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})	Andersen Instruments, Inc.	G25A 11MX	Tisch Environmental,Inc.	28062022	28 Jun 21	27 Jun 23	-
2	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	-
3	U-Tube Manometer	Total Suspended Particulate (TSP) Particulate Matter < 10 µm (PM_{10})	Dwyer	1221-36-W/M -	Technology Promotion Association (Thailand-Japan)	22P803	12 Mar 22	11 Mar 23	-
4	U-Tube Manometer	Total Suspended Particulate (TSP) Particulate Matter < 10 µm (PM_{10})	Dwyer	1221-36-W/M -	Technology Promotion Association (Thailand-Japan)	22P801	12 Mar 22	11 Mar 23	-
5	U-Tube Manometer	Total Suspended Particulate (TSP) Particulate Matter < 10 µm (PM_{10})	Dwyer	1221-36-W/M -	Technology Promotion Association (Thailand-Japan)	22P918	11 Jul 22	10 Jul 23	-
6	U-Tube Manometer	Total Suspended Particulate (TSP) Particulate Matter < 10 µm (PM_{10})	Dwyer	1221-36-W/M -	Technology Promotion Association (Thailand-Japan)	22P967	12 Aug 22	11 Aug 23	-
7	Aneroid Barometer	Total Suspended Particulate (TSP) Particulate Matter < 10 µm (PM_{10})	Barigo, Germany	-	Technology Promotion Association (Thailand-Japan)	22P2728	22 Jul 22	21 Jul 23	-
8	Dial Thermo-Hygrometer	Total Suspended Particulate (TSP) Particulate Matter < 10 µm (PM_{10})	Barigo, Germany	-	Technology Promotion Association (Thailand-Japan)	22H1587	27 Jul 22	26 Jul 23	-
9	High Volume Air Sampler	Total Suspended Particulate (TSP)	Thremo Scientific	CMCBD 1010	Tisch Environmental,Inc.	Ref. No.11MX	28 Jun 21	27 Jun 23	-
10	High Volume Air Sampler	Total Suspended Particulate (TSP)	Thremo Scientific	CMCBD 1011	Tisch Environmental,Inc.	Ref. No.11MX	28 Jun 21	27 Jun 23	-
11	High Volume Air Sampler	Total Suspended Particulate (TSP)	Thremo Scientific	CMCBD 1016	Tisch Environmental,Inc.	Ref. No.11MX	28 Jun 21	27 Jun 23	-
12	High Volume Air Sampler	Total Suspended Particulate (TSP)	Thremo Scientific	CMCBD 1017	Tisch Environmental,Inc.	Ref. No.11MX	28 Jun 21	27 Jun 23	-

List of Instruments Certification for Air & Noise Quality Analysis

No.	Instrument/Equipment	Parameter	Manufacturer	Model/Serial No.	Calibrator	Certification No.	Date of Calibration	Due date of Calibration	Remark
Ambient									
13	High Volume Air Sampler	Total Suspended Particulate (TSP)	Thremo Scientific	CMCBD 1020	Tisch Environmental,Inc.	Ref. No.11MX	28 Jun 21	27 Jun 23	-
14	High Volume Air Sampler	Total Suspended Particulate (TSP)	Thremo Scientific	GS2312-10105-1 2010-16	Tisch Environmental,Inc.	Ref. No.11MX	28 Jun 21	27 Jun 23	-
15	High Volume Air Sampler	Total Suspended Particulate (TSP)	Thremo Scientific	CMCBD 1010	Jiranatee Associates Co., Ltd.	Ref. No.3393	26 Jul 22	25 Jul 24	-
16	High Volume Air Sampler	Total Suspended Particulate (TSP)	Thremo Scientific	CMCBD 1011	Jiranatee Associates Co., Ltd.	Ref. No.3393	26 Jul 22	25 Jul 24	-
17	High Volume Air Sampler	Total Suspended Particulate (TSP)	Thremo Scientific	CMCBD 1016	Jiranatee Associates Co., Ltd.	Ref. No.3393	26 Jul 22	25 Jul 24	-
18	High Volume Air Sampler	Total Suspended Particulate (TSP)	Thremo Scientific	CMCBD 1017	Jiranatee Associates Co., Ltd.	Ref. No.3393	26 Jul 22	25 Jul 24	-
19	High Volume Air Sample	Total Suspended Particulate (TSP)	Thremo Scientific	CMCBD 1020	Jiranatee Associates Co., Ltd.	Ref. No.3393	26 Jul 22	25 Jul 24	-
20	High Volume Air Sample	Total Suspended Particulate (TSP)	Thremo Scientific	CMCBD 1008	Jiranatee Associates Co., Ltd.	Ref. No.3393	26 Jul 22	25 Jul 24	-
21	High Volume Air Sample	Total Suspended Particulate (TSP)	Thremo Scientific	CMCBD 1007	Jiranatee Associates Co., Ltd.	Ref. No.3393	26 Jul 22	25 Jul 24	-
22	High Volume Air Sample	Total Suspended Particulate (TSP)	Thremo Scientific	CMCBD 1009	Jiranatee Associates Co., Ltd.	Ref. No.3393	26 Jul 22	25 Jul 24	-
23	High Volume Air Sample	Total Suspended Particulate (TSP)	Thremo Scientific	CMCBD 1012	Jiranatee Associates Co., Ltd.	Ref. No.3393	26 Jul 22	25 Jul 24	-
24	High Volume Air Sample	Total Suspended Particulate (TSP)	Andersen Instruments, Inc.	GL 2000 H-1 0104-109	Jiranatee Associates Co., Ltd.	Ref. No.3393	26 Jul 22	25 Jul 24	-

List of Instruments Certification for Air & Noise Quality Analysis

No.	Instrument/Equipment	Parameter	Manufacturer	Model/Serial No.	Calibrator	Certification No.	Date of Calibration	Due date of Calibration	Remark
Ambient									
25	High Volume Air Sample	Particulate Matter < 10 µm (PM_{10})	Thremo Scientific	CMBBD 1011	Tisch Environmental,Inc.	Ref. No.11MX	28 Jun 21	27 Jun 23	-
26	High Volume Air Sample	Particulate Matter < 10 µm (PM_{10})	Thremo Scientific	CMBBD 1012	Tisch Environmental,Inc.	Ref. No.11MX	28 Jun 21	27 Jun 23	-
27	High Volume Air Sample	Particulate Matter < 10 µm (PM_{10})	Thremo Scientific	CMBBD 1013	Tisch Environmental,Inc.	Ref. No.11MX	28 Jun 21	27 Jun 23	-
28	High Volume Air Sample	Particulate Matter < 10 µm (PM_{10})	Thremo Scientific	CMBBD 1016	Tisch Environmental,Inc.	Ref. No.11MX	28 Jun 21	27 Jun 23	-
29	High Volume Air Sample	Particulate Matter < 10 µm (PM_{10})	Thremo Scientific	CMBBD 1016	Tisch Environmental,Inc.	Ref. No.11MX	28 Jun 21	27 Jun 23	-
30	High Volume Air Sample	Particulate Matter < 10 µm (PM_{10})	Thremo Scientific	IP10-1	Tisch Environmental,Inc.	Ref. No.11MX	28 Jun 21	27 Jun 23	-
31	High Volume Air Sample	Particulate Matter < 10 µm (PM_{10})	Thremo Scientific	CMBBD 1011	Jiranatee Associates Co., Ltd.	Ref. No.3393	26 Jul 22	25 Jul 24	-
32	High Volume Air Sample	Particulate Matter < 10 µm (PM_{10})	Thremo Scientific	CMBBD 1012	Jiranatee Associates Co., Ltd.	Ref. No.3393	26 Jul 22	25 Jul 24	-
33	High Volume Air Sample	Particulate Matter < 10 µm (PM_{10})	Thremo Scientific	CMBBD 1013	Jiranatee Associates Co., Ltd.	Ref. No.3393	26 Jul 22	25 Jul 24	-
34	High Volume Air Sample	Particulate Matter < 10 µm (PM_{10})	Thremo Scientific	CMBBD 1016	Jiranatee Associates Co., Ltd.	Ref. No.3393	26 Jul 22	25 Jul 24	-
35	High Volume Air Sample	Particulate Matter < 10 µm (PM_{10})	Thremo Scientific	CMBBD 1017	Jiranatee Associates Co., Ltd.	Ref. No.3393	26 Jul 22	25 Jul 24	-
36	High Volume Air Sample	Particulate Matter < 10 µm (PM_{10})	Thremo Scientific	CMBBD 1006	Jiranatee Associates Co., Ltd.	Ref. No.3393	26 Jul 22	25 Jul 24	-

List of Instruments Certification for Air & Noise Quality Analysis

No.	Instrument/Equipment	Parameter	Manufacturer	Model/Serial No.	Calibrator	Certification No.	Date of Calibration	Due date of Calibration	Remark
Ambient									
37	High Volume Air Sample	Particulate Matter < 10 µm (PM_{10})	Thremo Scientific	CMBBD 1005	Jiranatee Associates Co., Ltd.	Ref. No.3393	26 Jul 22	25 Jul 24	-
38	High Volume Air Sample	Particulate Matter < 10 µm (PM_{10})	Andersen Instruments, Inc.	IP10 4389	Jiranatee Associates Co., Ltd.	Ref. No.3393	26 Jul 22	25 Jul 24	-
39	High Volume Air Sample	Particulate Matter < 10 µm (PM_{10})	Andersen Instruments, Inc.	IP10 4390	Jiranatee Associates Co., Ltd.	Ref. No.3393	26 Jul 22	25 Jul 24	-
40	High Volume Air Sample	Particulate Matter < 10 µm (PM_{10})	Andersen Instruments, Inc.	IP10 4393	Jiranatee Associates Co., Ltd.	Ref. No.3393	26 Jul 22	25 Jul 24	-
41	Vibration Meter	Vibration Level Acceleration Level	Instantel Inc.	Micromate UM11356	Calibration Laboratory Co.Ltd	Q22097248	23 Sep 22	22 Sep 23	-
42	Vibration Meter	Vibration Level Acceleration Level	Instantel Inc.	Micromate UM12392	Calibration Laboratory Co.Ltd	Q22017950	22 Feb 22	21 Feb 23	-
43	Vibration Meter	Vibration Level Acceleration Level	Instantel Inc.	Micromate UM12393	Calibration Laboratory Co.Ltd	Q22012260	8 Feb 22	7 Feb 23	-
44	Vibration Meter	Vibration Level Acceleration Level	Instantel Inc.	Micromate UM12395	Calibration Laboratory Co.Ltd	Q22012258	8 Feb 22	7 Feb 23	-
45	Vibration Meter	Vibration Level Acceleration Level	Instantel Inc.	Micromate UM12889	Calibration Laboratory Co.Ltd	Q22053609	31 May 22	30 May 23	-
46	Vibration Meter	Vibration Level Acceleration Level	Instantel Inc.	Micromate UM11229	Calibration Laboratory Co.Ltd	Q22097008	23 Sep 22	22 Sep 23	-
47	Vibration Meter	Vibration Level Acceleration Level	Instantel Inc.	Micromate UM11230	Calibration Laboratory Co.Ltd	Q22086863	30 Aug 22	29 Aug 23	-
48	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									
49	Vibration Meter	Vibration Level Acceleration Level	Instantel Inc.	Micromate UM12393	Calibration Laboratory Co.Ltd	Q23019601	22 Feb 23	21 Feb 24	-
50	Vibration Meter	Vibration Level Acceleration Level	Instantel Inc.	Micromate UM12394	Calibration Laboratory Co.Ltd	Q23015866	13 Feb 23	12 Feb 24	-
51	Vibration Meter	Vibration Level Acceleration Level	Instantel Inc.	Micromate UM12866	Calibration Laboratory Co.Ltd	Q22097011	23 Sep 22	22 Sep 23	-
52	Vibration Meter	Vibration Level Acceleration Level	Instantel Inc.	Micromate UM12867	Calibration Laboratory Co.Ltd	Q22064051	27 Jun 22	26 Jun 23	-
53	Vibration Meter	Vibration Level Acceleration Level	Instantel Inc.	Micromate UM12888	Calibration Laboratory Co.Ltd	Q23022492	1 Mar 23	28 Feb 24	-
54	Vibration Meter	Vibration Level Acceleration Level	Instantel Inc.	Micromate UM12865	Calibration Laboratory Co.Ltd	Q22086865	30 Aug 22	29 Aug 23	-
55	Sound Level Calibrator (Acoustic Calibrator)	Calibrate Sound Level Meter	Larson Davis	CAL150 6307	Innovative Instrument Co.,Ltd.	22-ACT-373	8 Jun 22	7 Jun 23	-
56	Sound Level Calibrator (Acoustic Calibrator)	Calibrate Sound Level Meter	01dB	CAL31 84065	Innovative Instrument Co.,Ltd.	22-ACT-523	19 Aug 22	18 Aug 23	-
57	Sound Level Meter	$L_{Aeq\ 24\ hours}$, L_{Amax}, L_{A90}, L_{Adn}	Larson Davis	LxT2 0005286	Sithiporn Associates Co., Ltd.	ACL22081	25 Jan 22	24 Jan 23	-
58	Sound Level Meter	$L_{Aeq\ 24\ hours}$, L_{Amax}, L_{A90}, L_{Adn}	Larson Davis	LxT2 0005289	Sithiporn Associates Co., Ltd.	ACL22082	25 May 22	24 May 23	-
59	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 23	-
60	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 23	-

List of Instruments Certification for Air & Noise Quality Analysis

No.	Instrument/Equipment	Parameter	Manufacturer	Model/Serial No.	Calibrator	Certification No.	Date of Calibration	Due date of Calibration	Remark
Ambient									
61	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 23	-
62	Sound Level Meter	$L_{Aeq\ 24\ hours}$, L_{Amax}, L_{A90}, L_{Adn}	Larson Davis	LxT2 0005395	Innovative Instrument Co.,Ltd.	22-ACT-247	1 Apr 22	31 Mar 23	-
63	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 23	-
64	Sound Level Meter	$L_{Aeq\ 24\ hours}$, L_{Amax}, L_{A90}, L_{Adn}	Rion, Japan	NL-42 00321432	Innovative Instrument Co.,Ltd.	22-ACT-207	17 Mar 22	16 Mar 23	-
65	Sound Level Meter	$L_{Aeq\ 24\ hours}$, L_{Amax}, L_{A90}, L_{Adn}	Rion, Japan	NL-42 00321441	Innovative Instrument Co.,Ltd.	22-ACT-208	17 Mar 22	16 Mar 23	-
66	Sound Level Meter	$L_{Aeq\ 24\ hours}$, L_{Amax}, L_{A90}, L_{Adn}	Rion, Japan	NL-42 00558039	Innovative Instrument Co.,Ltd.	22-ACT-209	17 Mar 22	16 Mar 23	-
67	Sound Level Meter	$L_{Aeq\ 24\ hours}$, L_{Amax}, L_{A90}, L_{Adn}	Rion, Japan	NL-42 00558208	Innovative Instrument Co.,Ltd.	22-ACT-210	17 Mar 22	16 Mar 23	-
68	Sound Level Meter	$L_{Aeq\ 24\ hours}$, L_{Amax}, L_{A90}, L_{Adn}	Rion, Japan	NL-42 00558212	Innovative Instrument Co.,Ltd.	22-ACT-206	17 Mar 22	16 Mar 23	-
69	Sound Level Meter	$L_{Aeq\ 24\ hours}$, L_{Amax}, L_{A90}, L_{Adn}	Rion, Japan	NL-42 01010782	Sithiporn Associates Co., Ltd.	ACL22088	22 Apr 22	21 Apr 23	-
70	Sound Level Meter	$L_{Aeq\ 24\ hours}$, L_{Amax}, L_{A90}, L_{Adn}	Rion, Japan	NL-42 01010783	Sithiporn Associates Co., Ltd.	ACL22089	22 Apr 22	21 Apr 23	-
71	Sound Level Meter	$L_{Aeq\ 24\ hours}$, L_{Amax}, L_{A90}, L_{Adn}	Rion, Japan	NL-42 01010784	Sithiporn Associates Co., Ltd.	ACL22090	22 Apr 22	21 Apr 23	-
72	Sound Level Meter	$L_{Aeq\ 24\ hours}$, L_{Amax}, L_{A90}, L_{Adn}	Larson Davis	LxT2 0005286	Sithiporn Associates Co., Ltd.	ACL22081	25 Jan 22	25 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									
73	Sound Level Meter	$L_{Aeq\ 24\ hours}$, L_{Amax}, L_{A90}, L_{Adn}	Larson Davis	LxT2 0005289	Sithiporn Associates Co., Ltd.	ACL22082	26 Jan 22	25 Jan 24	-
74	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	-
75	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	-
76	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	-
77	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	-
78	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	-
79	Sound Level Meter	$L_{Aeq\ 24\ hours}$, L_{Amax}, L_{A90}, L_{Adn}	Larson Davis	LxT2 0005398	Innovative Instrument Co.,Ltd.	22-ACT-035	21 Jan 22	20 Jan 24	-

TISCH Environmental

RECALIBRATION DOCUMENT

Certificate of Calibration

เอกสารไม่ควบคุม

NAC

CERTIFICATE OF CALIBRATION

เอกสารไม่ควบคุม

NAC

เอกสารไม่ควบคุม

Certificate of Calibration

เอกสารไม่ควบคุม

Cert.No. [illegible]
Page [illegible]

Result of Calibration : Within adjustment
Facility : Pressure Measurement
Increasing Pressure

Applied Pressure (kPa)	Indicated Reading (kPa)	Lower Limit (kPa)	ΔP (kPa)	Error (kPa)
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

The uncertainty of measurement is [illegible] kPa
*LSL = Lower Limit Calibration
*UP = High pressure [illegible]
The reported uncertainty of measurement was based on a standard uncertainty multiplied by a coverage factor k = 2, providing a level of confidence of approximately 95 %.

-end-

เอกสารไม่ควบคุม

[illegible]

Certificate of Calibration

Certificate No. : [illegible]
Page : [illegible]

Equipment : [illegible]
Manufacturer : [illegible]
Model : [illegible]
Serial No. : [illegible]
ID No. : [illegible]
Condition As Received : [illegible]
Measured Date : [illegible]
Calibration Date : [illegible]
Reference : [illegible]
Ambient Temperature : [illegible] °C
Relative Humidity : [illegible] %
Atmospheric Pressure : [illegible]

Submitted by : [illegible]

Procedure used : The calibration was conducted by direct comparison method against Pressure Measuring Instrument Standard according to in-house calibration procedure [illegible] using "[illegible] Calibration of Pressure Gauges, [illegible]" as a guideline.

Condition of the result of calibration

Instrument	Model	Serial No.	Certificate No.	Due Date
1) Pressure Calibrator	[illegible]	[illegible]	[illegible]	[illegible]

2) The result of calibration was made on requested of the item specified by customer.
3) Scale and conversion factor is 1 kPa = [illegible] mmHg
4) The instrument was used done at as pressure mode.
5) The instrument was installed in normal condition and quality of calibration was done at the reference time.
6) The certificate is valid only to the item calibrated on date and place of calibration.
7) The Certificate is traceable to the International System of Unit maintained by National Institute of Metrology (Thailand) (NIMT).

Calibrated by : [illegible]
Issue Date : [illegible]
Approved Signatory : [illegible]
( ) Pressure Calibration
( ) Scale Conversion
( ) Deputy Manager

เอกสารไม่ควบคุม

[illegible]

Cert.No. [illegible]
Page [illegible]

Result of Calibration : Within adjustment
Facility : Pressure Measurement
Increasing Pressure

Applied Pressure (kPa)	Indicated Reading (kPa)	Lower Limit (kPa)	ΔP (kPa)	Error (kPa)
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

The uncertainty of measurement was [illegible] kPa
*LSL = Lower Limit Calibration
*UP = High pressure [illegible]
The reported uncertainty of measurement was based on a standard uncertainty multiplied by a coverage factor k = 2, providing a level of confidence of approximately 95 %.

-end-

เอกสารไม่ควบคุม

[illegible]

Certificate of Calibration

Certificate No. : [illegible]
Page : [illegible]

Equipment : [illegible]
Manufacturer : [illegible]
Model : [illegible]
Serial No. : [illegible]
ID No. : [illegible]
Condition As Received : [illegible]
Measured Date : [illegible]
Calibration Date : [illegible]
Reference : [illegible]
Ambient Temperature : [illegible] °C
Relative Humidity : [illegible] %
Atmospheric Pressure : [illegible]

Submitted by : [illegible]

Procedure used : The calibration was conducted by direct comparison method against Pressure Measuring Instrument Standard according to in-house calibration procedure [illegible] using "[illegible] Calibration of Pressure Gauges, [illegible]" as a guideline.

Condition of the result of calibration

Instrument	Model	Serial No.	Certificate No.	Due Date
1) Pressure Calibrator	[illegible]	[illegible]	[illegible]	[illegible]

2) The result of calibration was made on requested of the item specified by customer.
3) Scale and conversion factor is 1 kPa = [illegible] mmHg
4) The instrument was used done at as pressure mode.
5) The instrument was installed in normal condition and quality of calibration was done at the reference time.
6) The certificate is valid only to the item calibrated on date and place of calibration.
7) The Certificate is traceable to the International System of Unit maintained by National Institute of Metrology (Thailand) (NIMT).

Calibrated by : [illegible]
Issue Date : [illegible]
Approved Signatory : [illegible]
( ) Pressure Calibration
( ) Scale Conversion
( ) Deputy Manager

เอกสารไม่ควบคุม

[illegible]

เอกสารไม่ควบคุม

Certificate of Calibration

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Certificate of Calibration

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Certificate of Calibration

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CALIBRATION LABORATORY Co., LTD.

CERTIFICATE OF CALIBRATION

FOR

Calibrated By :

Approved By :

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เอกสารไม่ควบคุม

REPORT OF CALIBRATION

FOR

NOMENCLATURE	:	VIBRATED 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. [illegible]
2. [illegible]
3. [illegible]

UNCERTAINTY :

[illegible]

Certificate No. [illegible]

CONDITION OF CALIBRATION ITEM : GOOD

MEASUREMENT RESULTS : (X) without adjustment ( ) adjustment

CALIBRATION DATA

1. ACCELERATION RESULT

Excitation		Axis	STD Reading	DUT Reading	Error	Uncertainty
(g)	(frequency)		(g)	(g)	(g)	(% reading)
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[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		Axis	STD Reading	DUT Reading	Error	Uncertainty
(mm/s)	(frequency)		(mm/s)	(mm/s)	(mm/s)	(% reading)
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[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]

CALIBRATION DATA

3. DISPLACEMENT RESULT

Excitation		Axis	STD Reading	DUT Reading	Error	Uncertainty
(mm)	(frequency)		(mm)	(mm)	(mm)	(% reading)
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[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]

CERTIFICATE OF CALIBRATION

FOR

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

CUSTOMER : [illegible]

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

Calibrated By : Sunit Phanthuadong
Calibration Engineer

Approved By : Monghak Sawasatto
Authorized Signatory
24 February 2022

Certificate No. [illegible]

CALIBRATION LABORATORY CO., LTD.

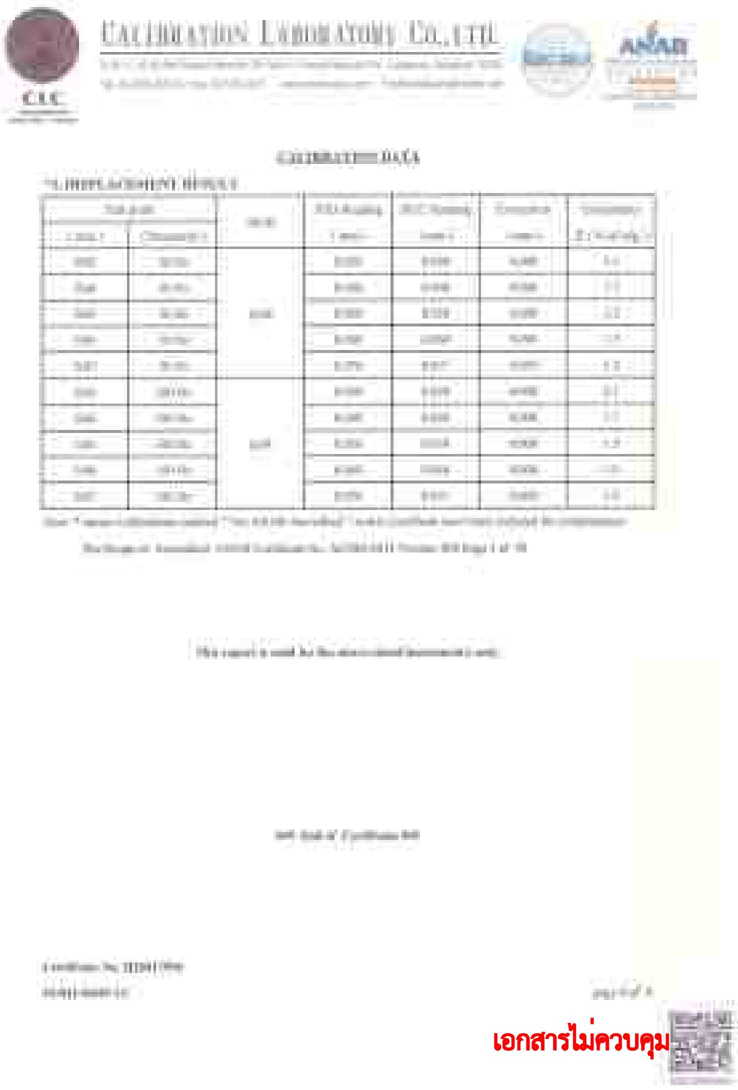
REPORT OF CALIBRATION

FOR

เอกสารไม่ควบคุม

CALIBRATION LABORATORY CO., LTD.

เอกสารไม่ควบคุม



CALIBRATION LABORATORY CO., LTD.

CALIBRATION DATA

เอกสารไม่ควบคุม

CALIBRATION LABORATORY CO., LTD.

CERTIFICATE OF CALIBRATION

FOR

เอกสารไม่ควบคุม

REPORT OF CALIBRATION

FOR

NOMENCLATURE : VIBRATION METER

MANUFACTURER :

MODEL / TYPE :

SERIAL NO. :

DATE OF CALIBRATION :

ENVIRONMENT CONDITIONS :

PROCEDURE USED :

REFERENCE STANDARD USED :

TRACEABILITY :

UNCERTAINTY :

CALIBRATION DATA

1. ACCELERATION RESULT

2. VELOCITY RESULT

CALIBRATION DATA

3. DISPLACEMENT RESULT

*** End of Certificate ***

CERTIFICATE OF CALIBRATION

FOR

NOMENCLATURE : VIBRATION METER

MANUFACTURER :

MODEL / TYPE :

SERIAL NO. :

CUSTOMER :

Calibrated By :

Calibration Engineer

Approved By :

Authorized Signatory

CALIBRATION LABORATORY CO.,LTD.

REPORT OF CALIBRATION

FOR

NOMENCLATURE : VIBRATION METER

MANUFACTURER :

MODEL / TYPE :

SERIAL NO. :

DATE OF CALIBRATION : 28 February 2022

ENVIRONMENT CONDITIONS :

PROCEDURE USED :

REFERENCE STANDARD USED :

TRACEABILITY :

UNCERTAINTY :

CALIBRATION LABORATORY CO.,LTD.

CALIBRATION DATA

1. ACCELERATION RESULT

2. VELOCITY RESULT

CALIBRATION LABORATORY CO.,LTD.

CALIBRATION DATA

3. DISPLACEMENT RESULT

*** End of Certificate ***

CALIBRATION LABORATORY CO.,LTD.

CERTIFICATE OF CALIBRATION

FOR

NOMENCLATURE : VIBRATION METER

MANUFACTURER :

MODEL / TYPE :

SERIAL NO. :

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

Calibrated By :

Calibration Engineer

Approved By :

Authorized Signatory

REPORT OF CALIBRATION

FOR

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

ENVIRONMENT CONDITIONS :

Temperature : [illegible] Relative Humidity : [illegible]

PROCEDURE USED :

[illegible]

REFERENCE STANDARD USED :

[illegible]

TRACEABILITY :

[illegible]

UNCERTAINTY :

[illegible]

CONDITION OF CALIBRATION ITEM : GOOD

MEASUREMENT RESULTS : [illegible]

CALIBRATION DATA

1. ACCELERATION RESULT

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

2. VELOCITY RESULT

Test point		Mode	UUC 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]

CALIBRATION DATA

3. DISPLACEMENT RESULT

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

[illegible]

*** End of Certificate ***

CERTIFICATE OF CALIBRATION

FOR

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

CUSTOMER : [illegible] ENGINEERING CONSULTANT CO., LTD.
[illegible]
[illegible]

DATE OF RECEIVED : [illegible] September 2022 DATE OF ISSUED : [illegible] September 2022

[illegible]

Calibrated By : [illegible]
Calibration Engineer

Approved By : [illegible]
Authorized Signatory
[illegible] September 2022

[illegible]


CALIBRATION LABORATORY CO.,LTD.

CLC

REPORT OF CALIBRATION

FOR

เอกสารไม่ควบคุม


CALIBRATION LABORATORY CO.,LTD.

CLC

CALIBRATION DATA

เอกสารไม่ควบคุม


CALIBRATION LABORATORY CO.,LTD.

CLC

CALIBRATION DATA

เอกสารไม่ควบคุม


CALIBRATION LABORATORY CO.,LTD.

CLC

CERTIFICATE OF CALIBRATION

FOR

Calibrated By :

Approved By :

เอกสารไม่ควบคุม

CALIBRATION LABORATORY CO.,LTD.

C.L.C

REPORT OF CALIBRATION

FOR

VIBRATION METER

ENVIRONMENT CONDITIONS :

PROCEDURE USED :

REFERENCE STANDARD USED :

TRACEABILITY :

UNCERTAINTY :

เอกสารไม่ควบคุม

CALIBRATION LABORATORY CO.,LTD.

C.L.C

CALIBRATION DATA

1. ACCELERATION RESULT

2. VELOCITY RESULT

เอกสารไม่ควบคุม

CALIBRATION LABORATORY CO.,LTD.

C.L.C

CALIBRATION DATA

3. DISPLACEMENT RESULT

เอกสารไม่ควบคุม

CALIBRATION LABORATORY CO.,LTD.

C.L.C

CERTIFICATE OF CALIBRATION

FOR

VIBRATION METER

Calibrated By :

Calibration Engineer

Approved By :

Authorized Signatory

February 2023

เอกสารไม่ควบคุม

CALIBRATION LABORATORY CO.,LTD.

REPORT OF CALIBRATION

FOR

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

ENVIRONMENT CONDITIONS :
Temperature : [illegible] °C Relative Humidity : [illegible]

PROCEDURE USED :

REFERENCE STANDARD USED :

TRACEABILITY :

UNCERTAINTY :

Certificate No. [illegible]

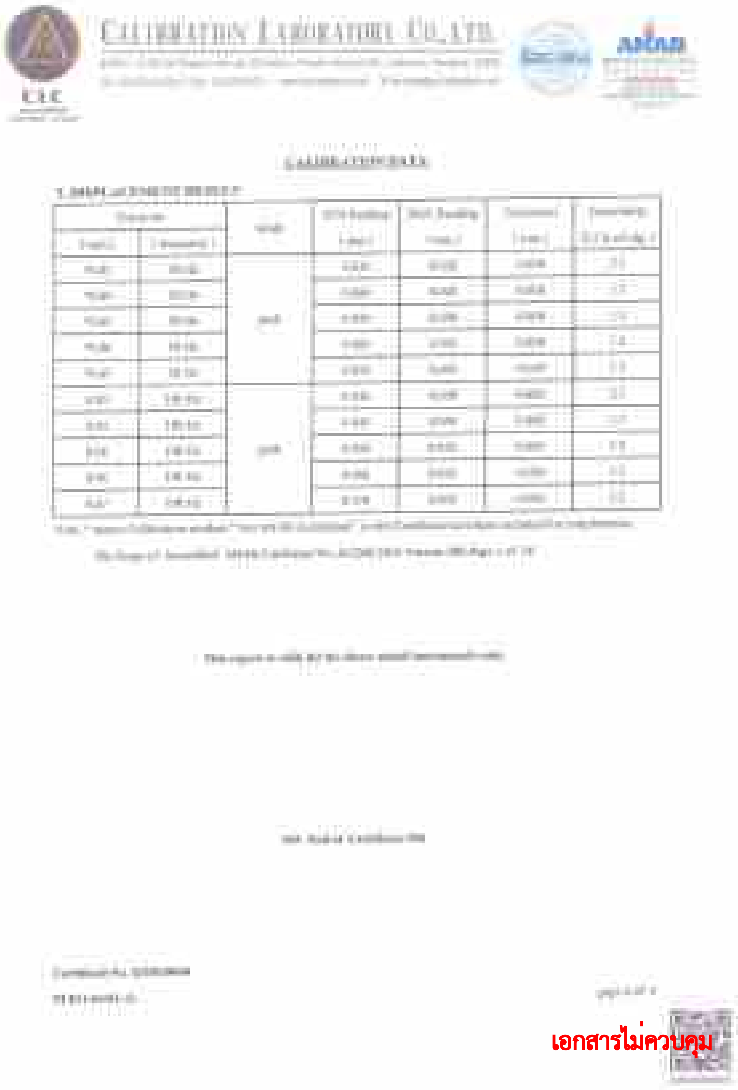
CALIBRATION LABORATORY CO.,LTD.

CALIBRATION DATA

1. ACCELERATION RESULT

2. VELOCITY RESULT

Certificate No. [illegible]



CALIBRATION LABORATORY CO.,LTD.

CALIBRATION DATA

3. DISPLACEMENT RESULT

Certificate No. [illegible]

CALIBRATION LABORATORY CO.,LTD.

