

ภาคผนวก ณ

ใบรับรองการสอบเทียบเครื่องมือ



รายการเครื่องมือที่ใช้ในการวิเคราะห์ / ทดสอบ

Sample Name	Parameter	Equipment Name	ID No.	Calibrated Date	Next Cal	Freq. Calibrate (Months)
Noise	Leq 24 hrs	Sound Calibrator	BKQ_F51221	14-Nov-22	14-Nov-23	12
Noise	Leq 24 hrs	Sound Level Meter	BKQ_F50924	25-Oct-22	25-Oct-23	12
Noise	Leq 24 hrs	Sound Level Meter	BKQ_F50927	18-Oct-22	18-Oct-23	12
Noise	Leq 24 hrs	Sound Level Meter	BKQ_F50923	25-Oct-22	25-Oct-23	12
Noise	Leq 24 hrs	Sound Calibrator	BKQ_F51221	14-Nov-22	14-Nov-23	12
Noise	Leq 24 hrs	Sound Level Meter	BKQ_F51339	23-Jan-23	23-Jan-24	12
Noise	Leq 24 hrs	Sound Level Meter	BKQ_F51338	23-Jan-23	23-Jan-24	12
Noise	Leq 24 hrs	Sound Level Meter	BKQ_F51340	23-Jan-23	23-Jan-24	12
Water Lab	pH at 25 °C	pH meter	BKQ_EN0072	12-Sep-22	12-Mar-24	18
Water Lab	Total Alkalinity	Burette	BKQ_EN0071	30-Aug-22	1-Mar-24	18
Water Lab	Total Hardness	Burette	BKQ_EN0171	30-Aug-22	1-Mar-24	18
Water Lab	Color	Chamber (Cold Room)	BKQ_EN0167	30-Jun-22	30-Dec-23	18
Water Lab	Turbidity	Chamber (Cold Room)	BKQ_EN0167	30-Jun-22	30-Dec-23	18
Water Lab	Dissolved Oxygen	Burette	BKQ_EN0171	30-Aug-22	1-Mar-24	18
Water Lab	Dissolved Oxygen	Chamber (Cold Room)	BKQ_EN0167	30-Jun-22	30-Dec-23	18
Water Lab	Nitrate	Ion Chromatography	BKQ_EN0069	12-Jan-23	12-Jan-24	12
Water Lab	Phosphate	Ion Chromatography	BKQ_EN0069	12-Jan-23	12-Jan-24	12
Water Lab	Chloride	Ion Chromatography	BKQ_EN0069	12-Jan-23	12-Jan-24	12
Water Lab	Sulfate	Ion Chromatography	BKQ_EN0069	12-Jan-23	12-Jan-24	12
Water Lab	Total Suspended Solids	Electronic Top-Loading Balance	BKQ_EN0002	8-Feb-23	8-Feb-24	12
Water Lab	Total Suspended Solids	Oven	BKQ_EN0273	29-Nov-22	29-May-24	18
Water Lab	Total Solids	Electronic Top-Loading Balance	BKQ_EN0002	8-Feb-23	8-Feb-24	12
Water Lab	Total Dissolved Solids 180°C	Oven	BKQ_EN0273	29-Nov-22	29-May-24	18
Water Lab	Total Dissolved Solids 180°C	Oven	BKQ_EN0273	29-Nov-22	29-May-24	18
Water Lab	Total Kjeldahl Nitrogen	Digestion Unit	BKQ_EN0366	30-Jun-22	30-Jun-23	12
Water Lab	Total Kjeldahl Nitrogen	Discrete analyzer	BKQ_EN0037	5-Jan-23	5-Jan-24	12
Water Lab	Conductivity	Conductivity meter	BKQ_EN0373	3-Jan-23	3-Jan-24	12
Water Lab	Salinity	Conductivity meter	BKQ_EN0373	3-Jan-23	3-Jan-24	12
Water Lab	BOD	DO Meter	BKQ_EN0017	24-May-22	24-Nov-23	18
Water Lab	BOD	Incubator	BKQ_EN0304	5-Apr-23	5-Apr-24	12
Water Lab	COD	Hot Block	BKQ_EN0222	1-Mar-23	1-Mar-24	12
Water Lab	COD	Spectrophotometer	BKQ_EN0018	16-Sep-22	16-Sep-23	12
Water Lab	Oil & Grease	Electronic Top-Loading Balance	BKQ_EN0002	8-Feb-23	8-Feb-24	12
Water Lab	Oil & Grease	Water Bath	BKQ_EN0148	31-Jan-22	1-Aug-23	18
Water Lab	Temperature	Digital Thermometer With Sensor	BKQ_LG0066	12-Sep-22	12-Sep-23	12
Water Lab	Temperature	Digital Thermometer With Sensor	BKQ_LG0064	12-Sep-22	12-Sep-23	12
Water Lab	Temperature	Digital Thermometer With Sensor	BKQ_LG0056	12-Sep-22	12-Sep-23	12
Water Lab	Hexavalent Chromium	Spectrophotometer	BKQ_EN0018	16-Sep-22	16-Sep-23	12
Water Lab	Iron	ICP-MS	BKQ_EL0026	14-Jun-22	14-Dec-23	18
Water Lab	Iron	Hot Block	BKQ_EL0054	7-Apr-22	7-Oct-23	18
Water Lab	Iron	Chamber (Cold Room)	BKQ_EN0167	30-Jun-22	30-Dec-23	18
Water Lab	Lead	ICP-MS	BKQ_EL0026	14-Jun-22	14-Dec-23	18
Water Lab	Lead	Hot Block	BKQ_EL0054	7-Apr-22	7-Oct-23	18
Water Lab	Lead	Chamber (Cold Room)	BKQ_EN0167	30-Jun-22	30-Dec-23	18
Water Lab	Manganese	ICP-MS	BKQ_EL0026	14-Jun-22	14-Dec-23	18
Water Lab	Manganese	Hot Block	BKQ_EL0054	7-Apr-22	7-Oct-23	18
Water Lab	Manganese	Chamber (Cold Room)	BKQ_EN0167	30-Jun-22	30-Dec-23	18
Water Lab	Calcium	ICP-OES	BKQ_EL0037	20-Mar-23	19-Sep-24	18
Water Lab	Calcium	Hot Block	BKQ_EL0054	7-Apr-22	7-Oct-23	18
Water Lab	Calcium	Chamber (Cold Room)	BKQ_EN0167	30-Jun-22	30-Dec-23	18
Water Lab	Magnesium	ICP-OES	BKQ_EL0037	20-Mar-23	19-Sep-24	18
Water Lab	Magnesium	Hot Block	BKQ_EL0054	7-Apr-22	7-Oct-23	18
Water Lab	Magnesium	Chamber (Cold Room)	BKQ_EN0167	30-Jun-22	30-Dec-23	18
Water Lab	Copper	ICP-OES	BKQ_EL0026	14-Jun-22	14-Dec-23	18
Water Lab	Copper	Hot Block	BKQ_EL0054	7-Apr-22	7-Oct-23	18
Water Lab	Copper	Chamber (Cold Room)	BKQ_EN0167	30-Jun-22	30-Dec-23	18
Water Lab	Cadmium	ICP-MS	BKQ_EL0026	14-Jun-22	14-Dec-23	18
Water Lab	Cadmium	Hot Block	BKQ_EL0054	7-Apr-22	7-Oct-23	18
Water Lab	Cadmium	Chamber (Cold Room)	BKQ_EN0167	30-Jun-22	30-Dec-23	18

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รายการเครื่องมือที่ใช้ในการวิเคราะห์ / ทดสอบ

Sample Name	Parameter	Equipment Name	ID No.	Calibrated Date	Next Cal	Freq. Calibrate (Months)
Water Lab	Zinc	ICP-MS	BKQ_EL0026	14-Jun-22	14-Dec-23	18
Water Lab	Zinc	Hot Block	BKQ_EL0054	7-Apr-22	7-Oct-23	18
Water Lab	Zinc	Chamber (Cold Room)	BKQ_EN0167	30-Jun-22	30-Dec-23	18
Water Lab	Nickel	ICP-MS	BKQ_EL0026	14-Jun-22	14-Dec-23	18
Water Lab	Nickel	Hot Block	BKQ_EL0054	7-Apr-22	7-Oct-23	18
Water Lab	Nickel	Chamber (Cold Room)	BKQ_EN0167	30-Jun-22	30-Dec-23	18
Water Lab	Selenium	ICP-MS	BKQ_EL0026	14-Jun-22	14-Dec-23	18
Water Lab	Selenium	Hot Block	BKQ_EL0054	7-Apr-22	7-Oct-23	18
Water Lab	Selenium	Chamber (Cold Room)	BKQ_EN0167	30-Jun-22	30-Dec-23	18
Water Lab	Barium	ICP-MS	BKQ_EL0026	14-Jun-22	14-Dec-23	18
Water Lab	Barium	Hot Block	BKQ_EL0054	7-Apr-22	7-Oct-23	18
Water Lab	Barium	Chamber (Cold Room)	BKQ_EN0167	30-Jun-22	30-Dec-23	18
Water Lab	Arsenic	ICP-MS	BKQ_EL0026	14-Jun-22	14-Dec-23	18
Water Lab	Arsenic	Hot Block	BKQ_EL0054	7-Apr-22	7-Oct-23	18
Water Lab	Arsenic	Chamber (Cold Room)	BKQ_EN0167	30-Jun-22	30-Dec-23	18
Water Lab	Mercury	Mercury Analyzer	BKQ_EL0128	30-Nov-22	30-Nov-23	12
Water Lab	Total Coliform	Autoclave	BKQ_ML0001	20-May-22	20-Nov-23	18
Water Lab	Total Coliform	Incubator	BKQ_ML0010	21-Jan-22	22-Jul-23	18
Water Lab	Total Coliform	Hot Air Oven	BKQ_ML0013	21-Nov-22	21-May-24	18
Water Lab	Fecal Coliform	Autoclave	BKQ_ML0001	20-May-22	20-Nov-23	18
Water Lab	Fecal Coliform	Incubator	BKQ_ML0010	21-Jan-22	22-Jul-23	18
Water Lab	Fecal Coliform	Hot Air Oven	BKQ_ML0013	21-Nov-22	21-May-24	18
Water Lab	Fecal Coliform	Water Bath	BKQ_ML0056	20-May-22	20-May-23	12

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SITHIPHORN ASSOCIATES CO.,LTD. CALIBRATION LABORATORY

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



Cert. No. : ACC22040
Pages : 1 of 3

Calibration Certificate

Equipment : SOUND CALIBRATOR
Manufacturer : RION
Model : NC-75
Serial No.: 35024431
ID No.: - RYU.151221



Condition As Found : GOOD

Customer : ALS LABORATORY GROUP (THAILAND) CO., LTD.
104 PHATTHANAKAN 40, PHATTHANAKAN ROAD,
KHWAENG PHATTHANAKAN, KHET SUAN LUANG,
BANGKOK, 10250 THAILAND.

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

Received Date : 03 NOVEMBER 2022
Calibration Date : 14 NOVEMBER 2022
Date of Issue : 15 NOVEMBER 2022

Calibrated by : Nathakorn Pisuatpaisan

Approved by :

T. Petchurai
(Thanakul Petchurai)

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

SITHIPHORN ASSOCIATES CO.,LTD. CALIBRATION LABORATORY

Continuation of Calibration Certificate

Cert. No. : ACC22040
Job No. : VC66AC0006
Pages : 2 of 3

Calibration Procedure : CP-AC-03

Calibration Method :

This equipment was calibrated by based on IEC:60942:2003 Standard.
The sound pressure level, frequency and total distortion of the sound calibrator was measured using the reference microphone.

Condition of this result of calibration :

1. Reference Standard Instruments :

Instrument	Model	Serial No.	Cert. No.	Due Date
Waveform Generator	33511B	MY52302742	EF-0008-22	04-Feb-23
Digital Multimeter	33461A	MY53220104	EEL.BP. 04/0265	09-Feb-23
Digital Multimeter	33461A	MY53220076	EEL.BP. 03/0265	09-Feb-23
Digital Multimeter	33461A	MY60024273	EEL.BP. 05/0265	09-Feb-23
Programmable Attenuator	MAT-1070	62100114	EF-0009-22	07-Feb-23
Condenser Microphone	4180	2977900	AA-1013-22	24-Feb-23
Measuring Amplifier	NA-42KA1	34560495	AA-3005-22	22-Feb-23
Audio Analyzer	AVR-3360A	V744B6069	EF-0010-22	07-Feb-23

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

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

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

T. Petchurai

Cert. No. : ACC22040
Job No. : VC66AC0006
Pages : 3 of 3

Result of calibration :

1. Sound pressure level

Specified sound pressure level (dB)	Measured value (dB)	Deviated value (dB)	Uncertainty (dB)	Tolerance limit (dB)
94	93.94	-0.06	0.40	0.40

2. Frequency

Specified Frequency (Hz)	Measured value (Hz)	Deviated value (%)	Uncertainty (%)	Tolerance limit (%)
1000	999.9	0.0	0.1	1.0

3. Total distortion

Measured value (%)	Uncertainty (%)	Tolerance limit (%)
0.31	0.10	3.0

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

End of Calibration Certificate

QF-TS12-04-04-020664

451-451/1 Sirinthon Rd, Bangbunru, Bangplud Bangkok 10700 THAILAND.
Tel:0-2435-8900 Fax:0-2433-1679 e-mail:cal-center@sithiphom.com http://www.sithiphom.com

Cert. No. : ACL22245

Pages : 1 of 8

Calibration Certificate

Equipment : SOUND LEVEL METER
Manufacturer : RION
Model : NL-42/ Microphone UC-52 / Preamplifier NH-24
Serial No.: 00572609 / 170133 / 72947
ID No.: BKK_FS0924

Condition As Found : GOOD

Customer : ALS LABORATORY GROUP (THAILAND) CO., LTD.
104 PHATTHANAKAN 40, PHATTHANAKAN ROAD,
KHWAENG PHATTHANAKAN, KHET SUAN LUANG,
BANGKOK, 10250 THAILAND,Location : -
Ambient Temperature : (23.0 ± 3) °C
Pressure : (101.3 ± 3) kPa
Relative Humidity : (50.0 ± 20) %Received Date : 11 OCTOBER 2022
Calibration Date : 25-26 OCTOBER 2022
Date of Issue : 27 OCTOBER 2022

Calibrated by : Nattakorn Pisutpaisan

Approved by :

T. Petchurai
(Thanakul Petchurai)

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

QF-TS12-04-04-020664

Cert. No. : ACL22245
Job No. : VC65AC0090
Pages : 2 of 8

Calibration Procedure : CP-AC-01

Calibration Method :

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

Condition of this result of calibration :

1. Reference Standard Instruments :

Instrument	Model	Serial No.	Cert. No.	Due Date
Waveform Generator	33210A	MY48017076	EF-0007-22	04-Feb-23
Waveform Generator	33511B	MY52302742	EF-0008-22	04-Feb-23
Digital Multimeter	33461A	MY53220104	EEL_BP_04/0265	09-Feb-23
Digital Multimeter	33461A	MY53220076	EEL_BP_03/0265	09-Feb-23
Digital Multimeter	34461A	MY60024273	EEL_BP_05/0265	09-Feb-23
Programmable Attenuator	MAT-1070	62100114	EF-0009-22	07-Feb-23
Condenser Microphone	4180	2977900	AA-1013-22	24-Feb-23
Measuring Amplifier	NA-42KAI	34560495	AA-3005-22	22-Feb-23

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

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

3.1 National Institute of Metrology (Thailand).

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

QF-TS12-04-04-020664

Cert. No. : ACL22245
Job No. : VC65AC0090
Pages : 3 of 8

Summary of Measurement Result :

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

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Continuation of Calibration Certificate

Cert. No. : ACL22245
Job No. : VC65AC0090
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Result of calibration :

1. Absolute sensitivity

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

2. Self-generated noise

2.1 Normal test

Measured Value (dB)
15.1

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

Frequency Weighting	Measured value (dB)
A - weight	11.6
C - weight	17.6
Flat	23.5

3. Acoustical signal tests of frequency weightings

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

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)			
	Flat	C-weight	A-weight	Acceptance Limits
125	0.0	0.1	0.1	± 1.5
1000	0.0	0.0	0.0	± 1.0
8000	0.5	0.6	0.6	±5.0

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Continuation of Calibration Certificate

Cert. No. : ACL22245
Job No. : VC65AC0090
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4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)			
	Flat	C-weight	A-weight	Acceptance Limits
63	0.0	0.0	-0.1	±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	±2.0
4000	0.0	0.0	0.0	±3.0
8000	0.0	0.1	0.1	±5.0

5. Frequency and time weightings at 1 kHz

5.1 Frequency weightings at 1 kHz

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

5.2 Time weighting at 1 kHz

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

6. Long - term stability

Frequency Weighting	SLM Display at initial (dB)	SLM Display at final (dB)	Deviated Value (dB)	Acceptance Limits (dB)
A - weight	94.0	94.0	0.0	± 0.3

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Continuation of Calibration Certificate

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Job No. : VC65AC0090
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7. Level linearity on the reference level range

Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
137.0	137.0	0.0	± 1.1
136.0	136.0	0.0	± 1.1
135.0	135.0	0.0	± 1.1
134.0	134.0	0.0	± 1.1
133.0	133.0	0.0	± 1.1
132.0	132.0	0.0	± 1.1
131.0	131.0	0.0	± 1.1
129.0	129.0	0.0	± 1.1
124.0	124.0	0.0	± 1.1
119.0	119.0	0.0	± 1.1
114.0	114.0	0.0	± 1.1
109.0	109.0	0.0	± 1.1
104.0	104.0	0.0	± 1.1
99.0	99.0	0.0	± 1.1
94.0	94.0	0.0	± 1.1
89.0	89.1	0.1	± 1.1
84.0	84.1	0.1	± 1.1
79.0	79.0	0.0	± 1.1
74.0	74.1	0.1	± 1.1
69.0	69.1	0.1	± 1.1
64.0	64.0	0.0	± 1.1
59.0	59.1	0.1	± 1.1
54.0	54.0	0.0	± 1.1
49.0	49.0	0.0	± 1.1
44.0	44.0	0.0	± 1.1
39.0	39.0	0.0	± 1.1
34.0	34.1	0.1	± 1.1
30.0	30.0	0.0	± 1.1
29.0	29.1	0.1	± 1.1
28.0	28.1	0.1	± 1.1
27.0	27.1	0.1	± 1.1
26.0	26.1	0.1	± 1.1
25.0	25.1	0.1	± 1.1

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Continuation of Calibration Certificate

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Job No. : VC65AC0090
Pages : 7 of 8

8. Level linearity including the level range control

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

9. Tone burst response

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

10. Peak C sound level

Number of cycle in test signal	Anticipated Value (dB)	Measured Value, L _{peak} (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.0	0.0	-
One	136.4	136.0	-0.4	±3.0

Number of cycle in test signal	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.1	0.1	-
Positive half cycle	135.4	135.3	-0.1	±2.0
Negative half cycle	135.4	135.3	-0.1	±2.0

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Continuation of Calibration Certificate

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11. Overload indication

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

12. High level stability

Frequency Weighting	SLM Display at initial (dB)	SLM Display at final (dB)	Deviated Value (dB)	Acceptance Limits (dB)
A - weight	137.0	137.0	0.0	±0.3

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

End of Calibration Certificate

QF-TS12-04-04-020664

T. Petchur

451-451/1 Sirinthon Rd, Bangbunru, Bangplud Bangkok 10700 THAILAND.
Tel:0-2435-8800 Fax:0-2433-1679 e-mail:cal-center@sithiporn.com http://www.sithiporn.comCert. No. : ACL22233
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Calibration Certificate

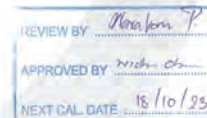
Equipment : SOUND LEVEL METER
Manufacturer : RION
Model : NL-42/ Microphone UC-52 / Preamp NH-24
Serial No.: 00672737 / 158772 / 58773
ID No.: BKK_FS0927

Condition As Found : GOOD

Customer : ALS LABORATORY GROUP (THAILAND) CO., LTD.
104 PHATTHANAKAN 40, PHATTHANAKAN ROAD,
KHWAENG PHATTHANAKAN, KHET SUAN LUANG,
BANGKOK, 10250 THAILAND.

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

Received Date : 03 OCTOBER 2022
Calibration Date : 18-19 OCTOBER 2022
Date of Issue : 20 OCTOBER 2022



Calibrated by : Nathakorn Pisutpaisan

Approved by :

T. Petchur
(Thanakul Petchurai)

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

QF-TS12-04-04-020664

Continuation of Calibration Certificate

Cert. No. : ACL22233
Job No. : VC65AC0088
Pages : 2 of 8

Calibration Procedure : CP-AC-01

Calibration Method :

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

Condition of this result of calibration :

1. Reference Standard Instruments :

Instrument	Model	Serial No.	Cert. No.	Due Date
Waveform Generator	33210A	MY48017076	EF-0007-22	04-Feb-23
Waveform Generator	33511B	MY52302742	EF-0008-22	04-Feb-23
Digital Multimeter	33461A	MY53220104	EEL_BP_04/0265	09-Feb-23
Digital Multimeter	33461A	MY53220076	EEL_BP_03/0265	09-Feb-23
Digital Multimeter	34461A	MY60024273	EEL_BP_05/0265	09-Feb-23
Programmable Attenuator	MAT-1070	62100114	EF-0009-22	07-Feb-23
Condenser Microphone	4180	2977900	AA-1013-22	24-Feb-23
Measuring Amplifier	NA-42KAI	34560495	AA-3005-22	22-Feb-23

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

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

3.1 National Institute of Metrology (Thailand).

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

QF-TS12-04-04-020664

T. Petchur

Continuation of Calibration Certificate

Cert. No. : ACL22233
Job No. : VC65AC0088
Pages : 3 of 8

Summary of Measurement Result :

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

QF-TS12-04-04-020664

T. Petchur

Continuation of Calibration Certificate

Cert. No. : ACL22233
Job No. : VC65AC0088
Pages : 4 of 8

Result of calibration :

1. Absolute sensitivity

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

2. Self-generated noise

2.1 Normal test

Measured Value (dB)
15.5

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

Frequency Weighting	Measured value (dB)
A - weight	10.8
C - weight	17.1
Flat	22.9

3. Acoustical signal tests of frequency weightings

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

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)			
	Flat	C-weight	A-weight	Acceptance Limits
125	0.3	0.3	0.3	± 1.5
1000	0.0	0.0	0.0	± 1.0
8000	-0.6	-0.5	-0.6	±5.0

QF-TS12-04-04-020664

7. Rth

Continuation of Calibration Certificate

Cert. No. : ACL22233
Job No. : VC65AC0088
Pages : 5 of 8

4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)			
	Flat	C-weight	A-weight	Acceptance Limits
63	-0.1	-0.1	-0.1	±2.0
125	0.0	0.0	-0.1	±1.5
250	0.0	0.0	-0.1	±1.5
500	0.0	0.0	-0.1	±1.5
1000	0.0	0.0	0.0	±1.0
2000	0.0	0.0	0.0	±2.0
4000	0.0	0.0	0.0	±3.0
8000	0.0	0.1	0.1	±5.0

5. Frequency and time weightings at 1 kHz

5.1 Frequency weightings at 1 kHz

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

5.2 Time weighting at 1 kHz

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

6. Long - term stability

Frequency Weighting	SLM Display at initial (dB)	SLM Display at final (dB)	Deviated Value (dB)	Acceptance Limits (dB)
A - weight	94.0	94.0	0.0	± 0.3

QF-TS12-04-04-020664

7. Rth

Continuation of Calibration Certificate

Cert. No. : ACL22233
Job No. : VC65AC0088
Pages : 6 of 8

7. Level linearity on the reference level range

Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
137.0	137.0	0.0	± 1.1
136.0	136.0	0.0	± 1.1
135.0	135.0	0.0	± 1.1
134.0	134.0	0.0	± 1.1
133.0	133.0	0.0	± 1.1
132.0	132.0	0.0	± 1.1
131.0	131.0	0.0	± 1.1
129.0	129.0	0.0	± 1.1
124.0	124.0	0.0	± 1.1
119.0	119.0	0.0	± 1.1
114.0	114.0	0.0	± 1.1
109.0	109.0	0.0	± 1.1
104.0	104.0	0.0	± 1.1
99.0	99.0	0.0	± 1.1
94.0	94.0	0.0	± 1.1
89.0	89.0	0.0	± 1.1
84.0	84.0	0.0	± 1.1
79.0	79.0	0.0	± 1.1
74.0	74.0	0.0	± 1.1
69.0	69.0	0.0	± 1.1
64.0	64.0	0.0	± 1.1
59.0	59.0	0.0	± 1.1
54.0	54.0	0.0	± 1.1
49.0	49.0	0.0	± 1.1
44.0	44.0	0.0	± 1.1
39.0	39.0	0.0	± 1.1
34.0	34.0	0.0	± 1.1
30.0	30.0	0.0	± 1.1
29.0	29.0	0.0	± 1.1
28.0	28.0	0.0	± 1.1
27.0	27.0	0.0	± 1.1
26.0	26.0	0.0	± 1.1
25.0	25.0	0.0	± 1.1

QF-TS12-04-04-020664

7. Rth

Continuation of Calibration Certificate

Cert. No. : ACL22233
Job No. : VC65AC0088
Pages : 7 of 8

8. Level linearity including the level range control

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

9. Tone burst response

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

10. Peak C' sound level

Number of cycle in test signal	Anticipated Value (dB)	Measured Value, Lpeak (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.0	0.0	-
One	136.4	136.1	-0.3	±3.0

Number of cycle in test signal	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.0	0.0	-
Positive half cycle	135.4	135.1	-0.3	±2.0
Negative half cycle	135.4	135.1	-0.3	±2.0

QF-TS12-04-04-020664

7. Rth

Continuation of Calibration Certificate

Cert. No. : ACL22243
Job No. : VC65AC0088
Pages : 8 of 8

11. Overload indication

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

12. High level stability

Frequency Weighting	SLM Display at initial (dB)	SLM Display at final (dB)	Deviated Value (dB)	Acceptance Limits (dB)
A - weight	137.0	137.0	0.0	±0.3

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

End of Calibration Certificate

QF-TS12-04-04-020664

451-451/1 Srinthorn Rd., Bangbunru, Bangplud Bangkok 10700 THAILAND.
Tel.0-2435-8800 Fax.0-2433-1679 e-mail:cal-center@sithiporn.com http://www.sithiporn.comCert. No. : ACL22243
Pages : 1 of 8

Calibration Certificate

Equipment : SOUND LEVEL METER
Manufacturer : RION
Model : NL-42 / Microphone UC-52 / Preamplifier NH-24
Serial No. : 00572457 / 170214 / 72795
ID No. : BKK_FS0923

Condition As Found : GOOD

Customer : ALS LABORATORY GROUP (THAILAND) CO., LTD.
104 PHATTHANAKAN 40, PHATTHANAKAN ROAD,
KHWAENG PHATTHANAKAN, KHET SUAN LUANG,
BANGKOK, 10250 THAILAND.

