	[illegible]	
PTFE waste tubing/Wire ref x 5mm id 3m	[illegible]	[illegible]	
Additional Parts may be required from engineer visit			
X-axis drive belt	[illegible]	[illegible]	
Z-axis drive belt	[illegible]	[illegible]	
Peristaltic pump tubing, PVC Orange/Blue, 3 Stopper	[illegible]	[illegible]	

Reviewer session

For IQ applications, ask the customer to complete their sample introduction system.

Leave system in an idle state, as used normally.

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

Service Review

- ☐ ASUs (or ITA status) in the system or instrument logbook based on the customer's request.
- ☐ Complete the Service Engineer Comments section below if there are additional comments.

เอกสารไม่ควบคุม

Agilent Technologies

Agilent 5110 and 5100 ICP-OES
Preventive Maintenance Checklist

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

Service Engineer Comments (optional)

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

Other Important Customer Web Links

Tips to get information on your product:

- ☐ Customer Library - [illegible]
- ☐ Need to know more? - [illegible]
- ☐ Need technical support, FAQs? - [illegible]
- ☐ Need supplies? - [illegible]

Service Completion

Service request number: [illegible] Date service completed: [illegible]

Agilent signature: [illegible] Customer signature: [illegible]

The manual part number: G8014-90070

เอกสารไม่ควบคุม

Report Summary

Instrument Model	Agilent 5100/5110 VDV ICP-OES
Instrument ID	CN01160907[illegible]
Instrument Serial Number	MY16[illegible]
Software Version	1.1.1.0457
Firmware Version	3642
Tested By	[illegible]
Test Completed On	11/3/2016 9:18:32 AM

Result Summary

Subsystem Communications Test	Skipped
Air Pump Test	Skipped
Water Flow Test	Skipped
Gas Flows Test	Skipped
RF Generator Test	Skipped
Camera Test	Skipped
Torque Test	Skipped
Advanced Valve System Test	Skipped
Repeatability Test	Pass
Sensitivity Test	Pass
Precision Test	Pass

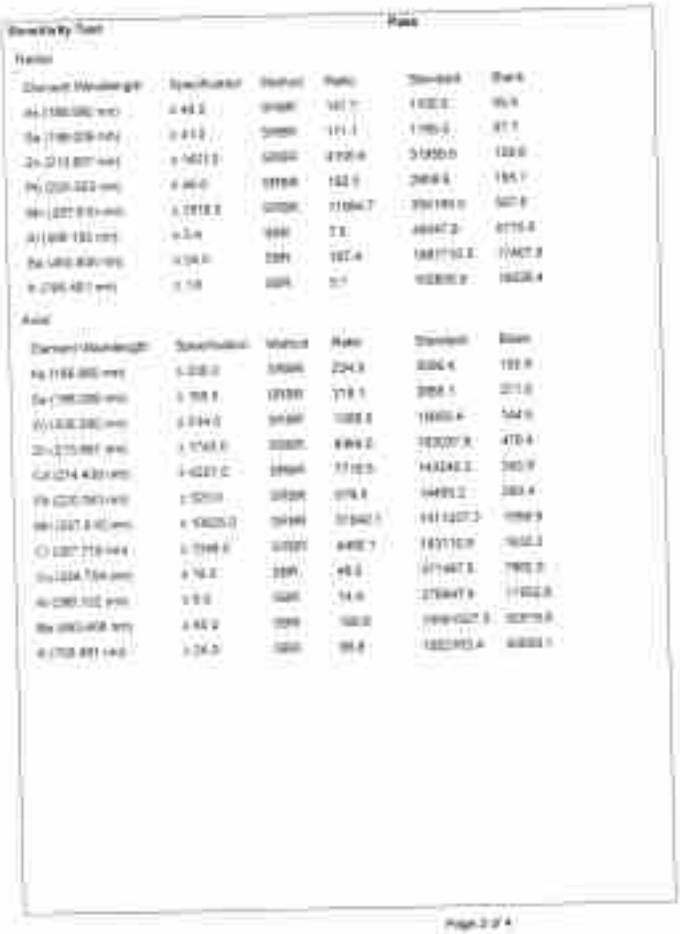
เอกสารไม่ควบคุม

Resolution Test — Pass

Element Wavelength	Specification	Width
N (174.272 nm)	≤ 8.40	8.02
Ho (180.282 nm)	≤ 8.20	6.20
Z (196.027 nm)	≤ 11.00	6.30
Mo (202.032 nm)	≤ 9.20	5.44
Cl (206.150 nm)	≤ 12.40	9.04
Zn (213.857 nm)	≤ 9.70	9.60
Pb (220.352 nm)	≤ 9.90	7.10
Cd (228.819 nm)	≤ 17.20	11.71
Ba (230.424 nm)	≤ 9.40	7.97
Mn (257.610 nm)	≤ 12.20	9.56
Mn (260.568 nm)	≤ 23.30	14.43
Cr (267.716 nm)	≤ 11.00	9.14
Cr (283.789 nm)	≤ 20.50	16.98
Cr (267.396 nm)	≤ 14.20	11.23
Sr (338.071 nm)	≤ 23.00	24.42
Ba (455.403 nm)	≤ 44.00	32.95
Sr (482.723 nm)	≤ 26.50	17.32
Ba (493.408 nm)	≤ 36.90	28.40
Ba (614.171 nm)	≤ 43.00	28.47
Ar (675.283 nm)	≤ 73.20	56.82
K (766.491 nm)	≤ 90.00	84.44

Page 2 of 4

เอกสารไม่ควบคุม



Sensitivity Test — Pass

Radial

Element Wavelength	Specification	Method	Ratio	Standard	Blank
As (188.980 nm)	≥ 48.0	Simple	141.7	1 630.0	95.9
Se (196.026 nm)	≥ 41.0	Simple	121.1	1 190.0	87.1
Zn (213.857 nm)	≥ 1621.0	Simple	4 791.6	5 595.0	133.0
Pb (220.353 nm)	≥ 46.0	Simple	182.0	2 958.5	155.1
Mn (257.610 nm)	≥ 1818.0	Simple	11 994.7	350 189.0	507.8
Al (308.193 nm)	≥ 3.4	Simple	7.5	48 647.2	6 715.4
Ba (455.403 nm)	≥ 134.0	Simple	167.4	1 881 712.5	11 467.3
K (766.491 nm)	≥ 1.0	Simple	5.1	10 830.9	16 228.4

Axial

Element Wavelength	Specification	Method	Ratio	Standard	Blank
As (188.980 nm)	≥ 238.0	Simple	234.9	8 284.4	191.9
Se (196.026 nm)	≥ 168.0	Simple	119.1	3 958.1	211.0
Al (308.193 nm)	≥ 2 844.0	Simple	1 988.8	19 850.4	544.9
Zn (213.857 nm)	≥ 5 743.0	Simple	4 864.2	183 207.8	470.4
Cd (214.439 nm)	≥ 4 231.0	Simple	3 110.5	143 242.3	342.9
Pb (220.353 nm)	≥ 520.0	Simple	378.8	14 481.2	283.4
Mn (257.610 nm)	≥ 10 625.0	Simple	10 642.1	1 141 427.3	1 068.9
Cr (267.716 nm)	≥ 7 048.0	Simple	6 402.7	1 831 103.9	1 032.3
Cu (324.754 nm)	≥ 16.0	Simple	46.0	671 447.5	785.3
Ni (380.102 nm)	≥ 9.0	Simple	14.4	276 647.9	1 152.8
Ba (493.408 nm)	≥ 45.0	Simple	100.0	1 909 027.3	1 270.8
K (766.491 nm)	≥ 24.0	Simple	66.8	1 822 953.4	4 893.1

Page 3 of 4

เอกสารไม่ควบคุม

Precision Test — Pass

Radial

Element Wavelength	Specification	Measured Value % RSD
As (188.980 nm)	≤ 2.84	2.92
Se (196.026 nm)	≤ 2.00	0.71
Zn (213.857 nm)	≤ 1.68	0.43
Pb (220.353 nm)	≤ 2.90	0.76
Mn (257.610 nm)	≤ 1.60	2.81
Al (308.193 nm)	≤ 1.90	0.68
Ba (455.403 nm)	≤ 1.66	0.89
K (766.491 nm)	≤ 1.50	2.42

Axial

Element Wavelength	Specification	Measured Value % RSD
As (188.980 nm)	≤ 1.53	0.97
Se (196.026 nm)	≤ 1.50	0.35
Al (308.193 nm)	≤ 1.50	0.87
Zn (213.857 nm)	≤ 1.50	0.61
Cd (214.439 nm)	≤ 1.50	0.39
Pb (220.353 nm)	≤ 1.55	0.93
Mn (257.610 nm)	≤ 1.60	0.54
Cr (267.716 nm)	≤ 1.60	0.68
Cu (324.754 nm)	≤ 1.50	0.69
Ni (380.102 nm)	≤ 1.50	0.91
Ba (493.408 nm)	≤ 1.50	0.40
K (766.491 nm)	≤ 1.60	1.22

Page 4 of 4

เอกสารไม่ควบคุม

Report Summary

Instrument Model	Agilent 5100 SVDV (G8010A)
Instrument ID	MY19123456
Instrument Serial Number	MY19123456
Software Version	1.0.1.4027
Firmware Version	3.04.2
Tested By	R&D Application Lab
Test Completed On	11/03/2020 11:43:36 AM

Result Summary

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

Subsystem Commissioning Test — Pass

Air Flow Test — Pass

20% Air Flow (residual applied)	25% Air Flow (residual applied)
19.93	24.91

Water Flow Test — Pass

RF Water Flow (L/min)	Camera Water Flow (L/min)	Water Inlet Temperature (°C)
1.49	1.50	18.51

Page 1 of 5

เอกสารไม่ควบคุม

Gas Flows Test — Pass

Nebulizer Target Flow	Nebulizer Actual Flow	Back Pressure	Auxiliary Target Flow	Auxiliary Actual Flow	Back Pressure
0.70	0.70	169.07	2.00	1.99	108.40

Makeup Target Flow	Makeup Actual Flow	Back Pressure	Plasma Target Flow	Plasma Actual Flow	Back Pressure
0.80	0.80	113.99	14.00	13.97	23.84

RF Generator Test — Pass

RF Power Supply Test	Passed
RF Power Supply (V)	147.697
RF Oscillator Test	Passed
RF Oscillator Frequency (MHz)	0.000
Work Coil Current (A)	42.809
RF Power Supply Current (A)	1.467

Camera Test — Pass

	Integration Time (ms)	Standard Deviation	Status
Electronic Offset Test	1000	5.906	Passed
Dark Current Test	6000	6.618	Passed
Noise Test	3	6.834	Passed
Linearity Test		6.110	Passed

เอกสารไม่ควบคุม

Report Summary

Instrument Model	Agilent [illegible] 5110VDV ICP-OES
Instrument ID	[illegible]
Instrument Serial Number	[illegible]
Software Version	[illegible]
Firmware Version	[illegible]
Tested By	[illegible]
Test Completed On	[illegible]

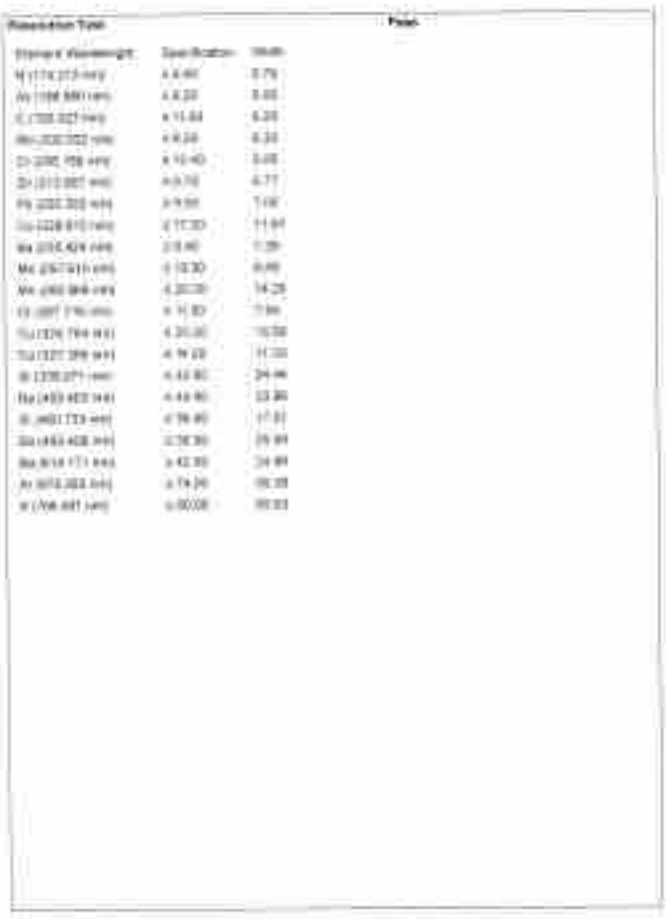
Result Summary

Subsystem Communication Test	Skipped
AJ Fan Test	Skipped
Water Flow Test	Skipped
Gas Flows Test	Skipped
RF Generator Test	Skipped
Camera Test	Skipped
Optics Test	Pass
Autosampler Valve System Test	Skipped
Resolution Test	Pass
Sensitivity Test	Pass
Precision Test	Pass

Optics Test — Pass

	Radial	Axial
Intensity	[illegible]	[illegible]
Wavelength	[illegible]	[illegible]

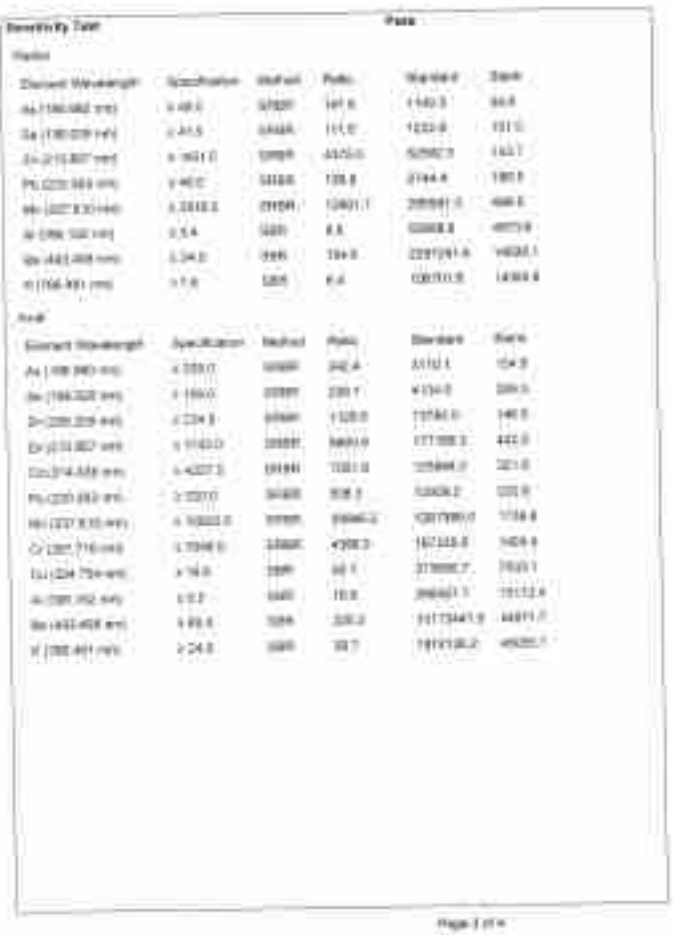
เอกสารไม่ควบคุม



Resolution Test — Pass

Element Wavelength	Specification	Width
[illegible]	[illegible]	[illegible]

เอกสารไม่ควบคุม



Sensitivity Test — Pass

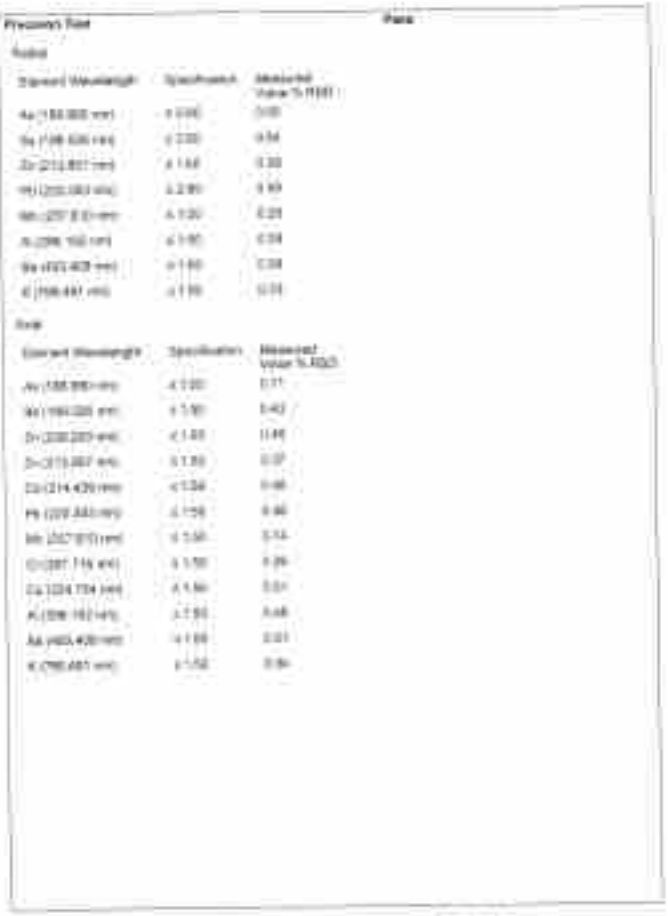
Radial

Element Wavelength	Specification	Method	Public	Standard	Blank
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

Axial

Element Wavelength	Specification	Method	Public	Standard	Blank
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

เอกสารไม่ควบคุม



Page 4 of 4

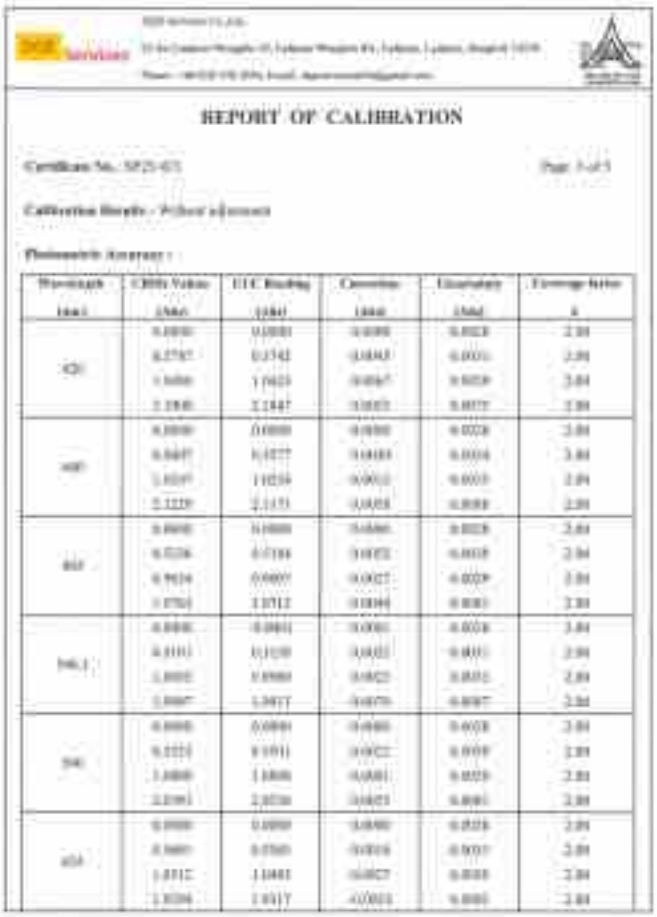
เอกสารไม่ควบคุม

CERTIFICATE OF CALIBRATION

Uncontrolled Document

REPORT OF CALIBRATION

Uncontrolled Document



REPORT OF CALIBRATION

Uncontrolled Document

REPORT OF CALIBRATION

Certificate No. [illegible] Page 1 of 3

Photometric Accuracy :

Wavelength (nm)	CRMs Value (Abs)	UUC Reading (Abs)	Correction (Abs)	Uncertainty (Abs)	Coverage Factor k
235	0.0000 0.1476	0.0000 0.1436	0.0000 0.0040	0.0000 0.0010	2.00 2.00
257	0.0000 0.4660	0.0000 0.4649	0.0000 0.0076	0.0000 0.0000	2.00 2.00
313	0.0000 0.2911	0.0000 0.2998	0.0000 0.0044	0.0000 0.0010	2.00 2.00
350	0.0000 0.6640	0.0000 0.6599	0.0000 0.0035	0.0000 0.0010	2.00 2.00

Uncontrolled Document

REPORT OF CALIBRATION

Certificate No. [illegible] Page 2 of 3

Wavelength Accuracy :

CRMs Value (nm)	UUC Reading (nm)	Correction (nm)	Uncertainty (nm)	Coverage Factor k
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

End of Certificate

Uncontrolled Document

CERTIFICATE OF CALIBRATION

Certificate No. : [illegible] Page 1 of 3

Customer : [illegible]

Address : [illegible]

Location of calibration : Laboratory 3 (3)

Equipment : UV-Vis Spectrophotometer

Manufacturer : Hitachi

Model : U-1900

Serial No. : 2021-004

ID No. : UAE-JOA-SOP-2233

Received Date : 6 January 2022

Calibration Date : 6 January 2022

Issue Date : 10 January 2022

Condition Instrument : Used

Calibrated by : [illegible] (Mr. Chaiwat Wiphatsri) Technical Manager

Approved by : [illegible] (Mrs. Chanthorn Tangsajjanon) Quality Manager

Uncontrolled Document

REPORT OF CALIBRATION

Certificate No. : [illegible] Page 2 of 3

Environment Condition : Ambient Temperature 23 ± 3 °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
Holmium Standard set	23760	90923	22 October 2023
Didymium Standard set	23757	90928	22 October 2023
Wavelength Standard set	23646	90916	22 October 2023
Wavelength Standard set	23758	90917	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 : 0.5 nm.

Scan Speed of UUC : 200 nm/min

Scan Interval of UUC : 0.1 nm

Resolution of UUC : Photometric 0.001 Abs.