CERTIFICATE OF CALIBRATION

FOR

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

Calibrated By : [illegible]
Calibration Engineer

Approved By : [illegible]
Authorized Signatory
[illegible] February 2023

Certificate No. [illegible]

REPORT OF CALIBRATION

FOR

NOMENCLATURE	:	VIBRATION METER
MANUFACTURER	:	[illegible]
MODEL / TYPE	:	[illegible]
SERIAL No.	:	[illegible]
DATE OF CALIBRATION	:	21 February 2021

ENVIRONMENT CONDITIONS :

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]

CORRECTION OF CALIBRATION ITEM : [illegible]

MEASUREMENT RESULTS : [illegible]

CALIBRATION DATA

1. MEASUREMENT RESULT

Frequency (Hz)	Frequency (Hz)	Mode	[illegible] (Hz)	[illegible] (Hz)	[illegible] (Hz)	[illegible] (%)
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[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 MODE :

Velocity (mm/s)	Velocity (mm/s)	Mode	[illegible] (mm/s)	[illegible] (mm/s)	[illegible] (mm/s)	[illegible] (%)
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[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]

CALIBRATION DATA

3. DISPLACEMENT RESULT

Frequency (Hz)	Frequency (Hz)	Mode	[illegible] (mm)	[illegible] (mm)	[illegible] (mm)	[illegible] (%)
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[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]

CERTIFICATE OF CALIBRATION

FOR

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

CUSTOMER : [illegible]

DATE OF RECEIVED : 21 February 2021 DATE OF ISSUED : 18 February 2021

Calibrated By : [illegible]
Calibration Engineer

Approved By : [illegible]
Authorized Signatory
18 February 2021

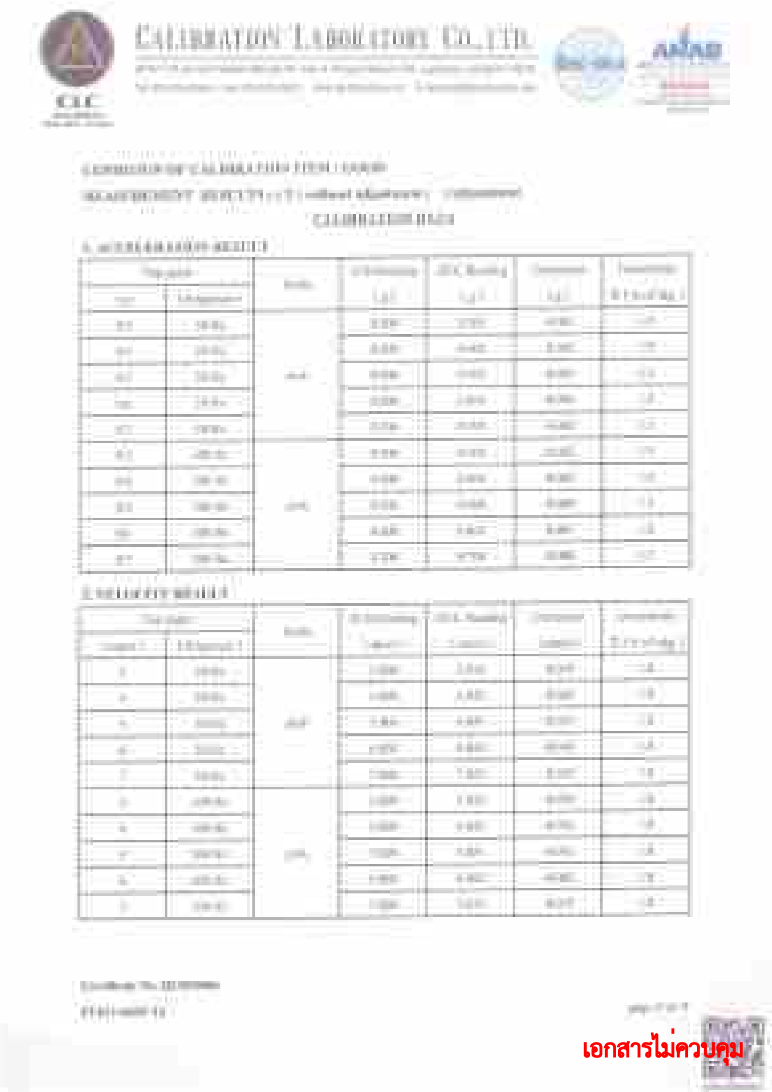
Certificate No. [illegible]

[illegible]

CALIBRATION LABORATORY CO.,LTD.

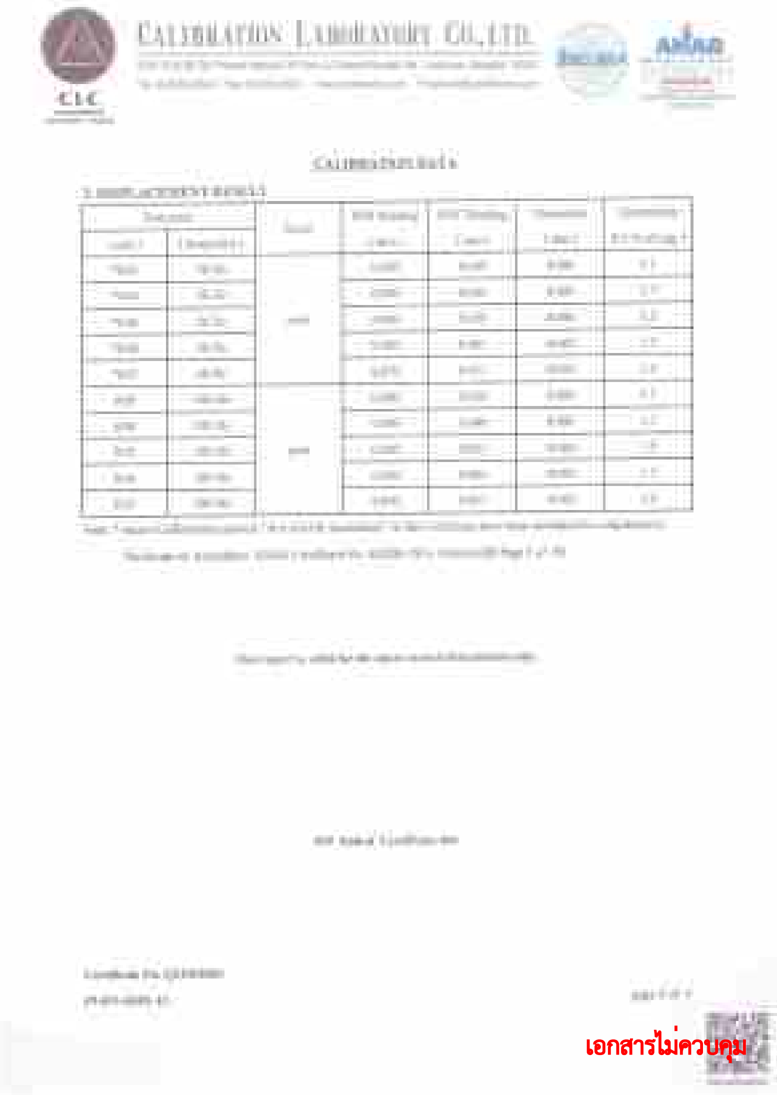
REPORT OF CALIBRATION

FOR



CALIBRATION LABORATORY CO.,LTD.

CALIBRATION DATA



CALIBRATION LABORATORY CO.,LTD.

CALIBRATION DATA

CALIBRATION LABORATORY CO.,LTD.

CERTIFICATE OF CALIBRATION

FOR

Calibrated By :

Calibration Engineer

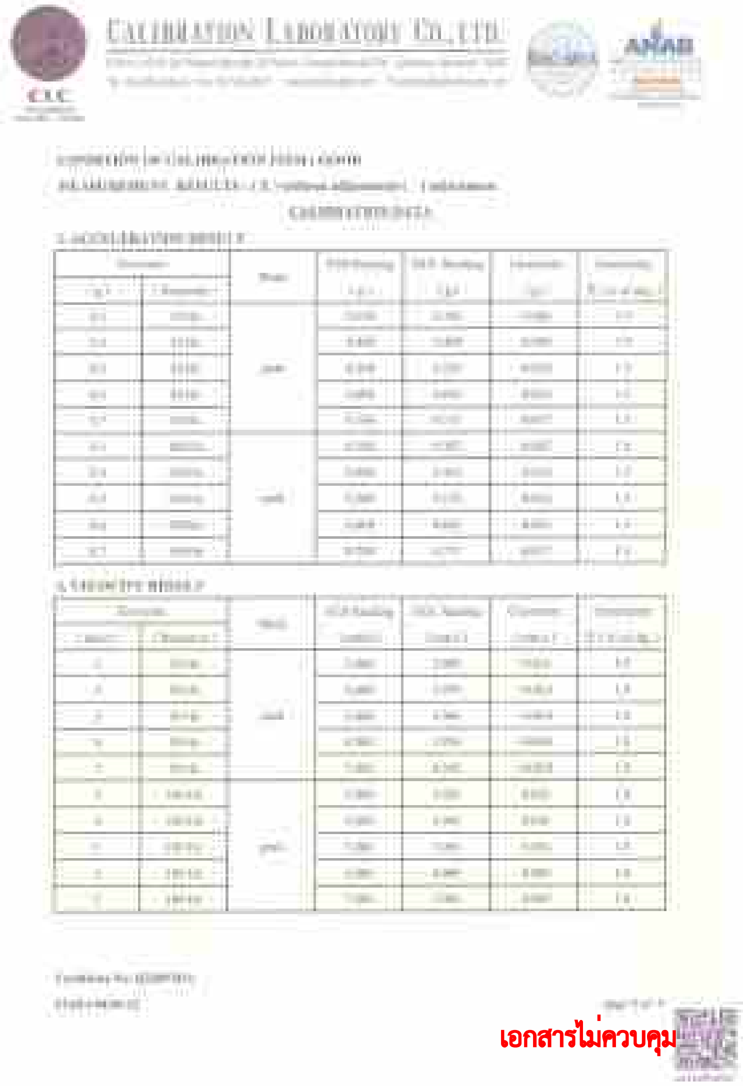
Approved By :

Authorized Signatory

CALIBRATION LABORATORY CO.,LTD.

REPORT OF CALIBRATION

FOR



CALIBRATION LABORATORY CO.,LTD.

CALIBRATION DATA

CALIBRATION LABORATORY CO.,LTD.

CALIBRATION DATA

CALIBRATION LABORATORY CO.,LTD.

CERTIFICATE OF CALIBRATION

FOR

Calibrated By :

Calibration Engineer

Approved By :

Authorized Engineer

CALIBRATION LABORATORY CO.,LTD.

REPORT OF CALIBRATION

FOR

NOMENCLATURE : VIBRATION METER

ENVIRONMENT CONDITIONS :

PROCEDURE USED :

REFERENCE STANDARD USED :

TRACEABILITY :

UNCERTAINTY :

CALIBRATION LABORATORY CO.,LTD.

CALIBRATION DATA

1. ACCELERATION RESULT

2. VELOCITY RESULT

CALIBRATION LABORATORY CO.,LTD.

CALIBRATION DATA

3. DISPLACEMENT RESULT

CALIBRATION LABORATORY CO.,LTD.

CERTIFICATE OF CALIBRATION

FOR

NOMENCLATURE : VIBRATION METER

Calibrated By :

Calibration Engineer

Approved By :

Authorized Signatory

CALIBRATION LABORATORY CO.,LTD.

REPORT OF CALIBRATION

FOR

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

ENVIRONMENT CONDITIONS :
Temperature : [illegible] °C Relative Humidity : [illegible]

PROCEDURE USED :

[illegible]

REFERENCE STANDARDS USED :

[illegible]

TRACEABILITY :

[illegible]

UNCERTAINTY :

[illegible]

Certificate No. [illegible]

CALIBRATION LABORATORY CO.,LTD.

CONDITION OF CALIBRATION ITEM : GOOD

MEASUREMENT RESULTS : [illegible]

CALIBRATION DATA

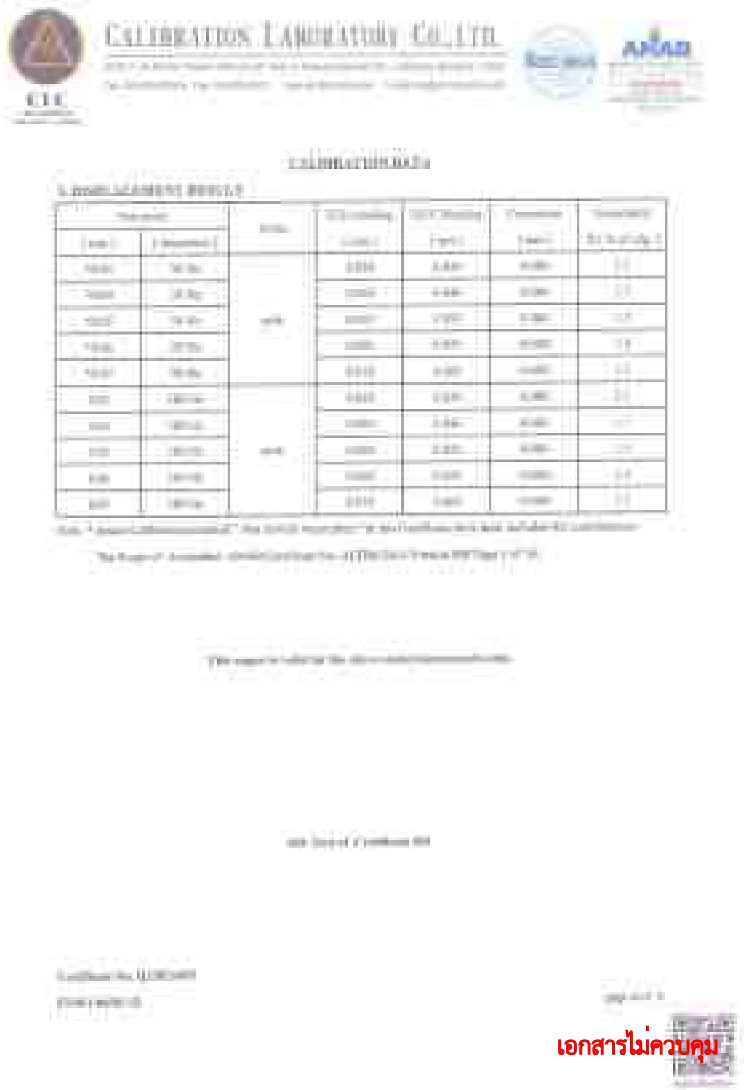
1. ACCELERATION RESULT

[illegible]

2. VELOCITY RESULT

[illegible]

Certificate No. [illegible]



CALIBRATION LABORATORY CO.,LTD.

CALIBRATION DATA

3. DISPLACEMENT RESULT

[illegible]

Certificate No. [illegible]

CALIBRATION LABORATORY CO.,LTD.

CERTIFICATE OF CALIBRATION

FOR

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

CUSTOMER : [illegible]

DATE OF RECEIVED : [illegible] August 2022 DATE OF ISSUE : [illegible] September 2022

Calibrated By : [illegible]
Calibration Engineer

Approved By : [illegible]
Authorized Signatory
[illegible] September 2022

Certificate No. [illegible]

CALIBRATION LABORATORY CO.,LTD.

REPORT OF CALIBRATION

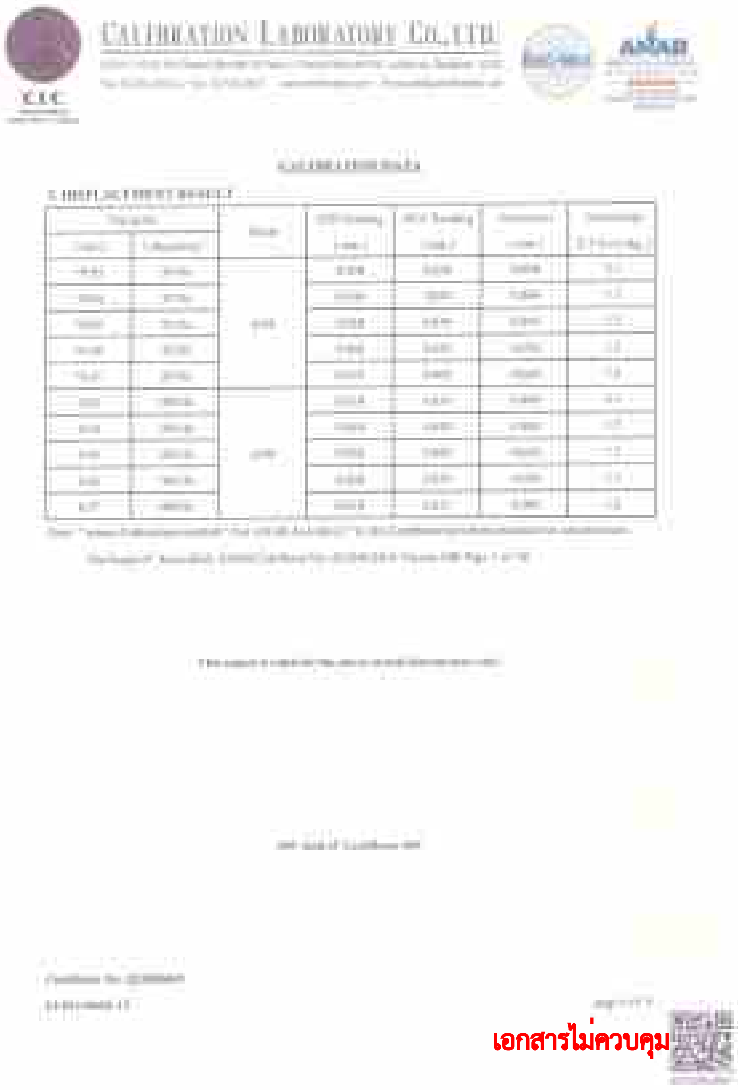
FOR

เอกสารไม่ควบคุม

CALIBRATION LABORATORY CO.,LTD.

CALIBRATION DATA

เอกสารไม่ควบคุม



CALIBRATION LABORATORY CO.,LTD.

CALIBRATION DATA

เอกสารไม่ควบคุม

Certificate of Calibration

เอกสารไม่ควบคุม

End of Calibration

เอกสารไม่ควบคุม

Certificate of Calibration

End of Calibration

เอกสารไม่ควบคุม

End of Calibration

เอกสารไม่ควบคุม

SITHIPORN ASSOCIATES CO.,LTD.
CALIBRATION LABORATORY

Calibration Certificate

Equipment :
Manufacturer :
Model :
Serial No. :
ID No. :

Condition As Found :

Customer :

Location :
Ambient Temperature :
Pressure :
Relative Humidity :

Received Date :
Calibration Date :
Date of Issue :

Calibrated by :

Approved By :

เอกสารไม่ควบคุม

SITHIPORN ASSOCIATES CO.,LTD.
CALIBRATION LABORATORY

Continuation of Calibration Certificate

Cert. No. : [illegible]
Job No. : [illegible]
Page : [illegible]

Calibration Procedure : [illegible]

Calibration Method :

[illegible]

Condition of this result of calibration :

1. Reference Standard Instruments :

Instrument	Model	Serial No.	Cert. No.	Due Date
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

1. The result of calibration was found accurate or within the tolerance of calibration. [illegible]
2. This certificate is issued in the represented system of unit measurement.
   2.1 National Institute of Metrology (Thailand)
   2.2 National Institute of Scientific and Technological Research (THAILAND)

SITHIPORN ASSOCIATES CO.,LTD.
CALIBRATION LABORATORY

Continuation of Calibration Certificate

Cert. No. : [illegible]
Job No. : [illegible]
Page : [illegible]

Result of calibration :

1. Absolute sensitivity

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

2. Self-generated noise

2.1 Normal use

Measured Value (dB)
[illegible]

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

Frequency Weighting	Measured value (dB)
A - weight	[illegible]
C - weight	[illegible]
Flat	[illegible]

3. Acoustical signal test at frequency weightings

Above that field acoustic response at a level of 94 dB.

Frequency (Hz)	Deviation from acoustic frequency weighting response curve (dB)			
	Flat	C-weight	A-weight	Acceptance Limits
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

เอกสารไม่ควบคุม

SITHIPORN ASSOCIATES CO.,LTD.
CALIBRATION LABORATORY

Continuation of Calibration Certificate

Cert. No. : [illegible]
Job No. : [illegible]
Page : [illegible]

Summary of Measurement Result :

Parameter	Pass	Fail	Uncertainty (dB)	Maximum permitted uncertainty of measurement (dB)
1. Absolute sensitivity	✓	-	[illegible]	[illegible]
2. Self-generated noise	✓	-	[illegible]	[illegible]
3. Acoustical signal test of frequency weightings				
[illegible] Hz	✓	-	[illegible]	[illegible]
[illegible] Hz	✓	-	[illegible]	[illegible]
[illegible] Hz	✓	-	[illegible]	[illegible]
4. Acoustical signal test of frequency weightings				
Flat ([illegible] to [illegible] Hz)	✓	-	[illegible]	[illegible]
Flat ([illegible] to [illegible] Hz)	✓	-	[illegible]	[illegible]
Flat ([illegible] to [illegible] Hz)	✓	-	[illegible]	[illegible]
5. Frequency weighting response at 1 kHz	✓	-	[illegible]	[illegible]
6. Long - term stability	✓	-	[illegible]	[illegible]
7. Level linearity on the reference level range	✓	-	[illegible]	[illegible]
8. Level linearity including the level range control	✓	-	[illegible]	[illegible]
9. Time burst response	✓	-	[illegible]	[illegible]
10. Peak C - sound level	✓	-	[illegible]	[illegible]
11. Overload indication	✓	-	[illegible]	[illegible]
12. High-level stability	✓	-	[illegible]	[illegible]

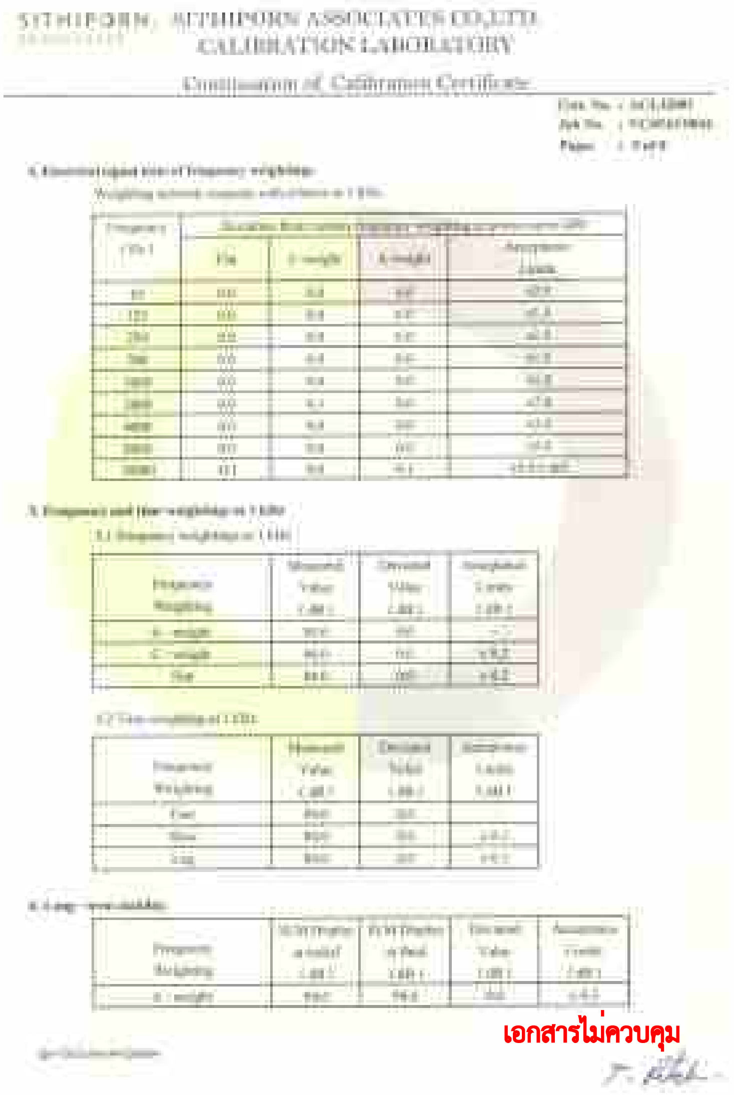
เอกสารไม่ควบคุม

SITHIPORN ASSOCIATES CO.,LTD.
CALIBRATION LABORATORY

Continuation of Calibration Certificate

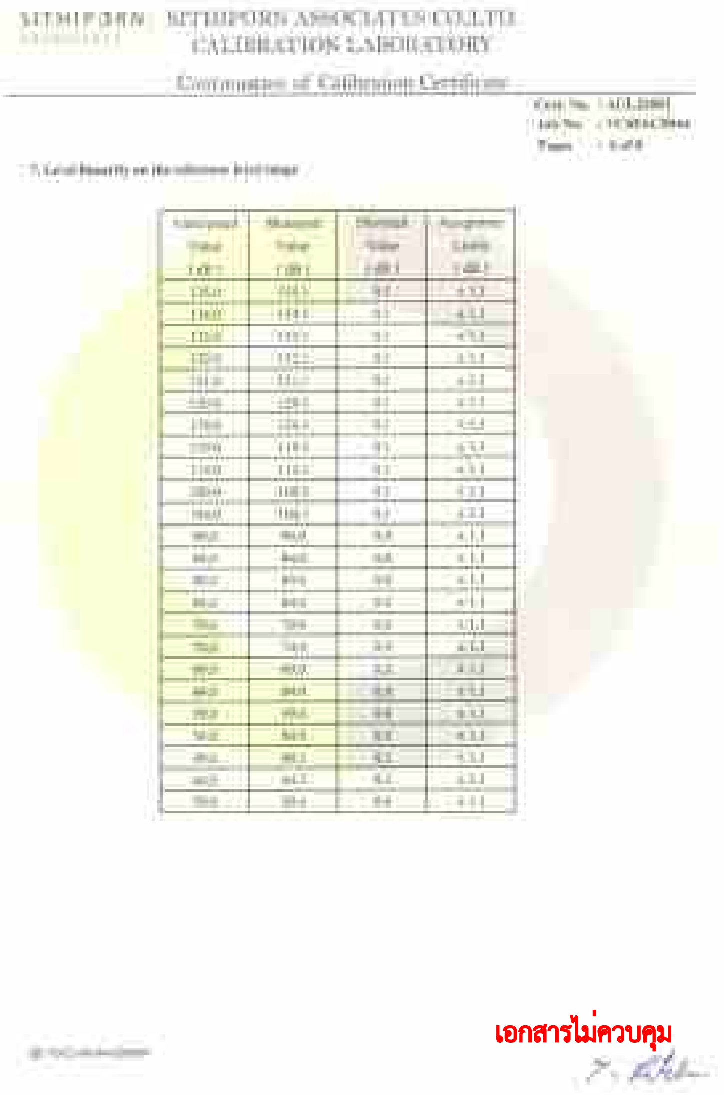
Cert. No. : [illegible]
Job No. : [illegible]
Page : [illegible]

เอกสารไม่ควบคุม


SITHIPORN ASSOCIATES CO.,LTD
CALIBRATION LABORATORY

Continuation of Calibration Certificate

เอกสารไม่ควบคุม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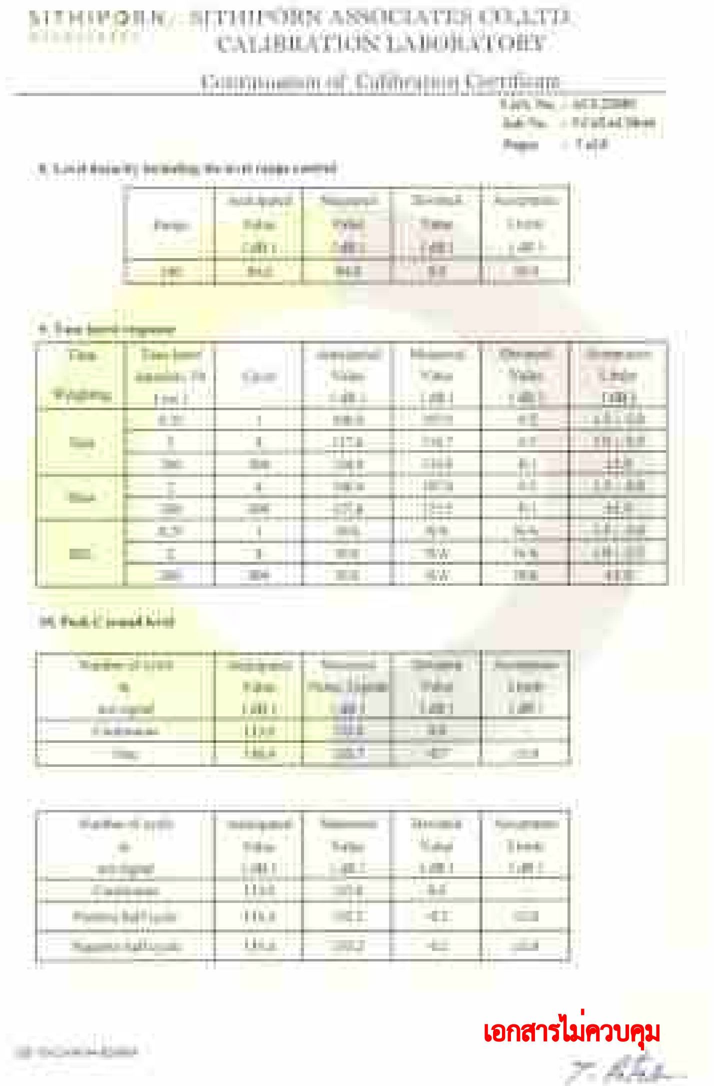
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Continuation of Calibration Certificate

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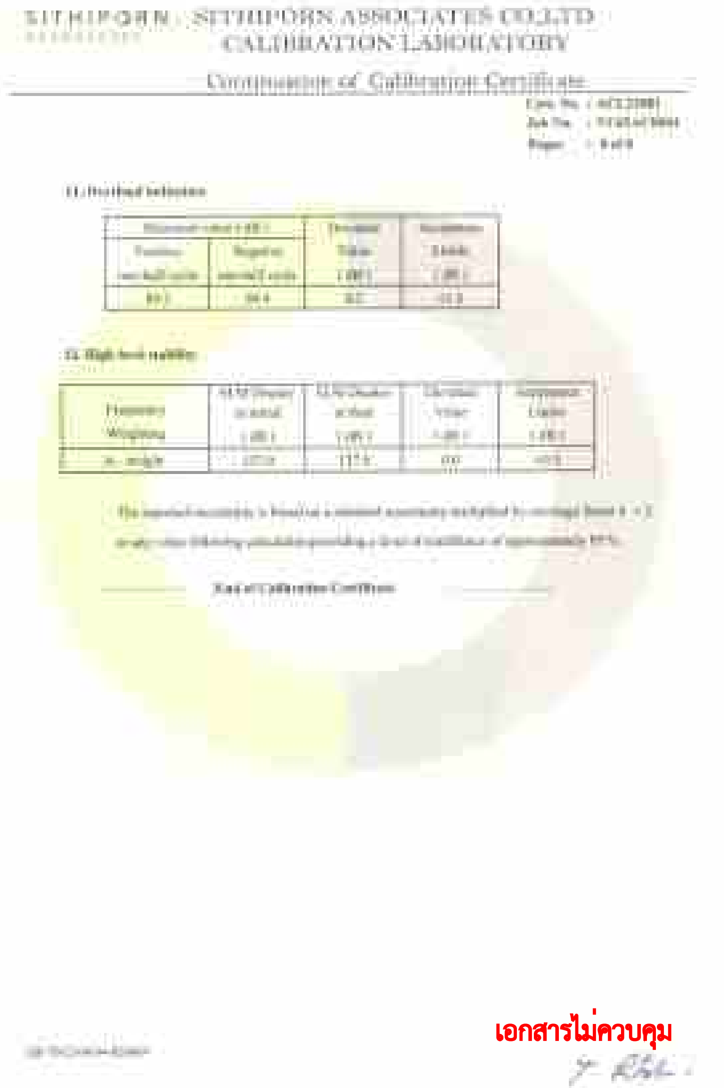
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CALIBRATION LABORATORY

Continuation of Calibration Certificate

เอกสารไม่ควบคุม

SITHIPORN ASSOCIATES CO.,LTD.
CALIBRATION LABORATORY

Calibration Certificate

Equipment :
Manufacturer :
Model :
Serial No. :
ID No. :

Condition As Found : GOOD

Customer :

Location :
Ambient Temperature : °C
Pressure : kPa
Relative Humidity : %

Received Date :
Calibration Date :
Date of Issue :

Calibrated by : Sutthiporn Phongsawan

Approved by : Thanakit Pitchan

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

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เอกสารไม่ควบคุม

SITHIPORN ASSOCIATES CO.,LTD.
CALIBRATION LABORATORY

Continuation of Calibration Certificate

Cert. No. : AC1.12001
Job No. : 1/Calibration
Page : 1 of 9

Calibration Procedure :

Calibration Method :

Condition of the result of calibration :

Instrument	Model	Serial No.	Cert. No.	Due Date
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[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]
Condensed Microphone	[illegible]	[illegible]	[illegible]	[illegible]
Measuring Amplifier	[illegible]	[illegible]	[illegible]	[illegible]

1. The result of calibration may be not accurate as above on date and place of calibration. All the calibrated data only.
2. This certificate is traceable to the international system of measurement at
   2.1 National Institute of Metrology (Thailand)
   2.2 National Institute of Scientific and Technological Research (TISTR)

เอกสารไม่ควบคุม

SITHIPORN ASSOCIATES CO.,LTD.
CALIBRATION LABORATORY

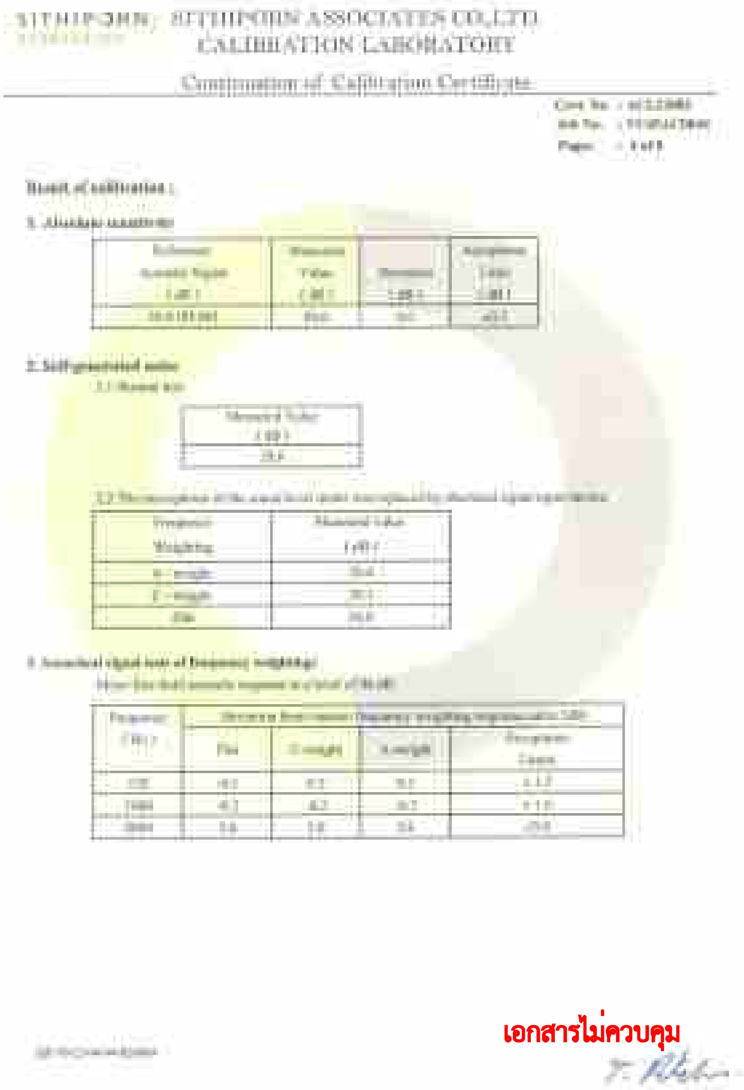
Continuation of Calibration Certificate

Cert. No. : AC1.12001
Job No. : 1/Calibration
Page : 2 of 9

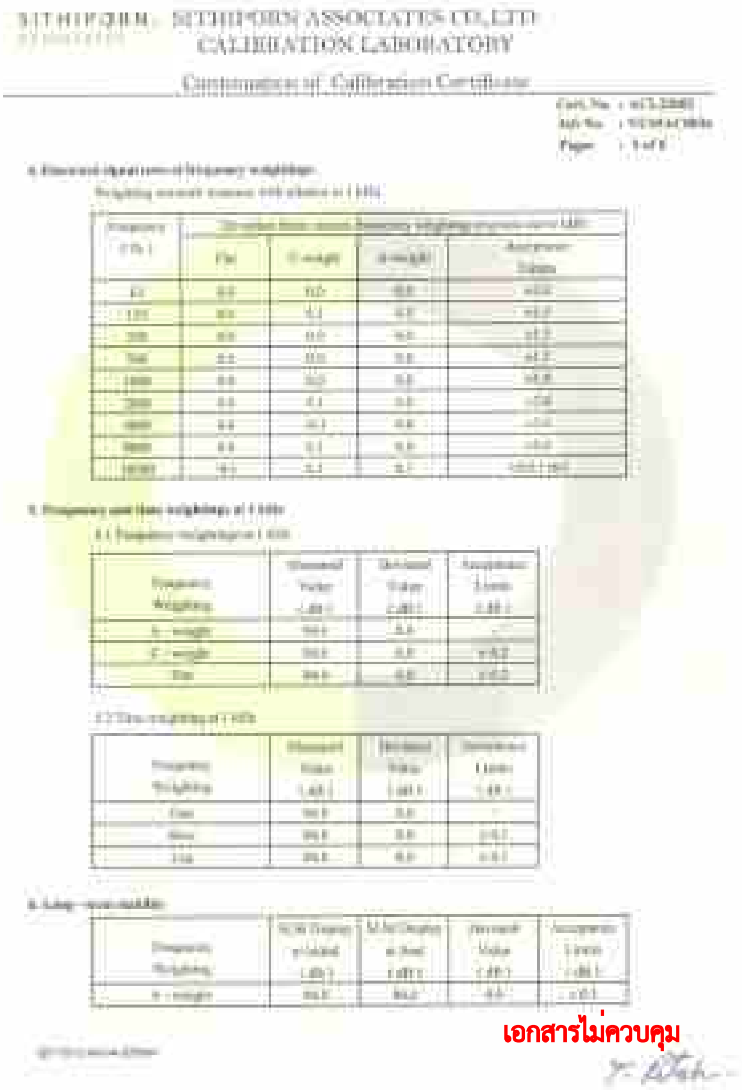
Summary of Measurement Result :

