

ภาคผนวก จ

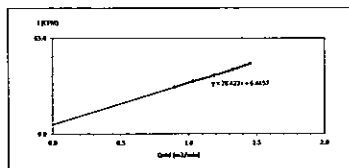
เอกสารการสอบเทียบเครื่องมือตรวจวิเคราะห์



High Volume Air Sampler Calibration Worksheet

Project Site: Banyan Industrial Park (Chang) Barometric Pressure (mm Hg): 756
 Calibration Location: Wattana, Bangkok, Thailand Temperature (°C): 32
 Calibration Date: 4 Dec 22 High Volume ID: RVS-750184
 Calibration Sheet No: C-091122-RVS-750184 High Volume Model: TS-5000
 Calibration ID: RVS-750184 High Volume S/N: 1792
 Calibration Model: TS-5000 Calibration Slope: 1.56763
 Calibration S/N: 1166 Calibration Intercept: -0.0041

Test No.	Inlet H ₂ O (inches)	Gas (m ³ /min)	1 Chart (CFM)	Linear Regression
1	1.0	0.0777	32	Slope: 26.4239
2	2.0	1.0334	36	Intercept: 0.4557
3	3.0	1.1992	40	Correlation Coefficient: 0.9993
4	4.0	1.3192	44	
5	5.0	1.4536	48	



Calibrated by: [Signature] Approved by: [Signature]
 [McKenzie Chalkins] Field Supervisor [Dr. Ruyang Jantaram] Factory Field Coordinator Scientist (I)

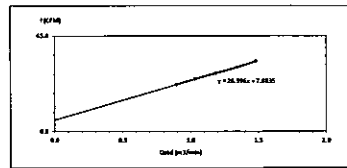
FORM NO. PM-074 REVISED 01-15-2016 DATE 11/15/16



High Volume Air Sampler Calibration Worksheet

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FORM NO. PM-074 REVISED 01-15-2016 DATE 11/15/16



63/14-15,67/35-36, Soi Petchkasem 7/1, Petchkasem Rd.
 Wattana, Bangkok, Thailand 10600 Thailand.
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CALIBRATION

Continued See W-030110222

Page 1 of 2 pages

Measurement Item: Flow rate with data logger

Manufacturer: Data logger: RVS-750184
Gas analyzer: RVS-750184

Model/Type: Data logger: RVS-750184
Gas analyzer: RVS-750184

Serial Number: Data logger: RVS-750184
Gas analyzer: RVS-750184

Alt. No.: Data logger: RVS-750184
Gas analyzer: RVS-750184

Condition: AS IS
AS IS

Test Conditions: Flow rate with data logger
Temperature: 32°C
Pressure: 756 mm Hg
Relative humidity: 65%

Test Results: Flow rate: 1.56763
Intercept: -0.0041
Correlation Coefficient: 0.9993

Calibration Procedure: Calibration procedure for flow rate
AS IS

Traceability: The calibration procedure is traceable to the National Institute of Standards and Technology (NIST) through the use of a primary standard.

Measurement Date: 4 Dec 22
 Issue Date: 4 Dec 22

Calibrated by: [Signature] Approved by: [Signature]
 [McKenzie Chalkins] Field Supervisor [Dr. Ruyang Jantaram] Factory Field Coordinator Scientist (I)



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Continuation of Certificate of Calibration

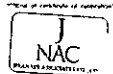
Continued See W-030110222
 Page 2 of 2 pages

Result of calibration: ☒ within statement ☐ with statement
 Calibration is the range of 1.1 to 1.5 m³/min at a relative humidity of 65%.

Flow Rate (m ³ /min)	Flow Rate (m ³ /min)	Flow Rate (m ³ /min)	Flow Rate (m ³ /min)
1.1	1.1	1.1	1.1
1.2	1.2	1.2	1.2
1.3	1.3	1.3	1.3
1.4	1.4	1.4	1.4
1.5	1.5	1.5	1.5
1.6	1.6	1.6	1.6
1.7	1.7	1.7	1.7
1.8	1.8	1.8	1.8
1.9	1.9	1.9	1.9
2.0	2.0	2.0	2.0
2.1	2.1	2.1	2.1
2.2	2.2	2.2	2.2
2.3	2.3	2.3	2.3
2.4	2.4	2.4	2.4
2.5	2.5	2.5	2.5
2.6	2.6	2.6	2.6
2.7	2.7	2.7	2.7
2.8	2.8	2.8	2.8
2.9	2.9	2.9	2.9
3.0	3.0	3.0	3.0

NOTE: The calibration procedure is based on standard uncertainty calculated by a primary standard and includes a value of confidence of approximately 95%.

NO.	Item	Manufacturer	Model/Type	Calibration Date	Calibration Result	Range
1	Flow rate	TS-5000	TS-5000	4 Dec 22	1.56763	1.1 to 1.5 m ³ /min
2	Flow rate	TS-5000	TS-5000	4 Dec 22	1.56763	1.1 to 1.5 m ³ /min
3	Flow rate	TS-5000	TS-5000	4 Dec 22	1.56763	1.1 to 1.5 m ³ /min
4	Flow rate	TS-5000	TS-5000	4 Dec 22	1.56763	1.1 to 1.5 m ³ /min
5	Flow rate	TS-5000	TS-5000	4 Dec 22	1.56763	1.1 to 1.5 m ³ /min
6	Flow rate	TS-5000	TS-5000	4 Dec 22	1.56763	1.1 to 1.5 m ³ /min
7	Flow rate	TS-5000	TS-5000	4 Dec 22	1.56763	1.1 to 1.5 m ³ /min



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CALIBRATION

Continued See W-030110222

Page 1 of 2 pages

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Manufacturer: Data logger: RVS-750184
Gas analyzer: RVS-750184

Model/Type: Data logger: RVS-750184
Gas analyzer: RVS-750184

Serial Number: Data logger: RVS-750184
Gas analyzer: RVS-750184

Alt. No.: Data logger: RVS-750184
Gas analyzer: RVS-750184

Condition: AS IS
AS IS

Test Conditions: Flow rate with data logger
Temperature: 32°C
Pressure: 756 mm Hg
Relative humidity: 65%

Test Results: Flow rate: 1.56763
Intercept: -0.0041
Correlation Coefficient: 0.9993

Calibration Procedure: Calibration procedure for flow rate
AS IS

Traceability: The calibration procedure is traceable to the National Institute of Standards and Technology (NIST) through the use of a primary standard.

Measurement Date: 4 Dec 22
 Issue Date: 4 Dec 22

Calibrated by: [Signature] Approved by: [Signature]
 [McKenzie Chalkins] Field Supervisor [Dr. Ruyang Jantaram] Factory Field Coordinator Scientist (I)



McKenzie Chalkins
 Factory Field Coordinator Scientist (I)



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Continuation of Certificate of Calibration

Continued See W-030110222
 Page 2 of 2 pages

Result of calibration: ☒ within statement ☐ with statement
 Calibration is the range of 1.1 to 1.5 m³/min at a relative humidity of 65%.

Flow Rate (m ³ /min)	Flow Rate (m ³ /min)	Flow Rate (m ³ /min)	Flow Rate (m ³ /min)
1.1	1.1	1.1	1.1
1.2	1.2	1.2	1.2
1.3	1.3	1.3	1.3
1.4	1.4	1.4	1.4
1.5	1.5	1.5	1.5
1.6	1.6	1.6	1.6
1.7	1.7	1.7	1.7
1.8	1.8	1.8	1.8
1.9	1.9	1.9	1.9
2.0	2.0	2.0	2.0
2.1	2.1	2.1	2.1
2.2	2.2	2.2	2.2
2.3	2.3	2.3	2.3
2.4	2.4	2.4	2.4
2.5	2.5	2.5	2.5
2.6	2.6	2.6	2.6
2.7	2.7	2.7	2.7
2.8	2.8	2.8	2.8
2.9	2.9	2.9	2.9
3.0	3.0	3.0	3.0

NOTE: The calibration procedure is based on standard uncertainty calculated by a primary standard and includes a value of confidence of approximately 95%.

Continuation of Certificate of Calibration



Cert. No.: ACC23023
Job No.: VC66AC0077
Page: 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.	Exp. Date
Waveform Generator	33211B	MY32302142	IT-0308-22	04-Feb-23
Digital Multimeter	33461A	MY33220094	EEL-03P, 040204	09-Feb-23
Digital Multimeter	33461A	MY33220076	EEL-03P, 030204	09-Feb-23
Digital Multimeter	33461A	MY33220073	EEL-03P, 030204	09-Feb-23
Programmable Attenuator	MA7-1070	62100114	IT-0309-22	05-Feb-23
Condenser Microphone	4180	2977900	AA-1013-22	24-Feb-23
Measuring Amplifier	NA-42KAI	34500495	AA-3005-22	22-Feb-23
Audio Analyzer	AVR-3360A	V744856069	EF-0010-22	07-Feb-23

2. The 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).

QP-TS12-04-04-02064

T. Petchani

Cert. No.: ACL22140
Job No.: VC66AC0069
Page: 2 of 3

Calibration Procedure: CP-AC-01

Calibration Method:

This equipment was calibrated by based on IEC-61672-2 (2013) Standard for sound level meter (SLM).
The SLM had been in Acoustic and Electrical signal test of frequency weighting with Acoustic chamber and Reference Standard Instruments.

The test results of each item were made by observation of each instrument display and also with SLM's display.

Condition of this result of calibration:

1. Reference Standard Instruments:

Instrument	Model	Serial No.	Cert. No.	Exp. Date
Waveform Generator	33210A	MY46017079	IT-0007-22	04-Feb-23
Waveform Generator	33511B	MY32302142	IT-0008-22	04-Feb-23
Digital Multimeter	33461A	MY33220104	LH-03P, 040204	09-Feb-23
Digital Multimeter	33461A	MY33220075	EEL-03P, 030204	09-Feb-23
Digital Multimeter	33461A	MY46017073	EEL-03P, 030204	09-Feb-23
Programmable Attenuator	MA7-1070	62100114	IT-0309-22	05-Feb-23
Condenser Microphone	4180	2977900	AA-1013-22	24-Feb-23
Measuring Amplifier	NA-42KAI	34500495	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:

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

QP-TS12-04-04-02064

T. Petchani

Cert. No.: ACC23023
Job No.: VC66AC0077
Page: 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	94.04	0.04	0.14	0.60

2. Frequency

Specified Frequency (Hz)	Measured value (Hz)	Deviated value (%)	Uncertainty (%)	Tolerance limit (%)
1000	1001.2	0.1	0.3	1.0

3. Total distortion

Measured value (%)	Uncertainty (%)	Tolerance limit (%)
1.70	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

QP-TS12-04-04-02064

T. Petchani

Cert. No.: ACL22140
Job No.: VC66AC0069
Page: 3 of 3

Summary of Measurement Results:

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. Acoustic 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 accuracy on the reference level range	✓	-	0.2	0.2
8. Level accuracy including the level range normal	✓	-	0.2	0.3
9. Time burst response	✓	-	0.2	0.3
10. Peak C-weight level	✓	-	0.2	0.35
11. Overload indication	✓	-	0.2	0.25
12. High level stability	✓	-	0.1	0.1

QP-TS12-04-04-02064

T. Petchani

431-4171 Sithiporn Rd., Bangkok, Bangkok 10700 THAILAND
Tel: 02-2435-9803 Fax: 02-2435-1879 e-mail: sithiporn@sithiporn.com Web: www.sithiporn.comCert. No.: ACL231148
Page: 1 of 8

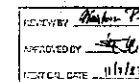
Calibration Certificate

Equipment: SOUND LEVEL METER
Manufacturer: RION
Model: NL-42 Microphone UC52 / Preamplifier NH-24
Serial No.: 00472132 / 149449 / 72466
ID No.: RYO_750104

Condition As Found: GOOD

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

Location: -
Ambient Temperature: (23.0 ± 3) °C
Pressure: (101.3 ± 3) kPa
Relative Humidity: (50.0 ± 2.0) %
Received Date: 06 JULY 2022
Calibration Date: 11-18 JULY 2022
Date of Issue: 19 JULY 2022



Calibrated by: T. Petchani

Approved by: T. Petchani
(Thanikul Petchani)

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

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Cert. No.: ACL22140
Job No.: VC66AC0069
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Result of calibration:

1. Absolute sensitivity

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

2. Self-generated noise

2.1 Normal level

Measured Value (dB)
34.2

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

Frequency Weighting	Measured value (dB)
A-weight	0.9
C-weight	36.3
F-weight	22.1

3. Acoustic signal tests of frequency weightings

Meter five-field acoustic response at a level of 94 dB

Frequency (Hz)	Deviation from reference frequency weighting response curve (dB)			Acceptance Limit
	F-weight	C-weight	A-weight	
125	0.2	0.2	0.2	±1.5
1000	-0.1	-0.1	-0.1	±1.0
8000	-0.1	-0.1	-0.1	±0.0

QP-TS12-04-04-02064

T. Petchani

Continuation of Calibration Certificate

Cert. No. : ACL321148
Job No. : VCA5AC0969
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A. Electrical signal level of frequency weightings

Weighting network response with reference 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	0.1	0.0	±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	0.1	0.0	±2.0
8000	0.0	0.1	0.1	±2.0

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	±0.2
C-weight	94.0	0.0	±0.2
Flat	94.0	0.0	±0.2

5.2 Time weightings at 1 kHz

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

A. Long-term stability

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

QF-TS12-04-01-02044

T. P. L.

Continuation of Calibration Certificate

Cert. No. : ACL321148
Job No. : VCA5AC0969
Page : 6 of 8

11. Overall indication

Measured value (dB)		Deviated Value (dB)	Acceptance Limits (dB)
Positive one-half cycle	Negative one-half cycle		
93.5	93.5	0.1	±1.5

12. High level stability

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

The reported accuracy 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-TS12-04-01-02044