Wavelength 0.1 nm

Uncontrolled Document

DGE Services

REPORT OF CALIBRATION

Certificate No. : [illegible] Page 1 of 3

Calibration Results : Within allowance

Photometric Accuracy :

Wavelength (nm.)	CRMs Value (Abs)	UUC Reading (Abs)	Correction (Abs)	Uncertainty (Abs)	Coverage factor k
120	0.0000 0.2747 1.0490 2.1906	0.000 0.279 1.044 2.181	0.0000 0.0027 0.0050 0.0096	0.0028 0.0031 0.0029 0.0080	2.00 2.00 2.00 2.00
440	0.0000 0.3007 1.0267 2.1229	0.000 0.319 1.021 2.113	0.0000 0.0017 0.0037 0.0079	0.0028 0.0034 0.0037 0.0041	2.00 2.00 2.00 2.00
465	0.0000 0.5726 0.9636 1.5791	0.000 0.575 0.961 1.568	0.0000 0.0026 0.0026 0.0091	0.0028 0.0030 0.0029 0.0039	2.00 2.00 2.00 2.00
546.1	0.0000 0.5101 1.0007 1.5997	0.000 0.516 1.006 1.601	0.0000 0.0041 0.0063 0.0107	0.0028 0.0035 0.0032 0.0064	2.00 2.00 2.00 2.00
586	0.0000 0.2322 1.0809 2.0394	0.000 0.232 1.082 2.021	0.0000 0.0002 0.0011 0.0081	0.0028 0.0030 0.0030 0.0080	2.00 2.00 2.00 2.00
635	0.0000 0.2001 1.0717 2.0556	0.000 0.202 1.072 2.073	0.0000 0.0014 0.0008 0.0064	0.0028 0.0032 0.0030 0.0079	2.00 2.00 2.00 2.00

Uncontrolled Document

DGE Services

REPORT OF CALIBRATION

Certificate No. : [illegible] Page 4 of 5

Photometric Accuracy :

Wavelength (nm.)	CRMs Value (Abs)	UUC Reading (Abs)	Correction (Abs)	Uncertainty (Abs)	Coverage factor k
235	0.0000 0.7478	0.000 0.743	0.0000 0.0048	0.0028 0.0027	2.00 2.00
257	0.0000 0.8998	0.000 0.901	0.0000 0.0018	0.0028 0.0029	2.00 2.00
313	0.0000 0.2912	0.000 0.291	0.0000 0.0002	0.0028 0.0031	2.00 2.00
334	0.0000 0.4448	0.000 0.439	0.0000 0.0058	0.0028 0.0035	2.00 2.00

Uncontrolled Document

DGE Services

REPORT OF CALIBRATION

Certificate No. : [illegible] Page 3 of 5

Wavelength Accuracy :

CRMs Value (nm.)	UUC Reading (nm.)	Correction (nm.)	Uncertainty (nm.)	Coverage factor k
[illegible]				

- End of Certificate -

Uncontrolled Document

DGE Services

CERTIFICATE OF CALIBRATION

Certificate No. : [illegible] Page 1 of 5

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

Address : 3 Soi Udomsuk 41, Sukhumvit Road, Bangchak, Phrakhanong, Bangkok 10260

Location of calibration : Laboratory 2/1

Equipment : UV-Vis Spectrophotometer

Manufacturer : Hitachi

Model : U-2900

Serial No. : 7-[illegible]

ID No. : 1) AE/WAT/001/064

Received Date : 6 January 2023

Calibration Date : 6 January 2023

Issue Date : 10 January 2023

Condition Instrument : Used

Calibrated by : [illegible] Approved by : [illegible]

(Mr. Pannee Wattana) (Mrs. Chonlada Yangjan)

Technical Manager Quality Manager

Uncontrolled Document

REPORT OF CALIBRATION

Certificate No. :

Page: 1 of 5

Environment Condition : Ambient Temperature 25 ± 3 °C

Relative humidity 55 ± 20 %RH

Calibration method : In house method (QP-01 Based on ASTM E275-08)

Certified Reference Materials :

Material	Serial No.	Certificate No.	Due date
Holmium Standard set	22769	89071	22 October 2021
Holmium Standard set	22727	89029	22 October 2021
Wavelength Standard (s)	22946	89216	22 October 2021
Wavelength Standard (s)	22758	89011	22 October 2021

Traceability: This certificate is traceable to the International System of Units maintained at National Institute of Standards and Technology (NIST) through Sciencific Limited

Spectral Band Width of UUC : 2.0 nm.

Scan Speed of UUC : 200 nm/min

Data Interval of UUC : 0.1 nm

Resolution of UUC : Photometric 0.001 Abs.

Wavelength 0.1 nm.

Uncontrolled Document

Uncontrolled Document

REPORT OF CALIBRATION

Certificate No. :

Page: 2 of 5

Photometric Accuracy :

Wavelength (nm)	CRMs Values (Abs)	UUC Reading (Abs)	Correction (Abs)	Uncertainty (Abs)	Coverage factor k
240	0.0000	0.000	0.0000	0.0020	2.00
	0.7470	0.744	0.0030	0.0037	2.00
257	0.0000	0.000	0.0000	0.0020	2.00
	0.8660	0.861	0.0055	0.0039	2.00
313	0.0000	0.000	0.0000	0.0020	2.00
	0.2912	0.290	0.0012	0.0031	2.00
350	0.0000	0.000	0.0000	0.0020	2.00
	0.4658	0.464	0.0018	0.0029	2.00

Uncontrolled Document

REPORT OF CALIBRATION

Certificate No. :

Page: 3 of 5

Wavelength Accuracy :

CRMs Values (nm)	UUC Reading (nm)	Correction (nm)	Uncertainty (nm)	Coverage factor k
241.15	241.0	0.2	0.18	2.00
279.44	279.8	-0.40	0.18	2.00
287.15	287.0	0.15	0.18	2.00
333.56	333.5	0.06	0.18	2.00
361.51	360.5	0.01	0.18	2.00
418.39	418.0	0.39	0.18	2.00
485.96	485.8	0.16	0.18	2.00
537.60	537.0	0.60	0.18	2.00
640.45	640.0	0.45	0.18	2.00
656.10	656.5	0.60	0.18	2.00
763.90	640.0	-0.42	0.18	2.00
841.45	840.0	0.76	0.18	2.00
885.99	885.8	0.46	0.18	2.00
913.47	913.0	0.47	0.18	2.00
930.90	930.5	0.58	0.18	2.00
932.17	932.5	0.31	0.18	2.00
961.31	960.0	0.31	0.20	2.00
966.80	966.0	0.80	0.18	2.00
749.72	749.5	0.22	0.20	2.00
750.37	750.5	0.87	0.18	2.00
887.92	887.5	0.42	0.18	2.00
890.28	890.5	-0.22	0.18	2.00

Remark : UUC = Unit Under Calibration

- End of Certificate -

Uncontrolled Document

HANNA instruments

Hanna Instruments (Thailand) Ltd.

CERTIFICATE OF CALIBRATION

Uncontrolled Document

HANNA instruments

Uncontrolled Document

nfi

Verification Certificate

Certificate No.:
Client name:
Address:

Equipment:
Manufacturer:
Model:
Serial No.:
ID No.:
Order No.:
Operation No.:
Date of Receipt:
Date of Calibration:

Calibrated by
Approved by
Date of Issue:

เอกสารไม่ควบคุม

nfi

Verification Report

Certificate No:
Equipment:
Date of Calibration:
Location:
Environment Condition:

เอกสารไม่ควบคุม

Verification Report

Certificate No.:
Equipment:
Model: 3530 Serial No.: 0179483
Resolution: 1 °C ID No.: LAB WHS 011/2559
Manufacturer: Kimo

Date of Calibration: 30 21 March 2022 Page 4 of 4
Calibration point: 100 °C
Calibration result:
Reporting of Temperature

Block No.	UUC* Reading (°C)	UUC* Reading (°C)	Stability (±°C)	Standard Temperature (°C)	Uncertainty (±°C)
1	100	100	0.00	100.24	1.1
2	100	100	0.00	100.24	1.1
3	100	100	1.38	100.82	1.1
4	100	100	0.44	100.19	1.1
5	100	100	0.01	100.30	1.1
6	100	100	0.18	100.80	1.1
7	100	100	1.17	101.84	1.1
8	100	100	0.00	100.00	1.1
9	100	100	0.16	100.20	1.1
10	100	100	0.86	100.56	1.1
11	100	100	1.04	100.24	1.1
12	100	100	0.00	100.00	1.1
13	100	100	0.00	100.00	1.1
14	100	100	0.00	100.00	1.1
15	100	100	0.00	100.00	1.1
16	100	100	0.00	100.00	1.1
17	100	100	0.00	100.00	1.1
18	100	100	0.00	100.00	1.1
19	100	100	0.00	100.00	1.1
20	100	100	0.01	100.00	1.1

Note:
UUC* = Unit Under Calibration
- Deviation equal of standard thermometer in tube level high of used to equal water point of UUC.
- Stability = One half of the greatest maximum difference of measured temperatures at one sensors, for at least half an hour after reaching steady state.

เอกสารไม่ควบคุม

Verification Report

Certificate No.:
Equipment:
Model: 3530 Serial No.: 0179483
Resolution: 1 °C ID No.: LAB WHS 011/2559
Manufacturer: Kimo

Date of Calibration: 30 21 March 2022 Page 4 of 4
Calibration point: 100 °C
Calibration result: Continuous

Figure 1 Location of Reference Standard and Work Diagram of Digester Unit

Note:
UUC* = Unit Under Calibration
- Deviation equal of standard thermometer in tube level high of used to equal water point of UUC.
- Stability = One half of the greatest maximum difference of measured temperatures at one sensors, for at least half an hour after reaching steady state.

This report consists of measurement was found to decrease consistently multiplied by coverage factor k, providing a level of confidence of approximately 95 %.

End

เอกสารไม่ควบคุม

FOSS

Customer Service Report

Report No: 7934

Work
Location
Date
Model
Serial
Hours
Travel
Labor
Travel and Expenses

Unit Type

Application	Item/ID	Operation	
Scanner	Cleaning Unit	Installation	Training
Monitoring	Wet Chemistry	Upgrade	Service
Instrument	Measuring	Repair	Other
Sample Conveyor	Sample Supply	Warranty	

Part Serial Number

Work Type | Problem Description | Technician No.

Activities Performed / Note	Completed / Status

Part No.	Article	Description	Qty.

Confirm the repair is successful and complete

Signature Service Technician		Signature Customer	
Name		Name	

Would you like to receive our newsletter by e-mail? If so, please write your e-mail address:

เอกสารไม่ควบคุม

© 2022 by Agilent Technologies

Agilent CrossLab Compliance Services

Certificate of System Qualification

OC-OQ

System ID:
Organization Name:
Organization Location:

Date:
EQP Name:
EQP Number:
Overall Qualification Status: Pass

System Inspection and Basic Safety and Operation

Name:
Subpoint Status: Pass

Overall System Inspection and Basic Safety and Operation Test Status
Pass

Inlet Pressure Decay

Name: Date:
Limit: 0.01

Subpoint Status: Pass
Pressure: 0.1 psi
Pressure Change: -0.1 psi % Pressure
Agilent Recommends: — 0.01 0.0 — 0.1

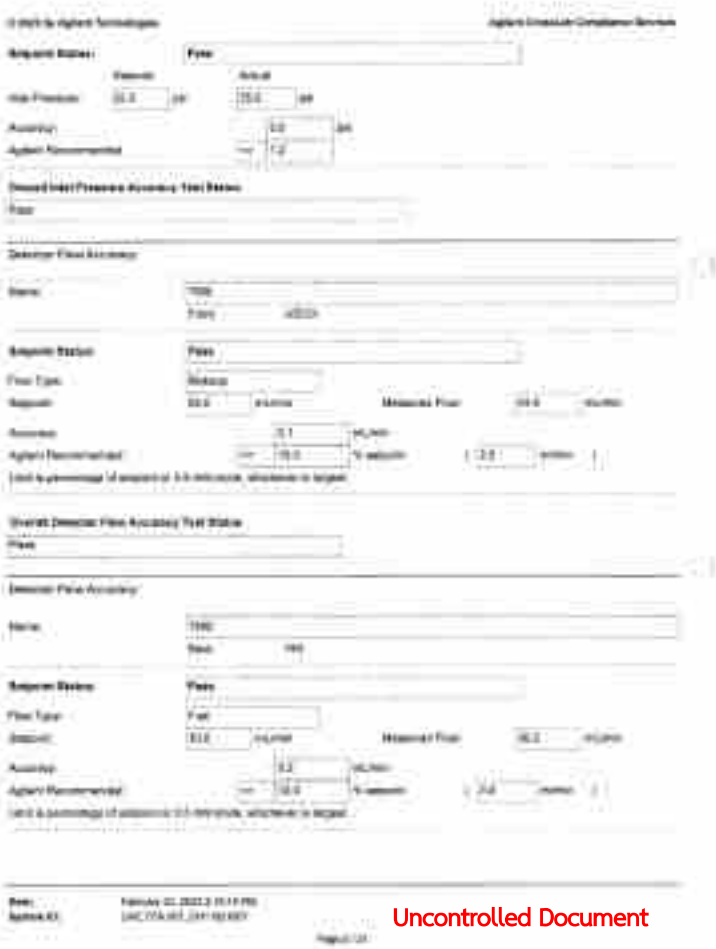
Overall Inlet Pressure Decay Test Status
Pass

Inlet Pressure Accuracy

Name: Date:
Limit: 0.01

Date:
System ID:

Uncontrolled Document



Uncontrolled Document

Uncontrolled Document

Uncontrolled Document

Uncontrolled Document

Uncontrolled Document

Uncontrolled Document

Instrument Details

Uncontrolled Document

Uncontrolled Document

© 2022 by Agilent Technologies

[redacted]

[redacted]	Agilent Technologies
[redacted]	7820
[redacted]	GC
[redacted]	Gas Mice
[redacted]	Electronic Pressure Control (EPC)
[redacted]	Back
[redacted]	Nitrogen

Uncontrolled Document

© 2022 by Agilent Technologies

Electronic Signature

Purpose

This signature page was created and published because the 2019 sign-off action was executed, which is valid for this version document including [redacted]. This UCM sign-off is an electronic signature that requires user-defined identification components, unique username and personal password. This Agilent exercise defines who has performed the exercise, understands the meaning and legal status of an electronic signature, for a trained official operator. The Agilent representative has a unique password and is given to access ACC 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 local access and control procedures.)

Details

Full Name of Signer:	[redacted]
Logged On User Name:	[redacted]
Signature Creation Date:	February 22, 2022
Reason for Signature:	Executed, product and published this original version of document.

Regulatory Disclaimer

This document provides as a service to verify and monitor instrument configuration and conditions of proper operation. It has been developed from an interpretation of applicable regulations as well as industry best practices. The instrument is designed to provide an important component of a complete compliance package. Validation demands open and a rational and use of this product shall be the service organization. Agilent Technologies makes no promises or representations as to its sufficiency for any specific regulatory program.

Warranty

Agilent Technologies makes no warranty of any kind on this material, including but not limited to, the implied warranties or merchantability and fitness for a particular purpose. Agilent Technologies shall not be liable for errors contained herein or for incidental or consequential damages in connection with the furnishing, performance, or use of this material.

Uncontrolled Document

© 2022 by Agilent Technologies

[redacted]

Time	Information Area	Activity Performed	Type of Transaction	Reason/Information
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]

Uncontrolled Document

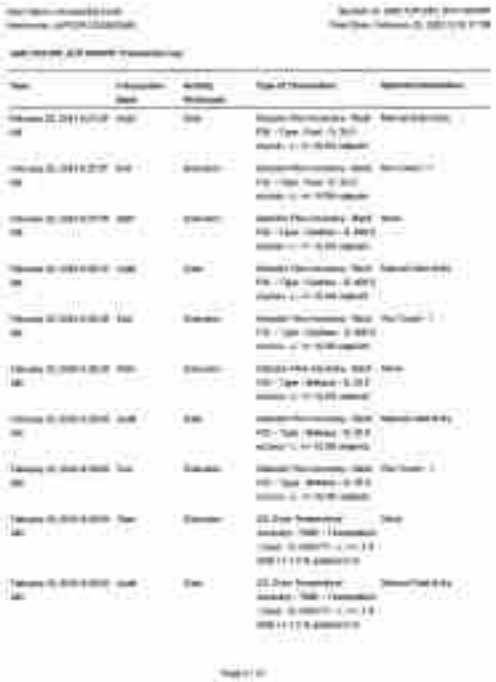
© 2022 by Agilent Technologies

[redacted]

Time	Transaction Type	Activity Performed	Type of Transaction	Reason/Information
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]

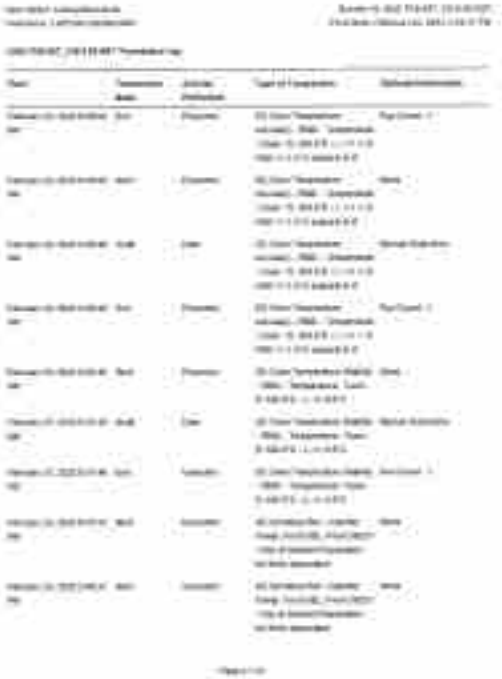
Uncontrolled Document

© 2022 by Agilent Technologies



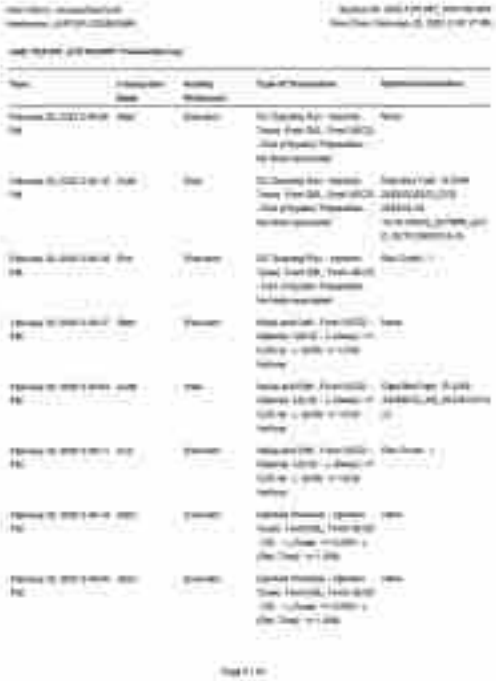
Uncontrolled Document

© 2022 by Agilent Technologies



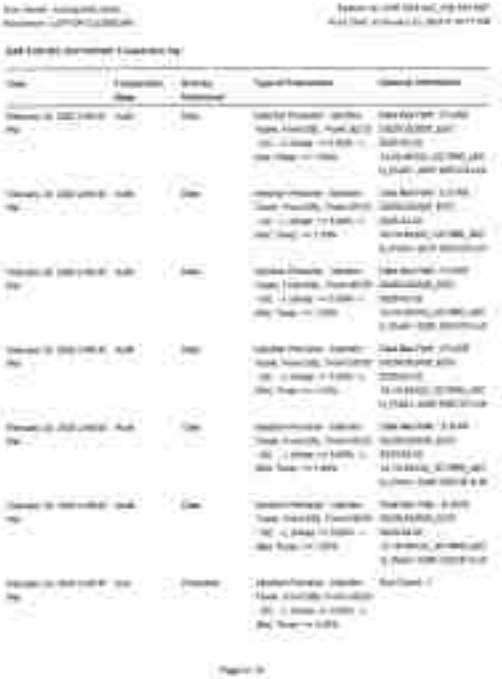
Uncontrolled Document

© 2022 by Agilent Technologies



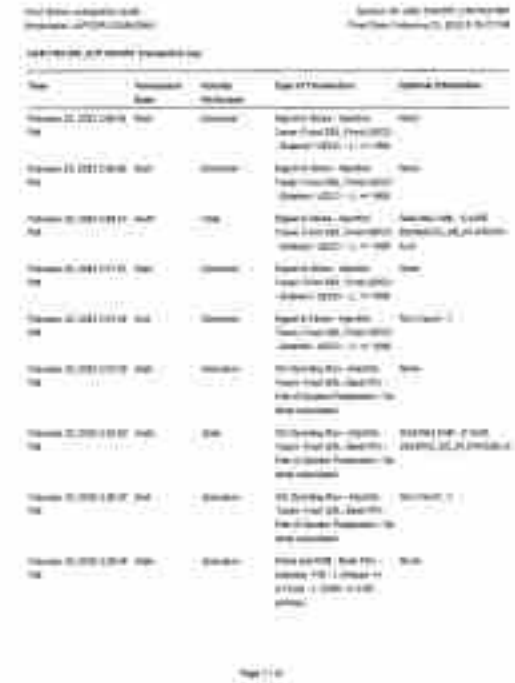
Uncontrolled Document

© 2022 by Agilent Technologies



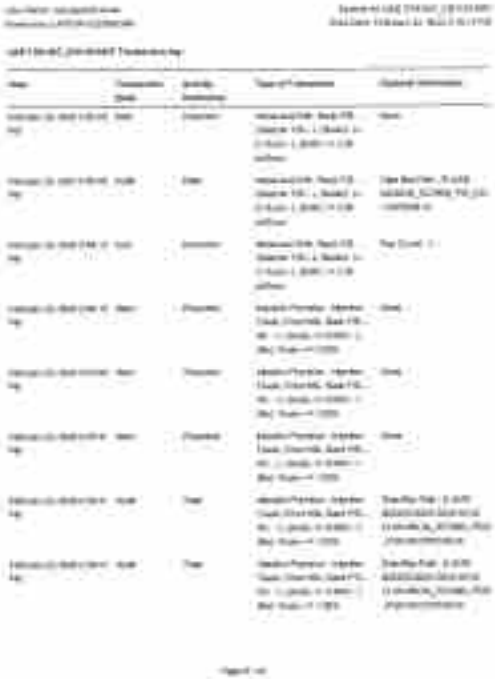
Uncontrolled Document

© 2022 by Agilent Technologies



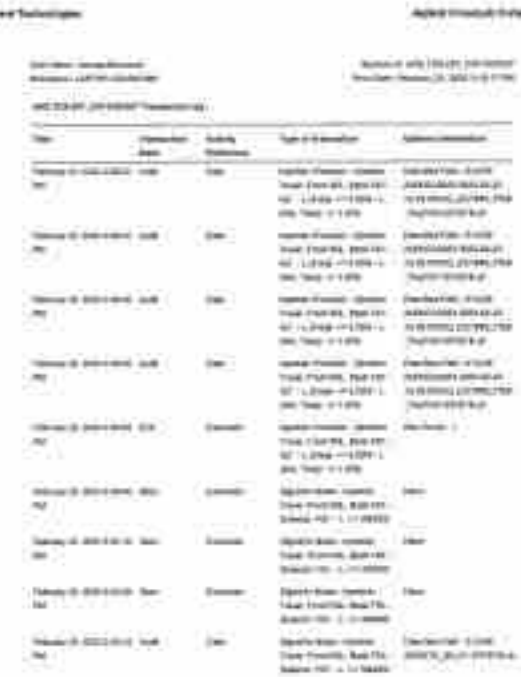
Uncontrolled Document

© 2022 by Agilent Technologies



Uncontrolled Document

© 2022 by Agilent Technologies



Uncontrolled Document

© 2022 by Agilent Technologies

Uncontrolled Document

Agilent CrossLab

Agilent CrossLab Start Up Services

Agilent 7890 Gas Chromatograph

Preventive Maintenance Checklist

[redacted]

Agilent Preventive Maintenance provides factory recommended service for your analytical instruments 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. The checklist will be completed at the end of the service and provided to you as a record of the preventive maintenance activities.

Uncontrolled Document

Agilent

Uncontrolled Document

Agilent CrossLab

Introduction

Customer Information

- Customers should provide all necessary operating supplies upon request of the engineer.
- A customer representative should be available to the engineer while performing the preventive maintenance procedures.
- Any parts not included in the Parts Lists sections of this document are not part of the recommended Preventive Maintenance service and are not included in the price of the service.
- If a system requires the use of extra or special procedures and/or parts for the maintenance service, then these must be ordered separately and charged as a repair, which may have additional costs.

Important Customer Web Links

- For more information about **Agilent Technologies services**, please visit our website using the following URL: http://www.agilent.com/en-us/products/consumables-and-services/service-repair
- The **Agilent Community** is an excellent place to get answers, collaborate with others about applications and Agilent products, and find in-depth documents and videos relevant to Agilent technologies. Visit https://community.agilent.com/welcome
- To access **Agilent University**, visit https://www.agilent.com/crm/cgi/university/ to learn about training options, which include online, classroom and remote delivery. A training specialist can work directly with you to help determine your best options.
- A useful **Agilent Resource Center** root page is available, which includes short videos on maintenance, quick lists of consumables for new instruments, and other valuable information. Check out the Resource Page here: https://www.agilent.com/en-us/agilentresources
- Need technical support, FAQs, supplies? — visit our **Support Home page**: http://www.agilent.com/chem/supportus
- **Videos** about specific preparation requirements for your instrument can be found by searching the **Agilent YouTube** channel at https://www.youtube.com/user/Agilent.
- **7890B Manuals** are also available on Agilent.com:
  - **Safety**: https://www.agilent.com/cs/library/usermanuals/public/7890B_Safety.pdf
  - **Installation and First Startup**: https://www.agilent.com/cs/library/usermanuals/Public/7890B_InstallGuide.pdf
  - **Operation Manual**: https://www.agilent.com/cs/library/usermanuals/Public/7890B_OperatingGuide.pdf
  - **Maintaining Your GC**: https://www.agilent.com/cs/library/usermanuals/public/G4482-90002_MaintainingYourGC.pdf

Uncontrolled Document

Agilent CrossLab

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 "✓" or not mark "—".
- Check "**Section Not Applicable**" if work is not to be performed or appropriate.
- Complete the Preventive Maintenance section in the order of the tasks listed.
- Complete the Service Report 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 "Modification Recommended" Service notes, plan to implement the changes on this unit before starting any qualification activities.
- Do not implement firmware updates, without any get approval from the customer and are sure that they are compatible with the if a chromatography software.