Parameter	Pass	Fail	Uncertainty (dB)	Maximum permissible uncertainty of measurement (dB)
[illegible]	✓		[illegible]	[illegible]
[illegible]	✓		[illegible]	[illegible]
[illegible]				
[illegible]	✓		[illegible]	[illegible]
[illegible]	✓		[illegible]	[illegible]
[illegible]	✓		[illegible]	[illegible]
[illegible]				
[illegible]	✓		[illegible]	[illegible]
[illegible]	✓		[illegible]	[illegible]
[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


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

เอกสารไม่ควบคุม


SITHIPORN ASSOCIATES CO.,LTD
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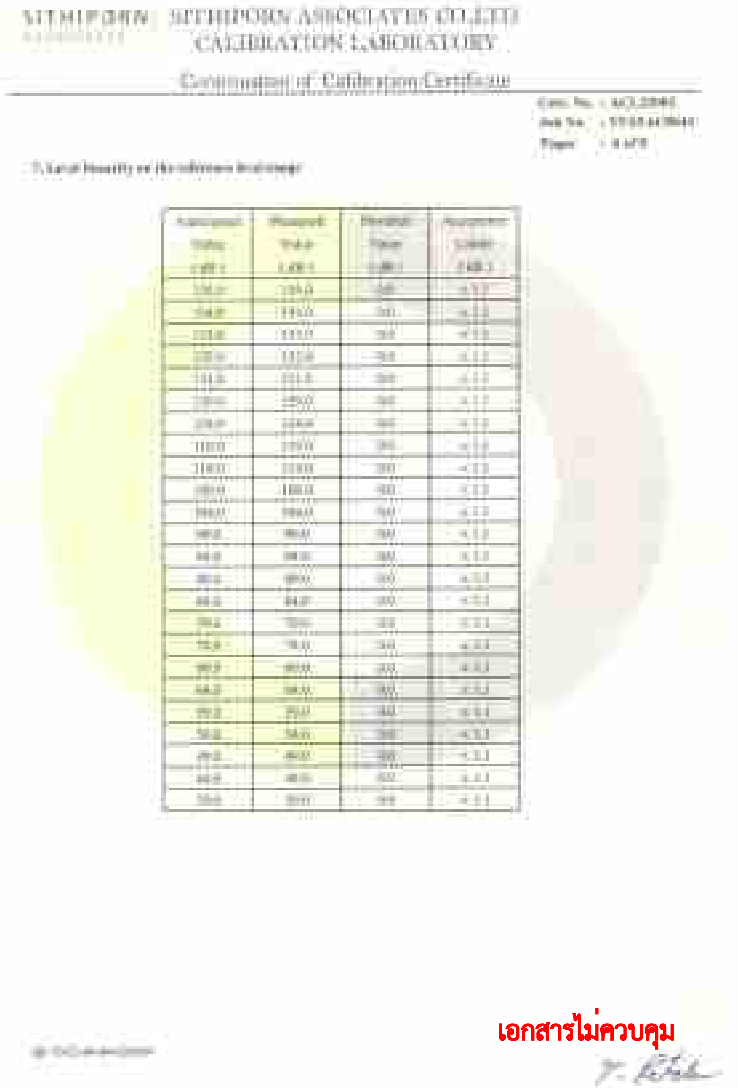
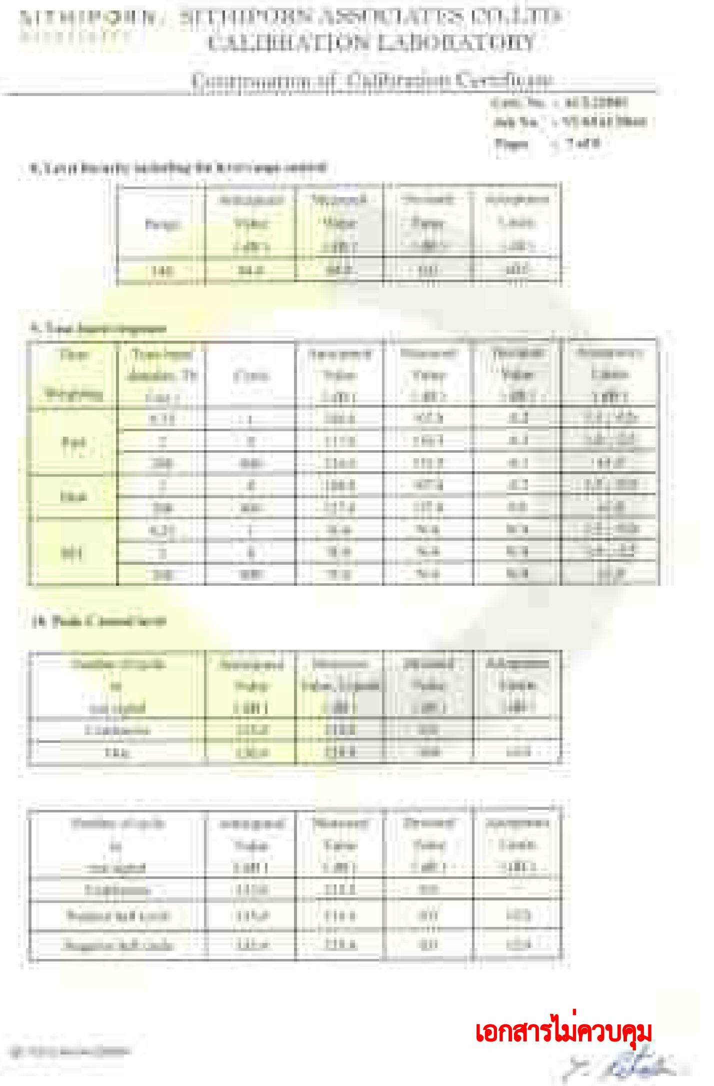
Continuation of Calibration Certificate

เอกสารไม่ควบคุม


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

เอกสารไม่ควบคุม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Continuation of Calibration Certificate

เอกสารไม่ควบคุม

SITHIPORN ASSOCIATES CO.,LTD.
CALIBRATION LABORATORY

Continuation of Calibration Certificate

Cert. No. : AC-[illegible]
Job No. : [illegible]
Page : [illegible]

[illegible]

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

[illegible]

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

[illegible]

End of Calibration Certificate

เอกสารไม่ควบคุม

[illegible]

[illegible]

Certificate of Calibration

[illegible]

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

[illegible]

เอกสารไม่ควบคุม

[illegible]

[illegible]

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

[illegible]

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

[illegible]

[illegible]

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


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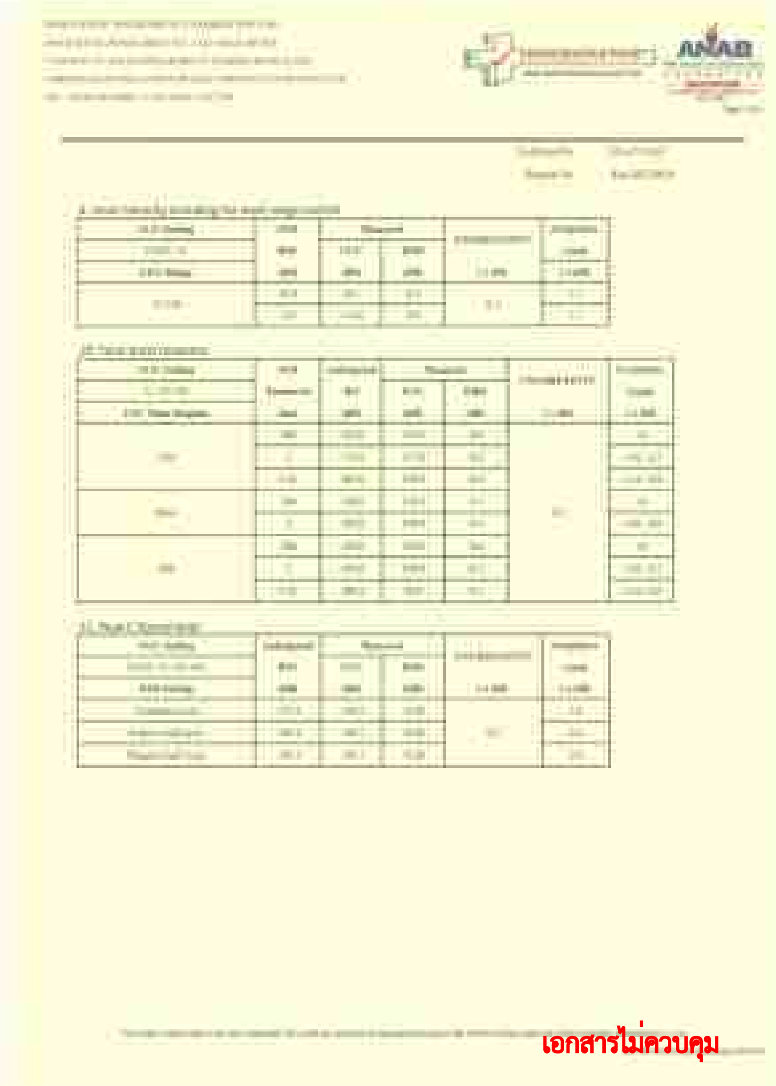

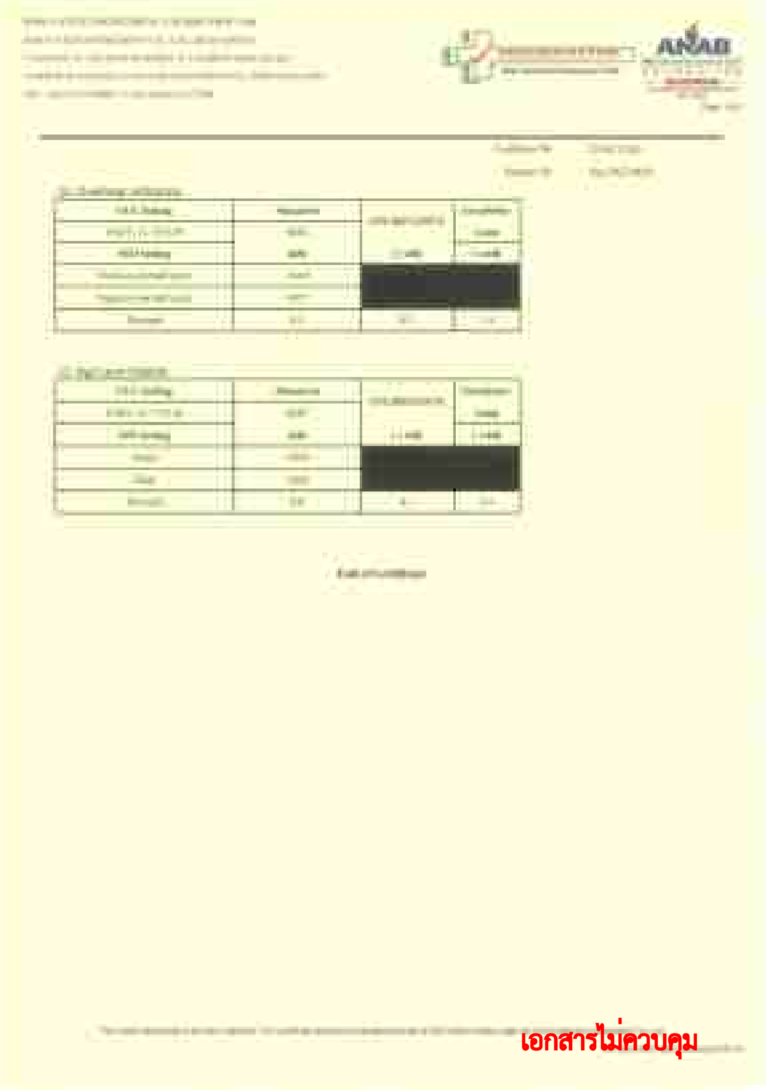
[redacted]

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เอกสารไม่ควบคุม

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เอกสารไม่ควบคุม

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เอกสารไม่ควบคุม

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เอกสารไม่ควบคุม

Certificate of Calibration

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เอกสารไม่ควบคุม

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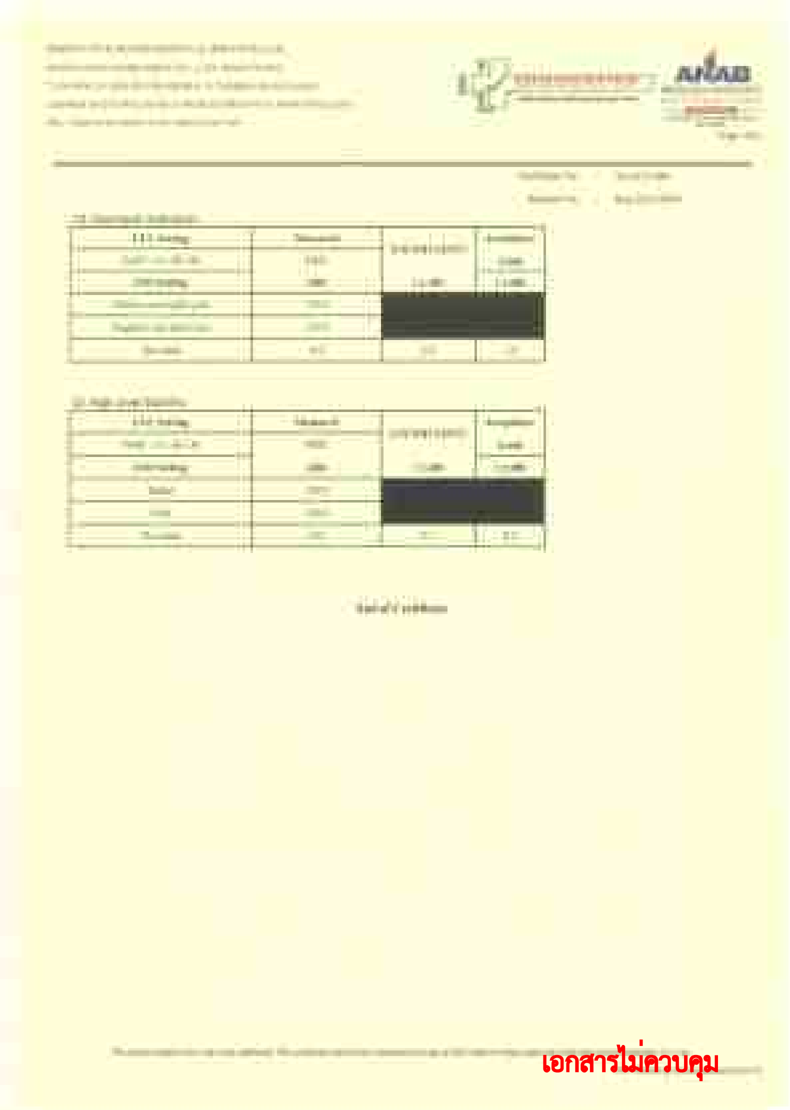
เอกสารไม่ควบคุม



SITHIPORN ASSOCIATES CO.,LTD.
CALIBRATION LABORATORY

Cert. No. :
Page : 1 of 8

Calibration Certificate

Equipment :
Manufacturer :
Model :
Serial No. :
ID No. :

Condition As Found :

Customer :

Location :
Ambient Temperature : (±) °C
Pressure : (±) kPa
Relative Humidity : (±) %

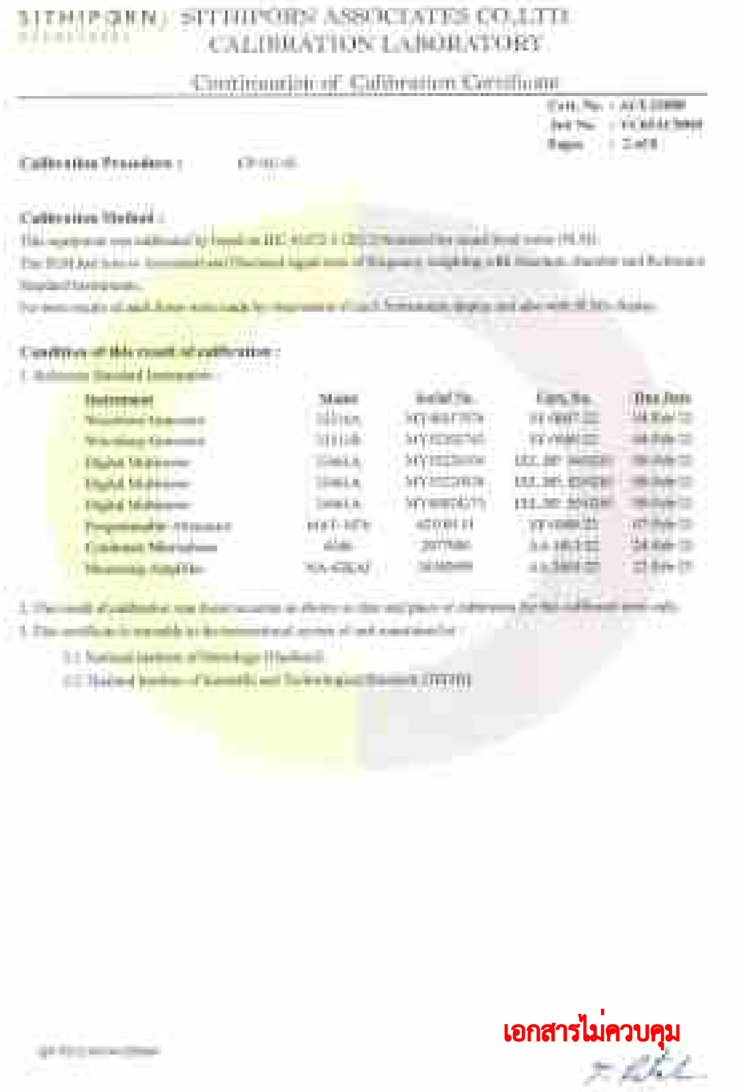
Received Date : APRIL
Calibration Date : APRIL
Date of Issue : APRIL

Calibrated by :

Approved by :

T. Pch

( )



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CALIBRATION LABORATORY

Continuation of Calibration Certificate

Cert. No. :
Job No. :
Page : 2 of 8

Calibration Procedure :

Calibration Method :

Condition of this result of calibration :

Instrument	Model	Serial No.	Cert. No.	Due Date

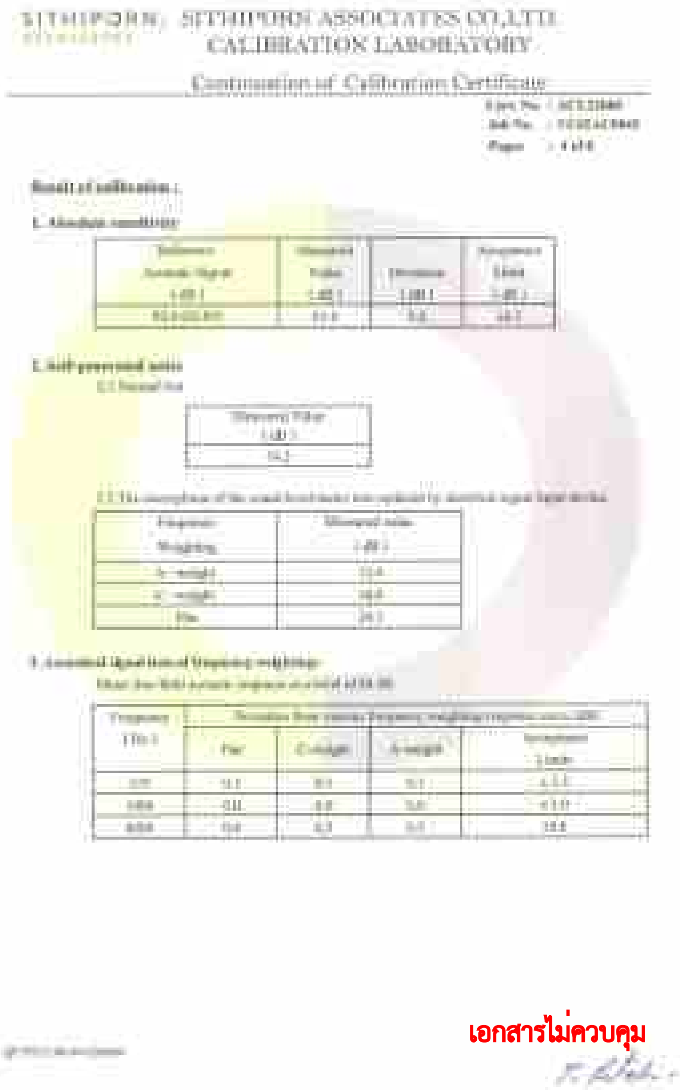
SITHIPORN ASSOCIATES CO.,LTD.
CALIBRATION LABORATORY

Continuation of Calibration Certificate

Cert. No. :
Job No. :
Page : 3 of 8

Summary of Measurement Result :

Parameter	Pass	Fail	Uncertainty (dB)	Maximum permitted uncertainty of measurement (dB)



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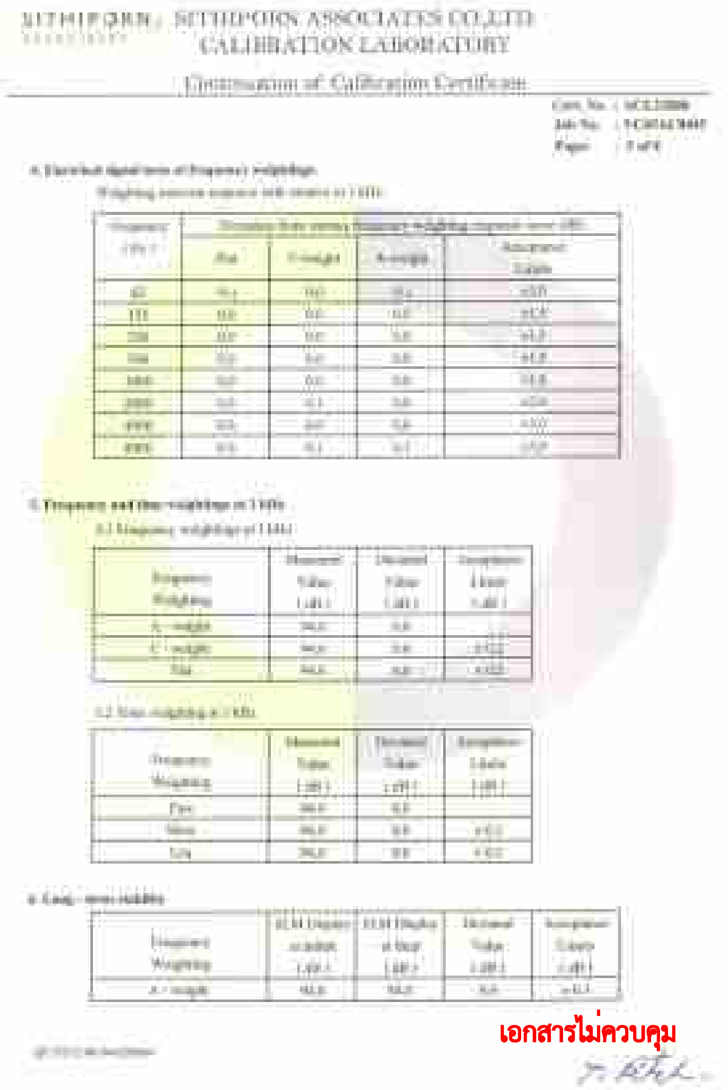
CALIBRATION LABORATORY

Continuation of Calibration Certificate

Cert. No. :
Job No. :
Page :

Result of calibration :

เอกสารไม่ควบคุม



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Continuation of Calibration Certificate

Cert. No. :
Job No. :
Page :

เอกสารไม่ควบคุม

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CALIBRATION LABORATORY

Continuation of Calibration Certificate

Cert. No. :
Job No. :
Page :

เอกสารไม่ควบคุม

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CALIBRATION LABORATORY

Continuation of Calibration Certificate

Cert. No. :
Job No. :
Page :

เอกสารไม่ควบคุม

SITHIPORN ASSOCIATES CO.,LTD.
CALIBRATION LABORATORY

Continuation of Calibration Certificate

Cert. No. : [illegible]
Job No. : [illegible]
Page : [illegible]

11. Overload indication

Maximum value (g)		Deviation Value (g)	Acceptance Limits (g)
Positive (non-half-cycle)	Negative (non-half-cycle)		
[illegible]	[illegible]	[illegible]	[illegible]

12. Digital resolution

Displayed Weighing	32,000 Display (e value) (g)	32,000 Display (e line) (g)	Deviation Value (g)	Acceptance Limits (g)
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

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

End of Calibration Certificate

เอกสารไม่ควบคุม

SITHIPORN ASSOCIATES CO.,LTD.
CALIBRATION LABORATORY

[illegible]

Cert. No. : [illegible]
Page : [illegible]

Calibration Certificate

Equipment : [illegible]
Manufacturer : [illegible]
Model : [illegible]
Serial No.: [illegible]
ID No.: -

Condition As Found : GOOD

Customer : [illegible]

Location :
Ambient Temperature : [illegible] °C
Pressure : [illegible] kPa
Relative Humidity : [illegible] %

Received Date : [illegible]
Calibration Date : [illegible]
Date of Issue : [illegible]

Calibrated by : [illegible]

Approved by : [illegible]

(Thanakit Pitchani)

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SITHIPORN ASSOCIATES CO.,LTD.
CALIBRATION LABORATORY

Continuation of Calibration Certificate

Cert. No. : [illegible]
Job No. : [illegible]
Page : 2 of 9

Calibration Procedure : [illegible]

Calibration Method :
[illegible]

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

Instrument	Model	Serial No.	Cert. No.	Due Date
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

2. This result of calibration was found accurate at moment on date and place of calibration for the calibrated item only.
3. This certificate is traceable to the international system of units maintained at :
   3.1 National Institute of Metrology (Thailand)
   3.2 National Institute of Scientific and Technological Research (TISTR)

เอกสารไม่ควบคุม

SITHIPORN ASSOCIATES CO.,LTD.
CALIBRATION LABORATORY

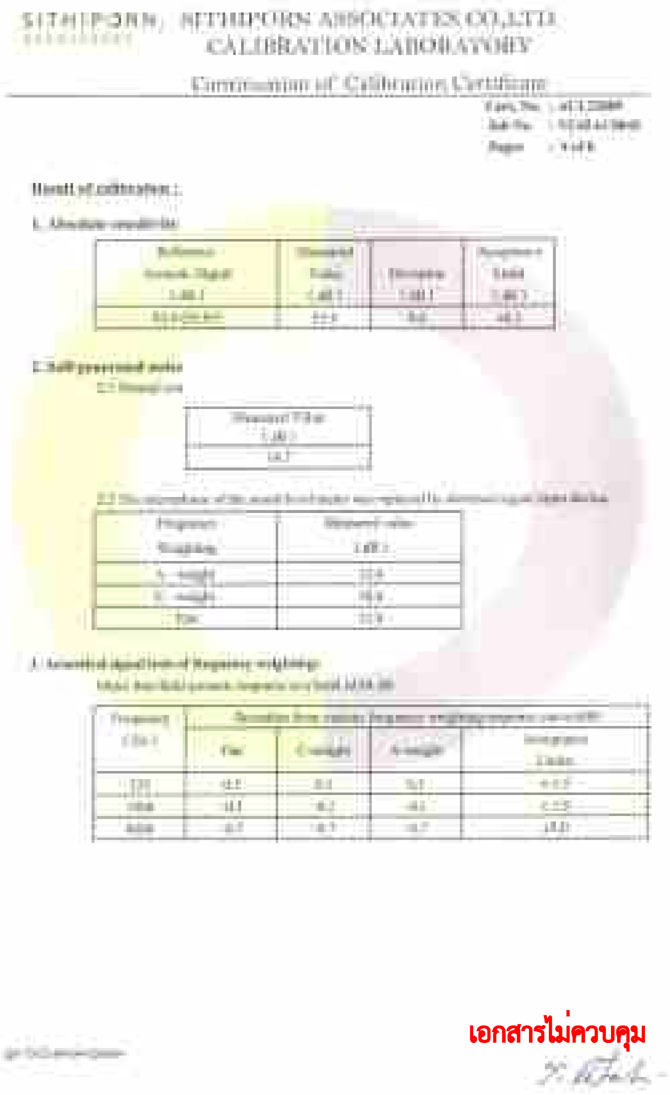
Continuation of Calibration Certificate

Cert. No. : [illegible]
Job No. : [illegible]
Page : [illegible]

Summary of Measurement Result :

Parameter	Pass	Fail	Uncertainty (g)	Maximum permitted uncertainty of measurement (g)
1. Minimum sensitivity	✓	-	[illegible]	[illegible]
2. Self generated noise	✓	-	[illegible]	[illegible]
3. Automatic signal zero of frequency weighing:				
[illegible]	✓	-	[illegible]	[illegible]
[illegible]	✓	-	[illegible]	[illegible]
[illegible]	✓	-	[illegible]	[illegible]
4. Manual signal zero of frequency weighing:				
[illegible]	✓	-	[illegible]	[illegible]
[illegible]	✓	-	[illegible]	[illegible]
[illegible]	-	-	-	[illegible]
5. Frequency positive weighing (d 1 kHz)	✓	-	[illegible]	[illegible]
6. Long term stability	✓	-	[illegible]	[illegible]
7. Level linearity on the reference level range	✓	-	[illegible]	[illegible]
8. Level linearity including the overrange control	✓	-	[illegible]	[illegible]
9. Time measurement	✓	-	[illegible]	[illegible]
10. Peak C sound level	✓	-	[illegible]	[illegible]
11. Overload indication	✓	-	[illegible]	[illegible]
12. Digital resolution	✓	-	[illegible]	[illegible]

เอกสารไม่ควบคุม



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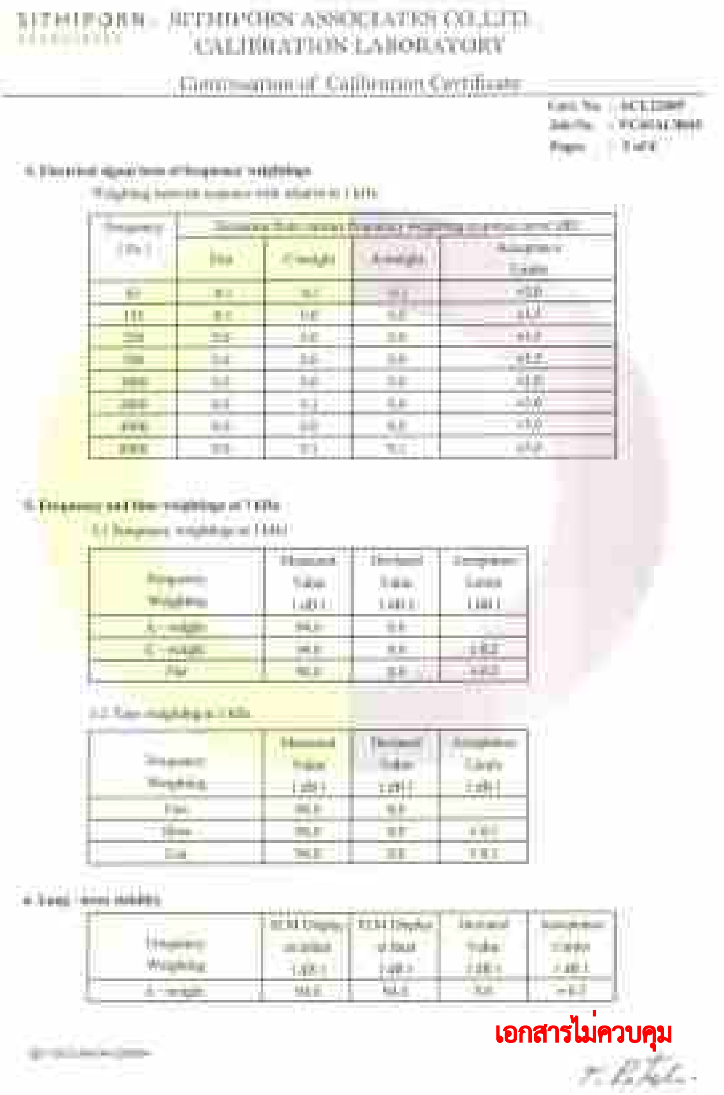
Continuation of Calibration Certificate

เอกสารไม่ควบคุม



SITHIPORN ASSOCIATES CO.,LTD.
CALIBRATION LABORATORY

Continuation of Calibration Certificate

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11. Overload indication

Maximum value (dB)		Deviation Value	Acceptance Limits
Positive	Negative		
[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]

12. High level stability

Frequency Weighting	SLM Display as found	SLM Display as left	Deviation Value	Acceptance Limits
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
A-weight	[illegible]	[illegible]	[illegible]	[illegible]

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

End of Calibration Certificate

Calibration Certificate

Equipment : [illegible]
Manufacturer : [illegible]
Model : [illegible]
Serial No. : [illegible]
ID No. :

Condition As Found : [illegible]

Customer : [illegible]

Location :
Ambient Temperature : [illegible] °C
Pressure : [illegible] kPa
Relative Humidity : [illegible] %

Received Date : [illegible]
Calibration Date : [illegible]
Date of Issue : [illegible]

Calibrated by : [illegible]

Approved by : [illegible]

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

Calibration Procedure : [illegible]

Calibration Method :
[illegible]

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

Instrument	Model	Serial No.	Cert. No.	Due Date
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[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. The result of calibration was found accurate in accordance with date and place of calibration for the calibrated date only.
3. The certificate is traceable to the international units of measurement of:
   3.1 National Institute of Metrology (Thailand).
   3.2 National Institute of Scientific and Technological Research (TISTR).