T. P. L.

Continuation of Calibration Certificate

Cert. No. : ACL321148
Job No. : VCA5AC0969
Page : 6 of 8

7. Level accuracy on the reference level range

Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
137.0	137.0	0.0	±0.3
136.0	136.0	0.0	±0.3
135.0	135.0	0.0	±0.3
134.0	134.0	0.0	±0.3
133.0	133.0	0.0	±0.3
132.0	132.0	0.0	±0.3
131.0	131.0	0.0	±0.3
130.0	130.0	0.0	±0.3
129.0	129.0	0.0	±0.3
128.0	128.0	0.0	±0.3
127.0	127.0	0.0	±0.3
126.0	126.0	0.0	±0.3
125.0	125.0	0.0	±0.3
124.0	124.0	0.0	±0.3
123.0	123.0	0.0	±0.3
122.0	122.0	0.0	±0.3
121.0	121.0	0.0	±0.3
120.0	120.0	0.0	±0.3
119.0	119.0	0.0	±0.3
118.0	118.0	0.0	±0.3
117.0	117.0	0.0	±0.3
116.0	116.0	0.0	±0.3
115.0	115.0	0.0	±0.3
114.0	114.0	0.0	±0.3
113.0	113.0	0.0	±0.3
112.0	112.0	0.0	±0.3
111.0	111.0	0.0	±0.3
110.0	110.0	0.0	±0.3
109.0	109.0	0.0	±0.3
108.0	108.0	0.0	±0.3
107.0	107.0	0.0	±0.3
106.0	106.0	0.0	±0.3
105.0	105.0	0.0	±0.3
104.0	104.0	0.0	±0.3
103.0	103.0	0.0	±0.3
102.0	102.0	0.0	±0.3
101.0	101.0	0.0	±0.3
100.0	100.0	0.0	±0.3
99.0	99.0	0.0	±0.3
98.0	98.0	0.0	±0.3
97.0	97.0	0.0	±0.3
96.0	96.0	0.0	±0.3
95.0	95.0	0.0	±0.3
94.0	94.0	0.0	±0.3
93.0	93.0	0.0	±0.3
92.0	92.0	0.0	±0.3
91.0	91.0	0.0	±0.3
90.0	90.0	0.0	±0.3
89.0	89.0	0.0	±0.3
88.0	88.0	0.0	±0.3
87.0	87.0	0.0	±0.3
86.0	86.0	0.0	±0.3
85.0	85.0	0.0	±0.3
84.0	84.0	0.0	±0.3
83.0	83.0	0.0	±0.3
82.0	82.0	0.0	±0.3
81.0	81.0	0.0	±0.3
80.0	80.0	0.0	±0.3
79.0	79.0	0.0	±0.3
78.0	78.0	0.0	±0.3
77.0	77.0	0.0	±0.3
76.0	76.0	0.0	±0.3
75.0	75.0	0.0	±0.3
74.0	74.0	0.0	±0.3
73.0	73.0	0.0	±0.3
72.0	72.0	0.0	±0.3
71.0	71.0	0.0	±0.3
70.0	70.0	0.0	±0.3
69.0	69.0	0.0	±0.3
68.0	68.0	0.0	±0.3
67.0	67.0	0.0	±0.3
66.0	66.0	0.0	±0.3
65.0	65.0	0.0	±0.3
64.0	64.0	0.0	±0.3
63.0	63.0	0.0	±0.3
62.0	62.0	0.0	±0.3
61.0	61.0	0.0	±0.3
60.0	60.0	0.0	±0.3
59.0	59.0	0.0	±0.3
58.0	58.0	0.0	±0.3
57.0	57.0	0.0	±0.3
56.0	56.0	0.0	±0.3
55.0	55.0	0.0	±0.3
54.0	54.0	0.0	±0.3
53.0	53.0	0.0	±0.3
52.0	52.0	0.0	±0.3
51.0	51.0	0.0	±0.3
50.0	50.0	0.0	±0.3
49.0	49.0	0.0	±0.3
48.0	48.0	0.0	±0.3
47.0	47.0	0.0	±0.3
46.0	46.0	0.0	±0.3
45.0	45.0	0.0	±0.3
44.0	44.0	0.0	±0.3
43.0	43.0	0.0	±0.3
42.0	42.0	0.0	±0.3
41.0	41.0	0.0	±0.3
40.0	40.0	0.0	±0.3
39.0	39.0	0.0	±0.3
38.0	38.0	0.0	±0.3
37.0	37.0	0.0	±0.3
36.0	36.0	0.0	±0.3
35.0	35.0	0.0	±0.3
34.0	34.0	0.0	±0.3
33.0	33.0	0.0	±0.3
32.0	32.0	0.0	±0.3
31.0	31.0	0.0	±0.3
30.0	30.0	0.0	±0.3
29.0	29.0	0.0	±0.3
28.0	28.0	0.0	±0.3
27.0	27.0	0.0	±0.3
26.0	26.0	0.0	±0.3
25.0	25.0	0.0	±0.3

QF-TS12-04-01-02044

T. P. L.

SITHIPORN ASSOCIATES CO.,LTD.
CALIBRATION LABORATORY451-45171 Srinakharin Rd, Bangkok, Bangkok 10700 THAILAND
Tel: 24754070 Fax: 24751679 e-mail: cs@caliphorn.com http://www.caliphorn.comCert. No. : ACL321148
Page : 7 of 8

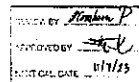
Calibration Certificate

Equipment : SOUND LEVEL METER
Manufacturer : RION
Model : SL-42 / Microphone UC-52 / Pre-amplifier NF-24
Serial No. : 00472130 / 137744 / 22464
ID No. : RYG, FS203

Condition As Found : (X)

Customer : A/S LABORATORY GROUP (THAILAND) CO., LTD.
104 PHATHANAKARAN 46, PHATHANAKARAN ROAD,
SITHIPORN PHATHANAKARAN, SITHIPORN 10150, BANGKOK, 10250 THAILAND.

Location :
Ambient Temperature : (25.0 ± 3.3) °C
Pressure : (101.3 ± 3.3) kPa
Relative Humidity : (50.0 ± 2.0) %
Received Date : 06 JULY 2022
Calibration Date : 13-14 JULY 2022
Date of Issue : 19 JULY 2022



Calibrated by : Kishoren Prachuan

Approved by : T. P. L.
(Thonchai Prachuan)

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-TS12-04-01-02044

Continuation of Calibration Certificate

Cert. No. : ACL321148
Job No. : VCA5AC0969
Page : 7 of 8

8. Level accuracy 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. Time based response

Time Weighting	Time duration, F _s (ms)	Cycle	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Fast	0.25	1	106.0	106.0	0.0	1.5 ± 0.0
	2	8	117.0	117.0	0.0	1.0 ± 0.5
	200	800	134.0	134.1	0.1	±0.2
Slow	2	8	106.0	106.0	0.0	1.5 ± 0.0
	200	800	127.6	127.6	0.0	±0.0
	0.25	1	99.0	99.0	-0.1	1.5 ± 0.0
REL	2	8	106.0	106.0	0.0	1.0 ± 0.5
	200	800	128.0	128.1	0.1	±0.0

10. Peak C sound level

Number of cycle in test signal	Anticipated Value (dB)	Measured Value, Leq (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.0	0.0	±
One	136.4	135.3	-1.1	±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-TS12-04-01-02044

T. P. L.

Continuation of Calibration Certificate

Cert. No. : ACL321148
Job No. : VCA5AC0969
Page : 8 of 8

Calibration Procedure : EP-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 in Acoustical and Electrical signal tests of frequency weighting with Acoustic chamber and Reference
Standard instruments.
For test results of each item were made by observation of each instrument display and also with SLM's display.

Condition of this result of calibration :

1. Reference Standard Instruments :

Instrument	Serial No.	Cert. No.	Due Date
Waveform Generator	13210A	MY04011976	04-Feb-23
Waveform Generator	73311H	MY53202742	04-Feb-23
Digital Multimeter	24461A	MY53220104	09-Feb-23
Digital Multimeter	33461A	MY53220076	09-Feb-23
Digital Multimeter	34461A	MY40054773	09-Feb-23
Programmable Attenuator	MAT-1070	62100134	07-Feb-23
Condenser Microphone	-4180	2079600	24-Feb-23
Measuring Amplifier	NA-425CA	54560495	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 valid to the international system of units maintained at :

3.1 National Institute of Metrology (Thailand).

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

QF-TS12-04-01-02044

T. P. L.

Continuation of Calibration Certificate

Cert. No. : ACL22159
Job No. : VCM5AC0069
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
1200 Hz	✓	-	0.3	0.6
2000 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 covered	✓	-	0.2	0.3
9. Fast burst response	✓	-	0.3	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-TS12-04-04-02064

~ P.L.L.

Continuation of Calibration Certificate

Cert. No. : ACL22159
Job No. : VCM5AC0069
Pages : 4 of 8

Result of Calibration.

1. Absolute sensitivity

Reference Acoustic Signal (dB)	Measured Value (dB)	Deviation (dB)	Acceptance Limits (dB)
92.9 (92.95)	93.9	0.0	±0.3

2. Self-generated noise

2.1. Normal test

Measured Value (dB)
23.4

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

Frequency Weighting	Measured value (dB)
A-weight	15.4
C-weight	21.0
Flat	26.9

3. Acoustical signal tests of frequency weightings

Measure three-field acoustic response at a level of 94 dB

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)			
	Flat	C-weight	A-weight	Acceptance Limits
125	0.0	0.0	0.0	±1.5
1000	-0.1	-0.1	-0.3	±1.0
2000	-0.3	-0.3	-0.3	±2.0

QF-TS12-04-04-02064

~ P.L.L.

Continuation of Calibration Certificate

Cert. No. : ACL22159
Job No. : VCM5AC0069
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	-0.2	-0.1	±2.0
125	-0.1	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	±1.0
8000	0.0	0.0	0.0	±3.0

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	±0.2
C-weight	94.0	0.0	±0.2
Flat	93.9	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	93.0	0.0	±0.1
1 sec	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	93.9	94.0	0.1	±0.3

QF-TS12-04-04-02064

~ P.L.L.

Continuation of Calibration Certificate

Cert. No. : ACL22159
Job No. : VCM5AC0069
Pages : 6 of 8

7. Level linearity on the reference level range

Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits
137.0	137.1	0.1	±1.1
136.0	136.1	0.1	±1.1
135.0	135.1	0.1	±1.1
134.0	134.1	0.1	±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	129.1	0.1	±1.1
125.0	124.0	-0.0	±1.1
119.0	118.1	-0.1	±1.1
114.0	114.1	0.1	±1.1
109.0	109.1	0.1	±1.1
104.0	104.1	0.1	±1.1
99.0	99.1	0.1	±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
26.0	26.0	0.0	±1.1
23.0	23.0	0.0	±1.1

QF-TS12-04-04-02064

~ P.L.L.

Continuation of Calibration Certificate

Cert. No. : ACL22159
Job No. : VCM5AC0069
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	±1.3

9. Time burst response

Time Weighting	Time burst duration, T _b (ms)	Cycle	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Fast	0.25	1	115.0	107.9	-0.1	1.5; -5.0
	2	8	117.0	114.1	-0.1	1.0; -2.5
Slow	200	800	134.0	134.0	0.0	±1.0
	2	8	108.0	108.0	0.0	1.5; -5.0
SEL	200	800	127.4	127.4	0.0	±1.0
	0.25	1	99.0	98.8	-0.2	1.5; -5.0
	2	8	106.0	106.0	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 (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.0	0.0	-
One	136.4	135.4	-0.8	±1.0

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-TS12-04-04-02064

~ P.L.L.

Continuation of Calibration Certificate

Cert. No. : ACL22159
Job No. : VCM5AC0069
Pages : 8 of 8

11. Overload indication

Measured value (dB)		Deviated Value (dB)	Acceptance Limits (dB)
Positive one-half cycle	Negative one-half cycle	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, giving a level of confidence of approximately 95 %

End of Calibration Certificate

QF-TS12-04-04-02064

~ P.L.L.

SITHIPORN ASSOCIATES CO.,LTD. CALIBRATION LABORATORY

411-411/1 Sathorn Rd., Bangkok, Thailand 10120 THAILAND
Tel: 0-2015-8800 Fax: 0-2015-1629 e-mail: cal@sitiporn.com.th http://www.sitiporn.com.th



Calibration Certificate

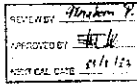
Equipment : SOUND LEVEL METER
Manufacturer : RION
Model : NL-427 Microphone UC-52 / Pre-amplifier 201-24
Serial No. : 0033141 / 144077 / 23232
ID No. : RYO_F30025

Condition As Found : GPOD

Customer : ALS LABORATORY GROUP (THAILAND) CO., LTD.
184 PHATHANAKAN RD. PHATHANAKAN ROAD,
KHWAENG PHATHANAKAN, KHUET SUAN LUANG,
BANGKOK, 10250 THAILAND.

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

Received Date : 14 JANUARY 2022
Calibration Date : 21-24 JANUARY 2022
Date of Issue : 25 JANUARY 2022



Calibrated by : Natchorn Pichairat

Approved by : *T. Pichairat*
(Thanakul Pichairat)

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QF-TS12-04-04-02064

SITHIPORN/ SITHIPORN ASSOCIATES CO.,LTD. CALIBRATION LABORATORY

Continuation of Calibration Certificate

Calibration Procedure : CP-AC-01

Calibration Method :
This equipment was calibrated by based on IEC-61672-1 (2013) Standard for sound level meters (SLM).
The SLM had been to Acoustical and Electrical signal tests of frequency weighting with Acoustic chamber and Reference Standard Instruments.
For test results of each item 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	MY48012076	FF-0012-21	10-Feb-22
Waveform Generator	33511H	MY23202742	FF-0011-21	10-Feb-22
Digital Multimeter	33461A	MY33220104	1ELAB-050204	10-Feb-22
Digital Multimeter	33461A	MY33220706	1ELAB-030204	06-Feb-22
Programmable Attenuator	34461A	MY16002272	1-16072221-1	15-Sep-21
Condenser Microphone	MA37-1070	6210114	1506-07774E	06-Nov-22
Measuring Amplifier	4180	2877900	AA-1008-21	05-Feb-22
Measuring Amplifier	NA-22KA1	3450495	AA-3003-21	16-Feb-22

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).

Cert. No. : ACL22004
Job No. : 1 VCM5AC0043
Pages : 2 of 8

SITHIPORN/ SITHIPORN ASSOCIATES CO.,LTD. CALIBRATION LABORATORY

Continuation of Calibration Certificate

Summary of Measurement Results

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	✓	-	0.3	0.6
125 Hz	✓	-	0.3	0.6
1000 Hz	✓	-	0.3	0.6
4. Electrical signal tests of frequency weightings	✓	-	0.3	0.6
For 10 Hz to 4 kHz	✓	-	0.3	0.7
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 accuracy on the reference level range	✓	-	0.2	0.3
8. Level accuracy including the level range extend	✓	-	0.2	0.3
9. Time burst response	✓	-	0.2	0.3
10. Peak C sound level	✓	-	0.2	0.35
11. Overload indicator	✓	-	0.2	0.25
12. High level stability	✓	-	0.1	0.1

Cert. No. : ACL22004
Job No. : 1 VCM5AC0043
Pages : 3 of 8

SITHIPORN/ SITHIPORN ASSOCIATES CO.,LTD. CALIBRATION LABORATORY

Continuation of Calibration Certificate

Cert. No. : ACL22004
Job No. : 1 VCM5AC0043
Pages : 4 of 8

Result of Calibration :

1. Absolute sensitivity

Reference Acoustic Signal (dB)	Measured Value (dB)	Deviation (dB)	Acceptance Limit (dB)
93.9 (93.96)	93.9	0.0	±0.3

2. Self-generated noise

2.1 Normal test

Measured Value (dB)
14.2

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

Frequency Weighting	Measured value (dB)
A-weight	17.0
C-weight	22.5
Flat	

3. Acoustical signal tests of frequency weightings

3.1 Free-field acoustic response at a level of 94 dB

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)			Acceptance Limits
	Flat	C-weight	A-weight	
125	0.2	0.2	0.2	±1.5
1000	0.0	0.0	0.0	±1.0
8000	-0.9	-0.8	-0.8	±1.0

SITHIPORN/ SITHIPORN ASSOCIATES CO.,LTD. CALIBRATION LABORATORY

Continuation of Calibration Certificate

Cert. No. : ACL22004
Job No. : 1 VCM5AC0043
Pages : 5 of 8

4. Electrical signal tests of frequency weightings

4.1 Weighting network response with reference 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	±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	±3.0

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
Imp	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-TS12-04-04-02064

SITHIPORN/ SITHIPORN ASSOCIATES CO.,LTD. CALIBRATION LABORATORY

Continuation of Calibration Certificate

Cert. No. : ACL22004
Job No. : 1 VCM5AC0043
Pages : 6 of 8

7. Level accuracy on the reference level range

Assigned 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	131.8	-0.1	±1.1
131.0	130.9	-0.1	±1.1
129.0	129.0	0.0	±1.1
128.0	128.0	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
29.0	29.0	0.0	±1.1
24.0	24.0	0.0	±1.1
19.0	19.0	0.0	±1.1
14.0	14.0	0.0	±1.1
9.0	9.0	0.0	±1.1
4.0	4.0	0.0	±1.1