Uncontrolled Document

System Information

Check that you have the necessary configuration report or detailed manual of completing this table below.

Instrument System Name and ID	UAE.TOF.07	CN 12345678
Instrument System Site and Location	UAE	Analytical Laboratory

	List System Component Product Numbers	List the Serial Numbers of each Component
1	G6854A	CN 12345678
2	G7116A	CN5234 9876
3	G4240A	CN 51248791
4		
5		
6		
7		
8		
9		
10		

Preparation

- Discuss any specific issues with the customer before starting
- Review the instrument logbook for reported 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 consumables, settings as defined by normal Service Notes
- Check for required firmware updates and verify with customer if they would like them installed
- Before starting the following procedures, record the Tensune Signal Value(s) in the results table. If the GC is not EPP or is a device model, comparing two detector outputs before and after the service is not possible.

Uncontrolled Document

Preventive Maintenance Procedure

Clean and Inspect GC

- Unplug power cord from the power source
- Open GC covers and inspect interior for any build-up. Pay particular attention to cooling fans.
- Inspect internal connections for proper connect and orientation
- Reconnect Power to the GC. Power the GC on and verify the power on self-test passes.
- Verify cool zones open freely and turns on with the oven door closed. Off when the door is opened.
- Verify operation of all other fans - the inlet and EPC cooling fans.
- Verify zone temperature (top, bottom) is operating correctly while heating and cooling the oven.

Inlet and detector consumable replacement

- For the tasks included perform user maintenance as defined in the 7890 manual – "Maintaining Your GC" for the item(s) installed.
- Replace the split and purge cartridge filter as a unit and check under Agilent Gas Saver (GS), Multi-Mode Inlet (MMI), Programmed Temperature Vaporizer (PTV), and Backflow Kit (BK).
- 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 wiring harness the inlet and the split vent trap.
- If the GC includes a Flame Ionization Detector (FID), replace the jet. If the ignitor shows any cracks or corrosion or immediately replace the ignitor. Clean collector and collector assembly if it contaminated. – Inspect as necessary.

Zero Samples and Leak Test

- Carry all pressure sensors per the procedure in the "GPR Subsystem Leak Audit"
- Perform inlet pressure decay test(s) as defined in the GPR "Troubleshooting Manual". If the GC is being prepared for an Operational Qualification, then the pressure decay test defined within the procedure can be used for this PM.
- Record if test passed or failed in the results table.

Uncontrolled Document

ALS Maintenance

- **Section NOT applicable**
- Check all tubing and configuration settings between GC tray and detectors
- 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 carrier – clean if necessary

Restore Instrument

- Restore the normal operating conditions or customer method using the Inlet System
- Purge the system with carrier flow for 15 minutes
- Bake out the system, then restore the normal operating conditions
- After equilibration, check and record the post PM detector signal output values. Results should be similar or lower than the detector outputs recorded prior to PM.
- Perform a checklist 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 this PM Service is performed prior to a qualification service, then use the qualification procedure as a guide for final instrument set up and checkout.

Uncontrolled Document

Signature Page

Service Review

- Was all available logbook comments of all tasks in this documentation
- Record the Preventive Maintenance service activity in the customer's service logbook
- Update maintenance schedule/software customer as appropriate
- Affix the PM sticker on the system or instrument logbook based on the customer's request
- Complete the Service Engineer Comments section if there are additional comments
- Review with the customer the service, parts replaced, and test results obtained
- If the instrument firmware was updated, record the details of the change in the Service Engineers Comments box in Chemstation, or the software of choice.
- Supply the customer with a copy of the Smart Alerts flyer.
- Describe Smart Alerts to the customer
- Install Smart Alerts if requested

7890 GC Test Results Table

Detector Signal Outputs	Before PM Service	After PM Service
Front detector output	11.0	12.0
Back detector output	4.5	4.5
Aux1 detector output	9.0	10.0
Pressure decay test	**Expected test result**	**Actual test result**
Front inlet pressure decay test	Pass	Pass
Back inlet pressure decay test	Pass	Pass

Uncontrolled Document

7890 Parts List Table

Part description	Part Number	Product or module where used	Quantity recommended
			1
			N/A
			N/A
			N/A
			N/A
			N/A
			N/A
			N/A
			1
			N/A
			N/A
			N/A
			N/A
			N/A
			N/A
			N/A
			N/A
			N/A

Uncontrolled Document

Service Engineer Comments

Service Completion

Service request number: [redacted] Date service completed: 28 Feb 2023

Agilent signature: [redacted] Customer signature: [redacted]

Total number of pages in this document: 19 pages

Uncontrolled Document

Do not include this section/page in the published customer-facing PDF version.

This page is only relevant for Agilent internal documents for document control purposes and is NOT intended for customer viewing. Refer to the SWIFM checklist Authoring Guide for more information.

Document Control Logs

Revision Log

Revision	Date	Author	Reason for update
Revision of document	Date of revision	Author of document	Author to describe main features/changes made for this specific revision
1.0 Draft	4 Mar 2011	Dave Park	Migrated the content of revision A.01.05 to the new Agilent template. Removed by subject matter expert: Dave Park
1.1 Draft	20 Jan 2012	Dave Park	Added 7890 PFD and 7890 PFC and VL - also PFD and FID PM Parts
1.2 Draft	21 March 2014	Dave Park	Added Ultra Inert Gold Seal and J-tee to HC Consumables
A.01.11	19 Dec 2018	Dave Park	Added step to perform maintenance on the 7890 steel TLAn and 0.01 ml2 percent numbers - Fixed broken web links
2.00	05 Dec 2020	Gary Gratamer	Updated New Template and terminology changes Transitioned to Introduction Create New Agilent Document Number: [redacted]

Approval Log

Revision	Approver	Title of approver
Add revision number	Add approver name here	Add approver's function or title here
A.01.09	Dan Sage	Product support manager
A.01.09	Ed Wang	Product support manager
A.01.10	Samantha Tsyganenko	Product support manager
A.01.11	Samantha Tsyganenko	Product support manager
2.00	Jason Rueck	GC Product Support Manager

Designated Evaluator Log

Revision	Designated Evaluator (DE)	Title of DE	DE Number
Add revision number	Add name	Add function or title	Add DE number here
2.00	Michael Schmidt	Chromatography Application Consulting Lead	[redacted]

Uncontrolled Document

© 2020 by Agilent Technologies

Agilent CrossLab

EQUIPMENT QUALIFICATION PLAN (EQP)

EQP Name: [redacted]

Revision Type: [redacted]

Company Name: [redacted]

Customer Name/Title: [redacted]

EQP Revision: [redacted]

EQP Release Date: [redacted]

Print Date: [redacted]

Uncontrolled Document

Table of Contents

Section	Page
Scope and Purpose	3
CrossLab Procedures	3
ACE Delivery System	6
ACE Delivery Use Cases	12
IQ/OQ	13
Report and Delivery Options	17
Optional Signature Options	17
Customer Approval	19
Legal Notice	19
Revision Details	20

Uncontrolled Document

Scope and Purpose

Overview

The Equipment Qualification Plan (EQP) document is the entire program that is performed during the qualification services for the applicable systems. A complete description of the test specifications is provided for the supported services, including executions and assignment criteria, (or limits) for each test. The test specification section of this document is created directly from the respective Agilent Equipment Qualification Plan (eEQP) Editor. The purpose of this document is to allow the user to review and record approval of the EQP that guides the delivery of compliance services provided by the Agilent Automation Compliance Engine.

CDS Software Pre-requisite (or hardware qualification)

Installed hardware qualification only Agilent recommends that the customer data system (CDS) software used during the qualification has been qualified within the qualification period specified by the customer's software qualification SOP.

Statement of Intent

Unless otherwise requested, the qualification is delivered according to the standard test program described in the Agilent_Recommended EQP. System defined parameters are changed to the default recommended values (as shown in the Agilent Recommended EQP) that fall within a predefined range. These changes are considered to be within the intended use range of the system under test.

Customers can choose that an subset the system to a test that exceed the typical operational range or (in exceptional case) that was not considered part of the core program required for completion of the selected service. Because system behavior and limits may exceed the operation or workload of the equipment, Agilent reserves the right to exclude such behavior and/or may exceed the operation or workload of the equipment. Agilent reserves the right to exclude such behavior and/or limits that fall outside of the specified operational range. These changes are considered to be within the intended use range of the system under test.

Customers can choose that an subset the system to a test that exceed the typical operational range or (in exceptional case) that was not considered part of the core program required for completion of the selected service. Because system behavior and limits may exceed the operation or workload of the equipment, Agilent reserves the right to exclude such behavior and/or limits that fall outside of the specified operational range. These changes are considered to be within the intended use range of the system under test.

A set of eSignature fields, as determined by the creator of this document, can be included at the end of this document. All fields should be completed or a single set of fields, initialed by an appropriate approver, run through any signature fields that are not to be used. This is an optional process that allows a paper record of signoff by the appropriate reviewers where a trusted electronic signature (ESIP is followed. If the document will be saved electronically and digitally signed in a document management system, it should be generated without the signature fields. The customer must sign the EQP where documents are return as electronic copy to Agilent prior to qualification delivery. The delivery of the services is done according to the terms and conditions stated in the corresponding service order. It is recommended that after approval, this EQP be archived with the equipment EQP file.

Uncontrolled Document

Understanding the Test Specification Section of Tailored Service Documents

Applies to hardware qualifications only) For Agilent-recommended setpoints and limits, the range of allowable values (i.e., for Set_1) is input is included, any applicable, numerical, non-numerical, and additional setpoints are listed and/or the Agilent recommended values and realized (if) before ranges, or in 'accepts of ranges' is one and accepts' (except for limited setpoints are also marked (N or C) and displayed after set configuration is tested. Blue limits are marked (SR or SC). Agilent is NOT responsible for test failures for out of range setpoints and limits. Optional tests that are enabled are included and marked as such. Any test listed that are disabled by the customer are included and marked as such.

NOTE: Limit ranges must be more tightly managed than setpoint ranges because they often reflect physical measurement limits and are directly linked to the testing method. Therefore "within range" test limits are rated to have effect reports if they cannot be met. In particular, Agilent will not be responsible for test failures for limit ranges (more demanding or challenging) than the recommended values.

Customer Responsibilities

If Agilent representatives use a customer CDS account to execute test data, they log off from the CDS account at the end of test completion. Agilent Technologies has no responsibility for those account credentials. It is up to the customer to protect the CDS from misuse.

- Any application Disable the account used by the Agilent representative or another CDS user.
- Safely store and archive this EQP.
- Maintain change control and version history.
- Review and optionally sign the EQP, making sure that any test deviation is acceptable.
- Review and approve any of the following customer-from the Agilent recommended:
  - Within Optional Range: changes to the Agilent recommended that are identified by Agilent as within the operation ranges determined in our test development.
  - Outside of Intended Range: changes to the Agilent recommended that System identified as outside of the operational ranges determined in our test development. Agilent is not under any obligation to make this instrument pass the more stringent limits that fall in the range and data detail is stated out in the EQP Test Specification.
  - Optional Tests: additional tests that are available but not part of the core testing suite and user added.
  - Disabled Tests: test or select all possible config options have been disabled (tests are flagged in the test specification).

Agilent Responsibilities

- Deliver the services following the test programs described in this customer EQP.
- Provide a review and a signed Qualification Report (EQR) upon completion of the service.
- If requested, provide an optional (e-signed) EQP-CS to the customer.

Uncontrolled Document

General Statements on the Testing Program

This recommended set of hardware OQ tests determined to link #EQP rationale from Agilent's interpretation of authoritative expert literature issued by the FDA, EMA, SWIFT, ASTM (ISO), and others. The OQ test design incorporates both nominal and limits testing which is a known approach, accepted in the (ISPE). An assessment on the #2 qualification methodology for analytical instrumentation Qualification (#00), the OQ tests is separated from the PQ as recommended by the regulatory guidelines.

Agilent CrossLab Compliance uses a balanced selection of technology and chemical tests to develop determine the performance of the customer without unnecessary reliance on internet or demand results. For example, direct metrology is used to measure flow rates and thermal controlled volume accomplishment and subsequently validate, indirect chemical testing is used for the evaluation of the forming critical operational parameters of clarity, precision, dignity to noise, and color shift.

Uncontrolled Document

© 2020 by Agilent Technologies

Agilent CrossLab

ASAP ASSURE CROSSLAN
COMPLIANCE SERVICES MANU

Agilent CrossLab Compliance Services

- [illegible]
- [illegible]
- [illegible]
- [illegible]
- [illegible]

Uncontrolled Document

© 2020 by Agilent Technologies

Design Qualification (DQ)

Installation Qualification (IQ)

Operational Qualification (OQ)

Dual Acceptance Limit

Uncontrolled Document

© 2020 by Agilent Technologies

Re-Qualification after Repair (RQ) Hardware

Re-Qualification After Repair		
Firmware Upgrade		
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]

Updated: November 2020

www.agilent.com/chem/cpsAllocation

Uncontrolled Document

© 2020 by Agilent Technologies

Agilent CrossLab

SERVICE DELIVERY METHODS
CUSTOMER APPROVAL OF ALTERNATIVE METHOD AND CDS STORAGE

Overview

Available Methods

Method	Description
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]

CDS Storage

Customer Approval of Alternative Method and CDS Storage

Updated: September 2020

www.agilent.com/chem/cpsAllocation

Uncontrolled Document

© 2020 by Agilent Technologies

Agilent CrossLab

AGILENT CROSSLAB QUALIFICATION SERVICES USE CASES FOR SERVICE DELIVERY

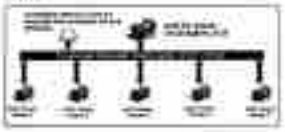
Introduction

Preferred Method 1	Network-distributed ACS (NDA)
Preferred Method 2	Dedicated gateway USB drive (or 2 if one remains with customer)
Alternative	Service-provided laptop or other PC not directly connected to customer data network (USB)

Preferred Method 1: Network-Distributed ACS (NDA)

Overview

Details



Requirements

Installation

- Install on a local PC with a separate drive (different from that of the OS)
- Attach to a network interface card or port
- USB HID
- HTTPS format
- Clear the local anti-malware rights

Uncontrolled Document

© 2020 by Agilent Technologies

Preferred Method 2: Dedicated Gateway USB Drive

Overview

Details

Alternative Method

Information, descriptions and specifications in this publication are subject to change without notice.
Agilent Technologies, Inc. 2020
Printed in USA

Uncontrolled Document

© 2020 by Agilent Technologies

Agilent CrossLab

SC HARDWARE OPERATIONAL QUALIFICATION

Standard OQ Test Suites

Item	Requirements and Parameters	Limits
System components and Basic Setup and Operation	N/A	Device, software drivers, assembly, workstation, hardware interfaces, and so on as required
DC Drive Characteristics (Accuracy and Stability, Digital Input, RMS)	Ambient temperature +18.0 °C Drive 1 = 256 nL Drive 2 = 128 nL Stability measured at range 2	Accuracy ≤ 0.5% and ≤ 0.5% of setpoint, to 4 areas Accuracy ≤ 1.0% and ≤ 0.5% of setpoint, to 4 locations maximum Stability ≤ 0.5%
DC Drive Characteristics (Accuracy and Stability, Digital Input, RMS)	Temperature 1 = 20.0 °C Temperature 2 = 10.0 °C Stability measured at temperature 1, 2	Accuracy ≤ 1.0% and ≤ 0.5% of setpoint, to 4 Stability ≤ 0.5% (Digital) Stability ≤ 1.0% (RMS/rms)
Maintenance mode (Offline only)	N/A	Active thermostat sessions over 500 hours (typ)
Maintenance Drive test (Thermocouple Open Integrity (OCDMA) and other)	N/A	Active thermostat sessions
Performance Monitor Drive Characteristics Accuracy	Drive 1 = 0.0 °C Sample count, 2 to 64 Sample Rate: 1.0 s/1 Drive: 100.0 °C Stability: 0.0 °C Additional data recorded per sample: 1. Cycle Mode on, Pulse Mode, 0, Turbo Mode = 0, Pulse Mode, 0, 100.0000, 100.0 °C Temperature (1), (2), (3), (4), (5), (6), (7), (8), (9), (10), (11), (12), (13), (14), (15), (16), (17), (18), (19), (20), (21), (22), (23), (24), (25), (26), (27), (28), (29), (30), (31), (32), (33), (34), (35), (36), (37), (38), (39), (40), (41), (42), (43), (44), (45), (46), (47), (48), (49), (50), (51), (52), (53), (54), (55), (56), (57), (58), (59), (60), (61), (62), (63), (64)	Drive accuracy ≤ 1.0 and ≤ 0.5% of setpoint (100.0, 99.0, 101.0) Drive accuracy ≤ 1.0 and ≤ 0.5 °C of setpoint (99.0 °C) Sample Rate accuracy ≤ 0.5 °C and ≤ 0.5 °C (0.999, 1.0000, 1.0010, 1.0010, 1.0010

Test	Sequence and Frequency	Limits
Injection Precision Purge & Packout	1,000 at the assigned standard sequence points without fail	Retention Vary (RT) ≤ 0.25% Area RSD ≤ 1.00% (Mid, TOP) Area RSD ≤ 5.00% (LOQ) - Advisory
Injection Carry Over (0.05 mL) Tested at Injection Precision		Zero carry over ≤ 1.00%

Test Design and Rationale

Overview

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

Known Inspection and Basic Rules and Operation

[illegible]

DC Zone Temperature Accuracy and Stability

[illegible]

Headspace Leak

[illegible]

Headspace Vial and Pressed Isolate Valve Integrity

[illegible]

Headspace Heated Zones Temperature Accuracy

[illegible]

Uncontrolled Document

Vial Water Temperature Accuracy

[illegible]

Vial Pressure Decay

[illegible]

Vial Pressure Accuracy

[illegible]

Vial Flow Stability

[illegible]

Detector Flow Accuracy

[illegible]

Noise and Drift

[illegible]

Bunching Run

[illegible]

Signal to Noise

[illegible]

Injection Precision

[illegible]

Uncontrolled Document

Injection Carry Over

[illegible]

Updated: November 2019 **www.agilent.com/chem/qualification**

Information, descriptions, and specifications in this publication are subject to change without notice.

© Agilent Technologies, Inc. 2019
Published in USA

Uncontrolled Document

Report and Delivery Options

[illegible]

Selected Signature Options

[illegible]

Uncontrolled Document

Customer Approval

Name
Title
Date
Signature

Name
Title
Date
Signature

Name
Title
Date
Signature

Name
Title
Date
Signature

Uncontrolled Document

Legal Notice

Uncontrolled Document

Protocol Details

Uncontrolled Document

Agilent CrossLab Compliance

Uncontrolled Document

© 2023 by Agilent Technologies

Table of Contents

Section	Page
Cover	1
Table of Contents	2
Test Summary	4
Service Details	5
Instrument Details	6
Calculation Formulas	8
Product Details	11
Tests	12
System Acquisition and Mass Spectrometer - TIMS	12
High Pressure Decay - Front SSL	12
Inlet Pressure Accuracy - Front SSL	14
Detector Flow Accuracy - Front LECO	16
Detector Flow Accuracy - Back FID	18
GC Oven Temperature Accuracy - TIMS	19
GC Oven Temperature Stability - TIMS	20
GC Shooting Run - Injection Tower, Front SSL, Front LECO	21
Noise and Drift - Front LECO	24
Injection Precision - Injection Tower, Front SSL, Front LECO	25
Signal to Noise - Injection Tower, Front SSL, Front LECO	27
GC Shooting Run - Injection Tower, Front SSL, Back FID	28

Uncontrolled Document

© 2023 by Agilent Technologies

Table of Contents

Section	Page
Noise and Drift - Back FID	28
Injection Precision - Injection Tower, Front SSL, Back FID	31
Signal to Noise - Injection Tower, Front SSL, Back FID	31
Declaration of Change Control	31
Attachments	32
Agilent Technologies Materials: 5191-3395	33
Electronic Signature	34
Transaction Logs	35

Uncontrolled Document

© 2023 by Agilent Technologies

Test Summary

Purpose:

This section includes the Overall Qualification Status and results for each test that meets at least one of the following criteria: (1) was not scheduled, (2) was scheduled but not run, (3) was processed more than once, (4) passed recommended limits only when deal limits were specified, (5) displayed deviation(s) or warning(s), (6) required integration event changes). Tests that pass and do not meet any criteria above are not included.

For a complete list of scheduled tests, see the Table of Contents. For supporting documentation, refer to the Attachments section.

NOTE: A View for the Overall Qualification Status indicates that all scheduled tests were run and passed. R, I, D, and C are blank if not applicable for that specific test.

R - run
I - Integration event changes
D - number of deviations submitted
C - number of comments submitted
Status: Pass, Not Scheduled, Not Run, Fail, Indicates test was completed

Samples:

Test	Status R	I	D	C
GC Shooting Run - Injection Tower, Front SSL, Front LECO	Pass	1	1	
Injection Precision - Injection Tower, Front SSL, Front LECO	Pass	1	1	
GC Shooting Run - Injection Tower, Front SSL, Back FID	Pass	1	1	
Injection Precision - Injection Tower, Front SSL, Back FID	Pass	1	1	
Signal to Noise - Injection Tower, Front SSL, Back FID	Pass	1	1	

Overall Qualification Status:
Pass

Uncontrolled Document

© 2023 by Agilent Technologies

Service Details

Purpose:

This section includes basic contact and delivery details for this service.

Shipment Details:

Service Order No./Request	5191-3395
CDP Server	AgilentChemstation
CDP Number	CC 32 01
Project Type	Project

Organization Details:

Name	United Analysis and Engineering Consultant Co., Ltd.
Location	2 Soi Ekkamai 41 / Sukhumvit Road, Bangkok, Phrakanong, Bangkok 10260

Local Contact Details:

Name	Mr.Benjamas Khyalee
Job Title	Manager
Qualification Location	Analytical Laboratory

Operator Details:

Name	Supaporn Tuntit
Job Title	Field Service Engineer

Data Acquisition Details:

Acquisition Software Name	ChemStation
Acquisition Software Revision	C.01.10 [Update 402011]
Customer Data System (CDS)	01 OpenLAB CDS

Uncontrolled Document

© 2022 by Agilent Technologies

Instrument Details

Purpose

This section describes the an Agilent system configuration.