Summary of Measurement Result :

Parameter	Pass	Fail	Uncertainty (dB)	Maximum permitted uncertainty of measurement (dB)
[illegible]	✓	-	[illegible]	[illegible]
[illegible]	✓	-	[illegible]	[illegible]
[illegible]				
[illegible]	✓	-	[illegible]	[illegible]
[illegible]	✓	-	[illegible]	[illegible]
[illegible]	✓	-	[illegible]	[illegible]
[illegible]				
[illegible]	✓	-	[illegible]	[illegible]
[illegible]	✓	-	[illegible]	[illegible]
[illegible]	-	-		[illegible]
[illegible]	✓	-	[illegible]	[illegible]
[illegible]	✓	-	[illegible]	[illegible]
[illegible]	✓	-	[illegible]	[illegible]
[illegible]	✓	-	[illegible]	[illegible]
[illegible]	✓	-	[illegible]	[illegible]
[illegible]	✓	-	[illegible]	[illegible]
[illegible]	✓	-	[illegible]	[illegible]
[illegible]	✓	-	[illegible]	[illegible]

Result of calibration :

1. Absolute sensitivity

Reference Acoustic Signal (dB)	Measured Value (dB)	Deviation (dB)	Acceptance Limit (dB)
114.0 (94.0Hz)	93.9	0.0	±0.3

2. Self generated noise

2.1 Normal test

Measured Value (dB)
14.2

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

Frequency Weighting	Measured value (dB)
A - weight	11.0
C - weight	16.2
Flat	24.0

3. Acoustical signal tests of frequency weightings

Noise: Pink-shaped noise respective to a level of 94 dB

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)			
	Flat	C-weight	A-weight	Acceptance Limits
250	0.0	0.2	0.1	±1.5
1000	0.1	-0.1	0.1	±1.0
8000	-0.9	-3.0	-5.6	±5.5

4. Electrical signal tests of frequency weightings

Weighting levels response with relative to 1 kHz

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)			
	Flat	C-weight	A-weight	Acceptance Limits
63	-0.1	-0.1	-0.5	±2.0
125	0.0	0.0	0.0	±1.5
250	0.0	0.0	0.0	±1.5
500	0.0	0.0	0.0	±1.5
1000	0.0	0.0	0.0	±1.0
2000	0.0	0.0	0.0	±1.0
4000	0.0	0.0	0.0	±1.0
8000	0.0	0.0	0.0	±1.0

5. Frequency and time weightings at 1 kHz

5.1 Frequency weightings at 1 kHz

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

5.2 Time weighting at 1 kHz

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

6. Long - term stability

Frequency Weighting	BGM Display at initial (dB)	BGM Display at final (dB)	Deviation Value (dB)	Acceptance Limits (dB)
A - weight	94.0	94.0	0.0	±0.5

7. Level linearity in the reference level range

Anticipated Value (dB)	Measured Value (dB)	Deviation Value (dB)	Acceptance Limits (dB)
127.0	127.0	0.0	±3.1
126.0	126.0	0.0	±3.1
125.0	125.0	0.0	±3.1
124.0	124.0	0.0	±3.1
123.0	123.0	0.0	±3.1
122.0	122.0	0.0	±3.1
121.0	121.0	0.0	±3.1
120.0	120.0	0.0	±3.1
119.0	119.0	0.0	±3.1
118.0	118.0	0.0	±3.1
117.0	117.0	0.0	±3.1
116.0	116.0	0.0	±3.1
115.0	115.0	0.0	±3.1
114.0	114.0	0.0	±3.1
113.0	113.0	0.0	±3.1
112.0	112.0	0.0	±3.1
111.0	111.0	0.0	±3.1
110.0	110.0	0.0	±3.1
109.0	109.0	0.0	±3.1
108.0	108.0	0.0	±3.1
107.0	107.0	0.0	±3.1
106.0	106.0	0.0	±3.1
105.0	105.0	0.0	±3.1
104.0	104.0	0.0	±3.1
103.0	103.0	0.0	±3.1
102.0	102.0	0.0	±3.1
101.0	101.0	0.0	±3.1
100.0	100.0	0.0	±3.1
99.0	99.0	0.0	±3.1
98.0	98.0	0.0	±3.1
97.0	97.0	0.0	±3.1
96.0	96.0	0.0	±3.1
95.0	95.0	0.0	±3.1
94.0	94.0	0.0	±3.1
93.0	93.0	0.0	±3.1
92.0	92.0	0.0	±3.1
91.0	91.0	0.0	±3.1
90.0	90.0	0.0	±3.1
89.0	89.0	0.0	±3.1
88.0	88.0	0.0	±3.1
87.0	87.0	0.0	±3.1
86.0	86.0	0.0	±3.1
85.0	85.0	0.0	±3.1
84.0	84.0	0.0	±3.1
83.0	83.0	0.0	±3.1
82.0	82.0	0.0	±3.1
81.0	81.0	0.0	±3.1
80.0	80.0	0.0	±3.1
79.0	79.0	0.0	±3.1
78.0	78.0	0.0	±3.1
77.0	77.0	0.0	±3.1

8. Level linearity including the level range control

Range	Anticipated Value (dB)	Measured Value (dB)	Deviation Value (dB)	Acceptance Limits (dB)
Auto	94.0	94.0	0.0	±1.1

9. Tone burst response

Time Weighting	Tone burst duration (Ts) (ms)	Cycles	Anticipated Value (dB)	Measured Value (dB)	Deviation Value (dB)	Acceptance Limits (dB)
Fast	0.25	1	100.0	99.9	-0.1	0.0 ~ 6.0
	2	8	117.0	117.0	0.0	3.0 ~ 9.0
	200	800	118.0	118.1	0.1	±0.8
Slow	2	8	108.0	108.0	0.0	-3.0 ~ 0.0
	200	800	117.0	117.0	0.0	±0.8
SEL	0.25	1	96.0	96.0	-0.1	0.0 ~ 9.0
	2	8	108.0	108.0	0.0	3.0 ~ 9.0
	200	800	118.0	118.1	0.1	±0.8

10. Peak C sound level

Number of cycle in test signal	Anticipated Value (dB)	Measured Value (dB)	Deviation Value (dB)	Acceptance Limits (dB)
Continuous	115.0	115.0	0.0	
One	118.0	117.9	-0.1	±2.0

Number of cycle in test signal	Anticipated Value (dB)	Measured Value (dB)	Deviation Value (dB)	Acceptance Limits (dB)
Continuous	115.0	115.0	0.0	
Positive half cycle	115.0	115.2	0.2	±2.0
Negative half cycle	115.0	115.1	0.1	±2.0

11. Thermal indicator

Maximum value (dB)		Nominal Value	Acceptance Limits
Positive	Negative		
[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]

12. High level stability

Frequency Weighting	SLM Display before level	SLM Display after level	Difference Value	Acceptance Limits
	[illegible]	[illegible]	[illegible]	[illegible]
A - weight	[illegible]	[illegible]	[illegible]	[illegible]

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

End of Calibration Certificate

Calibration Certificate

Equipment : [illegible]
Manufacturer : [illegible]
Model : [illegible]
Serial No. : [illegible]
ID No. : -

Condition As Found : GOOD

Customer : [illegible]

Location :
Ambient Temperature : [illegible] °C
Pressure : [illegible] kPa
Relative Humidity : [illegible] %

Received Date : [illegible]
Calibration Date : [illegible]
Date of Issue : [illegible]

Calibrated by : [illegible]

Approved by : [illegible]

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

Calibration Procedure : [illegible]

Calibration Method :
[illegible]

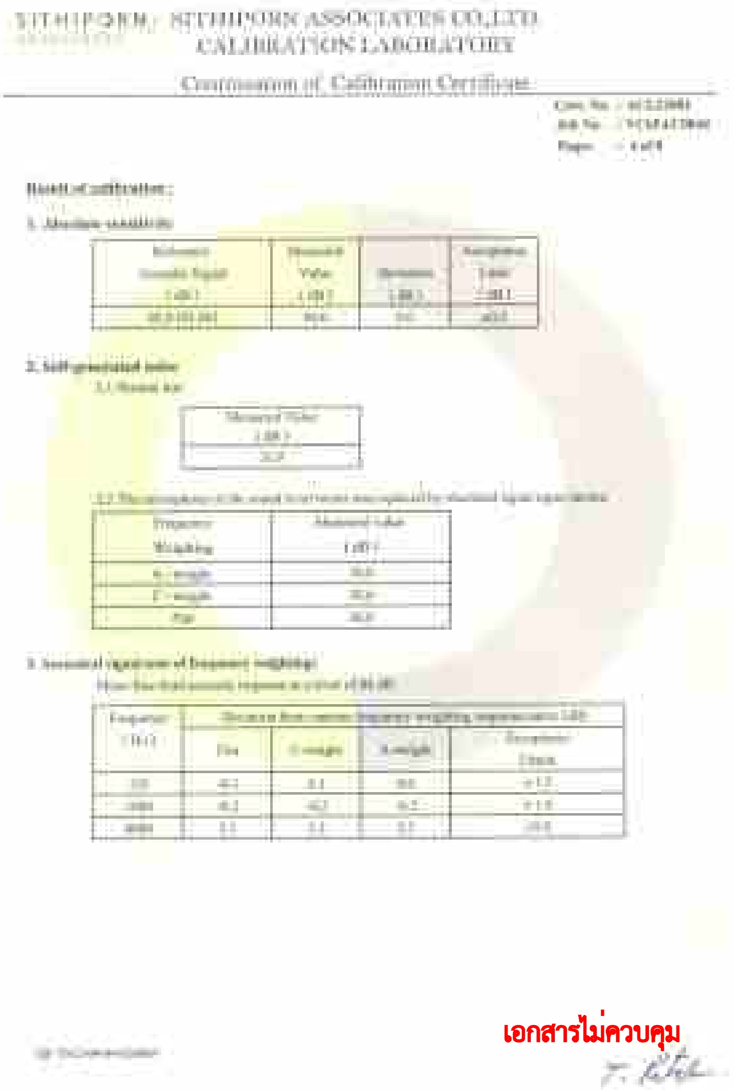
Condition of the result of calibration :
1. Reference Standard Instruments

Instrument	Model	Serial No.	Cert. No.	Due Date
Sound Calibrator	[illegible]	[illegible]	[illegible]	[illegible]
Sound 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 on date and place of calibration for the calibrated item only.
3. This certificate is traceable to the international system of units maintained at
3.1 National Institute of Metrology (Thailand)
3.2 National Institute of Scientific and Technological Research (TISTR)

Summary of Measurement Result :

Parameter	Pass	Fail	Uncertainty (dB)	Maximum permitted uncertainty of measurement (dB)
1. Electrical sensitivity	✓		[illegible]	[illegible]
2. Self generated noise	✓		[illegible]	[illegible]
3. Assessment signal form of frequency weighting				
[illegible]	✓		[illegible]	[illegible]
[illegible]	✓		[illegible]	[illegible]
[illegible]	✓		[illegible]	[illegible]
4. Assessment signal tones of frequency weighting				
[illegible]	✓		[illegible]	[illegible]
[illegible]	✓		[illegible]	[illegible]
[illegible]	✓		[illegible]	[illegible]
5. Frequency and time weighting at 1 kHz	✓		[illegible]	[illegible]
6. Long - term stability	✓		[illegible]	[illegible]
7. Level linearity at the reference level range	✓		[illegible]	[illegible]
8. Level linearity including the level range control	✓		[illegible]	[illegible]
9. Time base response	✓		[illegible]	[illegible]
10. Peak C sound level	✓		[illegible]	[illegible]
11. Thermal indicator	✓		[illegible]	[illegible]
12. High level stability	✓		[illegible]	[illegible]



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(1) Provided indication

Measurement result (dB)		Provided Value (dBm)	Acceptance Limits (dBm)
Positive non-shift mode	Negative non-shift mode		
[illegible]	[illegible]	[illegible]	[illegible]

(2) High level stability

Frequency Wavelength (dBm)	MAX Deviation of Level (dB)	MIN Deviation of Level (dB)	Provided Value (dBm)	Acceptance Limits (dBm)
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

The measured uncertainty is based on a standard uncertainty multiplied by coverage factor k = 2 and by using following calculation providing a level of confidence of approximately 95 %.

End of Calibration Certificate

Calibration Certificate

Equipment : [illegible]
Manufacturer : [illegible]
Model : [illegible]
Serial No. : [illegible]
ID No. : -

Condition As Found : GOOD

Customer : [illegible]

Location : -
Ambient Temperature : [illegible] °C
Pressure : [illegible] mBar
Relative Humidity : [illegible] %

Received Date : [illegible]
Calibration Date : [illegible]
Date of Issue : [illegible]

Calibrated by : [illegible]

Approved by : [illegible]

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

Calibration Procedure : [illegible]

Calibration Method :

[illegible]

Condition of the result of calibration :

1. Reference Standard Instruments

Instrument	Model	Serial No.	Cert. No.	Due Date
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

2. The result of calibration may be not valid for an above on date and place of calibration. All the calibrated data only.
3. This certificate is traceable to the international system of units maintained at
   3.1 National Institute of Metrology (Thailand)
   3.2 National Institute of Scientific and Technological Research (TISTR)

Summary of Measurement Result :

Parameter	Pass	Fail	Uncertainty (dB)	Maximum permitted uncertainty of measurement (dB)
[illegible]	✓		[illegible]	[illegible]
[illegible]	✓		[illegible]	[illegible]
[illegible]				
[illegible]	✓		[illegible]	[illegible]
[illegible]	✓		[illegible]	[illegible]
[illegible]	✓		[illegible]	[illegible]
[illegible]				
[illegible]	✓		[illegible]	[illegible]
[illegible]	✓		[illegible]	[illegible]
[illegible]	✓		[illegible]	[illegible]
[illegible]	✓		[illegible]	[illegible]
[illegible]	✓		[illegible]	[illegible]
[illegible]	✓		[illegible]	[illegible]
[illegible]	✓		[illegible]	[illegible]
[illegible]	✓		[illegible]	[illegible]
[illegible]	✓		[illegible]	[illegible]
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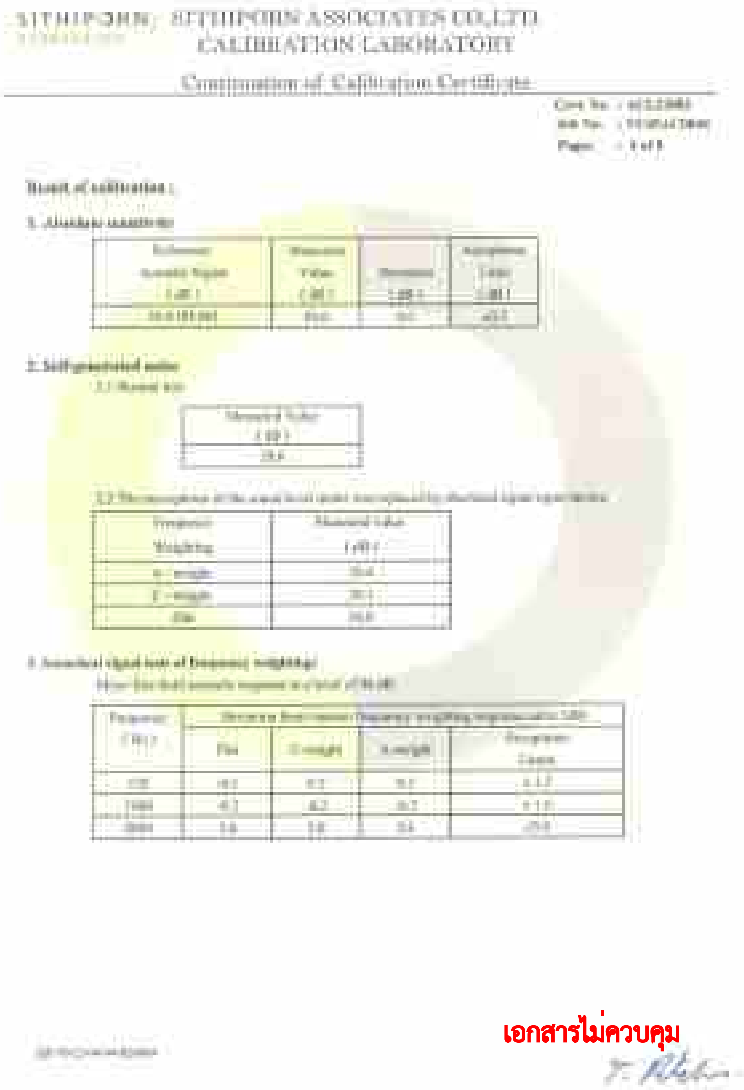
[illegible]	✓		[illegible]	[illegible]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Result of calibration :

1. Absolute sensitivity

2. Self-generated noise

3. Acoustical signal tests of frequency weightings

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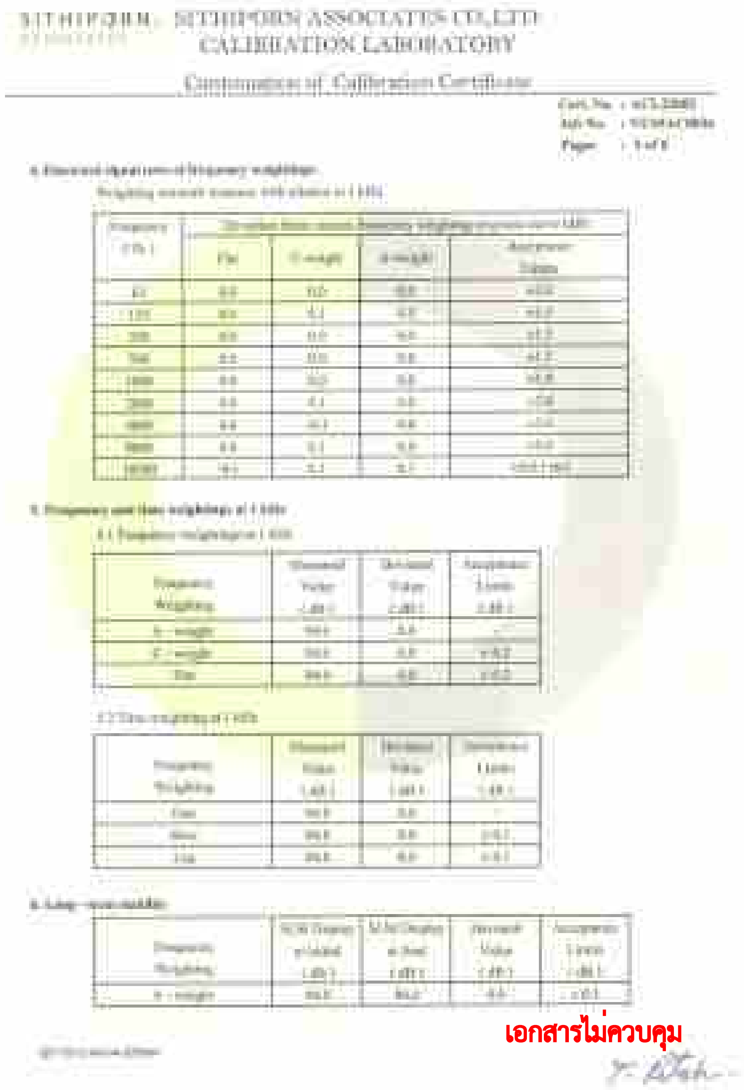
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4. Electrical signal tests of frequency weightings

5. Frequency and time weightings at 1 kHz

6. Long - term stability

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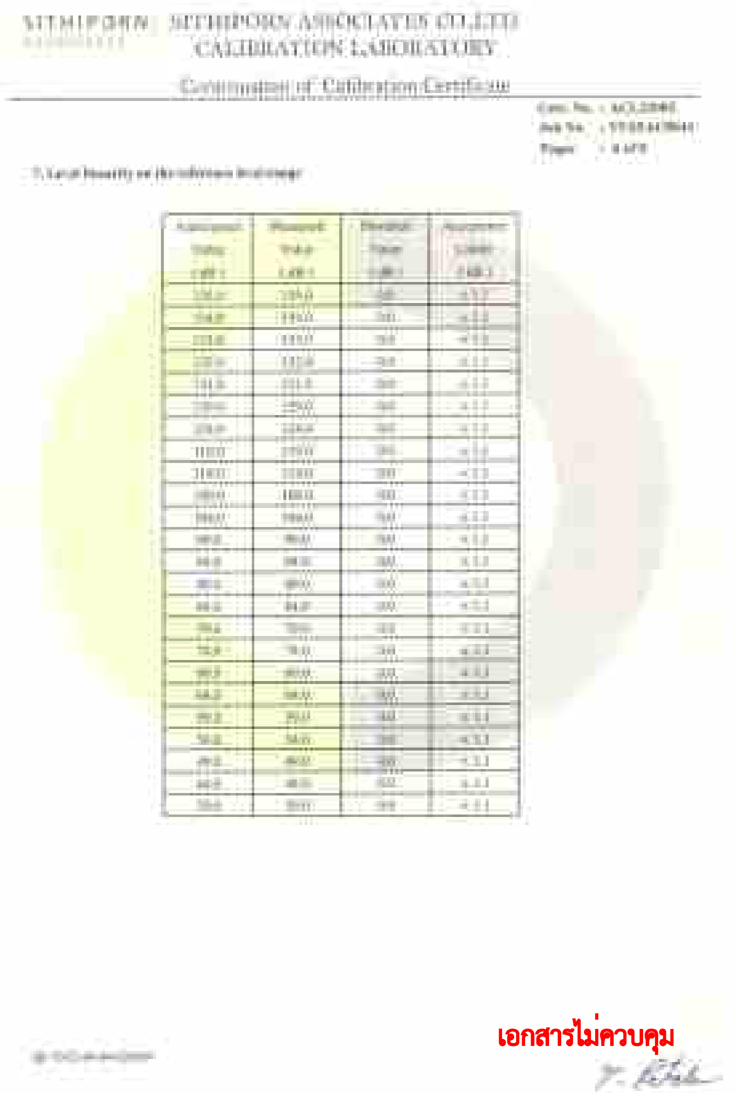
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7. Level linearity on the reference level range

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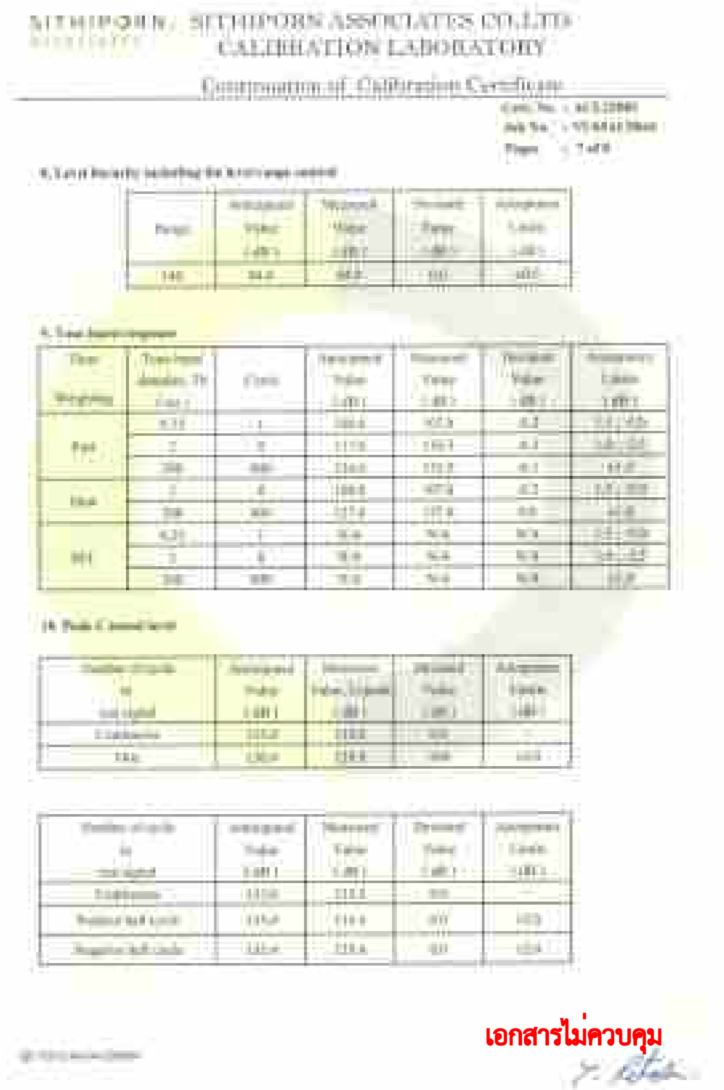
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8. Level linearity including the level range control

9. Toneburst response

10. Peak C sound level

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Job No. : [illegible]
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[illegible]	[illegible]	[illegible]	[illegible]
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[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

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Certificate of Calibration

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

[illegible]

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

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[illegible]

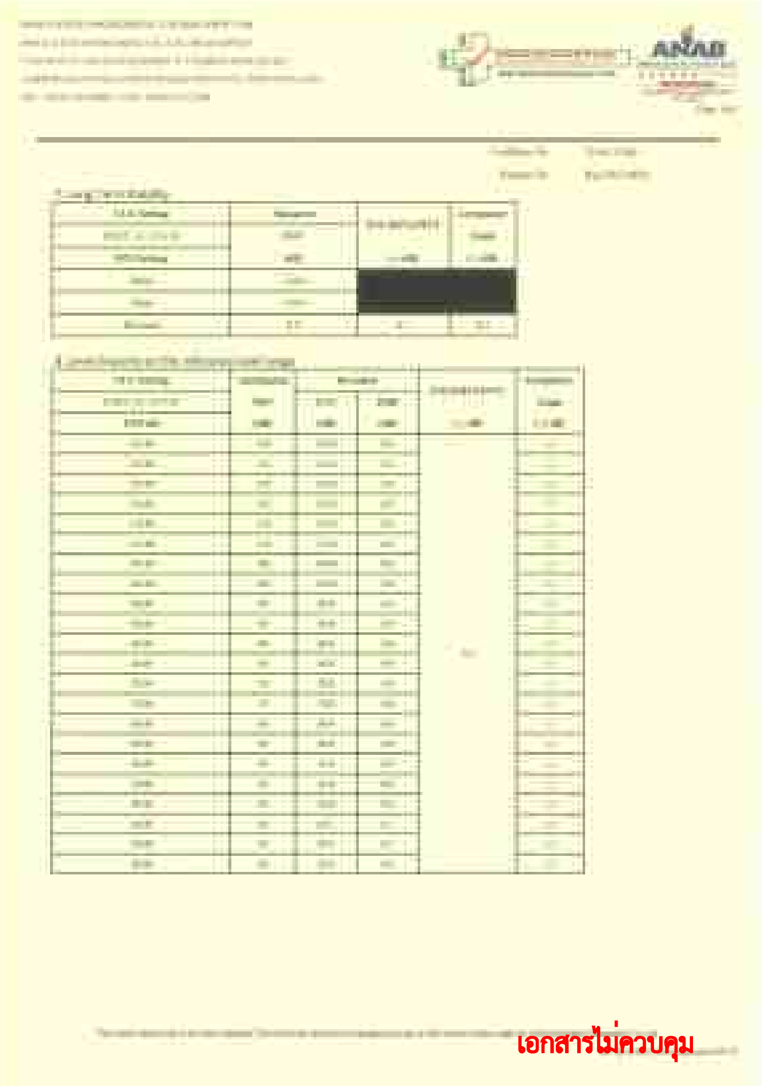
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

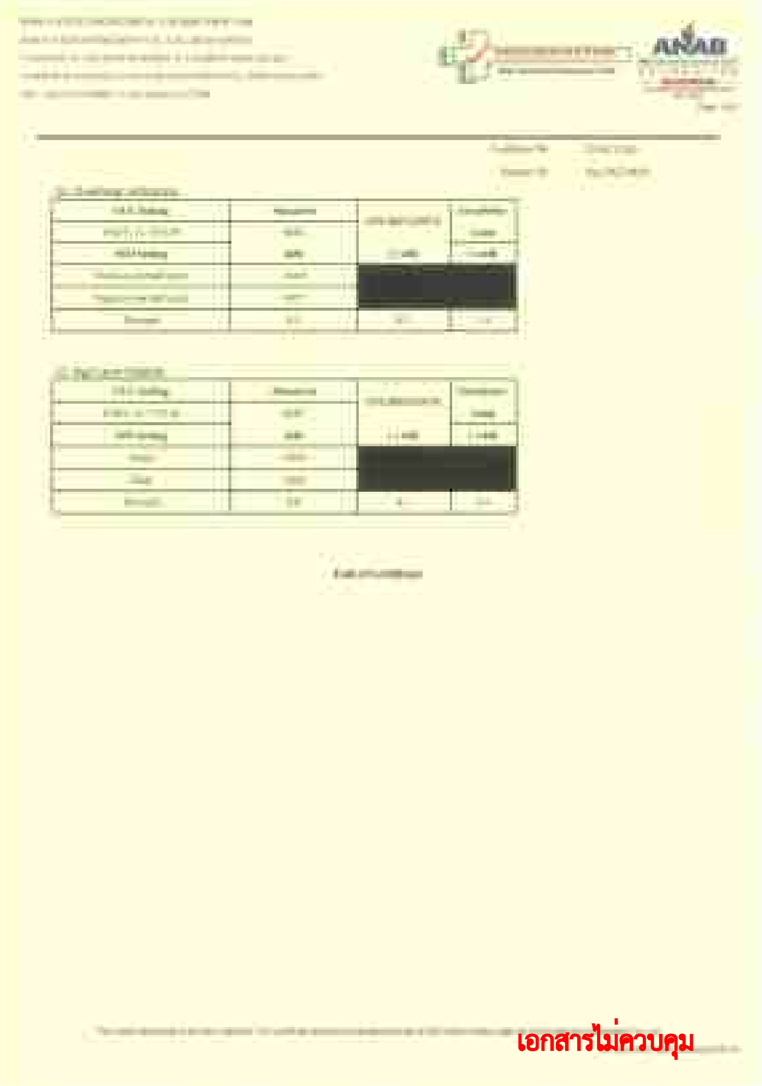
[illegible]

[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

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เอกสารไม่ควบคุม

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การติดตามตรวจสอบคุณภาพสิ่งแวดล้อม

บริษัท ทีพีไอ โพลีน จำกัด (มหาชน) จังหวัดสระบุรี

ระหว่างเดือนมกราคม ถึง เดือนมีนาคม 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.									
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	-
22	Distillation Unit (Kjeldahl Method)	Ammonia-Nitrogen Total Kjeldahl Nitrogen (TKN)	FOSS TECATOR	KT8100 / 91889052	FOSS South East Asia	6623	25 Jul 22	24 Jul 23	-
23	Gas 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	System ID: US2009M037 8890 (G3542A) / CN1945A066 5977B / US2009M037	Agilent Technologies (Thailand) Co.,Ltd.	Preventive Maintenance Checklist	13 Jun 22	12 Jun 23	-

การติดตามตรวจสอบคุณภาพสิ่งแวดล้อม

บริษัท ทีพีไอ โพลีน จำกัด (มหาชน) จังหวัดสระบุรี

ระหว่างเดือนมกราคม ถึง เดือนมีนาคม 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		Hanna Instrument	HI2020-02 / C0051107	National Food Institute, Ministry of Industry, Thailand	2203135-001-01	8 Jun 22	7 Jun 23	-
3	Conductivity Meter	Electrical Conductivity	SI Analytics	Lab955 / 16300356	DKSH Technology Limited	C24230059	16 Mar 23	14 Mar 24	-
4	Analytical Balance (Readability 0.01 mg)	Total Solids Total Dissolved Solids	Mettler-Toledo	XSR205DU / C009071872	Technology Promotion Association (Thailand-Japan)	22MM210	26 Apr 22	25 Apr 23	-
5	Hot Air Oven	Total Suspended Solids	Memmert	UF55 / B216.1666	Technology Promotion Association (Thailand-Japan)	22TM1490	19 Oct 22	18 Oct 23	-
6	BOD Incubator	Biochemical Oxygen Demand	Arco	UC4-1320 / (UAE.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	AB-204S/FACT / 1129361010	National Food Institute, Ministry of Industry, Thailand	2203120-001-01	1 Jun 22	31 May 23	-
9	Incubator	Total Coliform Bacteria Faecal Coliform Bacteria	Memmert	IPP 260 / V615.0187	Technology Promotion Association (Thailand-Japan)	23TM378	12 Apr 23	10 Apr 24	-
10	Incubator		Memmert	IPP 260 / V618.0033	Technology Promotion Association (Thailand-Japan)	22TM503	3 May 22	2 May 23	-

การติดตามตรวจสอบคุณภาพสิ่งแวดล้อม

บริษัท ทีพีไอ โพลีน จำกัด (มหาชน) จังหวัดสระบุรี

ระหว่างเดือนมกราคม ถึง เดือนมีนาคม พ.ศ. 2566

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No.	Instrument/Equipment	Parameter	Manufacturer	Model/Serial No.	Calibrator	Certification No.	Date of Calibration	Due date of Calibration*	Remark
Laboratory Instrument/Equipment.									
11	Water Bath		Memmert	WNE 14 / L416.0606	Technology Promotion Association (Thailand-Japan)	23TM193	15 Feb 23	14 Feb 24	-
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	SPC Calibration Center	C11220112	17 Jun 22	16 Jun 23	-
15	Atomic Absorption Spectrophotometer (AAS)	Iron, Titanium, Arsenic, Cadmium, Manganese, Chromium, Copper, Barium, Lead, Mercury, Nickel, Selenium, Chromium Trivalent, Chromium Hexalent, Zinc Titanium, Chromium	Agilent Technologies	System ID:G8432A 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)		Agilent Technologies	System ID:G8015A G8015AA / MY18030001	Agilent Technologies (Thailand) Co.,Ltd.	Preventive Maintenance Checklist	30 Nov 22	29 Nov 23	-
17	UV-VIS Spectrophotometer	Phosphate, Ammonia-Nitrogen Sulphate, Cyanide	Agilent Technologies	Cary60 G6860A / MY15410009	DQE Services Co.,Ltd.	SP22-016	31 May 22	30 May 23	-
18	UV-VIS Spectrophotometer	Nitrate Nitrogen, Phenols, Colour, Chromium Hexalent,Total Nitrogen Chemical Oxygen Demand Formaldehyde, Cyanide As HCN	Hitachi	U-1900 / 2021-064	DQE Services Co.,Ltd.	SP23-007	6 Jan 23	5 Jan 24	-
19	UV-VIS Spectrophotometer		Hitachi	U-2900 / 21E22-009	DQE Services Co.,Ltd.	SP23-008	6 Jan 23	5 Jan 24	-

การติดตามตรวจสอบคุณภาพสิ่งแวดล้อม

บริษัท ทีพีไอ โพลีน จำกัด (มหาชน) จังหวัดสระบุรี

ระหว่างเดือนมกราคม ถึง เดือนมีนาคม พ.ศ. 2566

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

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

Calibration Certificate

Certificate No.:
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:

Calibration Results:

เอกสารไม่ควบคุม

Calibration Report

Certificate No.:

Equipment:

Date of Calibration:

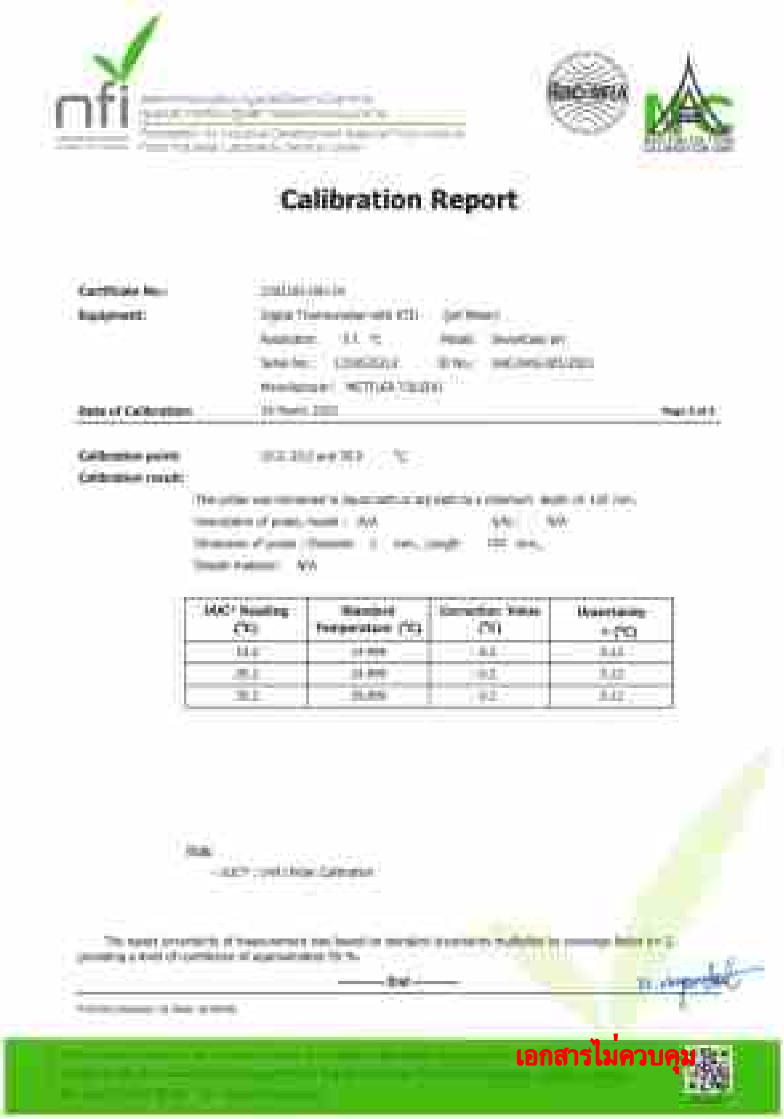
Location:

Environment Condition:

Condition of the results of Calibration:

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

เอกสารไม่ควบคุม



Calibration Report

Certificate No.:

Equipment:

Date of Calibration:

Calibration point:

Calibration result:

IAC* Reading (°C)	Standard Temperature (°C)	Correction Value (°C)	Uncertainty ± (°C)
[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]

Note:

------End------

เอกสารไม่ควบคุม

Calibration 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:

เอกสารไม่ควบคุม

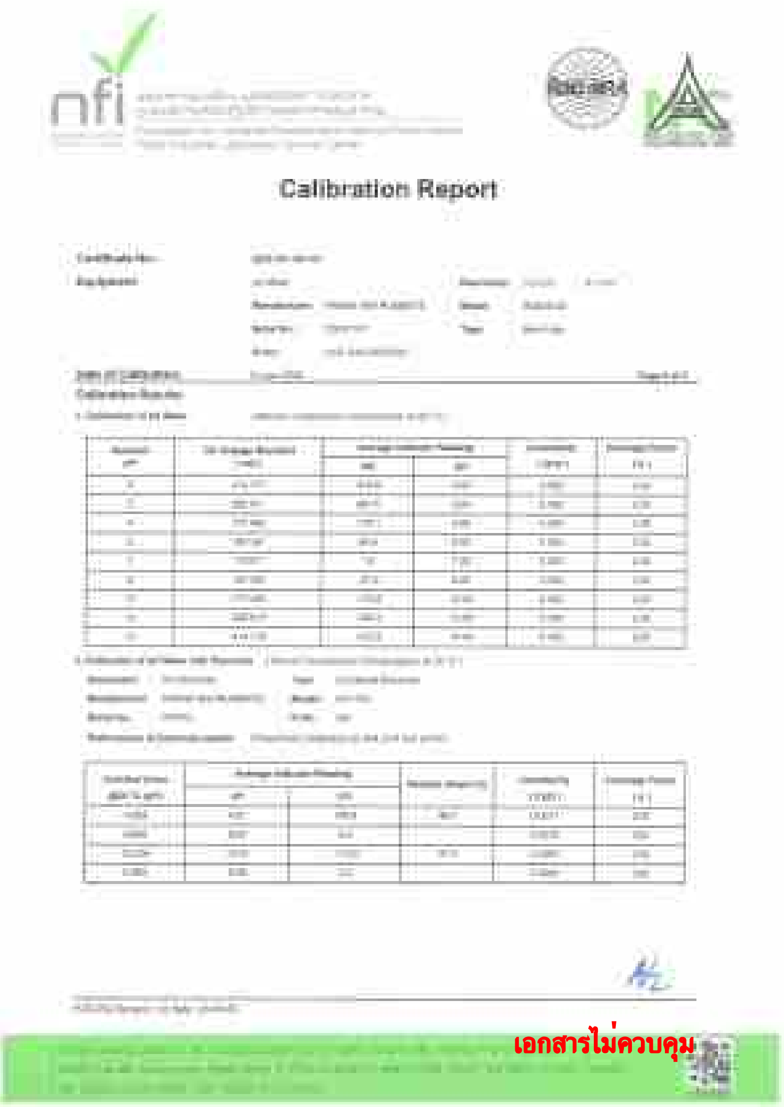
Calibration Report

Certificate No.:

Equipment:

Date of Calibration:

เอกสารไม่ควบคุม



Calibration Report

Certificate No.:

Equipment:

Date of Calibration:

Calibration Results:

เอกสารไม่ควบคุม

Calibration Report

Certificate No.:

Equipment:

Date of Calibration:

Condition

Environment Condition:

Condition of the results of Calibration:

☐ Meets specification ☐ Not approved

เอกสารไม่ควบคุม

Calibration Report

Certificate No.:

Equipment:

Date of Calibration:

Calibration place:

Calibration result:

Note:

——End——

เอกสารไม่ควบคุม

DKSH

Certificate of Calibration

Equipment:	CONDUCTIVITY METER	Certificate No.:	CH230008
Model:	Lab 962	Issued Date:	16 March 2023
Serial No. (or ID.):	1600286	Job No.:	66PR23044/0
Manufacturer:	SI Analytics	Page:	1 of 2
Electrode Serial No.:	1610/0067	Model: LF-913F	Brand: SI Analytics
Condition:	In Condition		

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

Environment Condition: Temperature 23 °C ± 3 °C
Humidity 50 %RH ± 10 %RH

Calibration Place: Environment Laboratory, DKSH Technology Limited
2533 Sukhumvit Road, Bangchak,
Prakhanong, Bangkok 10260 Thailand

Calibration By: Mr Akachai Ngamchanat
Calibration Date: 16 March 2023
The Method used: In-house method, CAL-WI-46, base on ASTM D 1125-14 and D 5391-14
Traceability: This certificate is traceable to the SI Units maintained by DPIA of NIST(NMI) through DPA chem Co., Ltd. (ISO/IEC 17034) Certificate No. 836712, 836713, 836714

(Mr. Akachai Ngamchanat)
Person in charge

(Mr. Witsun Siriwasin)
Authorized signatory

The results of measurements have been performed in accordance with the International System of Units (SI), to provide traceability of measurements to international or national standard or other recognized national standard laboratories.
The measurement uncertainty stated in the accompanied documents, which is obtained from the standard uncertainty multiplied by the coverage factor (k=2) to provide a level of confidence of approximately 95%, is in accordance to procedures and the Guide to Expression of Uncertainty in Measurements (GUM).
These results may be affected by deviations from specified conditions. The results made only to the items tested, calibrated or sampled. The report shall not be reproduced except in full without approval of DKSH Technology Limited.

DKSH Technology Limited
2533 Sukhumvit Road, Bangchak, Prakanong, Bangkok 10260
Office Business Unit Lab Info
2533 Sukhumvit Road, Bangchak, Prakanong, Bangkok 10260
Phone +66 2332 1000 Email: info.lab@dksh.com Website: www.dksh.com/th-en/lab-info

Delivering Growth – A Asia and Beyond.

CAL-FM-CS4-06, 12 Sep 2022

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	0.206 µS/cm	2.00	6.21 µS/cm
1413.0 µS/cm	1400 µS/cm	13.0 µS/cm	2.00	8.6 µS/cm
111.3 mS/cm	108.8 mS/cm	2.50 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	84.0 µS/cm	0.206 µS/cm	2.00	6.21 µS/cm
1413.0 µS/cm	1410 µS/cm	0.0 µS/cm	2.00	8.6 µS/cm
111.3 mS/cm	108.8 mS/cm	2.50 mS/cm	2.00	0.81 mS/cm

The End of Certificate

DKSH Technology Limited
2533 Sukhumvit Road, Bangchak, Prakanong, Bangkok 10260
Office Business Unit Lab Info
2533 Sukhumvit Road, Bangchak, Prakanong, Bangkok 10260
Phone +66 2332 1000 Email: info.lab@dksh.com Website: www.dksh.com/th-en/lab-info

Delivering Growth – A Asia and Beyond.

CAL-FM-CS4-06, 12 Sep 2022

เอกสารไม่ควบคุม

DKSH

ใบตรวจสอบสภาพเครื่องวัดค่าแวดล้อม

18 Mar 2025			18 Mar 2025		
ปกติ	ไม่ปกติ		ปกติ	ไม่ปกติ	
		General			
☑	☐	1.	☑	☐	
☑	☐	2.	☑	☐	
☑	☐	3.	☑	☐	
☑	☐	4.	☑	☐	
☑	☐	5.	☑	☐	
		Spectrophotometer			
☐	☐	6.	☐	☐	
☐	☐	7.	☐	☐	
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☐	☐	10.	☐	☐	
☐	☐	11.	☐	☐	
		pH Meter and Conductivity Meter			
☑	☐	12.	☑	☐	
☐	☐	13.	☐	☐	
☐	☐	14.	☐	☐	
☐	☐	15.	☐	☐	
		Turbidimeter			
☐	☐	16.	☐	☐	
☐	☐	17.	☐	☐	
		Automatic Water			
☐	☐	18.	☐	☐	
☐	☐	19.	☐	☐	
☐	☐	20.	☐	☐	

Electrode Replacing(ทุกปี (5 °C) Tap Control Wavelength ที่ (5.0 ±0.1 °C)

Mr.Akachai Hyanchanid

Service Engineer

เอกสารไม่ควบคุม

Delivering Growth – In Asia and Beyond.

Certificate of Calibration

Equipment : Electronic Balance

Manufacturer : Mettler Toledo

Model : AB204S

Serial No. : C230421 1372

ID No. : CAL-BAC-F-000083

Submitted by : United Analytical and Hydrometry Consultant Co.,Ltd. 3 Soi Chamnan 41, Sukhumvit Road, Klongtoei, Khlongtoei, Bangkok, 10330

Location : Balance Room

Received date : 28 April 2022

Calibration Date : 28 April 2022

Ambient Temperature : 22 °C to 23 °C

Relative Humidity : 50 % to 55 %

Calibrated by : Kanchit Prungsuk

Approved by : Approved Signatory

( ) Panthipa Tanapalo

( ) Wallop Sukhtaua

( ) Punit Inya

Issue Date : 28 April 2022

เอกสารไม่ควบคุม

Equipment : Electronic Balance

Condition As-Received : Used Item

Reference : 2204-0540-CC-1

Cert No. : 2204-0540

Page: 2 of 3

Procedure used :

Calibration were conducted using Kimoue calibration procedure CP-CB01 according to Anton Instrumente metric against standard weight

Condition of this report of calibration

1. Reference standard instruments

Instruments	Model	Serial No.	ID No.	Test report No.	Due date
1) Standard Weight Set (Cl.)	00284	-	7SWC-130	2022-0309-01	3 Feb 2023

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

Result of calibration : ( ) Without Adjustment ( ) After Adjustment by internal calibration

Range capacity : 0 g to 81 g Resolution : 0.0001 g

81 g to 220 g Resolution : 0.001 g

Before Adjustment :

Applied Weight (g)	Balance Reading (g)	Correction (g)	Measurement Uncertainty (± mg)	Coverage Factor
50	50.00004	-0.00004	0.14	2.00
200	199.9999	+0.0001	0.33	2.00

After Adjustment :

1. Determination of the standard deviation of weighing instrument (s = 10 g)

Applied Weight (g)	Standard Deviation of Reading (g)
50	0.00004
200	0.00003

เอกสารไม่ควบคุม

Equipment : Electronic Balance

Condition As-Received : Used Item

Reference : 2204-0540-CC-1

Cert No. : 2204-0540

Page: 3 of 3

Result of calibration

4. Effect of off-center loading

A mass of 100 g was placed in various position on the pan.

The weighing machine reading error obtained is 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)
-0.0002	-0.0001	0.0000	-0.0000	-0.0000	0.0002

5. Repeatness from constant value

Applied Weight (g)	Balance Reading (g)	Correction (g)	Measurement Uncertainty (± mg)	Coverage Factor
unloaded	0.0000	0.0000	0.07	2.00
5.00	5.00001	-0.00001	0.09	2.00
10.0	10.0001	-0.0001	0.11	2.00
1	1.00002	-0.00002	0.10	2.00
2	2.00003	-0.00003	0.09	2.00
20	20.00008	-0.00008	0.09	2.00
50	50.00010	-0.00010	0.08	2.00
80	80.00014	-0.00014	0.10	2.00
100	100.0001	-0.0001	0.11	2.00
150	150.0001	-0.0001	0.09	2.00
200	200.0001	-0.0001	0.08	2.00

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

เอกสารไม่ควบคุม

เอกสารไม่ควบคุม

Cert. No. :
Page : 1 of 2

Certificate of Calibration

Equipment : Hot Air Oven

Manufacturer :

Model :

Serial No. :

ID No. :

Submitted by :

Location :

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

Calibrated by :

Approved by :

Approved Signature

( ) Pornthipun Tanapatai
( ) Wiwat Kulnuan
(✓) Surit Inja

Issue Date :

The information on the a certificate probability of approximately 95%

เอกสารไม่ควบคุม

Cert. No. :
Page : 2 of 2

Equipment :
Condition As Received :
Reference :
Procedure Used :

Calibration was conducted using calibrator provided CP-0702 according to which measurement method with Data acquisition which connected with Resistance Temperature Detector (RTD) and Thermocouple Type T.

The temperature scale used was based on ITS-90

Condition of the need of calibration

1. Reference standard instrument :

Instrument	Model	Serial No.	Cert. No.	Due Date
T (Data Acquisition	[illegible]	[illegible]	[illegible]	[illegible]

2. The certificate is valid only in the item calibrated on date and place of calibration.
3. The certificate is traceable to the international System of Unit

Result of Calibration : (✓) Without Adjustment
Function of UUT : Temperature Source
Fresh air setting : Close

Environment during calibration		
	Beginning	Finished
Temp. (°C)	[illegible]	[illegible]
RH. (%RH)	[illegible]	[illegible]
Mains Supply (Volt)	[illegible]	[illegible]

Position	Ref. Std. ID No. @ Calibrated Point (184.1 °C)	Ref. Std. ID No. @ Calibrated Point (149.1 °C)
1	[illegible]	[illegible]
2	[illegible]	[illegible]
3	[illegible]	[illegible]
4	[illegible]	[illegible]
5	[illegible]	[illegible]
6	[illegible]	[illegible]
7	[illegible]	[illegible]
8	[illegible]	[illegible]
9 (ref.)	[illegible]	[illegible]

From watchface/ Empty :
x = [illegible] cm
y = [illegible] cm
z = [illegible] cm

Dimension of Chamber :
D = [illegible] cm
W = [illegible] cm
H = [illegible] cm
Volume = [illegible] cm³

เอกสารไม่ควบคุม

Equipment :
Condition As Received :
Reference :
Result of Calibration : (✓) Without Adjustment
Function of UUT : Temperature Source
Fresh air setting : Close

Cert. No. :
Page : 3 of 3

Calibration Point (°C)	UUT Setting (°C)	UUT Reading (°C)	Temperature stability (± °C)	Temperature uniformity (°C)	Overall Variation (± °C)	Uncertainty (± °C)	Coverage factor
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

Calibration Point (°C)	Measured Temperature (°C) Position								
	1	2	3	4	5	6	7	8	9 (ref.)
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

Average* : The average of 10 values in each position
Temperature stability : One half of the greatest maximum difference of measured temperature at any one sensor
Temperature uniformity : The maximum difference of measured temperature at any sensor and the measured temperature at the reference sensor, which are measured at the same time at as as close as practicable, time as possible to determine the temperature pattern or homogeneity within the chamber under steady state conditions
Overall Variation : The difference of the maximum and minimum measured temperatures throughout observation
UUT : Unit Under Calibration
Note : The reported uncertainty of measurement was included stability and nonuniformity

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

Cert. No. :
Page : 1 of 2

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 Signature

( ) Pornthipun Tanapatai
(✓) Wiwat Kulnuan
( ) Surit Inja

Issue Date :

The information on the a certificate probability of approximately 95%

เอกสารไม่ควบคุม

Equipment : [illegible]
Condition As Received : [illegible]
Reference : [illegible]
Procedure Used :-

Calibration were conducted using calibration procedure CP-0703 according to dryer measurement method with Data Acquisition which connected with Resistance Temperature Detector (RTD).

The temperature data 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	[illegible]	[illegible]	[illegible]	[illegible]

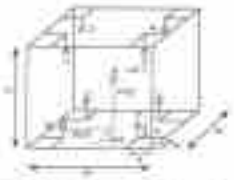
2. This certificate is valid only to the item calibrated on date and place of calibration.
3. This certification is traceable to the International System of Unit.

Result of Calibration :- (*) Without Adjustment

Function of UUC : Temperature Source

Fresh air setting : Not Available

Environment during calibration :		
	Beginning	Finished
Temp. (°C)	28	27
REL Humid. (%)	62	67
AC Supply (Volt)	220	220



Probe Installation Details :

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

Dimension of Chamber :

D =	0.67	m
W =	1.2	m
H =	1.2	m
Capacity =	0.96	m^3

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

เอกสารไม่ควบคุม

Equipment : [illegible]
Condition As Received : [illegible]
Reference : [illegible]
Result of Calibration : (*) Without Adjustment
Function of UUC : Temperature Source
Fresh air setting : Not Available

Calibration Point (°C)	UUC Setting (°C)	UUC Reading (°C)	Temperature stability (± °C)	Temperature uniformity (°C)	Overall Variation (°C)	Uncertainty (± °C)	Coverage Factor k
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

Calibration Point (°C)	Measured Temperature (°C)								
	Position								
	1	2	3	4	5	6	7	8	9 (ref.)
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

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

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

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

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

MAP : Mid-Point Calibration

Note : The reported uncertainty of measurement was calculated stating and evaluated uncertainty.

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

a 1140112

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

Certificate of Calibration

Equipment :	[illegible]
Manufacturer :	[illegible]
Model :	[illegible]
Serial No. :	[illegible]
ID No. :	[illegible]
Submitted by :	[illegible] Analysis and Engineering Consultant Co. Ltd. [illegible] Road, [illegible]
Location :	Lab Plant 2
Received Date :	17 April 2020
Calibration Date :	17 April 2020
Ambient Temperature :	(23 ± 1) °C
Relative Humidity :	(50 ± 10) %
Calibrated by :	[illegible]
Approved by :	Approved Signatory

( ) Pornthipan Tanyapiwat
( ) Manop Subkrue
( ) Sivalit Injut

Issue Date : 24 April 2020

The Expanded uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor k = 2, which corresponds to a coverage probability of approximately 95 %.

เอกสารไม่ควบคุม

a 1109739

Equipment : [illegible]
Condition As Received : [illegible]
Reference : [illegible]
Procedure Used :-

Calibration were conducted using calibration procedure CP-0703 according to dryer measurement method with Data Acquisition which connected with Resistance Temperature Detector (RTD).

The temperature data 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	[illegible]	[illegible]	[illegible]	[illegible]

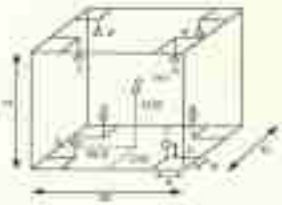
2. This certificate is valid only to the item calibrated on date and place of calibration.
3. This certification is traceable to the International System of Unit.

Result of Calibration :- (*) Without Adjustment

Function of UUC : Temperature Source

Fresh air setting : Not Available

Environment during calibration :		
	Beginning	Finished
Temp. (°C)	28	27
REL Humid. (%)	62	60
AC Supply (Volt)	219	220



Probe Installation Details :

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

Dimension of Chamber :

D =	0.60	m
W =	1.2	m
H =	1.2	m
Capacity =	0.86	m^3

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

เอกสารไม่ควบคุม

a 1109739

Equipment: BOD Incubator
Condition As Received: Used Item
Reference: [illegible]
Result of Calibration: [✓] Without Adjustment
Function of UUT: Temperature Source
Fresh air setting: Not Available

Cert. No.: [illegible]
Page: [illegible]

Calibration Point (°C)	UUT Setting (°C)	UUT Reading (°C)	Temperature stability (± °C)	Temperature uniformity (°C)	Overall Variation (°C)	Coverage Factor
20.0	20.0	20.0	0.46	0.48	1.2	2

Calibration Point (°C)	Measured Temperature (°C) Position 1	2	3	4	5	6	7	8	9 (UUT)	Overshooting (± °C)
20.0	20.240	20.470	20.240	20.000	19.700	19.700	[illegible]	20.100	20.020	0.08

Average : The average of 20 values in each position.
Temperature stability : One-half of the greatest maximum difference of measured temperatures at any one sensor.
Temperature uniformity : The maximum difference of measured temperatures at any sensors and the measured temperature at the reference location, which are observed at the same time or at as close an observation time as possible to determine the temperature pattern or homogeneity within the chamber under steady state conditions.
Overall Variation : The difference of the maximum and minimum measured temperatures throughout observation.
(UUT) : (Unit Under Calibration)
Note : The reported uncertainty of measurement was includes stability and expanded uncertainty.

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-

เอกสารไม่ควบคุม

Calibration Certificate

Certificate No.: [illegible]
Client name: UNITED [illegible] TEST AND ENGINEERING CONSULTANT CO., LTD.
Address: [illegible] Road, Bangkok, Prachinburi, Bangkok 10200

Page 1 of 1

Equipment: Electronic Balance
Manufacturer: METTLER TOLEDO
Model: AB204-S/FACT
Serial No.: [illegible]
ID No.: [illegible]
Order No.: [illegible]
Operation No.: [illegible]
Date of Receipt: 1 June 2022
Date of Calibration: 1 June 2022

Calibrated by: [illegible] Technician
Date of Calibration: 1 June 2022

Approved by: [illegible]
Manager, Division of Calibration Laboratory
Responsible for the Technical Management Team

The actual relative error for a confidence probability of approximately 95%

เอกสารไม่ควบคุม

Calibration Report

Certificate No.: [illegible]
Equipment: [illegible]
Manufacturer: [illegible]
Model: [illegible]
Resolution: [illegible]
Serial No.: [illegible]
ID No.: [illegible]
Capacity: [illegible]

Date of Calibration: [illegible]
Environment Condition: [illegible]
Place of Calibration: [illegible]
Condition of Equipment: [illegible]
Condition of The Results of Calibration:

Reference Standard	Model	Serial No.	Calibrated By	Certificate No.	Due Date
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

Equipment	Model	Serial No.	Calibrated By	Certificate No.	Due Date
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

Calibration Results
1. Repeatability of Reading

Nominal Value (g)	Standard Deviation of Reading (g)
[illegible]	[illegible]
[illegible]	[illegible]

2. Off Center Error

1	2	3	4	5	6	Maximum Difference
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

เอกสารไม่ควบคุม

Calibration Report

Certificate No.: [illegible]
Equipment: [illegible]
Manufacturer: [illegible]
Model: [illegible]
Resolution: [illegible]
Serial No.: [illegible]
ID No.: [illegible]
Capacity: [illegible]

Date of Calibration: [illegible]
Calibration Results: [illegible]
Calibration Range: [illegible]
Calibration Adjustment: [illegible]
1. Departure From Nominal Value

Nominal Value (g)	Standard Value (g)	Indication Reading (g)	Correction (g)	Uncertainty (g)	Coverage Factor
[illegible]	[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%.

-End-

เอกสารไม่ควบคุม

Certificate of Calibration

Cert. No. :
Page : 1 of 2

Equipment :

Manufacturer :

Model :

Serial No. :

ID No. :

Submitted by :

Location :

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

Calibrated by :

Approved by :

Approver Signatory

( ) Pornthipa Tanyapat
( ) Nitiee Bulunas
( ) Suat Hoe

Issue Date :

The Uncertainties are for a confidence probability of approximately 95%

เอกสารไม่ควบคุม

Equipment :
Condition As Received :
Reference :
Procedure Used :

Cert. No. :
Page :

Calibration was conducted using calibration procedure QP-0103 according to used 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

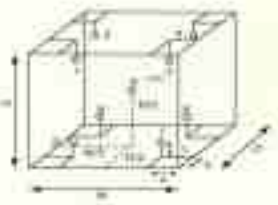
1. Reference standard instrument :

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

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 Display
Tests as setting : Not Available

Environment during calibration		
	Beginning	Finished
Temp. (°C)	25	25
Rel. Humidity (%)	57	57
AC Supply (Volt)	229	229



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

Probe resistance Details :

A =	0.2	mm
B =	0.2	mm
H =	0.5	mm

Dimension of Chamber

D =	0.30	m
W =	0.34	m
H =	0.50	m
Capacity =	5.10	m³

เอกสารไม่ควบคุม

Equipment :
Condition As Received :
Reference :
Result of Calibration : (✓) Without Adjustment
Function of UUC : Temperature Display
Tests as setting : Not Available

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	0.007	0.03	0.05	2

Calibration Point	Measured Temperature (°C) Position									Uncertainty
(°C)	1	2	3	4	5	6	7	8	9 (ref.)	(± °C)
30.0	29.992	29.948	34.017	29.948	29.994	30.002	29.972	29.934	29.952	0.30

Average* : The average of 30 values in each position.
Temperature stability : One half of the greatest maximum difference of measured temperature in any one sensor.
Temperature uniformity : The maximum difference of measured temperatures at any sensors and the reference temperature of the reference sensor, which are measured at the same time at all six sensor or composition time as possible to determine the temperature gradient or homogeneity within the chamber under varying state conditions.
Overall Variation : The difference of the maximum and minimum measured temperatures throughout measurement.
UUC* : Unit Under Calibration
Note : The reported uncertainty of measurement was included stability and measured uncertainty.

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 %.

-ooo-

เอกสารไม่ควบคุม

Certificate of Calibration

Cert. No. :
Page :

Equipment :

Manufacturer :

Model :

Serial No. :

ID No. :

Submitted by :

Location :

Received Date : 3 May 2022
Calibration Date : 3 May 2022
Ambient Temperature : (23 ± 10) °C
Relative Humidity : (50 ± 30) %

Calibrated by :

Approved by :

Approver Signatory

( ) Pornthipa Tanyapat
(✓) Nitiee Bulunas
( ) Suat Hoe

Issue Date : 10 May 2022

The Uncertainties are for a confidence probability of approximately 95%

เอกสารไม่ควบคุม

Equipment :
Condition As Received :
Reference :
Procedure Used :-
Condition of this result of calibration
Result of Calibration :-
Procedure of UUT :
Place as setting :

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

Environment during calibration	Beginning	Finished
Temp. (°C)		
RH. Humidity (%)		
AC Supply (VAC)		

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

Probe location (mm) :
Dimension of Chamber :

Equipment :
Condition As Received :
Reference :
Procedure Used :-
Condition of this result of calibration
Result of Calibration :-
Procedure of UUT :
Place as setting :

Calibration Point	UUT Setting	UUT Reading	Temperature stability	Temperature uniformity	Deviation Estimation	Accuracy	Coverage Factor
(°C)	(°C)	(°C)	(± °C)	(°C)	(± °C)	(± °C)	k

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

Average* : The average of 30 values in each position
Temperature stability : One-half of the greatest maximum difference of measured temperature at any one sensor
Temperature uniformity : The maximum difference of measured temperature at any sensors and the measured temperature at the reference sensor, which are observed at the same time or as close as observation time as possible to determine the temperature pattern or homogeneity within the chamber under steady-state conditions
Overall Variation : The difference of the minimum and maximum measured temperatures throughout observation
UUT : Unit Under Calibration
Note : The reported uncertainty of measurement was included stability and included uniformity
The reported uncertainty of measurement was based on a standard uncertainty multiplied by a coverage factor k, providing a level of confidence of approximately 95 %

Cert. No. :
Page :

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 :

Equipment :
Condition As Received :
Reference :
Procedure Used :-
Condition of this result of calibration
Result of Calibration :-
Procedure of UUT :

	Temperature (°C)	(%R.H.)	AC Voltage Supply (Vac)
Beginning of Calibration			
Finished of Calibration			

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

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

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

Calibration point (°C)	UUC* Setting (°C)	UUC* Reading (°C)	Average* Standard Reading (°C)				
			Position				
			1	2	3	4	5 (ref)
44.0	44.0	44.0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

Calibration point (°C)	Uniformity (°C)	Stability (± °C)	Uncertainty (± °C)	Coverage Factor k
44.0	[illegible]	[illegible]	[illegible]	2

Average* : The average of 30 values in each position.
Uniformity : The maximum difference of measured temperatures at any sensors and the measured temperature of the reference location, which are observed at the same time or at as close an observation time as possible to determine the temperature pattern or homogeneity within the chamber under steady-state conditions.
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 neither stability nor uniformity uncertainty.

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-

เอกสารไม่ควบคุม

[illegible]

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

Certificate of Calibration

Equipment : Water Bath
Manufacturer : [illegible]
Model : [illegible]
Serial No. : [illegible]
ID No. : [illegible]
Submitted by : United Analysis and Engineering Consultant Co. Ltd.
[illegible]
Bangkok, Thailand
Bangkok 10500
Location : Metrology Laboratory
Received Date : 13 February 2023
Calibration Date : 13 February 2023
Ambient Temperature : [illegible]
Relative Humidity : [illegible]
Calibration by : Suan Inap
Approved by : Approved Signatory
( ) Prachapan Tanapaku
( ) Manee Bulsong
Issue Date : 20 February 2023

The Calibration was for a confidence probability of approximately 95%

เอกสารไม่ควบคุม

Equipment : Water Bath
Condition As Received : Used item
Reference : [illegible]
Procedure Used :
Calibration were conducted using a house calibration procedure CP-0704 according to used 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

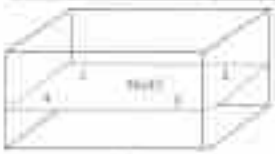
1. Reference standard indicated :

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

2. This certificate is valid only in the item calibrated on date and check 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	51	231
Finished of Calibration	23	51	230



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

Front

เอกสารไม่ควบคุม

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

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

Calibration point (°C)	UUC* Setting (°C)	UUC* Reading (°C)	Average* Standard Reading (°C)				
			Position				
			1	2	3	4	5 (ref)
44.0	44.0	44.0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

Calibration point (°C)	Uniformity (°C)	Stability (± °C)	Uncertainty (± °C)	Coverage Factor k
44.0	[illegible]	[illegible]	[illegible]	2

Average* : The average of 30 values in each position.
Uniformity : The maximum difference of measured temperatures at any sensors and the measured temperature of the reference location, which are observed at the same time or at as close an observation time as possible to determine the temperature pattern or homogeneity within the chamber under steady-state conditions.
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 neither stability and neither 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 %.

-end-

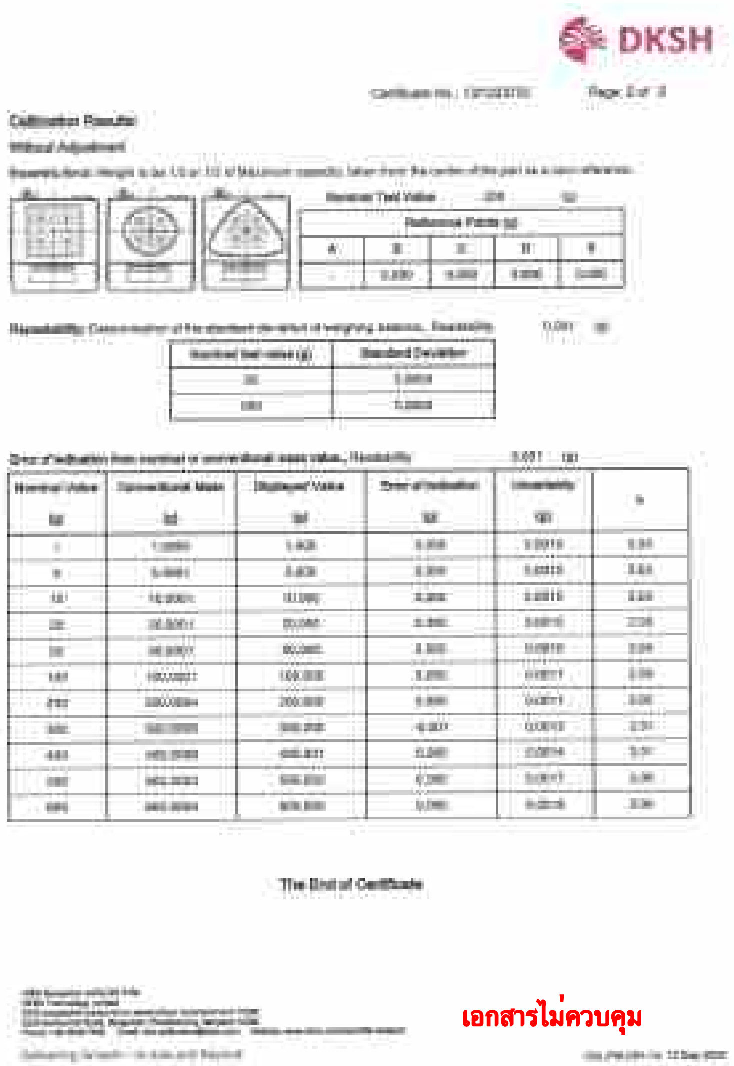
เอกสารไม่ควบคุม

DKSH

Certificate of Calibration

Person in charge

Authorized signatory



DKSH

Calibration Results

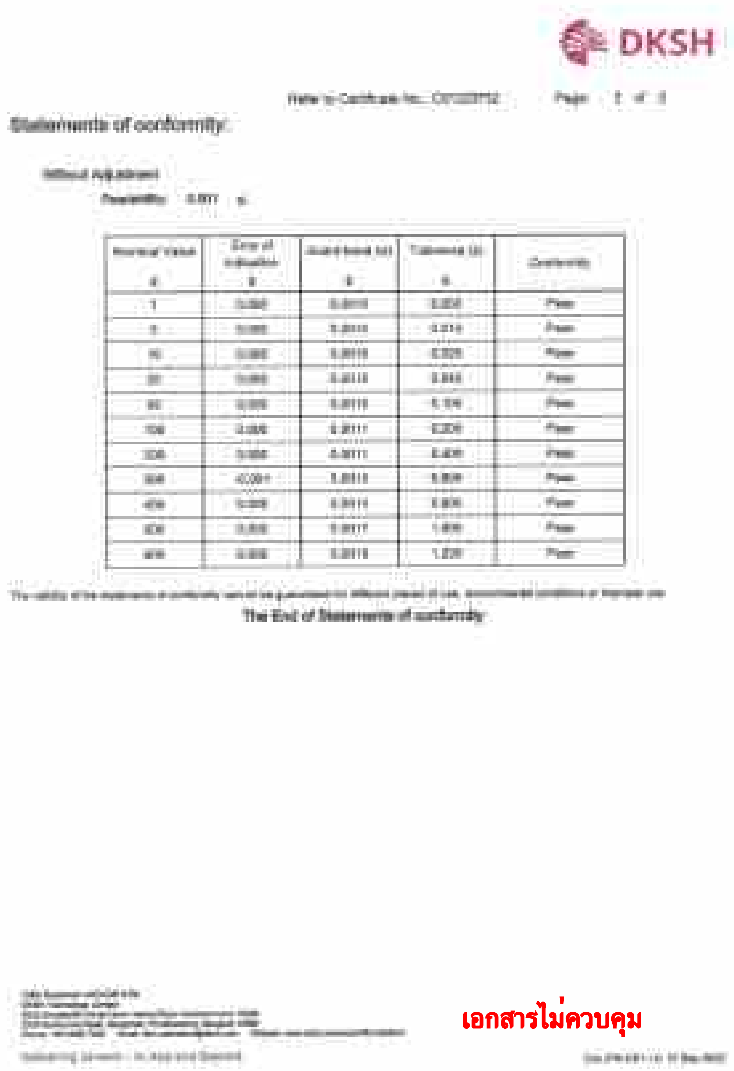
Without Adjustment

The End of Certificate

DKSH

Statements of conformity:

Authorized signatory

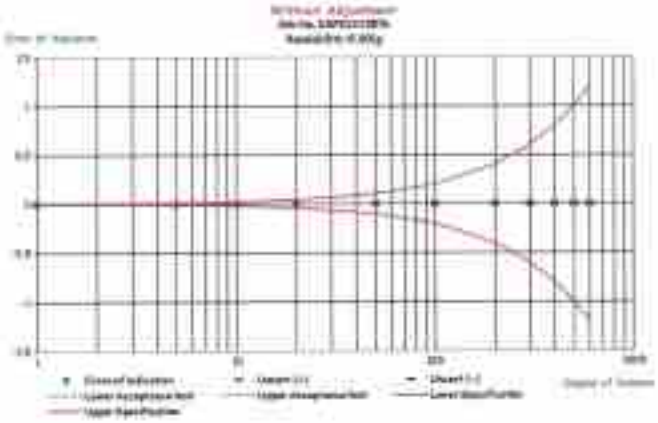


DKSH

Statements of conformity:

Without Adjustment

The End of Statements of conformity



Certificate of Calibration

Equipment:	Autoclave	Certificate No.:	[illegible]
Model:	[illegible]	Issued Date:	[illegible]
Serial No. (or ID.):	[illegible]	Job No.:	[illegible]
Manufacturer:	[illegible]	Page:	1 of 4
Condition:	In Condition		

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

Environment Condition:

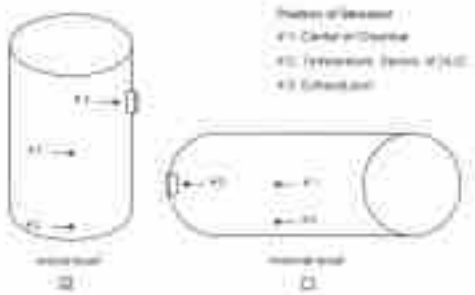
Temperature:	[illegible] °C	±	[illegible] °C
Humidity:	[illegible] %RH	±	[illegible] %RH
Voltage:	227 VAC	±	[illegible] VAC

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

Calibration By: Mr. Pasitha Ngamchana
Calibration Date: 17 June 2022
The Method Used: In house method, SPG-CAL-13, base on ISO 3744 : Part 5
Traceability: This certificate is traceable to the SI Units maintained by National Institute of Metrology (NIMT), Thailand through Quality-Inform Co., Ltd. Certificate No.QR21-1984

(Mr. Pasitha Ngamchana)
Person in charge

(Mr. Udon Srichana)
Authorized signatory



Standard Installation Locations

Standard Location (#1):	Geometric center of the chamber
Standard Location (#2):	Distance from temperature sensor of 1.0 ± 0.1 (cm.)
Standard Location (#3):	Distance from the wall 5 (cm.)