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

Received Date : 11 OCTOBER 2022
Calibration Date : 25-26 OCTOBER 2022
Date of Issue : 27 OCTOBER 2022



Calibrated by : Nathakorn Pisutpaisan

Approved by :

T. Petchur -
(Thanakul Petchurai)

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

QF-TS12-04-04-020664

Continuation of Calibration Certificate

Cert. No. : ACL22243
Job No. : VC65AC0090
Pages : 2 of 8

Calibration Procedure : CP-AC-01

Calibration Method :

This equipment was calibrated by based on IEC-61672-3 (2013) Standard for sound level meter (SLM).
The SLM had tests to Acoustical and Electrical signal tests of frequency weighting with Anechoic chamber and Reference
Standard Instruments.

For tests results of each items were made by observation of each Instruments display and also with SLM's display.

Condition of this result of calibration :

1. Reference Standard Instruments :

Instrument	Model	Serial No.	Cert. No.	Due Date
Waveform Generator	33210A	MY48017076	EF-0007-22	04-Feb-23
Waveform Generator	33511B	MY52302742	EF-0008-22	04-Feb-23
Digital Multimeter	33461A	MY53220104	EEL_BP_04/0265	09-Feb-23
Digital Multimeter	33461A	MY53220076	EEL_BP_03/0265	09-Feb-23
Digital Multimeter	34461A	MY60024273	EEL_BP_05/0265	09-Feb-23
Programmable Attenuator	MAT-1070	62100114	EF-0009-22	07-Feb-23
Condenser Microphone	4180	2977900	AA-1013-22	24-Feb-23
Measuring Amplifier	NA-42KAI	34560495	AA-3005-22	22-Feb-23

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

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

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

QF-TS12-04-04-020664

Continuation of Calibration Certificate

Cert. No. : ACL22243
Job No. : VC65AC0090
Pages : 3 of 8

Summary of Measurement Result :

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

QF-TS12-04-04-020664

Continuation of Calibration Certificate

Cert. No. : ACL22243
Job No. : VC65AC0090
Pages : 4 of 8

Result of calibration :

1. Absolute sensitivity

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

2. Self-generated noise

2.1 Normal test

Measured Value (dB)
14.6

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

Frequency Weighting	Measured value (dB)
A - weight	9.9
C - weight	16.9
Flat	22.6

3. Acoustical signal tests of frequency weightings

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

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)			
	Flat	C-weight	A-weight	Acceptance Limits
125	0.3	0.4	0.4	± 1.5
1000	0.0	0.0	0.0	± 1.0
8000	-1.4	-1.4	-1.3	±5.0

QF-TS12-04-04-020664

T. R. R. R.

Continuation of Calibration Certificate

Cert. No. : ACL22243
Job No. : VC65AC0090
Pages : 5 of 8

4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)			
	Flat	C-weight	A-weight	Acceptance Limits
63	0.0	0.0	0.0	±2.0
125	0.1	0.0	0.1	±1.5
250	0.0	0.0	0.0	±1.5
500	0.0	0.1	0.0	±1.5
1000	0.0	0.0	0.0	±1.0
2000	0.0	0.1	0.0	±2.0
4000	0.0	0.0	0.0	±3.0
8000	0.0	0.1	0.1	±5.0

5. Frequency and time weightings at 1 kHz

5.1 Frequency weightings at 1 kHz

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

5.2 Time weighting at 1 kHz

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

6. Long - term stability

Frequency Weighting	SLM Display at initial (dB)	SLM Display at final (dB)	Deviated Value (dB)	Acceptance Limits (dB)
A - weight	94.0	94.1	0.1	± 0.3

QF-TS12-04-04-020664

T. R. R. R.

Continuation of Calibration Certificate

Cert. No. : ACL22243
Job No. : VC65AC0090
Pages : 6 of 8

7. Level linearity on the reference level range

Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
137.0	137.0	0.0	± 1.1
136.0	136.0	0.0	± 1.1
135.0	135.0	0.0	± 1.1
134.0	134.0	0.0	± 1.1
133.0	133.0	0.0	± 1.1
132.0	132.0	0.0	± 1.1
131.0	131.0	0.0	± 1.1
129.0	129.0	0.0	± 1.1
124.0	124.0	0.0	± 1.1
119.0	119.0	0.0	± 1.1
114.0	114.0	0.0	± 1.1
109.0	109.0	0.0	± 1.1
104.0	104.0	0.0	± 1.1
99.0	99.0	0.0	± 1.1
94.0	94.0	0.0	± 1.1
89.0	89.0	0.0	± 1.1
84.0	84.0	0.0	± 1.1
79.0	79.0	0.0	± 1.1
74.0	74.0	0.0	± 1.1
69.0	69.0	0.0	± 1.1
64.0	64.0	0.0	± 1.1
59.0	59.0	0.0	± 1.1
54.0	54.0	0.0	± 1.1
49.0	49.0	0.0	± 1.1
44.0	44.0	0.0	± 1.1
39.0	39.0	0.0	± 1.1
34.0	34.0	0.0	± 1.1
30.0	30.0	0.0	± 1.1
29.0	29.0	0.0	± 1.1
28.0	28.0	0.0	± 1.1
27.0	27.0	0.0	± 1.1
26.0	26.0	0.0	± 1.1
25.0	25.1	0.1	± 1.1

QF-TS12-04-04-020664

T. R. R. R.

Continuation of Calibration Certificate

Cert. No. : ACL22243
Job No. : VC65AC0090
Pages : 7 of 8

8. Level linearity including the level range control

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

9. Tone burst response

Time Weighting	Tone burst duration, Tb (ms)	Cycle	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Fast	0.25	1	108.0	107.9	-0.1	1.5 ; -5.0
	2	8	117.0	117.0	0.0	1.0 ; -2.5
	200	800	134.0	134.1	0.1	±1.0
Slow	2	8	108.0	108.0	0.0	1.5 ; -5.0
	200	800	127.6	127.6	0.0	±1.0
SEL	0.25	1	99.0	98.9	-0.1	1.5 ; -5.0
	2	8	108.0	108.0	0.0	1.0 ; -2.5
	200	800	128.0	128.0	0.0	±1.0

10. Peak C sound level

Number of cycle in test signal	Anticipated Value (dB)	Measured Value, L _{peak} (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.0	0.0	-
One	136.4	136.2	-0.2	±3.0

Number of cycle in test signal	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.0	0.0	-
Positive half cycle	135.4	135.1	-0.3	±2.0
Negative half cycle	135.4	135.1	-0.3	±2.0

QF-TS12-04-04-020664

T. R. R. R.

Continuation of Calibration Certificate

Cert. No. : ACL22243
Job No. : VC65AC0090
Pages : 8 of 8

11. Overload indication

Measured value (dB)		Deviated	Acceptance
Positive	Negative	Value	Limits
one-half cycle	one-half cycle	(dB)	(dB)
89.7	89.6	-0.1	±1.5

12. High level stability

Frequency	SLM Display	SLM Display	Deviated	Acceptance
Weighting	at initial	at final	Value	Limits
	(dB)	(dB)	(dB)	(dB)
A - weight	136.9	136.9	0.0	±0.3

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

End of Calibration Certificate

QF-TS12-04-04-020664

T. Petchur

451-451/1 Si Rinthorn Rd, Bangbunru, Bangplud Bangkok 10700 THAILAND.
Tel:0-2435-8800 Fax:0-2433-1679 e-mail:cal-center@sithiphom.com http://www.sithiphom.comCert. No. : ACL23068
Pages : 1 of 8

Calibration Certificate

Equipment : SOUND LEVEL METER
Manufacturer : RION
Model : NL-52A / Microphone UC-59 / Preamplifier NH-25
Serial No. : 00920826 / 22186 / 22215
ID No. : -

Condition As Found : GOOD

Customer : ALS LABORATORY GROUP (THAILAND) CO., LTD.
104 PHATTHANAKAN 40, PHATTHANAKAN ROAD,
KHWAENG PHATTHANAKAN, KHET SUAN LUANG,
BANGKOK, 10250 THAILAND.

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

Received Date : 06 JANUARY 2023
Calibration Date : 23-24 JANUARY 2023
Date of Issue : 25 JANUARY 2023



Calibrated by : Nathakorn Pisutpaisan

Approved by :

T. Petchur
(Thanakul Petchurai)

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

QF-TS12-04-04-020664

Continuation of Calibration Certificate

Cert. No. : ACL23068
Job No. : VC66AC0029
Pages : 2 of 8

Calibration Procedure : CP-AC-01

Calibration Method :

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

Condition of this result of calibration :

1. Reference Standard Instruments :

Instrument	Model	Serial No.	Cert. No.	Due Date
Waveform Generator	33210A	MY48017076	EF-0007-22	04-Feb-23
Waveform Generator	33511B	MY52302742	EF-0008-22	04-Feb-23
Digital Multimeter	33461A	MY53220104	EEL_BP_04-0265	09-Feb-23
Digital Multimeter	33461A	MY53220076	EEL_BP_03-0265	09-Feb-23
Digital Multimeter	34461A	MY60024273	EEL_BP_05-0265	09-Feb-23
Programmable Attenuator	MAT-1070	62100114	EF-0009-22	07-Feb-23
Condenser Microphone	4180	2977900	AA-1013-22	24-Feb-23
Measuring Amplifier	NA-42KAI	34560495	AA-3005-22	22-Feb-23

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

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

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

QF-TS12-04-04-020664

T. Petchur

Continuation of Calibration Certificate

Cert. No. : ACL23068
Job No. : VC66AC0029
Pages : 3 of 8

Summary of Measurement Result :

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

QF-TS12-04-04-020664

T. Petchur

Cert. No. : ACL23068
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Result of calibration :

1. Absolute sensitivity

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

2. Self-generated noise

2.1 Normal test

Measured Value (dB)
14.3

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

Frequency Weighting	Measured value (dB)
A - weight	8.7
C - weight	14.1
Flat	19.8

3. Acoustical signal tests of frequency weightings

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

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)			
	Flat	C-weight	A-weight	Acceptance Limits
125	0.0	0.1	0.1	± 1.0
1000	0.1	0.1	0.1	± 0.7
8000	-0.5	-0.4	-0.4	+ 1.5, - 2.5

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T. Petch.

Cert. No. : ACL23068
Job No. : VC66AC0029
Pages : 5 of 8

4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

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

5. Frequency and time weightings at 1 kHz

5.1 Frequency weightings at 1 kHz

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

5.2 Time weighting at 1 kHz

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

6. Long - term stability

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

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T. Petch.

Cert. No. : ACL23068
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Pages : 6 of 8

7. Level linearity on the reference level range

Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
137.0	137.0	0.0	±0.8
136.0	136.0	0.0	±0.8
135.0	135.0	0.0	±0.8
134.0	134.1	0.1	±0.8
133.0	133.0	0.0	±0.8
132.0	132.0	0.0	±0.8
131.0	131.0	0.0	±0.8
129.0	129.0	0.0	±0.8
124.0	124.0	0.0	±0.8
119.0	119.0	0.0	±0.8
114.0	114.0	0.0	±0.8
109.0	109.0	0.0	±0.8
104.0	104.0	0.0	±0.8
99.0	99.0	0.0	±0.8
94.0	94.0	0.0	±0.8
89.0	89.0	0.0	±0.8
84.0	84.0	0.0	±0.8
79.0	79.0	0.0	±0.8
74.0	74.0	0.0	±0.8
69.0	69.0	0.0	±0.8
64.0	64.0	0.0	±0.8
59.0	59.0	0.0	±0.8
54.0	54.0	0.0	±0.8
49.0	49.0	0.0	±0.8
44.0	44.0	0.0	±0.8
39.0	39.0	0.0	±0.8
34.0	34.0	0.0	±0.8
30.0	30.0	0.0	±0.8
29.0	29.0	0.0	±0.8
28.0	28.0	0.0	±0.8
27.0	27.0	0.0	±0.8
26.0	26.0	0.0	±0.8
25.0	24.9	-0.1	±0.8

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T. Petch.

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Job No. : VC66AC0029
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8. Level linearity including the level range control

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

9. Tone burst response

Time Weighting	Tone burst duration, Tb (ms)	Cycle	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Fast	0.25	1	108.0	107.9	-0.1	1.5 ; -5.0
	2	8	117.0	116.9	-0.1	1.0 ; -2.5
	200	800	134.0	134.0	0.0	±1.0
Slow	2	8	108.0	107.9	-0.1	1.5 ; -5.0
	200	800	127.6	127.6	0.0	±1.0
SEL	0.25	1	99.0	98.8	-0.2	1.5 ; -5.0
	2	8	108.0	107.9	-0.1	1.0 ; -2.5
	200	800	128.0	128.0	0.0	±1.0

10. Peak C sound level

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

Number of cycle in test signal	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	132.9	-0.1	-
Positive half cycle	135.4	135.1	-0.3	±1.0
Negative half cycle	135.4	135.1	-0.3	±1.0

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T. Petch.

Continuation of Calibration Certificate

Cert. No. : ACL23068
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11. Overload indication

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

12. High level stability

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

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

End of Calibration Certificate

QF-TS12-04-04-020664

T. Petchur

451-451/1 Sirinthorn Rd., Bangbunru, Bangplud Bangkok 10700 THAILAND.
Tel:0-2435-8800 Fax:0-2433-1679 e-mail:cal-center@sithiporn.com http://www.sithiporn.comCert. No. : ACL23067
Pages : 1 of 8

Calibration Certificate

Equipment : SOUND LEVEL METER
Manufacturer : RION
Model : NL-52A / Microphone UC-59 / Preamplifier NH-25
Serial No. : 00920825 / 22185 / 22214
ID No. : -

Condition As Found : GOOD

Customer : ALS LABORATORY GROUP (THAILAND) CO., LTD.
104 PHATTHANAKAN 40, PHATTHANAKAN ROAD,
KHWANG PHATTHANAKAN, KHET SUAN LUANG,
BANGKOK, 10250 THAILAND.

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

Received Date : 06 JANUARY 2023
Calibration Date : 23-24 JANUARY 2023
Date of Issue : 25 JANUARY 2023



Calibrated by : Nathakorn Pisutpaisan

Approved by :

T. Petchur
(Thanakul Petchurai)

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QF-TS12-04-04-020664

Continuation of Calibration Certificate

Cert. No. : ACL23067
Job No. : VC66AC0029
Pages : 2 of 8

Calibration Procedure : CP-AC-01

Calibration Method :

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

Condition of this result of calibration :

1. Reference Standard Instruments :

Instrument	Model	Serial No.	Cert. No.	Due Date
Waveform Generator	33210A	MY48017076	EF-0007-22	04-Feb-23
Waveform Generator	33511B	MY52302742	EF-0008-22	04-Feb-23
Digital Multimeter	33461A	MY53220104	EEL_BP_04/0265	09-Feb-23
Digital Multimeter	33461A	MY53220076	EEL_BP_03/0265	09-Feb-23
Digital Multimeter	34461A	MY60024273	EEL_BP_05/0265	09-Feb-23
Programmable Attenuator	MAT-1070	62100114	EF-0009-22	07-Feb-23
Condenser Microphone	4180	2977900	AA-1013-22	24-Feb-23
Measuring Amplifier	NA-42KAJ	34560495	AA-3005-22	22-Feb-23

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

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

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

QF-TS12-04-04-020664

T. Petchur

Continuation of Calibration Certificate

Cert. No. : ACL23067
Job No. : VC66AC0029
Pages : 3 of 8

Summary of Measurement Result :

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

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T. Petchur

Continuation of Calibration Certificate

Cert. No. : ACL23067
Job No. : VC66AC0029
Pages : 4 of 8

Result of calibration :

1. Absolute sensitivity

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

2. Self-generated noise

2.1 Normal test

Measured Value (dB)
14.0

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

Frequency Weighting	Measured value (dB)
A - weight	8.7
C - weight	14.3
Flat	20.1

3. Acoustical signal tests of frequency weightings

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

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)			
	Flat	C-weight	A-weight	Acceptance Limits
125	0.1	0.1	0.1	± 1.0
1000	0.1	0.1	0.1	± 0.7
8000	-0.4	-0.3	-0.3	+ 1.5, -2.5

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7. Retch

Continuation of Calibration Certificate

Cert. No. : ACL23067
Job No. : VC66AC0029
Pages : 5 of 8

4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

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

5. Frequency and time weightings at 1 kHz

5.1 Frequency weightings at 1 kHz

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

5.2 Time weighting at 1 kHz

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

6. Long - term stability

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

QF-TS12-04-04-020664

7. Retch

Continuation of Calibration Certificate

Cert. No. : ACL23067
Job No. : VC66AC0029
Pages : 6 of 8

7. Level linearity on the reference level range

Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
137.0	137.0	0.0	±0.8
136.0	136.0	0.0	±0.8
135.0	135.0	0.0	±0.8
134.0	134.0	0.0	±0.8
133.0	133.0	0.0	±0.8
132.0	132.0	0.0	±0.8
131.0	131.0	0.0	±0.8
129.0	129.0	0.0	±0.8
124.0	124.0	0.0	±0.8
119.0	119.0	0.0	±0.8
114.0	114.0	0.0	±0.8
109.0	109.0	0.0	±0.8
104.0	104.0	0.0	±0.8
99.0	99.0	0.0	±0.8
94.0	94.0	0.0	±0.8
89.0	89.0	0.0	±0.8
84.0	84.0	0.0	±0.8
79.0	79.0	0.0	±0.8
74.0	74.0	0.0	±0.8
69.0	69.0	0.0	±0.8
64.0	64.0	0.0	±0.8
59.0	59.0	0.0	±0.8
54.0	54.0	0.0	±0.8
49.0	49.0	0.0	±0.8
44.0	44.0	0.0	±0.8
39.0	39.0	0.0	±0.8
34.0	34.0	0.0	±0.8
30.0	30.0	0.0	±0.8
29.0	29.0	0.0	±0.8
28.0	27.9	-0.1	±0.8
27.0	27.0	0.0	±0.8
26.0	25.9	-0.1	±0.8
25.0	24.9	-0.1	±0.8

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7. Retch

Continuation of Calibration Certificate

Cert. No. : ACL23067
Job No. : VC66AC0029
Pages : 7 of 8

8. Level linearity including the level range control

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

9. Tone burst response

Time Weighting	Tone burst duration, Tb (ms)	Cycle	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Fast	0.25	1	108.0	107.9	-0.1	1.5 ; -5.0
	2	8	117.0	117.0	0.0	1.0 ; -2.5
	200	800	134.0	134.1	0.1	±1.0
Slow	2	8	108.0	108.0	0.0	1.5 ; -5.0
	200	800	127.6	127.6	0.0	±1.0
SEL	0.25	1	99.0	98.9	-0.1	1.5 ; -5.0
	2	8	108.0	108.0	0.0	1.0 ; -2.5
	200	800	128.0	128.1	0.1	±1.0

10. Peak C sound level

Number of cycle in test signal	Anticipated Value (dB)	Measured Value, L _{peak} (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.0	0.0	-
One	136.4	136.0	-0.4	±2.0

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

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7. Retch

Continuation of Calibration Certificate

Cert. No. : ACL23067
Job No. : VC66AC0029
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11. Overload indication

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

12. High level stability

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

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

End of Calibration Certificate

QF-TS12-04-04-020664

451-451/1 Sirinthorn Rd.,Bangbunru, Bangplud Bangkok 10700 THAILAND.
Tel.0-2435-8800 Fax.0-2433-1679 e-mail:cal-center@sithiporn.com http://www.sithiporn.comCert. No. : ACL23069
Pages : 1 of 8

Calibration Certificate

Equipment : SOUND LEVEL METER
Manufacturer : RION
Model : NL-52A / Microphone UC-59 / Preamplifier NH-25
Serial No. : 00920827 / 22187 / 22216
ID No. : -

Condition As Found : GOOD

Customer : ALS LABORATORY GROUP (THAILAND) CO., LTD.
104 PHATTHANAKAN 40, PHATTHANAKAN ROAD,
KHWAENG PHATTHANAKAN, KHET SUAN LUANG,
BANGKOK, 10250 THAILAND.