Details

System

System ID	[illegible]
Manufacturer	Agilent Technologies
Name	7890
Pre Data Acq	Manual Data
Temperature Data Acq	Manual Data or Other Data Logging

Tower Compartment

Injector Technique	Injection Tower
Axis	Axial
Detector	Front
LTM Installed?	No

Tower Compartment

Injector Technique	Injection Tower
Axis	Axial
Detector	Back
LTM Installed?	No

Remarks 1

Manufacturer	Agilent Technologies
Type	Injection Tower
Name	7693A
Model Number	G4513A
Serial Number	CN32418000
Firmware Revision	A.1.13
Usage	Sample Injection
Location	Front
Syringe Volume (µL)	10

Uncontrolled Document

© 2022 by Agilent Technologies

Sample 1

Manufacturer	Agilent Technologies
Type	Tray
Name	7693A
Model Number	G4513A
Serial Number	CN32418000
Firmware Revision	A.1.13

Remarks 1

Manufacturer	Agilent Technologies
Name	7890
Model Number	G3430A
Serial Number	CN10122100
Firmware Revision	A.01.11
Oven Type	Standard

Inlet 1

Manufacturer	Agilent Technologies
Name	7890
Type	SSL
Location	Front
Carrier Gas	Helium
Control Type	Electronic Pressure Control (EPC)
Purged Flow	Yes

Detector 1

Manufacturer	Agilent Technologies
Name	7890
Type	NPD
Serial Number	123456
Adapter	Capillary
Control Type	Electronic Pressure Control (EPC)
Location	Front
Makeup Gas	Nitrogen

Uncontrolled Document

© 2022 by Agilent Technologies

Detector 2

Manufacturer	Agilent Technologies
Name	7890
Type	FID
Adapter	Capillary
Control Type	Electronic Pressure Control (EPC)
Location	Back
Makeup Gas	Nitrogen

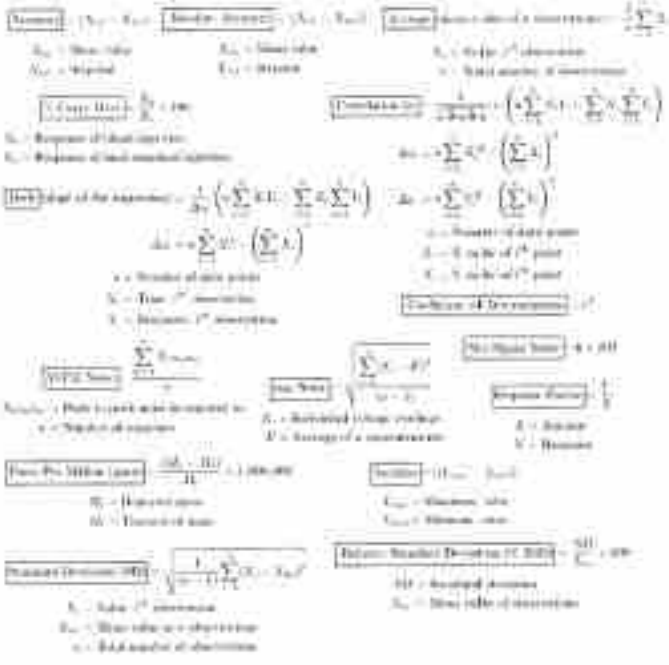
Uncontrolled Document

© 2022 by Agilent Technologies

Calculation Formulas

Purpose

This section includes calculation formulas for all available data. Depending upon which data acquisition rate, all or some apply to each quantitation.



Uncontrolled Document

© 2022 by Agilent Technologies

NOTE: For every test performed by the Automated Compliance Engine software, calculations are employed to reduce the raw data to a result easily from. These calculations when the full precision of each intermediate result on the algorithm progresses through the required calculation. Where intermediate or validation is displayed, these results may be rounded or truncated to provide the proper display values. Attempting to calculate the final value based on these display rounded intermediate can result in a small difference in the final result. These intermediate values presented are simply used to show algorithms assigned through the calculation and not intended to be as a means of algorithm validation. Beginning with ISC 21.06, results are rounded to see the same number of decimal places as defined in the limit, which must be less than or equal to the resolution provided by the measuring equipment.

Uncontrolled Document

© 2022 by Agilent Technologies

Protocol Details

Purpose

This section lists the revisions for all test scripts used in this report. For complete test specific and high level change details, refer to the Revision History document.

Test Number	Test
GC.02.01	Detector Flow Accuracy
GC.02.02	GC Oven Temperature Accuracy
GC.02.03	GC Oven Temperature Stability
GC.02.04	GC Cooling Run
GC.02.05	Injection Precision
GC.02.06	Inlet Pressure Accuracy
GC.02.07	Inlet Pressure Decay
GC.02.08	Noise and Drift
GC.02.09	Signal to Noise
GC.02.10	System Inspection and Basic Safety and Operation

Uncontrolled Document

© 2022 by Agilent Technologies

System Inspection and Basic Safety and Operation

Purpose

This test verifies that the GC is correctly installed and connected.

Configuration Details

Name: 7890

Setpoint

Results

Criteria	Observed Result	Expected Result	Status
Is the system in good operating condition and physical damage?	Yes	Yes	Pass
Is it free of potential environmental or environmental safety concerns?	No	No	Pass
Are required gases present and of required specification?	Yes	Yes	Pass
Is there an empty bottle for GC chassis, and the ground pin?	Yes	Yes	Pass
Does the power-on test complete the self-test without errors in "not ready" status or considered by the external errors?	Yes	Yes	Pass
Does the system reject incorrect entry of some network of errors?	Yes	Yes	Pass
Does a thorough safety shutdown start in accordance with the manual?	Yes	Yes	Pass

Setpoint Status: Pass — Runs: 1

Overall System Inspection and Basic Safety and Operation Test Status:

Pass

Uncontrolled Document

© 2022 by Agilent Technologies

Inlet Pressure Decay

Purpose

This test demonstrates the pressure integrity of the GC inlet with a valve and flow system closed. It automatically sets all flows controlled by the GC inlet pneumatics.

Configuration Details

Name: 7890

Front: SSL

Setpoint: Pressure: 25.0 psi

Measurements

Inlet Pressure	25.1	psi
Final Pressure	23.8	psi

Results

Pressure Change		1.3	psi	2.5% RSD	
Agilent Recommendation	>=	2.0	and	<=	5.0

Setpoint Status: Pass — Runs: 1

Overall Inlet Pressure Decay Test Status:

Pass

Uncontrolled Document

© 2022 by Agilent Technologies

Inlet Pressure Accuracy

Purpose

The test uses a digital calibrated manometer to demonstrate the ability of the system to provide accurate pressure at the head of the column. Accuracy is calculated as the absolute difference between the measured pressure and setpoint.

Configuration Details

Name: [redacted]

Flow: [redacted]

Setpoint	Inlet Pressure	[redacted]	psi
Measurements			
Reading		[redacted]	psi
Results			
Accuracy		[redacted]	psi
Agilent Recommended		<= [redacted]	
Setpoint Status:	Pass		Runs: 1

Overall Inlet Pressure Accuracy Test Status:

Pass

Uncontrolled Document

© 2022 by Agilent Technologies

Detector Flow Accuracy

Purpose

Detector flow accuracy is determined by measuring the flows with a calibrated mass flowmeter and comparing them to the set setpoints and the values displayed by the CDS (if applicable).

Configuration Details

Name: [redacted]

Flow: [redacted]

Setpoint	Flow Type	Makeup	[redacted]	[redacted]
Measurements and Results				
Time	Flow			
[redacted]	[redacted]	mL/min		
Accuracy		[redacted]	source	
Agilent Recommended		<= [redacted]	% setpoint	([redacted] minimum)

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

Setpoint Status:	Pass	Runs: 1

Overall Detector Flow Accuracy Test Status:

Pass

Uncontrolled Document

© 2022 by Agilent Technologies

Detector Flow Accuracy

Purpose

Detector flow accuracy is determined by measuring the flows with a calibrated mass flowmeter and comparing them to the set setpoints and the values displayed by the CDS (if applicable).

Configuration Details

Name: [redacted]

Flow: [redacted]

Setpoint	Flow Type	Makeup	[redacted]	[redacted]
Measurements and Results				
Time	Flow			
[redacted]	[redacted]	mL/min		
Accuracy		[redacted]	source	
Agilent Recommended		<= [redacted]	% setpoint	([redacted] minimum)

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

Setpoint Status:	Pass	Runs: 1

Overall Detector Flow Accuracy Test Status:

Pass

Setpoint	Flow Type	Makeup	[redacted]	[redacted]
Measurements and Results				
Time	Flow			
[redacted]	[redacted]	mL/min		
Accuracy		[redacted]	source	
Agilent Recommended		<= [redacted]	% setpoint	([redacted] minimum)

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

Setpoint Status:	Pass	Runs: 1

Uncontrolled Document

© 2022 by Agilent Technologies

Setpoint	Flow Type	Makeup	[redacted]	[redacted]
Measurements and Results				
Time	Flow			
[redacted]	[redacted]	mL/min		
Accuracy		[redacted]	source	
Agilent Recommended		<= [redacted]	% setpoint	([redacted] minimum)

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

Setpoint Status:	Pass	Runs: 1

Overall Detector Flow Accuracy Test Status:

Pass

Uncontrolled Document

© 2022 by Agilent Technologies

GC Oven Temperature Accuracy

Purpose

This test uses a calibrated digital thermometer to determine the accuracy of the GC oven. Accuracy is calculated as the absolute difference between the measured temperature and setpoint.

Configuration Details

Name: Test

Setpoint: Temperature: 220.0 °C

Time: Oven

Measurements and Results

Probe: A single probe is used for this service

Temp: Temperature:

10.00 220.0 °C

Accuracy: 0.0 °C

Agilent Recommended: >= -1.0 % setpoint or 0 (0.0 °C)

>= 1.0 % setpoint or 0 (0.0 °C)

Setpoint Status: Pass Runs: 1

Setpoint: Temperature: 100.0 °C

Time: Oven

Measurements and Results

Probe: A single probe is used for this service

Time: Temperature:

10.00 100.0 °C

Accuracy: 0.0 °C

Agilent Recommended: >= -1.0 % setpoint or 0 (-0.7 °C)

>= 1.0 % setpoint or 0 (0.7 °C)

Setpoint Status: Pass Runs: 1

Date: February 23, 2022 3:23:17 PM

System ID: LAB_TOA-001_CHY1021007

Uncontrolled Document

© 2022 by Agilent Technologies

Overall GC Oven Temperature Accuracy Test Status

Pass

Date: February 23, 2022 3:23:17 PM

System ID: LAB_TOA-001_CHY1021007

Uncontrolled Document

© 2022 by Agilent Technologies

GC Oven Temperature Stability

Purpose

This test uses a calibrated digital thermometer to determine the stability of the oven temperature. Stability is expressed as the delta between the highest and lowest measured temperatures.

Configuration Details

Name: Test

Setpoint: Temperature: 100.0 °C

Time: Oven

Measurements Results

Probe: A single probe is used for this service

	Time	Temperature
1	0:00:00	99.8 °C
2	0:10:21	100.0
3	0:20:26	99.8
4	0:31:01	99.7
5	0:41:03	100.0
6	0:51:04	100.0

Average: 100.1833 °C

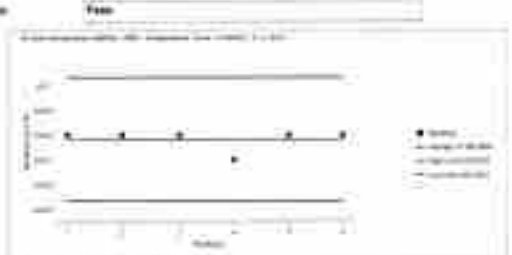
High: 100.0 °C

Low: 99.7 °C

Stability: 0.1 °C

Agilent Recommended: <= 0.5

Setpoint Status: Pass Runs: 1



Overall GC Oven Temperature Stability Test Status

Pass

Date: February 23, 2022 3:23:17 PM

System ID: LAB_TOA-001_CHY1021007

Uncontrolled Document

© 2022 by Agilent Technologies

Scouting Run

Purpose

This test is used to determine the chromatographic [illegible] of a prepared probe, sufficient run time, and proper integration events prior to the start of the qualification runs.

Requirement

The sequence has been set to perform a single injection of the evaluation standard.

Evaluation standard: 1 injection

Configuration Details

Name: [illegible]

Injector: [illegible] 1.0 uL

Conditions

Column: [illegible]

Configurations

Sample: [illegible]

Evaluation Compound: [illegible]

Evaluation Standard Concentration: [illegible] mg/L from Certificate of Analysis

Measurements

Does the run include sufficient flat baseline to the left? Yes

Actual start time for Signal to Noise (minutes) 15

Run time for Signal to Noise (minutes) 16.5

Run time for Retention Reproducibility and Peak Internal Calculation 1

Setpoint Status: Completed Runs: 1

Data Audit Log

Host Name: LAPTOP-[illegible]

Original Data Path: [illegible]

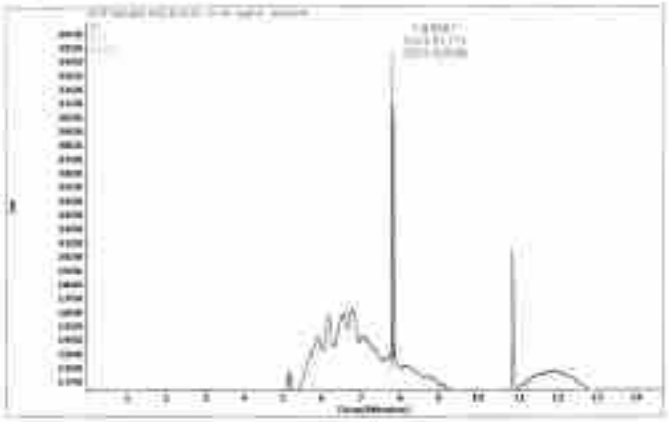
Analyzed Data Path: [illegible]

Date: February 23, 2022 3:23:17 PM

System ID: LAB_TOA-001_CHY1021007

Uncontrolled Document

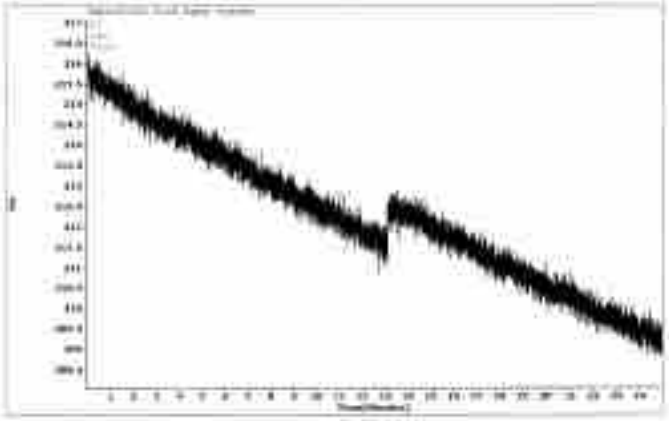
Uncontrolled Document



Uncontrolled Document

Noise and Drift

Uncontrolled Document



Uncontrolled Document

© 2022 by Agilent Technologies

Injection Precision

Purpose

This test plan is a reusable document to determine injection precision. The mean, standard deviation, and %RSD of six injection injections are calculated.

Acceptance

The acceptance has one or eight lines representing upon whether your output 7 levels from the same vial or vial 7 separate vials.

Evaluation calculated, 1 injection (system suitability)
Evaluation calculated, 1 injection (6 of 6 max)
Sample blank, 1 injection (applied only if carry over to run between after a blank)

Configuration Details

Tested Concentration: From 400 To 1600

Injection Volume

Name: 100ng/mL

Analyte: Injection Volume on Column: 1.0 uL

Conditions

Check Unit: No

Configuration

Sample: ICV 0.4x10_10^12 0.0100

Standard Compound: Unknown

Evaluation Standard Concentration: 0.000 mg/L (from Calibration of Analyte)

Measurements

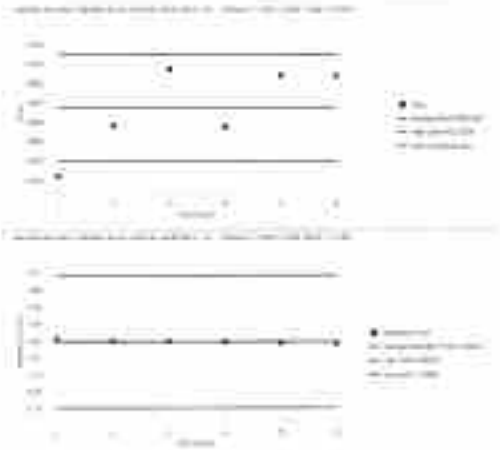
Area	Retention Time
4474.318 mAU*s	7.307700 minutes
4642.771	7.303534
4656.102	7.313534
4631.588	7.311813
4671.107	7.317219
4600.189	7.310201

Uncontrolled Document

© 2022 by Agilent Technologies

Results	Area		Retention Time	
Average	4636.282	%rsd	7.310170	minutes
95% Confidence	169.4131	%rsd	0.007180	minutes
RSD	3.66	%	0.10	%
Agilent Recommendation	<= 5.00		<= 1.00	
Status	Pass		Pass	

Subpoint Status: Pass



Data Audit Log

Host name: LAPTOP-CQ5BKOM7

Original Data Path: C:\Users\Public\Documents\CDS ChemStation Data\Sample Data\Sample_Data_1_2_0\Data_2_2_1\Pharmaceutical\Plan1

Analyzed Data Path: 2023-2\Sequence Data\CDS ChemStation Data\Sample Data\Sample_Data_1_2_0\Data_2_2_1\Pharmaceutical\Plan1

Uncontrolled Document

© 2022 by Agilent Technologies

Integration Parameters

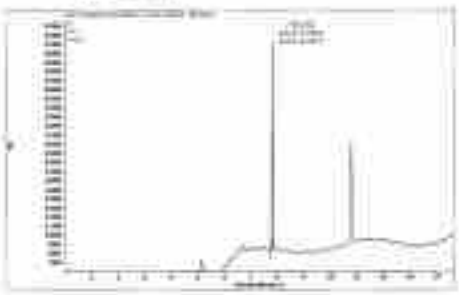
Type of Integration	Injection
Integration Count	1
Derived Values	
Baseline Correction Mode	Advanced
Initial Slope Sensitivity	10
Initial Peak Width	0.01
Initial Area Reject	0
Initial Height Reject	100
Initial Event Table	
Integration Type	Value
Integration	Off
Integration	On
Integration	Off

Acquisition operator: Autogenerated

Acquisition method: DG2021_LAB25_IEC-M

Data file acquired for this item: DG_DCTRIC_LAB25_Plan01-220912

Acquisition Date: 20-Feb-23, 20:38:37



Uncontrolled Document

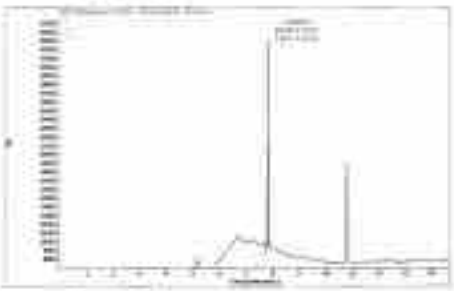
© 2022 by Agilent Technologies

Acquisition operator: Autogenerated

Acquisition method: DG2021_LAB25_IEC-M

Data file acquired for this item: DG_DCTRIC_LAB25_Plan01-220912

Acquisition Date: 20-Feb-23, 20:38:37

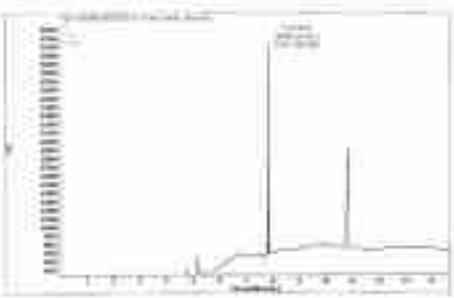


Acquisition operator: Autogenerated

Acquisition method: DG2021_LAB25_IEC-M

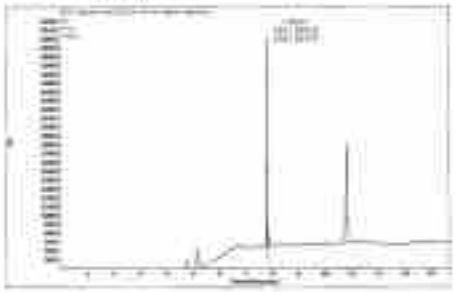
Data file acquired for this item: DG_DCTRIC_LAB25_Plan01-220912

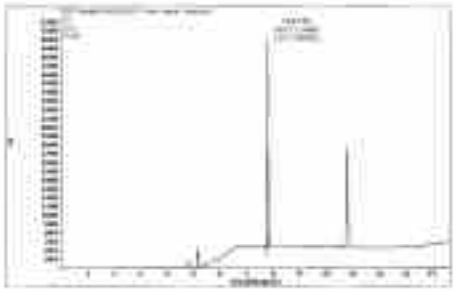
Acquisition Date: 22-Feb-23, 3:13:34



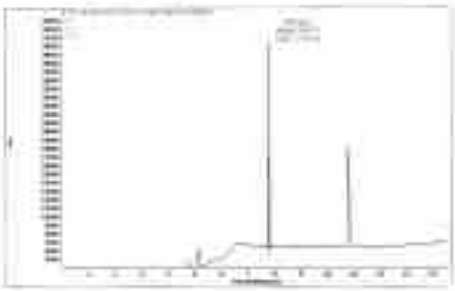
Uncontrolled Document

© 2022 by Agilent Technologies





© 2022 by Agilent Technologies



© 2022 by Agilent Technologies

Signal to Noise

© 2022 by Agilent Technologies

© 2022 by Agilent Technologies

Integration Parameters

Type of Integration	Inputted
Integration Count	6

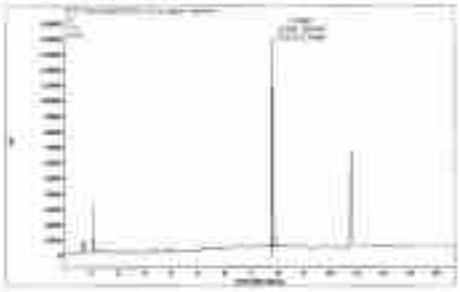
Optional Values

Baseline Correction Mode	Advanced
Initial Slope Sensitivity	10
Initial Peak Width	0.01
Initial Area Reject	0
Initial Height Reject	100

Timed Event Table

Integration Type	Value	Time
Integration	OFF	0
Integration	ON	0.5
Integration	OFF	8

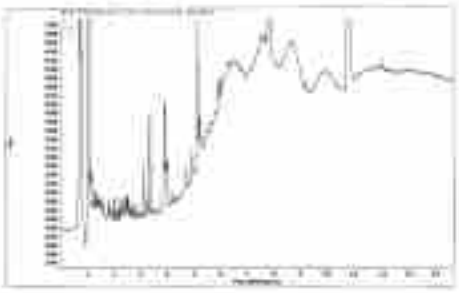
Acquisition operator	Samplefiller level
Acquisition method	[redacted]
Data file analyzed for this task	[redacted]
Acquisition Date	[redacted]



Uncontrolled Document

© 2022 by Agilent Technologies

Acquisition operator	Samplefiller level
Acquisition method	[redacted]
Data file analyzed for this task	[redacted]
Acquisition Date	[redacted]



Overall Signal to Noise Test Status

Flags

Uncontrolled Document

© 2022 by Agilent Technologies

Scouting Run

Purpose

This test is used to determine the chromatogram for presence of suspected peaks, surfactant run time, and proper integration events prior to the start of the quantitation runs.

Sequence

The sequence has one line to perform a single injection of the acquisition standard.