Position of Slot	#1	#2	#3
Channel of Logger	1	2	3

Definitions

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

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

Measured Stability: The over half of positive maximum difference of measured temperature at any one place.

Calibration Results

Without adjustment

Measurement Temperature at Spread Locations, Indicating at Unit Under Calibration: 115.0 °C

Locations	Measured Temperature (°C)	Correction of UUC (°C)	Uncertainty (± °C)
#1	116.19	0.16	0.35
#2	116.21	0.21	0.35
#3	116.22	0.22	0.35

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)*
115	115	115.0	0.08	116.19	116.21	116.22	0.35

Chamber Characteristics

Indicating Temperature (°C)	Indicating Pressure (MPa)	Measured Stability (± °C)
115.0	0.08	0.10

Note: * Maximum uncertainty of the each position.

Record every 15 seconds after reaching steady state or after one achieved complete cycle.

Without adjustment

Measurement Temperature at Spread Locations, Indicating of Unit Under Calibration: 122.0 °C

Locations	Measured Temperature (°C)	Correction of UUC (°C)	Uncertainty (± °C)
#1	[illegible]	[illegible]	[illegible]
#2	[illegible]	[illegible]	[illegible]
#3	[illegible]	[illegible]	[illegible]

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)*
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

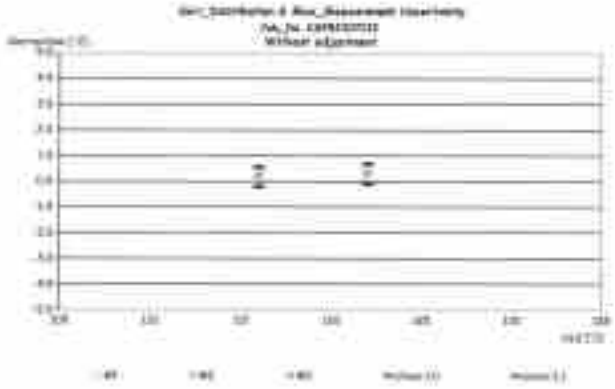
Chamber Characterization

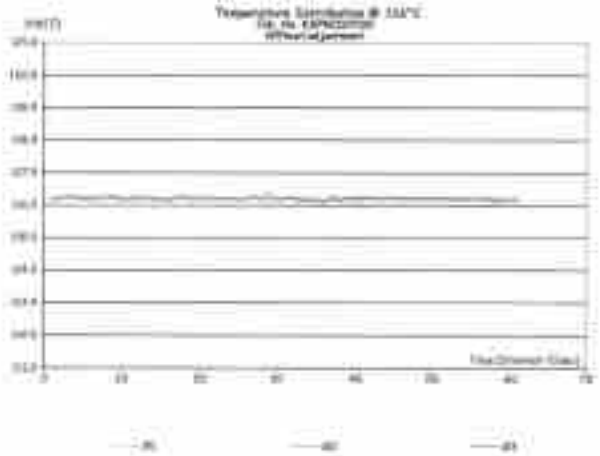
Indicating Temperature (°C)	Indicating Pressure (MPa)	Measured Stability (± °C)
[illegible]	[illegible]	[illegible]

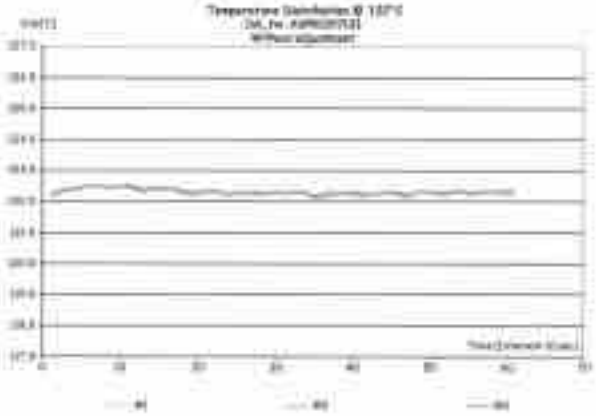
Note * Maximum uncertainty of the each position

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

The End of Certificate







ใบตรวจสอบสภาพเครื่องควบคุมอุณหภูมิ

17 Jun 2022			17 Jun 2022		
ปกติ	ไม่ปกติ		ปกติ	ไม่ปกติ	
		General			
☑	☐	1. [illegible]	☑	☐	
☑	☐	2. [illegible] Main Switch	☑	☐	
☑	☐	3. [illegible] Selector Key	☑	☐	
☑	☐	4. [illegible] Pressure & Temperature	☑	☐	
☑	☐	5. [illegible] Timer	☑	☐	
☑	☐	6. [illegible] (220VAC)	☑	☐	
☑	☐	7. [illegible]	☑	☐	
☑	☐	8. [illegible]	☑	☐	
☑	☐	9. [illegible] (220VAC)	☑	☐	
☑	☐	10. [illegible]	☑	☐	
☑	☐	11. [illegible]	☑	☐	

Remark: _____

Mr. Kachal Nganchoom
Service Engineer

Request No. 25-66 / 0323 MTC. ACL No. 387 / 66

CALIBRATION CERTIFICATE

NOMENCLATURE : 1. Atomic Absorption Spectrophotometer "Agilent Technologies"
Model [illegible], Serial No. [illegible]
2. Working standard solution "Standard Mixture"
Multi Analyte Custom Grade Solution, Lot No. [illegible]

SUBMITTED BY : [illegible] Analytical and Engineering Consultant Co., Ltd.
[illegible], Sukhumvit Road, Bangchak, Phakanong, Bangkok 10260

CALIBRATION PROCEDURE : 1. Performance Verification of Atomic Absorption Spectrophotometer
[illegible]
2. Estimation Uncertainty of Measurement in Analytical Chemistry [illegible]

CALIBRATION RANGE : [illegible]

CALIBRATION DATE : 2 February 2023

REFERENCE MATERIAL : Traceable to NIST "Cane Glass", "Stainless Steel Cans"
Cadmium Lot No. [illegible], Chromium Lot No. [illegible], Copper Batch No. [illegible], Iron Batch No. [illegible],
Lead Lot No. [illegible], Manganese Batch No. [illegible], Nickel Batch No. [illegible], Zinc Batch No. [illegible]

AMBIENT CONDITIONS : Temperature 23 °C, Relative Humidity 50 %

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

Calibrated by : [illegible]
(Mr. Danai Sirithongkum)

Approved by : [illegible]
[illegible]
Acting Director of Analytical Chemistry Laboratory
Ref. 2013/0040/2(2013/0040)
Issued Date : 13 February 2023

เอกสารไม่ควบคุม

Request No. 25-66 / 0323 1 / 5 MTC. ACL No. 387 / 66

CALIBRATION DATA

1. Noise Level

Element	Cd	Cr	Cu	Fe	Pb	Mn	Ni	Zn
Absorbance	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Average Absorbance	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

Continue 2 / 5

INDUSTRIAL METROLOGY AND TESTING SERVICE CENTRE

เอกสารไม่ควบคุม

Request No. 25-66 / 0323 2 / 5 MTC. ACL No. 387 / 66

2. Precision

Element	Conc. (mg/l)	Absorbance										Avg. Abs.	SD	RSD
Cd	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Cr	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Cu	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Fe	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Pb	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Mn	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Ni	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Zn	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

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INDUSTRIAL METROLOGY AND TESTING SERVICE CENTRE

เอกสารไม่ควบคุม

Request No. 25-66 / 0323 3 / 5 MTC. ACL No. 387 / 66

3. Trueness

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

Element	Standard Value of CRM (mg/l)	Reading (mg/l)	Error of Measurement (mg/l)	Error of Measurement (%)	Uncertainty (mg/l)
Cd	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

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

Element	Standard Value of CRM (mg/l)	Reading (mg/l)	Error of Measurement (mg/l)	Error of Measurement (%)	Uncertainty (mg/l)
Cr	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

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

Element	Standard Value of CRM (mg/l)	Reading (mg/l)	Error of Measurement (mg/l)	Error of Measurement (%)	Uncertainty (mg/l)
Cu	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

Continue 4 / 5

INDUSTRIAL METROLOGY AND TESTING SERVICE CENTRE

เอกสารไม่ควบคุม

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

Element	Standard Value of RM (mg/l)	Reading (mg/l)	Error of Measurement (mg/l)	Error of Measurement (%)	Uncertainty (mg/l)
Fe	[illegible]	[illegible]	[illegible]	[illegible]	± [illegible]
	[illegible]	[illegible]	[illegible]	[illegible]	± [illegible]
	[illegible]	[illegible]	[illegible]	[illegible]	± [illegible]

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

Element	Standard Value of RM (mg/l)	Reading (mg/l)	Error of Measurement (mg/l)	Error of Measurement (%)	Uncertainty (mg/l)
Pb	[illegible]	[illegible]	[illegible]	[illegible]	± [illegible]
	[illegible]	[illegible]	[illegible]	[illegible]	± [illegible]
	[illegible]	[illegible]	[illegible]	[illegible]	± [illegible]

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

Element	Standard Value of RM (mg/l)	Reading (mg/l)	Error of Measurement (mg/l)	Error of Measurement (%)	Uncertainty (mg/l)
Mn	[illegible]	[illegible]	[illegible]	[illegible]	± [illegible]
	[illegible]	[illegible]	[illegible]	[illegible]	± [illegible]
	[illegible]	[illegible]	[illegible]	[illegible]	± [illegible]

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INDUSTRIAL METROLOGY AND TESTING SERVICE CENTRE

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

Element	Standard Value of RM (mg/l)	Reading (mg/l)	Error of Measurement (mg/l)	Error of Measurement (%)	Uncertainty (mg/l)
Ni	[illegible]	[illegible]	[illegible]	[illegible]	± [illegible]
	[illegible]	[illegible]	[illegible]	[illegible]	± [illegible]
	[illegible]	[illegible]	[illegible]	[illegible]	± [illegible]

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

Element	Standard Value of RM (mg/l)	Reading (mg/l)	Error of Measurement (mg/l)	Error of Measurement (%)	Uncertainty (mg/l)
Zn	[illegible]	[illegible]	[illegible]	[illegible]	± [illegible]
	[illegible]	[illegible]	[illegible]	[illegible]	± [illegible]
	[illegible]	[illegible]	[illegible]	[illegible]	± [illegible]

Remark : [illegible]

Calibrated by : [illegible]
(Mr. Danai Sittiongkaew)
[illegible]
(Mr. Atipat Nawat)

Approved by : [illegible]
(Mr. [illegible])
Senior Technical Officer
Acting Director of
Analytical Chemistry Laboratory
Issued Date : 10 February 2023

INDUSTRIAL METROLOGY AND TESTING SERVICE CENTRE
End of Certificate

Agilent Technologies

Agilent 5110 and 5100 ICP-OES
Preventive Maintenance Checklist

Agilent Preventive Maintenance provides factory recommended service for your analytical system to assure reliable operation and the accuracy of your results. Performed by highly trained and certified service engineers using genuine Agilent parts and supplies, Agilent Preventive Maintenance provides unrivalled uptime and reduces unplanned downtime and keeps your systems operating at their peak.

For more information about Agilent Technologies service please visit our web site using the following URL: [illegible]

Customer Information

- Customers should provide all necessary operating supplies upon request of the engineer.
- For customers using HF applications, the torch parts should be removed to its standard sample introduction system.
- A customer representative should be available to the engineer while performing the preventive maintenance procedures.
- Any parts not included in the Parts List section of this document, are not part of the recommended Preventive Maintenance service, nor are they included in the price of this service.
- If a system requires the use of additional or special procedures and/or parts for the maintenance service, these should be noted 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 checkboxes in the checklist using a "✓" or tick mark "✓" in the checkbox.
- Complete the applicable check boxes to indicate services are delivered, as needed.
- Complete the PM service at the order of the fields listed.
- Complete the Service Report section together with the customer.

Agilent Technologies

Agilent 5110 and 5100 ICP-OES
Preventive Maintenance Checklist

System Information

Instrument system name and ID	[illegible]
Instrument system site and location	[illegible]
List system component product numbers	List the serial numbers of each component
1 [illegible]	1 [illegible]
2 [illegible]	2 [illegible]
3	3
4	4
5	5
6	6
7	7
8	8
9	9
10	10

ICP-OES Configuration Info	Check the type or write in the type if other
Nebulizer Type	Sealfast / Cyclonic / other
Spray Chamber	Cyclonic Scott Type / Cyclonic Double Pass / other
Torch	Radial / Axial Type / other
Injector Diameter	1.0mm / 1.5mm / 2.0mm / 2.5mm / other
Injector Material	Quartz / Ceramic / other

General Preparation

- ☑ Discuss any specific questions or issues with the customer prior to starting.
- ☑ Review the instrument logbook.
- ☐ Perform general external inspection or system for cleanliness.
- ☑ Check for proper installation of safety interlock parts, assemblies, sensors etc.
- ☑ Check for required hardware/software updates and notify with customers if they would like it installed.
- ☑ For RF 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 – Pre PM.

Inspect and clean the system

- ☑ Look for any obvious external damage or problems.
- ☑ Inspect water cooling hoses, gas lines and power cord for excessive wear or damage.
- ☑ Perform a general internal inspection of the system for excessive dust accumulation, clean if necessary.
- ☑ Inspect sample introduction components and record the required maintenance in the Service Engineer Comments and notify the customer as the required action 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 5100 and 5110 instruments.
- ☑ Check release free for the correct position extinction at the external door to ensure they meet minimum specifications.
- ☑ Replace air inlet dust filter.
- ☑ Replace high capacity air inlet dust filter element if installed.
- ☐ Remove and clean instrument room dust filter.

G8481A Cooling water system

- ☐ Section NOT Applicable
- ☑ Drain cooling fluid and remove any particles from the chiller reservoir.
- ☑ Remove chiller and remove water inlet metal mesh filter.
- ☐ Re-fill with Polyglycol cooling fluid.
- ☑ Clean the cooling system Air Filter and fan evaporator by compressed air or vacuum cleaner.

SPS 3 Auto Sampler

- ☑ Section NOT Applicable
- ☐ Power cycle the autosampler and verify successful initialization.
- ☑ Inspect X and Z axis belts for wear. Replace is necessary.
- ☐ Clean X and Z axis slide shafts.
- ☐ Using customer's name and the Agilent software move the sample probe to the A calibrant container and clean port, ensure that the probe is approximately centered in the vial.

SPS 4 Auto Sampler

- ☑ Section NOT Applicable
- ☑ Clean the split tray, rack locator tool, vial frames and cassette with a damp soft cloth and diluted mild detergent.
- ☑ Clean the auto sampler cover panels, if cover kit is installed, with domestic window cleaner.
- ☑ Check the X-axis and Z-axis drive belts for cracks, splits, damaged teeth, excessive fraying, axial changes or degradation from heat.
- ☑ Check the X-axis, Theta-axis and Z-axis FFC cables for cracks, excessive positioning, damaged edges or damaged connectors.
- ☑ Pump Tubing Replacement. Replace peristaltic pump tubing. Replace all tubing that goes from the draw station to the pump and from the pump to the waste/drain bottle.

AVS 4, 6, 7

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

Instrument Adjustment

- ☑ Check position of Z-jet probe, adjust if required.
- ☑ Check Argon flows, 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 instrument tests and record the result in the Instrument Test Results Table:
  - ☑ Spectrometer Communication Test
  - ☑ Air Flow

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

Instrument Performance Test Results Table

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

	Pre PM Sensitivity Check		Post PM Sensitivity Check	
	Radial	Axial *	Radial	Axial
Be 313.107 nm DDD	[illegible]	[illegible]	[illegible]	[illegible]
Be 313.042 nm DDD	[illegible]	[illegible]	[illegible]	[illegible]
[illegible] nm DDD	[illegible]	[illegible]	[illegible]	[illegible]
[illegible] nm DDD	[illegible]	[illegible]	[illegible]	[illegible]

* Axial results is not applicable for 5100 SVDV, 5110 SVDV Radial View instruments

Instrument Test Results Table

Note: The Instrument Test results are the outcome using ICP Expert version 7.2 and above only.

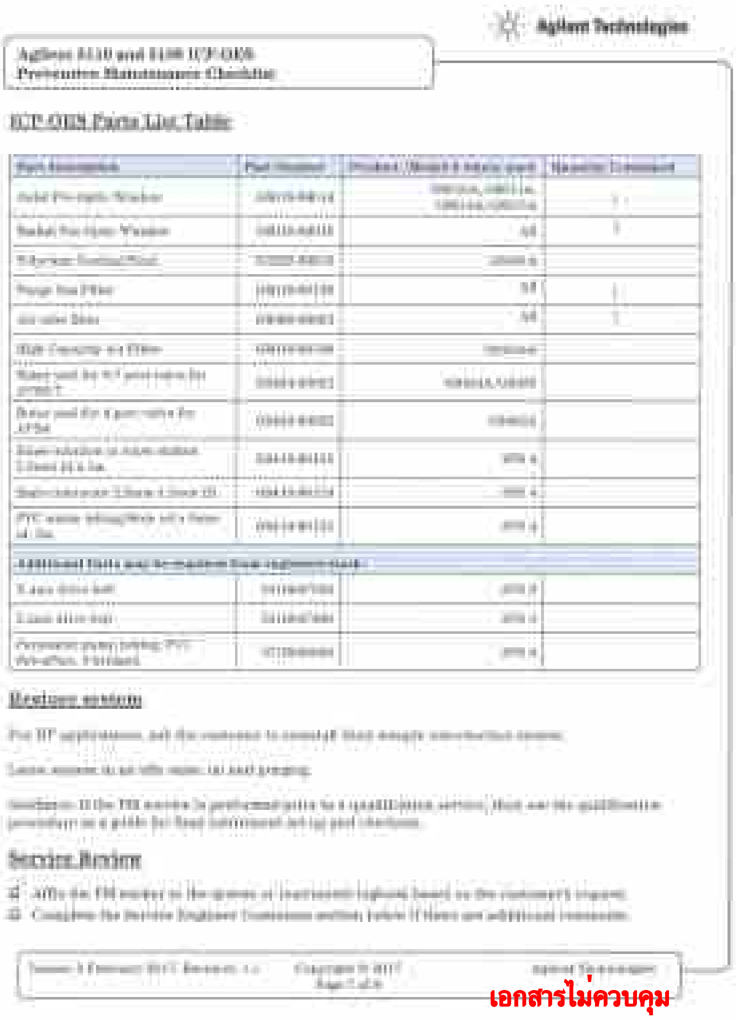
Instrument Test	Results
Spectrometer Communication Test	[illegible]
Air Flow	[illegible]
Water Flow	[illegible]
Gas Flows	[illegible]
RF Generator	[illegible]
Camera Test	[illegible]
Optics Test	[illegible]
Autoclave test	[illegible]

ICP-OES Status Results Table

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

Measurement	Results Before		Results After	
Mains Voltage	[illegible]	V(AC)	[illegible]	V(AC)
Mains Current	[illegible]	A	[illegible]	A
Instrument Temperature	[illegible]	°C	[illegible]	°C
RF Gen Fan (motor speed)	[illegible]	Hz	[illegible]	Hz
Plasma Ambient Temperature	No measurement		[illegible]	°C
Water Flow Outlet	No measurement		[illegible]	L/min
Water Flow Detector	[illegible]	L/min	[illegible]	L/min
Water Inlet Temperature	[illegible]	°C	[illegible]	°C
Autosampler Temperature	[illegible]	°C	[illegible]	°C
CCD Temperature	[illegible]	°C	[illegible]	°C
Thermal Stabilizer	[illegible]	°C	[illegible]	°C
Argon Supply Pressure	[illegible]	kPa	[illegible]	kPa
Extra Gas Supply Pressure* 1	[illegible]	kPa	[illegible]	kPa
Extra Gas Supply Pressure* 2	[illegible]	kPa	[illegible]	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 Supply Current	No measurement		[illegible]	A
RF Supply Voltage	No measurement		[illegible]	V

* 1 If optical installed



Agilent 5110 and 5100 ICP-OES
Preventive Maintenance Checklist

ICP-OES Parts List Table

Restore system

Service Review

Agilent 5110 and 5100 ICP-OES
Preventive Maintenance Checklist

Service Engineer Comments (optional)

Other Important Customer Web Links

Service Completion

Report Summary

Result Summary

Sensitivity Test — **Pass**

Header

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

Axial

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

Page 2 of 4

เอกสารไม่ควบคุม

Precision Test — **Pass**

Header

Element Wavelength	Specification	Measured Value % RSD
[illegible]	[illegible]	[illegible]

Axial

Element Wavelength	Specification	Measured Value % RSD
[illegible]	[illegible]	[illegible]

Page 4 of 4

เอกสารไม่ควบคุม

Report Summary

Instrument Model	Agilent 5110/5100 VDV ICP-OES
Instrument ID	[illegible]
Instrument Serial Number	[illegible]
Software Version	1.1.1.6622
Firmware Version	3HC
Tested By	[illegible]
Test Completed On	[illegible]

Result Summary

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

Subsystem Communications Test — **Pass**

Air Flow Test — **Pass**

20% Air Flow (release speed)	70% Air Flow (uniform speed)
[illegible]	[illegible]

Water Flow Test — **Pass**

RF Stable Power (kW)	Optimal Water Flow (L/min)	Water Inlet Temperature (°C)
1.40	1.20	[illegible]

Page 1 of 2

เอกสารไม่ควบคุม

Gas Flows Test — **Pass**

Nebulizer Target Flow	Actual Flow	Gas Pressure	Auxiliary Target Flow	Actual Flow	Gas Pressure
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

Plasma Target Flow	Actual Flow	Gas Pressure	Plasma Target Flow	Actual Flow	Gas Pressure
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

RF Generator Test — **Pass**

RF Power Supply Test	Passed
RF Power Supply (V)	[illegible]
RF Oscillator Test	Passed
RF Oscillator Frequency (MHz)	[illegible]
Work Coil Current (A)	[illegible]
RF Power Supply Current (A)	[illegible]

Camera Test — **Pass**

	Integration Time (ms)	Standard Deviation	Status
Electronic Offset Test	[illegible]	[illegible]	Passed
Dark Current Test	[illegible]	[illegible]	Passed
Array Test	[illegible]	[illegible]	Passed
Linearity Test		[illegible]	Passed

Page 2 of 2

เอกสารไม่ควบคุม

Report Summary

Instrument Model	[illegible]
Instrument ID	[illegible]
Instrument Serial Number	[illegible]
Software Version	[illegible]
Firmware Version	[illegible]
Tested By	[illegible]
Test Completed On	[illegible]

Result Summary

Subsystem Connectivity Test	Skipped
Air Flow Test	Skipped
Water Flow Test	Skipped
Gas Flow Test	Skipped
3D Geometric 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	Value
Intensity	[illegible]	[illegible]
Wavelength	[illegible]	[illegible]

เอกสารไม่ควบคุม

Resolution Test — **Pass**

Standard Wavelength	Specification	Value
[illegible]	[illegible]	[illegible]

เอกสารไม่ควบคุม

Sensitivity Test — **Pass**

Tracer

Standard Wavelength	Specification	Method	Value	Standard	Error
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

Total

Standard Wavelength	Specification	Method	Value	Standard	Error
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

เอกสารไม่ควบคุม

Precision Test — **Pass**

Tracer

Standard Wavelength	Specification	Measured Value % RSD
[illegible]	[illegible]	[illegible]

Total

Standard Wavelength	Specification	Measured Value % RSD
[illegible]	[illegible]	[illegible]

เอกสารไม่ควบคุม

CERTIFICATE OF CALIBRATION

Certificate No. : SPT2-010 Page 1 of 3

Customer : Grand Analytical Engineering Consultant Co.,Ltd. (Head Office)

Address : 7 Soi Udomsuk 41, Sukhumvit Road, Bangchak, Phrakanong,

Bangkok 10260

Location of calibration : Laboratory 101

Equipment : UV-Vis Spectrophotometer

Manufacturer : Agilent Technologies

Model : Cary 60

Serial No. : MY19410009

ID No. : N/A

Received Date : 23 May 2022

Calibration Date : 23 May 2022

Next Date : 25 May 2022

Condition Instrument : Good

Calibrated by : (Mr. Natthawat Wongkaew) Technical Manager

Approved by : (Mr. Chanthakit Tongpaen) Quality Manager

The calibration results in this certificate are valid only at the time of calibration and for the item as specified above. It certifies only.

The measurement results in this certificate are traceable to Bangkok National Standards and to the units of measurement realized by 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. Page 1 of 3

เอกสารไม่ควบคุม

REPORT OF CALIBRATION

Certificate No. : SPT2-010 Page 2 of 5

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
Aluminum Standard set	25700	90024	22 October 2021
Aluminum Standard set	25707	90029	22 October 2021
Wavelength Standard set	25906	90016	22 October 2021
Wavelength Standard set	25708	90011	22 October 2021

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

เอกสารไม่ควบคุม

REPORT OF CALIBRATION

Certificate No. : SPT2-010 Page 3 of 5

Calibration Results : Without adjustment

Photometric Accuracy :

Wavelength (nm)	CRM's Value (Abs)	UUC Reading (Abs)	Correction (Abs)	Uncertainty (Abs)	Coverage factor k
420	0.0000	0.0000	0.0000	0.0020	2.00
	0.5737	0.5733	0.0032	0.0011	2.00
	1.0440	1.0436	0.0036	0.0020	2.00
	2.1900	2.1887	0.0032	0.0037	2.00
440	0.0000	0.0000	0.0000	0.0020	2.00
	0.5602	0.5599	0.0019	0.0014	2.00
	1.0247	1.0232	0.0015	0.0019	2.00
	2.1126	2.1121	0.0014	0.0032	2.00
465	0.0000	0.0000	0.0000	0.0020	2.00
	0.5230	0.5197	0.0034	0.0029	2.00
	0.9634	0.9623	0.0009	0.0020	2.00
	1.9767	1.9752	0.0011	0.0070	2.00
546.1	0.0000	0.0000	0.0000	0.0020	2.00
	0.5101	0.5171	0.0020	0.0011	2.00
	1.0007	0.9966	0.0019	0.0017	2.00
	2.1987	1.9946	0.0041	0.0044	2.00
590	0.0000	0.0000	0.0000	0.0020	2.00
	0.5723	0.5709	0.0014	0.0016	2.00
	1.0809	1.0799	0.0010	0.0020	2.00
	2.2101	2.2119	0.0002	0.0080	2.00
635	0.0000	0.0000	0.0000	0.0020	2.00
	0.5407	0.5384	0.0017	0.0031	2.00
	1.0513	1.0498	0.0014	0.0029	2.00
	2.2254	2.2247	0.0029	0.0082	2.00

เอกสารไม่ควบคุม

REPORT OF CALIBRATION

Certificate No. : SPT2-010 Page 4 of 5

Photometric Accuracy :

Wavelength (nm)	CRM's Value (Abs)	UUC Reading (Abs)	Correction (Abs)	Uncertainty (Abs)	Coverage factor k
257	0.0000	0.0001	-0.0001	0.0070	2.00
	0.7478	0.7421	0.0057	0.0050	2.00
297	0.0000	0.0000	0.0000	0.0070	2.00
	0.9684	0.9619	0.0067	0.0050	2.00
313	0.0000	0.0000	0.0000	0.0070	2.00
	0.3412	0.3399	0.0010	0.0071	2.00
350	0.0000	0.0000	0.0000	0.0090	2.00
	0.6448	0.6439	0.0043	0.0075	2.00

เอกสารไม่ควบคุม

REPORT OF CALIBRATION

Certificate No. [illegible]

Page [illegible] of [illegible]

Wavelength accuracy :

CRM's Value (nm.)	UUC Reading (nm.)	Correction (nm.)	Uncertainty (nm.)	Coverage factor k
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

- End of Certificate -

เอกสารไม่ควบคุม

CERTIFICATE OF CALIBRATION

Certificate No. : [illegible]

Page [illegible] of [illegible]

Customer : [illegible]

Address : [illegible]

Location of calibration : [illegible]

Equipment : UV-Vis Spectrophotometer

Manufacturer : Hitachi

Model : [illegible]

Serial No. : [illegible]

ID No. : [illegible]

Received Date : [illegible]

Calibration Date : [illegible]

Issue Date : [illegible]

Condition (instrument) : Good

Calibrated by : ([illegible])

Approved by : ([illegible])

เอกสารไม่ควบคุม

REPORT OF CALIBRATION

Certificate No. : [illegible]

Page [illegible] of [illegible]

Environment Condition : Ambient Temperature [illegible] °C

Relative humidity : [illegible] %RH

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

Certified Reference Materials :

Material	Serial No.	Certificate No.	Due date
[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]

Traceability : [illegible]

Spectral Band Width of UUC : [illegible] nm.

Scan Speed of UUC : [illegible]

Scan Interval of UUC : [illegible] nm.

Resolution of UUC : Photometric [illegible] Abs.

Wavelength [illegible] nm.