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

Received Date : 06 JANUARY 2023
Calibration Date : 23-24 JANUARY 2023
Date of Issue : 25 JANUARY 2023

Calibrated by : Nathakorn Pisutpaisan

Approved by :

T. Petchur
(Thanakul Petchurai)

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QF-TS12-04-04-020664

Continuation of Calibration Certificate

Cert. No. : ACL23069
Job No. : VC66AC0029
Pages : 2 of 8

Calibration Procedure : CP-AC-01

Calibration Method :

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

Condition of this result of calibration :

1. Reference Standard Instruments :

Instrument	Model	Serial No.	Cert. No.	Due Date
Waveform Generator	33210A	MY48017076	EF-0007-22	04-Feb-23
Waveform Generator	33511B	MY52302742	EF-0008-22	04-Feb-23
Digital Multimeter	33461A	MY53220104	EEL-BP_04/0265	09-Feb-23
Digital Multimeter	33461A	MY53220076	EEL-BP_03/0265	09-Feb-23
Digital Multimeter	34461A	MY60024273	EEL-BP_05/0265	09-Feb-23
Programmable Attenuator	MAT-1070	62100114	EF-0009-22	07-Feb-23
Condenser Microphone	4180	2977900	AA-1013-22	24-Feb-23
Measuring Amplifier	NA-42KA1	34560495	AA-3005-22	22-Feb-23

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

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

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

QF-TS12-04-04-020664

Continuation of Calibration Certificate

Cert. No. : ACL23069
Job No. : VC66AC0029
Pages : 3 of 8

Summary of Measurement Result :

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

QF-TS12-04-04-020664

Continuation of Calibration Certificate

Cert. No. : ACL23069
Job No. : VC66AC0029
Pages : 4 of 8

Result of calibration :

1. Absolute sensitivity

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

2. Self-generated noise

2.1 Normal test

Measured Value (dB)
14.1

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

Frequency Weighting	Measured value (dB)
A - weight	8.7
C - weight	14.5
Flat	20.2

3. Acoustical signal tests of frequency weightings

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

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)			
	Flat	C-weight	A-weight	Acceptance Limits
125	0.1	0.1	0.2	± 1.0
1000	0.1	0.1	0.1	± 0.7
8000	-0.4	-0.3	-0.3	+ 1.5, - 2.5

QF-TS12-04-04-020664

7. B.Tch.

Continuation of Calibration Certificate

Cert. No. : ACL23069
Job No. : VC66AC0029
Pages : 5 of 8

4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

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

5. Frequency and time weightings at 1 kHz

5.1 Frequency weightings at 1 kHz

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

5.2 Time weighting at 1 kHz

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

6. Long - term stability

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

QF-TS12-04-04-020664

7. B.Tch.

Continuation of Calibration Certificate

Cert. No. : ACL23069
Job No. : VC66AC0029
Pages : 6 of 8

7. Level linearity on the reference level range

Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
137.0	137.0	0.0	±0.8
136.0	136.0	0.0	±0.8
135.0	135.0	0.0	±0.8
134.0	134.0	0.0	±0.8
133.0	133.0	0.0	±0.8
132.0	132.0	0.0	±0.8
131.0	131.0	0.0	±0.8
129.0	129.0	0.0	±0.8
124.0	124.0	0.0	±0.8
119.0	119.0	0.0	±0.8
114.0	114.0	0.0	±0.8
109.0	109.0	0.0	±0.8
104.0	104.0	0.0	±0.8
99.0	99.0	0.0	±0.8
94.0	94.0	0.0	±0.8
89.0	89.0	0.0	±0.8
84.0	84.0	0.0	±0.8
79.0	79.0	0.0	±0.8
74.0	74.0	0.0	±0.8
69.0	69.0	0.0	±0.8
64.0	64.0	0.0	±0.8
59.0	59.0	0.0	±0.8
54.0	54.0	0.0	±0.8
49.0	49.0	0.0	±0.8
44.0	44.0	0.0	±0.8
39.0	39.0	0.0	±0.8
34.0	33.9	-0.1	±0.8
30.0	29.9	-0.1	±0.8
29.0	28.9	-0.1	±0.8
28.0	27.9	-0.1	±0.8
27.0	26.9	-0.1	±0.8
26.0	25.9	-0.1	±0.8
25.0	24.8	-0.2	±0.8

QF-TS12-04-04-020664

7. B.Tch.

Continuation of Calibration Certificate

Cert. No. : ACL23069
Job No. : VC66AC0029
Pages : 7 of 8

8. Level linearity including the level range control

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

9. Tone burst response

Time Weighting	Tone burst duration, Tb (ms)	Cycle	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Fast	0.25	1	108.0	107.9	-0.1	1.5 ; -5.0
	2	8	117.0	117.0	0.0	1.0 ; -2.5
	200	800	134.0	134.1	0.1	±1.0
Slow	2	8	108.0	108.0	0.0	1.5 ; -5.0
	200	800	127.6	127.6	0.0	±1.0
SEL	0.25	1	99.0	98.9	-0.1	1.5 ; -5.0
	2	8	108.0	108.0	0.0	1.0 ; -2.5
	200	800	128.0	128.1	0.1	±1.0

10. Peak C sound level

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

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

QF-TS12-04-04-020664

7. B.Tch.

Continuation of Calibration Certificate

Cert. No. : ACL23069
Job No. : VC66AC0029
Pages : 8 of 8

11. Overload indication

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

12. High level stability

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

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

End of Calibration Certificate

QE-TS12-04-04-020664



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
CORPORATE SERVICES & EQUIPMENT CALIBRATION AND TESTING SERVICES
1344 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG BANGKOK 10250
TEL. 0-2717-3000-21 FAX. 0-2719-0484



Cert.No.: 22CH1222
Page.: 1 of 2

Certificate of Calibration

Equipment : pH Meter
Manufacturer : Mettler Toledo
Model : Seven Compact S220
Serial No. : B520948426
ID No. : BKK_EN0072
Condition As-Received : Used item
Received Date : 09 September 2022
Calibration Date : 12 September 2022
Reference : 2209-0312DSC-1
Submitted by : ALS Laboratory Group (Thailand) Co.,Ltd.
104 Phatthanakan 40, Phatthanakan Rd.,
Khwaeng Phatthanakan, Khet Suan Luang,
Bangkok 10250 Thailand
Ambient Temperature : (25 ± 2.5) °C
Relative Humidity : (50 ± 15) %
Calibration Procedure : In - house method :
- CP-CH5 by direct measurement with standard
voltage calibrator and direct measurement
with certified reference material (CRM)

REVIEW BY	Sinluk P.
APPROVED BY	KLAL
NEXT CAL. DATE	12/03/24

Calibrated by : Warakorn Lemgagrakul

Approved by :
Approved Signatory

(/) Malee Butkruea
() Sathip Meangmai
() Warakorn Lemgagrakul

Issue Date : 15 September 2022

The Uncertainties are for a confidence probability of approximately 95%

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



Cert. No.: 22CH1222
Page.: 2 of 2

Condition of this calibration result

1. Reference Standard Instrument

Instrument Serial No. ID No. Cert. No. Due Date
1) Document Process Calibrator 54030049 130RC116 22E2769 24 Aug 2023

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

2. Certified Reference Materials

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

Buffer Solution	Manufacturer	Lot No.	Exp. date
pH 4.008	CPA chem	823320	20 June 2024
pH 6.985	CPA chem	794122	14 Feb 2023
pH 10.008	CPA chem	823323	20 June 2023

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

Calibration Results

Function : mV Measurement

Performing standard curve by Fluke at pH (4,7,10)

Unit Under Calibration	Nominal Value	Standard Voltage Input	Actual Reading		Uncertainty of Measurement (±mV)	Coverage factor k
			mV	pH		
pH Meter S/N : B520948426	4.000	177.48	177.4	4.000	0.058	2.00
	7.000	0.00	0.0	7.000	0.058	2.00
	10.000	-177.48	-177.5	10.000	0.058	2.00

Function : pH Measurement

Performing three buffers standard curve by using buffer nominal pH (4,7,10)

Unit Under Calibration	Standard pH Buffer Solution	Actual pH Reading	Actual mV Reading (mV)	Uncertainty of pH measurement (±)	Coverage factor k
pH Electrode S/N : PCE-88-EX1001	4.008	3.999	153.9	0.0055	2.09
	6.985	7.017	-13.7	0.0084	2.00
	10.008	9.986	-179.0	0.0078	2.06

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

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a 1126274



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
CORPORATE SERVICES & EQUIPMENT CALIBRATION AND TESTING SERVICES
1344 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG BANGKOK 10250
TEL. 0-2717-3000-21 FAX. 0-2719-0484



Cert.No.: 22CG3154
Page.: 1 of 2

Certificate of Calibration

Equipment : Burette
Capacity : 50 mL
Serial No. :
ID No. : BKK_EN0171
Manufacturer : Witeg
Made in : Germany
Submitted by : ALS Laboratory Group (Thailand) Co.,Ltd.
104 Phatthanakan 40, Phatthanakan Rd.
Khwaeng Phatthanakan, Khet Suan Luang
Bangkok 10250 Thailand
Ambient Temperature : (20 ± 2.5) °C
Relative Humidity : (50 ± 10) %
Barometric Pressure : 759 mmHg
Calibration Procedure : ASTM E 542 - 01
Calibrated by : Panward Pramklam
Approved by :
Approved Signatory
() Pornthipha Tameyakul
() Malee Butkruea
(/) Ponpan Paipim
() Srisuda Khamthia
Issue Date : 31 August 2022

REVIEW BY	Sinluk P.
APPROVED BY	KLAL
NEXT CAL. DATE	11/03/2024

The Uncertainties are for a confidence probability of approximately 95%

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

A 0044607



Equipment : Burette
 Received Date : 28 August 2022
 Condition As-Received : Used Item
 Calibration Date : 30 August 2022
 Reference : 2208-0818DSC-2

Cert.No.: 22CG3154
 Page: 2 of 2

Condition of this result of calibration

1. Reference Standard Instruments :

Instruments	Model	Serial No.	ID No.	Certificate No.	Traceability	Due date
1) Balance	AE200S	N03679	140RC091	21MM429	NIMT	22 Sep 2022
2) Thermo-Hygrograph	THDX-CE	00016540	140EC001	22H1243	NIST, NIMT	09 June 2023
3) Thermometer	-	1584592	140EC010	221181	NIMT	10 Feb 2023

This certification is traceable to SI Unit

- The certificate is valid only to the item calibrated on date and place of calibration.
- True value is converted to true volume at the standard temperature of 20 °C

Calibration result :

Nominal capacity (mL)	Reading (mL)	Uncertainty (± mL)	k Factor
50	48.9859	0.010	2.00

Remark : mL = cm³

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 %.

-000-

1123908



Metrological Center

SCI ECO Services Company Limited

33/2 Moo 3, T.Banpa, A.Kaengkhroi, Saraburi 18110, Thailand.

Saraburi Tel : +66 3627 3096 Fax : +66 3627 3100

Bangkok Tel : +668 9205 6851 , +669 8247 2360

Website : www.scieco.co.th E-Mail : calibrate@scg.co.th



Certificate No. T221644

Page 1 of 4

Certificate of Calibration

Equipment : Chamber (Cold Room)

Manufacturer : KOLDTECH

Model : KM 320

Serial No. : TBN-1012061/05

Customer Code : BKK_EN0167

ID No. : T2463A3

Customer : ALS Laboratory Group (Thailand) Co.,Ltd.

104 Phatthanakan 40, Phatthanakan Rd., Khwaeng Phatthanakan,

Khet Suan Luang, Bangkok 10250

Customer Location : Environmental Laboratory

Date of Receipt : 27 June 2022

Calibrated By : Sujjar Nakhakred (Site Calibration Manager)

Approved By : Boonchai Suriyawong (Site Calibration Manager)

Date of Issue : 6 JUL 2022

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

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

FM-L13 11/7/01-02-04



Metrological Center

SCI ECO Services Company Limited

33/2 Moo 3, T.Banpa, A.Kaengkhroi, Saraburi 18110, Thailand.



Certificate No. T221644

Page 2 of 4

Calibration Report

Equipment : Chamber (Cold Room)
 Date of Calibration : 30 June - 1 July 2022
 Environment : Temperature : 18.9-23.7 °C
 Line Voltage : 222.9-226.5 V
 Relative Humidity : 55 - 65 %RH

Condition of this results of calibration :

- This equipment was calibrated by insert nine standard thermocouples type T into its chamber , the other one standard thermocouples type T use for ambient temperature measurement . The calibration was done in according to WI-T20 (based on ASTM E145-94 (Reapproved 2001) and AS2853-1986).

All data show below were final values and the initial data from customer request . The temperature scale used was based on ITS - 90 .

2. Reference Standard Instrument :

Instrument	Model	Instrument No.	Certificate No.	Due Date
TC	TYPE T	TN161-TN170	T210009	30 July 2022
TC	TYPE T	TN171-TN180	T210009	30 July 2022
DATA LOGGER	34970A	T149	T210009	30 July 2022

3. This certificate is traceable to :

National Institute of Metrology (Thailand) through Metrological Center (NSC-TISI-TIS 17025 CALIBRATION 0244)

4. Condition of calibrated item : good

Equipment Description :

Time Constant 3 Hour - Minute At 3 °C

Fresh Air Damper ☐ Open ☐ Min ☐ Medium ☐ Max

☐ Close

☒ Not Available

5. Adjustment :

() without adjustment

(X) after adjustment

Approved By:

[Signature]

FM-L13 11/7/01-03-03



Metrological Center

SCI ECO Services Company Limited

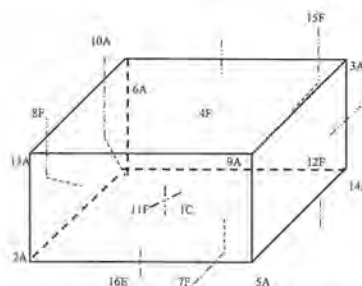
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Certificate No. T221644

Page 3 of 4

Calibration Report



C = Centre, F = Centre of Face, A = Corner, E = Centre of Edge.

1C =	TN161
2A =	TN162
3A =	TN163
4F =	TN164
5A =	TN165
6A =	TN166
7F =	TN167
8F =	TN168
9A =	TN169
10A =	TN170

11F =	TN171
12F =	TN172
13A =	TN173
14A =	TN174
15F =	TN175
16E =	TN176

Approved By:

[Signature]

FM-L13 11/7/01-03-03

Certificate No. T221644

Page 4 of 4

Calibration Report

Measurement Results:

Calibration Point	Average Standard Reading at each position (°C)									
	TN161	TN162	TN163	TN164	TN165	TN166	TN167	TN168	TN169	TN170
3	2.71	2.82	2.75	2.89	2.95	3.08	3.02	2.96	3.03	2.85
	TN171	TN172	TN173	TN174	TN175	TN176				
	2.97	3.02	2.89	3.04	2.97	3.33				

Chamber (Cold Room)			Temperature Distribution				
Setting (°C)	Reading (°C)		Average (°C)	Stability (±°C)	Uniformity (°C)	Uncertainty (±°C)	Coverage Factor k
	Min, Max	Average					
3.0	2.9, 4.0	3.2	2.99	1.05	1.30	1.66	2.00

* The quoted uncertainty exclude "uniformity"

The calibration result apply only the above calibrated item.

The result of test was found accurate as shown on date and place of test only.

The reported expanded uncertainty is based on a standard uncertainty multiplied by a coverage factor k, which for a t-distribution, providing a level of confidence of approximately 95 %.

Approved By: 

TM-L15 11/15-05-03

GUL-EN0069

REVIEW BY: Autcharawan S.
APPROVED BY: Sirarat M.
NEXT CAL DATE: 12.5.2024

Certificate of Calibration

ICS-2100: Anion (ID#659)

This certificate is to verify that instrument below are calibrated

by Archimica Lab Co., Ltd.

ICS-2100 S/N: 15010977

AS-HV S/N: 5450A36659

For

ALS Laboratory Group (Thailand) Co., Ltd.

Operator Signature: Nutdanai Date: Jan 12, 2023

(Mr.Nutdanai Laekhwan)

Application Chemist

Sartorius (Thailand) Co., Ltd.

129 Rama 9 Road, Huaykwang, Huaykwang, Bangkok 10310
Tel: +66 2043 8361-0, e-mail: service.thailand@sartorius.comMSC-TIS-TS 17025
CALIBRATION 0426

SARTORIUS

REVIEW BY: Sirirat P.
APPROVED BY: LL AL
NEXT CAL DATE: 8/2/24Model Number: MSE224S-100-DU
Description: Analytical Balance
Serial Number: 26207042
ID No.: BKK_EN0002
Manufacturer: SartoriusCertificate No.: 23BCI0072
Issued Date: Monday, February 13, 2023
Reference No.: 203245
Page No.: 1 of 2

Customer Name: ALS Laboratory Group (Thailand) Co., Ltd.

104 Phatthanakan 40, Phatthanakan Rd., Khwaeng Phatthanakan, Khet Suan Luang, Bangkok 10250

Calibrated Place: Balance Room

Calibrated By: Mr. Chonchai Inthana
Calibration Date: Wednesday, February 08, 2023Calibration
Procedure No.: This calibration was conducted by
Using in-house calibration procedure number (WI-003)
Based on UKAS LAB 14 : 2019Metrological data:
Capacity: 220 g Readability: 0.0001 gAmbients Conditions:
Temperature: 23.2 °C ± 5.0 °C
Humidity: 60.0 % RH ± 10.0 % RH
Pressure: ±
Equipment Condition: ☒ Good Operate ☐ Fair

Reasons for calibration

☐ New Installation ☐ Service / Repair ☒ In calibration Maintenance

Measurement Method UKAS Publication Ref: Lab 14

The measurement uncertainty stated is the expanded uncertainty which is obtained from the standard uncertainty multiplied by the coverage factor (k=2) to provide a level of confidence of approximately 95%. It is determined in accordance with the Guide to Expression of Uncertainty in Measurement (GUM). The calibration certificate documents the traceability to National Standards, which realise the unit of measurement according to the International Standard System of Units (SI). Report of Tolerance came from list of Sartorius Metrological Specifications.

Traceability:

Model Number	Description	Traceability	Certificate No.	Due Date
YCS011-522-00	Sartorius weight set 1mg - 5000g E2, YCS011-522-00	SPC-RT	C03212885	14-Sep-2023
MHB-36250	Humidity/Barenometer/Temp. Lutron MHB-36250	DKSH	C18220444	5-Sep-2023

This certificate relate and apply this equipment only.

This certificate may not be reproduced other than in full except with the prior written approval of the Verification Operation Division Sartorius (Thailand) Co., Ltd.

Mr Chonchai Inthana (Technical Manager)



SOP FM 33 03 February 2022

Sartorius (Thailand) Co., Ltd.

129 Rama 9 Road, Huaykwang, Huaykwang, Bangkok 10310
Tel: +66 2043 8361-0 Fax: +66 2043 6367, e-mail: service.thailand@sartorius.com

SARTORIUS

Certificate of Calibration

Model Number: MSE224S-100-DU
Description: Analytical Balance
Serial Number: 26207042
ID No.: BKK_EN0002
Manufacturer: SartoriusCertificate No.: 23BCI0072
Issued Date: Monday, February 13, 2023
Reference No.: 203245
Page No.: 2 of 2

Calibration Results : Without Adjustment

Repeatability			Eccentricity (Off-center loading error)		
The repeatability is the ability of a weighing instrument to display nearly identical results under constant test conditions when the same load within a measurement series is placed repeatedly on the weighing pan in the same manner. The standard deviation is used to assess repeatability quantitatively.			The off-center loading error is yielded by the difference between the readout of the load, i.e. 1/3 or 1/4 of maximum capacity, placed in the middle of the weighing pan and between each of four additional measurement points (positions defined according to OIML R76).		
Nominal Value : (Low Load)	20.0000 g	200.0000 g	Nominal value :	50 g	
Tolerance	0.0001 g	0.0005 g	Tolerance	0.0004 g	
			Difference		
			1		
			2		
			3		
			4		
			5		
			6		
Standard Deviation					

Linearity

The linearity, also called linearity error, describes the deviation of the characteristic curve of a weighing instrument from the linear slope.

Tolerance 0.0002 g				
Nominal Value (g)	Conventional Mass Value (g)	Displayed Value (g)	Deviation (g)	Uncertainty (g)
0.01	0.0100	0.0100	0.0000	0.00014
0.1	0.1000	0.1000	0.0000	0.00014
1	1.0000	1.0000	0.0000	0.00014
2	2.0000	2.0000	0.0000	0.00014
5	5.0000	5.0000	0.0000	0.00014
10	10.0000	10.0000	0.0000	0.00014
20	20.0000	20.0000	0.0000	0.00014
50	50.0000	50.0000	0.0000	0.00015
100	100.0000	100.0000	0.0000	0.00019
200	200.0000	199.9999	-0.0001	0.00030

End of Report

SOP FM 33 03 February 2022

Certificate No. T222502

Page 1 of 4

Certificate of Calibration

Equipment : Chamber (Oven)

Manufacturer : Memmert

Model : UF 450

Serial No. : B7170531

Customer Code : BKK_EN0273

ID No. : T8042A4

Customer : ALS Laboratory Group (Thailand) Co.,Ltd.

104 Phatthanakan 40, Phatthanakan Rd., Khwaeng Phatthanakan,

Khet Suan Luang, Bangkok 10250

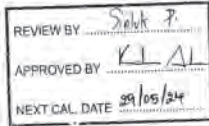
Customer Location : Oven Room

Date of Receipt : 23 November 2022

Calibrated By : Sujjar Naknakred (Site Calibration Manager)

Approved By : /Boonchai Suriyawong (Site Calibration Manager)

Date of Issue : 09 DEC 2022



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

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

FM-L15117/15-05-63

Certificate No. T222502

Page 2 of 4

Calibration Report

Equipment : Chamber (Oven)
Date of Calibration : 29 November 2022
Environment : Temperature : 29.1-29.6 °C
Line Voltage : 221.3-223.2 V
Relative Humidity : 55 - 65 %RH

Condition of this results of calibration :

1. This equipment was calibrated by insert nine resistance thermometer detectors and nine standard thermocouples type T into its chamber , the other one resistance thermometer detector use for ambient temperature measurement .
The calibration was done in according to WI-T20 (based on ASTM E145-94 (Reapproved 2001) and AS2853-1986) .
All data show below were final values and the initial data from customer request . The temperature scale used was based on ITS - 90 .

2. Reference Standard Instrument :

Instrument	Model	Instrument No.	Certificate No.	Due Date
RTD	100 ohm	27-CH1-10	T210004	30 December 2022
TC	TYPE T	TN261-TN270	T210010	30 December 2022
DATA LOGGER	34970A	T149	T210004	30 December 2022

3. This certificate is traceable to :

National Institute of Metrology (Thailand) through Metrological Center (NSC-TISI-TIS 17025 CALIBRATION 0244)

4. Condition of calibrated item : good

Equipment Description :

Time Constant : 1 Hour 49 Minute At 104 °C
Fresh Air Damper : ☒ Open ☐ Min ☐ Medium ☒ Max
☐ Close
☐ Not Available

5. Adjustment :

() without adjustment (X) after adjustment

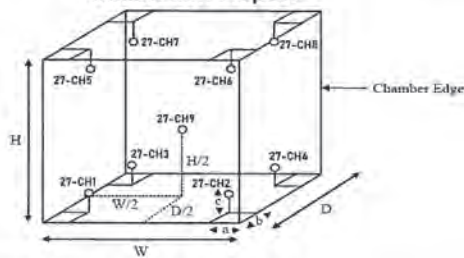
Approved By :

FM-L15117/15-05-63

Certificate No. T222502

Page 3 of 4

Calibration Report



Remark :

Internal Dimensions of Chamber : W (Width) = 104 cm., H (Height) = 72 cm. and D (Depth) = 60 cm.
Size of Installed Standard sensor number 27-CH1 to number 27-CH9 : a = 5 cm., b = 5 cm. and c = 5 cm.
Size of Installed Standard sensor number 27-CH9 : W/2 = 104 cm./2 , H/2 = 72 cm./2 and D/2 = 60cm./2

Measurement Results

Average Standard Reading at each position (°C)								
Calibration Point	27-CH1	27-CH2	27-CH3	27-CH4	27-CH5	27-CH6	27-CH7	27-CH8
104	101.07	103.80	103.45	104.62	104.47	103.57	104.39	101.75

Chamber (Oven)			Temperature Distribution				
Setting (°C)	Reading (°C)		Average (°C)	Stability (± °C)	Uniformity (°C)	Uncertainty (± °C)	Coverage
	Min ,Max	Average					Factor k
104.0	-	104.0	101.97	0.07	0.70	0.42	2.00

* The quoted uncertainty exclude "uniformity"

The calibration result apply only the above calibrated item.

The result of test was found accurate as shown on date and place of test only.

The reported expanded uncertainty is based on a standard uncertainty multiplied by a coverage factor k which for a t-distribution, providing a level of confidence of approximately 95 % .

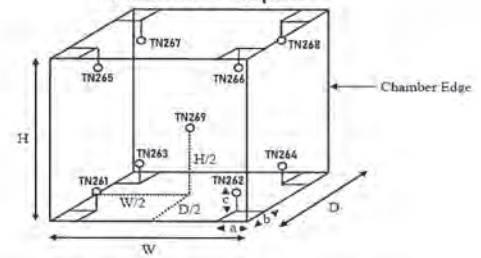
Approved By :

FM-L15117/15-05-63

Certificate No. T222502

Page 4 of 4

Calibration Report



Remark :

Internal Dimensions of Chamber : W (Width) = 104 cm., H (Height) = 72 cm. and D (Depth) = 60 cm.
Size of Installed Standard sensor number TN261 to number TN269 : a = 5 cm., b = 5 cm. and c = 5 cm.
Size of Installed Standard sensor number TN269 : W/2 = 104 cm./2 , H/2 = 72 cm./2 and D/2 = 60cm./2

Measurement Results

Average Standard Reading at each position (°C)								
Calibration Point	TN261	TN262	TN263	TN264	TN265	TN266	TN267	TN268
180	179.14	179.17	179.65	179.26	180.41	179.64	181.18	180.99

Chamber (Oven)			Temperature Distribution				
Setting (°C)	Reading (°C)		Average (°C)	Stability (± °C)	Uniformity (°C)	Uncertainty (± °C)	Coverage Factor k
	Min , Max	Average					
180.0	-	180.0	179.98	0.38	1.78	1.10	2.00

* The quoted uncertainty exclude "uniformity"

The calibration result apply only the above calibrated item.


The result of test was found accurate as shown on date and place of test only.

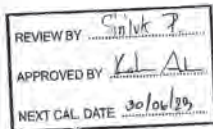
The reported expanded uncertainty is based on a standard uncertainty multiplied by a coverage factor k which for a t-distribution, providing a level of confidence of approximately 95 % .

Approved By :

FM-L15117/15-05-63

Certificate of Calibration

Equipment : Digestion Unit
 Manufacturer : SCP Science
 Model : DigiPRER HT
 Serial No. : HTC1120480658
 Customer Code : BKK_EN0366
 ID No. : T2635A5
 Customer : ALS Laboratory Group (Thailand) Co.,Ltd.
 194 Phatthakan 40, Phatthakan Rd., Khwaeng Phatthakanau,
 Khet Suan Luang, Bangkok 10250
 Customer Location : Wet Chemistry Lab 1
 Date of Receipt : 27 June 2022
 Calibrated By : Sujjar Naknakred (Site Calibration Manager)
 Approved By :  / Boonchai Suriyawong (Site Calibration Manager)
 Date of Issue : 04 JUL 2022



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

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

FM-L12 108/30-05-57

Calibration Report

Equipment : Digestion Unit
 Date of Calibration : 30 June 2022
 Environment : Temperature : 23.9 - 26.3 °C
 Line Voltage : 221.4 - 225.1 V
 Relative Humidity : 55 - 65 %RH

Condition of this results of calibration :

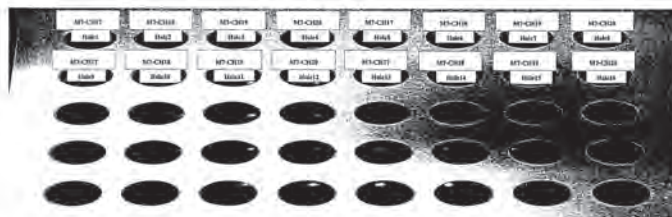
- This equipment was calibrated by insert four standard thermocouples type S into its chamber, the other one thermocouple type T use for ambient temperature measurement. The calibration was done in according to WI-T10.
- Reference Standard Instrument :

Instrument	Model	Instrument No.	Certificate No.	Due Date
TC	Type S	M7-(CH16-17,CH19-CH20)	T212004	15 October 2022
DATA LOGGER	34970A	T121	T212004	15 October 2022
- This certificate is traceable to :
 National Institute of Metrology (Thailand) through Metrological Center (NSC-TISI-TIS 17025 CALIBRATION 0244).
- Condition of calibrated item : good
 Equipment Description :
 Time Constant : - Hour 26 Minute At 380 °C
 Fresh Air Damper : ☐ Open ☐ Min ☐ Medium ☐ Max
☐ Close
☒ Not Available
- Adjustment :
 (X) without adjustment () after adjustment

Approved By. 