QF-TS12-04-04-02064

Continuation of Calibration Certificate

Cert. No. : CAL22054
Job No. : YCAL00045
Page : 7 of 8

6. Level linearity including the level range control

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

8. Time based response

Time	Time burst duration, T _B (ms)	Cycle	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limit (dB)
Fast	0.25	1	110.0	107.9	-0.1	±3.5
	2	3	117.0	117.0	0.0	±2.0
	200	300	154.0	154.0	0.0	±1.0
Slow	2	8	106.0	106.0	0.0	±1.5
	200	800	127.4	127.4	0.0	±1.0
	0.25	1	99.0	99.9	0.9	±3.5
SEL	2	8	108.0	108.0	0.0	±2.5
	200	800	128.0	128.0	0.0	±1.0

10. Peak C level test

Number of cycle in test signal	Anticipated Value (dB)	Measured Value, 1 peak (dB)	Deviated Value (dB)	Acceptance Limit (dB)
Continuous	133.0	133.0	0.0	-
One	136.4	136.4	0.0	±1.0

Number of cycle in test signal	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limit (dB)
Continuous	135.0	135.0	0.0	-
Positive half cycle	135.4	135.4	-0.3	±2.0
Negative half cycle	135.4	135.2	-0.2	±2.0

UM-TN12-04-04-0204-4

7. RTR

Continuation of Calibration Certificate

Cert. No. : CAL22054
Job No. : YCAL00045
Page : 8 of 8

11. Overload indication

Measured value (dB)	Deviated Value (dB)	Acceptance Limit (dB)
Positive over half cycle	-0.1	±1.5
Negative over half cycle	-0.1	±1.5

12. High level stability

Frequency	SIM Display at start (dB)	SIM Display at end (dB)	Deviated Value (dB)	Acceptance Limit (dB)
Weighting	137.0	137.0	0.0	±0.3
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 other following calculation, providing a level of confidence of approximately 95 %

End of Calibration Certificate

UM-TN12-04-04-0204-4

7. RTR

Bera Scientific Co., Ltd.
188 U Chu Long Building Floor 7 Room 708
Bangkok Bangkok, Thailand 10200
Tel : 02-633-1880 Fax : 02-633-1887
www.bersascientific.com

Certificate of Calibration

Certificate No. : BSCC-UN-20722
Equipment : LAFV-1500 Spectrophotometer
Model : UN-1500
Manufacturer : Shimadzu
Serial No. : A11548063300
ID No. : BKC_EN0018
Date of receipt : 16 September 2022
Date of calibration : 16 September 2022
Date of issue : 23 September 2022

Customer name : ALS Laboratory Group (Thailand) Co., Ltd.
Address : 104 Bha Phraithanank Road, Phraithanank Road, Phraithanank, Samut Prakan, Bangkok 10200

Temperature : (22 ± 2) °C (On site)
Humidity : (58 ± 5) % RH (On site)

Equipment condition : Good Operation
Calibration Location : Organic Plant
Calibration Procedure : In-house method YH-UN-702-01 based on AS 141 E27-01

Traceability : Wavelength Accuracy is traceable to certificate No. 95017 and 95018
Photometric Accuracy is traceable to certificate No. 95014 and 95017
Step Light is traceable to certificate No. 95009
The above certificate is traceable to SI unit through Bera Scientific Ltd.
(UKAS accredited calibration laboratory NO. 0601)

Calibrated by : Mr. T. N. N. N.

Approved by :
Mr. N. N. N. N.
Technical Manager

The above results are valid exclusively for the calibrated item(s) as mentioned in the report certificate.
Any other use of the report certificate and validity of the results are prohibited and also shall not be reproduced
except in full, without written approval of the Bera Scientific Co., Ltd.

PM-LA-00-02 Rev 01 (220104)

Bera Scientific Co., Ltd.
188 U Chu Long Building Floor 7 Room 708
Bangkok Bangkok, Thailand 10200
Tel : 02-633-1880 Fax : 02-633-1887
www.bersascientific.com

Certificate of Calibration

Certificate No. : BSCC-UN-20722
Number of Page(s) : 2 of 2

Calibration Results:

1. Wavelength Accuracy

Wavelength (nm)	UNC (nm)	Error (nm)	Uncertainty (nm)
313.70	±0.05	-0.05	0.18
313.00	±0.05	-0.10	0.18
410.03	±0.06	-0.07	0.18
517.96	±0.06	-0.03	0.18
578.41	±0.17	-0.24	0.18

2. Photometric Accuracy (UV)

Wavelength (nm)	Certified Absorbance (A)	UNC (A)	Error (A)	Uncertainty (A)
235	0.0000	0.0008	0.0000	0.0075
257	0.0000	0.0007	-0.0008	0.0075
297	0.0000	0.0007	0.0000	0.0075
313	0.0000	0.0007	0.0000	0.0075
350	0.0000	0.0007	0.0000	0.0075

*CNR = Customer not request

The above results are valid exclusively for the calibrated item(s) as mentioned in the report certificate.
Any other use of the report certificate and validity of the results are prohibited and also shall not be reproduced
except in full, without written approval of the Bera Scientific Co., Ltd.

PM-LA-00-02 Rev 01 (220104)

Bera Scientific Co., Ltd.
188 U Chu Long Building Floor 7 Room 708
Bangkok Bangkok, Thailand 10200
Tel : 02-633-1880 Fax : 02-633-1887
www.bersascientific.com

Certificate of Calibration

Certificate No. : BSCC-UN-20722
Number of Page(s) : 2 of 2

Calibration Results:

3. Photometric Accuracy (Visible)

Wavelength (nm)	Certified Absorbance (A)	UNC (A)	Error (A)	Uncertainty (A)
405.8	0.0000	0.0000	0.0000	0.0042
	0.5750	0.0000	-0.0000	0.0042
	0.7600	0.0000	0.0000	0.0042
	1.0000	0.0000	0.0000	0.0042
440.9	0.0000	0.0000	0.0000	0.0042
	0.8421	0.0000	-0.0000	0.0042
	0.7400	0.0000	0.0000	0.0042
	0.9900	0.0000	0.0000	0.0042
485.0	0.0000	0.0000	0.0000	0.0042
	0.9207	0.0000	-0.0000	0.0042
	0.8800	0.0000	0.0000	0.0042
	0.9400	0.0000	0.0000	0.0042
546.1	0.0000	0.0000	0.0000	0.0042
	0.9207	0.0000	-0.0000	0.0042
	0.8800	0.0000	0.0000	0.0042
	0.9400	0.0000	0.0000	0.0042
589.3	0.0000	0.0000	0.0000	0.0042
	0.9207	0.0000	-0.0000	0.0042
	0.8800	0.0000	0.0000	0.0042
	0.9400	0.0000	0.0000	0.0042

*CNR = Customer not request

4. Step Light

Wavelength (nm)	Time Under Calibration (min)	Wavelength (nm)	Time Under Calibration (min)
200.000 ± 0.001	200.00	200.000 ± 0.001	200.00

The above results are valid exclusively for the calibrated item(s) as mentioned in the report certificate.
Any other use of the report certificate and validity of the results are prohibited and also shall not be reproduced
except in full, without written approval of the Bera Scientific Co., Ltd.

PM-LA-00-02 Rev 01 (220104)

SCG Metrological Center
SCI ECO Services Company Limited
33/2 Moo 3, T. Bangna, A. Klongkiet, Bangkok 10110, Thailand
Bangkok Tel : +66 2627 3006 Fax : +66 2627 3100
Bangkok Tel : +66 2626 6851 + +66 2627 2360
Website : www.scgco.co.th E-Mail : center@scg.co.th

Certificate of Calibration

Certificate No. : T221444
Page 1 of 4

Equipment : Chamber (Cold Room)
Manufacturer : KOLDTECH
Model : KN 330
Serial No. : TBN-1012061/05
Customer Code : BKC_EN0167
ID No. : T2463A3
Customer : ALS Laboratory Group (Thailand) Co., Ltd.
104 Phatthanank Road, Phatthanank Rd., Khwaeng Phatthanank,
Khet Sam Luang, Bangkok 10250

Customer Location : Environmental Laboratory
Date of Receipt : 27 June 2022
Calibrated By : Sujjar Nakanakred (Site Calibration Manager)
Approved By : / Boonchai Suriyawan (Site Calibration Manager)
Date of Issue : 01 JUL 2022

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

The Certificate is issued in accordance with the conditions of accreditation granted by the Thai Laboratory Accreditation Scheme which has measured the measurement capability of the laboratory and its traceability is recognized nationally and internationally and to the quality of the measurement results of the laboratory. This certificate may be reproduced only when it is full except with the prior written approval of the Metrological Center.

PM-LA-00-02 Rev 01 (220104)

Calibration Report

Equipment : Chamber (Cold Room)
Date of Calibration : 30 June - 1 July 2022
Environment : Temperature : 18.9-23.7 °C
Line Voltage : 222.9-216.5 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 in chamber , the other one standard thermocouples type T use for ambient temperature measurement . The calibration was done in accordance with ISO 9001 (based on ASTM E143-04 (Reapproved 2013) and AS2355-1986) .
All data shown 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-TN176	T210009	30 July 2022
TC	TYPE T	TN177-TN180	T210009	30 July 2022
DATA LOGGER	34720A	T149	T210009	30 July 2022

3. This certificate is traceable to :

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

4. Condition of calibrated item : good

Equipment Description :

Time Counters : ☐ Hour ☒ Minute At ☐ °C
Fresh Air Disposal : ☐ Open ☐ Min ☐ Medium ☐ Max
☐ Close
☒ Not Available

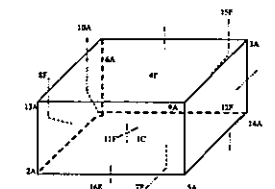
5. Adjustment :

☐ without adjustment ☒ after adjustment

Approved By: *[Signature]*

PM-13 (17-15-05-43)

Calibration Report



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

1C = TN161	11F = TN171
2A = TN162	12F = TN172
3A = TN163	13A = TN173
4F = TN164	14A = TN174
5A = TN165	15F = TN175
6A = TN166	16E = TN176
7F = TN167	
8F = TN168	
9A = TN169	
10A = TN170	

Approved By: *[Signature]*

PM-13 (17-15-05-43)

Calibration Report

Measurement Results:

Calibration Point	Average Standard Reading at each position (°C)									
	TN161	TN162	TN163	TN164	TN165	TN166	TN167	TN168	TN169	TN170
1	2.71	2.82	2.35	2.39	2.95	3.48	3.02	3.94	3.83	2.83
	TN171	TN172	TN173	TN174	TN175	TN176				
	2.47	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)
	Min	Max	Average				
1.0	29.40	3.3	2.99	3.05	1.38	1.64	2.00

* The quoted uncertainty include " uniformity "

For calibration result apply only the above calibrated item

The result of test are based accuracy 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 normal distribution, providing a level of confidence of approximately 95 % .

Approved By: *[Signature]*

PM-13 (17-15-05-43)

TECHNOLOGY PROMOTION ASSOCIATION (THAILAND) SPAN
CALIBRATION SERVICES & EQUIPMENT CALIBRATION AND TESTING SERVICES
33/2 Moo 3, T. Bangpa, A. Kaengkhro, Saraburi 18110, Thailand.
TEL: 0342 78831 FAX: 0342 78834

Cert. No.: 22CH405
Page: 1 of 3

Certificate of Calibration

Equipment : pH Meter
Manufacturer : Merck Titrodo
Model : Seven Compact 5220
Serial No. : C10426440
ID No. : RYD, ENE153
Condition As-Received : Used Item
Received Date : 16 March 2022
Calibration Date : 17 March 2022
Reference : 2703-0811026G-4
Submitted by : A.S. Laboratory Group (Thailand) Co., Ltd.
Rajong Branch
818/10 Moo 3, T. Maenam KNU,
A. Phrasang, Rayong 21140, Thailand

Ambient Temperature : (25 ± 2.5) °C
Relative Humidity : (50 ± 15) %
In-house method :
Calibration Procedure :
- CPH-15 by direct measurement with standard voltage calibrator and direct measurement with certified reference material (CRM)
- CPH-15 by comparison with standard thermometer

Calibrated by : Waratorn Lemjajayakul
Approved by : *[Signature]*
Approved Signature
() Molek Butnua
() Sathira Meangyot
() Waratorn Lemjajayakul
Issued Date : 22 March 2022
The Uncertainty are for a confidence probability of approximately 95 %
This certificate is for the purpose of calibration only and does not constitute a warranty.
Signatures of the Head of Calibration Services & Equipment Calibration and Testing Services

A 0037307

Cert. No.: 22CH405
Page: 2 of 3

Condition of this calibration result

1. Reference Standard Instrument

Instrument	Serial No.	ID No.	Cert. No.	Due Date
1) Document Process Calibrator	54030048	13005116	21E2982	25 Aug 2022
2) Ref. Standard Thermometer	4902054	110R0041	211201	26 Oct 2022

The calibration 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 IS through CPA chem Ltd., ANISO-ISO National Accreditation Board, Accredited No. AN-1836

Buffer Solution	Manufacturer	Lot No.	Exp. date
pH 4.008	CPA chem	796895	01 Jan 2024
pH 6.862	CPA chem	791017	02 Aug 2022
pH 10.015	CPA chem	795624	04 Sep 2022

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

Calibration Results

Function : mV Measurement
Performing standard curve by Phosphate at pH (4.7, 10)

Unit Under Calibration	Nominal Value	Standard Voltage Input	Actual Reading	Uncertainty of Measurement	Coverage factor
pH Meter SN: C10426440	4.000	mV	mV	mV	
		177.48	177.4	0.008	3.00
		0.00	-0.1	0.008	2.00
	10.000	-177.48	-177.5	0.008	2.00

Mole

A 1100955

Cert. No.: 22CH405
Page: 3 of 5

Calibration Results

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	Uncertainty of pH measurement	Coverage factor
pH Electrode SN: 1453404	4.008	177.3	0.004	2.00	
		6.902	3.6	0.004	
		10.015	-172.9	0.0073	

EXPEND : Temperature Measurement

(*) Without adjustment
This equipment was constructed with Temperature Probe

- Model : InLab Expert Pro-ISM
- Serial No. : 1453401
- Dimension of probe :
 - Length : 120 mm
 - Diameter : 12 mm
 - Immersion Depth : 100 mm

Calibration Point (°C)	Standard Temperature (°C)	LMC Reading (°C)	Error (°C)	Uncertainty of Measurement (°C)	Coverage factor
25.0	25.002	24.9	-0.102	0.13	2.00

Remark : - LMC = 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 % .

A 1100954

TECHNOLOGY PROMOTION ASSOCIATION (THAILAND) P.A.
CORPORATE SERVICES & EQUIPMENT CALIBRATION AND TESTING SERVICES
1344 PATTANAKARN ROAD PO BOX 18 BANNAHONG, BANGKOK 10250
TEL 02-771-8805 FAX 02-771-8806

Certificate of Calibration Certificate No.: T22099
Page: 1 of 2

Equipment: JH Meter
Manufacturer: Mettler-Toledo
Model: SevenCompact 8220
Serial No.: C104259460
ID No.: RYG_040103
Condition As-Received: Used Item
Received Date: 16 March 2022
Calibration Date: 21 March 2022
Maintenance: 2223-08120AC Submitted by: ALS Laboratory Group (Thailand) Co., Ltd. (Rayong Branch)
Ambient Temperature: (23 ± 2) °C
Relative Humidity: (50 ± 10) % S1079 Neo 5 T-Measure Pro, A-Phosphoryl, Rayong 21142, Thailand

This certificate may not be reproduced without prior written approval of the head of Corporate Services, Equipment Calibration and Testing Services.

Pressures used: Calibration was conducted using in-house calibration procedures CP-0117 according to direct measurement method with MPM-Product Calibrator.

