

ภาคผนวก ง

เอกสารการสอบเทียบเครื่องมือตรวจวิเคราะห์



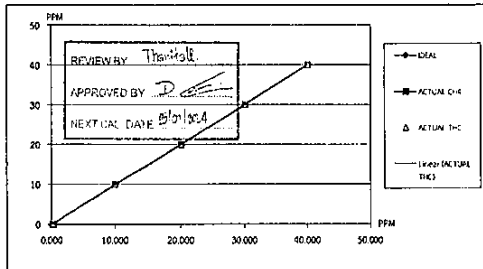
TEST REPORT

RYG_EN0038

CUSTOMER NAME	ALS Laboratory Group (Thailand) Co., Ltd. (บริษัท แอลเอส กรุ๊ปประเทศไทย จำกัด)		
EQUIPMENT NAME	THC Analyzer		
MANUFACTURER	HORIBA	MODEL	APHA-370
SERIAL NO	UA3HG4TH		
STANDARD GAS CONCENTRATION (PPM)	506.1 PPM	CYLINDER NO	CC734373
CYLINDER PRESSURE (psig)	1,600 PSI	CERTIFIED DATE	12/03/2020
CERTIFIED BY	AIRGAS	EXPIRED DATE	12/03/2028

TEST RESULTS

POINT NO	IDEAL	ACTUAL CH4	ERROR CH4	NEAROR CH4	ACTUAL THC	ERROR THC	NEAROR THC
ZERO	0.000	0.210	0.210	-	0.200	0.200	-
1	10.000	10.050	0.050	0.50	10.050	0.050	0.50
2	20.000	20.120	0.120	0.60	20.150	0.150	0.75
3	30.000	30.110	0.110	0.37	30.050	0.050	0.17
4	40.000	40.030	0.030	0.08	40.030	0.030	0.08
AVERAGE (%)				0.39			0.37



CALIBRATED BY: *[Signature]* DATE: 25/1/16
 CHECKED BY: *[Signature]* DATE: 25/1/16

For more information, please contact: (Mr.) Jirawat Sakam, Tel: 02-668-0812 # 15-16, E-Mail: Engineer@jirawat.com
 หรือ 02-14-15-67/25-36 หรือโทรหา 7/71 หรือโทรหา 02-668-0812 หรือโทรหา 10600 โทร 02-668-0812 โทร 02-668-1089

FO-EN-205 100/22-10 14



CHECK LIST

CUSTOMER NAME	ALS Laboratory Group (Thailand) Co., Ltd. (บริษัท แอลเอส กรุ๊ปประเทศไทย จำกัด)		
EQUIPMENT NAME	THC Analyzer		
MANUFACTURER	HORIBA	MODEL	APHA-370
SERIAL NO	UA300THB		

TEST VALUES

NO.	THC Analyzer (APHA-370)	UNIT	BEFORE	AFTER
1	Signal (CH4)	mV	4.300	42.400
2	Signal (THC)	mV	3.200	64.400
3	Detector	Temp °C, Standard Value: Ambient temp (15°C to 19°C) Pressure kPa, Standard Value: (Ambient/1013x100-200)±40	46.700	50.000
4	Ambient	kPa current atmospheric pressure	101.000	101.100
5	Full/Free	°C, Standard Value: 390 °C to 430 °C	420.400	421.200
6	Flow	kPa, Normal value: 8 kPa to 25 kPa	9.600	9.800
7	Flow	°C, Standard Value: 230 °C to 260 °C	244.600	245.100
8	DC 24 V	V, Standard Value: 24 V ± 0.5 V	23.900	23.900
9	DC 5 V	V, Standard Value: 5 V ± 0.5 V	5.000	5.000
10	Bypass (Optional)	L/min, Normal value: 0.9 L/min ± 0.3 L/min	-	-
11	Over Flow (Optional)	L/min, Standard Value: 0.8 L/min or More	-	-
12	CH4 Sampling Reading	PPM	3.530	2.330
13	THC Sampling Reading	PPM	4.280	1.150
14	Zero Gas CH4/THC	PPM	0.21/0.20	0.00/0.00
15	Span Gas	PPM	54.87/55.78	45.03/40.03
16	Gas H2	20 PSI	20	20

Remark: Reference: EX-EN 017-58, Ambient THC Monitor APHA-370 Operation Manual Page 81

Remark: (Ambient Temperature = 5°C to 40°C)