FM-L13 108/30-05-57

Calibration Report



FRONT

Measurement Results

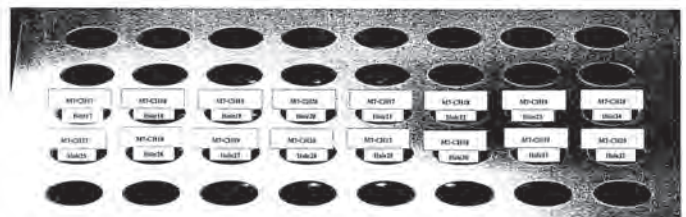
Cal. Point	Setting	Reading	STD.	Position of Standards at Block							
°C	°C	°C	Reading	Hole1	Hole2	Hole3	Hole4	Hole5	Hole6	Hole7	Hole8
				M7-CH17	M7-CH18	M7-CH19	M7-CH20	M7-CH17	M7-CH18	M7-CH19	M7-CH20
380.0	380.0	379.4 - 380.7	Max °C	379.1	379.4	379.3	377.4	377.6	379.3	379.6	377.9
			Min °C	378.7	379.4	378.9	377.0	377.3	378.8	379.1	377.3
			Average °C	378.9	379.6	379.1	377.2	377.4	379.1	379.3	377.6
			Stability ± °C	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.3

Cal. Point	Setting	Reading	STD.	Position of Standards at Block							
°C	°C	°C	Reading	Hole9	Hole10	Hole11	Hole12	Hole13	Hole14	Hole15	Hole16
				M7-CH17	M7-CH18	M7-CH19	M7-CH20	M7-CH17	M7-CH18	M7-CH19	M7-CH20
380.0	380.0	379.4 - 380.7	Max °C	378.5	378.8	378.1	379.0	380.3	381.6	381.0	379.5
			Min °C	377.8	378.2	377.6	378.6	379.9	381.2	380.5	378.9
			Average °C	378.2	378.5	377.9	378.8	380.1	381.4	380.7	379.2
			Stability ± °C	0.3	0.3	0.2	0.2	0.2	0.2	0.3	0.3

Approved By. 

FM-L13 108/30-05-57

Calibration Report



FRONT

Measurement Results

Cal. Point	Setting	Reading	STD.	Position of Standards at Block							
°C	°C	°C	Reading	Hole17	Hole18	Hole19	Hole20	Hole21	Hole22	Hole23	Hole24
				M7-CH17	M7-CH18	M7-CH19	M7-CH20	M7-CH17	M7-CH18	M7-CH19	M7-CH20
380.0	380.0	379.4 - 380.7	Max °C	378.4	378.8	378.0	379.2	379.0	382.0	381.5	380.3
			Min °C	377.8	378.2	377.7	378.8	378.7	381.5	381.1	379.8
			Average °C	378.1	378.5	377.9	379.0	378.9	381.8	381.3	379.9
			Stability ± °C	0.3	0.3	0.2	0.2	0.2	0.2	0.3	0.4

Cal. Point	Setting	Reading	STD.	Position of Standards at Block							
°C	°C	°C	Reading	Hole25	Hole26	Hole27	Hole28	Hole29	Hole30	Hole31	Hole32
				M7-CH17	M7-CH18	M7-CH19	M7-CH20	M7-CH17	M7-CH18	M7-CH19	M7-CH20
380.0	380.0	379.4 - 380.7	Max °C	378.5	378.7	378.4	378.8	379.6	382.6	382.0	380.8
			Min °C	377.8	378.3	377.9	378.4	379.3	382.2	381.4	380.0
			Average °C	378.8	378.5	378.1	378.6	379.5	382.4	381.7	380.4
			Stability ± °C	0.3	0.2	0.2	0.2	0.2	0.2	0.3	0.4

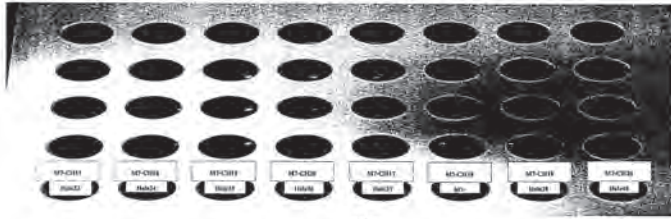
Approved By. 

FM-L13 108/30-05-57

Certificate No. T221642

Page 5 of 5

Calibration Report



FRONT

Measurement Results

Cal. Point	Setting	Reading	STD.	Position of Standards at Block							
$^{\circ}\text{C}$	$^{\circ}\text{C}$	$^{\circ}\text{C}$	Reading	Hole33	Hole34	Hole35	Hole36	Hole37	Hole38	Hole39	Hole40
				M7-CH17	M7-CH18	M7-CH19	M7-CH20	M7-CH17	M7-CH18	M7-CH19	M7-CH20
			Max $^{\circ}\text{C}$	376.6	376.7	377.2	376.0	380.0	382.2	381.5	379.7
			Min $^{\circ}\text{C}$	376.1	376.2	376.7	377.5	379.5	381.7	380.9	378.1
			Average $^{\circ}\text{C}$	376.3	376.5	377.0	377.7	379.8	381.9	381.2	379.4
			Stability $\pm ^{\circ}\text{C}$	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3

The expanded uncertainty of temperature measurement was $\pm 2.49 ^{\circ}\text{C}$

The calibration result apply only the above calibrated item.

The result of test was found accurate as shown on date and place of test only.

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

Approved By:

FM-L13 108/30-05-57

Maintenance Plan YEAR : 2023

เดือน	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
10M	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Periodical maintenance check list for Konelab

	6M	12M	Note
1.Diluent-wash tubing change	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
2.ISE tubing change	<input checked="" type="checkbox"/>	<input type="checkbox"/>	None
3.Syringe check/change	<input type="checkbox"/>	<input type="checkbox"/>	
4.Dispensing check/ change	<input type="checkbox"/>	<input type="checkbox"/>	
5.Waste tubing change when necessary	<input type="checkbox"/>	<input type="checkbox"/>	
6.Lamp check/change	<input type="checkbox"/>	<input type="checkbox"/>	
7.Mixer paddle/paddle change(not Konelab20)	<input type="checkbox"/>	<input type="checkbox"/>	
8.ISE needles check/change	<input type="checkbox"/>	<input type="checkbox"/>	
9.Pump tubing check/ change	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
10.Broken/worn out part check /change	<input type="checkbox"/>	<input type="checkbox"/>	
11.Peristaltic pump check /cleaning/ lubrication	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
12.Heating check	<input type="checkbox"/>	<input type="checkbox"/>	
13.Cooling check	<input type="checkbox"/>	<input type="checkbox"/>	
14.Dispenser mechanic check/adjustment	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
15.Cuvette transfer mechanic check/adjustment	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
16.Dispenser movement check/adjustment	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
17.Sample/reagent register check/adjustment	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
18.Dispensing tubing tightness check	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
19.Photometer and optics cleaning/check/adjustment	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
20.Workstation PC cleaning if necessary	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
21.Mechanic cleaning/lubrication	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
22.Instrument cleaning if necessary	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
23.Complete analyzer testing with waterblank/QC or sample	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
24.Test parameters/Adjustment/config. Save to USB key	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
25.UPS Test	<input checked="" type="checkbox"/>	<input type="checkbox"/>	

Place: Als Laboratory Instrument: Konelab 350

Date/Time: 05-01-2023 Serial no: 09981

Service done by: Mr. Nattapat Rungueang Install date:

Signature of customer: Mr. Nattapat Rungueang Date/Time:



Certificate of Calibration

Equipment: CONDUCTIVITY METER Certificate No.: C24230001
 Model: DRION STAR A215 Issued Date: 5 January 2023
 Serial No. (or ID.): X58031 Job No.: KSPR2216356
 Manufacturer: Thermo Scientific Page: 1 of 2
 Electrode Serial No: YV1-16416 Model: DRION 013006MD Brand: Thermo Scientific
 Condition: In Condition

Customer: ALS Laboratory Group (Thailand) Co., Ltd.
 104 Soi Pattanakarn 40, Pattanakarn Rd.,
 Suan Luang, Bangkok 10250 Thailand

Environment Condition: Temperature 21.8 $^{\circ}\text{C}$ \pm 0.2 $^{\circ}\text{C}$
 Humidity 58.0 %RH \pm 2.0 %RH

Calibration Place: ALS Laboratory Group (Thailand) Co., Ltd. (Wet Chemistry Lab 2)
 104 Soi Pattanakarn 40, Pattanakarn Rd.,
 Suan Luang, Bangkok 10250 Thailand

Calibration By: Mr.Nattapat Rungueang
 Calibration Date: 3 January 2023
 The Method used: In house method, CAL-WH49, base on ASTM D 1125-14 and D 5391-14

Traceability: This certificate is traceable to the SI Units maintained by CRM of NIST(SRM) through CPA chem Co., Ltd. (ISO/IEC 17034) Certificate No. 838317, 838313, 838315

(Mr. Nattapat Rungueang)
 Person in charge

(Mr. Nitin Srihawan)
 Authorized signatory

This certificate is issued to the units of measurement according to the International System of Units (SI). It provides traceability of measurement to international or national standard or other recognized national standard laboratories.

The measurement uncertainty stated in the expanded uncertainty which is obtained from the standard uncertainty multiplied by the coverage factor ($k=2$) to provide a level of confidence of approximately 95%. It is determined in accordance with the Guide to Expression of Uncertainty in Measurement (GUM).

These results may be affected by deviations from specified conditions. The results relate only to the items tested, calibrated or sampled. The report shall not be reproduced except in full without approval of DKSH Technology Limited.

DKSH Technology Limited
 2533 Sukhumvit Road, Bangkok, Phrakhanong, Bangkok 10260
 Phone: +66 2037 7000 Email: info.calibration@dksh.com Website: www.dksh.com/calibration-thailand

Delivering Growth - In Asia and Beyond.

CAL-FM-C24-09: 12 Sep 2022

Certificate No.: C24230001

Page: 2 of 2

Calibration Results:

Before Adjustment

Standard	Unit Under Calibration	Correction	Coverage Factor	Uncertainty (\pm)
Conductivity Solution	Reading		(k)	
84.000 $\mu\text{S/cm}$	102.4 $\mu\text{S/cm}$	-18.400 $\mu\text{S/cm}$	2.00	0.69 $\mu\text{S/cm}$
1413.0 $\mu\text{S/cm}$	1689 $\mu\text{S/cm}$	-276.0 $\mu\text{S/cm}$	2.00	11 $\mu\text{S/cm}$
12.881 mS/cm	15.42 mS/cm	-2.5390 mS/cm	2.00	0.098 mS/cm

After Adjustment ; at 84.0 $\mu\text{S/cm}$, 1413 $\mu\text{S/cm}$, 12.88 mS/cm

Standard	Unit Under Calibration	Correction	Coverage Factor	Uncertainty (\pm)
Conductivity Solution	Reading		(k)	
84.000 $\mu\text{S/cm}$	84.09 $\mu\text{S/cm}$	-0.090 $\mu\text{S/cm}$	2.00	0.66 $\mu\text{S/cm}$
1413.0 $\mu\text{S/cm}$	1413 $\mu\text{S/cm}$	0.0 $\mu\text{S/cm}$	2.00	11 $\mu\text{S/cm}$
12.881 mS/cm	12.89 mS/cm	-0.0090 mS/cm	2.00	0.098 mS/cm

The End of Certificate

DKSH Technology Limited
 2533 Sukhumvit Road, Bangkok, Phrakhanong, Bangkok 10260
 Phone: +66 2037 7000 Email: info.calibration@dksh.com Website: www.dksh.com/calibration-thailand

Delivering Growth - In Asia and Beyond.

CAL-FM-C24-09: 12 Sep 2022

ใบตรวจสอบสภาพเครื่องวัดสิ่งแวดล้อม

เลขที่ใบงาน: KSPR2216356

ชนิดเครื่องมือ: CONDUCTIVITY METER

รุ่น: ORION STAR A215

หมายเลขเครื่อง: X58031

ตรวจสอบ (รับ)		รายการตรวจเช็ค	ตรวจสอบ (ส่ง)		หมายเหตุ
03 Jan 2023			03 Jan 2023		
ปกติ	ไม่ปกติ		ปกติ	ไม่ปกติ	
		General			
<input checked="" type="checkbox"/>	<input type="checkbox"/>	1. ความสมบูรณ์เครื่อง	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	2. ความสะอาด (ช่องใส่ตัวอย่าง, ภายใน-นอกเครื่อง)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	3. สวิตช์ เปิด – ปิด เครื่อง (On-Off Switch)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	4. ปุ่มกด (Keypad)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	5. หน้าจอ (Display, Screen Contrast)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
		Spectrophotometer			
<input type="checkbox"/>	<input type="checkbox"/>	6. แบตเตอรี่ไฟฟ้า (Battery Backup) >= 2.5 VDC	<input type="checkbox"/>	<input type="checkbox"/>	
<input type="checkbox"/>	<input type="checkbox"/>	7. ตัวควบคุมความยาวคลื่น (Wavelength Control)	<input type="checkbox"/>	<input type="checkbox"/>	
<input type="checkbox"/>	<input type="checkbox"/>	8. ความยาวคลื่น (Wavelength Check)	<input type="checkbox"/>	<input type="checkbox"/>	
<input type="checkbox"/>	<input type="checkbox"/>	9. แสงฟาร์อัลตราไวโอเล็ต (UV < 3,000 hour)	<input type="checkbox"/>	<input type="checkbox"/>	
<input type="checkbox"/>	<input type="checkbox"/>	10. แสงที่มองเห็นแสง (Visible < 5,000 hour)	<input type="checkbox"/>	<input type="checkbox"/>	
<input type="checkbox"/>	<input type="checkbox"/>	11. ช่องวัดหลายตัวอย่าง (Carousel Module)	<input type="checkbox"/>	<input type="checkbox"/>	
		pH Meter and Conductivity Meter			
<input checked="" type="checkbox"/>	<input type="checkbox"/>	12. อิเล็กโทรด (Electrode and Connection Cable)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input type="checkbox"/>	<input type="checkbox"/>	13. ระดับสารละลายใน Electrode (Level KCl)	<input type="checkbox"/>	<input type="checkbox"/>	
<input type="checkbox"/>	<input type="checkbox"/>	14. ฝาปิดกันปลาย Electrode (Dust Protection Hood)	<input type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	15. ขาจับอิเล็กโทรด (Stand)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
		Turbidimeter			
<input type="checkbox"/>	<input type="checkbox"/>	16. ค่าความขุ่นที่ต่ำสุด (No Sample)	<input type="checkbox"/>	<input type="checkbox"/>	
<input type="checkbox"/>	<input type="checkbox"/>	17. ระดับการส่องสว่างของแสง (>= 2.5 ไม่นเกิน 3.0)	<input type="checkbox"/>	<input type="checkbox"/>	
		Automatic titrator			
<input type="checkbox"/>	<input type="checkbox"/>	18. สภาพ Piston Bureties	<input type="checkbox"/>	<input type="checkbox"/>	
<input type="checkbox"/>	<input type="checkbox"/>	19. Function Rinsing and Dosing	<input type="checkbox"/>	<input type="checkbox"/>	
<input type="checkbox"/>	<input type="checkbox"/>	20. ระบบท่อสายยางและอุปกรณ์ประกอบ	<input type="checkbox"/>	<input type="checkbox"/>	

ขอแนะนำ:

Mr.Nattapat Rungruang
Service Engineer

Unit: Business Development
DKSH Technology Limited
2533 Sukhumvit Road, Bangkok, Thailand 10260
Phone: +66 2039 7000 Email: info@dksh.com Website: www.dksh.com

Delivering Growth - In Asia and Beyond.

CAL-FM-R31-03: 20 Jul 2022



Certificate of Calibration

Equipment: CONDUCTIVITY METER Certificate No.: C24230001
Model: ORION STAR A215 Issued Date: 5 January 2023
Serial No. (or ID.): X58031 Job No.: KSPR2216356
Manufacturer: Thermo Scientific Page: 1 of 2
Electrode Serial No. YV1-18416 Model: ORION 013005MD Brand: Thermo Scientific
Condition: In Condition

Customer: ALS Laboratory Group (Thailand) Co., Ltd.
104 Soi Pattanakam 40, Pattanakam Rd.,
Suan Luang, Bangkok 10250 Thailand

Environment Condition: Temperature 21.6 °C \pm 0.2 °C
Humidity 58.0 %RH \pm 2.0 %RH

Calibration Place: ALS Laboratory Group (Thailand) Co., Ltd. (Wet Chemistry Lab 2)
104 Soi Pattanakam 40, Pattanakam Rd.,
Suan Luang, Bangkok 10250 Thailand

Calibration By: Mr.Nattapat Rungruang

Calibration Date: 3 January 2023

The Method used: In house method, CAL-WI-49, base on ASTM D 1125-14 and D 5391-14

Traceability: This certificate is traceable to the SI Units maintained by CRM of NIST(SRM) through
CPA Chem Co., Ltd. (ISO/IEC 17034) Certificate No. 638317, 638313, 638315

(Mr. Nattapat Rungruang)
Person in charge

(Mr. Nitinun Srihawan)
Authorized signatory

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

Unit: Business Development
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Delivering Growth - In Asia and Beyond.

CAL-FM-C24-09: 12 Sep 2022

Certificate No.: C24230001

Page: 2 of 2

Calibration Results:

Before Adjustment

Standard	Unit Under Calibration	Correction	Coverage Factor	Uncertainty (\pm)
Conductivity Solution	Reading		(k)	
84.000 μ S/cm	102.4 μ S/cm	-18.400 μ S/cm	2.00	0.69 μ S/cm
1413.0 μ S/cm	1689 μ S/cm	-276.0 μ S/cm	2.00	11 μ S/cm
12.881 mS/cm	15.42 mS/cm	-2.5396 mS/cm	2.00	0.098 mS/cm

After Adjustment; at 84.0 μ S/cm, 1413 μ S/cm, 12.88 mS/cm

Standard	Unit Under Calibration	Correction	Coverage Factor	Uncertainty (\pm)
Conductivity Solution	Reading		(k)	
84.000 μ S/cm	84.09 μ S/cm	-0.090 μ S/cm	2.00	0.68 μ S/cm
1413.0 μ S/cm	1413 μ S/cm	0.0 μ S/cm	2.00	11 μ S/cm
12.881 mS/cm	12.89 mS/cm	-0.0080 mS/cm	2.00	0.098 mS/cm

The End of Certificate

Unit: Business Development
DKSH Technology Limited
2533 Sukhumvit Road, Bangkok, Thailand 10260
Phone: +66 2039 7000 Email: info@dksh.com Website: www.dksh.com

Delivering Growth - In Asia and Beyond.

CAL-FM-R31-03: 20 Jul 2022

ใบตรวจสอบสภาพเครื่องวัดสิ่งแวดล้อม

เลขที่ใบงาน: KSPR2216356

ชนิดเครื่องมือ: CONDUCTIVITY METER

รุ่น: ORION STAR A215

หมายเลขเครื่อง: X58031

ตรวจสอบ (รับ)		รายการตรวจเช็ค	ตรวจสอบ (ส่ง)		หมายเหตุ
03 Jan 2023			03 Jan 2023		
ปกติ	ไม่ปกติ		ปกติ	ไม่ปกติ	
		General			
<input checked="" type="checkbox"/>	<input type="checkbox"/>	1. ความสมบูรณ์เครื่อง	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	2. ความสะอาด (ช่องใส่ตัวอย่าง, ภายใน-นอกเครื่อง)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	3. สวิตช์ ปิด - เปิด เครื่อง (On-Off Switch)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	4. ปุ่มกด (Keypad)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	5. หน้าจอ (Display, Screen Contrast)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
		Spectrophotometer			
<input type="checkbox"/>	<input type="checkbox"/>	6. แบตเตอรี่สำรอง (Battery Backup) >= 2.5 VDC	<input type="checkbox"/>	<input type="checkbox"/>	
<input type="checkbox"/>	<input type="checkbox"/>	7. ตัวควบคุมความยาวคลื่น (Wavelength Control)	<input type="checkbox"/>	<input type="checkbox"/>	
<input type="checkbox"/>	<input type="checkbox"/>	8. ความยาวคลื่น (Wavelength Check)	<input type="checkbox"/>	<input type="checkbox"/>	
<input type="checkbox"/>	<input type="checkbox"/>	9. แสงอัลตราไวโอเล็ต (UV < 3,000 hour)	<input type="checkbox"/>	<input type="checkbox"/>	
<input type="checkbox"/>	<input type="checkbox"/>	10. แสงที่มองเห็น (Visible < 5,000 hour)	<input type="checkbox"/>	<input type="checkbox"/>	
<input type="checkbox"/>	<input type="checkbox"/>	11. ช่องวัดหลายตัวอย่าง (Carousel Module)	<input type="checkbox"/>	<input type="checkbox"/>	
		pH Meter and Conductivity Meter			
<input checked="" type="checkbox"/>	<input type="checkbox"/>	12. อิเล็กโทรด (Electrode and Connection Cable)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input type="checkbox"/>	<input type="checkbox"/>	13. ระดับสารละลายใน Electrode (Level KCl)	<input type="checkbox"/>	<input type="checkbox"/>	
<input type="checkbox"/>	<input type="checkbox"/>	14. ฝาปิดกันปลาย Electrode (Dust Protection Hood)	<input type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	15. ขาจับอิเล็กโทรด (Stand)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
		Turbidimeter			
<input type="checkbox"/>	<input type="checkbox"/>	16. ค่าความขุ่นที่ต่ำสุด (No Sample)	<input type="checkbox"/>	<input type="checkbox"/>	
<input type="checkbox"/>	<input type="checkbox"/>	17. ระดับการส่องสว่างของแสง (>= 2.5 ไม่นเกิน 3.0)	<input type="checkbox"/>	<input type="checkbox"/>	
		Automatic titrator			
<input type="checkbox"/>	<input type="checkbox"/>	18. สภาพ Piston Burettes	<input type="checkbox"/>	<input type="checkbox"/>	
<input type="checkbox"/>	<input type="checkbox"/>	19. Function Rinsing and Dosing	<input type="checkbox"/>	<input type="checkbox"/>	
<input type="checkbox"/>	<input type="checkbox"/>	20. ระบบท่อสายยางและอุปกรณ์ประกอบ	<input type="checkbox"/>	<input type="checkbox"/>	

ขอแนะนำ:

Mr.Nattapat Rungruang
Service Engineer

Unit: Business Development
DKSH Technology Limited
2533 Sukhumvit Road, Bangkok, Thailand 10260
Phone: +66 2039 7000 Email: info@dksh.com Website: www.dksh.com

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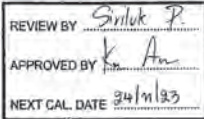
CAL-FM-R31-03: 20 Jul 2022



Cert.No.: 22TW122
Page.: 1 of 2

Certificate of Testing

Equipment : DO Meter
Manufacturer : YSI
Model : 5000-230V
Serial No. : 09J101147
ID No. : BKK_EN0017
Received Date : 20 May 2022
Test Date : 24 May 2022
Reference : 2205-0638DSC-8
Submitted by : ALS Laboratory Group (Thailand) Co.,Ltd.
104 Phatthanakan 40, Phatthanakan Rd.,
Khwaeng Phatthanakan, Khet Suan Luang,
Bangkok 10250 Thailand
Laboratory Condition : Temperature (25 ± 5) °C
Humidity (50 ± 20) %
Test Procedure : In - house method : CP-CH9
by Comparison Technique with Azide Modification Method
Tested by : Warakorn Lemgagrakul
Approved by :
Approved Signatory
(/) Malee Butkruea
(/) Sathig Meangmai
(/) Warakorn Lemgagrakul
Issue Date : 31 May 2022



B 0285244



Cert.No.: 22TW122
Page.: 2 of 2

Condition of this result of calibration

1. Reference Standard Instruments ;
This certification is traceable to the International System of Unit through the reference standards laboratory of Industrial Calibration Center, Technology Promotion Association (Thailand-Japan).