Conditions of this result of calibration:

- Reference standard instrument: Installed Model Serial No. Certificate No. Due Date
1) MPM Product Calibrator 3000A 6440057 21E1444 07 May 2022
- This result of calibration was made on request at the point specified by customer.
- This certificate is valid only to the item calibrated on date and place of calibration.
- This Certificate is traceable to the International System of Unit maintained at: National Institute of Metrology (NIMT)

REVIEWED BY: *[Signature]*
APPROVED BY: *[Signature]*
NEXT CAL. DATE: 21/03/23

Calibrated by: Pongpaton Boonyaporn
Issue Date: 22 March 2022
Approved Signature: *[Signature]*
1) Pongpaton Boonyaporn
2) Pongpaton Boonyaporn
3) Pongpaton Boonyaporn

0284414

Result of calibration: () Without adjustment () After adjustment

Function	QC voltage measurement	Standard Value	Meas. Reading	Range	2000 mV	Uncertainty
		(mV)	(mV)		(mV)	(±µV)
		-200.0000	-200.0	0.0	0.0	72
		-150.0000	-150.0	0.0	0.0	66
		-100.0000	-100.0	0.0	0.0	65
		-50.0000	-50.0	0.0	0.0	62
		0.0000	0.0	0.0	0.0	58
		50.0000	50.0	0.0	0.0	62
		100.0000	100.0	0.0	0.0	66
		150.0000	150.0	0.0	0.0	65
		200.0000	200.0	0.0	0.0	72

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

*UAC= Unit Under Calibration.

-00-

01101070

Metrological Center
SCI ECO Services Company Limited
332 Moo 3, T. Banpa, A. Kaengkhro, Saraburi 18110, Thailand.
Saraburi Tel: +66 3827 3066 Fax: +66 3827 3100
Bangkok Tel: +66 8205 6851, +66 8247 2360
Website: www.sci-eco.co.th E-Mail: cal@sci-eco.co.th

Certificate No. T22034101 "Substitute for Calibration Certificate Number T220341" Page 1 of 4

Certificate of Calibration

Equipment: Chamber (Cold Room)
Manufacturer: MODULAR
Model: IREVOIC1000
Serial No.: C00351439
Customer Code: RYG_EN0184
ID No.: T1939A5
Customer: ALS Laboratory Group (Thailand) Co., Ltd. (Rayong Branch)
616/10 Moo 5 T. Maenam Khu,
A. Phukdaeng, Rayong 21140

Customer Location: Laboratory
Date of Receipt: 18 February 2022
Calibrated By: Boonchal Suriyamong (Site Calibration Manager)
Approved By: *[Signature]* / Soljar Naksakred (Site Calibration Manager)
Date of Issue: 18 MAR 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.

PM-113 07/10/2014

SCG **Metrological Center**
SCI ECO Services Company Limited
332 Moo 3, T. Banpa, A. Kaengkhro, Saraburi 18110, Thailand.

Certificate No. T22038101 Page 2 of 4

Calibration Report

Equipment: 1 Chamber (Cold Room)
Date of Calibration: 22 February 2022
Environment: 1 Temperature: 23.3-24.3 °C
Line Voltage: 221.9-227.2 V
Relative Humidity: 55-45 %RH

Conditions of this result of calibration:

- This equipment was calibrated by inserting 10 standard thermocouples type T into its chamber, the other one standard thermocouple type T was for ambient temperature measurement. The calibration was done in accordance with T220 (based on ASTM E145-01 (Reapproved 2001) and ASME B19.9-10a).
- All data shown below were final values and the final data from customer request. The temperature scale used was based on ITS-90.
- Reference Standard Instrument:

Instrument	Model	Instrument No.	Certificate No.	Due Date
TC	TYPE T	TN114-TN150	T210745	21 April 2022
TC	TYPE T	TN111-TN160	T210748	21 April 2022
DATA LOGGER	34970A	1150	T210743	21 April 2022

5. This certificate is traceable to:
National Institute of Metrology (Thailand) through Metrological Center (NSC-TN115 19025 CALIBRATION 0244)

6. Condition of calibrated item: good

Equipment Description:

Time Constant: 1 Hour 40 Minute At 3 °C
Fresh Air Damper: ☐ Open ☐ Min ☐ Medium ☐ Max
☒ Close
☒ Not Available

7. Adjustment:
(X) without adjustment () after adjustment

Approved By: *[Signature]*

SCG **Metrological Center**
SCI ECO Services Company Limited
332 Moo 3, T. Banpa, A. Kaengkhro, Saraburi 18110, Thailand.

Certificate No. T22038101 Page 3 of 4

Calibration Report

Diagram showing the chamber layout with points 1C, 2A, 3A, 4F, 5A, 6A, 7F, 8F, 9A, 10A, 11F, 12F, 13A, 14A, 15F, 16A.

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

1C = TN1141	12F = TN152
2A = TN142	13A = TN155
3A = TN143	14A = TN154
4F = TN144	15F = TN155
5A = TN145	16A = TN154
6A = TN146	
7F = TN147	
8F = TN148	
9A = TN149	
10A = TN150	
11F = TN151	

Approved By: *[Signature]*

SCG **Metrological Center**
SCI ECO Services Company Limited
332 Moo 3, T. Banpa, A. Kaengkhro, Saraburi 18110, Thailand.

Certificate No. T22038101 Page 4 of 4

Calibration Report

Measurement Results

Calibration Point	Average Standard Reading at each position (°C)									
	TN1141	TN142	TN143	TN144	TN145	TN146	TN147	TN148	TN149	TN150
30	2.98	3.96	2.96	3.97	3.16	3.29	2.95	3.16	3.50	3.45
	TN1141	TN155	TN154	TN155	TN154					
	3.04	3.19	3.05	3.24	3.21	3.17				

Chamber (Cold Room)		Temperature Distribution					
Position (°C)	Reading (°C)		Average (°C)	Stability (±°C)	Uniformity (°C)	Uncertainty (±°C)	Coverage Factor 2
	Min, Max	Average					
30	2.5, 4.1	3.3	3.11	1.20	1.20	2.00	2.65

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

Approved By: *[Signature]*



Cert. No.: 221934
Page: 1 of 2

Certificate of Testing

Equipment: DO Meter
Manufacturer: YSI
Model: 5000-115V
Serial No.: 15E102798
ID No.: RYD_EN0202
Received Date: 11 February 2022
Test Date: 14 February 2022
Reference: ZT02-040405C-4
Submitted by: ALS Laboratory Group (Thailand) Co., Ltd.
(Rajong Branch)
616/10 Moo 5 T. Maenam Klu, A Phrakhaeng,
Rajong 21140, Thailand
Laboratory Condition: Temperature: (25 ± 5) °C
Humidity: (50 ± 20) %
Test Procedure: In-house method: CP-010
by Comparison Technique with Auto Modification Method
Tested by: Watsak Ertthan
Approved by:
Approved Signatory
() Metro: Burekua
() Sathit: Manogun
() Watsak: Longyaput
Issue Date: 18 February 2022

REVIEW BY:
APPROVED BY:
NEXT CAL. DATE: 15/02/23

0201285



Cert. No.: 221934
Page: 2 of 2

Result: Dissolved Oxygen Meter Adjustment With Air 100 %
Dissolved Oxygen Probe No.: 15E102484

Titration Method (Auto Modification Method)	DO Meter Reading (mg/L)	Standard Deviation (mg/L)
0.02	0.02	0.004

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

-00-

0034744



Cert. No.: 221412
Page: 1 of 2

Certificate of Calibration

Equipment: DO Meter with Sensor
Manufacturer: YSI
Model: 5000-115V
Serial No.: 15E102798
ID No.: RYD_EN0202
Submitted by: ALS Laboratory Group (Thailand) Co., Ltd. (Rajong Branch)
616/10 Moo 5 T. Maenam Klu, A Phrakhaeng,
Rajong 21140, Thailand
Location: TPA On Site Calibration Laboratory
Received Date: 11 February 2022
Calibrated Date: 21 February 2022
Ambient Temperature: (25 ± 10) °C
Relative Humidity: (50 ± 30) %
AC Line Voltage: (220 ± 22) V
Calibrated by: Kuntak Pongpant
Approved by:
Approved Signatory
() Pongpant: Tanayakul
() Mee: Burekua
() Sathit: Longyaput
Issue Date: 21 February 2022

The Uncertainty are for a confidence probability of approximately 95 %
(This certificate was not to be reproduced other than in full, except with the prior written
approval of the head of Corporate Services & Equipment Calibration and Testing Services.)

0038008



Equipment: DO Meter with Sensor
Condition As-Received: Used Item
Reference: ZT02-040405C-4
Procedure Used:

Cert. No.: 221412
Page: 2 of 2

Calibration was conducted using in-house calibration procedure CP-0101 according to comparison with
Industrial Platinum Resistance Thermometer (IPRT) Into Temperature Bath.
The temperature scale used was based on ITS-90.

Condition of the result of calibration

- Reference standard instrument:
- Digital Thermometer
- This certificate is valid only to the item calibrated on date and place of calibration.
- This certificate is traceable to the International System of Unit.

Result of Calibration: (*) Without Adjustment

Function: Temperature measurement

The instrument was corrected with temperature sensor, SN: 15E102484

Calibration Point (°C)	Immersion Depth (mm)	Standard Temperature (°C)	UUT Reading (°C)	Error (°C)	Uncertainty (°C)	Coverage Factor
20.00	45	20.001	19.99	0.121	0.15	2.00

UUT: 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 %

-00-

1095714



Cert. No.: 221412
Page: 1 of 2

Certificate of Calibration

Equipment: Low Temp. Incubator
Manufacturer: Memmert
Model: PP750
Serial No.: V5181061
ID No.: RYD_EN0154
Submitted by: ALS Laboratory Group (Thailand) Co., Ltd.
(Rajong Branch)
616/10 Moo 5 T. Maenam Klu, A Phrakhaeng,
Rajong 21140, Thailand
800 Room
Location:
Received Date: 22 April 2022
Calibration Date: 22 April 2022
Ambient Temperature: (29 ± 10) °C
Relative Humidity: (50 ± 30) %
Calibrated by: Man Pananongpaiboon
Approved by:
Approved Signatory
() Pongpant: Tanayakul
() Mee: Burekua
() Sathit: Longyaput
Issue Date: 3 May 2022

REVIEW BY:
APPROVED BY:
NEXT CAL. DATE: 31/05/23

The Uncertainty are for a confidence probability of approximately 95 %

(This certificate was not to be reproduced other than in full, except with the prior written
approval of the head of Corporate Services & Equipment Calibration and Testing Services.)

0040735



Equipment: Low Temp. Incubator
Condition As-Received: Used Item
Reference: ZT04-01400C-1
Procedure Used:

Cert. No.: 221412
Page: 2 of 3

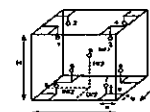
Calibration was conducted using calibration procedure CP-0102 according to direct measurement
The temperature scale used was based on ITS-90.
Condition of the result of calibration

- Reference standard instrument:
- Digital Thermometer
- This certificate is valid only to the item calibrated on date and place of calibration.
- This certificate is traceable to the International System of Unit.

Result of Calibration: (*) Without Adjustment

Function of UUT: Temperature Source

Fresh air setting: Close



Probe Installation Details: Observation of Chamber:
h = 10 cm D = 0.60 m
b = 10 cm W = 1.0 m
c = 10 cm H = 1.2 m
Capacity = 0.75 m³

Environment during calibration		
Temp. (°C)	Beginning	Finished
REL. Humid. (%)	54	58
AC Supply (Vol.)	221	223

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

1105485

Equipment: 1 Unit Temp. Indicator
Condition As-Received: Used Item
Reference: 2204-01490C-1
Result of Calibration: () Without Adjustment
Function of UUC: Temperature Source
Final or setting: Close

Calibration Point (°C)	UUC Setting (°C)	UUC Reading (°C)	Temperature stability (± °C)	Temperature uniformity (°C)	Overall Variation (°C)	Uncertainty (°C)	Coverage Factor
20.0	20.0	20.0	0.022	0.30	0.22	0.30	2

Measured Temperature (°C)

Calibration Point (°C)	1	2	3	4	5	6	7	8	9 (avg.)
20.0	20.209	20.174	20.128	20.110	20.075	20.082	20.037	20.048	20.050

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 sensor and the measured temperature at the reference location, which are observed at the same time or at its 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 %.

a 1105494

TECHNOLOGY PROMOTION ASSOCIATION (THAILAND) P.A.
 114/114 PATTANAKARN ROAD SUKH 15, NAKHON RATCHASIMA, NAKHON RATCHASIMA 30000
 TEL: 0-2710-9627 FAX: 0-2710-9628

Certificate of Calibration

Equipment: pH Meter
Manufacturer: Metro Toledo
Model: SevenGo
Serial No.: 8531250371
ID No.: NYG_P30400
Condition As-Received: Used Item
Received Date: 11 March 2022
Calibration Date: 14 March 2022
Reference: 2203-04950C-1
Submitted by: ALS Laboratory Group (Thailand) Co., Ltd. Ruyong Branch
 81610 Moo 5 T.Mueang KHU, A.Phuakdaeng, Rayong 21140, Thailand
Ambient Temperature: (25 ± 2.5) °C
Relative Humidity: (50 ± 10) %
Calibration Procedure: - CP-015 by direct measurement with standard voltage calibrator and direct measurement with certified reference material (CRM)
Calibrated by: Worakorn Lampragat
Approved by: [Signature]
 () Uthairat Boonrat
 () Sathorn Muangrui
 () Worakorn Lampragat
Issue Date: 17 March 2022

REVIEW BY: [Signature]
APPROVED BY: [Signature]
NEXT CAL DATE: 14/03/23

The uncertainties are for a confidence probability of approximately 95 %
 This certificate may only be reproduced after due to full extent with the prior written approval of the head of Laboratory Services / Equipment Calibration and Testing Services.

a 0039308

Equipment: 1 Unit pH Meter
Condition As-Received: Used Item
Reference: 2204-01490C-1
Result of Calibration: () Without Adjustment
Function of UUC: Temperature Source
Final or setting: Close

Certificate of Calibration

Equipment: pH Meter
Manufacturer: Metro Toledo
Model: SevenGo
Serial No.: 8531250371
ID No.: NYG_P30400
Condition As-Received: Used Item
Received Date: 11 March 2022
Calibration Date: 14 March 2022
Reference: 2203-04950C-1
Submitted by: ALS Laboratory Group (Thailand) Co., Ltd. Ruyong Branch
 81610 Moo 5 T.Mueang KHU, A.Phuakdaeng, Rayong 21140, Thailand
Ambient Temperature: (25 ± 2.5) °C
Relative Humidity: (50 ± 10) %
Calibration Procedure: - CP-015 by direct measurement with standard voltage calibrator and direct measurement with certified reference material (CRM)
Calibrated by: Worakorn Lampragat
Approved by: [Signature]
 () Uthairat Boonrat
 () Sathorn Muangrui
 () Worakorn Lampragat
Issue Date: 17 March 2022

REVIEW BY: [Signature]
APPROVED BY: [Signature]
NEXT CAL DATE: 14/03/23

The uncertainties are for a confidence probability of approximately 95 %
 This certificate may only be reproduced after due to full extent with the prior written approval of the head of Laboratory Services / Equipment Calibration and Testing Services.

a 1105494

TECHNOLOGY PROMOTION ASSOCIATION (THAILAND) P.A.
 114/114 PATTANAKARN ROAD SUKH 15, NAKHON RATCHASIMA, NAKHON RATCHASIMA 30000
 TEL: 0-2710-9627 FAX: 0-2710-9628