Evaluation standard: 1 injection

Configuration Details

Tower Commission[	Front	Bulk	/ Back	250	
	Injection Tower				
Name	[redacted]				

Analysis	Injection Volume or Collector	2.0	uL

Conditions

Purity [ppb]	95

Configuration

Sample	[redacted]
Evaluation Compound	Sample Phase
Evaluation Standard Concentration	100 % Mole Calculate of Analyte

Measurements

Does the run include sufficient flat baseline for the FM test?	Yes
Noise start time for Signal to Noise (minutes)	0
Run time for Signal to Noise (minutes)	0.5
Run delay for spectral reporting data during interval (minutes)	0

Sequence Status: Completed Runs: 1

Data Audit Log

Host name	[redacted]
Original Data Path	[redacted]
Associated Data Path	[redacted]

Uncontrolled Document

© 2022 by Agilent Technologies

Integration Parameters

Type of Integration	Inputted
Integration Count	7

Optional Values

Baseline Correction Mode	Advanced
Initial Slope Sensitivity	10
Initial Peak Width	0.01
Initial Area Reject	0
Initial Height Reject	100

Timed Event Table

Integration Type	Value	Time
Integration	ON	0
Integration	On	0.5 0.5
Integration	OFF	0.7

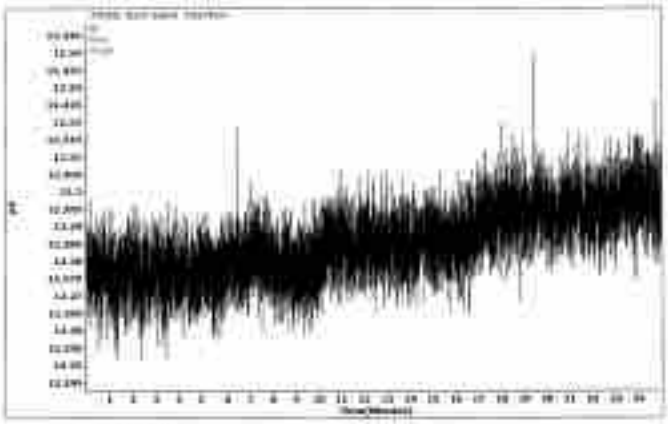
Acquisition operator	Samplefiller level
Acquisition method	[redacted]
Data file analyzed for this task	[redacted]
Acquisition Date	[redacted]

Uncontrolled Document

Uncontrolled Document

Noise and Drift

Uncontrolled Document

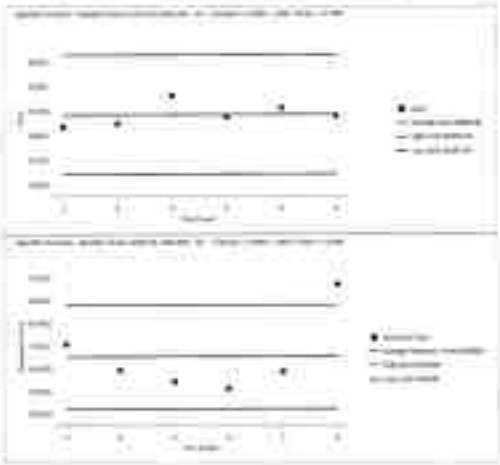


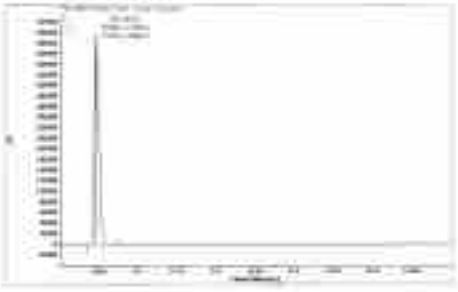
Uncontrolled Document

Injection Precision

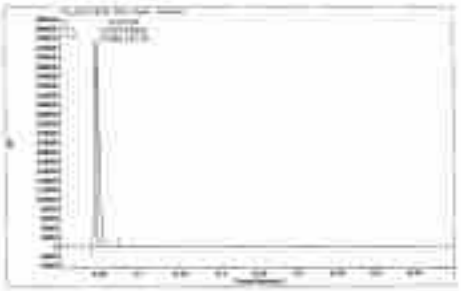
Uncontrolled Document

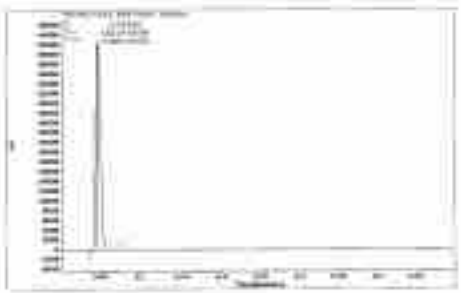
Uncontrolled Document



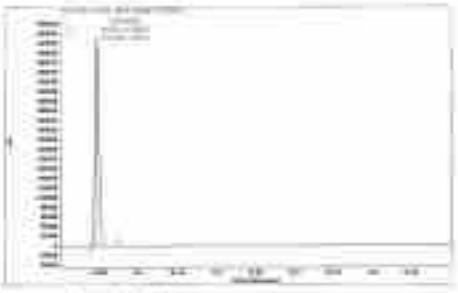


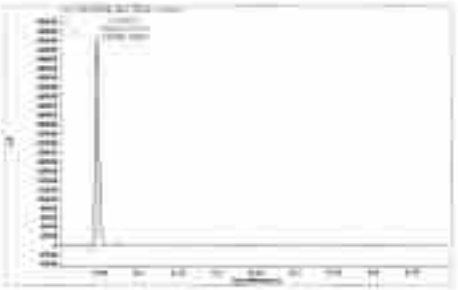
Uncontrolled Document





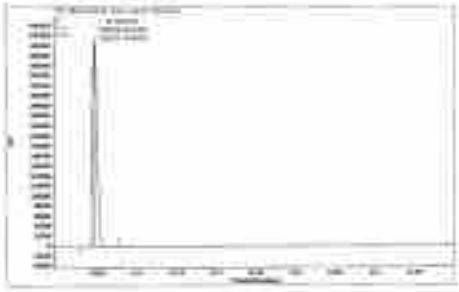
Uncontrolled Document





Uncontrolled Document

Uncontrolled Document



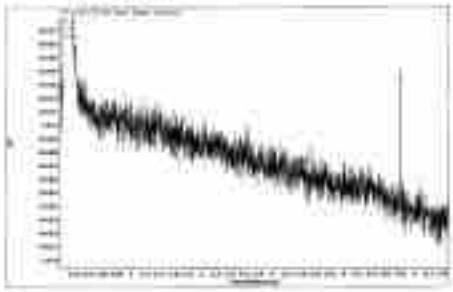
Uncontrolled Document

Signal to Noise

Uncontrolled Document

Uncontrolled Document

© 2022 by Agilent Technologies



© 2022 by Agilent Technologies

Declaration of Change Control

© 2022 by Agilent Technologies

Attachments

Location	Category	Document Name	Page
ECR	Operator	ACE Self Qualification Certificate	01
ECR	Operator	Operator's training certificate and qualifications	04
ECR	General	Operator's training certificate and qualifications	05
ECR	General	Operator's training certificate and qualifications	06
ECR	Software	Operator's training certificate and qualifications	07
ECR	General	Operator's training certificate and qualifications	08
ECR	General	Operator's training certificate and qualifications	09
ECR	Tool	Certificate of Calibration: Gas Flow Meter	10
ECR	Tool	Certificate of Calibration: Micrometer	04
ECR	Tool	Certificate of Calibration: Thermometer Probe	05
ECR	Tool	Certificate of Calibration: Thermometer	73
ECR	Tool	Certificate of Calibration: Thermometer Probe	76
ECR	Tool	Certificate of Calibration: Thermometer Probe	80
ECR	Material	Certificate of Analysis (CO2 sample, ~91% Ar/N2)	84
ECR	Material	Certificate of Analysis (10 ppm H2, 5 ppm O2, 5 ppm CO2, 5 ppm CO, 5 ppm CH4, 5 ppm H2O, balance N2)	85
ECR	General	ECR Logon	86
ECR	General	Certificate of System Qualification	87
ECR	General	Certificate of System Qualification	88
ECR	General	Certificate of System Qualification	89

© 2022 by Agilent Technologies

General

Document Name: ACE Self Qualification Certificate

Agilent Technologies

Agilent Compliance Engine Self Qualification

© 2022 by Agilent Technologies

Classified

Document Name: Operator's training certificate and qualifications

Agilent Technologies

Certificate of Completion

Learner Name: [redacted]

Title Of Course: [redacted]

Completion Date: July 5, 2022

Confirmed By Instructor: Training at Agilent

[redacted]

[redacted]

Uncontrolled Document

© 2022 by Agilent Technologies

Agilent Global Job Compliance Services

Classified

Document Name: Operator's training certificate and qualifications

Agilent Technologies

Certificate of Completion

Learner Name: [redacted]

Title Of Course: [redacted]

Completion Date: [redacted]

Confirmed By Instructor: Training at Agilent

[redacted]

[redacted]

Date: [redacted]
System ID: [redacted]
Page 1 of 1

Uncontrolled Document

© 2022 by Agilent Technologies

Agilent Global Job Compliance Services

Classified

Document Name: Operator's training certificate and qualifications

Agilent Technologies

Certificate of Completion

Learner Name: [redacted]

Title Of Course: [redacted]

Completion Date: [redacted]

Confirmed By Instructor: Training at Agilent

[redacted]

[redacted]

Date: [redacted]
System ID: [redacted]
Page 1 of 1

Uncontrolled Document

© 2022 by Agilent Technologies

Agilent Global Job Compliance Services

Classified

Document Name: Operator's training certificate and qualifications

Agilent Technologies

Certificate of Completion

Learner Name: [redacted]

Title Of Course: [redacted]

Completion Date: [redacted]

Confirmed By Instructor: Training at Agilent

[redacted]

[redacted]

Date: [redacted]
System ID: [redacted]
Page 1 of 1

Uncontrolled Document

© 2022 by Agilent Technologies

General

Document Name: Operator training certificate and qualification

Agilent Technologies

Certificate of Completion

Learner Name: Mahaguthe Sanjay Vasudeo

Title of Course: GC-Agilent 8890 and 8860 GC Hardware Maintenance and Operation

Completion Date: 15-Feb-2022

Completed By Company: Learning @ Agilent

All items and Programs mentioned in this Certificate are registered trademarks or trademarks of Agilent Technologies or its affiliates in the United States and/or other countries. All other trademarks are the property of their respective owners. Information, text, and representations published in this document is the property of Agilent Technologies or its affiliates and is subject to change without notice. Agilent Technologies or its affiliates reserve the right to change the offerings and specifications of Agilent in this document at any time without notice. Agilent Technologies or its affiliates makes no warranty of any kind with regard to this document and disclaims the implied warranties of merchantability and fitness for a particular purpose. Agilent Technologies or its affiliates shall not be liable for errors contained herein or for incidental or consequential damages in connection with the furnishing, performance or use of this document or the information contained herein. Should Agilent Technologies or its affiliates and the user have a separate written agreement with warranty terms covering the material in this document that conflict with these terms, the warranty terms in the separate agreement shall control.

Uncontrolled Document

© 2022 by Agilent Technologies

Agilent CrossLab Compliance Services

General

Document Name: Operator training certificate and qualification

Agilent Technologies

Certificate of Completion

Learner Name: Mahaguthe Sanjay Vasudeo

Title of Course: GC-Agilent 8890 and 8860 GC Hardware Maintenance and Operation

Completion Date: 15-Feb-2022

Completed By Company: Learning @ Agilent

All items and Programs mentioned in this Certificate are registered trademarks or trademarks of Agilent Technologies or its affiliates in the United States and/or other countries. All other trademarks are the property of their respective owners. Information, text, and representations published in this document is the property of Agilent Technologies or its affiliates and is subject to change without notice. Agilent Technologies or its affiliates reserve the right to change the offerings and specifications of Agilent in this document at any time without notice. Agilent Technologies or its affiliates makes no warranty of any kind with regard to this document and disclaims the implied warranties of merchantability and fitness for a particular purpose. Agilent Technologies or its affiliates shall not be liable for errors contained herein or for incidental or consequential damages in connection with the furnishing, performance or use of this document or the information contained herein. Should Agilent Technologies or its affiliates and the user have a separate written agreement with warranty terms covering the material in this document that conflict with these terms, the warranty terms in the separate agreement shall control.

Uncontrolled Document

© 2022 by Agilent Technologies

Agilent CrossLab Compliance Services

Tools

Document Name: Certificate of Calibration Gas Flowmeter

Trescal

Certificate of Calibration

Cert. No. MSYP- 22000830

Uncontrolled Document

© 2022 by Agilent Technologies

Agilent CrossLab Compliance Services

Document Name: Certificate of Calibration Gas Flowmeter

Uncontrolled Document

© 2022 by Agilent Technologies

Document Name: Certificate of Calibration Gas Flowmeter

Trescal

Certificate of Calibration

Cert. No. PSYP-E2000828

© 2022 by Agilent Technologies

Document Name: Certificate of Calibration Gas Flowmeter

© 2022 by Agilent Technologies

Document Name: Certificate of Calibration Manometer

ISOLAB

CERTIFICATE OF CALIBRATION

© 2022 by Agilent Technologies

Document Name: Certificate of Calibration Manometer

Document Name: Certificate of Calibration Slip-on probe

CERTIFICATE OF CALIBRATION

No.: C/2214/384
Date of Issue: 29th August 2022

Digital Thermistor
Serial No: 99846197

Test: 1 of 1
Calibration Start Date: 29th August 2022
Calibration End Date: 29th August 2022

Results of Calibration

Applied Temperature (°C)	UUT Indicated Value (°C)	Correction (°C)	Uncertainty (±°C)	Is Error
0.0	0.0	0.0	0.0	0.0
37.0	37.0	0.0	0.1	0.0
100.0	100.0	0.0	0.1	0.0
75.0	37.0	0.0	0.1	0.0
0.0	0.0	0.0	0.0	0.0

Applied Temperature (°C)	UUT Indicated Value (°C)	Correction (°C)	Uncertainty (±°C)	Is Error
0.0	0.0	0.0	0.0	0.0
37.0	37.0	0.0	0.1	0.0
100.0	100.0	0.0	0.1	0.0
75.0	37.0	0.0	0.1	0.0
0.0	0.0	0.0	0.0	0.0

Remarks:
1. No Adjustment Performed as result of this calibration.
2. Although there may be calibration due date on the UUT, calibration performed is subject to the "As Found" and "As Left" results of calibration certificate.

Calibrated By
Calibration Officer

Uncontrolled Document

Document Name: Certificate of Calibration Thermometer

Uncontrolled Document

Form

Document Name: Certificate of Calibration Thermometer Probe

CERTIFICATE OF CALIBRATION

ISOLAB
Excellence in Calibration

No.: C/2222/201
Date of Issue: 09th September 2022

Issued By: ISOLAB (Singapore) Pte Ltd

Requested by: Agilent Technologies Pharmatech Ltd
1 Tai Seng Avenue #03-01
Agilent IT Park@Aviva Building
Singapore 534184

Test: 1 of 1

Description
Instrument: Liquid Thermometer (Pilot Station)
Model: 6418
Serial No: 6418-2020-24
Asset No: Unit Under Test (UUT)
Calibration Range: 0 to 200 °C
Calibration Start Date: 07th Sept 2022
Calibration End Date: 09th September 2022
Issue Date Issued: 12th September 2022

Results of Calibration
The Type S Thermometer (Pilot Station) has been calibrated at ISOLAB's laboratory under the condition stated in the same and in accordance to procedure ISOLAB-04. The Type S Thermometer (Pilot Station) has calibrated by comparison with a Reference Master Thermometer Unit. The Reference Master Unit calibrated traceable to national standard(s) maintained by National Metrology Center (NMC) Singapore, Nanyang Technological University, Singapore (NTU), [To enter name] Physical Laboratory (NPL). The calibration was performed as a result of the Manufacturer Thermometer Probe of (Type S) 6418.

The following calibration equipment were used during the calibration:

S/N	Reference Equipment	Serial Number	Cal. Certificate	Next Calibration Due Date
1.	Reference Device	6418-1	C/2214/384	29th August 2023
2.	Reference Device	6418-2	C/2214/385	29th September 2023
3.	Reference Device	6418-3	C/2214/386	29th September 2023
4.	Reference Device	Platinum Resistance	C/2214/387	29th September 2023
5.	Reference Device	11Feb1751111955	C/2214/388	27th May 2023
6.	Reference Thermometer, Type S Unit	1234567-1	C/2214/389	27th February 2023

Remarks:

Calibrated By
Calibration Officer

Approved By
Ronald Ngeow
Approved Signatory

** This certificate is issued in accordance to accreditation of the Republic of Singapore under the Singapore Accreditation Council.

This certificate may not be reproduced, other than in full, except with the prior approval of ISOLAB.

ISOLAB (Singapore) Pte Ltd
11 Jalan Ho Ah Kin Singapore 459797 Tel: (65) 6345 6789 Fax: (65) 6345 6790
Email: calibration@isolab.sg Web: www.isolab.sg

Uncontrolled Document

Document Name: Certificate of Calibration Thermometer Probe

Notes

1. The calibration was performed using equipment traceable to national standards and in accordance with the specified procedure. Uncertainties of measurement are stated at a confidence level of approximately 95% (coverage factor k=2) unless otherwise stated.
2. Unless otherwise stated, calibration results apply only to the item submitted and identified on this certificate. This certificate shall not be reproduced except in full, without written approval of the issuing laboratory.
3. Measurements and observations of calibration are recorded as found. Do not rely on the last calibration of your instrument unless specified by ISOLAB's QA system requirements. Refer to your quality system requirements or applicable regulations for recommended calibration intervals.
4. Additional copies of this certificate may be obtained for a fee unless otherwise stated. Requests for copies should be made within 30 days of the calibration date. After this period, records may be archived or disposed of.
5. This certificate shall not be used as a guarantee of performance by any agency or organization. Any misuse, including duplication or falsification, will be subject to legal action.
6. Results of calibration are valid only at the time of calibration. The user is responsible for the subsequent performance of the instrument and for determining the appropriate calibration interval.
7. This certificate is issued in accordance with the laboratory accreditation requirements of the Singapore Accreditation Council. The laboratory is accredited for the calibrations listed in the scope of accreditation. Calibrations outside the scope of accreditation are performed using traceable methods.
8. Where applicable, the following statements of conformity apply: The measurement results fall within the specified tolerance limits. Uncertainty of measurement has been taken into account in accordance with ISO/IEC Guide 98-3 (GUM).
9. This certificate may not be reproduced, other than in full, except with the prior written approval of ISOLAB. Any alteration or unauthorized use of this certificate is strictly prohibited.

Uncontrolled Document

Document Name: Certificate of Calibration: Thermometer Probe

CERTIFICATE OF CALIBRATION

No.: CC21252
Date of Issue: 31st August 2021

Type K Thermocouple Wire Sensor
Serial No.: 0487B0A1B0F0 (P)

Date
Calibration Due Date: 31st August 2022
Calibration Due Date: 31st August 2021

Results of Calibration

Oven Temperature (°C)	UUT Average Value (°C)	Correction (°C)	Uncertainty (°C)	k Factor
5.0	-0.1	0.1	0.1	2.00
25.0	25.0	0.0	0.1	2.00
125.0	125.0	0.0	0.1	2.00

Oven Temperature (°C)	UUT Average Value (°C)	Correction (°C)	Uncertainty (°C)	k Factor
5.0	-0.1	0.1	0.1	2.00
25.0	25.0	0.0	0.1	2.00
125.0	125.0	0.0	0.1	2.00

Remarks:

Issued by:
Technical Officer

Uncontrolled Document

Document Name: Certificate of Calibration: Thermometer Probe

Uncontrolled Document

Document Name: Certificate of Calibration: Thermometer

ISOLAB

CERTIFICATE OF CALIBRATION

No.: CC21252
Date of Issue: 31st August 2021

Issue by: ISOLAB (SINGAPORE) PTE LTD

Customer:
Address:
Instrument:
Model:
Serial No.:
Calibration Range:
Calibration Date:
Calibration Due Date:
Next Due Date:

Method of Calibration:

No.	Reference Instrument / Equipment	Serial Number	Cert. No.	Traceability
1.				
2.				

Calibrated By:
Technical Officer

Approved By:
Technical Signatory

Uncontrolled Document

Document Name: Certificate of Calibration: Thermometer

Terms

Uncontrolled Document

© 2022 by Agilent Technologies

Document Name: Certificate of Calibration Thermometer

CERTIFICATE OF CALIBRATION

No. CC23182
Date of Issue: 11th August 2022

Agilent Thermometer
Serial No. MY49520

Test: 1 of 1
Calibration Date Code: 11th August 2022
Calibration Due Date: 11th August 2024

Results of Calibration

The results of the calibration are given in the below table. The reported measurement of the measurement are at a 95 % level of confidence (approximately 2 SD) and are in range factor 'k' as recommended.

Channel 1 Measurements (1 Point)

Applied Voltage (mV)	Applied Temperature (°C)	Average DUT Indicated Value (°C)	Uncertainty (°C)	Correction (°C)	In Spec.
0.000	0.0	0.1	±0.1	-0.1	Pass
4.096	100.0	100.1	±0.1	-0.1	Pass
12.209	298.0	298.1	±0.1	-0.1	Pass
20.322	496.0	496.1	±0.1	-0.1	Pass

Channel 2 Measurements (1 Point)

Applied Voltage (mV)	Applied Temperature (°C)	Average DUT Indicated Value (°C)	Uncertainty (°C)	Correction (°C)	In Spec.
0.000	0.0	0.1	±0.1	-0.1	Pass
4.096	100.0	100.1	±0.1	-0.1	Pass
12.209	298.0	298.1	±0.1	-0.1	Pass
20.322	496.0	496.1	±0.1	-0.1	Pass

Notes

1. The calibration and results are traceable to the International System of Units (SI) through calibrations performed at Agilent Cross Lab Compliance Services, which are traceable to the International Temperature Scale of 1990 (ITS-90) and the International Practical Temperature Scale of 1968 (IPTS-68).
2. The uncertainty of measurement is stated as the standard uncertainty multiplied by the coverage factor k=2, which for a normal distribution corresponds to a coverage probability of approximately 95%. The uncertainty of measurement was determined in accordance with EA-4/02 M:2013 and the Agilent Cross Lab Compliance Services Quality Manual.
3. Agilent Cross Lab Compliance Services is accredited to ISO/IEC 17025:2017 by the United Kingdom Accreditation Service (UKAS). This certificate may not be reproduced, other than in full, except with the prior written approval of Agilent Cross Lab Compliance Services.
4. Calibrations are performed using calibrated reference standards which are traceable to the International System of Units (SI).
5. Unless otherwise agreed, this instrument was calibrated as received. The results given in this certificate relate only to the items calibrated.
6. Agilent Cross Lab Compliance Services shall not be liable for any loss or damage howsoever arising as a result of the use of this certificate or the information contained herein.
7. This certificate shall not be reproduced except in full without the written approval of Agilent Cross Lab Compliance Services.

Approved By:

Agilent Cross Lab Compliance Services
Approved Signatory

Uncontrolled Document

© 2022 by Agilent Technologies

Agilent CrossLab Compliance Services

Document Name: Certificate of Calibration Thermometer

Date: February 23, 2023 3:23:17 PM
System ID: UKE-TCH-001_CAL-INT-0001

Uncontrolled Document

© 2022 by Agilent Technologies

Agilent CrossLab Compliance Services

Document Name: Certificate of Calibration Thermometer Probe

CERTIFICATE OF CALIBRATION

ISOLAB

No. CC23182
Date of Issue: 09th September 2022

Item No. ISOLAB-SERIC/KOMBELT/T.E.T.D

Requested by: Isolab Laboratorio Ltd
Unit 3 The Long Building, Old Town, Lane
Old Town, Northamptonshire
Bridgeton, NN40 7DW

Identification: 23 Deg
Nominal Temperature: 23 ± 0.1°C
Number of Readings: 23 ± 0.1°C to ambient conditions
Test: 1 of 1

Description:
Nominal: Type K Needle Probe
Model: Temp
Serial No: 1.5 M Cable Length
Probe No: 1.5 M Cable Length
Manufacturer: Isolab Laboratorio Ltd
Calibration Period: 0.5 to 23.0 °C
Calibration Date: 09th September 2022
Calibration Due Date: 09th September 2023
Date Rec'd: 09th September 2022

Method of Calibration

The Type K Needle Probe was calibrated in accordance with the method, conditions and procedures described in Isolab Laboratorio procedure SOP/T/ISOLAB. The Type K Needle Probe was calibrated by comparison with a reference Master or standard temperature probe. The Calibration Master was calibrated in accordance with traceable to national measurement standards maintained at National Metrology Institutes (NMIs) e.g. National Physical Laboratory (NPL), United Kingdom, Bundesanstalt für Materialforschung und -prüfung (BAM), Germany and National Institute of Standards and Technology (NIST), United States of America (USA). The calibration was performed in terms of the International Temperature Scale of 1990 (ITS-90).

The following reference standards were used during the calibration:

ID	Reference Equipment / Comments	Serial Number	Cal. Certificate	Date Calibration Due Date
a.	Reference Master	00001	CC23001-1	23rd August 2022
b.	Reference Master	00002	CC23001-2	23rd August 2022
c.	Reference Master	00003	CC23001-3	23rd August 2022
d.	Reference Multimeter	Fluke 1587	Fluke	23rd August 2022
e.	Reference Calibrator	Fluke 724	Fluke	23rd August 2022
f.	Reference Thermometer Unit B	00004	CC23004-1	23rd August 2022

Calibrated By:

Approved By:

Agilent Cross Lab Compliance Services
Approved Signatory

* This calibration has been carried out in accordance with the terms of accreditation held by the Agilent Accreditation Council.
** Environmental conditions were maintained in accordance with the Agilent Accreditation Council.