Instruments	Serial No.	ID No.	Certificate No.	Due Date
1) Burette	-	130BU10	21CG1389	25 Mar 2023
2) Balance	1126143754	140RC004	21MM430	21 Sep 2022

2. Standard Material :-

Material	Manufacturer	Lot.No.	Assay
Sodium Thiosulfate pentahydrate	Merck	AM1763316	100.2%

Result : Dissolved Oxygen Meter Adjustment With Air 100 %

Dissolved Oxygen Probe No.: 16K100498

Titration Method (Azide Modification Method) (mg/L)	DO Meter Reading (mg/L)	Standard Deviation (mg/L)
8.12	8.13	0.015

This report was certified only for the instrument we tested. It is allowable to use for study the system efficiency, The environmental impact control and present to organization if may concerned intend to use for advertising and referral purpose is prohibited. This report may not be reproduced other in full, without written approval of the laboratory.

-080-

a 1110482



Cert. No.: 22LM83
Page.: 1 of 2

Certificate of Calibration

Equipment : DO Meter with Sensor
Manufacturer : YSI
Model : 5000-230V
Serial No. : 09J 101147
ID No. : BKK_EN0017
Submitted by : ALS Laboratory Group (Thailand) Co.,Ltd.
104 Phatthanakan 40, Phatthanakan Rd.,
Khwaeng Phatthanakan, Khet Suan Luang,
Bangkok 10250 Thailand
Location : TPA On Site Calibration Laboratory
Received Order : 20 May 2022
Calibrated Date : 30 May 2022
Ambient Temperature : (26 ± 10) °C
Relative Humidity : (50 ± 30) %
AC Line Voltage : (220 ± 22) V
Calibrated by : Tawatchai Pana
Approved by :
Approved Signatory
(/) Pormthippa Tameysakul
(/) Malee Butkruea
(/) Suwit Imjai
Issue Date : 31 May 2022

The Uncertainties are for a confidence probability of approximately 95%

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

A 0039957



Equipment : DO Meter with Sensor
Condition As-Received : Used Item
Reference : 2205-0638DSC-10
Cert. No.: 22LM83
Page.: 2 of 2

Procedure Used :-

Calibration were conducted using in-house calibration procedure CP-QT01 according to comparison with Industrial Platinum Resistance Thermometer (IPRT) into Temperature Bath.

The temperature scale used was based on ITS-90.

Condition of this result of calibration

1. Reference standard instrument:-

Instrument	Model	Serial No.	Cert. No.	Due Date
1) Digital Thermometer	1502A	A09204	2218	04 Jan 2023

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 : Temperature measurement.

This instrument was connected with thermistor sensor, ID No.: 16K100498

Calibration Point (°C)	Immersion Depth (mm)	Standard Temperature (°C)	UUC* Reading (°C)	Error (°C)	Uncertainty (± °C)	Coverage Factor k
20.00	60	20.003	20.01	0.007	0.15	2.00

UUC* : Unit Under Calibration

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

-080-

a 1090806



Metrological Center

SCI ECO Services Company Limited

33/2 Moo 3, T.Banpa, A.Kaengkhoh, Saraburi 18110, Thailand.

Saraburi Tel : +66 3627 3096 Fax : +66 3627 3100

Bangkok Tel : +668 9205 8851 , +669 8247 2360

Website : www.scieco.co.th

E-Mail : calibrate@scg.com



Certificate No. T230682

Page 1 of 4

Certificate of Calibration

Equipment : Chamber (Incubator)

Manufacturer : MEMMERT

Model : ICP 750

Serial No. : F819.0021

Customer Code : BKK_EN0304

ID No. : T9572A4

Customer : ALS Laboratory Group (Thailand) Co.,Ltd.

104 Phatthanakan 40, Phatthanakan Rd., Khwaeng Phatthanakan,

Khet Suan Luang, Bangkok 10250

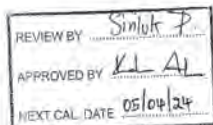
Customer Location : Wet Chemistry Lab 2

Date of Receipt : 30 March 2023

Calibrated By : Sujjar Naknakred (Site Calibration Manager)

Approved By : Sujjar Naknakred / Boonchai Suriyawong (Assistant Calibration Manager)

Date of Issue : 10 APR 2023



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

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

FM-L15117/15-05-64



Metrological Center

SCI ECO Services Company Limited

33/2 Moo 3, T.Banpa, A.Kaengkhoh, Saraburi 18110, Thailand.



Certificate No. T230682

Calibration Report

Page 2 of 4

Equipment : Chamber (Incubator)

Date of Calibration : 5 April 2023

(Finished Time 4:30 PM)

Environment : Temperature 22.9-28.6 °C

Line Voltage 221.7-225.5 V

Condition of this results of test :

1. This instrument was calibrated by insert 12 standard resistance thermometer into its chamber and test according to WI-T20 (based on ASTM E145-94 (Reapproved 2001) and AS2853-1986.)

All data show below were final values and the initial data may be obtained upon request.

The temperature scale used was based on ITS - 90.

2. Reference Standard Instrument :

Instrument	Model	Instrument No.	Certificate No.	Due Date
RTD	100 ohm	37-(CH1-10)	T222493	28 November 2023
RTD	100 ohm	36-(CH1-10)	T222493	28 November 2023
DATA LOGGER	34970A	T193	T222493	28 November 2023

3. This certificate is traceable to :

National Institute of Metrology (Thailand) through Metrological Center (NSC-TISI-TIS 17025 CALIBRATION 0244.)

4. Condition of calibrated item : good

UUC Description :

Time Constant	1 Hour	37 Minute	At 20 °C
Fresh Air Damper	<input type="checkbox"/> Open <input type="checkbox"/> Min <input type="checkbox"/> Medium <input type="checkbox"/> Max		
	<input type="checkbox"/> Close		
	<input checked="" type="checkbox"/> Not Available		

5. Result of test :

() without adjustment

(X) after adjustment

Approved By: Sujjar Naknakred

FM-L15117/15-05-64



Metrological Center

SCI ECO Services Company Limited

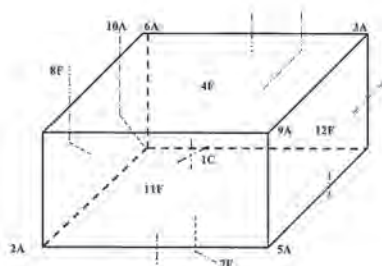
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Certificate No T230682

Calibration Report

Page 3 of 4





Metrological Center

SCI ECO Services Company Limited

33/2 Moo 3, T.Banpa, A.Kaengkhoh, Saraburi 18110

Telephone : +66 2 586 5792-4 Fax : +66 2 586 5109

Website : www.scieco.co.th E-Mail : calibrate@scg.co.th

Certificate No. T230352

Page 1 of 5

Certificate of Calibration

Equipment : HOT BLOCK

Manufacturer : Environmental Express

Model : B3000-240

Serial No. : 2017CODW116

Customer Code : BKK_EN0222

ID No. : T6769A4

Customer : ALS Laboratory Group (Thailand) Co.,Ltd.

104 Phatthanakan 40, Phatthanakan Rd., Khwaeng Phatthanakan,

Khet Suan Luang, Bangkok 10250

Customer Location : Wet Chemistry Lab2

Date of Receipt : 21 February 2023

Calibrated By : Watcharasak Puttarat (Technician)

Approved By : [Signature] / Boonchai Suriyawong (Site Calibration Manager)

Date of Issue : 20 MAR 2023

REVIEW BY [Signature]
APPROVED BY [Signature]
NEXT CAL. DATE 01/09/2024

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

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

FM-L12 08/20-05-57



Metrological Center

SCI ECO Services Company Limited

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Telephone : +66 2 586 5792-4 Fax : +66 2 586 5109

Website : www.scieco.co.th E-Mail : calibrate@scg.co.th

Certificate No. T230352

Page 2 of 5

Calibration Report

Equipment : HOT BLOCK

Date of Calibration : 1 March 2023

Environment : Temperature : 22.9-24.4 °C

Line Voltage : 222.7-227.8 V

Relative Humidity : 55 - 65 %RH

Condition of this results of calibration :

1. This equipment was calibrated by insert 20 standard thermocouples type T into its chamber, the other one standard thermocouples type T use for ambient temperature measurement. The calibration was done in according to WI-T20. All data show below were final values and the initial data from customer request. The temperature scale used was based on ITS - 90.

2. Reference Standard Instrument :

Instrument	Model	Instrument No.	Certificate No.	Due Date
TC	TYPE T	TN121-TN130	T222122	5 October 2023
TC	TYPE T	TN131-TN140	T222122	5 October 2023
DATA LOGGER	34970A	T150	T222122	5 October 2023

3. This certificate is traceable to :

National Institute of Metrology (Thailand) through Metrological Center (NSC-TISI-TIS 17025 CALIBRATION 0244)

4. Condition of calibrated item : good

Equipment Description :

Time Constant : 2 Hour 22 Minute At : 150 °C
Fresh Air Damper : ☐ Open ☐ Min ☐ Medium ☐ Max
☐ Close
☒ Not Available

5. Adjustment :

(X) without adjustment () after adjustment

Approved By : [Signature]

FM-L13 08/20-05-57



Metrological Center

SCI ECO Services Company Limited

33/2 Moo 3, T.Banpa, A.Kaengkhoh, Saraburi 18110

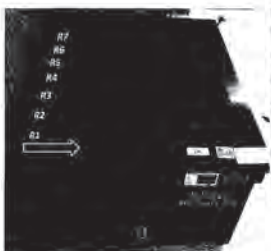
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Certificate No. T230352

Page 3 of 5

Calibration Report



H1 : STANDARD THERMOCOUPLE TYPE T

H1	=	TN121	H9	=	TN129	H17	=	TN137	H25	=	TN125	H33	=	TN133	H41	=	TN121	H49	=	TN129
H2	=	TN122	H10	=	TN130	H18	=	TN138	H26	=	TN126	H34	=	TN134	H42	=	TN122	H50	=	TN130
H3	=	TN123	H11	=	TN131	H19	=	TN139	H27	=	TN127	H35	=	TN135	H43	=	TN123	H51	=	TN131
H4	=	TN124	H12	=	TN132	H20	=	TN140	H28	=	TN128	H36	=	TN136	H44	=	TN124	H52	=	TN132
H5	=	TN125	H13	=	TN133	H21	=	TN121	H29	=	TN129	H37	=	TN137	H45	=	TN125	H53	=	TN133
H6	=	TN126	H14	=	TN134	H22	=	TN122	H30	=	TN130	H38	=	TN138	H46	=	TN126	H54	=	TN134
H7	=	TN127	H15	=	TN135	H23	=	TN123	H31	=	TN131	H39	=	TN139	H47	=	TN127	H55	=	TN135
H8	=	TN128	H16	=	TN136	H24	=	TN124	H32	=	TN132	H40	=	TN140	H48	=	TN128	H56	=	TN136

Approved By : [Signature]

FM-L13 08/20-05-57



Metrological Center

SCI ECO Services Company Limited

33/2 Moo 3, T.Banpa, A.Kaengkhoh, Saraburi 18110

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Certificate No. T230352

Page 4 of 5

Calibration Report

Measurement Results

Calibration Point		Average Standard Reading at each position (°C)																	
		TN121	TN122	TN123	TN124	TN125	TN126	TN127	TN128	TN129	TN130	TN131	TN132	TN133	TN134	TN135	TN136	TN137	TN138
150	Setting	Max	152.61	150.49	150.10	148.27	149.85	151.19	149.99	149.29	149.97	150.03							
	Min	152.15	149.87	149.73	147.73	149.26	150.78	149.49	148.56	149.15	149.15								
	Average	152.41	150.22	149.90	147.99	149.48	150.92	149.71	148.92	149.51	149.67								
	Setting	Max	149.84	148.34	148.34	149.88	152.39	149.73	149.66	149.16	149.76	151.18							
	Min	149.35	147.85	148.40	148.94	152.39	149.19	148.83	148.69	149.51	150.92								
	Average	149.67	148.10	148.39	149.35	152.39	149.36	149.25	148.96	149.64	151.05								
	Setting	Max	152.91	150.56	149.20	148.63	149.78	151.28	150.09	148.83	148.16	148.33							
	Min	152.72	150.04	148.59	147.96	149.42	150.96	149.83	148.20	147.62	147.29								
	Average	152.80	150.29	148.89	148.30	149.60	151.08	149.97	148.52	147.90	147.80								
	Setting	Max	148.81	148.04	148.56	148.11	149.07	149.06	148.58	149.85	149.07	150.89							
	Min	148.08	147.63	148.07	147.63	148.61	148.62	148.18	149.60	148.86	150.63								
	Average	148.45	147.84	148.35	147.81	148.94	148.84	148.37	149.74	148.96	150.78								
	Setting	Max	150.76	152.63	151.14	150.47	151.07	150.93	149.35	150.31	149.28	149.81							
	Min	150.59	152.40	150.69	150.17	150.77	150.54	148.80	149.93	148.84	149.23								
	Average	150.69	152.52	150.95	150.35	150.94	150.75	149.18	150.10	149.84	149.56								
	Setting	Max	150.97	150.34	151.70	149.10	151.13	150.74											
	Min	150.77	149.94	151.36	148.83	152.91	150.61												
	Average	150.87	150.13	151.53	148.97	153.05	150.66												

Approved By : [Signature]

FM-L13 08/20-05-57

Certificate No. T230352

Page 5 of 5

Calibration Report

Measurement Results

HOT BLOCK			Temperature Distribution	
Setting (°C)	Reading (°C)		Stability (± °C)	Uncertainty (± °C)
	Min	Max		
150.0	150.1	150.0	0.60	1.01

The calibration result apply only the above calibrated item.

The result of test was found accurate as shown on date and place of test only.

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

Approved By


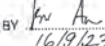


FM-L13 (08/09-05-5)

Certificate of Calibration

Number of Page(s) 1 of 3

Certificate No. BSCC-UV-307/22
Equipment UV-Vis Spectrophotometer
Model UV-1800
Manufacturer Shimadzu
Serial No. A11454908533CD
ID No. BKK_EN0018
Date of receipt 16 September 2022
Date of calibration 16 September 2022
Date of issue 23 September 2022

REVIEW BY 
APPROVED BY 
NEXT CAL DATE 23/09/23

Customer name ALS Laboratory Group (Thailand) Co., Ltd.

Address 104 Soi Phatthanakan 40, Phatthanakan Road, Phatthanakan, Suan Luang, Bangkok 10250

Temperature (22.1-23.3) °C (On site)
Humidity (58.8-63.2) %RH (On site)

Equipment condition Good Operation

Calibration Location Organic Prep

Calibration Procedure In-house method W-UV-702-01 based on ASTM E275-01

Traceability Wavelength Accuracy is traceable to certificate No. 85917 and 95918
Photometric Accuracy is traceable to certificate No. 95924 and 95937
Stray Light is traceable to certificate No. 95908
The above certificate are traceable to SI unit through Sigma Scientific Ltd.
(UKAS accredited calibration laboratory NO. 0659)

Calibrated By Mr.Wanath.Lanphung

Approved By



Mr.Kanchit Choothep
Technical Manager

The above results are valid exclusively for the calibrated item(s) as mention in this report / certificate.
Advertising the report / Certificate and publicity of the results are prohibited and also shall not be reproduced
except in full, without written approval of the Bara Scientific Co., Ltd.

FM-UV-708-02 Rev 01 (23/01/63)

Certificate of Calibration

Certificate No. BSCC-UV-307/22

Number of Page(s) 2 of 3

Calibration Results:

1.Wavelength Accuracy

Certified Wavelength (nm)	UUC (nm)	Error (nm)	Uncertainty (±nm)
241.70	241.65	-0.05	0.18
334.02	333.92	-0.10	0.18
418.53	418.46	-0.07	0.18
572.99	572.86	-0.03	0.18
879.41	879.17	-0.24	0.18

2.Photometric Accuracy (UV)

Wavelength (nm)	Certified Absorbance (A)	UUC (A)	Error (A)	Uncertainty (±A)
235	0.0000	0.0000	0.0000	0.0075
	0.7467	0.7461	-0.0006	0.0075
257	0.0000	0.0000	0.0000	0.0075
	0.8662	0.8647	-0.0015	0.0075
313	0.0000	0.0000	0.0000	0.0075
	0.2904	0.2911	0.0007	0.0075
350	0.0000	0.0000	0.0000	0.0075
	0.8429	0.8426	-0.0003	0.0075

*CNR = Customer not request

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FM-L13 (08/09-05-5)

Certificate of Calibration

Certificate No. BSCC-UV-307/22

Number of Page(s) 3 of 3

Calibration Results:

3.Photometric Accuracy (Visible)

Wavelength (nm)	Certified Absorbance (A)	UUC (A)	Error (A)	Uncertainty (±A)
420.0	0.0000	0.0000	0.0000	0.0042
	0.5783	0.5777	-0.0006	0.0042
	0.7628	0.7635	0.0007	0.0046
	1.0206	1.0230	0.0024	0.0042
440.0	0.0000	0.0000	0.0000	0.0042
	0.5621	0.5618	-0.0003	0.0042
	0.7455	0.7460	0.0005	0.0048
	0.9985	1.0005	0.0020	0.0042
465.0	0.0000	0.0000	0.0000	0.0042
	0.5227	0.5219	-0.0008	0.0042
	0.6880	0.6884	0.0004	0.0051
	0.9487	0.9503	0.0016	0.0042
546.1	0.0000	0.0000	0.0000	0.0042
	0.5207	0.5199	-0.0008	0.0042
	0.6973	0.6971	-0.0002	0.0049
	0.9959	0.9964	0.0005	0.0042
590.0	0.0000	0.0000	0.0000	0.0042
	0.5544	0.5534	-0.0010	0.0042
	0.7253	0.7242	-0.0011	0.0050
	1.0942	1.0943	0.0001	0.0042
635.0	0.0000	0.0000	0.0000	0.0042
	0.5616	0.5606	-0.0010	0.0042
	0.6927	0.6921	-0.0006	0.0063
	1.0861	1.0865	0.0004	0.0042

*CNR = Customer not request

4.Stray Light*

Standard cut-off wavelength (nm)	Unit Under Calibration(UUC) Wavelength (nm)	Transmission (%T)	Absorbance (A)
200.95±0.11nm	200.30	0.9505	2.0229

The Stray light transmission reference is less than 1.0%T and Stray light absorbance reference is greater than 2.00A

*Stray Light not NSC-ONSC Accredited.

The measurement uncertainty is base on a standard uncertainty multiplied by a coverage factor k=2 providing a level of confidence of approximately 95%.

End of Certificate

The above results are valid exclusively for the calibrated item(s) as mention in this report / certificate.
Advertising the report / Certificate and publicity of the results are prohibited and also shall not be reproduced
except in full, without written approval of the Bara Scientific Co., Ltd.

FM-UV-708-02 Rev 01 (23/01/63)



Metrological Center

SCI ECO Services Company Limited

33/2 Moo 3, T.Banpa, A.Kaengkhoh, Saraburi 18110, Thailand.

Saraburi Tel : +66 3627 3096 Fax : +66 3627 3100

Bangkok Tel : +668 9205 6851, +669 8247 2360

Website : www.scieco.co.th E-Mail : calibrate@scg.co.th



NSC-TIS-17025
CALIBRATION 0244

Certificate No. T220139

Page 1 of 3

Certificate of Calibration

Equipment : Liquid Bath (Water)

Manufacturer : MEMMERT

Model : WNB29

Serial No. : L611.0135

Customer Code : BKK_EN0148

ID No. : T6455A4

Customer : ALS Laboratory Group (Thailand) Co.,Ltd.

104 Phatthanakan 40, Phatthanakan Rd., Khwaeng Phatthanakan,

Khet Suan Luang, Bangkok 10250

Customer Location : ORGANIC PREPARATION LAB

Date of Receipt : 26 January 2022

Calibrated By : Watcharapon Sangtong (Technician)

Approved By :  / Sujjar Nakhakred (Site Calibration Manager)

Date of Issue : 08 FEB 2022

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

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

FM-L14 117/01-02-04



Metrological Center

SCI ECO Services Company Limited

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NSC-TIS-17025
CALIBRATION 0244

Certificate No. T220139

Page 2 of 3

Calibration Report

Equipment : Liquid Bath (Water)

Date of Calibration : 31 January 2022

Environment : Temperature : 22.4-23.9 °C

Line Voltage : 221.4-225.4 V

Relative Humidity : 55 - 65 %RH

Condition of this results of calibration :

1. This equipment was calibrated by insert five resistance thermometer detectors into its water bath, the other one thermocouple type T use for ambient temperature measurement. The calibration was done in according to WI-T36 (based on ASTM E715-80 (Reapproved 2001)). All data show below were final values and the initial data from customer request. The temperature scale used was based on ITS - 90.

2. Reference Standard Instrument :

Instrument	Model	Instrument No.	Certificate No.	Due Date
RTD	100 OHM	M34 (CH1-CH5)	T210115	2 February 2022
DATA LOGGER	34970A	T47	T210115	2 February 2022

3. This certificate is traceable to :

National Institute of Metrology (Thailand) through Metrological Center (NSC-TIS-TIS 17025 CALIBRATION 0244)

4. Condition of calibrated item : good

Equipment Description :

Time Constant : 1 Hour - Minute At 60 °C

5. Adjustment :

(X) without adjustment () after adjustment

Approved By: 

FM-L15 117/15-05-03



Metrological Center

SCI ECO Services Company Limited

33/2 Moo 3, T.Banpa, A.Kaengkhoh, Saraburi 18110, Thailand.

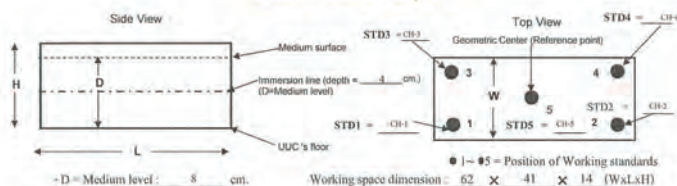


NSC-TIS-17025
CALIBRATION 0244

Certificate No. T220139

Page 3 of 3

Calibration Report



- D = Medium level : 8 cm.
- UUC's medium : Water
- Working standards are located at 2.5 cm. away from each corner and walls.

Measurement Results:

Calibration Point	Average Standard Reading at each position (°C)				
	CH-1	CH-2	CH-3	CH-4	CH-5
60	59.95	60.04	60.12	60.01	59.89
85	85.17	84.89	85.34	84.78	84.93
95	93.46	93.14	93.81	93.05	93.28

Liquid Bath (Water)			Temperature Distribution			
Setting (°C)	Reading (°C)		Stability (±°C)	Uniformity (±°C)	Uncertainty (±°C)	Coverage Factor k
	Min	Max				
61.0	60.9	61.1	0.10	0.19	0.25	2.00
86.0	85.9	86.1	0.12	0.39	0.32	2.06
95.0	94.8	95.1	0.14	0.51	0.38	2.11

* The quoted uncertainty exclude "uniformity"

The calibration result apply only the above calibrated item.

The result of test was found accurate as shown on date and place of test only.

The reported expanded uncertainty multiplied by a coverage factor k which for a t-distribution, providing a level of confidence of approximately 95%.

Approved By: 

FM-L15 117/15-05-03



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



Certificate of Calibration

Certificate No. : 22T1696
Page : 1 of 2

Equipment : Digital Thermometer With Sensor

Manufacturer : Testo

Model : 106

Serial No. : 83637909/0122

ID No. : BKK_LG0066

Condition As-Received: New item

Received Date : 26 August 2022

Calibration Date : 12 September 2022

to 18 September 2022

Reference : 2208-0918DSC

Ambient Temperature : (25 ± 3) °C

Relative Humidity : (50 ± 20) %

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

Submitted by: ALS Laboratory Group (Thailand) Co.,Ltd.

104 Phatthanakan 40, Phatthanakan Rd.,
Khwaeng Phatthanakan, Khet Suan Luang,
Bangkok 10250 Thailand

Procedure used: Calibration were conducted using in-house calibration procedure CP-T01 according to comparison with Industrial Platinum Resistance Thermometer (IPRT) into liquid bath temperature controller. The temperature scale used was based on ITS-90.

Condition of this result of calibration



1. Reference standards Instruments :

Instrument	Model	Serial No.	Certificate No.	Due Date
1) Digital Thermometer	1529	A7A809	2111126	14 Oct 2022
2) Industrial Platinum Resistance Thermometer	5627	824304	2111126	14 Oct 2022

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


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

-National Institute of Metrology Thailand (NIMT)

REVIEW BY: 
APPROVED BY: 
NEXT CAL. DATE: 12/09/2023

Calibrated by : Thatchanan Chankong
Issue Date : 22 September 2022

Approved Signatory :


[] Phalinee Prabpaipal
[] Chatchawan Khunpluek
[x] Wanlop Larpium

n 0296882



Cert. No.: 22T1696
Page.: 2 of 2

Result of Calibration:-

Without Adjustment

Function: Temperature measurement

Dimension of probe : Diameter 3 mm., Length 55 mm. Sheath material : Stainless Steel

Immersion Depth (mm.)	Standard Temperature (°C)	UUC* Reading (°C)	Error (°C)	Uncertainty of Measurement (± °C)
50	25.0022	24.9	-0.1022	0.12
50	30.0018	30.0	-0.0018	0.12
50	35.0028	34.9	-0.1028	0.12
50	40.0035	40.0	-0.0035	0.12
50	45.0025	45.0	-0.0025	0.12

UUC* : Unit Under Calibration

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%.