Certificate of Calibration

Equipment: pH Meter with Sensor
Manufacturer: Metro Toledo
Model: SevenGo
Serial No.: 8531250371
ID No.: NYG_P30400
Submitted by: ALS Laboratory Group (Thailand) Co., Ltd. Ruyong Branch
 81610 Moo 5 T.Mueang KHU, A.Phuakdaeng, Rayong 21140, Thailand
Location: TPA On Site Calibration Laboratory
Received Date: 11 March 2022
Calibrated Date: 15 March 2022
Ambient Temperature: (28 ± 10) °C
Relative Humidity: (30 ± 30) %
AC Line Voltage: (220 ± 22) V
Calibrated by: Maitree Boonrat
Approved by: [Signature]
 () Pongthep Tameyaku
 () Maitree Boonrat
Issue Date: 17 March 2022

REVIEW BY: [Signature]
APPROVED BY: [Signature]
NEXT CAL DATE: 02/10/23

The uncertainties are for a confidence probability of approximately 95 %
 This certificate may only be reproduced after due to full extent with the prior written approval of the head of Laboratory Services / Equipment Calibration and Testing Services.

a 0039307

TECHNOLOGY PROMOTION ASSOCIATION (THAILAND) P.A.
 114/114 PATTANAKARN ROAD SUKH 15, NAKHON RATCHASIMA, NAKHON RATCHASIMA 30000
 TEL: 0-2710-9627 FAX: 0-2710-9628

Certificate of Calibration

Equipment: pH Meter with Sensor
Condition As-Received: Used Item
Reference: 2203-04950C-2
Procedure Used: Calibration was conducted using in-house calibration procedure CP-0701 according to comparison with equalized Platinum Resistance Thermometer (SPRT) into Temperature Bath.
 The temperature scale used was based on ITS-90.
Condition of this result of calibration:
 1. Reference standard instrument -
 Instruments Model Serial No. Cert. No. Due Date
 1) Digital Thermometer 1229 2118200 2111173 22 Nov 2022
 2. This certificate is valid only to the item calibrated on date and place of calibration
 3. This certificate is traceable to the International System of Unit.
Result of Calibration: () Without Adjustment
Function: Temperature Measurement
 This instrument was connected with temperature sensor, SN: 1311427

Calibration Point (°C)	Immersion Depth (mm)	Standard Temperature (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (± °C)	Coverage Factor
25.0	100	25.008	25.4	0.391	0.18	2.00
30.0	100	30.008	30.5	0.482	0.18	2.00
40.0	100	39.967	40.6	0.633	0.18	2.00
50.0	100	49.967	50.6	0.633	0.18	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 %.

a 1105597

SPC Calibration Center

Certificate of Calibration

Equipment: SPECTROPHOTOMETER
Model: DR6000
Serial No. (or ID): 1827845 (RYG_EH0037)
Manufacturer: HACH
Condition: In Condition
Customer: ALS Laboratory Group (Thailand) Co., Ltd. (Rayong Branch)
 81610 Moo 5 T.Mueang KHU, A.Phuakdaeng, Rayong 21140, Thailand.
Environment Condition: Temperature 25.1 °C ± 0.4 °C
 Humidity 48.5 %RH ± 3.7 %RH
Calibration Place: ALS Laboratory Group (Thailand) Co., Ltd. (Rayong Branch) (Wat Chemistry Lab)
 81610 Moo 5 T.Mueang KHU, A.Phuakdaeng, Rayong 21140, Thailand.
Calibration by: Mr. Chaitanthon Pathong
Calibration Date: 01 April 2021
The Method Used: In house method, SPCC-W-24, base on ASTM E 275-08 and ASTM E 387-04
Traceability: This certificate is traceable to the CRM maintained by National Institute of Standards and Technology (NIST) through Sigma Scientific Limited.
 The standard for Wavelength Certificate No. 87146 and 87152
 The standard for Photometric Certificate No. 87220 and 87139
 The standard for Stray light Certificate No. 87153 and 87161
 The standard for Spectral resolution Certificate No. 87173

REVIEW BY: [Signature]
APPROVED BY: [Signature]
NEXT CAL DATE: 02/10/23

The uncertainties are for a confidence probability of approximately 95 %
 This certificate may only be reproduced after due to full extent with the prior written approval of the head of Laboratory Services / Equipment Calibration and Testing Services.

a 1105597

Calibration Results:
Without Adjustment

Wavelength Accuracy (nm), The spectral bandwidth of Set at 2 nm and UUC at 2 nm				
Standard Wavelength	Unit Under Calibration	Correction	Uncertainty	
418.81	418.4	0.21	0.13	
536.86	536.7	-0.04	0.13	
837.99	838.3	-0.31	0.14	
748.49	748.7	-0.22	0.14	
807.03	807.4	-0.37	0.14	
Photometric Accuracy (Absorbance)				
Wavelength	Standard absorbance	Unit Under Calibration	Correction	Uncertainty
320 nm	0.0000	0.000	0.0000	0.0043
	0.5890	0.580	-0.0010	0.0045
	0.7616	0.762	-0.0004	0.0045
440 nm	1.0261	1.027	-0.0007	0.0045
	0.0000	0.000	0.0000	0.0045
	0.5787	0.579	-0.0003	0.0045
460 nm	0.7442	0.744	0.0002	0.0045
	1.0039	1.004	-0.0001	0.0045
	0.0000	0.000	0.0000	0.0045
480 nm	0.5282	0.530	-0.0008	0.0045
	0.8880	0.887	-0.0005	0.0045
	0.9534	0.954	-0.0006	0.0045
545.1 nm	0.0000	0.000	0.0000	0.0045
	0.5468	0.548	0.0008	0.0045
	0.6957	0.695	0.0007	0.0045
590 nm	0.9091	0.908	0.0011	0.0045
	0.0000	0.000	0.0000	0.0045
	0.5851	0.584	-0.0011	0.0045
635 nm	0.7238	0.723	0.0008	0.0045
	1.0937	1.094	-0.0017	0.0045
	0.0000	0.000	0.0000	0.0045
650 nm	0.5882	0.588	0.0012	0.0045
	0.9214	0.921	0.0004	0.0045
	1.0861	1.087	-0.0011	0.0045

As used with this
Certificate, the
equipment has been found to be in compliance with the requirements of ISO 17025:2017 for the purpose of the calibration of the equipment.

Calibration Results:
Without Adjustment

Photometric Accuracy (Absorbance)					
Wavelength	Standard absorbance	Unit Under Calibration	Correction	Uncertainty	
325 nm	0.0000	0.000	0.0000	0.0083	
	0.7387	0.738	0.0007	0.0080	
357 nm	0.0000	0.000	0.0000	0.0080	
	0.9516	0.950	0.0016	0.0080	
313 nm	0.0000	0.000	0.0000	0.0080	
	0.2838	0.285	-0.0014	0.0080	
350 nm	0.0000	0.000	0.0000	0.0080	
	0.8318	0.832	-0.0029	0.0080	
Stray light *					
Standard: cut-off		UUC: Wavelength (nm)	UUC: Transmission (%)	Absorbance (A)	
260.57 +/- 0.11 nm		260.8	1.5	1.824	
392.03 +/- 0.11 nm		392.0	1.5	1.824	
The stray light transmission tolerance is less than 1.0 T(%) and absorbance is greater than 2.0 (A)					
Spectral Resolution *					
Nominal Concentration 0.02 % w/v		Peak	Trough	Ratio	SDW
Standard Wavelength (nm)		268.72	268.78	1.39	2.80
UUC: Wavelength (nm)		268.2	266.1		
Std Absorbance (A)		0.4616	0.2787		
Absorbance (A)		0.418	0.300		

* Calibration Marked "Not TSI Accredited" in this Certificate have been included for completeness.

The End of Certificate

As used with this
Certificate, the
equipment has been found to be in compliance with the requirements of ISO 17025:2017 for the purpose of the calibration of the equipment.

ใบตรวจสอบสภาพเครื่องวัดค่าแวดล้อม

เลขที่ใบตรวจ: KSPR2104738

vSerialNo: SPECTROPHOTOMETER Pin: DR0000 หมายเลขเครื่อง: 1827945				
ตรวจโดย (Pin)		ตรวจโดย (Pin)		ตรวจโดย
01 Apr 2021		01 Apr 2021		
Pin	ไม่ผ่าน	Pin	ไม่ผ่าน	ไม่ผ่าน
General				
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	1. การตรวจเช็ค	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	2. การตรวจเช็ค (จอแสดงผล, ปุ่ม/ปุ่มสัมผัส)	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	3. สวิตช์ On-Off (On-Off Switch)	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	4. ปุ่ม (Buttons)	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	5. หน้าจอ (Display, Screen Control)	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Spectrophotometer				
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	6. แหล่งไฟ (Binary Backlight) >= 2.5 VDC	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	7. การตรวจเช็คความยาวคลื่น (Wavelength Control)	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	8. การตรวจเช็ค (Wavelength Check)	<input checked="" type="checkbox"/>	858.1 ± 0.5, 1 nm
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	9. ความไว (Sensitivity) (λ = 3,000 nm)	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	10. ความไว (Sensitivity) (λ = 3,000 nm)	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	11. การตรวจเช็ค (Control Module)	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
pH Meter and Conductivity Meter				
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	12. อิเล็กโทรด (Electrode and Connection Cable)	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	13. การตรวจเช็คอิเล็กโทรด (Level KCl)	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	14. อิเล็กโทรดอิเล็กโทรด (Dust Protection Hood)	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	15. ควบคุมเวลา (Start)	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Turbidimeter				
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	16. การตรวจเช็ค (No Sample)	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	17. การตรวจเช็คความไว (>= 2.5 nm 3.0)	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Automatic Meter				
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	18. Alarm Protection Device	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	19. Function Rinsing and Dosing	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	20. การตรวจเช็คความไว/ความแม่นยำ	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>

ตรวจสอบโดย:

Mr. Chetaphon Polthong
Service Engineer

As used with this
Certificate, the
equipment has been found to be in compliance with the requirements of ISO 17025:2017 for the purpose of the calibration of the equipment.



Agilent CrossLab Compliance

Qualification Type: KPM5-00

System ID: JP15471188

EDP Name: Agilent Recommended

EDP Revision: KPM5.02.00

EDP Publish Date: March 2020

Date: September 30, 2021 4:07:18 PM

Report Type: Report

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

Org. Location: 104 Praditumthi 40, Suan Luang, Bangkok 10250

REVIEW BY: S. H.

APPROVED BY: S. H.

NEXT CAL DATE: 24 Feb 2022

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Test Summary

Purpose

The section includes a status for each scheduled test and the in-scope qualification. For each test that is run, (1) the status is automatically determined based on pre-test results, 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.

Details	Result	Run
Test		
Autosampler Check: SPS4	Pass	1
Integrated Sample Introduction System (SIS) Check: SPS3	Pass	1
Autosampler: G5423A	Pass	1
Background (No Gas Mode): G5423A	Pass	1
Background (Gas Mode): G5423A	Pass	1
20-Minute Stability (No Gas Mode): G5423A	Pass	1
Overall Qualification Status		
Pass		

Service Details

Purpose

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

General Details

Service Order No./Request: 8021327154
ECP Name: AgilentRecommended
ECP Function: ICPMS G2.60
Report Type: Report

Original event Details

Name: ALS Laboratory Group | Thailand Co., Ltd.
Location: 704 Phrakaramin Rd, Beem Luang, Bangkok 10250

Local Contact Details

Name: Chatchana Komsaikul
Job Title: Manager
Organization: Laboratory

Operator Details

Name: Parthap Kumsaithan
Job Title: Field Service Engineer

Data Acquisition Details

Acquisition Software Name: MassHunter
Acquisition Software Version: C01.04

Customer Data System (CDS): ICPMS MassHunter

Date: September 30, 2021 4:57:18 PM
System ID: JP15471169

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Instrument Details

Purpose

This section describes the in-bound system configuration.

Details

ICP MS 1

Manufacturer	Agilent Technologies
Name	7800
Model Number	G8403A
Installed Options	#10294, Standard Package with Hydrogen option
Detector Type	SPQ
Nebulizer	Mistra Mist (53181)
Spray Chamber	Quartz
Torch	Quartz
Sampling Cone	N
Simmer Cone	N
Serial Number	JP19471159
Firmware Revision	C.01.04

G20 1

Manufacturer	Agilent Technologies
Name	G203
Model Number	G8611A
Type	Pneumatic pump system
Serial Number	JP13510272

Autosampler 1

Manufacturer	Agilent Technologies
Name	825A
Model Number	G8610A
Serial Number	AL76AC0722

Date: September 30, 2021 4:57:18 PM
System ID: JP15471169

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Other 1

Manufacturer	Agilent Technologies
Name	Other
Model Number	G2624
Serial Number	3J1610713

Date: September 30, 2021 4:57:18 PM
System ID: JP15471169

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Calculation Formulas

Purpose

This section includes calculation formulas for all available tests. Depending upon which tests are selected, 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.

Date: September 30, 2021 4:57:18 PM
System ID: JP15471169

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Protocol Details

Purpose

This section lists the versions for all test units used in this report. For analysis test-specific and high-level change controls, refer to the Revision History document.

Test Revision	Test
ICPMS G2.60	30 Minute Stability (No Gas Mode)
ICPMS G2.60	Autosampler Check
ICPMS G2.60	Autotune
ICPMS G2.60	Background (One Mode)
ICPMS G2.60	Background (No Gas Mode)
ICPMS G2.60	Integrated Sample Introduction System (SIS) Check

Date: September 30, 2021 4:57:18 PM
System ID: JP15471169

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Autosampler Check

Purpose

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

Subject

Results

Criteria	Observed Result	Expected Result	Status
After the self test, a probe in the home position?	Yes	Yes	Pass
As commanded, is the probe positioned at end 27?	Yes	Yes	Pass

Setup/Status: Pass

Overall Autosampler Check Test Status:

Pass

Date: September 30, 2021 4:57:18 PM
System ID: JP15471169

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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.

Sequence

Results	Details	Observed Result	Accepted Result	Status
As commented, does the pump run?	Yes	Yes	Pass	
As commented, do the valves test and eject?	Yes	Yes	Pass	
Sequenced Status:	Pass			Run: 1
Overall Integrated Sample Introduction System (ISIS) Check Test Status:				
Pass				

Date: September 30, 2021 4:07:10 PM
System ID: JP15471160

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Background (No Gas Mode)

Purpose

This test measures the background of the IC/MS in no gas mode by monitoring time during a blank run.

Sequence

Conditions				
Masses:	7	AMU	90	AMU
	99	AMU	206	AMU
Measurements and Results				
Measured Value:	7	3.300	90	13.300
Agilent Recommended:	7	0.5	90	1.5
Status:	Pass	Pass	Pass	Pass
Sequenced Status:	Pass			Run: 1
Overall Background (No Gas Mode) Test Status:				
Pass				

Date: September 30, 2021 4:07:10 PM
System ID: JP15471160

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Autotune

Purpose

This test uses internal check-out standards to run a software-generated autotune in all modes. The test reports priority values for peak width, mass 81%, sensitivity, stable baseline, and doubly-charged species ratio.

Sequence

Results				
Priority/4 Mass 7	10.719	AMU		
Agilent Recommended:	10	0.00		
Status:	Pass			
Priority/4 Mass 81	10.750	AMU		
Agilent Recommended:	10	0.00		
Status:	Pass			
Priority/4 Mass 206	10.713	AMU		
Agilent Recommended:	10	0.00		
Status:	Pass			
Mass Axis 7	7.05	AMU		
Agilent Recommended:	7	4.9		
Status:	Pass			
Mass Axis 90	10.88	AMU		
Agilent Recommended:	10	9.9		
Status:	Pass			
Mass Axis 206	12.00	AMU		
Agilent Recommended:	10	204.9		
Status:	Pass			

Date: September 30, 2021 4:07:10 PM
System ID: JP15471160

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Background (Gas Mode)

Purpose

This test measures the background of the IC/MS in the various gas modes by monitoring time during a blank run.