This certificate may not be reproduced other than in full, except with the prior written approval of Agilent Cross Lab Compliance Services.

Uncontrolled Document

Date: February 23, 2023 3:23:17 PM
System ID: UKE-TCH-001_CAL-INT-0001

Uncontrolled Document

CERTIFICATE OF CALIBRATION

© 2022 by Agilent Technologies
Agilent Scientific Compliance Services
Document Name: Certificate of Calibration Thermometer Probe

CERTIFICATE OF CALIBRATION

ISOLAB

© 2022 by Agilent Technologies
Agilent Scientific Compliance Services
Document Name: Certificate of Calibration Thermometer Probe

© 2022 by Agilent Technologies

Document Name: Certificate of Calibration: Thermometer Probe

CERTIFICATE OF CALIBRATION

No.: [illegible]

Date of Issue: 06th September 2022

Type & Serial: Probe

Asset No: [illegible]

Tag: [illegible]

Calibration Issue Date: [illegible]

Calibration Due Date: [illegible]

Results of Calibration

The results of the calibrations are stated in the below table. The expanded uncertainties of the measurements are that of calibration at approximately 95% in accordance with the "k" as mentioned below.

Calibration Results (+) Graph

Actual Temperature (°C)	UUT Average Value (°C)	Correction (°C)	Uncertainty (°C)	k Factor
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

Calibration Results (+) Graph

Actual Temperature (°C)	UUT Average Value (°C)	Correction (°C)	Uncertainty (°C)	k Factor
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

Remarks:

1. The instrument/Offset were found having calibration
2. [illegible]

[illegible]

Calibration Officer

Uncontrolled Document

© 2022 by Agilent Technologies

Agilent Cross-Lab Compliance Services

Document Name: Certificate of Calibration: Thermometer Probe

[illegible]

Uncontrolled Document

© 2022 by Agilent Technologies

Materials

Document Name: Certificate of Analysis [illegible]

Agilent Technologies

Certificate of Analysis

[illegible]

[illegible]

[illegible]

Uncontrolled Document

© 2022 by Agilent Technologies

Agilent Cross-Lab Compliance Services

[illegible]

[illegible]

Uncontrolled Document

© 2022 by Agilent Technologies

General

Document Name: CDR Log In

Uncontrolled Document

© 2022 by Agilent Technologies

General

Document Name: Certificate of System Qualification

Software Verification Report

Details

Uncontrolled Document

© 2022 by Agilent Technologies

General

Document Name: Continuous System Qualification

Software Verification Report

Uncontrolled Document

© 2022 by Agilent Technologies

General

Document Name: Continuous System Qualification

Software Verification Report

Details

Uncontrolled Document

© 2022 by Agilent Technologies

Agilent Technologies Materials: 5191-5436

This section lists above for a set of Agilent materials sourced for an qualification. If devices part numbers are listed for an item, only the version that apply to the tested configuration are used.

Redeploy Kits

For 5977[1] 7693[2][3]: 5190-5978 seals, for 5977[2] more product Response Levels

Part No. 7693-0282[3] or equivalent

5190-5978 (1) | Amount 5900[1][2]

Capillary Column

HP-5 30 m x 0.32 mm x 0.25 um, for 5191 Response Levels, all other intermediate combinations

Part No. 19091J-413[1] or equivalent

19091J-413 (HP) or equivalent (5%-ph) 4900 GC)

Capillary Column (5113)

DB-1 30 m x 0.32 mm x 1.0 um, for 4C22

Part No. [1] -1212 or equivalent

Capillary Column (5110, 7G, G-7107)

HP-5MS 30 m x 0.25 mm x 0.25 um, for 5110, 7G, and G-7107 seals

Part No. 19091S-413[1] or equivalent (5975 and below)

19091S-4123 or equivalent (5977 and up, 7G, and G-7047)

Capillary Column (for 7 bp)

HP-5MS 20 m x 0.18 mm x 0.20 um, for five 7 bp seals

Part No. CP5944 or equivalent

Uncontrolled Document

© 2022 by Agilent Technologies

Electronic Signature

Purpose

This signature page was created and published because the ACE 21 CFR Part 11 software was executed, which is used for the entire document, including attachments. This ACE sign-off is an electronic signature that requires both distinct identification components by unique user name and secure password. The Agilent representative who has achieved this service understands the meaning and responsibilities of an electronic signature. As a trained official operator, the Agilent representative has a unique password and logon to access ACE and electronically sign this document. (Other e-signatures may be applied to this document using a Document Content Office agreement or other suitable method (MS Word / Acrobat data access and control procedures.)

Details

Full Name of Signer	[illegible] Smith
Logged On User Name	[illegible]@[illegible].com
Signature Created Date	February 23, 2022
Reason for Signature	Executed process and customized this original version of document

Regulatory Disclaimer

This document provides a method to verify and record executed configuration and compliance of people, operation. It has been and tested from and representation of applicable regulations as internal industry best practices. This document is designed to provide an important component in a complete compliance package. Validation depends upon many factors and use of this product alone does not assure compliance. Agilent Technologies makes no promises or representations as to its sufficiency for any specific regulatory program.

Warranty

Agilent Technologies expressly warrants to or error in this material, including but not limited to, the implied warranties of merchantability and fitness for a particular purpose. Agilent Technologies shall not be liable for errors contained herein or for incidental or consequential damages in connection with the furnishing, performance, or use of this material.

Uncontrolled Document

© 2022 by Agilent Technologies

[illegible]

Time	Transaction Steps	Activity Performed	Type of Transaction	Detailed Information
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

Uncontrolled Document

© 2022 by Agilent Technologies

[illegible]

Time	Transaction Steps	Activity Performed	Type of Transaction	Detailed Information
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

Uncontrolled Document

Uncontrolled Document

Uncontrolled Document

Uncontrolled Document

Uncontrolled Document

Uncontrolled Document

© 2022 by Agilent Technologies

Certificate of System Qualification

OQ/PQ

System ID
Organization Name
Organization Location
Date
SOP Name
SOP Revision
Overall Qualification Status Pass

System Response and Basic Safety and Operation

Name
Subpoint Status Pass

Overall System Response and Basic Safety and Operation Test Status

Pass

Inlet Pressure Decay

Name
Flow

Subpoint Status Pass
Pressure

Pressure Change
Agilent Recommended

Overall Inlet Pressure Decay Test Status

Pass

Inlet Pressure Accuracy

Name
Flow

Date
System ID

Uncontrolled Document

© 2022 by Agilent Technologies

Subpoint Status Pass

Inlet Pressure

Accuracy
Agilent Recommended

Overall Inlet Pressure Accuracy Test Status

Pass

Detector Flow Accuracy

Name
Gain

Subpoint Status Pass
Flow Type
Setpoint
Measured Flow

Accuracy
Agilent Recommended

Limit is percentage of setpoint or 0.5 ml/min, whichever is largest.

Subpoint Status Pass
Flow Type
Setpoint
Measured Flow

Accuracy
Agilent Recommended

Limit is percentage of setpoint or 0.5 ml/min, whichever is largest.

Subpoint Status Pass
Flow Type
Setpoint
Measured Flow

Accuracy
Agilent Recommended

Limit is percentage of setpoint or 0.5 ml/min, whichever is largest.

Date
System ID

Uncontrolled Document

© 2022 by Agilent Technologies

Overall Detector Flow Accuracy Test Status

Pass

Detector Flow Accuracy

Name
Gain

Subpoint Status Pass
Flow Type
Setpoint
Measured Flow

Accuracy
Agilent Recommended

Limit is percentage of setpoint or 0.5 ml/min, whichever is largest.

Subpoint Status Pass
Flow Type
Setpoint
Measured Flow

Accuracy
Agilent Recommended

Limit is percentage of setpoint or 0.5 ml/min, whichever is largest.

Subpoint Status Pass
Flow Type
Setpoint
Measured Flow
Purge Offset
Adjusted Setpoint

Accuracy
Agilent Recommended

Limit is percentage of setpoint or 0.5 ml/min, whichever is largest.

Overall Detector Flow Accuracy Test Status

Pass

DS Oven Temperature Accuracy

Date
System ID

Uncontrolled Document

Uncontrolled Document

Uncontrolled Document

Uncontrolled Document

Uncontrolled Document

Overall Signal to Noise Test Status

Pass

Uncontrolled Document

Instrument Details

Purpose

This section describes the system configuration.

Details

System

System ID	CH1211024
Manufacturer	Agilent Technologies
Name	7890
Flow Data Input	Manual Data
Temperature Data Input	Method Data or Other Data Logging

Sampler 1

Manufacturer	Agilent Technologies
Type	Injection Tower
Name	7693A
Model Number	G4513A
Serial Number	CN12205010
Firmware Revision	A.1.12
Usage	Sample Injection
Location	Front
Syringe Volume (µL)	10

Uncontrolled Document

Sampler 2

Manufacturer	Agilent Technologies
Type	Tray
Name	7693A
Model Number	G4513A
Serial Number	CN12205108
Firmware Revision	A.1.12
Vial Heater	Not Installed

Injection 1

Manufacturer	Agilent Technologies
Name	7890
Model Number	G3540B
Serial Number	CN10213001
Firmware Revision	B.02.01.1
Oven Type	Standard

Inlet 1

Manufacturer	Agilent Technologies
Name	7890
Type	SSL
Location	Front
Carrier Gas	Helium
Control Type	Electronic Pressure Control (EPC)
Purged Flow	Yes

Detector 1

Manufacturer	Agilent Technologies
Name	7890
Type	FID
Adapter	Capillary
Control Type	Electronic Pressure Control (EPC)
Location	Front
Makeup Gas	Nitrogen

Uncontrolled Document

Detector 2

Manufacturer	Agilent Technologies
Name	7890
Type	FPD+
Adapter	Capillary
Control Type	Electronic Pressure Control (EPC)
Location	Back
Makeup Gas	Nitrogen
Flow Mode Tracked	Pressure

Uncontrolled Document

© 2022 by Agilent Technologies

Electronic Signature

Purpose

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

Details

Full Name of Signer	Rajangadhar Talluri
Logged On User Name	rajangadhar.talluri@can.agilent.com
Signature Creation Date	April 18, 2022
Reason for Signature	Executed protocol and approved. End original content of document.

Regulatory Disclaimer

This document provides a process to verify and record electronic configurations and execution of proper operations. It has been created with the intention of applicable regulations as well as industry best practices. This document is designed to provide an important component of a complete compliance package. Validation should be used in many cases and are of this process alone does not assure compliance. Agilent Technologies makes no promises or representations as to its sufficiency for any specific regulatory program.

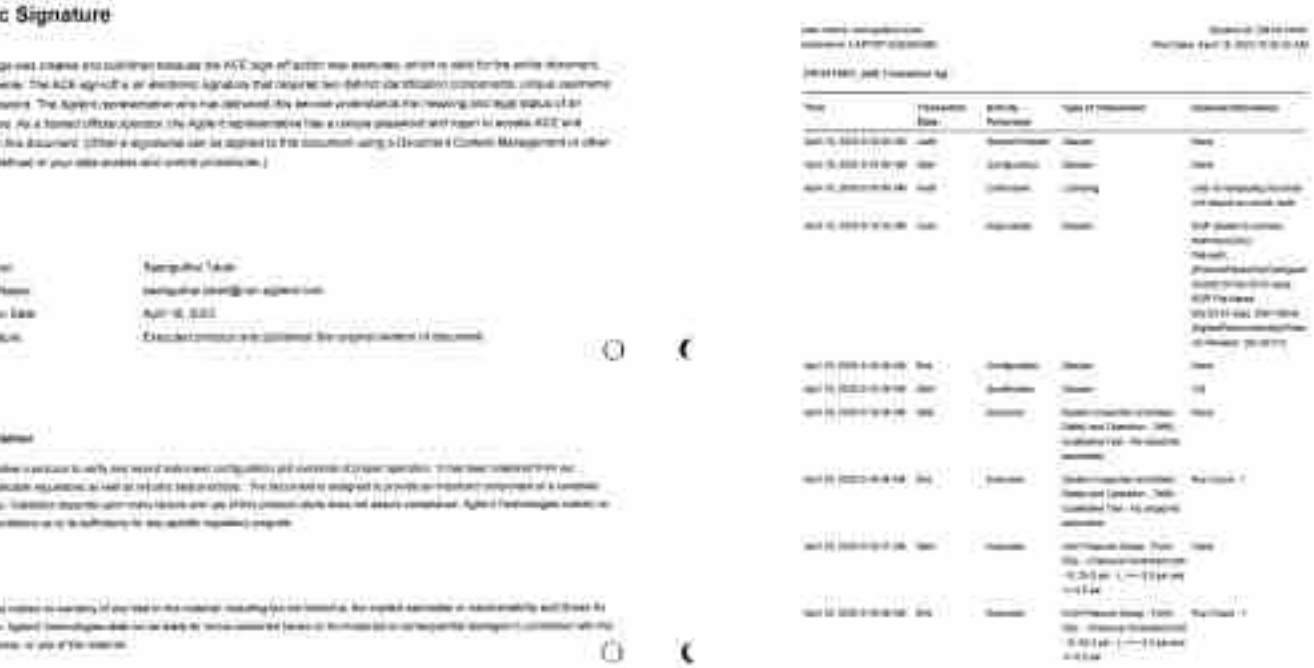
Warranty

Agilent Technologies makes no warranty of any kind in this material, including but not limited to, the implied warranties of merchantability and fitness for a particular purpose. Agilent Technologies shall not be liable for errors contained herein or for incidental or consequential damages in connection with the furnishing, performance, or use of this material.

Date: April 18, 2022 10:36:30 AM
System ID: CDT2112001

Uncontrolled Document

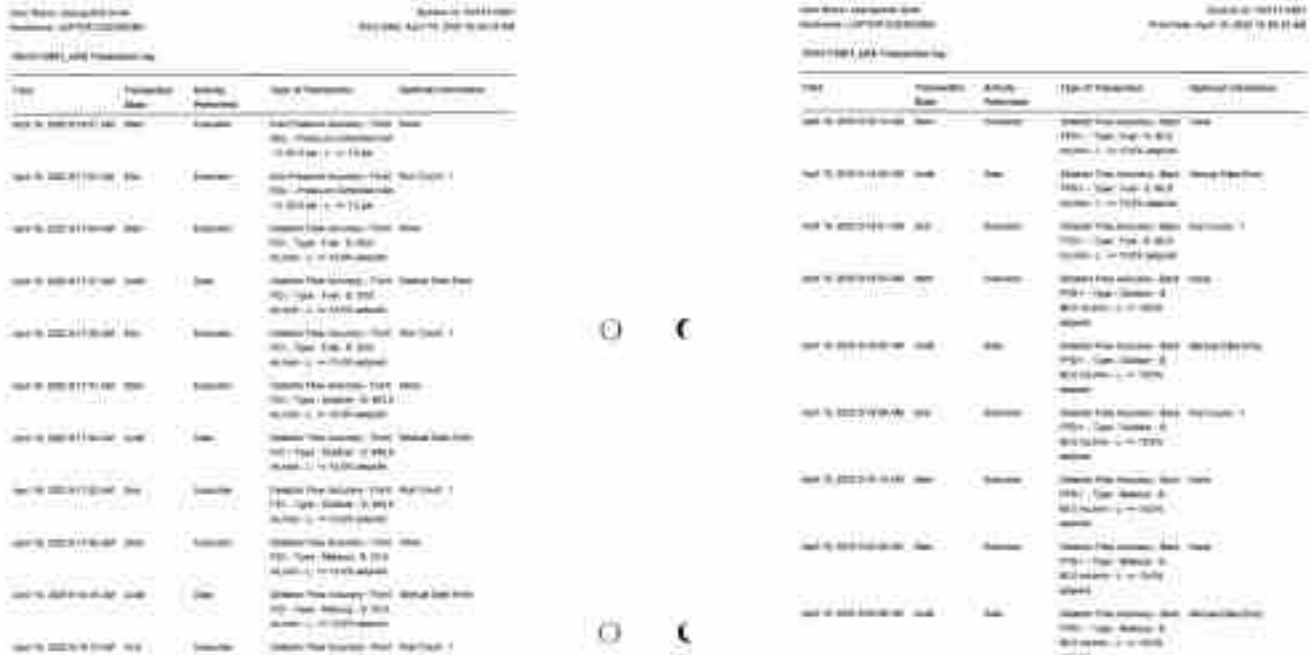
© 2022 by Agilent Technologies



Date: April 18, 2022 10:36:30 AM
System ID: CDT2112001

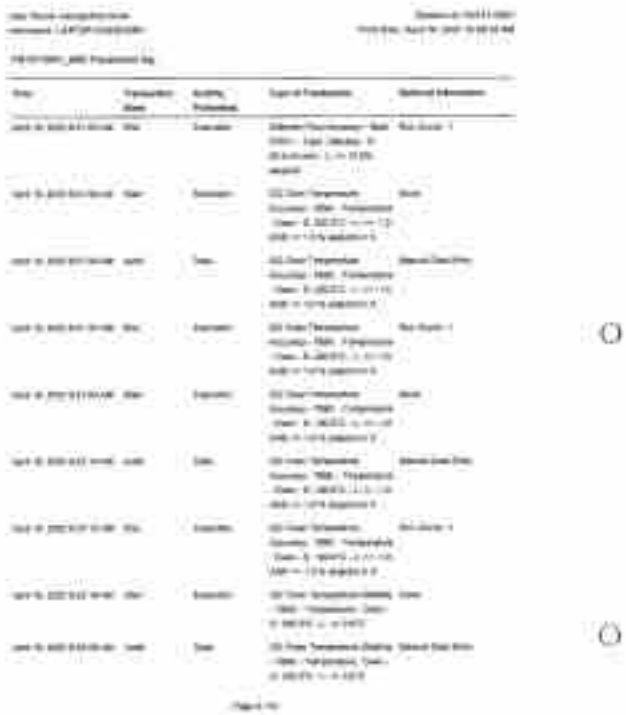
Uncontrolled Document

© 2022 by Agilent Technologies



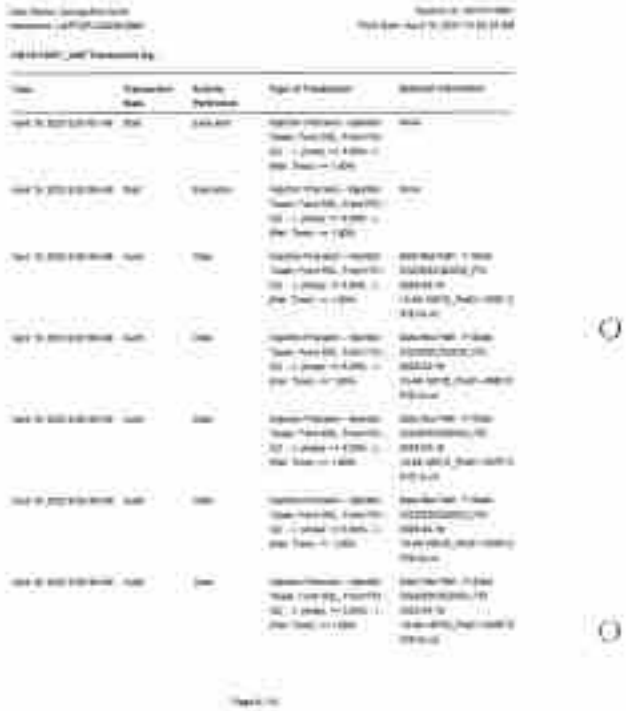
Date: April 18, 2022 10:36:30 AM
System ID: CDT2112001

Uncontrolled Document

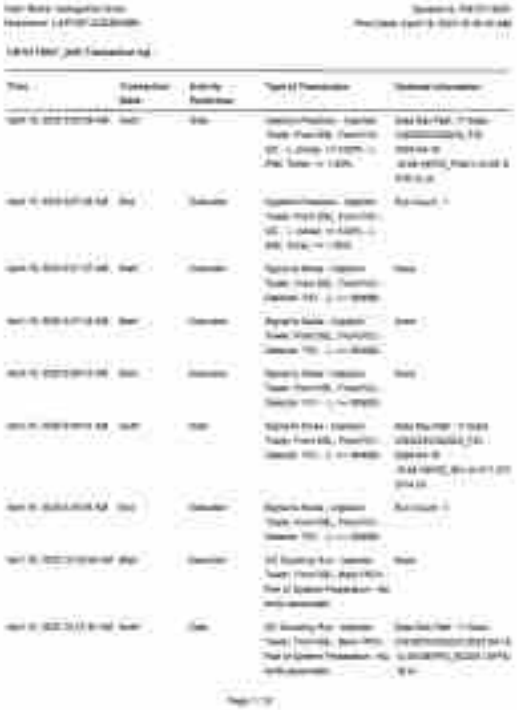


Uncontrolled Document

Uncontrolled Document



Uncontrolled Document

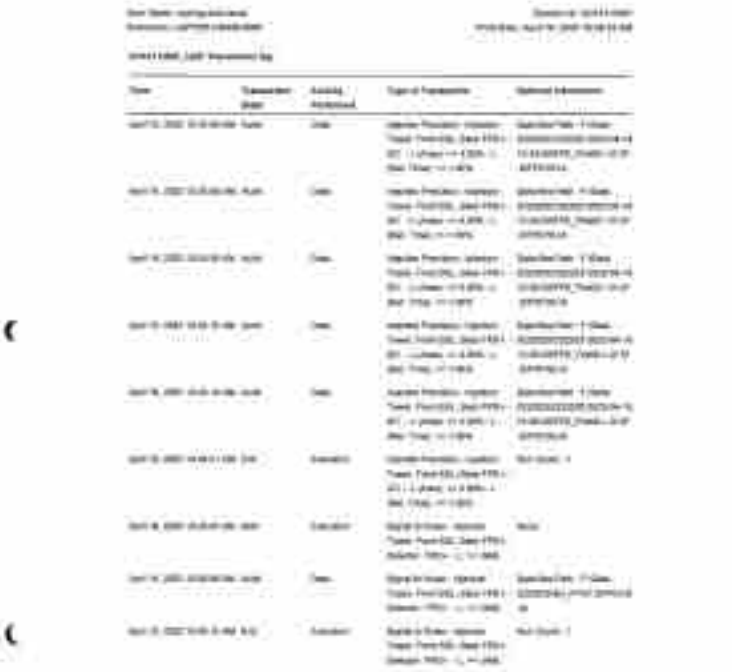


Uncontrolled Document

© 2022 by Agilent Technologies

Uncontrolled Document

© 2022 by Agilent Technologies



Uncontrolled Document

© 2022 by Agilent Technologies

Uncontrolled Document

Agilent CrossLab

Agilent CrossLab Start Up Services

Agilent 7890 Gas Chromatograph

Preventive Maintenance Checklist

[redacted]

Agilent Preventive Maintenance provides factory-recommended service for your analytical instrument 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 list will be completed at the end of the service and provided to you as a record of the preventive maintenance activities.

Agilent

Uncontrolled Document

Introduction

Customer Information

- Customers should provide all necessary operating supplies upon request of the engineer.
- A customer representative should be available to the engineer while performing the preventive maintenance procedures.
- Any parts, not included in the Parts 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 some or special procedures, and/or parts for the maintenance service, then these must be ordered separately and charged as a repair, which may incur additional costs.