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a 1127721



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TEL. 0-2717-3000-24 FAX. 0-2719-9484



Certificate of Calibration

Certificate No.: 22T1694
Page : 1 of 2

Equipment : Digital Thermometer With Sensor

Manufacturer: Testo

Model : 106

Serial No.: 83637904/0122

ID No.: BKK_LG0064

Condition As-Received: New Item

Received Date: 26 August 2022

Calibration Date: 12 September 2022
to 19 September 2022

Reference: 2208-0918DSC

Ambient Temperature: (25 ± 3) °C

Relative Humidity: (50 ± 20) %

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Corporate Services 3: Equipment Calibration and Testing Services.

Submitted by: ALS Laboratory Group (Thailand) Co.,Ltd.

104 Phatthanakan 40, Phatthanakan Rd.,
Khwaeng Phatthanakan, Khet Suan Luang,
Bangkok 10250 Thailand

Procedure used: Calibration were conducted using in-house calibration procedure CP-T01 according to comparison with
Industrial Platinum Resistance Thermometer (IPRT) into liquid bath temperature controller.
The temperature scale used was based on ITS-90.

Condition of this result of calibration

1. Reference standards instruments :

Instrument	Model	Serial No.	Certificate No.	Due Date
1) Digital Thermometer	1529	A7A609	2111126	14 Oct 2022
2) Industrial Platinum Resistance Thermometer	5627	824304	2111126	14 Oct 2022

2. The certificate is valid only to the item calibrated on date and place of calibration.
3. This Certification is traceable to the International System of Unit maintained at-
National Institute of Metrology Thailand (NIMT)



Calibrated by : Thatchanan Chankong
Issue Date : 22 September 2022

Approved Signatory :

☐ Phalinee Prabpai
☐ Chatchawan Khunpluek
☒ Wanlop Larpum

B 0296884



Cert. No.: 22T1694
Page.: 2 of 2

Result of Calibration:-

Without Adjustment

Function: Temperature measurement

Dimension of probe : Diameter 3 mm., Length 55 mm. Sheath material : Stainless Steel

Immersion Depth (mm.)	Standard Temperature (°C)	UUC* Reading (°C)	Error (°C)	Uncertainty of Measurement (± °C)
50	25.0028	25.0	-0.0028	0.12
50	30.0026	30.0	-0.0026	0.12
50	35.0036	35.0	-0.0036	0.12
50	40.0042	40.0	-0.0042	0.12
50	45.0031	45.0	-0.0031	0.12

UUC* : Unit Under Calibration

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%.

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a 1127719



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
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TEL. 0-2717-3000-24 FAX. 0-2719-9484



Certificate of Calibration

Certificate No.: 22T1686
Page : 1 of 2

Equipment : Digital Thermometer With Sensor

Manufacturer: Testo

Model : 106

Serial No.: 83637025/0122

ID No.: BKK_LG0056

Condition As-Received: New Item

Received Date: 26 August 2022

Calibration Date: 12 September 2022
to 19 September 2022

Reference: 2208-0918DSC

Ambient Temperature: (25 ± 3) °C

Relative Humidity: (50 ± 20) %

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

Submitted by: ALS Laboratory Group (Thailand) Co.,Ltd.

104 Phatthanakan 40, Phatthanakan Rd.,
Khwaeng Phatthanakan, Khet Suan Luang,
Bangkok 10250 Thailand

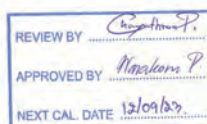
Procedure used: Calibration were conducted using in-house calibration procedure CP-T01 according to comparison with
Industrial Platinum Resistance Thermometer (IPRT) into liquid bath temperature controller.
The temperature scale used was based on ITS-90.

Condition of this result of calibration

1. Reference standards instruments :

Instrument	Model	Serial No.	Certificate No.	Due Date
1) Digital Thermometer	1529	A7A609	2111126	14 Oct 2022
2) Industrial Platinum Resistance Thermometer	5627	824304	2111126	14 Oct 2022

2. The certificate is valid only to the item calibrated on date and place of calibration.
3. This Certification is traceable to the International System of Unit maintained at-
National Institute of Metrology Thailand (NIMT)



Calibrated by : Thatchanan Chankong
Issue Date : 22 September 2022

Approved Signatory :

☐ Phalinee Prabpai
☐ Chatchawan Khunpluek
☒ Wanlop Larpum

B 0296893



Cert. No.: 22T1686
Page: 2 of 2

Result of Calibration:-
Function:

Without Adjustment
Temperature measurement

Dimension of probe : Diameter 3 mm., Length 55 mm. Sheath material : Stainless Steel

Immersion Depth (mm.)	Standard Temperature (°C)	UUC* Reading (°C)	Error (°C)	Uncertainty of Measurement (± °C)
50	25.0024	24.9	-0.1024	0.12
50	30.0021	29.9	-0.1021	0.12
50	35.0036	35.0	-0.0036	0.12
50	40.0031	40.0	-0.0031	0.12
50	45.0032	45.0	-0.0032	0.12

UUC* : Unit Under Calibration

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%.

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a 1127708



Agilent CrossLab Compliance Services

Agilent
CrossLab
From Insight to Outcome

EQUIPMENT QUALIFICATION REPORT (EQR)

Agilent CrossLab Compliance

Qualification Type:	ICPMS-OQ	REVIEW BY <u>Tattapan C.</u>
System ID:	JP12091612	APPROVED BY <u>Santa N.</u>
EQP Name:	AgilentRecommended	NEXT CAL. DATE <u>19/12/23</u>
EQP Revision:	ICPMS.02.50	
EQP Publish Date:	March 2020	
Date:	June 14, 2022 10:32:16 AM	
Report Type:	Report	
Org. Name:	ALS Laboratory Group (Thailand) Co.,Ltd.	
Org. Location:	104 Phatthanakarn 40, Suan Luang, Bangkok 10250 Thailand.	

Date: June 14, 2022 10:32:16 AM
System ID: JP12091612

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Date: June 14, 2022 10:32:16 AM
System ID: JP12091612

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Test Summary

Purpose

This section includes a status for each scheduled test and the overall qualification. For each test that is run, (1) the status is automatically determined based on pre-defined limits, and (2) the total number of times the test was run is displayed. For detailed results and specifications for a test, refer to the test results in this EQR.

Test	Status	Runs
Autosampler Check : ASX-520	Pass	1
Integrated Sample Introduction System (ISIS) Check : ISIS2	Pass	1
Autotune : G3281A	Pass	1
Background (No Gas Mode) : G3281A	Pass	1
Background (Gas Modes) : G3281A	Pass	1
20-Minute Stability (No Gas Mode) : G3281A	Pass	1

Overall Qualification Status

Pass

Date: June 14, 2022 10:32:16 AM
System ID: JP12091612

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Service Details

Purpose
This section includes local contact and delivery details for this service.

General Details

Service Order No./Request:	6005218484
EQP Name:	AgilentRecommended
EQP Revision:	ICPMS.02.50
Report Type:	Report

Organization Details

Name:	ALS Laboratory Group (Thailand) Co.,Ltd.
Location:	104 Phatthanakarn 40, Suan Luang, Bangkok 10250 Thailand.

Local Contact Details

Name:	Khan Chatchansri
Job Title:	Lab Manager
Qualification Location:	Spectro Room

Operator Details

Name:	Panlthep Kurasalhai
Job Title:	Field Service Engineer

Data Acquisition Details

Acquisition Software Name:	MassHunter
Acquisition Software Revision:	D.01.01

Customer Data System (CDS):	IcpMsc MassHunter
-----------------------------	-------------------

Instrument Details

Purpose
This section describes the as found system configuration.

Details

ICP-MS 1	
Manufacturer	Agilent Technologies
Name	7700x
Model Number	G3281A
Detector Type	SQ
Nebulizer	Mira Mist (G3161)
Spray Chamber	Quartz
Torch	Quartz
Sampling Cone	Ni
Skimmer Cone	Ni
Serial Number	JP12091612
Firmware Revision	D.01.01
ISIS 1	
Manufacturer	Agilent Technologies
Name	ISIS2
Model Number	G4911A
Installed Options	#003: 2 pumps, 1 vialin, auto dilution and discrete sampling
Type	Peristaltic pump system
Autosampler 1	
Manufacturer	Agilent Technologies
Name	ASX-620
Model Number	G3296A
Serial Number	031403A520
Chiller 1	
Manufacturer	Agilent Technologies
Name	Chiller
Model Number	G3292A
Serial Number	4N1220700

Calculation Formulas

Purpose
This section includes calculation formulas for all available tests. Depending upon which tests are scheduled, all or some apply to your qualification.

For a description of calculations for ICP-MS tests performed by the MassHunter software, refer to the MassHunter application and documentation.

Protocol Details

Purpose
This section lists the revisions for all test units used in this report. For complete test-specific and high-level change details, refer to the Revision History document.

Test Revision	Test
ICPMS.02.50	20-Minute Stability (No Gas Mode)
ICPMS.02.50	Autosampler Check
ICPMS.02.50	Autotune
ICPMS.02.50	Background (Gas Modes)
ICPMS.02.50	Background (No Gas Mode)
ICPMS.02.50	Integrated Sample Introduction System (ISIS) Check

Autosampler Check

Purpose

This test demonstrates that the autosampler module is correctly installed and connected. It does not test module performance.

Setpoint

Results	Criteria	Observed Result	Expected Result	Status
After the self test, is probe in the home position?		Yes	Yes	Pass
As commanded, is the probe positioned at vial 2?		Yes	Yes	Pass

Setpoint Status: Pass Runs: 1

Overall Autosampler Check Test Status

Pass

Date: June 14, 2022 10:32:16 AM
System ID: JPI2091612

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Integrated Sample Introduction System (ISIS) Check

Purpose

This test demonstrates that the ISIS module is correctly installed and connected. It does not test module performance.

Setpoint

Results	Criteria	Observed Result	Expected Result	Status
As commanded, does the pump rotate?		Yes	Yes	Pass
As commanded, do the valves load and inject?		Yes	Yes	Pass

Setpoint Status: Pass Runs: 1

Overall Integrated Sample Introduction System (ISIS) Check Test Status

Pass

Date: June 14, 2022 10:32:16 AM
System ID: JPI2091612

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Autotune

Purpose

This test uses traceable checkout standards to run a software-executed autotune in all modes. The tune report provides values for peak width, mass axis, sensitivity, oxide species, and doubly-charged species tests.

Setpoint

Results	Criteria	Observed Result	Expected Result	Status
Peakwidth Mass 7		0.735	AMU	
Agilent Recommended:		>= 0.65	<= 0.80	
Status:		Pass		
Peakwidth Mass 89		0.732	AMU	
Agilent Recommended:		>= 0.65	<= 0.80	
Status:		Pass		
Peakwidth Mass 205		0.746	AMU	
Agilent Recommended:		>= 0.65	<= 0.80	
Status:		Pass		
Mass Axis 7		7.00	AMU	
Agilent Recommended:		>= 6.9	<= 7.1	
Status:		Pass		
Mass Axis 89		89.00	AMU	
Agilent Recommended:		>= 88.9	<= 89.1	
Status:		Pass		
Mass Axis 205		205.00	AMU	
Agilent Recommended:		>= 204.9	<= 205.1	
Status:		Pass		

Date: June 14, 2022 10:32:16 AM
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Mass 7 Sensitivity No Gas	81.18	Mcps/ppm
Agilent Recommended:	>= 25.5	
Status:	Pass	
Mass 89 Sensitivity No Gas	247.81	Mcps/ppm
Agilent Recommended:	>= 85	
Status:	Pass	
Mass 205 Sensitivity No Gas	184.87	Mcps/ppm
Agilent Recommended:	>= 51	
Status:	Pass	
Mass 59 Sensitivity He	84.86	Mcps/ppm
Agilent Recommended:	>= 20.4	
Status:	Pass	
Oxide Ratio 156/140	1.119	%
Agilent Recommended:	<= 1.38	
Status:	Pass	
Doubly Charged Species Ratio 70/140	1.140	%
Agilent Recommended:	<= 2.3	
Status:	Pass	

Setpoint Status: Pass Runs: 1

Overall Autotune Test Status

Pass

Date: June 14, 2022 10:32:16 AM
System ID: JPI2091612

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Background (No Gas Mode)

Purpose

This test examines the background of the ICP-MS in no gas mode by monitoring ions during a blank run.

Setpoint

Conditions

Masses: 7 AMU
89 AMU
205 AMU

Measurements and Results

Masses (AMU): 7 89 205
Measured Value: 4,900 7,100 18,400 cps
Agilent Recommended: <10 10 30
Status: Pass Pass Pass

Setpoint Status: Pass

Runs: 1

Overall Background (No Gas Mode) Test Status

Pass

Date: June 14, 2022 10:32:16 AM
System ID: JP12091612

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Background (Gas Mode)

Purpose

This test examines the background of the ICP-MS in the various gas modes by monitoring ions during a blank run.

Setpoint

Gas Mode: Helium

Conditions

Mass: 78 AMU
Integration Time: 1.0 sec
Cycles: 20

Measurements and Results

Mass (AMU): 78
Measured Value: 21,100 cps
Agilent Recommended: <480
Status: Pass

Setpoint Status: Pass

Runs: 1

Overall Background (Gas Mode) Test Status

Pass

Date: June 14, 2022 10:32:16 AM
System ID: JP12091612

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20-Minute Stability (No Gas Mode)

Purpose

This test monitors the abundance of ions present in the checkout standard over a 20-minute period to verify that the signal is stable. The %RSD of the abundance of given ions is calculated internally by the software and compared to the limit.

Setpoint

Conditions

Mode: Spectrum
Masses: 7, 9, 89, 140, 205
Integration Time: 9.99 sec
Peak Pattern: 3 points/peak
Repetitions: 20
Sweeps/Repetitions: 100

Measurements and Results

Masses (AMU): 7 89 205
Stability RSD: 10.2 10.6 0.6
Agilent Recommended: <3.45 3.45 3.45
Status: Pass Pass Pass

Setpoint Status: Pass

Runs: 1

Overall 20-Minute Stability (No Gas Mode) Test Status

Pass

Date: June 14, 2022 10:32:16 AM
System ID: JP12091612

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Declaration of Change Control

This document is under change control. Revision history is maintained and printed on each document. Access to the master documents is limited to process owners. Documents receive periodic review and cannot be assigned an evergreen status. This qualification performed according to this document refers only to the hardware/software configuration in place at the time of the qualification. Agilent Technologies recommends that instrument configuration change management procedures be in place in order to maintain the validation process. Any changes to the analytical or computer hardware or software must be clearly specified. A change management system provides a means for determining the degree of requalification required according to the extent of the changes made. All details of the changes must be thoroughly recorded and documented, together with details of completed tests and their results. Note: Hardware/software configuration management is the customer's responsibility.

Date: June 14, 2022 10:32:16 AM
System ID: JP12091612

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Attachments

Training requirements note: The delivery engineer attaches an ACE technique-specific training certificate to the Equipment Qualification Report (EQR). Obtaining ACE technique-specific certification includes pre-requisite trainings for Data Integrity, General Compliance topics (GMP, GLP, ALCOA, etc.), instrument hardware and software components, and the ACE technique itself. This one certificate encompasses all pre-requisite trainings as documented in the Agilent Learning Management System called Success Factors.


Location	Category	Document Name	Page
EQR	General	Certificate of System Qualification	17
EQR	General	Operator's training certificate and qualifications	19
EQR	General	Certificate of Qualification for ACE	19
EQR	General	Certificate of Qualification for ACE	20
EQR	General	Tune reports	21
EQR	General	Test Report	24
EQR	General	Test Report	26

Date: June 14, 2022 10:32:16 AM
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General

Document Name: Certificate of System Qualification

 Agilent Technologies

Agilent Compliance Engine Self Qualification

Date: September 14, 2021 4:58:15 PM
Drive Serial #: ACA2209 Platform Revision: ACE 3.11

Individual self-qualification reports for each specific technique included are also available upon request. They provide additional details for the general report from the course summary and are generated by the actual algorithms developed during the process. There is not a one-to-one relationship between algorithms and OQ program tests because some algorithms are used by several tests and across multiple similar hardware components of the qualified system.

Technique Type	Tests Completed	Result
Atomic Absorption	7	Confirmed
Capillary Electrophoresis	10	Confirmed
Discolorator	6	Confirmed
Emission Spectroscopy	3	Confirmed
Gas Chromatography - GC/MS	17	Confirmed
Gas Chromatography	29	Confirmed
Gas Permeation Chromatography	9	Confirmed
ICP-MS	6	Confirmed
Infrared Spectroscopy	7	Confirmed
Liquid Chromatography	17	Confirmed
Liquid Chromatography - LC/MS	6	Confirmed
Microlabids	18	Confirmed
Sample Preparation - Gas Chromatography	9	Confirmed
Sample Preparation - Liquid Chromatography	6	Confirmed
Supercritical Fluid Chromatography	15	Confirmed
Software	6	Confirmed
UV-Vis Spectrophotometer	13	Confirmed
Overall Qualification Status		Confirmed

Date: June 14, 2022 10:32:16 AM
System ID: JP12091612

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General

Document Name: Operator's training certificate and qualifications

 Agilent Technologies

Certificate of Completion

Learned Name: Pashup Kurnasathin

Title Of Course: AN-CE-ICPMS-2.0 (7.0L-7700u/7700s ICP-MS Intro, 4per/14W/SW & OQ/PV)

Completion Date: November 22, 2012

Certified By Company: Learning at Agilent

All Service and Support training certificates have the following specific limitations:

A certificate for Service and Support training is only valid while employed by Agilent Technologies or while working as an Agilent authorized service provider, through which the service employee has ongoing access to Agilent's Safety Alerts, Service Notes, Internal technical updates, update training, current documentation, software support, current parts, and parts updates. Completion of training alone, without being employed by Agilent Technologies, does not qualify as individual to safety, quality, service or accurate Agilent products.

Date: June 14, 2022 10:32:16 AM
System ID: JP12091612

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General

Document Name: Certificate of Qualification for ACE

 Agilent Technologies

Certificate of Completion

Learned Name: Pashup Kurnasathin

Title Of Course: AN-CE-SS-41-R30-A: ACE 3.X User Update Training

Completion Date: July 7, 2020

Certified By Company: Learning at Agilent

All Service and Support training certificates have the following specific limitations:

A certificate for Service and Support training is only valid while employed by Agilent Technologies or while working as an Agilent authorized service provider, through which the service employee has ongoing access to Agilent's Safety Alerts, Service Notes, Internal technical updates, update training, current documentation, software support, current parts, and parts updates. Completion of training alone, without being employed by Agilent Technologies, does not qualify as individual to safety, quality, service or accurate Agilent products.

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System ID: JP12091612

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General

Document Name: Certificate of Qualification for ACE

Certificate of Completion

Agilent Technologies

Learning Name: Participate Knowledge

Title Of Course: AN-CPMS-0-035-0: CrossLab Compliance Hardware Specific Delivery for Agilent ICP-MS Systems

Completion Date: October 31, 2020

Certified By Company: Learning at Agilent

All Service and Support training certificates have the following specific disclaimer:

A certificate for Service and Support training is only valid while employed by Agilent Technologies or while working as an Agilent-authorized service provider, through which the service provider has ongoing access to Agilent's delivery Alerts, Service Alerts, internal technical updates, system releases, course documentation, technical support, current parts, and parts updates. Completion of training alone, without being employed by Agilent Technologies, does not qualify an individual to safely install, service or maintain Agilent products.

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General


Document Name: Tune reports

Tune Report

Operator Name: Agilent
Acq/Chk Date: 01/10/2022 08:15 AM
Acq/Chk Time: 01/10/2022 08:15 AM
Report Comment: PMDO 14 June 2022
Instrument Name: Q221A-IP12091612

No Gas

Sensitivity




Time	Range	Count	Abundance	Background
1	10000	1118	3.08	4.00
10	10000	1470	2.10	7.00
100	10000	1467	3.60	15.00

Shooting Period (sec): 0.31
Integration Time (sec): 0.1

Gas/Carrier Charged Tests

Carrier: 100 / 140 1.13 %
Doubly Charged: 70 / 140 1.10 %

Resolution



Peak	Peak Height	Area	Abundance	Resolution
1	1005.47	7.00	0.00	0.70
10	1470.01	80.00	0.01	0.70
100	1467.01	100.00	0.00	0.70

Integration Time (sec): 0.1
Acquisition Time (sec): 22.54
Y Axis: Linear

Tune Parameters


Parameter	Value	Unit	Target	Unit
Plasma Mode	—	—	1.00	Unit
RF Power	1000 W	—	1000 W	—
RF Matching	1.00 V	—	1.00 V	—
Sample Depth	0.0 mm	—	0.0 mm	—
SIC Temp	2 °C	—	2 °C	—
Exhaust 1	0.0 V	—	0.0 V	—
Exhaust 2	-20.0 V	—	-20.0 V	—
Exhaust 3	-20.0 V	—	-20.0 V	—
Exhaust 4	-20.0 V	—	-20.0 V	—
Exhaust 5	-20.0 V	—	-20.0 V	—
Exhaust 6	-20.0 V	—	-20.0 V	—
Exhaust 7	-20.0 V	—	-20.0 V	—
Exhaust 8	-20.0 V	—	-20.0 V	—
Exhaust 9	-20.0 V	—	-20.0 V	—
Exhaust 10	-20.0 V	—	-20.0 V	—
Exhaust 11	-20.0 V	—	-20.0 V	—
Exhaust 12	-20.0 V	—	-20.0 V	—
Exhaust 13	-20.0 V	—	-20.0 V	—
Exhaust 14	-20.0 V	—	-20.0 V	—
Exhaust 15	-20.0 V	—	-20.0 V	—
Exhaust 16	-20.0 V	—	-20.0 V	—
Exhaust 17	-20.0 V	—	-20.0 V	—
Exhaust 18	-20.0 V	—	-20.0 V	—
Exhaust 19	-20.0 V	—	-20.0 V	—
Exhaust 20	-20.0 V	—	-20.0 V	—
Exhaust 21	-20.0 V	—	-20.0 V	—
Exhaust 22	-20.0 V	—	-20.0 V	—
Exhaust 23	-20.0 V	—	-20.0 V	—
Exhaust 24	-20.0 V	—	-20.0 V	—
Exhaust 25	-20.0 V	—	-20.0 V	—
Exhaust 26	-20.0 V	—	-20.0 V	—
Exhaust 27	-20.0 V	—	-20.0 V	—
Exhaust 28	-20.0 V	—	-20.0 V	—
Exhaust 29	-20.0 V	—	-20.0 V	—
Exhaust 30	-20.0 V	—	-20.0 V	—
Exhaust 31	-20.0 V	—	-20.0 V	—
Exhaust 32	-20.0 V	—	-20.0 V	—
Exhaust 33	-20.0 V	—	-20.0 V	—
Exhaust 34	-20.0 V	—	-20.0 V	—
Exhaust 35	-20.0 V	—	-20.0 V	—
Exhaust 36	-20.0 V	—	-20.0 V	—
Exhaust 37	-20.0 V	—	-20.0 V	—
Exhaust 38	-20.0 V	—	-20.0 V	—
Exhaust 39	-20.0 V	—	-20.0 V	—
Exhaust 40	-20.0 V	—	-20.0 V	—
Exhaust 41	-20.0 V	—	-20.0 V	—
Exhaust 42	-20.0 V	—	-20.0 V	—
Exhaust 43	-20.0 V	—	-20.0 V	—
Exhaust 44	-20.0 V	—	-20.0 V	—
Exhaust 45	-20.0 V	—	-20.0 V	—
Exhaust 46	-20.0 V	—	-20.0 V	—
Exhaust 47	-20.0 V	—	-20.0 V	—
Exhaust 48	-20.0 V	—	-20.0 V	—
Exhaust 49	-20.0 V	—	-20.0 V	—
Exhaust 50	-20.0 V	—	-20.0 V	—
Exhaust 51	-20.0 V	—	-20.0 V	—
Exhaust 52	-20.0 V	—	-20.0 V	—
Exhaust 53	-20.0 V	—	-20.0 V	—
Exhaust 54	-20.0 V	—	-20.0 V	—
Exhaust 55	-20.0 V	—	-20.0 V	—
Exhaust 56	-20.0 V	—	-20.0 V	—
Exhaust 57	-20.0 V	—	-20.0 V	—
Exhaust 58	-20.0 V	—	-20.0 V	—
Exhaust 59	-20.0 V	—	-20.0 V	—
Exhaust 60	-20.0 V	—	-20.0 V	—
Exhaust 61	-20.0 V	—	-20.0 V	—
Exhaust 62	-20.0 V	—	-20.0 V	—
Exhaust 63	-20.0 V	—	-20.0 V	—
Exhaust 64	-20.0 V	—	-20.0 V	—
Exhaust 65	-20.0 V	—	-20.0 V	—
Exhaust 66	-20.0 V	—	-20.0 V	—
Exhaust 67	-20.0 V	—	-20.0 V	—
Exhaust 68	-20.0 V	—	-20.0 V	—
Exhaust 69	-20.0 V	—	-20.0 V	—
Exhaust 70	-20.0 V	—	-20.0 V	—
Exhaust 71	-20.0 V	—	-20.0 V	—
Exhaust 72	-20.0 V	—	-20.0 V	—
Exhaust 73	-20.0 V	—	-20.0 V	—
Exhaust 74	-20.0 V	—	-20.0 V	—
Exhaust 75	-20.0 V	—	-20.0 V	—
Exhaust 76	-20.0 V	—	-20.0 V	—
Exhaust 77	-20.0 V	—	-20.0 V	—
Exhaust 78	-20.0 V	—	-20.0 V	—
Exhaust 79	-20.0 V	—	-20.0 V	—
Exhaust 80	-20.0 V	—	-20.0 V	—
Exhaust 81	-20.0 V	—	-20.0 V	—
Exhaust 82	-20.0 V	—	-20.0 V	—
Exhaust 83	-20.0 V	—	-20.0 V	—
Exhaust 84	-20.0 V	—	-20.0 V	—
Exhaust 85	-20.0 V	—	-20.0 V	—
Exhaust 86	-20.0 V	—	-20.0 V	—
Exhaust 87	-20.0 V	—	-20.0 V	—
Exhaust 88	-20.0 V	—	-20.0 V	—
Exhaust 89	-20.0 V	—	-20.0 V	—
Exhaust 90	-20.0 V	—	-20.0 V	—
Exhaust 91	-20.0 V	—	-20.0 V	—
Exhaust 92	-20.0 V	—	-20.0 V	—
Exhaust 93	-20.0 V	—	-20.0 V	—
Exhaust 94	-20.0 V	—	-20.0 V	—
Exhaust 95	-20.0 V	—	-20.0 V	—
Exhaust 96	-20.0 V	—	-20.0 V	—
Exhaust 97	-20.0 V	—	-20.0 V	—
Exhaust 98	-20.0 V	—	-20.0 V	—
Exhaust 99	-20.0 V	—	-20.0 V	—
Exhaust 100	-20.0 V	—	-20.0 V	—