Sequence	Gas Mode:	Hydrium		
Conditions				
Mass:	70	AMU		
Integration Time:	1.0	sec		
Cycles:	25			
Measurements and Results				
Mass (AMU)	70			
Measured Value:	42.8500	cps		
Agilent Recommended:	40	1.5		
Status:	Pass			
Sequenced Status:	Pass			Run: 1
Overall Background (Gas Mode) Test Status:				
Pass				

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Mass 7 Sensitivity No Gas

Purpose

This test measures the sensitivity of the IC/MS in no gas mode by monitoring time during a blank run.

Sequence	Mass 7 Sensitivity No Gas			
Conditions				
Mass:	7	3.300	90	13.300
Integration Time:	1.0	sec		
Cycles:	25			
Measurements and Results				
Mass (AMU)	7	3.300	90	13.300
Measured Value:	7	3.300	90	13.300
Agilent Recommended:	7	0.5	90	1.5
Status:	Pass	Pass	Pass	Pass
Sequenced Status:	Pass			Run: 1
Overall Mass 7 Sensitivity No Gas Test Status:				
Pass				

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20-Minute Stability (No Gas Mode)

Purpose

This test monitors the abundance of ions present in the baseline 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 test.

Sequence	20-Minute Stability (No Gas Mode)			
Conditions				
Mass:	7	3.300	90	13.300
Integration Time:	1.0	sec		
Cycles:	25			
Measurements and Results				
Mass (AMU)	7	3.300	90	13.300
Measured Value:	7	3.300	90	13.300
Agilent Recommended:	7	0.5	90	1.5
Status:	Pass	Pass	Pass	Pass
Sequenced Status:	Pass			Run: 1
Overall 20-Minute Stability (No Gas Mode) Test Status:				
Pass				

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Declaration of Change Control

The document is under change control. Relevant history is maintained and deleted as much document. Access to the master documents is limited to process owners. Documents receive periodic review and can be assigned an expiration date. The qualifications personnel according to the document's history as to the responsibility for configuration in place at the time of the qualification. Agilent Technology recommends that instrument configuration change management procedures be in place in order to maintain the validation process. Any changes to the peripheral or computer hardware or software must be clearly specified. A change management system provides a means to document the degree of revalidation required according to the nature of the changes made. As details of the changes must be thoroughly reviewed and documented, together with details of acceptance tests and their results. Note: Hardware/software configuration management is the customer's responsibility.

Attachments

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

Location	Category	Document Name	Page
EQM	General	Certificate of System Classification	18
EQM	General	Operator's training certificates and qualifications	18
EQM	General	Certificate of Classification for ACS	20
EQM	General	Certificate of Classification for ACE	21
EQM	General	Tune reports	22
EQM	General	Trial Report	26
EQM	General	Trial Report	27
EQM	General	Trial Report	28

General

Professor of System Qualification

[illegible]

General

Document Name: Operator's training certificate and qualification

C. Agency Information	
Executive Director	_____ _____ _____
File ID Number	_____ _____
Completion Date	_____ _____
Submitted by Company	_____ _____

Certificate of Completion

AM CREDITABLE 401A-A, Applicant FIRM KPMG LLP, system including
June 7, 2015
I witness as Applicant

Summary

Document Number: Certificate of Qualification for ACE

<p>➤ Apknet Technologies</p>	
<p align="center">Certificate of Completion</p>	
Learner Name	<u>Prashant Kumbharth</u>
Title Of Course	<u>AI/ML/DS/Python/AIACE 3.0 User Update Training</u>
Completion Date	<u>July 13, 2024</u>
Issued By/Company	<u>Learning at Apknet</u>

AI/ML/DS/Python/AIACE 3.0 User Update Training

A certificate for **Prashant Kumbharth** is hereby issued as evidence of having completed the **AI/ML/DS/Python/AIACE 3.0 User Update Training** course, which is a part of the **AI/ML/DS/Python/AIACE 3.0 User Update Training** program. This certificate is awarded to the learner for completing the course and achieving the required learning objectives. The learner has demonstrated a strong understanding of the course content and has successfully completed all the required assignments and projects. This certificate is valid for **12 months** from the date of completion. The learner is encouraged to continue their learning and stay updated with the latest developments in the field of **AI/ML/DS/Python/AIACE 3.0 User Update Training**.

Comment

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[illegible]

Document Name: Test Report

Batch Summary Report	
Batch Name	10-10-10
Batch Size	100
Batch Date	10/10/10

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Date: September 30, 2021 4:07:18 PM
System ID: JPT1471140

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General

Document Name: Test Report

Batch Summary Report	
Batch Name	10-10-10
Batch Size	100
Batch Date	10/10/10

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Date: September 30, 2021 4:07:18 PM
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Document Name: Test Report

Batch Summary Report	
Batch Name	10-10-10
Batch Size	100
Batch Date	10/10/10

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Date: September 30, 2021 4:07:18 PM
System ID: JPT1471140

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Electronic Signature

Purpose

This signature page was created and authorized because the ACE sign-off action was executed, which is valid for this document, including attachments. The ACE sign-off is an electronic signature that requires use of a valid identification, unique username and password. The Agilent representative who has delivered this service understands that meeting and being able to do so electronically. 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 record and control procedures.]

Details

Full Name of Signer: Piyush Kumar
Signed On User Name: p_kumar_kumar@agilent.com
Signature Creation Date: September 30, 2021
Reason for Signature: I received product and published this original version of document

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Date: September 30, 2021 4:07:18 PM
System ID: JPT1471140

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Batch Summary Report				
Batch Name: 10-10-10				
Batch Size: 100				
Batch Date: 10/10/10				
Item	Item Name	Item Description	Item Status	Item Location
1	10-10-10	10-10-10	10-10-10	10-10-10
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3	10-10-10	10-10-10	10-10-10	10-10-10
4	10-10-10	10-10-10	10-10-10	10-10-10
5	10-10-10	10-10-10	10-10-10	10-10-10
6	10-10-10	10-10-10	10-10-10	10-10-10
7	10-10-10	10-10-10	10-10-10	10-10-10
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99	10-10-10	10-10-10	10-10-10	10-10-10
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Date: September 30, 2021 4:07:18 PM
System ID: JPT1471140

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Batch Summary Report				
Batch Name: 10-10-10				
Batch Size: 100				
Batch Date: 10/10/10				
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52	10-10-10	10-10-10	10-10-10	10-10-10
53	10-10-10	10-10-10	10-10-10	10-10-10
54	10-10-10	10-10-10	10-10-10	10-10-10
55	10-10-10	10-10-10	10-10-10	10-10-10
56	10-10-10	10-10-10	10-10-10	10-10-10
57	10-10-10	10-10-10	10-10-10	10-10-10

Best Value Quality Technology
 Instrument: 1100-MSD-TOF
 Last Date: September 26, 2021 14:27:00
 Last User: JPS15147

Agilent PDS Method: PDS000000

Date	Temperature Point	Agilent Reference	Type of Measurement	Method Information
September 26, 2021 14:27:00	Auto	Reference	Isotope	Agilent Reference Compendium
September 26, 2021 14:27:00	Auto	Reference	Isotope	Agilent Reference Compendium
September 26, 2021 14:27:00	Auto	Reference	Isotope	Agilent Reference Compendium
September 26, 2021 14:27:00	Auto	Reference	Isotope	Agilent Reference Compendium
September 26, 2021 14:27:00	Auto	Reference	Isotope	Agilent Reference Compendium
September 26, 2021 14:27:00	Auto	Reference	Isotope	Agilent Reference Compendium
September 26, 2021 14:27:00	Auto	Reference	Isotope	Agilent Reference Compendium
September 26, 2021 14:27:00	Auto	Reference	Isotope	Agilent Reference Compendium

Page 2 of 2

Instrument: 1100-MSD-TOF
 Last Date: September 26, 2021 14:27:00
 Last User: JPS15147

Page 2 of 2

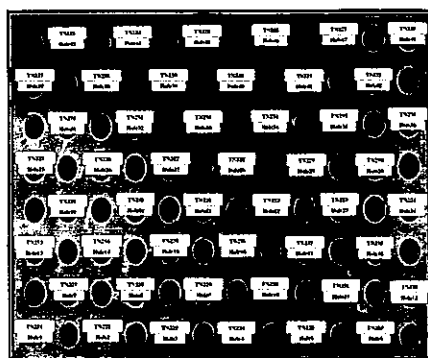


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 Telephone : +66 2 586 5792-4 Fax : +66 2 586 5109
 Website : www.sceco.co.th E-Mail : calibrate@scg.co.th

Certificate No. T228730

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Calibration Report



FRONT CONTROL

Approved By:

TME11300 30-05-57



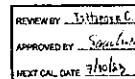
Metrological Center
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 Website : www.sceco.co.th E-Mail : calibrate@scg.co.th

Certificate No. T228730

Page 1 of 6

Certificate of Calibration

Equipment : HEATING BLOCK
 Manufacturer : Environmental Express
 Model : SC 196
 Serial No. : 6974CECW3285
 Customer Code : BKK_FLA054
 ID No. : T3306A3
 Customer : ALS Laboratory Group (Thailand) Co., Ltd.
 104 Phatthanasak 46, Phatthanasak Rd., Khwaeng Phatthanasak,
 Khet Suan Luang, Bangkok 10250
 Customer Location : Acid Digestion Lab
 Date of Receipt : 30 March 2022
 Calibrated By : Waicharaporn Sangtong (Technician)
 Approved By : / Sujjar Nakmakred (Site Calibration Manager)
 Date of Issue : 12 APR 2022



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

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TME11300 30-05-57



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

Certificate No. T228730

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Calibration Report

Measurement Results

Calibration Point	Average Standard Reading at each position (°C)					
B1 (Heating Block)	TN221	TN222	TN223	TN224	TN225	TN226
CAL POINT	Min	91.66	91.62	91.60	91.58	91.56
Max	91.67	91.76	91.71	91.68	91.67	91.71
Average	91.62	91.66	91.65	91.63	91.62	91.63
B2 (Heating Block)	TN227	TN228	TN229	TN230	TN231	TN232
Min	91.58	91.57	91.55	91.53	91.52	91.50
Max	91.65	91.71	91.68	91.67	91.65	91.64
Average	91.62	91.64	91.63	91.62	91.61	91.62
B3 (Heating Block)	TN233	TN234	TN235	TN236	TN237	TN238
Min	91.59	91.58	91.56	91.54	91.53	91.51
Max	91.66	91.71	91.68	91.67	91.65	91.64
Average	91.62	91.64	91.63	91.62	91.61	91.62
B4 (Heating Block)	TN239	TN240	TN241	TN242	TN243	TN244
Min	91.59	91.57	91.55	91.53	91.52	91.50
Max	91.66	91.71	91.68	91.67	91.65	91.64
Average	91.62	91.64	91.63	91.62	91.61	91.62
B5 (Heating Block)	TN245	TN246	TN247	TN248	TN249	TN250
Min	91.58	91.57	91.55	91.53	91.52	91.50
Max	91.66	91.71	91.68	91.67	91.65	91.64
Average	91.62	91.64	91.63	91.62	91.61	91.62
B6 (Heating Block)	TN251	TN252	TN253	TN254	TN255	TN256
Min	91.58	91.57	91.55	91.53	91.52	91.50
Max	91.66	91.71	91.68	91.67	91.65	91.64
Average	91.62	91.64	91.63	91.62	91.61	91.62
B7 (Heating Block)	TN257	TN258	TN259	TN260	TN261	TN262
Min	91.58	91.57	91.55	91.53	91.52	91.50
Max	91.66	91.71	91.68	91.67	91.65	91.64
Average	91.62	91.64	91.63	91.62	91.61	91.62
B8 (Heating Block)	TN263	TN264	TN265	TN266	TN267	TN268
Min	91.58	91.57	91.55	91.53	91.52	91.50
Max	91.66	91.71	91.68	91.67	91.65	91.64
Average	91.62	91.64	91.63	91.62	91.61	91.62

Approved By:

TME11300 30-05-57



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.sceco.co.th E-Mail : calibrate@scg.co.th

Certificate No. T228730

Page 5 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 result of calibration :
 1. This equipment was calibrated by using standard thermocouples type T to check the other one standard thermocouples type T use for ambient temperature measurement. The calibration was done in accordance to NIST 170-1.
 2. Reference Standard Instrument :
 Instrument Model Instrument No. Certificate No. Due Date
 TC TYPE T TN221-TN230 T110006 04 June 2022
 TC TYPE T TN231-TN249 T110008 04 June 2022
 DATA LOGGER 34970A T110005 09 June 2022
 3. This certificate is traceable to:
 National Institute of Metrology (Thailand) through Metrological Center (NIST-TN170-1 NIST CALIBRATION 0244)
 4. Condition of calibrated item : good
 Equipment Description :
 Type Constant 2 Heat 22 Minute 42 53 °C
 Fresh Air Dumper ☐ Types ☐ Min ☐ Medium ☐ Max
☐ Close
☒ Not Available
 5. Adjustment :
 () without adjustment (X) after adjustment

Approved By:

TME11300 30-05-57



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.sceco.co.th E-Mail : calibrate@scg.co.th

Certificate No. T228730

Page 6 of 6

Calibration Report

Measurement Results

Calibration Point	Average Standard Reading at each position (°C)					
B1 (Heating Block)	TN221	TN222	TN223	TN224	TN225	TN226
CAL POINT	Min	91.66	91.62	91.60	91.58	91.56
Max	91.67	91.76	91.71	91.68	91.67	91.71
Average	91.62	91.66	91.65	91.63	91.62	91.63
B2 (Heating Block)	TN227	TN228	TN229	TN230	TN231	TN232
Min	91.58	91.57	91.55	91.53	91.52	91.50
Max	91.65	91.71	91.68	91.67	91.65	91.64
Average	91.62	91.64	91.63	91.62	91.61	91.62
B3 (Heating Block)	TN233	TN234	TN235	TN236	TN237	TN238
Min	91.59	91.58	91.56	91.54	91.53	91.51
Max	91.66	91.71	91.68	91.67	91.65	91.64
Average	91.62	91.64	91.63	91.62	91.61	91.62
B4 (Heating Block)	TN239	TN240	TN241	TN242	TN243	TN244
Min	91.59	91.57	91.55	91.53	91.52	91.50
Max	91.66	91.71	91.68	91.67	91.65	91.64
Average	91.62	91.64	91.63	91.62	91.61	91.62
B5 (Heating Block)	TN245	TN246	TN247	TN248	TN249	TN250
Min	91.58	91.57	91.55	91.53	91.52	91.50
Max	91.66	91.71	91.68	91.67	91.65	91.64
Average	91.62	91.64	91.63	91.62	91.61	91.62
B6 (Heating Block)	TN251	TN252	TN253	TN254	TN255	TN256
Min	91.58	91.57	91.55	91.53	91.52	91.50
Max	91.66	91.71	91.68	91.67	91.65	91.64
Average	91.62	91.64	91.63	91.62	91.61	91.62
B7 (Heating Block)	TN257	TN258	TN259	TN260	TN261	TN262
Min	91.58	91.57	91.55	91.53	91.52	91.50
Max	91.66	91.71	91.68	91.67	91.65	91.64
Average	91.62	91.64	91.63	91.62	91.61	91.62
B8 (Heating Block)	TN263	TN264	TN265	TN266	TN267	TN268
Min	91.58	91.57	91.55	91.53	91.52	91.50
Max	91.66	91.71	91.68	91.67	91.65	91.64
Average	91.62	91.64	91.63	91.62	91.61	91.62

Approved By:

TME11300 30-05-57

Certificate No. T221644

Page 5 of 6

Calibration Report

Measurement Results:


HEATING BLOCK			Temperature Distribution	
Setting (°C)	Reading (°C)		Stability (°C)	Uniformity (°C)
	Min./Max	Average		
100.0	100.0, 100.1	100.1	0.29	0.01
150.0	149.9, 149.4	149.1	0.29	0.70

* The spread uncertainty include "repeatability"

The reference result apply only the above calibration 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 distribution providing a level of confidence of approximately 95 %.