Important Customer Web Links

- For more information about **Agilent Technologies services**, please visit our website using the following link: http://www.agilent.com/en-us/products/customer-services/service-support
- The **Agilent Community** is an excellent place to get answers, collaborate with others about applications and Agilent products, and find in depth documents and videos relevant to Agilent technologies. Visit https://community.agilent.com/welcome
- To access **Agilent University**, visit http://www.agilent.com/crm/education/training to learn about training options, which include online, classroom and onsite delivery. A training specialist can work directly with you to help determine your best options.
- A useful **Agilent Resource Center** web page is available, which includes short videos on maintenance, quick lists of consumables for new instruments, and other valuable information. Check out the Resource Page here: https://www.agilent.com/en-us/agilentresources
- Need technical support, FAQs, supplies? – visit our **Support Home page** http://www.agilent.com/search/support
- **Videos** about specific preparation requirements for your instrument can be found by searching the **Agilent** YouTube channel at http://www.youtube.com/user/agilent
- **7890B Manuals** are also available on Agilent.com:
  - **Safety**
    https://www.agilent.com/cs/library/usermanuals/public/7890B_Safety.pdf
  - **Installation and First Startup**
    https://www.agilent.com/cs/library/usermanuals/Public/7890B_Installation.pdf
  - **Operation Manual**
    https://www.agilent.com/cs/library/usermanuals/Public/7890B_Operation.pdf
  - **Maintaining Your GC**
    https://www.agilent.com/cs/library/usermanuals/public/G3452-
    90570_7890B_Maintaining_GC_ENG.pdf

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 "0" or tick mark "✓".
- Check **"Section not applicable"** check boxes to indicate services/tasks not performed, 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 the unit. If there are any applicable "Safety" or "Modifications Recommended" service notes, plan to implement the changes on this visit 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 environment control software.

Uncontrolled Document

Uncontrolled Document

System Information

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

Instrument System Name and ID	
Instrument System Site and Location	

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

Preparation

☐ Discuss any specific issues with the customer before starting.
☐ Review the instrument logbook for recorded problems and performance.
☐ Save instrument control settings before starting the procedure.
☐ Perform a general inspection of the system for cleanliness.
☐ Check for proper installation of parts, assemblies, services etc.
☐ Check system for required installation of consumables, settings as defined by current Service Notes.
☐ Check for required firmware updates and verify with customer if they would like them installed.
☐ Before starting the following procedure, record the Detector Signal Output(s) in the results table. If the GC is turned OFF or in a sleep mode, completing the detector stabilization after the service is not possible.

Preventive Maintenance Procedure

Clean and inspect GC

☐ Unplug power cord from the power source.
☐ Open GC covers and vacuum/remove any dust debris. Pay particular attention to cooling fans.
☐ Inspect internal connectors for proper contact and attachment.
☐ Reconnect Power to the GC. Power the GC on and verify the power on self-test passed.
☐ Verify oven metal spins freely and turns on with the oven door closed. (If fails the door is opened)
☐ Verify operation of all other fans - the inlet and EPC cooling fans.
☐ Verify valve module multi flap assembly is operating smoothly while moving and cooling the oven.

Inlet and detector consumable replacement

☐ For the inlets installed, perform inlet maintenance as defined in the 7890 manual - "Maintaining Your GC". For the inlet(s) installed:
☐ Replace the split vent trap cartridge (filter or unit) with these parts: Split/Splitless Capillary (SSL), Multimode Inlet (MMI), Programmed Temperature Vaporizer (PTV), Volatiles Interface (VI).
☐ If the inlet system in use is a split mode with manual setting, inspect and clean the split vent tube 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 ignitor shows any buildup of deposits or corrosion, replace the ignitor. Examine the FID collector and clean assemblies for contamination – clean as necessary.

Zero Sensors and Leak test

☐ Zero all pressure sensors per the procedure in the 7890 "Advanced User Guide".
☐ Perform inlet pressure decay test(s) as defined in the 7890 "Troubleshooting Manual".
(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).
☐ Record if test passed or failed in the results table.

Uncontrolled Document

Uncontrolled Document

ALS Maintenance

- ☐ **Section NOT applicable**
- ☑ Check all tubing and configuration settings between GC, loop and injection
- ☑ Vacuum or remove any dust, especially around fans
- ☑ Check operation of all fans
- ☑ Check pumps for smooth plunger operation
- ☑ Check for smooth operation of the needle syringe – clean if necessary

Restore instrument

- ☑ Restore the normal operating conditions or customer method using the loop system
- ☑ Purge the system with carrier flow for 15 minutes
- ☑ Bake out the system, then restore the normal operating conditions
- ☑ After equilibration, check and record the post PM detector signal output values. Results should be similar or lower than the detector outputs recorded prior to PM.
- ☑ Perform a manual check-out. If there is a routine PM, inject the customer's sample using the 8 x 8 methods. This will act as a final checkout of both the ALS and the GC.

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

Uncontrolled Document

Signature Page

Service Review

- ☑ Attach any additional reports and historical service data to this documentation.
- ☑ Record the Preventive Maintenance service activity in the customer's records/logbook.
- ☑ Update/view instrument maintenance counters as appropriate.
- ☑ Affix the PM sticker to the system or instrument (optional) based on the customer's request.
- ☑ Complete the Service Engineer Comments section if there are additional comments.
- ☑ Review with the customer the service parts replaced, and test results obtained.
- ☑ If the instrument firmware was updated, record the details of the change in the Service Engineer's Comments box or if necessary, in the customer's CE records.
- ☑ Supply the customer with a copy of the Smart Alerts flyer.
- ☑ Describe Smart Alerts to the customer.
- ☑ Install Smart Alerts if requested.

7890 GC Test Results Table

Detector Signal Outputs	Before PM Service	After PM Service
Front detector output	9.6	11.7
Back detector output	10.8	12.4
AUX detector output	4.26	4.96
Pressure decay test	**Expected test result**	**Actual test result**
Front inlet pressure decay test	Pass	Pass
Back inlet pressure decay test	Pass	Pass

Uncontrolled Document

7890 Parts List Table

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

Part description	Part number	Product or model when used	Quantity consumed
SSL Capillary inlet PM kit, Splitless	5190-0451	7890A/B	1
SSL Capillary inlet PM kit, split	5188-6496	7890A/B	1
SSL Capillary Ultra Inert inlet Gold seal with liner kit	5190-1434	7890A/B	1
SSL Capillary Ultra Inert inlet Splitless Liner-Single taper with Wool, Pkg/	5190-2293	7890A/B	1
SSL Capillary Ultra Inert Gold Low Pressure Drop Split Liner-with Glass Wool	5190-2295	7890A/B	1.0
PTV inlet PM kit	5188-6498	7890A/B	1
Split/splitless PTV inlet, single cartridge (for 6890 PTV & on)	5188-6499	7890A/B	1
MMI Cleaning Kit	5190-6499	7890A/B	1
PTV Septumless Head Rebuild Kit	5182-4767	7890A/B	1
PTV Septumless Head Teflon Guide	5182-5748	7890A/B	1
Agilent Spine plug assembly with O-ring	19231-00880	7890A/B	1
PTV Solvent Rebuild O-ring Kit	0100-1308	7890A/B	1
Standard, 0.1 inch ID Jet for capillary FID base	5181-8958	7890A/B	1
High Temperature, 0.18 inch FID Jet for capillary FID base	5181-8963	7890A/B	1
Standard, 0.1 inch FID Jet for packed columns with packed ID base	18710-20709	7890A/B	1
Standard, 0.1 inch FID Jet for capillary column with packed adaptable FID base	19244-80850	7890A/B	1
High Temperature, 0.18 inch FID Jet for capillary column with packed adaptable FID base	19244-80851	7890A/B	1
NPD Jet, universal FID, 0.11 inch ID	5181-8959	7890A/B	1
NPD Jet, universal FID, 0.11 inch ID, Extended Tip	5181-8959	7890A/B	1
SSL Capillary Ultra Inert Inlet Gold Seal with Washer	5190-2292	7890A/B	1
SSL Capillary Ultra Inert Inlet Splitless Liner-Single taper with Glass Wool	5190-2293	7890A/B	1
PTV GC Column Replacement Kit, if needed	5183-4383	7890A/B	1

Uncontrolled Document

Service Engineer Comments

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

Service Completion

Service request number: [illegible] Date service completed: 11 Apr/2019

Agilent signature: [illegible] Customer signature:

Total number of pages in the document: 11 Pages

Uncontrolled Document

Do not include this section/page in the published, customer-facing PDF version.

This page is only relevant for Agilent source documents for document control purposes and is NOT intended for customer viewing. Refer to the SPDHW sharkfin authoring Guide for more information.

Document Control Logs

Revision Log

Revision	Date	Author	Reason for update
Revision of document	Date of revision	Author of document	Author to describe main features/changes made for this specific revision
1.0 Draft	4-Mar-2011	Dave Park	Migrated the content of revision A.01.09 to the new Agilent template. Reviewed by subject matter expert, Dave Park.
1.1 Draft	01-Jun-2015	Dave Park	Added Soft Yard Key to HMILITV and V5 - also PTV part #'s Mid Note.
1.2 Draft	01-March-2019	Dave Park	Added Ultra Inert Gold Seal and Liner to 20 Consumables
A.01.11	10-Dec-2020	Dave Park	Added step to perform maintenance on the Soft Yard Tube and .018" HD UP part numbers - Yusuf broken web links
1.20	30-Dec-2020	Katy Rowntree	updated New Template and terminology changes, harmonization to introduction. Create New Agile Document Number: [redacted]

Approval Log

Revision	Approver	Title of approver
Add revision number	Add approver name here	Add approver's function or title here
A.01.06	Dan Gage	Product support manager
A.01.08	Bill Wang	Product support manager
A.01.10	Surendra Tipparaddi	Product support manager
A.01.11	Surendra Tipparaddi	Product support manager
1.20	Joan Boots	EC Product Support Manager

Designated Evaluation Log

Revision	Designated Evaluator (DE)	Title of DE	DE Number
Add revision number	Add name	Add function or title	Add DE number here
1.20	Michael Zyskwell	Cross-de Rad Lig Sciences Applications Consulting Lead	44-No 2001222222

Uncontrolled Document

Agilent CrossLab Compliance Services

Agilent CrossLab

EQUIPMENT QUALIFICATION PLAN (EQP)

EQP Name: [redacted]

Service Type: [redacted]

Company Name: United Rental and Engineering Controlled Co. Ltd.

Customer Name/Title: Tim Thompson, Regional Planning Manager

EQP Filename: [redacted]

EQP Release Date: [redacted]

Print Date: [redacted]

Uncontrolled Document

Table of Contents

Section	Page
Scope and Purpose	3
Customer Commitments	4
ACE Delivery Options	4
ACE Delivery Use Cases	10
[redacted]	10
Rejected Delivery Options	11
Required Signature Options	11
Customer Approval	11
Legal Notice	12
Protocol Details	20

Uncontrolled Document

Scope and Purpose

Overview

The Equipment Qualification Plan (EQP) documents the activity program that is performed during the qualification services for the applicable systems. A complete description of the test specifications is provided for the supported services, including setpoints and acceptance criteria (or limits) for each test. The test specification section of this document is created directly from the EQP file name listed on the cover. This document is an abstraction of the EQP file used to perform the service and is generated directly from the electronic Agilent Equipment Qualification Plan (eEQP) Editor. The purpose of this document is to allow the user to review and record approval of the EQP that guides the delivery of compliance services provided by the Agilent Automated Compliance Engine.

CDS Software Prerequisites for Hardware Qualifications

Applies to hardware qualifications only. Agilent recommends that the customer data system (CDS) software used during the qualification has been qualified within the qualification period specified by the customer's software qualification SOP.

Statement of Intent

Unless otherwise requested, the qualification is performed according to the standard test program described in the Agilent_Recommended EQP. Agilent defines reference test changes to the default recommended values (as stated in the Agilent Permit Handbook (QSP), that fall within a user-defined range. These changes are considered to be within the intended use range of the system under test.

Customers are aware that any request the system to make that exceed the typical operational range or the additional tests that are not considered part of the core program required for completion of the standard service. Because custom requests and limits may exceed the operational envelope of the equipment, Agilent reserves the right to approve conformance only to the tested nominal value. The user is notified of the deviations at EQP setup time and the qualification report (EQR) will reflect this decision.

A set of e-signature fields, as determined by the creator of the document, can be included at the end of this document. All fields should be completed by a single set of fields, initiated by an appropriate approver, run through any signature fields that will not be used. This is an optional process that allows a paper record of signoff by the appropriate reviewers where a hybrid (electronic/wet signature) EQP is followed. If this document will be stored electronically and digitally signed in a document management system, it should be generated without the signature fields. The customer must sign the EQP review documents and return an electronic copy to Agilent prior to qualification delivery. The delivery of the services is done according to the terms and conditions stated in the corresponding service contract. It is recommended that after approval, this EQP be scanned with the electronic EQP file.

Uncontrolled Document

© 2020 by Agilent Technologies

Understanding the Test Specification Section in Tabular Runtime Documents

(Applies to hardware qualifications only) For Agilent recommended setpoints and limits, the range of allowable values (i.e. for run, in-tol, high) is included. No applicable minimum, recommended, and additional setpoints are listed beneath the Agilent recommended values and marked IR (within range) or IT (outside of range) in the last margin column for tested setpoints and after marked W or D and observed after all configurations values. Dual limits are marked (W or DW) in red. Agilent is NOT responsible for test failures for out of range setpoints and limits. Optional tests that are skipped are included and marked as such. Required tests that are disabled by the customer are included and marked as such.

NOTE: Limit ranges must be more tightly managed than setpoint ranges because they often reflect physical measurement limits and are directly linked to the testing method. Therefore "within range" user limits are subject to post-effort repairs if they cannot be met. In particular, Agilent will not be responsible for test failures for limits tighter (more demanding or challenging) than the recommended values.

Customer Responsibilities

If Agilent representatives use a customer ODS account to acquire test data, they log off from the ODS account at the end of test acquisition. Agilent Technologies has no responsibility for stored account credentials. It is up to the customer to protect the ODS from misuse.

a. (As applicable) Disable the account used by the Agilent representative to acquire ODS data
b. Safely store and archive the EQP
c. Maintain change control and revision history
d. Review and personally sign the EQP, making sure the service delivery is what was approved
e. Review and approve any of the following variances from the Agilent recommended:

- (Within Tolerance Range) changes to the Agilent recommended that are identified by Agilent as within the operation ranges determined in our test development
- (Outside of Tolerance Range) changes to the Agilent recommended that Agilent identifies as outside of the operational ranges determined in our test development. Agilent is not under any obligation to make the instrument pass the more stringent limits that fall in the step-and-fail detail as called out in the EQP Test Specification.
- (Optional Tests) additional tests that are available but not part of the core testing suite and User limits.
- (Disabled Tests) test for which all practical configurations have been disabled (tests are flagged in the test specification)

Agilent Responsibilities

a. Deliver the services detailing the test programs described in the customer EQP.
b. Provide a signed and approved Qualification Report (EQR) upon completion of the services.
c. (If requested) provide an optional (no signed EQP) CD to the customer.

Uncontrolled Document

© 2020 by Agilent Technologies

General Statements on the Testing Programs

The recommended set of hardware ISE tests described in this EQP derives from Agilent's interpretation of authoritative expert literature (such as the FDA, cGMP, GAMP, ISO/IEC 2000, and others). The ISE test design incorporates both revolution and evolution leading up to a proven approach, acceptable to regulators. As prescribed by the ICE qualification methodology for Analytical Instrumentation Qualification (AIQ). The OQ step is separated from the PQ as recommended by the regulatory guidelines.

Agilent CrossLab Compliance uses a balanced selection of technology and screening tests to accurately determine the performance of the system in well and undesirable conditions as defined by specific results. For example, tests for accuracy from delay and flow rate are divided between multiple tests at low and high flow rates. Multiple statistical testing is used for the evaluation of the following: a most instrument characteristics: linearity, precision, signal to noise, and carry over.

Uncontrolled Document

© 2020 by Agilent Technologies

Agilent CrossLab Compliance Services

Agilent CrossLab is leading in the traditional quality systems used for 21 CFR Part 11 and GxP compliance and audit readiness worldwide.

Note: Enterprise Edition does some compare and Agilent CrossLab Compliance will have benefits for this section.

How Agilent CrossLab aligns with a traditional waterfall methodology

- Policy recommends an audit the need for validating and quality rigour of GAMP / GLP compliance and is usually mandated (the 21 CFR Part 11 is one). This process is analogous for Agilent CrossLab, from customer process desk to an approved EQP, methods called DEP, PTSS, Specification of IQ/OQ, Agilent is an Agilent CrossLab, this equipment qualification test (EQP) has the same concept, but modified specification EQP.
- The maintenance EQP provides tools of inputs and forms for the range of expected configurations based on the application. The EQP follows the method. The "should not" questions considered by an EQP or EQP changes are not time to the scheduled or expected period.
- The traditional qualification EQP typically has black-results forms and instruments to be printed out for each IQ or OQ event—the results are hard to re-work, manage, maintain. At Agilent CrossLab, final customer process is considered and automated in one of Agilent forms and the Agilent CrossLab Engine (ACE) software used. It provides reports within the testing cycle, validated calculations, automated pass / fail report, traceability between tests and the customer or former tests over time. This paperwork generation is a process.
- The traditional qualification EQP is approved and released each server, applied up the level to each of the instruments in each individual application. This is the only concept for the EQP. The approved model has been customized, configured and personalized by ACE from the 1st to the approved EQP—at time of delivery. The final report are ready for each system and each qualification event. But the single approved EQP can cover a trial, deployment, or an entire enterprise network.
- In the traditional qualification environment, there are some reasons or choices in executing the actual test. When of the tests does not work as intended, in the event there is error / repeated testing, the Agilent CrossLab Library, ACE Instrument, or a validation test, is to perform a automatically re-run and report for CFR compliance terms, and no engineer, procedures or declaration were written the ACE reports.

Uncontrolled Document

© 2020 by Agilent Technologies

Design Qualification (DQ)

(If the user-specified lab test selected is recommended because one set of questions was not relevant. Definition of DQ as per questionnaire and then specific verification to establish each section as need time record. Screen for a required reading, more than a record to which we commissioned them the most recent or most critical as approximating that to the customer that have designed for instrument to record and summary audit to select it. Where more DQ at Practical maturity of a user-required set with specific calibration document (CRS) which can be a formal test kit test. ISE report that was for correspondence. Other to execution ISE as normal for the system testing to a screening.

ISE Compliance Services specification of DQ

Design qualification (DQ) of the documented safety record of to which we that define and documented specifications of the instrument and suitable for the selection of the models, based on the intended purposes or the user's needs. Design qualification (DQ) does not test functionality and do the measurement techniques or calculations as per instructions for the user. The manufacturer is generally responsible for software design and engineering, while end-to-end testing from the point of the consult to execution based upon specifications. Instrument requirements are documented and documented by users. Nonetheless, the user should review their purchase or off-the-shelf ACE CFR compliance software available for their intended applications and use. The manufacturer has established a quality system that complies to standards and protocol. Users should also understand capability of the manufacturer for support, installation, calibration, and training.

For user reference, Agilent provides the following considerations for DQ purposes:

1. All Agilent hardware and software have been assessed including the ACE software used or data as qualified/approved users are developed, as established and tested and working as Agilent software Quality in the Core Development Principles.
2. Core Process of Agilent operating, validation, and performance or standard use as provided in these Agilent industrial record, personal identification as per specific ACE software. These documentary are reviewed and revised in Agilent CrossLab Compliance Services IQ.
3. Agilent provides reference data testing base procedures and recommended and maintains a problem and bug report log, assigned and observed by trained staff and tested quality system tools.
4. The ES specifications in this EQP are the select are applicable, to the user to prepared DQ. The DQ record the tests in the EQP—approved—to be test or performance acceptable configuration segments for the test session. Agilent is to capture specifications based on validation Design tests and results available for ES as recommended user requiring TQ throughout operational lifetime are approved in the ES upon the above statement to the Agilent Support Engineer to each USER to execute and use available for ES as recommended user requiring TQ throughout operational lifetime are approved in the ES upon the above statement to the customer, signed by customer and use available for ongoing requirements.
5. Agilent Technologies or suppliers of hardware, support, and maintenance information, ongoing qualifications and to customer as per users and user training and status.

Installation Qualification (IQ)

IQ of each and tested for Agilent hardware and software products includes the following:

1. The Users Order Validation. Whether this purchase is used by that then was received being qualified or received then during requirements of acceptable and purchase terms.
2. Preparation and Installation Details. Planning and key notes in the standard about preparation and not after test documents.
3. Documentation Verified. Each received with manufacturer instructions and user manuals for initial installations.
4. Product Quality Assessment Testing. Customer and vendor certificates and test from the then as the first test and was delivered and found (by product) according to their set acceptance.
5. Warranty. Verified that all activities exist as present to.
6. Hardware and Check Hardware tested. Demonstrated that all locations of the instrument was correct for installation and Customer to show user team instruments performance as per Suite as QQ. This test is not necessary even if performed elsewhere. If an QQ was be performed by a given operator as mentioned above it.
7. Installation Verification performed within the then the test was and all specifications required that.

Operational Qualification (OQ)

Refer to the appropriate Test Definition document for a detailed description of the testing program, components, and requirements for the Agilent challenge, configure, and instrument configurations.

Dual Acceptance Limits

(Applicable to hardware qualifications only)

Within the EQP of Agilent CrossLab, analysis of the results that would use the accepted ranges and different testing frequency. This offers a method to configured OQ to meet regulatory from the Users Guide. Agilent Recommended Limits (Limits) and Requirements.

In the standard EQP requirements, Limit 1 and 2 values are specified for each test. When the test results fall within Limit 1, the test is considered to have passed. If the test results fall outside of Limit 1 but within Limit 2, the test is considered to have passed with a warning. If the test results fall outside of Limit 2, the test is considered to have failed. The Limit 1 and Limit 2 values are specified in the EQP and are based on the Agilent Recommended Limits and Limit 1 and Limit 2 values are approved by the user.

Uncontrolled Document

© 2020 by Agilent Technologies

Re-Qualification after Repair (RQ) Hardware

(Applies to hardware qualifications only)

In the event of a hardware breakdown it is necessary, as engineering required, a qualification process. It is necessary to re-qualify the system to our appropriate level set our company basis the appropriate one.

For external site maintenance technicians: Agilent offers a service certificate to repair and re-qualify your instrument during the period necessary scheduled service FSE.

The level of re-testing is always based on the HQ analysis of ACE's work is displayed for the operator ensuring all repairs as been possible and also re-testing required. Part of an overall ISO/IEC17025 compliance.

Pre-Qualification After Repair		
Pump Diagnostic		
Internal pump head seals, active inlet valve kit, active out, NV cartridge, ASTM, dry-check valves, adhesive, valves, main assembly, or pump drive, or valve, screw, insert seal, or drain / screw repair	Validate	Log into Logbook
	Run query	View Accuracy & Precision
Pulse damper, pressure transducer	Run query	View Accuracy & Precision
Solid manual, gradient, valve	Validate	View Accuracy & Precision Validate, Transmitter

The full, full IQ report as an test generated is available for review by customers at the FSE service.

The IQ Form in ACE does automatically mark the application result parameter as pass / fail / conditional. The test parameters, output file, and errors will be an record report of the technician IQ test (1) registration / verification stage.

Updated: November 2019

www.agilent.com/chem/qualification

Information, descriptions and specifications in this publication are subject to change without notice.

© Agilent Technologies, Inc. 2019
Published in USA

Uncontrolled Document

© 2020 by Agilent Technologies

Agilent CrossLab

SERVICE DELIVERY METHOD2
CUSTOMER APPROVAL OF ALTERNATIVE METHOD AND EDR STORAGE

Purpose

Agilent's internal qualification services are offered choices for the delivery method as described below. The decision making process method is initiated according to the information data integrity and general compliance requirements. To determine customer data compliance, Agilent has identified two available methods that protect data by both technical (automated), an information workflow or other available data methods through a separate process. If neither of the available methods is chosen, then customer approval, evidenced approval of the alternative delivery method.