การตรวจสอบ

Service Maintenance

รายละเอียดการดำเนินการ

Calibration Zero/Span, Multipoint

ผลการดำเนินงาน

เงื่อนไขหรือเอกสารที่เกี่ยวข้องที่แนบมา

CALIBRATED BY: *[Signature]* DATE: 25/1/16
 CHECKED BY: *[Signature]* DATE: 25/1/16

For more information, please contact: (Mr.) Jirawat Sakam, Tel: 02-668-0812 # 15-16, E-Mail: Engineer@jirawat.com
 หรือ 02-14-15-67/25-36 หรือโทรหา 7/71 หรือโทรหา 02-668-0812 หรือโทรหา 10600 โทร 02-668-0812 โทร 02-668-1089

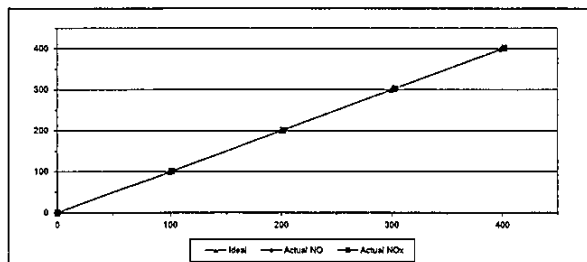
FO-EN-207 100/01-00-13



MULTIPOINT CALIBRATION REPORT

Calibration Date	5-Jan-23	Equipment Name	NOx Analyzer
Manufacturer	HORIBA	Model	APNA-370
Serial No.	R06KD177	Equipment ID	RYG_F80483
Calibrator Manufacturer	Teledyne API	Model	700
Serial No.	847		
Std. Gas Concentration (PPM)	55.88	Cylinder No.	GN0027222
Cylinder Pressure (ps)	1800	Certified By	Airgas Inc.
Certified Date	8-Feb-22	Expired Date	8-Feb-30

Point	Ideal	Actual NO	Error NO	%Error NO	Actual NOx	Error NOx	%Error NOx
ZERO	0.00	0.10	0.10	0.10	0.10	0.10	0.10
1	100.00	98.60	-1.20	-1.20	101.10	1.10	1.10
2	200.00	201.80	1.80	0.90	201.50	1.50	0.75
3	300.00	298.40	-0.60	-0.20	302.60	2.60	0.87
4	400.00	398.10	-1.90	-0.47	401.80	1.80	0.47
AVERAGE (%)				-0.18			0.66



Calibrated By
[Signature]
 (Mr.) Jirawat Sakam
 Field Environmental Scientist (3)

Approved By
[Signature]
 (Mr.) Sarayuth Jitranont
 Assistant General Manager

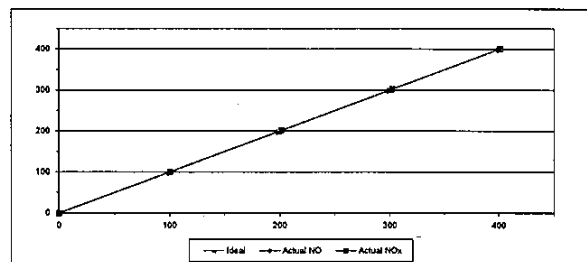
ALS Laboratory Group
 FORM NO.: F-06-056 REVISION NO.: 1 ISSUE DATE: 02/04/12



MULTIPOINT CALIBRATION REPORT

Calibration Date	5-Jan-23	Equipment Name	NOx Analyzer
Manufacturer	HORIBA	Model	APNA-370
Serial No.	BEEAW33E	Equipment ID	RYG_F80281
Calibrator Manufacturer	Teledyne API	Model	700
Serial No.	847		
Std. Gas Concentration (PPM)	55.88	Cylinder No.	GN0027222
Cylinder Pressure (ps)	1800	Certified By	Airgas Inc.
Certified Date	8-Feb-22	Expired Date	8-Feb-30

Point	Ideal	Actual NO	Error NO	%Error NO	Actual NOx	Error NOx	%Error NOx
ZERO	0.00	0.10	0.10	0.10	0.10	0.10	0.10
1	100.00	98.70	-1.30	-1.30	100.40	0.40	0.40
2	200.00	197.80	-2.20	-1.10	201.50	1.50	0.75
3	300.00	298.10	-1.90	-0.63	302.20	2.20	0.73
4	400.00	398.50	-1.50	-0.38	401.40	1.40	0.35
AVERAGE (%)				-0.66			0.47