Approved By: 

FM 43117-15-05-41

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 48, Phatthanakan Rd., Khwaeng Phatthanakan,
Khet Suan Luang, Bangkok 10250

Customer Location : Environmental Laboratory

Date of Receipt : 27 June 2022



Calibrated By : Sujjar Nakanred (Site Calibration Manager)

Approved By :  / Boonchai Sanyawang (Site Calibration Manager)

Date of Issue : 21 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 defined 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.

REVIEW BY: 
APPROVED BY: 
NEXT CAL DATE: 30/12/23

FM 43117-15-05-44

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 : 222.9-236.5 V
Relative Humidity : 55 - 65 %RH

Condition of this result of calibration :

1. This equipment was calibrated by insert nine standard thermocouples type T into the chamber, the other one standard thermocouples type E was for ambient temperature measurement. The calibration was done in accordance with NIST (based on ASTM E145-94 (Reapproved 2001) and ASSESS-1996).
All data above were found 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	TN164-TN176	T210099	30 July 2022
TC	TYPE T	TN171-TN180	T210099	30 July 2022
DATA LOGGER	34970A	T149	T210099	30 July 2022

3. This certificate is traceable to : National Institute of Metrology (Thailand) through Metrological Center (NIST-TS-715 17025 CALIBRATION 0244)

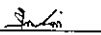
4. Condition of calibrated item : good

Equipment Description :

Time Constant : 5 Hour
Fresh Air Disposal : ☐ Open ☐ Min ☐ Medium ☐ Max
☐ Close
☒ Not Available

5. Adjustment :

() without adjustment (X) after adjustment

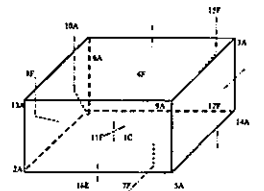
Approved By: 

FM 43117-15-05-43

Certificate No. T221644

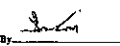
Page 3 of 4

Calibration Report



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

1C = TN114	8F = TN167
2A = TN142	8F = TN168
3A = TN163	9A = TN169
4F = TN164	10A = TN170
5A = TN165	
6A = TN166	
7F = TN167	
8F = TN168	
9A = TN169	
10A = TN170	

Approved By: 

FM 43117-15-05-41

Certificate No. T221644

Page 4 of 4

Calibration Report

Measurement Results:

Calibration Point	Average Standard Reading at each position (°C)									
	TN141	TN142	TN143	TN144	TN145	TN146	TN147	TN148	TN149	TN170
A	2.71	2.82	2.75	2.89	2.95	3.06	3.02	2.96	3.05	2.85
	TN171	TN172	TN173	TN174	TN175	TN176				
	2.97	3.02	2.85	3.04	2.97	3.33				

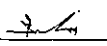
Chamber (Cold Room)			Temperature Distribution				
Setting (°C)	Reading (°C)		Average (°C)	Stability (± °C)	Uniformity (°C)	Uncertainty (± °C)	Coverage Factor
	Min.	Max.					
	Average						
10	29.48	3.2	2.99	1.01	1.30	1.66	2.00

* The spread uncertainty include "repeatability"

The calibration result apply only the above calibration 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 distribution providing a level of confidence of approximately 95 %.

Approved By: 

FM 43117-15-05-41

Maintenance Protocol

Atomic Fluorescence Spectrometer mercure / mercure plus

REVIEW BY: 
APPROVED BY: 
NEXT CAL DATE: 01/01/23

Maintenance with following Operational Qualification (OQ) ☐
(requires a separate OQ protocol)

Company	NORTH KANSAS POWER AND LIGHTING CO.
User	gregory.brown@nksl.com
Department	Lab
Street	214 KANSAS HWY 100, LAWRENCE, KANSAS 66044
Zip Code, City	LAWRENCE, KANSAS 66044
Country	USA
Phone	
Fax	
E-mail	

Reprints: Dr. J. H. J. van't Hof-Grootenboer, Department of Obstetrics and Gynaecology, University Hospital Groningen, P.O. Box 30.001, 3000 RB Groningen, The Netherlands. Tel.: +31 (0) 931 304541; fax: +31 (0) 931 304542; e-mail: j.h.j.van't.hof-grootenboer@azg.umcg.nl

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Maintenance works Autosampler	Serial No.:	YOT
lubricate the dosing-winding (Talon-grease-spray)		
clean the dosing cylinder, if necessary exchange it		
lubricate the winding system of the height drive with some drops of oil		
check the footbed belt		
check the position of the mechanical stopper (height: 135mm)		
check the pump rate of mixing pump (14x AS52, typ 7x+20x AS525, typ 10x)		
check the pump rate of washing cup		
check the electrical hose connections for good contact		
check the connectors of the magnetic valves		
check the dosing hose for buckling, if necessary exchange it		

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Synopsis Jura S.², 18 sept./2 oct. 1971. ¹ 11161, juv., Germany.

Device parameter	nominal value	actual value	
visual check general lightness inside the Mercury	o.k.	<input checked="" type="checkbox"/> changed	
visual check Goldpans	o.k.	<input checked="" type="checkbox"/> changed	
visual check spectrometer			
	convex lens	o.k.	<input checked="" type="checkbox"/> changed
		o.k.	<input checked="" type="checkbox"/> changed
check pump hoses	o.k.	<input checked="" type="checkbox"/> changed	
check hoses and hose connectors	o.k.	<input checked="" type="checkbox"/> changed	
check and clean reactor	o.k.	<input checked="" type="checkbox"/> changed	
check drying hose output Gas-liquid-separator	o.k.	<input checked="" type="checkbox"/> changed	
check bubble sensor	o.k.	<input checked="" type="checkbox"/> not o.k.!	
Check gasflow			
	Argon pressure valve 4	1.2 - 1.5 bar	1.5
	Valve 1	10 Nl/min 0.165 Nl/min 30 Nl/min	0.167 Nl/min
	Valve 2	0.820 Nl/min 9 Nl/min	0.15 Nl/min
	Valve 3	0.285 Nl/min 10 Nl/min	0.03 Nl/min
	Valve 4	2.160 Nl/min	0.14 Nl/min
Check liquid flow			
	Acid	2.5 ml/min 2.1 ml	1.5 ml/min
	Red-agent	2.5 ml/min 2.1 ml	1.6 ml/min
	Sample	10 ml/min 2.1 ml	10 ml/min
Adventitious light - values			
	(V)	Room file	
	100	0	0
	200	0	0
	300	0	0
	350	0	0
	400	1	1
	450	2	2
	500	6	6
	550	10	10
	575	12	12
	600	22	22

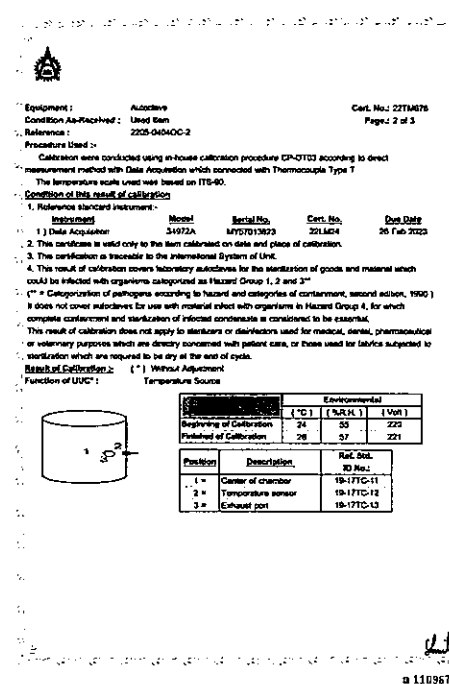
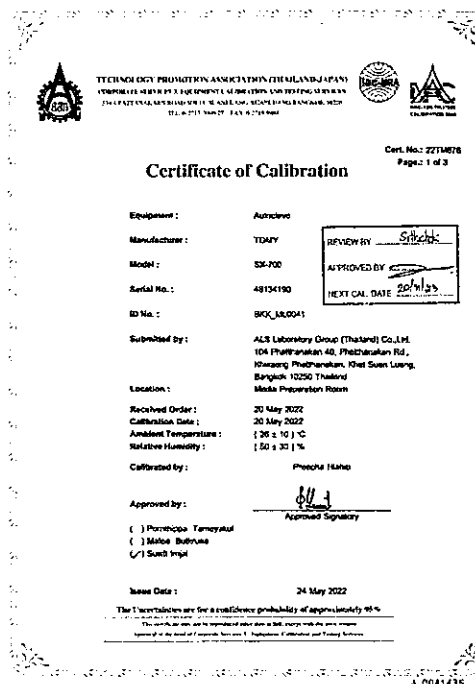
Laurenzini P. *Journal of Management Education* 2013; 37(1): 1-14.

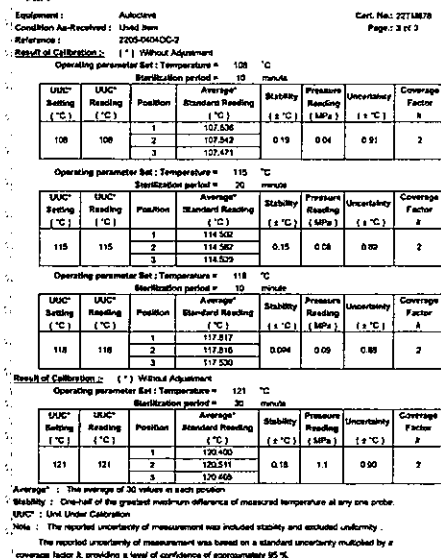
Device parameter	nominal value	actual value
Analytical parameters		
Conditions: max conc.: 10 µg/L PMT-voltage: <u>300</u> V		
Blank-solution without enrichment / FBR 30 ng/L	Int. > 0.0015 RSD < 3.5	Int. <u>0.0005</u> RSD. <u>1.18</u> %
Conditions: max conc.: 1 µg/L PMT-voltage: <u>310</u> V		
Blank-solution with enrichment / FBR 30 ng/L	Int. > 0.008 RSD < 3.5	Int. <u>0.0010</u> RSD. <u>2.51</u> %
Fok. factor (Int./ Int.)		<u>9</u>
Comments		

Brigade, 7/06/2022
Place Date (DDMMYY)

04/04/2021
Page: Data (DDMMYY)

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Q 1109669

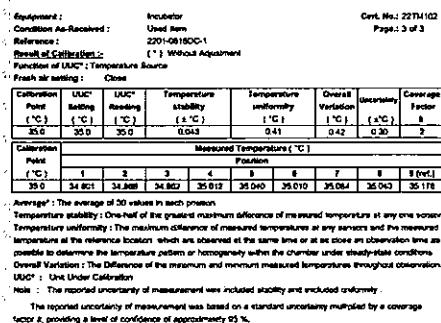


Cont. No.: 22TM100
Page : 1 of 2

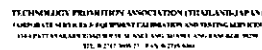
Equipment:	Incubator	REVIEW BY: <i>S. Chit</i>
Manufacturer:	SHIM-LAB	APPROVED BY: <i>S. Chit</i>
Model:	1915A	TEST CAL DATE: <i>20/03/03</i>
Serial No.:	000509	
ID No.:	BKA_IL0013	
Submitted by:	ALS Laboratory Group (Thailand) Co. Ltd. 104 Phatthanawan 40, Phatthanawan Rd., Klongwong Phatthanawan, Khat Suan Luang, Bangkok 10250 Thailand	
Location:	Incubator & Microorganism Reading	
Received Date:	21 January 2002	
Calibration Date:	21 January 2002	
Ambient Temperature:	(28 ± 10) °C	
Relative Humidity:	(50 ± 30) %	
Calibrated by:	Kittika Mahan	
Approved by:	 Approved Signatory	
() Porntipha Tamayaiul () Walee Chutruue () Suwit Inpa		
Issue Date:	3 February 2002	

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



4 0032377



8 1092308

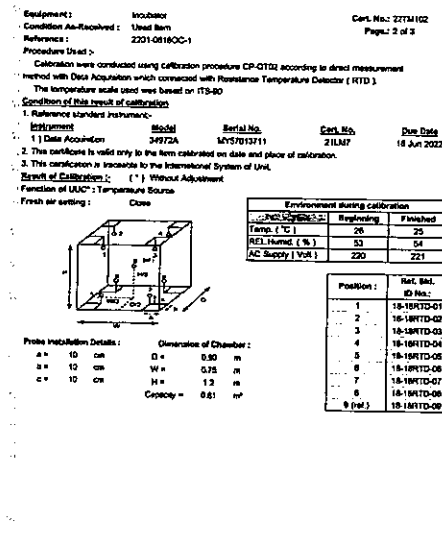


Cart. No.: 21TM110
Page: 1 of 2

Equipment:	Hot Air Oven	
Manufacturer:	Breda	
Model:	ED45E2	
Serial No.:	CO-15533	
IO No.:	BK02_JUL03	
Submitted by:	ALS Laboratory Group (Thailand) Co., Ltd. 104 Phatthanaburi 40, Phatthanaburi Rd., Klongseng Phatthanaburi, Klong Suan Luang, Bangkok 10520 Thailand	
Location:	Media Preparation Room	
Received Order:	7 June 2021	
Collection Date:	7 June 2021	
Ambient Temperature:	(26 ± 10) °C	
Relative Humidity:	(30 ± 30) %	
Coltivated by:	Preecha Hahnle	
Approved by:	 Approved Signatory	
(/) Porntipree Tanyasakul (/) Mahavee Butrom (/) Suan Pree		
Issue Date:	21 June 2021	

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

A 0029135



a 1092309



Equipment: Hot Air Oven
Condition As-Received: Used Item
Reference: 2105-01010C2
Result of Calibration: (*) Without Adjustment
Function of UUC: Temperature Source

Cert. No.: 21TM1101
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	0.07	2.4	2.3	1.5	2

Calibration Point (°C)	Position							
	1	2	3	4	5	6	7	8
180	179.315	181.246	178.854	180.005	179.841	180.511	179.439	180.288

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

0001

a 1059244



TECHNOLOGY PROMOTION AGENCY (TIPA) AND PENTACAL
CERTIFICATE OF CALIBRATION FOR TEMPERATURE
THE PENTACAL CERTIFICATE IS VALID FOR ONE YEAR FROM THE DATE OF CALIBRATION
TIPACAL 001/2022



Certificate of Calibration

Cert. No.: 21TM1077
Page: 1 of 3

Equipment: Water Bath
Manufacturer: Memmert
Model: WNE 45
Serial No.: L712 DQ9
ID No.: BNA 341056
Submitted by: ALS Laboratory Group (Thailand) Co., Ltd.
Location: 104 Phatthanaburi Rd., Phatthanaburi Rd., Krasang Phatthanaburi, Khut Sun Luang, Bangkok 10250 Thailand
Insulator & Microbiological Reading
Received Order: 20 May 2022
Calibration Date: 20 May 2022
Ambient Temperature: (25 ± 1) °C
Relative Humidity: (50 ± 30) %
Calibrated by: Pheecha Hahn

Approved by:
() Homotep Tachayakul
() Mamee Bunnas
() Suwit Inpa

Issue Date: 24 May 2022
The measurements are for a confidence probability of approximately 95 %.
This certificate is valid for one year from the date of calibration, provided that the equipment is used in accordance with the conditions of use specified on the certificate.

a 0041433



Equipment: Water Bath
Condition As-Received: Used Item
Reference: 2205-01010C2
Procedure Used: Calibration was conducted using in-house calibration procedure CP-0734 according to direct measurement method with Dead Aspiration which connected with Industrial Platinum Resistance Thermometer (IPRT).