เอกสารไม่ควบคุม

REPORT OF CALIBRATION

Certificate No. [illegible]

Page [illegible] of [illegible]

Calibration Results : Without adjustment

Photometric Accuracy :

Wavelength (nm.)	CRM's Value (Abs)	UUC Reading (Abs)	Correction (Abs)	Uncertainty (Abs)	Coverage factor 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]

เอกสารไม่ควบคุม

REPORT OF CALIBRATION

Certificate No. [illegible]

Page [illegible]

Photometric Accuracy :

Wavelength (nm)	CRMs Value (Abs)	UUC Reading (Abs)	Correction (Abs)	Uncertainty (Abs)	Coverage factor k
235	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
257	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
313	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
546	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

เอกสารไม่ควบคุม

REPORT OF CALIBRATION

Certificate No. [illegible]

Page [illegible]

Wavelength Accuracy :

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

- End of Certificate -

เอกสารไม่ควบคุม

CERTIFICATE OF CALIBRATION

Certificate No. : [illegible]

Page [illegible]

Customer : [illegible]

Address : [illegible]

Location of calibration : Laboratory [illegible]

Equipment : UV-Vis Spectrophotometer

Manufacturer : Hitachi

Model : U-2900

Serial No. : [illegible]

ID No. : [illegible]

Received Date : [illegible] January 2023

Calibration Date : [illegible] January 2023

Next Date : [illegible] January [illegible]

Condition Interested : Used

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

Approved By : (Mr. [illegible]) Quality Manager

เอกสารไม่ควบคุม

REPORT OF CALIBRATION

Certificate No. : [illegible]

Page [illegible]

Environment Condition : Ambient Temperature [illegible] °C

Relative humidity [illegible] %

Calibration method : In house method [illegible] Based on ASTM [illegible]

Certified Reference Materials :

Material	Serial No.	Certificate No.	Due date
Absorbance Standard set	[illegible]	[illegible]	[illegible]
Absorbance Standard set	[illegible]	[illegible]	[illegible]
Wavelength Standard set	[illegible]	[illegible]	[illegible]
Wavelength Standard set	[illegible]	[illegible]	[illegible]

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

Spectral Band Width of UUC : [illegible] nm

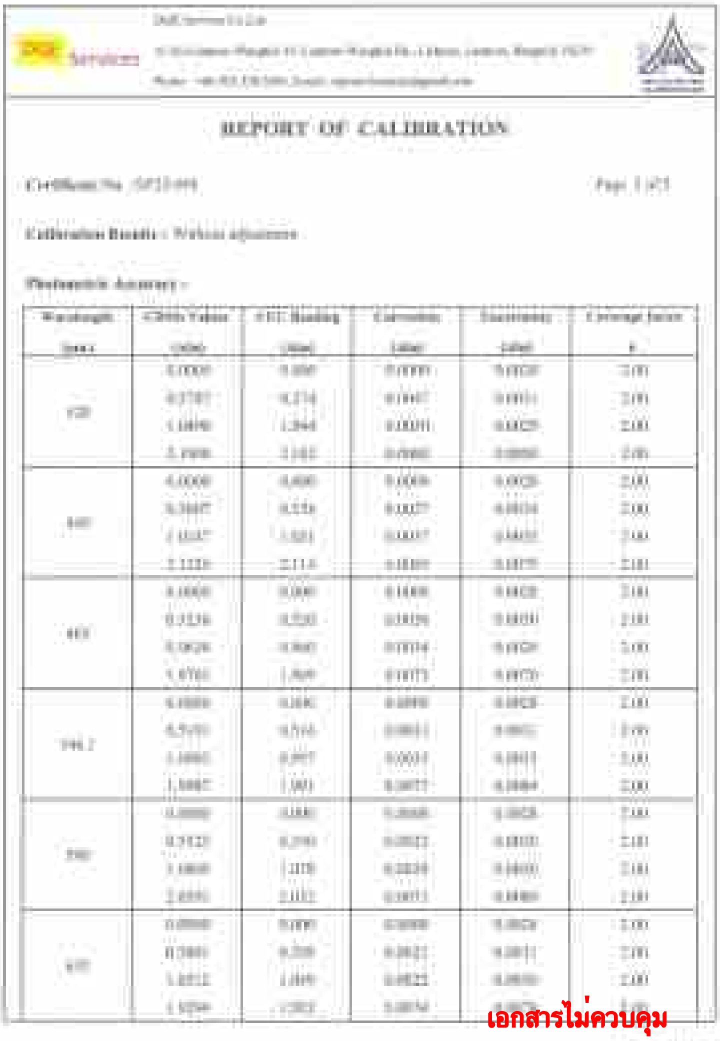
Scan Speed of UUC : [illegible]

Scan Interval of UUC : [illegible] nm

Resolution of UUC : Photometric [illegible] Abs

Wavelength [illegible] nm

เอกสารไม่ควบคุม

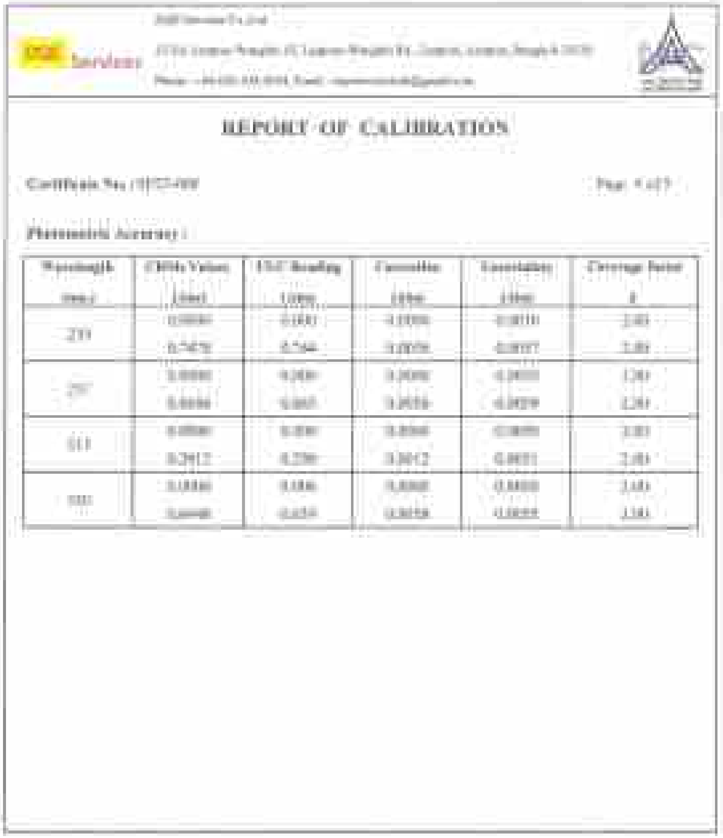


REPORT OF CALIBRATION

Calibration Results : Without adjustment

Photometric Accuracy :

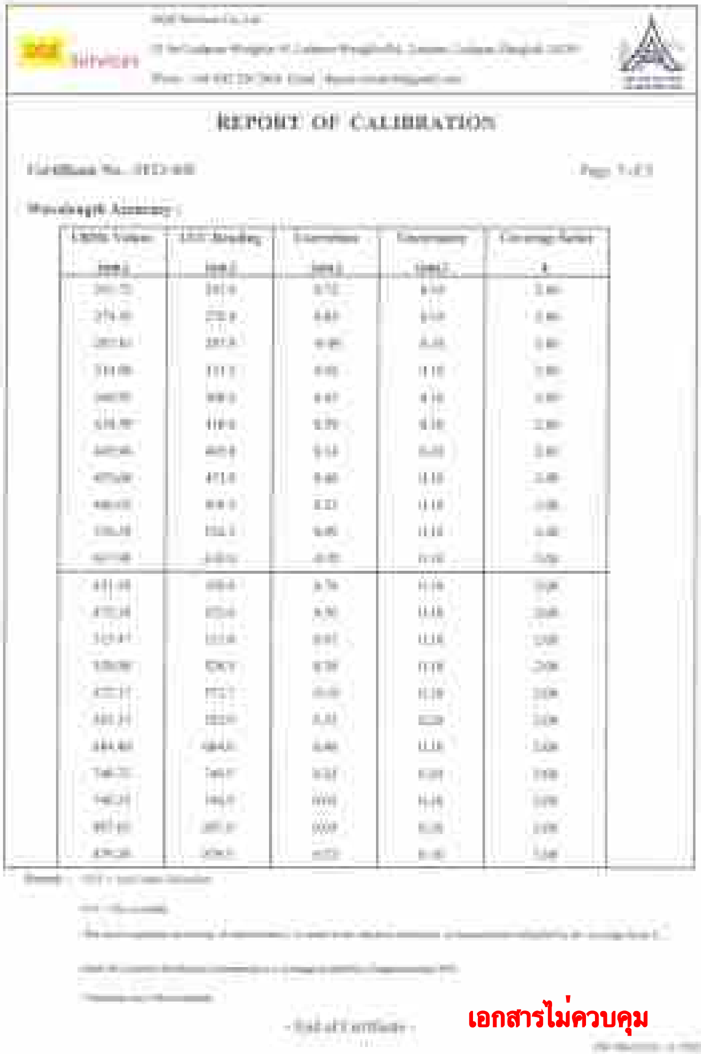
Wavelength (nm)	CRM's Values (Abs)	UUC Reading (Abs)	Correction (Abs)	Uncertainty (Abs)	Coverage factor k



REPORT OF CALIBRATION

Photometric Accuracy :

Wavelength (nm)	CRM's Values (Abs)	UUC Reading (Abs)	Correction (Abs)	Uncertainty (Abs)	Coverage factor k



REPORT OF CALIBRATION

Wavelength Accuracy :

CRM's Values (nm)	UUC Reading (nm)	Correction (nm)	Uncertainty (nm)	Coverage factor k

- End of Certificate -

Hanna Instruments (Thailand) Ltd.

CERTIFICATE OF CALIBRATION

Equipment :
Meter Model : **Serial No. :**
Tube Heater : 25 Vial Capacity **Accuracy :**
Temperature Range :
Ambient Temperature : **Relative Humidity :**
Manufacturer : Hanna Instruments **Made in :** Romania
Condition As Received : **Reference :**
Customer name :
Received date :
Calibration date :
Issue date :
Calibrated Location : Hanna Instruments (Thailand) Ltd.
Calibration Procedure :

Calibrated by : **Approved by :**

Authorized Signatory

HANNA instruments

Certificate No.: [illegible]

Page: 1 of 1

Condition of the calibration result

Reference Standard Instruments

Instruments	Model	Serial No.	Certificate No.	Traceable
Data Acquisition Switch Unit	[illegible]	[illegible]	[illegible]	WE Electric CO., Ltd.

Calibration Result

Measurement Temperature Source Accuracy for CCD Reactor

Capacity (Vial)	Nominal Value (°C)	Average Value (°C)	(±) Uncertainty (°C)	(±) Tolerance of EDE (°C)	Acceptance Criteria
20 Vial	[illegible]	[illegible]	[illegible]	3	Pass

Figure: Shows the location of the temperature sensor.

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

Remark: The acceptance criteria is the error value plus or minus the Measurement Uncertainty, and then the Mean that the Tolerance value of EDE, therefore mentioned the pass.

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

** End of certificate **

เอกสารไม่ควบคุม

nfi

Verification Certificate

Certificate No.: [illegible]
Client name: [illegible]
Address: [illegible]

Page: 1 of 1

Equipment: HEATING BLOCK DIGESTION
Manufacturer: [illegible]
Model: [illegible]
Serial No.: [illegible]
ID No.: [illegible]
Order No.: [illegible]
Operation No.: [illegible]
Date of Receipt: [illegible]
Date of Calibration: [illegible]

Calibrated by [illegible] **Approved by** [illegible]

Date of Issue: [illegible]

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

เอกสารไม่ควบคุม

nfi

Verification Report

Certificate No.: [illegible]
Equipment: [illegible]
Date of Calibration: [illegible]

Page: 1 of 1

Location: [illegible]
Environment Condition: [illegible]

Condition of the results of Calibration

1. [illegible]
2. [illegible]
3. Reference Standard Instrument

Instrument	Model	Serial No.	Certificate No.	Due Date	Through
Digital Thermometer	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Type-K Thermocouple	Type-K	[illegible]			

4. [illegible]
5. [illegible]
6. [illegible]
7. [illegible]
8. Condition of Calibration Item : [illegible]
9. Result of Calibration : [illegible]

เอกสารไม่ควบคุม

nfi

Verification Report

Certificate No.: [illegible]
Equipment: [illegible]
Date of Calibration: [illegible]

Page: 1 of 1

Calibration point: [illegible]
Calibration result:
Reporting of Temperature

Block No.	UUT* Setting (°C)	UUT* Reading (°C)	Stability (±°C)	Standard Instrument (°C)	Uncertainty (±°C)
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]
11	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
12	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
13	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
14	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
15	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
16	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
17	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
18	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
19	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
20	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

Note:

- UUT* = Unit Under Calibration
- Uncertainty depth of standard thermometer in case used high of zone is equal heater zone of UUT.
- 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:

Date of Calibration:

Calibration point:

Calibration result:

Figure 1. Location of Temporary Standard and Back Diagram of Digestion Unit

Top view

Sensor Installation Location

Note:

- UUT = Unit Under Calibration
- Immersion depth of standard thermometer in tube from high of sand is equal height of UUT.
- Stability = One half of the greatest maximum difference of measured temperature at two seconds. It is also half as true after reaching steady state.

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

——— End ———

เอกสารไม่ควบคุม

FOSS

Customer Service Report

Report No: 6823

เอกสารไม่ควบคุม

FOSS

Customer Service Report

Report No: 6834

เอกสารไม่ควบคุม

FOSS Installation Qualification

Kjeltec™ 8100 Distillation Unit

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

1 Intended Use

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

2 Purpose

The Installation Qualification is designed to assure that:

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

3 Identification

Description	Serial Number
Kjeltec 8100 Distillation Unit	[illegible]

Continuous Analysis of Substance

เอกสารไม่ควบคุม

4 Control of Received Equipment

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

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

Packing List Item	Acceptance Criteria	Pass (Y/N)
[illegible]	No visible damage, exposed in undamaged FEDS module(s) (earlier) shipping container	Y
[illegible]	Included. No visible damage, exposed in undamaged FEDS module(s) (earlier) shipping container	Y
Handling device for digestion tube	Included. No visible damage	Y
Safety with inner covers for shade, mist and water	Included. No visible damage	Y
Reagent Tray	Included. No visible damage	Y
One digestion tube 250ml One digestion tube 100 ml	Included. No visible damage	Y
Tube adapter	Included. No visible damage	Y
Lab manual	Name: [illegible]	Y
Generic guide	Name: [illegible]	Y
Quick guide	Name: [illegible]	Y
Spare parts manual	Name: [illegible]	Y
Application notes	AN 000 included AN 001 included	Y

5 Installation

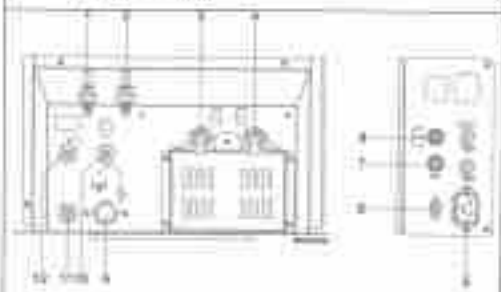
5.1 The equipment must be installed in a suitable location with power, water and draining available

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

Location Requirements	Acceptance Criteria	Pass (Y/N)
Adequate space for instrument	Dimensions, see Guide on	Y
AC mains available for instrument	220-240 V 50/60Hz	Y
Current	20 A	Y
Cold water supply available	1 L/min at 20°C	Y
Drain	For cooling water and waste (depending on local waste disposal regulation)	Y
Ambient temperature	Max. 40°C	Y
Ambient humidity	Max. 80% relative	Y
Exterior Type	Type AH	Y

5.2 The instrument must be assembled correctly

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

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

1. Demineralized water in (source generator)
2. Demineralized water in (distillation unit)
3. *) Effluent solution in
4. Alkali in
5. Acid
6. Hot water
7. External titration module
8. Cold water
9. Cooling water in (tap water)
10. Waste water out (tube duct unit)
11. Drain
12. Cooling water out (tap water)

*) (EN) ref Tighter 2000

5.3 The instrument should be assembled and powered up

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

Action	Expected Response	Pass (Y/N)
Switch on the power	The instrument starts up and the LED and will run. The display screen shows the version of assigned module(s) (FEDS power and the TuPower module) shows the version of the instrument software.	Y
	After starting, Program 1 is loaded and the Analysis menu is displayed.	Y
Turn on the cold water tap	No visible reaction	Y
Press the **"Manual"** menu	The Manual menu is opened.	Y
Open the door with the handle, place the 100 ml vial, remove fluid + stopper. Close the door.		Y
Select **Dilution** and press **Start**	Water is added to the vial.	Y
Select **Alkali** and press **Start**	Alkali is added to the vial.	Y
Select **Steam** and press start	After heating up, steam is entering the vial.	Y
Select **Stop** and press **Start**	The vial is drained.	Y

6 Summary of Deviations/Comments

Deviation	Action	Comment

7 IQ Documentation

Upon successful completion and recording of all deviations above, sign and date the check below. If required by customer, have the signature witnessed.

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

Executed By: [illegible]

Company: [illegible]

Customer Name: [illegible]

Company: [illegible]

Date completed: [illegible]

Kjeltec™ 8100 Distillation Unit

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

1 Intended Use

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

2 Purpose

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

- Alkali volume
- Distillation Accuracy
- Distillation Repeatability

3 Identification

Description	Serial Number
Kjeltec 8100 Distillation Unit, 230 240 V 50/60 Hz	[illegible]

Confidential Analytical Solutions

4 Performance

4.1 Verify the dispensed volumes of reagents

Note! To verify the dispensed volumes of reagents a high cost should be done in the metrology control. Then calculate a mean value.

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

Water

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

Note! If the water volume needs to be calibrated, go to 4.2 Dilution Pump Calibrate in the User Manual.

Alkali

- Press **Alkali** and then press **Start**. 75 ml of alkali will be filled into the tube.
- Measure the collected alkali in a graduated measuring glass and note the result in table 1 below.
- Check acceptance criteria in the table and make the judgement if passed or not.

Date / Initials (name)

Test	Result	Expected result	Passed (Y/N)
Water volume	[illegible] ml [illegible] ml [illegible] ml Mean: [illegible] ml	[illegible]	Y
Alkali volume	[illegible] ml [illegible] ml [illegible] ml Mean: [illegible] ml	[illegible] ml	Y

4.2 Verify the distillation procedure, accuracy and precision

The distillation principle is to convert ammonium (NH_4^+) into ammonia (NH_3) by using an alkali. The NH_3 is then transfer from distillate to form a receiver flask containing boric acid and titrate with standard acid solution using colorimetric end point detection. Ammonium sulphate, a substance with known ammonia content, can be used to check the accuracy of the distillation. The recovery is calculated from obtained result.

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

Chemical Check

Use ammonium sulphate ($(NH_4)_2SO_4$, purity > 99.5 %)

Test weight = [illegible] g(s), Nitrogen content in ammonium sulphate ([illegible] %) = [illegible] (Min [illegible] %)

Analysis conditions according to AN 300

Water	80 ml
Alkali	50 ml NaOH (40%w/v)
Receiver solution	30 ml boric acid (4%)
Distillation time	3 minutes
D.H.O.	3 seconds
Titrant	0.1N HCl

For reagent preparation see Appendix A

1. Weigh the [illegible] ammonium sulphate into a tube. Prepare 6 samples (tubes).
2. Run the six samples according to above analysis conditions. Titrate with a standard acid solution using colorimetric end point detection.
3. Calculate the recovery according to below equations. Expected results of recovery should be [illegible] %.

Recovery test	Result	Expected result	Passed (Y/N)
Blank value (water blank)	1. [illegible] ml 2. [illegible] ml	[illegible]	Y
Recovery	1. [illegible] % 2. [illegible] % 3. [illegible] % 4. [illegible] % 5. [illegible] % 6. [illegible] %		
Accuracy	Mean value: [illegible]	[illegible] %	Y
Repeatability	SD: [illegible]	[illegible] %	Y

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

Purity	Nitrogen content
99.0%	21.00%
99.0%	21.13%
99.7%	21.14%
99.8%	21.16%
99.9%	21.18%

$$\%\,Nitrogen = \frac{[m_{Cell_{Final}} - m_{Cell_{Initial}}] \times 14.007 \times 100}{m_{Sample}} \qquad (\pm 0.2)$$

(± = Normality of tester to 4 places of decimal)

$$\%\,Accuracy = \frac{\%\,Nitrogen}{21.00} \times 100$$

e.g. 21.2%

$$\%\,Accuracy = \frac{21.2}{21.00} \times 100$$

5 Summary of Deviations/Comments

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

Deviation	Action	Comment

6 OQ Documentation

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

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

Performed By: _____

Company: _____

Customer Name: _____

Company: _____

Date completed: _____

7 Appendix A

7.1 Preparation of Reagents

7.1.1 Alkali

To convert ammonium into nitrogen as ions of sodium hydroxide is necessary.

Use 600 g NaOH per liter of solution. Commercially available in concentration up to 50 %. Do not use concentration above 40 % as this will lead to crystal formation depending the fraction of the pump. If you use only low concentration (~40 %), dilute it before use.

7.1.2 Titrant acid, determination of concentration

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

- **Standard reference**
  Weigh approx. 10 g of anhydrous sodium carbonate (Na_2CO_3). Use a mortar to make a fine powder. Dry it for 1 h at 265 °C or 2 h at 200 °C. After cooling in a desiccator, transfer the sodium carbonate to a beaker with a tight lid. Store it in a desiccator.
- **Indicator solution**
  Dissolve 0.1 g methyl red in 100 ml methanol. Dissolve 0.1 g bromocresol green in 100 ml methanol.
- **Procedure**
  Weigh approx. 0.4 g of the standard reference, using an analytical balance, note the weight (W_1). Transfer the sodium carbonate to a titration flask and add 40 ml of H_2O (distilled or demineralized). Add 8 drops from each of the indicator solutions. Titrate to pink. Note the amount in ml used (A_1). Boil this solution for a few minutes. The solution will turn green. Cool rapidly to room temperature under running water. Continue the titration until the next pink colour change occurs. Note also this volume (A_2). Boil the solution for a few minutes. Cool rapidly to room temperature under running water. Continue the titration until the next pink colour occurs. Note also this volume (A_3).

  Note! Temperature changes will influence the volume and the concentration of the titrant solution. The working temperature of the titrant should approximate that of the temperature during manufacturing. If temperature corrections are necessary, sufficient accuracy may be obtained by use of a correction table (AOAC 942.23).

7.2 Calculation

$$\text{Molarity (M)} = \frac{10.375 \times W_1}{(A_1 + A_2 + A_3)}$$

Note! Concentration must be accurate to four digits, i.e. 0.2000 M.

Note! The colour change of this official procedure (AOAC 938.13) may be difficult to see, therefore a pH meter or a mixed indicator (e.g. 0.1 g bromocresol green in 100 ml methanol) will make it much easier to perform.

7.3 Receiver Solution

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

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

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

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

1. Transfer 25 ml boric acid solution to a receiver flask and add 100 ml of distilled water. If the solution in the flask is still red, titrate with 0.1 M sodium hydroxide solution until a neutral pink colour is obtained. Calculate the amount of sodium hydroxide solution necessary to adjust the boric acid solution in the 10 l flask with the formula ml 0.1 M alkali × 400 (from ×40).
2. Add the calculated amount of 0.1 M alkali solution to the boric acid solution. Mix.
3. To check, proceed as follows using 25 ml of the boric acid solution from a blank. If the value of this blank is high (0.5 ml of 0.1 M HCl) the boric acid is incorrectly adjusted. This might cause irregular blanks. For correction add HCl (briefly) into the boric acid tank, mix it carefully and repeat until a reading of 0.05 - 0.20 ml HCl is obtained. If a positive blank is not achieved, add further small quantities of 0.1 M NaOH and repeat the check until a satisfactory value is achieved.

Kjeltec™ 8100 Distillation Unit
Tecator™ 2508/2520 Digestor

1 Scope

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

2 Intended Use

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

3 Purpose

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

The Performance Qualification (PQ) includes the process of documenting that the Digestion system 2508/2520 (including exhaust and scrubber unit) and the Kjeltec 8100 Distillation unit consistently perform according to a specification appropriate for its intended use. Major sub-divisions in the PQ phase are:

- Preventive maintenance
- On-going verification tests

This document suggests methods to fulfill the requirements for an acceptable PQ but the final procedure should be adapted to local needs and the vendor equipment.

4 Definition of Test Procedures

4.1 Preventive Maintenance

Maintenance of the Kjeltec 8100 should be performed according to the instructions in manual, see User Manual Kjeltec 8100/8200 Distillation Unit, chapter 7, Maintenance. A service agreement is recommended (service agreement).

Maintenance of the Digestion/Exhaust (including exhaust and scrubber) should be performed according to instructions in the user manual, see User Manual Tecator Digestor, chapter 6 Maintenance.

Preliminary Service Level Indicators

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

4.2 Ongoing Qualification Tests

Block Temperature

The temperature for the digestion is limited by the boiling point for the sulphuric acid, this can be increased by adding water (H_2O) to the digestion mixture. It's important that the optimal ratio between acid and salt is kept, please follow recommendation in AN 300 or suggested procedures for a specific kind of sample material.

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

Use the reagents and method procedure specified in AN 300. Use only reagents of recognized analytical grade, unless otherwise specified and distilled or demineralized water or water of equivalence purity.

Suggested standard material for internal quality control:

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

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

Alternatively ammonium iron(II) sulphate, $(NH_4)_2Fe(SO_4)_2 \cdot 6H_2O$, with certified purity may be used.

Tryptophan ($C_{11}H_{12}N_2O_2$), minimum assay 99 % (mass fraction). Nitrogen content 12.2 g/kg. Do not dry in an oven before use.

Acetanilide (C_8H_9NO), minimum assay 99 % (mass fraction). Nitrogen content 10.4 g/kg. Do not dry in an oven before use.

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

Blank Tests

Carry out a blank test following the currently used procedure for digestion, distillation and titration taking 7 ml of water and about 0.7 g of sucrose instead of the test portion. Keep a record of blank values. If blank values change, identify the cause.

Note: The amount of titrant used in the blank test should always be greater than 0.0 ml. Blanks within the same laboratory should be consistent across time.

4.3 Recovery Tests

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

- *Nitrogen loss* – Use 0.22 g ammonium sulphate and 0.67 g sucrose per flask weighed to the nearest 0.1 mg. Add all other reagents as used in the method currently used (Kjeldahl, H_2SO_4, etc). Digest and distil under same conditions as for samples. Recoveries shall be >99 %.
- *Digestion efficiency* – Use a test portion of tryptophan or acetanilide and 0.67 g sucrose per flask weighed to the nearest 0.1 mg. Determine the nitrogen content according to the normal procedure in use. The recoveries of tryptophan shall be >98.5 %, the recoveries of acetanilide shall be >99.5 %.
- *Distillation and titration efficiency* – Dissolve 0.10 – 0.12 g (±0.001 g) ammonium sulphate, omitting the digestion step. The recoveries should be >98.5 %.

Note: Results less than 98.5 % or more than 101.5 % in either of the recovery tests indicate failures in the procedure and/or inaccurate concentration of the standard volumetric hydrochloric acid solution (should be adjusted to four decimals accuracy according to procedure in AN 300).

External Quality Control Program

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

Calculation and Expression of Results

$$w_N = \frac{(V_1 - V_2)c \times 14.007 \times 100\%}{m}$$

Where:

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

V_1 is the numerical value of the volume of the hydrochloric acid standard volumetric solution used in the sample test, in millilitres, expressed to the nearest 0.05 ml.

V_2 is the numerical value of the volume of the hydrochloric acid standard volumetric solution used in the blank test, in millilitres, expressed to the nearest 0.05 ml.

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

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

5 Maintenance

5.1 Maintenance Kjeltec™ 8100

See instructions in User Manual - Kjeltec 8100/8200, chapter 7 Maintenance.

5.2 Maintenance Tecator™ Digestor

See instructions in User Manual - Tecator Digestor, chapter 6 Maintenance.

6 The Maintenance Record Charts

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

6.1 FossCare™ Service Log

Date	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

6.2.2 Weekly Maintenance

Date														
[illegible]														
[illegible]														
[illegible]														
Signature														
Number of [illegible]														

Date	Work Performed and Parts Used	FOCS Quantity/Date	Customer Representative	FuelCare™ Service Report No.

Applicable for FOCS sales and service companies

6.2.3 Every 1-3 Months Maintenance

Date														
[illegible]														
[illegible]														
[illegible]														
[illegible]														
Signature														
Number of [illegible]														

6.2 FuelCare™ Customer Log

6.2.1 Daily Maintenance

Date														
[illegible]														
[illegible]														
[illegible]														
[illegible]														
[illegible]														
Signature														
Number of [illegible]														

6.2.4 Additional Maintenance

Date	Description	Signature	Number of pages

6.2.3 Yearly Maintenance

Date	Description	Signature	Number of pages

6.2.5 Exchange of Parts and Reagents Maintenance

Date	Exchange of Parts and Reagents	Signature

Agilent GmbH Lab Compliance Services

Certificate of System Qualification

GC/GC

System ID: [illegible]
Organization Name: [illegible]
Organization Location: [illegible]

Date: [illegible]
EDP Name: [illegible]
EDP Revision: [illegible]
Overall Qualification Status: Pass

System Inspection and Basic Safety and Operation

Name: [illegible]
Subpart Status: Pass

Overall System Inspection and Basic Safety and Operation Test Status
Pass

Inlet Pressure Decay

Name: [illegible]
Front: [illegible]

Subpart Status: Pass
Pressure: [illegible] psi
Pressure Change: [illegible] psi [illegible] Pressure
Agilent Recommendation: [illegible]

Overall Inlet Pressure Decay Test Status
Pass

Inlet Pressure Accuracy

Name: [illegible]
Front: [illegible]

Date: [illegible]
Summary ID: [illegible]

Overall Signal to Noise Test Status

Pass

Screening Run

Tested Combination: Front, DSL, / Back, FID

Injection Taken

Name:

Subpoint Status: Completed

Injection Volume in Counter:

Overall Screening Run Status

Completed

Noise and Drift

Tested Combination: Front, DSL, / Back, FID

Name:

Subpoint Status: Pass

Raw Signal: pA

	mAU/h Noise		SN	
	pA		pA/mV	
Agilent Recommended:				
Status:	Pass		Pass	

Overall Noise and Drift Test Status

Pass

Injection Precision

Tested Combination: Front, DSL, / Back, FID

Name:

Subpoint Status: Pass

Injection Volume in Counter: / 0

Area RSD: 0.07 % Retention Time RSD: 0.15 %

Agilent Recommended: <= 2.0 <= 1.0

Overall Injection Precision Test Status

Pass

Signal to Noise

Tested Combination: Front, DSL, / Back, FID

Injection Taken

Name:

Subpoint Status: Pass

Signal to Noise:

Agilent Recommended: >= 3.0

Overall Signal to Noise Test Status

Pass

Instrument Details

Purpose

This section describes the all Actual system configuration.

Details

System

Session ID	LAB_TCD_DET_CM-1102-001
Manufacturer	Agilent Technologies
Name	7890
Flow Data Index	Manual Data
Temperature Data Input	Manual Data or Online Data Logging

Tested Combination 1

Injection Technique	Injection Taken
Inlet	Front
Detector	Front
∆TM Included?	No

Tested Combination 2

Injection Technique	Injection Taken
Inlet	Front
Detector	Back
∆TM Included?	No

Sample 1

Manufacturer	Agilent Technologies
Type	Injection Taken
Name	[illegible]
Model Number	[illegible]
Serial Number	[illegible]
Firmware Revision	[illegible]
Usage	Sample Injection
Location	Front
Syringe Volume (µL)	10

Column 1

Manufacturer	Agilent Technologies
Type	Tray
Name	[illegible]
Model Number	[illegible]
Serial Number	[illegible]
Firmware Revision	[illegible]

Manifold 1

Manufacturer	Agilent Technologies
Name	[illegible]
Model Number	[illegible]
Serial Number	[illegible]
Firmware Revision	[illegible]
Event Table	Standard

Valve 1

Manufacturer	Agilent Technologies
Name	[illegible]
Type	[illegible]
Location	Front
Carrier Gas	Helium
Control Type	Electronic Pneumatic Control (EPC)
Purged Port	Yes

Detector 1

Manufacturer	Agilent Technologies
Name	[illegible]
Type	[illegible]
Serial Number	[illegible]
Adapter	Capillary
Counter Type	Electronic Pneumatic Control (EPC)
Location	Front
Makeup Gas	Nitrogen

(Version 2)

Manufacturer	Agilent Technologies
Name	OSC
Type	HW
Subject	Qualifiers
Control Type	Electronic Processes Control (EPC)
Location	Work
Retention Time	Indefinite

Electronic Signature

Purpose

This signature page was created and published because the OSC sign-off action was executed, which is used for the review document including signature. The OSC sign-off is an electronic signature that requires non-shared identification components, unique username and password. The Agilent username below with has authorized the user to be responsible for the meaning and legal status of an electronic signature. As a trusted offline operator, the Agilent representative has a unique password and login to execute ACK 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 service and control procedures.)

Details

Full Name of Signer	Siang-Ma Tarik
Logged On User Name	siang-ma.tarik@non.agilent.com
Signature Creation Date	February 22, 2021
Reason for Signature	Executed, Approved and published the original version of document.

Regulatory Disclaimer

This document provides a method to verify and ensure correct configuration and validation of proper operation. It has been developed from an interpretation of applicable regulations as well as industry best practices. This document is designed to provide an important component of a complete compliance package. Validation demands upon end-user review and use of this product fall on the end-user organization. Agilent Technologies makes no promises or representations as to its sufficiency for any specific regulatory purpose.

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User Name: [illegible]
Instrument: [illegible]

System ID: [illegible]
Time Date: February 21, 2022 3:13:13 PM

[illegible] Transaction log

Time	Transaction Date	Activity Performed	Type of Transaction	Approval Information
[illegible]	[illegible]	[illegible]	[illegible]	None
[illegible]	[illegible]	Error	[illegible]	[illegible]
[illegible]	[illegible]	Configuration	[illegible]	None
[illegible]	[illegible]	Calibration	[illegible]	[illegible]
[illegible]	[illegible]	Calibration	[illegible]	[illegible]
[illegible]	[illegible]	Processes	[illegible]	[illegible]
[illegible]	[illegible]	Configuration	[illegible]	None
[illegible]	[illegible]	Qualification	[illegible]	[illegible]
[illegible]	[illegible]	Execution	[illegible]	None

User Name: [illegible]
Instrument: [illegible]

System ID: [illegible]
Time Date: February 21, 2022 3:13:13 PM

[illegible] Transaction log

Time	Transaction Date	Activity Performed	Type of Transaction	Approval Information
[illegible]	[illegible]	Execution	[illegible]	[illegible]
[illegible]	[illegible]	Execution	[illegible]	[illegible]
[illegible]	[illegible]	Execution	[illegible]	[illegible]
[illegible]	[illegible]	Execution	[illegible]	[illegible]
[illegible]	[illegible]	Execution	[illegible]	[illegible]
[illegible]	[illegible]	Execution	[illegible]	[illegible]
[illegible]	[illegible]	Calib	[illegible]	[illegible]
[illegible]	[illegible]	Execution	[illegible]	[illegible]
[illegible]	[illegible]	Execution	[illegible]	[illegible]

Time	Transaction Date	Activity Performed	Type of Transaction	Optional 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]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

Time	Transaction Date	Activity Performed	Type of Transaction	Optional 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]

Time	Transaction Date	Activity Performed	Type of Transaction	Optional 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]

Time	Transaction Date	Activity Performed	Type of Transaction	Optional Information
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

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

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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 List section 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/crosslab/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** 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/chem/support
- **Videos** about specific preparation requirements for your instrument can be found by searching the **Agilent YouTube** channel at https://www.youtube.com/user/Agilent.
- **7890 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/G4483-90002_7890_Maintaining_GC.pdf

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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 simply fields with the relevant information.
- Complete the relevant checkboxes in the checklist using either a "✓" or not mark "✗".
- Check "**Section Not Applicable**" if not focused to indicate sections fields not applicable as 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 visit plan signature.**

Additional Instruction Notes

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

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System Information

Instrument System Name and ID: UAE.TOC.07 CN 17207007

Instrument System Site and Location: UAE Analytical Laboratory

List System Component Product Numbers:

List the Serial Numbers of each Component:

Preparation

Preventive Maintenance Procedure

Clean and Inspect OC

Inlet and detector consumable replacement

Zero Sensitivity and Leak Test

ALS Maintenance

Restore Instrument

Signature Page

Service Review

7890 GC Test Results Table

Detector Signal Outputs	Before PM Service	After PM Service
Flame detector output		
Back detector output		
Front detector output		
Pneumatic decay test	**Expected test result**	**Actual test result**
Front inlet pneumatic decay test	Pass	
Back inlet pneumatic decay test		

7890 Parts List Table

Part description	Part number	Product or module where used	Quantity consumed
[illegible]	[illegible]	[illegible]	1
[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]	1
[illegible]	[illegible]	[illegible]	N/A
[illegible]	[illegible]	[illegible]	1
[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

Page [illegible] of [illegible]

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Service Engineer Comments

If there are any specific points you wish to note as part of setting up the service order demand for the customer, please write outside them in the box.

Service Completion

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

Agilent signature: [illegible] Customer signature:

Total number of pages in this document: 19 pages

Page [illegible] of [illegible]

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

This page is only relevant for Agilent secure documents for document control purposes and is not intended for customer viewing. Refer to the SRPPM (Quality) 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 technical changes made for this specific revision
1.0 (Last)	4 Mar 2011	Dave Park	Migrated the content of revision A.01.05 to the new Agilent template. Reviewed by subject matter expert: Dave Park
1.1 (Draft)	20 Jan 2012	Dave Park	Added 7890 Vial Tray to MMS, PTV and VA - also PTV and FID PM Parts
1.1 (Last)	21 March 2014	Dave Park	Added Ultra Inert Gold Seal and Liner to SC Consumables
A.01.11	10 Dec 2018	Dave Park	Added step to perform maintenance on the 7890 Inlet Tube and 0.97 ID jet part numbers - Fixed broken web links
2.00	05 Dec 2020	Gary Gracanin	Updated form Template and terminology changes. Transitioned to Introduction. Create New Agilent Document Number: [illegible]

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 Gage	Product support manager
A.01.09	Ed Wang	Product support manager
A.01.10	Sunadha Tripathy	Product support manager
A.01.11	Sunadha Tripathy	Product support manager
2.00	Jack Kuck	UC 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	Chromatic Start Up Services Application Consulting Lead	[illegible]

Page [illegible] of [illegible]

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Agilent CrossLab Compliance Services

Agilent CrossLab Compliance Services

Agilent CrossLab

From Insight to Outcome

EQUIPMENT QUALIFICATION PLAN (EQP)

EQP Name: [illegible]

Revision Type: [illegible]

Company Name: [illegible]

Customer Name/Title: [illegible]

EQP Revision: [illegible]

EQP Release Date: [illegible]

Print Date: [illegible]

[illegible] Page 1 (1) [illegible]

เอกสารไม่ควบคุม

Table of Contents

Scope and Purpose

Overview

The Equipment Qualification Plan (EQP) document 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 assumptions 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 quote. This document is an extension 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: Pre-requisite for hardware qualifications

Required for 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 delivered according to the standard test program described in the Agilent_Recommended EQP. Agilent defined recipients can change to the default recommendation values (as stated in the Agilent Recommended EQP) but not within a predefined range. These changes are considered to be within the intended use range of the system under test.