Shooting Period (sec): 0.31
Integration Time (sec): 0.1

Gas/Carrier Charged Tests

Carrier: 100 / 140 1.13 %
Doubly Charged: 70 / 140 1.10 %

Resolution



Peak	Peak Height	Area	Abundance	Resolution
1	1005.47	7.00	0.00	0.70
10	1470.01	80.00	0.01	0.70
100	1467.01	100.00	0.00	0.70

Integration Time (sec): 0.1
Acquisition Time (sec): 22.54
Y Axis: Linear

Tune Parameters

Parameter	Value	Unit	Target	Unit
Plasma Mode	—	—	1.00	Unit
RF Power	1000 W	—	1000 W	—
RF Matching	1.00 V	—	1.00 V	—
Sample Depth	0.0 mm	—	0.0 mm	—
SIC Temp	2 °C	—	2 °C	—
Exhaust 1	0.0 V	—	0.0 V	—
Exhaust 2	-20.0 V	—	-20.0 V	—
Exhaust 3	-20.0 V	—	-20.0 V	—
Exhaust 4	-20.0 V	—	-20.0 V	—
Exhaust 5	-20.0 V	—	-20.0 V	—
Exhaust 6	-20.0 V	—	-20.0 V	—
Exhaust 7	-20.0 V	—	-20.0 V	—
Exhaust 8	-20.0 V	—	-20.0 V	—
Exhaust 9	-20.0 V	—	-20.0 V	—
Exhaust 10	-20.0 V	—	-20.0 V	—
Exhaust 11	-20.0 V	—	-20.0 V	—
Exhaust 12	-20.0 V	—	-20.0 V	—
Exhaust 13	-20.0 V	—	-20.0 V	—
Exhaust 14	-20.0 V	—	-20.0 V	—
Exhaust 15	-20.0 V	—	-20.0 V	—
Exhaust 16	-20.0 V	—	-20.0 V	—
Exhaust 17	-20.0 V	—	-20.0 V	—
Exhaust 18	-20.0 V	—	-20.0 V	—
Exhaust 19	-20.0 V	—	-20.0 V	—
Exhaust 20	-20.0 V	—	-20.0 V	—
Exhaust 21	-20.0 V	—	-20.0 V	—
Exhaust 22	-20.0 V	—	-20.0 V	—
Exhaust 23	-20.0 V	—	-20.0 V	—
Exhaust 24	-20.0 V	—	-20.0 V	—
Exhaust 25	-20.0 V	—	-20.0 V	—
Exhaust 26	-20.0 V	—	-20.0 V	—
Exhaust 27	-20.0 V	—	-20.0 V	—
Exhaust 28	-20.0 V	—	-20.0 V	—
Exhaust 29	-20.0 V	—	-20.0 V	—
Exhaust 30	-20.0 V	—	-20.0 V	—
Exhaust 31	-20.0 V	—	-20.0 V	—
Exhaust 32	-20.0 V	—	-20.0 V	—
Exhaust 33	-20.0 V	—	-20.0 V	—
Exhaust 34	-20.0 V	—	-20.0 V	—
Exhaust 35	-20.0 V	—	-20.0 V	—
Exhaust 36	-20.0 V	—	-20.0 V	—
Exhaust 37	-20.0 V	—	-20.0 V	—
Exhaust 38	-20.0 V	—	-20.0 V	—
Exhaust 39	-20.0 V	—	-20.0 V	—
Exhaust 40	-20.0 V	—	-20.0 V	—
Exhaust 41	-20.0 V	—	-20.0 V	—
Exhaust 42	-20.0 V	—	-20.0 V	—
Exhaust 43	-20.0 V	—	-20.0 V	—
Exhaust 44	-20.0 V	—	-20.0 V	—
Exhaust 45	-20.0 V	—	-20.0 V	—
Exhaust 46	-20.0 V	—	-20.0 V	—
Exhaust 47	-20.0 V	—	-20.0 V	—
Exhaust 48	-20.0 V	—	-20.0 V	—
Exhaust 49	-20.0 V	—	-20.0 V	—
Exhaust 50	-20.0 V	—	-20.0 V	—
Exhaust 51	-20.0 V	—	-20.0 V	—
Exhaust 52	-20.0 V	—	-20.0 V	—
Exhaust 53	-20.0 V	—	-20.0 V	—
Exhaust 54	-20.0 V	—	-20.0 V	—
Exhaust 55	-20.0 V	—	-20.0 V	—
Exhaust 56	-20.0 V	—	-20.0 V	—
Exhaust 57	-20.0 V	—	-20.0 V	—
Exhaust 58	-20.0 V	—	-20.0 V	—
Exhaust 59	-20.0 V	—	-20.0 V	—
Exhaust 60	-20.0 V	—	-20.0 V	—
Exhaust 61	-20.0 V	—	-20.0 V	—
Exhaust 62	-20.0 V	—	-20.0 V	—
Exhaust 63	-20.0 V	—	-20.0 V	—
Exhaust 64	-20.0 V	—	-20.0 V	—
Exhaust 65	-20.0 V	—	-20.0 V	—
Exhaust 66	-20.0 V	—	-20.0 V	—
Exhaust 67	-20.0 V	—	-20.0 V	—
Exhaust 68	-20.0 V	—	-20.0 V	—
Exhaust 69	-20.0 V	—	-20.0 V	—
Exhaust 70	-20.0 V	—	-20.0 V	—
Exhaust 71	-20.0 V	—	-20.0 V	—
Exhaust 72	-20.0 V	—	-20.0 V	—
Exhaust 73	-20.0 V	—	-20.0 V	—
Exhaust 74	-20.0 V	—	-20.0 V	—
Exhaust 75	-20.0 V	—	-20.0 V	—
Exhaust 76	-20.0 V	—	-20.0 V	—
Exhaust 77	-20.0 V	—	-20.0 V	—
Exhaust 78	-20.0 V	—	-20.0 V	—
Exhaust 79	-20.0 V	—	-20.0 V	—
Exhaust 80	-20.0 V	—	-20.0 V	—
Exhaust 81	-20.0 V	—	-20.0 V	—
Exhaust 82	-20.0 V	—	-20.0 V	—
Exhaust				

General

Document Name: Test Report

Batch Summary Report

Batch folder:	D:\Agilent Service\PMOD\TS-6-27\00_Hs US
Analysis File:	00_Hs.usain.bin
Time Step:	#1 file

	Exp	Arr Date-Time	Date File	Sample Name	Time	Level	Q Ratio
1		6/14/2022 10:45:49 AM	0015895.d	SC-10	Sample		1.0000

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By: 1/12/2012 12:09:04 AM

Date: June 14, 2022 10:32:16 AM
System ID: JP12091512

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Document Name: Test Report

Batch Summary Report

Appendix 1

		75	1401
	Standard Name	CPS	CPS/50
1	BT 14	21.000	420

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8/14/2022 10:00:04 AM

Date: June 14, 2022 10:32:16 AM
System ID: JP12091612

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General

Document Name: Test Report

Batch Summary Report

Birth Folder:	D:\Göğün Şemsi\PM212 16-6-22\CIQ 20 MİMAR
Apple's File:	(CIQ 20 Mimar)ciq20.m
Core Step:	R1 ile G1

Ref	Ass. Date/Time	Date/Time	Sampled/Metric	Time	Level	Division
1	2014/07/28 09:05 AM	2014/07/28	20 m/s	Sample		10000

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6/14/2022 10:51:50 AM

Date: June 14, 2022 10:32:16 AM
System ID: JP12091612

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Document Name: Test Report

Batch Summary Report

— **Charles Vance**

Analysis Table									
		7 / 100 G/L		9 / 100 G/L		19 / 100 G/L		30 / 100 G/L	
Specimen Name		CPS	CPS BSTD	CPS	CPS BSTD	CPS	CPS BSTD	CPS	CPS BSTD
1	20 min	16071.6093	0.7	2011.1811	5.0	16071.6093	0.7	24141.8726	0.6

		140 / 100 G/L		200 / 100 G/L	
Specimen Name		CPS	CPS BSTD	CPS	CPS BSTD
2	20 min	25142.6090	0.7	19135.6265	0.6

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0140022 051 NW A11

Date: June 14, 2022 10:32:16 AM
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Electronic Signature

Purpose

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

Details

Full Name of Signer: Panthep Kurasthain
Logged On User Name: panthep_kurasthain@agilent.com
Signature Creation Date: June 14, 2022
Reason for Signature: Executed protocol and published this original version of document

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Date: June 14, 2022 10:32:16 AM
System ID: JP12091612

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User Name: panthep_kurasthain Username: ASDK009313					System ID: JP12091612 Print Date: June 14, 2022 10:32:29 AM
ALS DQHW 7706-14Jun2022 Transaction Log :					
Time	Transaction State	Activity Performed	Type of Transaction	Optional Information	
June 14, 2022 10:14:43 AM	Auth	Session Created	Session	None	
June 14, 2022 10:14:43 AM	Start	Configuration	Session	None	
June 14, 2022 10:14:43 AM	Auth	Endtime	Logging	Use is Field/Invent and does not require an LMS code	
June 14, 2022 10:19:18 AM	Auth	Sign-off	Session	EQP details for primary technique (ipmle) - File path: [ProtocolPath\ipmle\Curving\analysis\02.50\02\02.50\02.50\eqp] EQP File Name: [ipmle_02.50\eqp] EQP Name: [AgilentRecommended]	
June 14, 2022 10:19:20 AM	End	Configuration	Session	None	
June 14, 2022 10:19:24 AM	Start	Qualification	Session	OQ	
June 14, 2022 10:19:24 AM	Start	Execution	Autosampler Check : ASD-600 Autosampler Check	None	
June 14, 2022 10:19:42 AM	End	Execution	Autosampler Check : ASD-600 Autosampler Check	Run Count : 1	
June 14, 2022 10:18:43 AM	Start	Execution	Integrated Sample Introduction System (ISIS) Check : Full Integrated Sample Introduction System (ISIS) Check	None	
June 14, 2022 10:18:47 AM	End	Execution	Integrated Sample Introduction System (ISIS) Check : Full Integrated Sample Introduction System (ISIS) Check	Run Count : 1	
June 14, 2022 10:19:30 AM	Start	Execution	Autotune : Q3281A; Autosampler	None	
June 14, 2022 10:22:22 AM	End	Execution	Autotune : Q3281A; Autosampler	Run Count : 1	

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Date: June 14, 2022 10:32:16 AM
System ID: JP12091612

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User Name: panthep_kurasthain Username: ASDK009313					System ID: JP12091612 Print Date: June 14, 2022 10:32:30 AM
ALS DQHW 7709-14Jun2022 Transaction Log :					
Time	Transaction State	Activity Performed	Type of Transaction	Optional Information	
June 14, 2022 10:22:24 AM	Start	Execution	Background (No Gas Mode) : Q3281A; No Gas Mode Background 1	None	
June 14, 2022 10:22:48 AM	End	Execution	Background (No Gas Mode) : Q3281A; No Gas Mode Background 1	Run Count : 1	
June 14, 2022 10:22:49 AM	Start	Execution	Background (Gas Mode) : Q3281A; Gas Mode Background Helium	None	
June 14, 2022 10:23:35 AM	End	Execution	Background (Gas Mode) : Q3281A; Gas Mode Background Helium	Run Count : 1	
June 14, 2022 10:23:37 AM	Start	Execution	20-Minute Stability (No Gas Mode) : Q3281A; 20-Minute Stability (No Gas Mode) 1	None	
June 14, 2022 10:24:08 AM	End	Execution	20-Minute Stability (No Gas Mode) : Q3281A; 20-Minute Stability (No Gas Mode) 1	Run Count : 1	
June 14, 2022 10:24:09 AM	End	Qualification	Session	OQ	
June 14, 2022 10:24:08 AM	Start	Reporting	Session	None	
June 14, 2022 10:25:28 AM	Auth	Reporting	Session	Report Generated : DataBase	
June 14, 2022 10:25:39 AM	Auth	Reporting	Session	Report Generated : Report	

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Date: June 14, 2022 10:32:16 AM
System ID: JP12091612

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Certificate of System Qualification

ICPMS-OQ

System ID: JP12091612
Organization Name: ALS Laboratory Group (Thailand) Co., Ltd.
Organization Location: 104 Phatthanakarn 40, Suan Luang, Bangkok 10250 Thailand.

Date: June 14, 2022 10:32:51 AM
EQP Name: AgilentRecommended
EQP Revision: ICPMS.02.50
Overall Qualification Status: Pass

Autosampler Check

Overall Autosampler Check Test Status

Pass

Integrated Sample Introduction System (ISIS) Check

Overall Integrated Sample Introduction System (ISIS) Check Test Status

Pass

Autotune

Peakwidth Mass 7	Pass
Peakwidth Mass 89	Pass
Peakwidth Mass 205	Pass
Mass Axis 7	Pass
Mass Axis 89	Pass
Mass Axis 205	Pass
Mass 7 Sensitivity No Gas	Pass
Mass 89 Sensitivity No Gas	Pass
Mass 205 Sensitivity No Gas	Pass
Mass 59 Sensitivity He	Pass
Oxide Ratio 156/140	Pass
Doubly Charged Species Ratio 70/140	Pass

Overall Autotune Test Status

Pass

Date: June 14, 2022 10:32:51 AM
System ID: JP12091612

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Background (No Gas Mode)

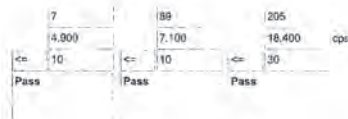
Setpoint Status: Pass

Masses (AMU):

Measured Value:

Agilent Recommended:

Status:



Overall Background (No Gas Mode) Test Status

Pass

Background (Gas Mode)

Gas Mode: Helium

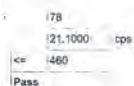
Setpoint Status: Pass

Mass (AMU):

Measured Value:

Agilent Recommended:

Status:



Overall Background (Gas Mode) Test Status

Pass

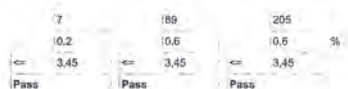
20-Minute Stability (No Gas Mode)

Masses (AMU):

Stability RSD:

Agilent Recommended:

Status:



Overall 20-Minute Stability (No Gas Mode) Test Status

Pass

Date: June 14, 2022 10:32:51 AM
System ID: JP12091612

Instrument Details

Purpose

This section describes the as found system configuration.

Details

ICP-MS 1

Manufacturer	Agilent Technologies
Name	7700x
Model Number	G3291A
Detector Type	SQ
Nebulizer	Mira Mist (G3161)
Spray Chamber	Quartz
Torch	Quartz
Sampling Cone	NI
Skimmer Cone	NI
Serial Number	JP12091612
Firmware Revision	D.01.01

ISIS 1

Manufacturer	Agilent Technologies
Name	ISIS2
Model Number	G4911A
Installed Options	8003: 2 pumps, 1 valve, auto dilution and eluents sampling
Type	Panastaltic pump system

Autosampler 1

Manufacturer	Agilent Technologies
Name	ASX-520
Model Number	G3286A
Serial Number	G31403A520

Chiller 1

Manufacturer	Agilent Technologies
Name	Chiller
Model Number	G3292A
Serial Number	4N1220700

Date: June 14, 2022 10:32:51 AM
System ID: JP12091612

Electronic Signature

Purpose

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

Details

Full Name of Signer:	Panthop Kurusathain
Logged On User Name:	panthop_kurasathain@agilent.com
Signature Creation Date:	June 14, 2022
Reason for Signature:	Executed protocol and published this original version of document

Regulatory Disclaimer

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

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Date: June 14, 2022 10:32:51 AM
System ID: JP12091612

User: Name: panthop, Autosampler Hardware: ASX520V313				System ID: JP12091612 Print Date: June 14, 2022 10:32:51 AM
ALS QSHW F109 14Jun2022 Transaction Log:				
Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
June 14, 2022 10:14:43 AM	Auto	SessionCreated	Session	None
June 14, 2022 10:14:43 AM	Start	Configuration	Session	None
June 14, 2022 10:14:43 AM	Auto	EndSession	Session	User is Field Engineer and does not require an unlock code
June 14, 2022 10:15:16 AM	Auto	ExpLoaded	Session	EOP details for primary technique (testM): File path: [Protocol]testM\testMConfig\userinit9.50mgMuOS.50.eop EOP File Name: (testM).50.50.eop, EOP Name: (AgilentRecommended)
June 14, 2022 10:18:23 AM	End	Configuration	Session	None
June 14, 2022 10:19:24 AM	Start	Qualification	Session	OQ
June 14, 2022 10:19:29 AM	Start	Execution	Autosampler Check	Autosampler Check: ASX-520: None
June 14, 2022 10:19:42 AM	End	Execution	Autosampler Check	Autosampler Check: ASX-520: Run Count: 1
June 14, 2022 10:19:43 AM	Start	Execution	Integrated Sample Introduction System (SIS) Check: (SIS2) Integrated Sample Introduction System (SIS) Check	None
June 14, 2022 10:19:47 AM	End	Execution	Integrated Sample Introduction System (SIS) Check: (SIS2) Integrated Sample Introduction System (SIS) Check	Run Count: 1
June 14, 2022 10:19:50 AM	Start	Execution	Autobase: G3291A: Autosampler 1	None
June 14, 2022 10:22:28 AM	End	Execution	Autobase: G3291A: Autosampler 1	Run Count: 1

Date: June 14, 2022 10:32:51 AM
System ID: JP12091612

User Name: patthaporn_kurathorn
Host Name: ASDKRW313
System ID: JP12091812
Print Date: June 14, 2022 10:32:51 AM

ALS OQHW 7700 14Jun2022 Transaction Log:

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
June 14, 2022 10:22:29 AM Start	Execution	Background (No Gas Mode)	Background	None
June 14, 2022 10:22:45 AM End	Execution	Background (No Gas Mode)	Background	Run Count: 1
June 14, 2022 10:22:49 AM Start	Execution	Background (Gas Mode)	Background	None
June 14, 2022 10:23:35 AM End	Execution	Background (Gas Mode)	Background	Run Count: 1
June 14, 2022 10:23:37 AM Start	Execution	20-Minute Stability (No Gas Mode)	Stability	None
June 14, 2022 10:24:08 AM End	Execution	20-Minute Stability (No Gas Mode)	Stability	Run Count: 1
June 14, 2022 10:24:09 AM End	Qualification	Session	Session	OK
June 14, 2022 10:24:08 AM End	Reporting	Session	Session	None
June 14, 2022 10:30:26 AM Avail	Reporting	Session	Session	Report Generated: Certificate
June 14, 2022 10:30:39 AM Avail	Reporting	Session	Session	Report Generated: Report

Page 2 / 2

Date: June 14, 2022 10:32:51 AM
System ID: JP12091812

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User Name: patthaporn_kurathorn
Host Name: ASDKRW313
System ID: JP12091812
Print Date: June 14, 2022 10:32:51 AM

ALS OQHW 7700 14Jun2022 Transaction Log:

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
June 14, 2022 10:32:36 AM Audit	Reporting	Session	Session	Report Signed: Report PDF Name: ALS OQHW 7700 14Jun2022_20220614_OQ Report_1.pdf User Name: patthaporn_kurathorn@agilent.com Full Name of Signer: Patthaporn Kurathorn Reason for signature: Creation, approval and publication (the original version of document)

Page 3 / 3

Date: June 14, 2022 10:32:51 AM
System ID: JP12091812

Page 7 / 7



Metrological Center

SCI ECO Services Company Limited

33/2 Moo 3, T.Banpa, A.Kaengkhoi, Saraburi 18110
Telephone : +66 2 586 5792-4 Fax : +66 2 586 5109
Website : www.scieco.co.th E-Mail : calibrate@scg.co.th

Certificate No. T220730

Page 1 of 6

Certificate of Calibration

Equipment : HEATING BLOCK
Manufacturer : Environmental Express
Model : SC 196
Serial No. : 6974CECW3285
Customer Code : BKK_EL0054
ID No. : T5306A3
Customer : ALS Laboratory Group (Thailand) Co., Ltd.
104 Phatthanakan 40, Phatthanakan Rd., Khwaeng Phatthanakan,
Khet Suan Luang, Bangkok 10250
Customer Location : Acid Digestion Lab
Date of Receipt : 30 March 2022
Calibrated By : Watcharapon Sangtong (Technician)
Approved By : [Signature] / Sujjar Naknakred (Site Calibration Manager)
Date of Issue : 12 APR 2022

REVIEW BY Tatthaporn C.
APPROVED BY [Signature]
NEXT CAL. DATE 7/10/23

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

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



Metrological Center

SCI ECO Services Company Limited

33/2 Moo 3, T.Banpa, A.Kaengkhoi, Saraburi 18110
Telephone : +66 2 586 5792-4 Fax : +66 2 586 5109
Website : www.scieco.co.th E-Mail : calibrate@scg.co.th

Certificate No. T220730

Page 2 of 6

Calibration Report

Equipment : HEATING BLOCK
Date of Calibration : 7 April 2022
Environment : Temperature : 21.8-23.1 °C
Line Voltage : 221.6-226.3 V
Relative Humidity : 55 - 65 %RH

Condition of this results of calibration :

1. This equipment was calibrated by insert nine standard thermocouples type T into its chamber, the other one standard thermocouples type T use for ambient temperature measurement. The calibration was done in according to WI-T20.

All data show below were final values and the initial data from customer request. The temperature scale used was based on ITS - 90.

2. Reference Standard Instrument :

Instrument	Model	Instrument No.	Certificate No.	Due Date
TC	TYPE T	TN221-TN230	T210008	08 June 2022
TC	TYPE T	TN231-TN240	T210008	08 June 2022
DATA LOGGER	34970A	T149	T210008	08 June 2022

3. This certificate is traceable to :

National Institute of Metrology (Thailand) through Metrological Center (NSC-TISE-TIS 17025 CALIBRATION 0244.)

4. Condition of calibrated item : good

Equipment Description :

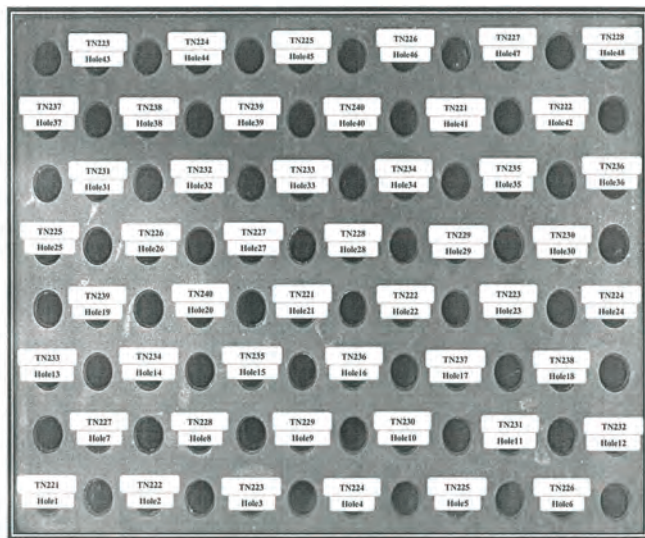
Time Constant : 2 Hour 25 Minute At 95 °C
Fresh Air Damper : ☐ Open ☐ Min ☐ Medium ☐ Max
☐ Close
☒ Not Available

5. Adjustment :

() without adjustment (X) after adjustment

Approved By: [Signature]

Calibration Report



FRONT CONTROL

Approved By. 