Cert. No.: 22TM1077
Page: 2 of 3

The temperature scale used was based on ITS-90.
Condition of this result of calibration:
1. Reference standard instrument:
1.1 Data Acquisition Model: 34972A Serial No.: M757013023 Cert. No.: 22LM24 Due Date: 26 Feb 2023
2. This certificate is valid only to the item calibrated on date and place of calibration.
3. This certificate is traceable to the International System of Units.
Depth of Calibration: (*) Without Adjustment
Function of UUC: Temperature Source

Registration of Calibration	Environmental		AC Voltage Supply	
	(°C)	(%RH)	(Vol)	(V)
24	47	220		
26	52	221		

Position: 1 4804539-008
2 4804539-007
3 4804539-006
4 4804539-009
5 4804539-010

Free

a 1205674



Equipment: Water Bath
Condition As-Received: Used Item
Reference: 2205-01010C2
Result of Calibration: (*) Without Adjustment
Function of UUC: Temperature Source

Cert. No.: 22TM1077
Page: 2 of 3

Calibration point (°C)	UUC Setting (°C)	UUC Reading (°C)	Average Standard Reading (°C)				
44.5	44.4	44.4	1	2	3	4	5
			44.509	44.497	44.470	44.505	44.507

Calibration point (°C)	Uniformity (°C)	Stability (± °C)	Uncertainty (± °C)	Coverage Factor k
44.5	0.009	0.030	0.15	2

Average: The average of 30 values in each position.
Uniformity: The maximum difference of measured temperature 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 1105673



PENTA CALIBRATION CO., LTD.
86/124 The Connect 33 Village Farmvannachon Road
Dinard Phatthanaburi 10250
Tel: +66 89 7088 8779
www.pentacal.com

Certificate of Calibration

Represent to Certificate of Calibration: PTC01/2021
Certificate No.: PTC01/2021 Page: 1 of 2
Equipment: Digital Balance
Manufacturer: Sartorius
Model: MS224-105-00
Type of Balance: Single pan
Serial No.: 2607042
ID No.: BNA 341056

Customer: ALS Laboratory Group (Thailand) Co., Ltd.
104 Phatthanaburi Rd., Phatthanaburi Rd., Krasang Phatthanaburi, Khut Sun Luang, Bangkok 10250

Environment Condition: Temperature: 21.5 °C ± 0.7 °C
Humidity: 61.8 %RH ± 4.7 %RH
Air density: 1.19 kg/m³

Calibration Place: ALS Laboratory Group (Thailand) Co., Ltd.
104 Phatthanaburi Rd., Phatthanaburi Rd., Krasang Phatthanaburi, Khut Sun Luang, Bangkok 10250

The Method used: In-house method, PTC-01/07, based on Form 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52, 53, 54, 55, 56, 57, 58, 59, 60, 61, 62, 63, 64, 65, 66, 67, 68, 69, 70, 71, 72, 73, 74, 75, 76, 77, 78, 79, 80, 81, 82, 83, 84, 85, 86, 87, 88, 89, 90, 91, 92, 93, 94, 95, 96, 97, 98, 99, 100.
Traceability: This certificate is traceable to the SI Unit through The Calibration Service Co., Ltd. (NIST-ORIG Accredited for Calibration 0102)
Date Received: February 25, 2022
Calibration Date: February 25, 2022
Issued Date: March 01, 2022
Calibration By: Mr. Rungroj Meechai

Approved By:
(Mr. Rungroj Meechai)
Reviewed By:
(Mr. Rungroj Meechai)

This certificate is valid for one year from the date of calibration, provided that the equipment is used in accordance with the conditions of use specified on the certificate.
The measurements are for a confidence probability of approximately 95 %.
This certificate is valid for one year from the date of calibration, provided that the equipment is used in accordance with the conditions of use specified on the certificate.
The measurements are for a confidence probability of approximately 95 %.
This certificate is valid for one year from the date of calibration, provided that the equipment is used in accordance with the conditions of use specified on the certificate.



THE END OF THE CERTIFICATE



PENTA CALIBRATION CO., LTD.
86/124 The Connect 33 Village Farmvannachon Road
Dinard Phatthanaburi 10250
Tel: +66 89 7088 8779
www.pentacal.com

Represent to Certificate of Calibration: PTC01/2021
Certificate No.: PTC01/2021 Page: 2 of 2

Measurement Results:
Without Adjustment:
Function Calibration: Non Adjustment
Economic Error Weight to be 1/2 of 1/2 of Maximum capacity

Capacity test	Position (g)				
	1	2	3	4	5
	0.000	-0.002	-0.001	0.001	-0.001
Maximum deviation	0.002				

Repeatability Test: Weight to be 1/2 of 1/2 of Maximum capacity
Determination of the standard deviation of weighing balance: Repeatability: 0.001 (g)

Normal test value (g)	Standard Deviation
200	0.0005

Normal Value (g)	Conventional Mass (g)	Indication (g)	Correction of Balance (g)	Uncertainty (g)	k
0	0.0000	0.0000	0.0000	0.00016	2.57
0.1	0.1000	0.1000	0.0000	0.00017	2.30
0.5	0.5000	0.5000	0.0000	0.00016	2.28
1	1.0001	1.0001	0.0000	0.00016	2.28
2	2.0001	2.0001	0.0000	0.00016	2.28
5	5.0001	5.0001	0.0000	0.00016	2.28
10	10.0002	10.0002	0.0000	0.00016	2.28
20	20.0002	20.0002	0.0000	0.00016	2.23
50	50.0001	50.0001	0.0000	0.00017	2.15
100	100.0002	99.9999	0.0001	0.00020	2.08
120	120.0004	120.0000	0.0000	0.00023	2.03
150	150.0003	150.0000	0.0000	0.00026	2.00
200	200.0003	199.9999	0.0001	0.00030	2.00

New Weight of 500g

The End of Certificate

THE END OF THE CERTIFICATE

Time	Transaction State	Activity Pattern	Type of Transaction	Optional Information
November 23, 2021 19:28:42 ms	Start	Execution	System Integration and Repair Safety and Control Test Qualification Test - No subjects associated	None
November 23, 2021 19:34:54 ms	End	Execution	System Integration and Repair Safety and Control - TDRS Operations Test - No subjects associated	Run Count: 1
November 23, 2021 19:38:04 ms	Start	Execution	Intel Processor Accuracy - Front IMU - Pressure Controlled Mid - 3.75 kPa; L = 1.5 Pa	None
November 23, 2021 19:37:01 ms	End	Execution	Intel Processor Accuracy - Front IMU - Pressure Controlled Mid - 3.75 kPa; L = 1.5 Pa	Run Count: 1
November 23, 2021 19:27:09 ms	Start	Execution	GC Data Temperature Accuracy - 7800 - Temperature Check - 1200 F; L = 1.0 F AND = 1.0 F segment in E	None
November 23, 2021 19:27:26 ms	Auto	Idle	Accuracy - 7800 - Temperature Check - 1200 F; L = 1.0 F AND = 1.0 F segment in E	Manual Data Entry
November 23, 2021 19:27:49 ms	End	Execution	GC Data Temperature Accuracy - 7800 - Temperature Check - 1200 F; L = 1.0 F AND = 1.0 F segment in E	Run Count: 1
November 23, 2021 19:27:52 ms	Start	Execution	GC Data Temperature Accuracy - 7800 - Temperature Check - 1200 F; L = 1.0 F AND = 1.0 F segment in E	None
November 23, 2021 19:27:44 ms	Auto	Idle	Accuracy - 7800 - Temperature Check - 1200 F; L = 1.0 F AND = 1.0 F segment in E	Manual Data Entry

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User Name: jstuart@sternberg.su.se Account: ALMOG07253				System No: 236158 Print Date: November 21, 2021 11:23 PM
ALLO_00018 Transaction log:				
Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
November 17, 2021 17:27:46 AM	End	Execution	GC Clean Temperature Accuracy: 7800 - Temperature Error: 1.98 DEG. C. \pm 1.0 AND \pm 0.5% subject to K.	Run Count: 3
November 18, 2021 10:20:20 AM	Start	Execution	GC Clean Temperature Stability - 7800 - Temperature: Clean - 1.98 DEG. C. \pm 0.5%	None
November 18, 2021 10:20:24 AM	Start	Execution	GC Clean Temperature Stability - 7800 - Temperature: Clean - 1.98 DEG. C. \pm 0.5%	None
November 18, 2021 10:20:29 AM	Start	Execution	GC Clean Temperature Stability - 7800 - Temperature: Clean - 1.98 DEG. C. \pm 0.5%	None
November 18, 2021 10:27:44 AM	Start	Execution	GC Clean Temperature Stability - 7800 - Temperature: Clean - 1.98 DEG. C. \pm 0.5%	None
November 17, 2021 10:26:26 AM	Abort	Done	GC Clean Temperature Stability - 7800 - Temperature: Clean - 1.98 DEG. C. \pm 0.5%	Manual Data Entry
November 18, 2021 10:26:23 AM	End	Execution	GC Clean Temperature Stability - 7800 - Temperature: Clean - 1.98 DEG. C. \pm 0.5%	Run Count: 3
November 18, 2021 10:26:26 AM			Test Set: 70000 T2 - Source - None D1 - Educator Element 1 K1 - Source - No samples measured.	None
November 18, 2021 10:41:10 AM	End	Execution	Test Set: 70000 T2 - Source - None D1 - Educator Element 1 K1 - Source - No samples measured.	Run Count: 3

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User Name: jayant@cloudfury
 Hostname: ARB060x255

Syslog ID: CSM 1

Print Date: November 21, 2021 1:12:38 PM

JAL_SMTX Transactions Log :

Time	Transaction Start	Activity Completion	Type of Transaction	Optional Information
November 21, 2021 15:11:12 AM	Start	Execution	Trans ID : 708001 TD - Source : None ID : External Source 1 (Default) - No sequence assignment	
November 21, 2021 15:11:34 AM	End	Execution	Trans ID : 708001 TD - Source : None ID : External Source 2 (Default) - No sequence assignment	Run Count : 1
November 21, 2021 16:43:47 AM	Start	Execution	Executing Rule - Injection Tweak, Basic First Mile, TD - Source : C1 External Port of CSM System Preparation	Basic
November 21, 2021 16:43:59 AM	End	Done	Executing Rule - Injection Tweak, Data Bus Path First Mile, TD - Source : C1 External Port of CSM System Preparation	Data Bus Path : WipeupRuleOCM@10Mhz VignetteOCM@10Mhz_001
November 21, 2021 16:49:16 AM	End	Execution	Executing Rule - Injection Tweak, Run Count : 1 First Mile, TD - Source : C1 External Port of CSM System Preparation	Run Count : 1
November 21, 2021 16:49:16 AM	Start	Completion	Injection Definition Link - First Mile, TD - Source : C1 External Port of CSM (Flat Tweak) - 1.00%	None
November 21, 2021 16:49:36 AM	Apply	Done	Injection Definition Link - First Mile, TD - Source : C1 External Port of CSM (Flat Tweak) - 1.00%	Data Bus Path : WipeupRuleOCM@10Mhz VignetteOCM@10Mhz_001 L/Vignette - 10.00% - 0.00 L (Flat Tweak) - 1.00%
November 21, 2021 16:49:36 AM	Apply	Done	Injection Definition Link - Second Mile, First Mile, TD - Source : C2 - External - 0.00 L (Flat Tweak) - 1.00%	Data Bus Path : WipeupRuleOCM@10Mhz VignetteOCM@10Mhz_001 L/Vignette - 10.00% - 0.00 L (Flat Tweak) - 1.00%

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User Name [system,chenmingzhang] Inbound Area 4.000 FV2729				System ID: GM-16 Print Date: 2020.11.12 10:38 PM	
ALL_CMED (This section log) :					
Time	Transaction State	Activity	Type of Transaction	Optional Information	
November 23, 2021 10:46:30 AM	Auth	Date	Interconnect Database Link :	Data Base Path :	
			Inspection Times: Peak MAX: 170	D:\Microsoft\CCM\Files	
			Scenario : 11 - Entrance - R320	Vulnerability:CC2ENTR_005.D	
			L Value: 10 (20% x R320)		
			Offet Times : 10 (20%)		
November 23, 2021 10:46:30 AM	Auth	Date	Interconnect Database Link :	Data Base Path :	
			Inspection Times: Peak MAX: 170	D:\Microsoft\CCM\Files	
			Scenario : 11 - Entrance - R320	Vulnerability:CC2ENTR_005.D	
			L Value: 10 (20% x R320)		
			Offet Times : 10 (20%)		
November 23, 2021 10:46:30 AM	Auth	Date	Interconnect Database Link :	Data Base Path :	
			Inspection Times: Peak MAX: 170	D:\Microsoft\CCM\Files	
			Scenario : 11 - Entrance - R320	Vulnerability:CC2ENTR_005.D	
			L Value: 10 (20% x R320)		
			Offet Times : 10 (20%)		
November 23, 2021 10:46:30 AM	Auth	Date	Interconnect Database Link :	Data Base Path :	
			Inspection Times: Peak MAX: 170	D:\Microsoft\CCM\Files	
			Scenario : 11 - Entrance - R320	Vulnerability:CC2ENTR_005.D	
			L Value: 10 (20% x R320)		
			Offet Times : 10 (20%)		
November 23, 2021 10:46:30 AM	Auth	Date	Interconnect Database Link :	Data Base Path :	
			Inspection Times: Peak MAX: 170	D:\Microsoft\CCM\Files	
			Scenario : 11 - Entrance - R320	Vulnerability:CC2ENTR_005.D	
			L Value: 10 (20% x R320)		
			Offet Times : 10 (20%)		
November 23, 2021 10:46:30 AM	Auth	Date	Interconnect Database Link :	Data Base Path :	
			Inspection Times: Peak MAX: 170	D:\Microsoft\CCM\Files	
			Scenario : 11 - Entrance - R320	Vulnerability:CC2ENTR_005.D	
			L Value: 10 (20% x R320)		
			Offet Times : 10 (20%)		

[illegible]

Time	Transaction	Authority	Type of Transaction	Optional Information
November 23, 2021 10 47:23 AM	Audit	Date	More Rules Processed - Ingestion	Data Rec Path: Tensor, Input UMS, T2 - B Model Name:OCM SI/Phase Source ID - Customer - 1, (2500) Vaghen:OCM20210919_008 D -- 5.00%
November 23, 2021 10 48:02 AM	End	Execution	More Rules Processed - Ingestion	Fun. Caut: 1 Tensor, Input UMS, T2 - Source ID - Customer - 1, (2500) -- 5.00%
November 23, 2021 10 48 07 AM	End	Qualification	Session	QID
November 23, 2021 10 48 09 AM	Start	Reporting	Session	None
November 23, 2021 1 01 45 PM	Audit	Avr/Closed	Session	None
November 23, 2021 1 02 30 PM	Audit	Avr/UnClosed	Session	None
November 23, 2021 1 03:02 PM	Audit	Session/UnClosed	Session	None
November 23, 2021 1 03:37 PM	Work	Qualification	Session	QID
November 23, 2021 1 11 04 PM	Audit	Reporting	Session	Report Generated: CarPath