Customers can choose that go outside the system to test that exceed the typical operational range or (in addition) test that are not considered part of the core program required for completion of the selected service. Because custom adaptions and tests may exceed the operation or envelope of the equipment, Agilent reserves the right to exclude certain tests or to the stated acceptance values. The user is notified of the deviation in EQP setup time and the qualification report (EQR) not when the deviation.

A set of eSignature Rules, as determined by the creator of this document, can be included at the end of this document. All tests should be executed or a single set of tests, initiated by an appropriate approver, run through any signature rules that are not to be used. This is an optional process that allows a paper results of signoff by the appropriate reviewers where a hybrid electronically signature EQP is followed. If this document will be saved electronically and digitally signed in a document management system, it should be generated without the signature rules. The customer must sign the EQP cover 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 order. It is recommended that after approval, this EQP be provided with the equipment EQP file.

Understanding the Test Specification Version or Tailored Review Documents

Applies to hardware qualifications only For Agilent-recommended adaptions and limits, the range or allowable values (i.e. for Sys_11 b) might be included. Any applicable numerical, nonnumerical, and additional adaptions are listed as both the Agilent recommended values and marked IQ (within range) or OQ (outside of range) in the test results. Values for added adaptions are also marked IQ or OQ and displayed after all configuration values. Due limits are marked DIR or DIC. Agilent is NOT responsible for test failures due to out of range adaptions and limits. Optional tests that are enabled are included and marked as such. Disabled tests that are disabled by the customer are included and marked as such.

NOTE: Less stringent must the more tightly changed than adaptions ranges removed they often affect physical measurement limits and are directly linked to the testing method. Therefore "within range" test limits are subject to been affect results. These 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 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 intrusion.
- Only applicable: Disable the account used by the Agilent representative to execute CDS data.
- Safely store and archive the EQP.
- Maintain change control and revision history.
- Review and optionally sign the EQP, making it ready for service delivery & when was approved.
- Review and approve any of the following customer-from the Agilent recommended:
  - Minor Adaptions Range: changes to the Agilent recommended that are identified by Agilent as within the operation ranges determined in our test development.
  - Acceptable Minor 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 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 not done.
  - Disabled Tests: test in which all possible config options have been disabled (tests are flagged in the test specifications)

Agilent Responsibilities

- Deliver the services following the test programs described in the customer EQP.
- Provide a signed and a signed Qualification Report (EQR) upon completion of the service.
- If requested, provide an optional re-signed EQP-CS to the customer.

General Statements on the Testing Program

The recommended set of hardware OQ tests determined to be EQP delivery from Agilent's compilation of current tests against devices issued by the FDA, EMA, SWIFT, ASTM (USP), and others. The OQ test design incorporates both manual and vendor testing which is a mixed approach, accepted in the USFDA. As presented in the IQ qualification methodology for analytical laboratory equipment (ALE), the OQ tests is separated from the PQ as recommended by the regulatory guidelines.

Agilent CrossLab Compliance uses a combined selection of technology and chemical tests to always determine the performance of the instrument without unnecessary reliance on internal or optional results. For example, direct wavelength is used to measure the data and thermal controlled source accessories and sustainable solvents. Analog chemical testing is used for the evaluation in the forming actual test where necessary (e.g. precision, digital to mass, and carry over.

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AGILENT CROSSLAB COMPLIANCE SERVICES (WWW)

Agilent CrossLab Compliance Services

Agilent CrossLab is designed to ITIL-certified quality standards and is used by Force and recognized by regulatory agencies worldwide.

Note: Because the Billion has been reviewed Agilent CrossLab Compliance, all Force Quality services documents.

How Agilent CrossLab aligns with a traditional, paper-based methodology:

- Force's methodology designs the need for validation and qualification of GxP IT/OT operational quality systems, the 21 CFR Part 11 rules. The Force and Compliance for IT/OT Compliance in Agilent CrossLab. The equipment qualification and validation (IQ/OQ) can be more cost-effective than traditional methodology.
- The traditional GMP paradigm focus of tests and forms on the usage of numerous pre-designed and tested in the laboratory. The GMP follows that concept. The validation is conducted by an IT or GMP analyst who does not need to be an expert in IT.
- The traditional qualification GMP approach has many aspects that are not necessary to be performed and recorded for each IT, OT, lab based. The cost of it provides a lot with the quality and efficiency. In Agilent CrossLab, this is a better approach to manageable and implementation cost. In Agilent CrossLab and the Agilent Consultant Engineer (ACE) defined tests to provide a set of tests that are high-value, cost-effective, and meet pass/fail tests, traceability and pass between the customer IT, server, network, etc. The approach provides efficiency and effective compliance implementation.
- The traditional qualification GMP approach uses documents, forms, and checklists that need to capture information and evidence for each IT, OT, lab equipment. This is the process concept for the GMP. The approach has many aspects and implementation and quality processes. ACE from the IT is the approved GMP up-front of deliverables. The final deliverables are created in Agilent Engineer and each audit trail is created. Since the Agilent approved GMP was not a Lab deliverable, or not under control by Agilent.
- In the traditional qualification methodology, there is an independent process to record the actual qualification of the equipment or the test. In the end that a test is independent of the Agilent or manual delivery. ACE maintains a complete per test and which is a complete and independent for GxP compliance tools, and the Agilent Engineer is a document-centric for ACE report.

Design Qualification (DQ)

[illegible]

Installation Qualification (IQ)

[illegible]

Operational Qualification (OQ)

[illegible]

Dual Acceptance Limits

[illegible]

Re-Qualification after Repair (RQ) Hardware

[illegible]

Re-Qualification After Repair		
Wiping Strategies		
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]

[illegible]

Updated: November 2020 www.agilent.com / clean / qualification

Agilent CrossLab

SERVICE DELIVERY METHODS
CUSTOMER APPROVAL OF ALTERNATIVE METHOD AND CDR STORAGE

Overview

[illegible]

Available Methods

Method	Description
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]

CDR Storage

[illegible]

Customer Approval of Alternative Method and CDR Storage

[illegible]

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AGILENT CROSSLAB QUALIFICATION SERVICES
USE CASES FOR SERVICE DELIVERY

Introduction

Preferred Method 1: Network-Distributed ACE (NDA)

Requirements

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Preferred Method 2: Dedicated Spinning USB Drive

Alternative Method

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GC HARDWARE
OPERATIONAL QUALIFICATION

Standard OQ Test Suite

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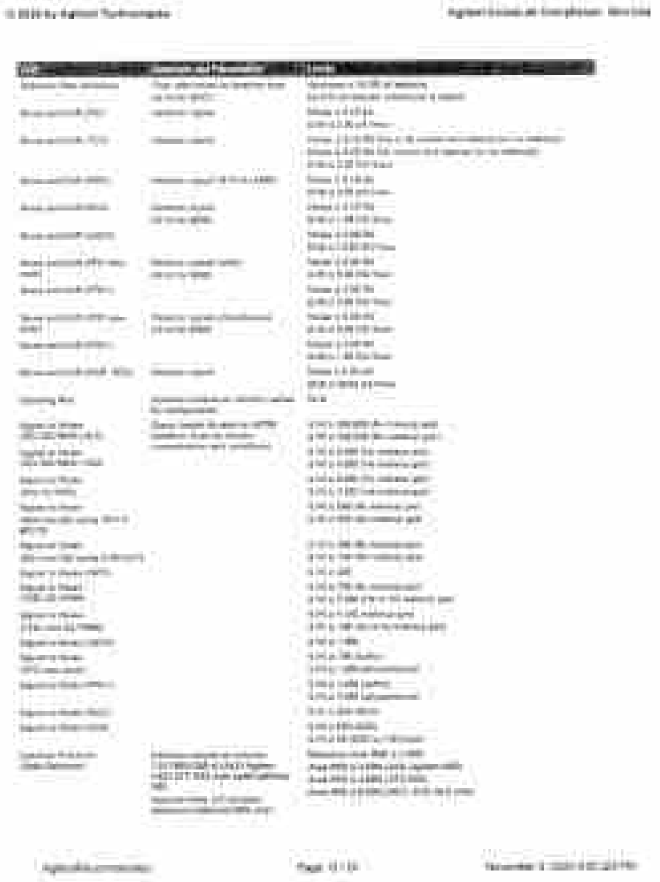

เอกสารไม่ควบคุม

Test	Sequence and Frequency	Limits
Injection Precision Phase Noise	[illegible]	[illegible]

Injection Data Rate 6.125 only. Same as Injection Precision. [illegible]

Test Design and Rationale

Description

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

Receiver Inspection and Basic Setup and Operation

[illegible]

DC Bias Temperature Accuracy and Stability

[illegible]

Bandpass Loss

[illegible]

Bandpass Rise and Fastest Jumbo Pulse Integrity

[illegible]

Bandpass Muted Jumbo Temperature Accuracy

[illegible]

Mid Jumbo Temperature Accuracy

[illegible]

Mid Pressure Jumbo

[illegible]

Mid Pressure Accuracy

[illegible]

Mid Flow Stability

[illegible]

Detector Flow Accuracy

[illegible]

Noise and Drift

[illegible]

Running Pair

[illegible]

Signal to Noise

[illegible]

Injection Precision

[illegible]

Injection Carry Over

[illegible]

Updated: November 2019

www.agilent.com/chem/specification

[illegible]

Report and Delivery Options

[illegible]

Selected Signature Options

[illegible]

Customer Approval

Name
Title
Date
Signature

Name
Title
Date
Signature

Name
Title
Date
Signature

Name
Title
Date
Signature

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Legal Notice

Agilent OpenLab Compliance is a suite of easy-to-configure software and processes that integrate analytical data, chemical reference materials, and operator training materials into a designed, tested, validated, and deployed for commercial use following Agilent's Life Cycle Development Quality Management methodology.

Agilent OpenLab Group R&D VP and Dir. of Technology: Mel Scott, Santa Clara, California USA
Agilent OpenLab Group Quality Manager: John Weiss, Santa Clara, California USA.

Agilent OpenLab Compliance is endorsed by Dr. Ludwig Huber on behalf of the compliance world.

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Protocol Details

Protocol Revision Used for this Document	Protocol Revision Release Date
[illegible]	[illegible]

NOTE: The Revision Notes, ECP Data Sheet Version Details for source and other available revisions

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Certificate of System Qualification

[illegible]

Instrument ID	[illegible]
Organization Name	United Analytical and Engineering Consultant
Organization Location	[illegible]
Date	[illegible]
ECP Name	[illegible]
ECP Revision	[illegible]
Overall Qualification Status	Pass

System Installation and Basic Safety and Operation

Name [illegible]
Subpartial Status Pass

Overall System Installation and Basic Safety and Operation Test Status
Pass

Leak Pressure Decay

Name [illegible]
[illegible] [illegible]

Subpartial Status Pass
[illegible]
Pressure Change [illegible]
Agilent Recommended [illegible]

Overall Leak Pressure Decay Test Status
Pass

Leak Pressure Accuracy

Name [illegible]
[illegible] [illegible]

Date [illegible]
Remarks [illegible]

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Instrument Details

Sampler 1

Manufacturer	Agilent Technologies
Type	Tray
Name	7693A
Model Number	[illegible]
Serial Number	[illegible]
Firmware Revision	[illegible]
[illegible]	Not installed

[illegible] 1

Manufacturer	Agilent Technologies
Name	[illegible]
Model Number	[illegible]
Serial Number	[illegible]
Firmware Revision	[illegible]
[illegible]	[illegible]

Inlet 1

Manufacturer	Agilent Technologies
Name	[illegible]
Type	[illegible]
Location	Front
Carrier Gas	Helium
Control Type	Electronic Pressure Control (EPC)
[illegible]	Yes

Detector 1

Manufacturer	Agilent Technologies
Name	[illegible]
Type	FID
Adapter	Capillary
Control Type	Electronic Pressure Control (EPC)
Location	Front
Makeup Gas	Nitrogen

Detector 2

Manufacturer	Agilent Technologies
Name	[illegible]
Type	[illegible]
Adapter	Capillary
Control Type	Electronic Pressure Control (EPC)
Location	Back
Makeup Gas	Nitrogen
[illegible]	[illegible]

Electronic Signature

Purpose

[illegible]

Details

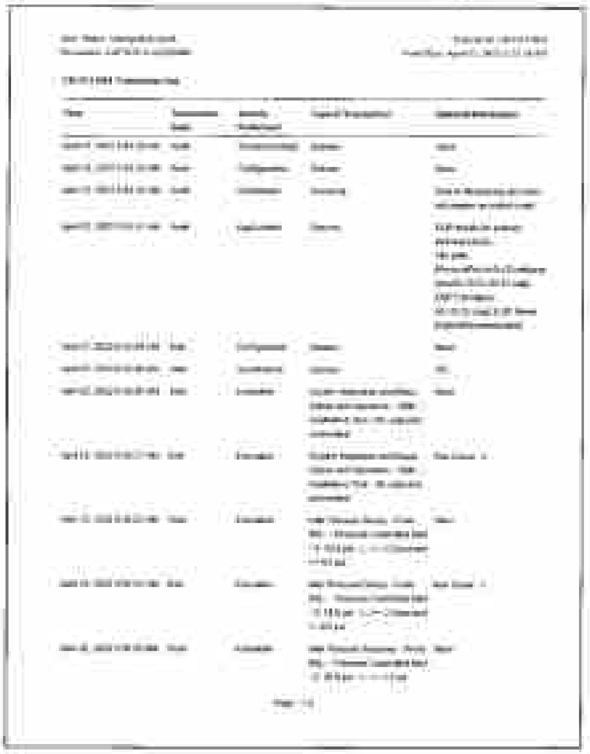
Full Name of Signer	[illegible]
Logged On User Name	[illegible]
Signature Creation Date	April 22, 2021
Reason for Signature	[illegible]

Regulatory Disclaimer

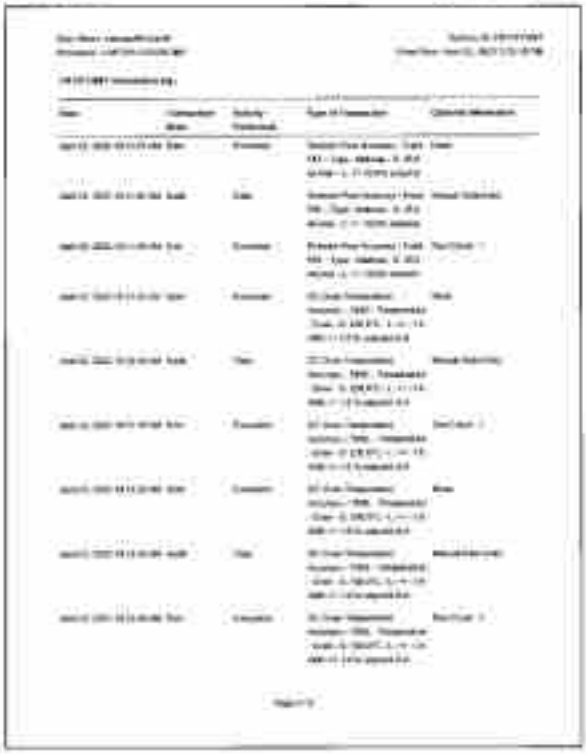
[illegible]

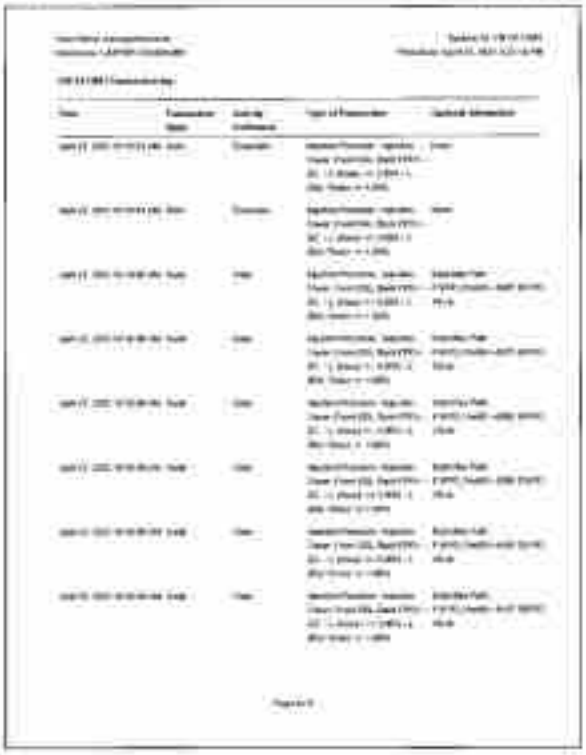
Warranty

[illegible]



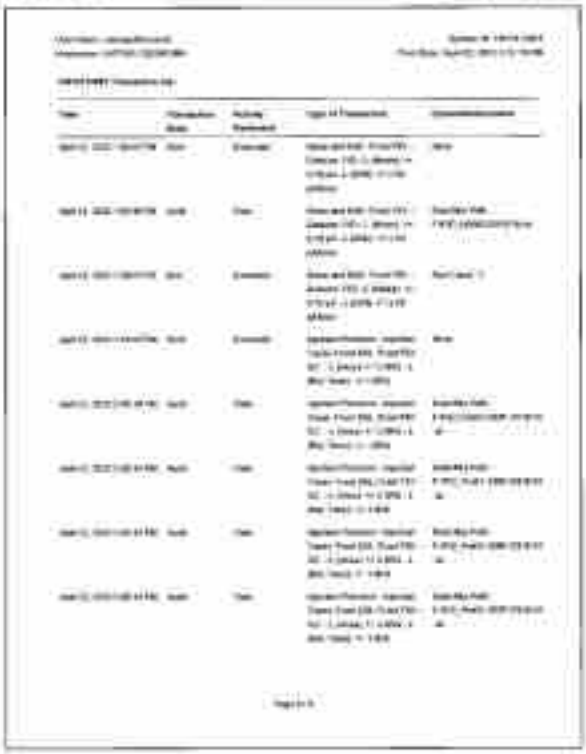
[illegible]



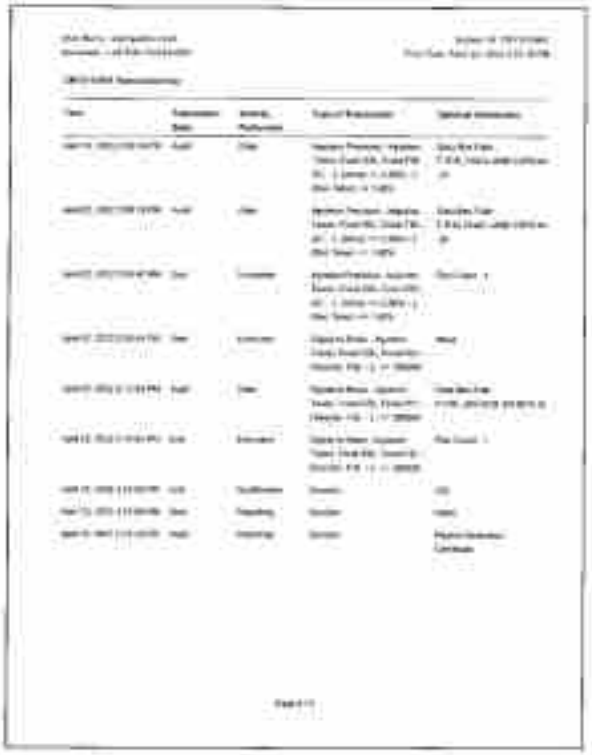


เอกสารไม่ควบคุม

เอกสารไม่ควบคุม



เอกสารไม่ควบคุม



เอกสารไม่ควบคุม

CrossLab

Agilent 8890 Gas Chromatograph Preventive Maintenance Checklist

Agilent Preventive Maintenance provides factory-recommended service for your analytical **instruments** to assure reliable operation and the accuracy of your results.
Delivered by highly trained and certified service engineers using genuine Agilent parts and supplies, Agilent Preventive Maintenance provides everything you need to reduce unplanned downtime and keep your systems operating at their peak. This checklist will be completed at the end of the service and provided to you as a record of the installation.

Customer Information

- Customer should provide all necessary operating supplies upon request of the engineer.
- A customer representative should be available to the engineer while performing the preventive maintenance procedure.
- Any parts, not included in the Parts 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 extra or special procedures and/or parts for the maintenance service, then these must be ordered separately and charged as a repair, which may incur additional costs.

Important Customer Web Links

- For more information about **Agilent Technologies services**, please visit our website using the following URL: http://www.agilent.com/chemsupport/services/maintenance
- To access **Agilent University**, visit http://www.agilent.com/chemsolutions/university/ to learn about training options, which include online, classroom and onsite delivery. A training specialist can work directly with you to help determine your best options.
- A useful **Agilent Resource Center** web page is available, which includes short videos on maintenance, quick tips of consumables for new instruments, and other valuable information. Check out the Resource Page here: https://www.agilent.com/chem/resourcecenter
- Need technical support, FAQs, Agilent7 – visit our **Support Home page**: http://www.agilent.com/search/support

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 simply fields with the relevant information.
- Complete the relevant checkboxes in the checklist using either a "X" or tick mark "√".
- Check "Section not applicable" check boxes to indicate services/tasks not delivered, as appropriate.
- Complete the Preventive Maintenance service in the order of the tasks listed.
- Complete the Service Review section together with the customer.
- Complete the fields for page numbers at the foot of each completed 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 "Maintenance Recommended" Service notes, plan to implement the changes on this unit before doing any qualification service.
- Do not implement firmware updates unless you get approval from the customer and are sure that they are compatible with the instrument control software.

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System Information

☐ Check the 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	1
2	2
3	3
4	4
5	5
6	6
7	7
8	8
9	9
10	10

Preparation

☐ Discuss any specific issues with the customer before starting.
☐ Review the instrument logbook for recent problems and comments.
☐ Save instrument control settings before starting the procedure.
☐ Perform a general inspection of the system for cleanliness.
☐ Check for proper installation of parts, assemblies, sensors etc.
☐ Check system for required installation of components, settings as defined in control software.
☐ Check for required firmware updates and verify with customer if they would like them installed.
☐ Before starting the following procedures, record the Detector Signal Outputs, in the results table. If the GC is turned OFF, or in a service mode, compare by the detector outputs before and after the service is not possible.

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PM Procedure

Clean and Inspect GC

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

Inlet and detector consumable replacement

☐ For the cross-installed, perform inlet maintenance using the Maintenance procedure from either the Touchscreen or Browser User interfaces. Record the results. (Leak and Restriction Test)
☐ Replace the split vent trap cartridge filter using the Maintenance procedure from either the Touchscreen or Browser User interfaces as calls with these notes: Split/Splitless Capillary (SNL), Multi-mode Inlet (MMI), Programmed Temperature Vaporizer (PTV), Gas/Gas Interface (GI). Record the results. (Leak and Restriction Test)
☐ If the inlet system is used in Split mode with viscous samples, inspect and clean the split vent line in 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 sample or contaminants, replace the ignitor. Examine the FID collectors and ceramic assemblies for contamination – clean as necessary.

Zero Sensors and Leak test

☐ Zero all pressure sensors using the Touchscreen User Interface.
☐ Perform inlet pressure decay test(s) from the diagnostics screen in either the Touchscreen or Browser User interfaces. Record if test passed or failed in the results table.
☐ Note: If the VM is done in preparation for an Operational Qualification, then the pressure decay test defined within that protocol can be used for the VM.

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ALS Maintenance

- ☑ **Section NVII applicable**
- ☐ Check all cabling and configuration settings between ISC, tray, and injectors.
- ☐ Verify air is removed any dust, especially around trays
- ☐ Check operation of all trays
- ☐ Check syringe for smooth plunger operation
- ☐ Check for smooth operation of the needle support – Clean if necessary

Restore Instrument

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

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

Service Review

- ☑ Attach available inspection photos of all tests to this documentation.
- ☑ Record the Preventive Maintenance service activity in the customer's records/logbook.
- ☑ Update/record consumed maintenance counters as appropriate.
- ☑ Affix the PM sticker to the system or instrument logbook based on the customer's request.
- ☑ Complete the Service Engineer Comments section if there are additional comments.
- ☑ Review the service, parts replaced and test results obtained with the customer.
- ☑ If the instrument firmware was updated, record the details of the change in the Service Engineer's Comments box or if necessary, in the customer's EQ records.
- ☐ Please ask the customer if they would like to have their more beautiful smiling computer.

PM Test Results Table

Test description	Before PM Service	After PM Service
Front detector output	[illegible]	[illegible]
Back detector output	[illegible]	[illegible]
ALS 1 detector output	[illegible]	[illegible]
ALS 2 detector output	[illegible]	[illegible]
Test description	**Expected test result**	**Actual test result**
Lock and Restriction Test after front inlet main transport	Pass	
Lock and Restriction Test after back inlet main transport	Pass	[illegible]
Lock and Restriction Test after front inlet split tray replacement	Pass	
Lock and Restriction Test after back inlet split tray replacement	Pass	[illegible]
Front inlet pneumatic delay test	Pass	
Back inlet pneumatic delay test	Pass	[illegible]

PM Parts List Table

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

Part description	Part number	Product or number when used	Quantity consumed
ISC Capillary Inlet PM Kit, Multimode	[illegible]	[illegible]	[illegible]
ISC Capillary Inlet PM Kit, Split	[illegible]	[illegible]	[illegible]
ISC Capillary Microseal Inlet Split Seal with Washer	[illegible]	[illegible]	—
ISC Capillary Ultra Inert Inlet liner Line – Single taper with Glass Wool	[illegible]	[illegible]	—
ISC Capillary Ultra Inert Inlet Line Pressure Drop Split Liner – with Glass Wool	[illegible]	[illegible]	—

Part description	Part number	Product or number when used	Quantity consumed
[illegible]	[illegible]	[illegible]	—
Split vent trap PM kit, single trap liner (for Split, PTV & VI)	[illegible]	[illegible]	—
[illegible]	[illegible]	[illegible]	—
PTV Deactivated Head Rebuild Kit	[illegible]	[illegible]	—
PTV Deactivated Head Pellet Guide	[illegible]	[illegible]	—
Syringe plunger assembly with O-ring	[illegible]	[illegible]	—
ISC Collector Rebuild/Cleaning Kit	[illegible]	[illegible]	—
ITC Collector Replacement Kit	[illegible]	[illegible]	—
Standard, 8 L and ITC set	[illegible]	[illegible]	—

Service Engineer Comments (Optional)

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 a brief note here in the box.

Service Completion

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

Agilent signature: [illegible] Qualified signature: _____

Total number of pages in this document: 2

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 SOP/PM creation authoring guide for more information.

Document Control Logs

Revision Log

Revision	Date	Reason for update
Add revision number of document here	Date of revision	Author to describe high level changes made for this specific revision
1.00	22-Jun-2018	Initial Release

Approval Log

Revision	Approver	Title of approver
Add revision number	Add approver name here	Add approver's function or title here
1.00	Suwanna Tippawala	QC and SCMS Product Support Manager

Agilent Technologies

Agilent GC/MS Preventive Maintenance Checklist

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

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

- ☐ Interim Preventive Maintenance — 6 months
- ☐ Major Preventive Maintenance — Yearly

This checklist covers the following model(s):

Type	Model
XX	[illegible]
XX	[illegible]
XX	[illegible]
7890	7890 Series [illegible]
7890	7890 Series [illegible]
5975B	7890 Series 5975B
5975C	7890 Series 5975C

Selection of the Task/Recommended items within the document.

Task		Recommended			
Yes	No	Interim	Major	As needed	
☒	☐	☐	☐	☐	Was selected means that the task was done or the part was replaced.
☐	☒	☐	☐	☐	Was selected means that the task was not done or the part was replaced.
☐	☐	☒	☐	☐	Means that the task is recommended to be done **every 6 month** interval.
☐	☐	☐	☒	☐	Means that the task is recommended to be done **yearly**. If the customer would like a service to be done in the 6 month interval then the service could be purchased.
☐	☐	☐	☐	☒	**As needed** means that the task was done or the part was used as needed. Double two type of filters could be used and this was the one which was selected.

For more information about Agilent Technologies services please visit our web site using the following URL:
http://www.chem.agilent.com/en-US/contact/pages/default.aspx

เอกสารไม่ควบคุม

Customer Information

- Customers should provide all necessary operating supplies upon request of the engineer.
- A customer representative should be available to the engineer while performing the preventive maintenance procedures.
- Any parts not listed, in the Parts Lists section of this document, are not included in the price of this service.
- If a factor requires the use of additional or special procedures and/or parts for the listed preventive maintenance, that items must be ordered separately and charged as a repair, which may incur additional costs.

Service Engineer Responsibilities

- Fill out all pages of the document and complete sections that relate to the system being installed.
- Complete empty fields with the relevant information.
- Complete the relevant checkboxes in the checklist using ☑ or ☒ and ✓ in the checklist.
- Check the Not Applicable check boxes or specify N/A (where appropriate) to indicate optional services not delivered.
- Complete the Service Review and Service Completion sections together with the customer.

Additional Instruction Notes

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

เอกสารไม่ควบคุม

System Information

System Name and ID	System Site and Location
[illegible]	[illegible]

System Components

☐ Record the main 3 or more component configuration inputs (in alphabetical/numerical order of a displaying the table)

List system component product numbers	List the serial numbers of each component
1 [illegible]	1 [illegible]
2	2
3	3
4	4
5	5
6	6
7	7
8	8
9	9
10	10

Preparation

- ☐ Discuss any specific issues with the customer prior to starting.
- ☐ Review the instructions (optional).
- ☐ Save consumable control readings before starting the procedure.
- ☐ Perform general inspection of system for Cleanliness.
- ☐ Check for loose connections of cables, missing parts, consumables, damaged etc.
- ☐ Check for damaged or missing cables and verify with customer if they consider this a condition.

เอกสารไม่ควบคุม

Preventive Maintenance for MSs

Customer Responsibilities

Customers should ensure that all necessary consumables, consumables and usage disposable items such as gases, oils, vacuum, calibrant solution and solvents required for the successful preventive maintenance are available.
A customer representative should be available while the preventive maintenance procedure is being performed.

Important notice for customers

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

☑ Perform an autotune and check the autotuned tune report just prior to the start of the PM to verify performance of the instrument.

Note: It is recommended to have the customer run the autotune and tune evaluation the night prior to the PM and then email the report to the customer will be ready for the service representative.

เอกสารไม่ควบคุม

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Agilent GC/MS Preventive Maintenance Checklist

Parts – Included and as needed as part of the preventive maintenance

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Parts – Needs to purchased if found defective or worn out

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Agilent GC/MS Preventive Maintenance Checklist

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Preventive Maintenance Checklist:

Yes/No	Interim/Major	Description

Yes/No	Interim/Major	Description	

Yes/No	Interim/Major	Description

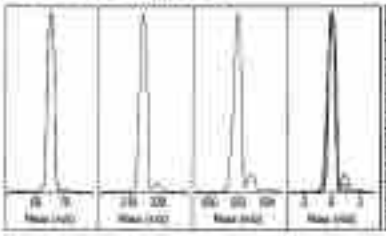
Yes/No	Interim/Major	Description	

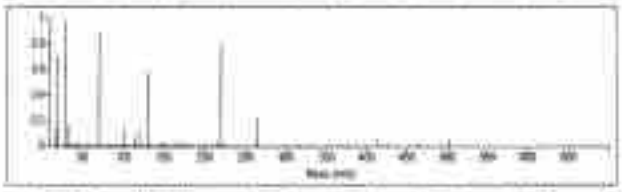
Yes/No	Interim/Major	Description

Yes/No	Interim/Major	Description	

Yes/No	Interim/Major	Description	

Autotune - 5977

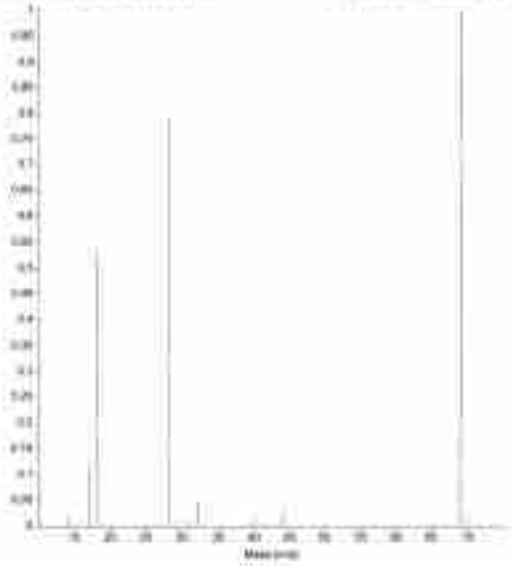




เอกสารไม่ควบคุม

5977a Air and Water Check

Instrument: GCMS
Mon Jun 13 14:38:41 2022 D:\MASSHUNTER\GCMS\3\5977\



Current Pytune used: atune.u

Relative abundances:

18/69 =	33.00	water%	(counts=134561)
28/69 =	79.32	Nitrogen%	(counts=180672)
32/69 =	4.36	Oxygen%	(counts=21848)
44/69 =	2.67	Carbon Dioxide%	(counts=12340)
28/18 =	149.48	Nitrogen/water%	

เอกสารไม่ควบคุม

TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
CALIBRATION AND TESTING EQUIPMENT SERVICES

Certificate of Calibration

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

Equipment :	Turbidity meter
Manufacturer :	Hach
Model :	TU5X
Serial No. :	[illegible]
ID. No. :	[illegible]
Condition Received :	Good
Received Date :	01 August 2022
Calibration Date :	08 September 2022
Reference :	[illegible]
Submitted by :	Intact Analyst and Engineering Consultant Co.,Ltd 2 Bhi Sukhumvit 41, Sukhumvit Road, Bangkok, Phrakanong, Bangkok 10260
Ambient Temperature :	25 ± 2.0 °C
Relative Humidity :	50 ± 20 %
Calibration Procedure :	In-house method (CP-QI-[illegible]) Meets to meet measurement by using Formazin standard solution
Calibrated by :	[illegible]
Approved by :	Approved Signatory

(/) Mr. [illegible]
( ) Sang Mungmee
( ) Wanlop Langgajakul

Issue Date : 8 September 2022

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

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Condition of the calibration result

1. Reference Standard Instruments :
   This certification 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	[illegible]	[illegible]	[illegible]	12 June 2023
2) Digitemp Sensor	[illegible]	[illegible]	[illegible]	21 Sep 2023

2. Standard Material : The Formazin suspension has been prepared gravimetric from

Material	Manufacturer	Lot No.	Assay
1) Hexamethylenetetramine	[illegible]	[illegible]	[illegible]
2) Hydrazinium Sulfate	[illegible]	[illegible]	[illegible]

3. This certificate is valid only to the item calibration 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 : [illegible]

Standard Formazin suspension (NTU)	UUC* Reading (NTU)	Uncertainty of Measurement (± NTU)	Coverage Factor k
0	[illegible]	[illegible]	[illegible]
20	[illegible]	[illegible]	[illegible]
100	[illegible]	[illegible]	[illegible]
400	[illegible]	[illegible]	[illegible]
800	[illegible]	[illegible]	[illegible]

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 %.

-end-

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