FM-L13 108/30-05-57

Calibration Report

Measurement Results

Calibration Point	Average Standard Reading at each position (°C)					
R1 Hole1-Hole6	TN221	TN222	TN223	TN224	TN225	TN226
CAL POINT	Max	93.60	93.82	94.05	94.20	94.36
	Min	93.07	93.26	93.51	93.66	93.82
	Average	93.33	93.54	93.78	93.93	94.09
R2 Hole7-Hole12	TN227	TN228	TN229	TN230	TN231	TN232
	Max	94.59	94.79	94.63	94.55	94.82
	Min	94.05	94.25	94.08	93.97	94.26
	Average	94.32	94.52	94.36	94.26	94.54
R3 Hole13-Hole18	TN233	TN234	TN235	TN236	TN237	TN238
	Max	95.03	94.54	94.78	94.84	95.06
	Min	94.46	93.98	94.20	94.28	94.49
	Average	94.74	94.26	94.49	94.56	94.78
R4 Hole19-Hole24	TN239	TN240	TN221	TN222	TN223	TN224
	Max	94.89	94.82	95.73	95.85	95.73
	Min	94.33	94.26	95.51	95.62	95.51
	Average	94.61	94.54	95.62	95.73	95.62
R5 Hole25-Hole30	TN225	TN226	TN227	TN228	TN229	TN230
	Max	96.28	96.39	96.37	96.54	96.19
	Min	96.01	96.10	96.02	96.20	95.89
	Average	96.15	96.24	96.20	96.37	96.04
R6 Hole31-Hole36	TN231	TN232	TN233	TN234	TN235	TN236
	Max	96.84	96.97	97.03	96.48	96.33
	Min	96.53	96.65	96.71	96.08	95.98
	Average	96.68	96.81	96.87	96.28	96.16
R7 Hole37-Hole42	TN237	TN238	TN239	TN240	TN221	TN222
	Max	96.46	96.15	96.19	96.06	96.95
	Min	96.13	95.84	95.85	95.72	96.64
	Average	96.30	95.99	96.02	95.89	96.80
R8 Hole43-Hole48	TN223	TN224	TN225	TN226	TN227	TN228
	Max	96.91	96.58	96.13	96.19	96.34
	Min	96.55	96.21	95.80	95.87	96.03
	Average	96.73	96.40	95.96	96.03	96.18

Approved By. 

FM-L13 108/30-05-57

Calibration Report

Measurement Results

Calibration Point	Average Standard Reading at each position (°C)					
R1 Hole1-Hole6	TN221	TN222	TN223	TN224	TN225	TN226
CAL POINT	Max	104.47	104.65	104.79	105.31	105.47
	Min	104.15	104.27	104.45	104.98	105.14
	Average	104.31	104.46	104.62	105.15	105.31
R2 Hole7-Hole12	TN227	TN228	TN229	TN230	TN231	TN232
	Max	105.55	105.73	105.65	105.84	105.97
	Min	105.28	105.43	105.35	105.52	105.68
	Average	105.42	105.58	105.50	105.68	105.82
R3 Hole13-Hole18	TN233	TN234	TN235	TN236	TN237	TN238
	Max	106.14	106.06	105.81	106.05	105.81
	Min	105.85	105.81	105.55	105.80	105.53
	Average	106.00	105.94	105.68	105.92	105.67
R4 Hole19-Hole24	TN239	TN240	TN221	TN222	TN223	TN224
	Max	105.86	105.60	104.44	104.51	104.28
	Min	105.61	105.37	104.27	104.35	104.12
	Average	105.74	105.48	104.35	104.43	104.20
R5 Hole25-Hole30	TN225	TN226	TN227	TN228	TN229	TN230
	Max	104.94	104.93	104.97	105.08	104.68
	Min	104.77	104.75	104.76	104.90	104.51
	Average	104.85	104.84	104.86	104.99	104.60
R6 Hole31-Hole36	TN231	TN232	TN233	TN234	TN235	TN236
	Max	105.44	105.45	105.61	104.95	104.84
	Min	105.27	105.27	105.44	104.76	104.66
	Average	105.36	105.36	105.53	104.86	104.75
R7 Hole37-Hole42	TN237	TN238	TN239	TN240	TN221	TN222
	Max	105.17	104.70	104.59	104.51	105.22
	Min	105.00	104.53	104.41	104.35	105.04
	Average	105.08	104.62	104.50	104.43	105.13
R8 Hole43-Hole48	TN223	TN224	TN225	TN226	TN227	TN228
	Max	105.61	105.45	105.10	104.77	104.87
	Min	105.44	105.28	104.92	104.60	104.70
	Average	105.53	105.37	105.01	104.69	104.79

Approved By. 

FM-L13 108/30-05-57

Calibration Report

Measurement Results:

HEATING BLOCK			Temperature Distribution	
Setting (°C)	Reading (°C)		Stability (± °C)	Uncertainty (± °C)
	Min , Max	Average		
100.0	100.0 , 100.4	100.1	0.29	0.83
105.0	105.0 , 105.4	105.1	0.29	0.79

* The quoted uncertainty exclude " uniformity "

The calibration result apply only the above calibrated item.

The result of test was found accurate as shown on date and place of test only.

The reported expanded uncertainty is based on a standard uncertainty multiplied by a coverage factor k which for a t-distribution, providing a level of confidence of approximately 95 % .

Approved By. 

FM-L13 108/30-05-57



Agilent Technologies (Thailand) Limited
 U CHU LIANG BLDG. 22/F UNIT A.D.
 968 RAMA 4 ROAD, SILOM, BANGKOK
 Bangkok 10500 Thailand
 Tel: +662 637 6383
 Fax: +662 632 4334
 Email: ccc-smt@agilent.com
 Website: www.agilent.com/chem

Service Confirmation Number: 6904800024
 Service Confirmation Date: 20.03.2023

Customer Contact:

ALS Laboratory Group (Thailand) Co
 Ltd
 Head Office
 104 Phatthanakan 40 Phatthanakan Rd
 Khwaeng Phatthanakan Khet Suan
 TAX ID : 0105540004859
 Chanattagarn.jmchom@alsglobal.com
 27603068

Invoice To:

ALS Laboratory Group (Thailand) Co
 Ltd
 Head Office
 104 Phatthanakan 40 Phatthanakan Rd
 Khwaeng Phatthanakan Khet Suan

Delivery Site:

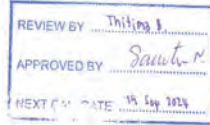
ALS Laboratory Group (Thailand) Co
 Ltd
 Head Office
 104 Phatthanakan 40 Phatthanakan Rd
 Khwaeng Phatthanakan Khet Suan

Location:

Room
 Bldg
 Lab
 Dept

SERVICE REPORT

Customer Purchase Order Number:	Customer Number:
	70371013
Service Request:	Service Request Date:
Service Order:	Service Confirmation:
6006033911	6904800024



Direct Inquiries to:
 Contact Name: Customer Contact Center
 Contact E-mail: ccc-smt@agilent.com
 Contact Telephone: +662 637 6383
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 Acc. No: 012-4452-097
 T10/Kong Thai Bank PCL
 Siam Square Bldg. 416/1-2 Rama 1 Rd./Pathumvithi BKK 10330
 Thailand

Page 1 of 3

Service Instrument:

Model Number	Model Description	Serial Number	System Handle	Parent Asset
SYS-IO-5100	ICP-OES 5100/5110 System			
G3010A	Agilent 5100 SVDV ICP-OES Spectrometer	MY1601000E	ICP OES 5100	SYS-IO-5100
G2410A	SPS 4 Autosampler	AU15440764	ICP OES 5100	SYS-IO-5100

Service Items:

Item	Service/Part #	Description	Qty	Entitlement	Service Start	Service End
1000	EQO	Enterprise Operational Qualification	1.00	Agreement Entitlement - 100 % covered	20.03.2023	20.03.2023

Additional Information:

Service Confirmation Number: 6904800024
 Service Confirmation Date: 20.03.2023

Service Information:

Problem Description: WU-S-QG-IO-5100-5001143313		
Service Provided: Complete DOHW 5100ICP OES Equipment ID: BKK_EL0037, all tools passed		
Service Overview Code: Reason Code: Scheduled Service Diagnosis Code: Scheduled Service Resolution Code: Scheduled Service		
Reported Hours: 4.0	Travel Hours: 2.0	
Customer Field Service Representative Name: Kanyakorn Sukahtajjarern	Customer Field Service Representative Signature: 	Date: 29 Mar 2023
Customer Name: Thitima Boonpeng	Customer Signature: 	Date: 20 Mar 2023
Additional Comments:		

Page 2 of 3



Performance Verification Certificate

for Mercury Analyzer

Product ID Quicktrace M-8000 , Teledyne Leeman Labs
Equipment ID BKK_EL0128 Mercury Analyzer
 S/N: US22133002
 BKK_EL0129 Autosampler
 S/N: 052222A560
Customer Name ALS Laboratory Group (Thailand) Co., Ltd.
Address 104 Soi Pattana 40, Pattana Rd. Suan Luang, Suan Luang
 Bangkok 10250 Thailand

Date of Qualified November 30, 2022
Next Due date November 30, 2023

This certifies for products which was performed in acceptable criteria specifications

Autosampler & Sample Introduction	PASSED
Analyzer	PASSED
Gas Liquid Separator & Dryer	PASSED
CVFS Detector	PASSED
Electronics/Mechanical	PASSED
Data station/PC	PASSED
Analytical test	PASSED

Provided by

Scientist Instrument Co., Ltd.
 113 Soi Ekachai 44, Ekachai Road
 Khlong Bang Phran, Bangbon
 Bangkok 10150 Thailand

Certified by

Thunraphol Sakdayos
 Service Engineer



Cert. No.: 22TM676
Page.: 1 of 3

Certificate of Calibration

Equipment : Autoclave
Manufacturer : TOMY
Model : SX-700
Serial No. : 48134190
ID No. : BKK_ML0041

Submitted by : ALS Laboratory Group (Thailand) Co., Ltd.
104 Phatthanakan 40, Phatthanakan Rd.,
Khwaeng Phatthanakan, Khet Suan Luang,
Bangkok 10250 Thailand
Location : Media Preparation Room

Received Order : 20 May 2022
Calibration Date : 20 May 2022
Ambient Temperature : (26 ± 10) °C
Relative Humidity : (50 ± 30) %

Calibrated by : Preecha Hlahib

Approved by :
Approved Signatory

() Pornthippa Tameyakul
() Malee Butkruea
(✓) Suwit Imjai

Issue Date : 24 May 2022

The Uncertainties are for a confidence probability of approximately 95%

This certificate may not be reproduced other than in full, except with the prior written
Approval of the head of Corporate Services 1: Equipment Calibration and Testing Services.

A 0041435



Equipment : Autoclave
Condition As-Received : Used Item
Reference : 2205-0404OC-2
Procedure Used :-

Cert. No.: 22TM676
Page.: 2 of 3

Calibration were conducted using in-house calibration procedure CP-OT03 according to direct measurement method with Data Acquisition which connected with Thermocouple Type T
The temperature scale used was based on ITS-90.

Condition of this result of calibration

1. Reference standard instrument:-

Instrument	Model	Serial No.	Cert. No.	Due Date
1) Data Acquisition	34972A	MY57013823	22LM24	26 Feb 2023

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.

4. This result of calibration covers laboratory autoclaves for the sterilization of goods and material which could be infected with organisms categorized as Hazard Group 1, 2 and 3**

(** = Categorization of pathogens according to hazard and categories of containment, second edition, 1990)
It does not cover autoclaves for use with material infect with organisms in Hazard Group 4, for which complete containment and sterilization of infected condensate is considered to be essential.

This result of calibration does not apply to sterilizers or disinfectors used for medical, dental, pharmaceutical or veterinary purposes which are directly concerned with patient care, or those used for fabrics subjected to sterilization which are required to be dry at the end of cycle.

Result of Calibration :- (*) Without Adjustment

Function of UUC* : Temperature Source



	Environmental		
	(°C)	(%R.H.)	(Volt)
Beginning of Calibration	24	55	220
Finished of Calibration	26	57	221

Position	Description	Ref. Std. ID No.:
1 =	Center of chamber	19-17TC-11
2 =	Temperature sensor	19-17TC-12
3 =	Exhaust port	19-17TC-13

a 1109670



Equipment : Autoclave
Condition As-Received : Used Item
Reference : 2205-0404OC-2
Result of Calibration :- (*) Without Adjustment

Cert. No.: 22TM676
Page.: 3 of 3

Operating parameter Set : Temperature = 108 °C Sterilization period = 10 minute							
UUC* Setting (°C)	UUC* Reading (°C)	Position	Average* Standard Reading (°C)	Stability (± °C)	Pressure Reading (MPa)	Uncertainty (± °C)	Coverage Factor k
108	108	1	107.536	0.19	0.04	0.91	2
		2	107.542				
		3	107.471				

Operating parameter Set : Temperature = 115 °C Sterilization period = 20 minute							
UUC* Setting (°C)	UUC* Reading (°C)	Position	Average* Standard Reading (°C)	Stability (± °C)	Pressure Reading (MPa)	Uncertainty (± °C)	Coverage Factor k
115	115	1	114.502	0.15	0.08	0.89	2
		2	114.582				
		3	114.539				

Operating parameter Set : Temperature = 118 °C Sterilization period = 10 minute							
UUC* Setting (°C)	UUC* Reading (°C)	Position	Average* Standard Reading (°C)	Stability (± °C)	Pressure Reading (MPa)	Uncertainty (± °C)	Coverage Factor k
118	118	1	117.517	0.094	0.09	0.88	2
		2	117.616				
		3	117.530				

Result of Calibration :- (*) Without Adjustment

Operating parameter Set : Temperature = 121 °C Sterilization period = 30 minute							
UUC* Setting (°C)	UUC* Reading (°C)	Position	Average* Standard Reading (°C)	Stability (± °C)	Pressure Reading (MPa)	Uncertainty (± °C)	Coverage Factor k
121	121	1	120.400	0.18	1.1	0.90	2
		2	120.511				
		3	120.465				

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

Stability : One-half of the greatest maximum difference of measured temperature at any one probe.

UUC* : Unit Under Calibration

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

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

-000-

a 1109669



Cert. No.: 22TM102
Page.: 1 of 3

Certificate of Calibration

Equipment : Incubator

Manufacturer : SHEL-LAB

Model : 1915A

Serial No. : 0200599

ID No. : BKK_ML0010

Submitted by : ALS Laboratory Group (Thailand) Co., Ltd.
104 Phatthanakan 40, Phatthanakan Rd.,
Khwaeng Phatthanakan, Khet Suan Luang,
Bangkok 10250 Thailand

Location : Incubation & Micrological Reading

Received Order : 21 January 2022

Calibration Date : 21 January 2022

Ambient Temperature : (26 ± 10) °C

Relative Humidity : (50 ± 30) %

Calibrated by : Krisda Malee

Approved by :
Approved Signatory

() Pornthippa Tameyakul
(✓) Malee Butkruea
() Suwit Imjai

Issue Date : 3 February 2022

The Uncertainties are for a confidence probability of approximately 95%

This certificate may not be reproduced other than in full, except with the prior written
Approval of the head of Corporate Services 1: Equipment Calibration and Testing Services.

A 0037377



Equipment : Incubator
Condition As-Received : Used Item
Reference : 2201-0616OC-1
Procedure Used :-

Cert. No.: 22TM102
Page: 2 of 3

Calibration were conducted using calibration procedure CP-OT02 according to direct measurement method with Data Acquisition which connected with Resistance Temperature Detector (RTD).

The temperature scale used was based on ITS-90.

Condition of this result of calibration

1. Reference standard instrument:-

Instrument	Model	Serial No.	Cert. No.	Due Date
1) Data Acquisition	34972A	MY57013711	21LM7	16 Jun 2022

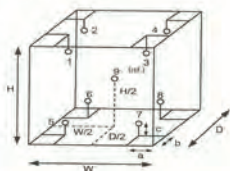
2. This certificate is valid only to the item calibrated on date and place of calibration.

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

Result of Calibration :- (*) Without Adjustment

Function of UUC* : Temperature Source

Fresh air setting : Close



Probe Installation Details :

Dimension of Chamber :

a = 10 cm
b = 10 cm
c = 10 cm
D = 0.90 m
W = 0.75 m
H = 1.2 m
Capacity = 0.81 m³

Environment during calibration		
	Beginning	Finished
Temp. (°C)	26	25
REL.Humid. (%)	53	54
AC Supply (Volt)	220	221

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

Malu.

a 1092309



Equipment : Incubator
Condition As-Received : Used Item
Reference : 2201-0616OC-1
Result of Calibration :- (*) Without Adjustment
Function of UUC* : Temperature Source
Fresh air setting : Close

Cert. No.: 22TM102
Page: 3 of 3

Calibration Point (°C)	UUC* Setting (°C)	UUC* Reading (°C)	Temperature stability (± °C)	Temperature uniformity (°C)	Overall Variation (°C)	Uncertainty (± °C)	Coverage Factor k
35.0	35.0	35.0	0.043	0.41	0.42	0.30	2

Measured Temperature (°C)									
Calibration Point (°C)	Position								
	1	2	3	4	5	6	7	8	9 (ref.)
35.0	34.801	34.868	34.862	35.012	35.040	35.010	35.084	35.040	35.178

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

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

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

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

UUC* : Unit Under Calibration

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

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

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Malu.

a 1092308



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
CORPORATE SERVICES & EQUIPMENT CALIBRATION AND TESTING SERVICES
5344 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG BANGKOK 10250
TEL. 0-2717-3000-27 FAX. 0-2719-9484



Cert. No.: 22TM1571
Page: 1 of 3

Certificate of Calibration

Equipment : Hot Air Oven

Manufacturer : Binder

Model : ED 240/E2

Serial No. : 00-15533

ID No. : BKK_ML0013

Submitted by : ALS Laboratory Group (Thailand) Co.,Ltd.
104 Phatthanakan 40, Phatthanakan Rd.,
Khwaeng Phatthanakan, Khet Suan Luang,
Bangkok 10250 Thailand

Location : Media Preparation Room

Received Order : 21 November 2022
Calibration Date : 21 November 2022

Ambient Temperature : (26 ± 10) °C
Relative Humidity : (50 ± 30) %

Calibrated by : Krisda Malee

Approved by :
Approved Signatory

() Pornthippa Tamayakul
() Malee Butkruea
() Suwit Imjai

Issue Date : 29 November 2022

The Uncertainties are for a confidence probability of approximately 95%

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Approval of the head of Corporate Services & Equipment Calibration and Testing Services.

A 0048150



Equipment : Hot Air Oven
Condition As-Received : Used Item
Reference : 2211-0623OC-1

Cert. No.: 22TM1571
Page: 2 of 3

Procedure Used :-

Calibration were conducted using calibration procedure CP-OT02 according to direct measurement method with Data Acquisition which connected with Thermocouple Type T.

The temperature scale used was based on ITS-90.

Condition of this result of calibration

1. Reference standard instrument:-

Instrument	Model	Serial No.	Cert. No.	Due Date
1) Data Acquisition	34970A	MY44067817	22LM121	22 Aug 2023

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

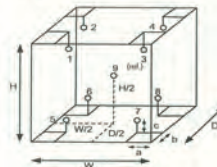
3. This certification is traceable to the International System of Unit.

Result of Calibration :- (*) After Adjustment

Function of UUC* : Temperature Source

Fresh air setting : Not Available

Environment during calibration		
	Beginning	Finished
Temp. (°C)	26	26
REL.Humid. (%)	53	55
AC Supply (Volt)	219	220



Probe Installation Details :

Dimension of Chamber :

a = 5.0 cm
b = 5.0 cm
c = 5.0 cm
D = 0.50 m
W = 0.80 m
H = 0.60 m
Capacity = 0.24 m³

Position :	Ref. Std. ID No.:
1	21-15TC-01
2	21-15TC-02
3	21-15TC-03
4	21-15TC-04
5	21-15TC-05
6	21-15TC-06
7	21-15TC-07
8	21-15TC-08
9 (ref.)	21-15TC-09

Malu.

a 1138049



Equipment : Hot Air Oven
 Condition As-Received : Used Item
 Reference : 2211-0623OC-1
 Result of Calibration :- (*) After Adjustment
 Function of UUC* : Temperature Source
 Fresh air setting : Not Available

Cert. No.: 22TM1571
 Page: 3 of 3

Calibration Point (°C)	UUC* Setting (°C)	UUC* Reading (°C)	Temperature stability (± °C)	Temperature uniformity (°C)	Overall Variation (°C)	Uncertainty (± °C)	Coverage Factor k
180	180	180	0.70	1.5	2.9	1.4	2

Calibration Point (°C)	Measured Temperature (°C)								
	Position								
	1	2	3	4	5	6	7	8	9 (ref.)
180	179.520	180.585	178.855	179.482	178.827	179.938	179.074	180.199	180.068

Average* : The average of 30 values in each position.
 Temperature stability : One-half of the greatest maximum difference of measured temperature at any one sensor.
 Temperature uniformity : The maximum difference of measured temperatures at any sensors and the measured temperature at the reference location which are observed at the same time or at as close an observation time as possible to determine the temperature pattern or homogeneity within the chamber under steady-state conditions.
 Overall Variation : The Difference of the maximum and minimum measured temperatures throughout observation.
 UUC* : Unit Under Calibration
 Note : The reported uncertainty of measurement was included stability and excluded uniformity.

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

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a 1138053



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
 CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES
 534/1 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG BANGKOK 10250
 TEL. 0-2717-5000-27 FAX. 0-2719-9484



Certificate of Calibration

Cert. No.: 22TM677
 Page.: 1 of 3

Equipment : Water Bath
 Manufacturer : Memmert
 Model : WNE 45
 Serial No. : L712.0429
 ID No. : BKK_ML0056
 Submitted by : ALS Laboratory Group (Thailand) Co., Ltd.
 104 Phatthanakan 40, Phatthanakan Rd.,
 Khwaeng Phatthanakan, Khet Suan Luang,
 Bangkok 10250 Thailand
 Location : Incubator & Microbiological Reading
 Received Order : 20 May 2022
 Calibration Date : 20 May 2022
 Ambient Temperature : (26 ± 10) °C
 Relative Humidity : (50 ± 30) %
 Calibrated by : Praecha Hlahib

Approved by :
 Approved Signatory
 () Pornthippa Tameyakul
 () Malee Butkruea
 (x) Suwit Imjai

Issue Date : 24 May 2022
 The Uncertainties are for a confidence probability of approximately 95 %

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

A 0041433



Equipment : Water Bath
 Condition As-Received : Used Item
 Reference : 2205-0404OC-1

Cert. No.: 22TM677
 Page.: 2 of 3

Procedure Used :-

Calibration were conducted using in-house calibration procedure CP-OT04 according to direct measurement method with Data Acquisition which connected with Industrial Platinum Resistance Thermometer (IPRT).

The temperature scale used was based on ITS-90.

Condition of this result of calibration

1. Reference standard instrument:-

Instrument	Model	Serial No.	Cert. No.	Due Date
1) Data Acquisition	34972A	MY57013823	22LM24	26 Feb 2023

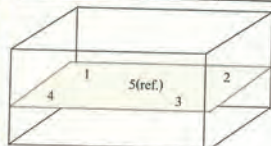
2. This certificate is valid only to the item calibrated on date and place of calibration.

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

Result of Calibration :- (*) Without Adjustment

Function of UUC* : Temperature Source

	Environmental		AC Voltage Supply
	(°C)	(%R.H.)	(Volt)
Beginning of Calibration	24	47	220
Finished of Calibration	24	52	221



Front

Position :	Ref. Std. S/N.:
1	4804539-006
2	4804539-007
3	4804539-008
4	4804539-009
5 (ref.)	4804539-010

a 1109674



Equipment : Water Bath
 Condition As-Received : Used Item
 Reference : 2205-0404OC-1
 Result of Calibration :- (*) Without Adjustment
 Function of UUC* : Temperature Source

Cert. No.: 22TM677
 Page.: 3 of 3

Calibration point (°C)	UUC* Setting (°C)	UUC* Reading (°C)	Average* Standard Reading (°C)				
			Position				
			1	2	3	4	5 (ref.)
44.5	44.4	44.4	44.539	44.497	44.476	44.506	44.507

Calibration point (°C)	Uniformity (°C)	Stability (± °C)	Uncertainty (± °C)	Coverage Factor k
44.5	0.068	0.030	0.15	2

Average* : The average of 30 values in each position.
 Uniformity : The maximum difference of measured temperatures at any sensors and the measured temperature at the reference location which are observed at the same time or at as close an observation time as possible to determine the temperature pattern or homogeneity within the chamber under steady-state conditions.
 Stability : One-half of the greatest maximum difference of measured temperature at any one probe.
 UUC* : Unit Under Calibration

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

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

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a 1109673