Available Methods

Method	Definition
Preferred 1	Software using USB drive connects the ACE software installed on customer's device and stores data from the instrument's LAN infrastructure. Requires collaboration with the customer's IT Dept ACE method that customer network. Data sent to secure area is validated in the established qualification report (EQR), which customers and is not modified in any way. Data is encrypted and is only modified at the customer.
Preferred 2	Software running USB drive connects the ACE software installed on an independent device that stores data from the system's controller. Requires no LAN network. Because the USB operating drive is connected to the USB, the validity of the method is dependent on the preferred 1 method. Raw data is transmitted through the ACE to the drive then again out, with the data verify process implemented in the secure server and data is encrypted during transmission. This is the most commonly used method.
Alternative	The ACE software is installed on one non-lock a PC not directly connected to the customer data system (CDS), such as the PDF's device. Sample data files are transferred manually from the CDS to the laptop, based on preferred 1 and 2 methods. Requires customer's non-approval or technical team support to run data integrity. **NOTE:** The PDF in ACE used in this method is available for data collection submission.

EDR Storage

Select this checkbox (when in order) to Agilent to store a copy of the Customer's Qualification Records (EDR) generated in Agilent's Compliance Engine for internal assessments. The retention of the assessments is an available data method of the qualification process, with a focus on customer delivery and maintain the capabilities/data or data integrity measures. This process is not intended for the technical assessments by Agilent and does not be allowed over other organizations. It is not to be considered as a backup for the ESDF processes or qualification services.

Customer Approval of Alternative Method and EDR Storage

Customer Agilent to use the alternative method chosen for approval.

Customer to Agilent to store EDR for data retrieval assessment should be required.

Approved by/date: _____ / _____

Comments:

Updated: September 2020

www.agilent.com/chem/qualification

Information, descriptions and specifications in this publication are subject to change without notice.
© Agilent Technologies, Inc. 2020
Published in USA

Uncontrolled Document

© 2020 by Agilent Technologies

Agilent CrossLab

AGILENT CROSSLAB QUALIFICATION SERVICES
USE CASES FOR SERVICE DELIVERY

Introduction

With heightened emphasis on data integrity, Agilent's ACE (Automated Compliance Engine) software can facilitate secure and automated user data files that are of technical, (1) (from the, saving file to protection software) relevant review or verify the server (2) (all items through temporary storage) to a remote location. In this document, data integrity refers to the value, utility and volume of data used in generating an ACE assessment and therefore meets, or MEET.

ACE includes three main services delivered, one choice that achieves data integrity requirements. The type of data document is unique specific to determine restrictions specific to customer's needs.

Regardless of the delivery method, ACE features and delivers a reliable and compatible:

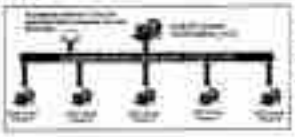
Preferred Method 1	Network-distributed ACE (NDA)
Preferred Method 2	Dedicated gateway USB drive connected to a single workstation
Alternative	Manual workflow using an offline PC not directly connected to customer's data system (CDS)

Preferred Method 1: Network-Distributed ACE (NDA)

Overview

ACE software is installed on a network server, and the raw data is collected and stored. Agilent then collaborates with the customer to test ACE's defined User Threshold. Note that conditions are verified implemented in the ACE, which provides real time and less workflow over a Fully Automated workflow over the delivery.

Details



Installing ACE in a networked mode (as in a dedicated PC) on the customer's network so the customer controller offline data processing that is equivalent to an installation on the system computer (again). This system, comprising (shown in the ACE) system) and the ACE host PC are identified and used for the server and support to the customer's data access controls and general IT controls. The CDS could then route the data from one or more instruments refer to instrument the client and server, and ACE's data connectivity features identify the original data directories and metadata processes and its workflow connectivity.

The ACE host PC has a connector (see diagram) to the PC ACE software. During ACE's installation, two services are running on the operating machine (OS) must be evaluated for this server as a workstation. Because the ACE host PC sits on the network as a shared drive, engineers access ACE through the network folders. ACE (i.e. not installed on ACE PC but on shared PC).

Requirements

Installation:

- Installation a local PC with a connection to a LAN/Network from client of the PC
- Direct from a network that shares with network
- OS (OS)
- ACE Software
- Customer to provide network access rights

Uncontrolled Document

© 2020 by Agilent Technologies

Operational:

- User has an ACE client login with administrator/power user rights and necessary user role (has a specialist ACE account with password stored through the ACE Licensing tool)
- Up to 5 users can be logged and connected to the PC and simultaneously
- Exception access (1 (1) (1) (1) on ACE audit, status, applications) to Shared Data computer on the network

Preferred Method 2: Dedicated Gateway USB Drive

Overview

ACE software resides on an independent device that is driven from the system controller, where the CDS resides. Because the drive is connected to the CDS, it is treated a data integrity requirement as preferred 1 method. It does need to connect directly to the ACE to ACE's Cloud Storage (not, and data points are captured in reports to provide data traceability).

Details

A dedicated gateway USB drive connects ACE software without requiring integration to the host PC. Therefore, it can be connected directly to the system controller, supported by IEEE standard and have attachments for scanner's specifications. The additional protection that ensures secure drive data, available host PC on the client's network value, the USB drive can remain idle until the customer's IT service to the Agilent PQS during service delivery only.

Alternative Method

The ACE software is installed on one non-lock a PC not directly connected to the customer data system (CDS), such as the PDF's device. If server does not have any workflows (data quality from the CDS to the laptop, method to ensure data is encrypted and is not), and is archived.

Regardless of how you approach to set these data requirements are met, integrity.

Updated: November 2019

www.agilent.com/chem/qualification

Information, descriptions and specifications in this publication are subject to change without notice.
© Agilent Technologies, Inc. 2019
Published in USA

Uncontrolled Document

Standard GC Test Suite

This document describes the test program for qualifying GC systems, and the following table lists all GC tests.

Note: [illegible]

Test	Purpose and Procedure	Limits
System Inspection and Basic Safety and Operation	N/A	Power, obvious errors, grounding, corrosion, leakage, cleanness, and so on, all correct.
GC Oven Temperature Accuracy and Stability, Agilent Series GC	Column oven set: [illegible] Temperature 1: [illegible] Temperature 2: [illegible] Stability: [illegible]	[illegible]
GC Oven Temperature Accuracy and Stability, [illegible]	Temperature 1: [illegible] Temperature 2: [illegible] Stability: [illegible]	[illegible]
Headspace Loop (1000 psi max)	N/A	Valve functions properly and 100 psi leak test
Headspace Vent and Pressurization Valve Integrity (2000psi and vent)	N/A	Valve functions properly
Headspace Heated Zones Temperature Accuracy	Valve: [illegible] Sample Loop: [illegible] Syringe Heater: [illegible] Trans: [illegible] Needle: [illegible] [illegible]	[illegible]
Heated Transfer Line (HTL) and Pressurization Valve Integrity (2000psi and vent)	Valve and flow control	Pressure change [illegible]
Headspace Pressure Accuracy and Stability	Pressure accuracy: [illegible]	Accuracy: [illegible]
Headspace Vent and Pressurization Valve Integrity (2000psi and vent)	Valve and flow control	Accuracy [illegible] Pressure [illegible]

Uncontrolled Document

Test	Purpose and Procedure	Limits
Autosampler Tray Accuracy	Vials and inserts in tray for autosampler (or 1 to 10 vials)	Accuracy ± 0.2% of setpoint (or 0.5 mL minimum, whichever is larger)
Valve and Path Inertness	Detector signal	Areas 0.5 pA 0.5 to 2.5 pA·min
Valve and Path Inertness [illegible]	Detector signal	Areas 0.5 [illegible] Areas 0.5 [illegible] [illegible]
Valve and Path Inertness [illegible]	Detector signal (0.5 to 1 [illegible])	Areas 0.5 pA·s 0.5 to 1.5 pA·min
Valve and Path Inertness [illegible]	Detector signal	Areas 0.5 [illegible] [illegible]
Valve and Path Inertness [illegible]	Detector signal [illegible]	Areas 0.5 [illegible] [illegible]
Valve and Path Inertness [illegible]	Detector signal

Published: November 2020

www.agilent.com/ chem / qualification

Information, descriptions and specifications in this publication are subject to change without notice.

© Agilent Technologies, Inc. 2020
Published in USA

Uncontrolled Document

Report and Delivery Options

For Agilentable system types only. 3 different options are shown for the primary and supported system types the primary system options are used for both hardware in the SCM.

- Shows chromatographs
- Shows header and footer on report
- Include reviewer's logo
- Include Transcript's logo

Selected Signature Options

Status: SCM is not signed

- Require reviewer to sign report in the SCM

Uncontrolled Document

Customer Approval

Name: [illegible]
Title: Laboratory Manager
Date: [illegible]
Signature: [illegible]

Name:
Title:
Date:
Signature:

Name:
Title:
Date:
Signature:

Name:
Title:
Date:
Signature:

Uncontrolled Document

Legal Notice

Agilent CrossLab Compliance and its primary components (ACE software tool, procedures, and design, training tools, internal reference documents, and validation training materials) have been designed, tested, validated, and released for commercial use following Agilent's Life Cycle Development Quality Assurance methodology.

Agilent CrossLab Group R&D VP and Co. of Technology: Hal Clark, Santa Clara, California USA
Agilent CrossLab Group Quality Manager: Julio Herrera, Santa Clara, California USA

Agilent CrossLab Compliance is endorsed by Dr. Ludwig Huber on behalf of labcompliance.com

ACE software is subject to Copyright as claimed by the assertion for all original work comprising Agilent CrossLab Compliance. Any unauthorized use, reproduction, or translation will be prosecuted to the maximum extent possible by law. All is operator misuse of ACE approved, final qualification reports, and raw data provided to customer at delivery of this service become the property of the customer.

Uncontrolled Document

© 2020 by Agilent Technologies

Protocol Details

Protocol Revision Used for this Document	Protocol Revision Release Date
GC/GC/3	30-Jun-Mar-2020

NOTE: The Revision Display, PDF Date Document number details for above and all the available versions

Agilent CrossLab Start Up Services

Agilent GCMS Preventive Maintenance Checklist

Agilent Preventive Maintenance provides factory-recommended service for your analytical instruments 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. This checklist will be completed at the end of the service and provided to you as a record of the preventive maintenance activities.

Uncontrolled Document

เอกสารไม่ควบคุม

Introduction

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

- ☐ Interim Preventive Maintenance — 6 months
- ☑ Major Preventive Maintenance — Yearly

The checklist covers the following model(s):

Type	Model
GC	7820 Series GC
GC	8860 Series GC
GC	8890 Series GC
TQ	7000 Series GC/MS
TQ	7010 Series GC/MS
QQQ	7000 Series QQQ
QQQ	7200 Series QTOF

Customer Information

- Customers should provide all necessary operating conditions required of the engineer.
- A customer representative should be available to the engineer while performing the preventive maintenance procedures. Customers are responsible for regular maintenance and are encouraged to observe the service representative.
- Any parts not included in the Parts List section of this document are not part of the recommended Preventive Maintenance service and may be billed at the price of the service.
- If a system requires the use of extra or special overhead and/or parts for the maintenance service, that charge must be entered separately and charged as a result, which may incur additional costs.

Agilent

เอกสารไม่ควบคุม

Important Customer Web Links

- For more information about Agilent Technologies products, please visit our website using the following URL: http://www.agilent.com/chem/supportandservices/instrumentsystemsservicesandsupport
- To access Agilent resources, visit http://www.agilent.com/chem/supportandservices for more about ordering options, which include online, telephone and onsite delivery. A training specialist can work directly with you to help determine your best options.
- A useful Agilent Resource Center web page is available which includes short videos on maintenance, quick lists of consumables for new instruments, and other valuable information. Check out the Resource Page here: http://www.agilent.com/chem/gcmsmaintenance
- Need technical support, FAQs, supplies? – visit our Support Home page at http://www.agilent.com/chem/supportandservices
- Get answers. Share insights. Solve problems. Join the Agilent Community at http://community.agilent.com/community/

Service Engineer's Responsibilities

- Contact the customer and ensure that all necessary supplies are available before the preventive maintenance visit.
- Complete empty fields with the relevant information.
- Complete the relevant checkboxes in the checklist using either a "✓" or "☒" mark "✓".
- Check "**Section not applicable**" check boxes to indicate servers/tasks not performed, as appropriate.
- Complete the Preventive Maintenance services in the most logical order relevant to the individual system service in the order of the tasks listed.
- Complete the **Service Notes** section together with the customer.
- **Ask the customer to sign the Service Completion section including the customer's and your signature.**

Additional Instruction Notes

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

Agilent

เอกสารไม่ควบคุม

System Information

Check the box if environmental configuration report is attached instead of completing the table.

Instrument System Name and ID	US22010012
Instrument System Site and Location	United Analytical Engineering Lab

List System Component Product Numbers	List the Serial Numbers of each Component
1 G7111B	US22010012
2	
3	
4	
5	
6	
7	
8	

Preparation

- Discuss any specific issues with the customer before starting.
- Review the instrument logbook for recorded problems and interventions.
- Save method and correct settings before starting the procedure.
- Perform a general inspection of the system for cleanliness.
- Check for proper installation of some preventive measures etc.
- Check system for required installation of components and settings as defined by current Service Notes.
- Check for firmware updates and verify with customers if they would like more detailed firmware update(s) and change recommendation.

Customer Responsibilities

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

Agilent

เอกสารไม่ควบคุม

Important notice for customers

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

- Perform an analytical and check the overall instrument performance of the HPLC to verify performance of the equipment.

Note: It is recommended to have the customer run the analysis and have evaluation prior to the PM, and then start the next cycle so that the instrument will be ready for the service representative.

Definition of the Task Recommended Items within the Document

Task: Yes	No	Recommended: Interim / Major	/ As needed	
☑	☐	☐	☐	☐ **Yes** selected means that the task was done or the part was required.
☐	☑	☐	☐	☐ **No** selected means that the task was not done or the part was not required.
☐	☐	☑	☐	☐ **Interim** selected means that the task is recommended to be done at a certain interval.
☐	☐	☐	☑	☐ **Major** selected means that the task is recommended to be done shortly if the customer would like a service to be done at the lowest interval for the service could be purchased.
☐	☐	☐	☐	☑ **As needed** selected means that the task was done or the part was used as needed. For example, there could be less types of items that would be used and this was the one selected.

Preventive Maintenance Procedures

Agilent

เอกสารไม่ควบคุม

Agilent

เอกสารไม่ควบคุม

Service Review

- Attach available reports/printouts of all tests to this documentation.
- Discuss the Preventive Maintenance service activity in the customer's service logbook. Record the PM dates in the Green Refrigerant, if applicable.
- Update/read maintenance counters as appropriate.
- Apply 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 the service parts replaced, and see supply ordered with the customer.
- If the instrument firmware was updated, record the details of the change in the Service Engineer's Comments box. Updates to a controlled environment may need additional documentation.

Agilent Test Results Table

Test Description	Expected Test Result	Actual Test Result
Auto Tune	pass	pass
Autozero Test	pass	pass

Agilent

เอกสารไม่ควบคุม

Agilent Consumed Parts List Table

Agilent

เอกสารไม่ควบคุม

Signature Page

Service Engineer Comments (optional)

Service Completion

Agilent signature: Customer signature:

Total number of pages in this document: 8 pages

Agilent

เอกสารไม่ควบคุม

Agilent CrossLab

Agilent CrossLab Start Up Services

Agilent 8890 Gas Chromatograph
Preventive Maintenance Checklist

Agilent Preventive Maintenance provides factory recommended actions for your analytical instruments to support

Delivered by highly trained and certified service engineers using genuine Agilent parts and supplies, Agilent

Agilent

เอกสารไม่ควบคุม

Introduction

Customer information

- Customer should provide all necessary operating supplies appropriate for the engineer
- Any costs not included in the Price Lists section of this document, are not part of the
- If a system requires the use of extra or special procedures and/or parts for the maintenance service, that should be ordered separately and charged as a repair, which may incur additional costs.

Important Customer Web Links

- For more information about Agilent
- The **Agilent Community** is an excellent place to get answers, collaborate with others about applications and Agilent products, and find insight, discoveries, and tricks relevant to Agilent technologies. Visit
- To access **Agilent University**, visit
- Access the **Agilent Resource Center** web page to find
- Need technical support, FAQs, supplies? — visit our **Support Home page**.
- Visit us

Agilent

เอกสารไม่ควบคุม

Service Engineer's Responsibilities

- Contact the customer and ensure that all necessary supplies are available before the preventive maintenance visit.
- Complete as per Safety with the relevant if applicable.
- Document the relevant observations on the checklist using letters or "X" or tick mark "✓".
- Check, "Section not applicable" check boxes to indicate activities/tasks not performed, as appropriate.
- Complete the PM workflow maintenance service at the order of the tasks listed.
- Complete the fields for page numbers at the foot of each individual page.
- Complete the total number of pages field in the Service Completion section.
- **Ask the customer to sign the Service Completion section including the customer's and your signature.**

Additional Instruction Notes

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

เอกสารไม่ควบคุม

System Information

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

Instrument System Name and ID	GC7890A444
Instrument System Site and Location	UAE SCHLUMBERGER

List System Component Product Numbers	List the Serial Numbers of each Component
1. 8760A	CN 10404044
2.	
3.	
4.	
5.	
6.	
7.	
8.	
9.	
10.	

Preparation

- Discuss any specific issues with the customer before starting.
- Review the instrument logbook for reported problems and remarks.
- Save instrument control settings before starting the procedure.
- Perform a general inspection of the system for cleanliness.
- Check for proper installation of parts, assemblies, options etc.
- Check system for required installation of consumables, settings as defined by current Service Notes.
- Check for required firmware updates and verify with customer if they would like them installed.
- Before starting the following procedures, record the Detector Signal Sensitivity in the results table. If the GC is labeled DFF or is a service model, complete the detector sections before and after the removal is not possible.

เอกสารไม่ควบคุม

Preventive Maintenance Procedure

Clean and inspect GC

- Unplug power cord from the power source.
- Open GC covers and remove any accessories. Pay particular attention to cooling fans.
- Inspect internal electronics for proper connect and placement.
- Reconnect Power to the GC. Power the GC on and verify the power up self-test passes.
- Verify oven motor spins freely and turns on with the oven door closed (off when the door is open).
- Verify operation of all other fans. The inlet and EPC cooling fans.
- Verify oven chamber flap opens fully on opening smoothly while heating and cooling the oven.

Inlet and detector consumable replacement

- Replace the split vent trap cartridge filter using the Maintenance procedure from within the Browser user interface (or only with newer inlets: Split/Splitless 3 (Split) (G3), Multimode Inlet (MMI), Programmed Temperature Vaporizer (PTV), Weldable Graphite (WG)
- If the unit 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.
- For the steps installed perform inlet maintenance using the Maintenance procedure from the Browser User Interface. Record the results. (Leak and Restriction Test)
- If the GC includes a Flame Ionization Detector (FID), replace the jet. If the lighted shows any buildup of particles or corrosion, replace the ignitor. Examine the FID collector and clean deposits for contamination – clean as necessary.

Zero Sensors and Leak test

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

Note: If this PM is done in preparation for an Operational Qualification, then the pressure decay test defined above (leak) should not be used for this PM.

เอกสารไม่ควบคุม

ALS Maintenance

- **Section NOT applicable**
- Check all tubing and configuration settings between GC, inlet, and detectors.
- Vacuum or remove any dust, especially around fans.
- Check operation of all fans.
- Check syringe for correct plunger operation.
- Check for smooth operation of the needle support – clean if necessary.

Restore Instrument

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

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

เอกสารไม่ควบคุม

Signature Page

Service Review

- Attach available supporting details of all tests to this documentation
- Record the Preventive Maintenance service activity in the customer's service logbook
- Update/send Instrument maintenance contract as appropriate
- Affix the PM sticker to the system or instrument (sign is issued on the customer's receipt)
- Complete the Service Engineer Comments section if there are additional comments
- Review with the customer the service parts replaced, and test results obtained
- If the instrument firmware was updated, record the details of the change in the Service Engineer's Comments box or if necessary in the customer's PC records
- Supply the customer with a copy of the Smart Alerts flyer
- Describe Smart Alerts to the customer
- Install Smart Alerts if requested

PM Test Results Table

Test description	Before PM Service	After PM Service
Front Scanner output	N/A	N/A
Back Scanner output	N/A	N/A
ADR 1 detector output	N/A	N/A
ADR 2 detector output	N/A	N/A
Test description	**Expected test result**	**Actual test result**
Lock and Restriction Test after front side maintenance	Pass	Pass
Lock and Restriction Test after back side maintenance	Pass	Pass
Lock and Restriction Test after front side split valve Tray replacement	Pass	Pass
Lock and Restriction Test after back side split valve Tray replacement	Pass	Pass
Front Unit pressure decay test	Pass	Pass
Back Unit pressure decay test	N/A	N/A

Agilent

เอกสารไม่ควบคุม

PM Parts List Table

Note: The following lists are recommended for routinely and proactively replaced parts. If this is a general PM and the customer has a preferred set of parts/activities, you may add the customer's recommendations.

Part description	Part number	Product or accessory where used	Quantity recommended
[illegible]	[illegible]	[illegible]	1
[illegible]	[illegible]	[illegible]	2
[illegible]	[illegible]	[illegible]	N/A
[illegible]	[illegible]	[illegible]	N/A
[illegible]	[illegible]	[illegible]	N/A
[illegible]	[illegible]	[illegible]	N/A
[illegible]	[illegible]	[illegible]	N/A
[illegible]	[illegible]	[illegible]	N/A
[illegible]	[illegible]	[illegible]	N/A
[illegible]	[illegible]	[illegible]	N/A
[illegible]	[illegible]	[illegible]	N/A
[illegible]	[illegible]	[illegible]	N/A

Agilent

เอกสารไม่ควบคุม

Service Engineer Comments

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

Service Completion

Service request number: [illegible] Date service completed: [illegible]

Agilent signature: [illegible] Customer signature:

Total number of pages in this document: 4 Page

Agilent

เอกสารไม่ควบคุม

TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
CORPORATE SERVICES : EQUIPMENT CALIBRATION AND TESTING SERVICES

Cert.No.: [illegible]
Page: 1 of 2

Certificate of Calibration

Equipment :	Turbidity Meter
Manufacturer :	Orbeco
Model :	T2000
Serial No. :	[illegible]
ID. No. :	[illegible]
Condition As-Received :	Used, Sun
Received Date :	10 September 2020
Calibration Date :	10 September 2020
Reference :	[illegible]
Submitted by :	Global Analysis and Engineering Consultant Co.,Ltd. 2 Soi Udomsuk 41, Sukhumvit Road, Bangchak, Phrakhanong, Bangkok 10260
Ambient Temperature :	25 ± 2.5 °C
Relative Humidity :	50 ± 20 %
Calibration Procedure :	In - house method : QP-CA01 based on direct measurement by using Formazin standard solution
Calibrated by :	Rapatsa Tothiwan
Approved by :	Approved Signatory
	( ) Sathit Mangkorn
	( ) Wanchart Jongpaibool
	( ) Pongsak Rajpim
Issue Date :	15 September 2020

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

เอกสารไม่ควบคุม

A 0221053

Condition of this calibration result

1. Reference Standard Instruments :
This verification is traceable to the international System of unit (SI unit) through :
- Technology Promotion Association (Thailand - Japan)

Instruments	Serial No.	ID No.	Certificate No.	Due date
1) Thermo-Hygrograph	1100205	0203231	22C1061	13 June 2024
2) Electronic Balance	1124011660	1405C030	2308N16	20 Feb. 2024

2. Standard Material : The Formazin suspension has been prepared gravimetric from

Material	Manufacturer	Lot No.	Assay
1) Hexamethylenetetramine	MERCK	[illegible]	99.83%
2) Hydrazinium Sulfate	MERCK	[illegible]	99.83%

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

Calibration result

Performing the - Formazin suspension standard curve by using 0,20,100,400,800 NTU
Turbidity Meter Serial Number : 1120501017

Standard Formazin suspension (NTU)	UUC* Reading (NTU)	Uncertainty of Measurement (± NTU)	Coverage Factor k
0	0.00	0.0007	2.00
20	20.0	0.09	2.00
100	101	0.76	2.00
400	401	1.5	2.00
800	800	3.1	2.00

Remark - UUC* = Unit Under Calibration
- NTU = Nephelometric Turbidity Units

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 %.

-ends-

เอกสารไม่ควบคุม