Calibrated By
[Signature]
 (Mr.) Jirawat Sakam
 Field Environmental Scientist (3)

Approved By
[Signature]
 (Mr.) Sarayuth Jitranont
 Assistant General Manager

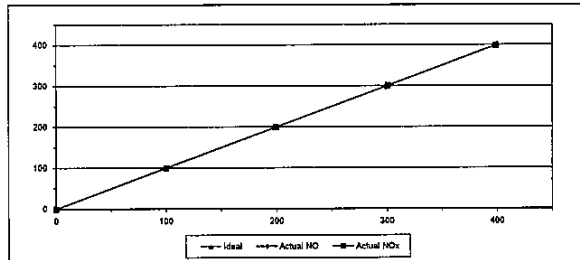
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 FORM NO.: F-06-056 REVISION NO.: 1 ISSUE DATE: 02/04/12



MULTIPOINT CALIBRATION REPORT

Calibration Date	5-Jan-23	Equipment Name	NOx Analyzer
Manufacturer	HORIBA	Model	APNA-370
Serial No.	7AV88544	Equipment ID	RYG_F80272
Calibrator Manufacturer	Teledyne API	Model	700
Serial No.	847		
Std. Gas Concentration (PPM)	55.88	Cylinder No.	GN0027222
Cylinder Pressure (psi)	1800	Certified By	Algas Inc.
Certified Date	9-Feb-22	Expired Date	8-Feb-30

Point	CALIBRATION RESULTS						
	Ideal	Actual NO	Error NO	%Error NO	Actual NOx	Error NOx	%Error NOx
ZERO	0.00	0.05	0.05	0.05	0.10	0.10	0.10
1	100.00	99.10	-0.90	-0.90	100.10	0.10	0.10
2	200.00	198.60	-1.40	-0.70	199.00	-1.00	-0.50
3	300.00	298.70	-1.30	-0.43	300.50	0.50	0.17
4	400.00	398.00	-2.00	-0.50	398.70	-1.30	-0.33
AVERAGE (%)				-0.50			-0.08



Calibrated By

(Mr. Jirawat Sakam)
Field Environmental Scientist (3)

Approved By

(Mr. Barayuth Uthairat)
Assistant General Manager

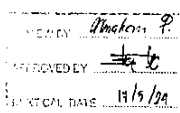
ALS Laboratory Group
FORM NO.: F-06-055 REVISION NO.: ISSUE DATE: 02/04/12



Transfer Associates Co. Ltd.
43/14 15, 20/15 Rd.
Prachinburi 21120, Prachinburi, Bangkok
Tel: 046082111
Mobile: 08441399943
E-mail: jnac@transfer.co.th
Web site: www.jnac.co.th

Accredited calibration laboratory
ISO/IEC 17025:2017
NAC-155-115-17025
CALIBRATION 0367

Air speed measurement laboratory
Calibration services department



Certificate Number

CL-002-65

CERTIFICATE OF CALIBRATION

Page 1 of 2 Pages

MEASUREMENT ITEM	Wind Direction Sensor
MANUFACTURER	Novelty
MODEL/TYPE	Sensor: WS-01T Data logger: 110-WS-2500-0
SERIAL NUMBER	Sensor: WSD-012 Data logger: A5509
ID NUMBER	RYG_F80608
CONDITION AS RECEIVED	New item
CUSTOMER	ALS Laboratory group (Thailand) co., Ltd. 104 Phatthanasak 40, Phatthanasak Rd., Khwaeng Suan Luang, Khet Suan Luang, Bangkok 10250 Thailand

RECEIVED DATE	09 Nov 2022
MEASUREMENT DATE	17 Nov 2022
ISSUE DATE	23 Nov 2022

ENVIRONMENTAL CONDITIONS:

Ambient condition in the laboratory are as follows:	
Temperature	23.0 ± 3.0 °C
Relative Humidity	55.0 ± 15.0 %RH
Atmospheric Pressure	1010 ± 10 hPa

PLACE OF CALIBRATION

Effel type wind tunnel of Transfer Associates Co., Ltd

CALIBRATION CONDITION	Wind tunnel cross section area ¹	900	cm ²
	Win direction frontal area ²	329	cm ²
	Diameter of mounting pipe ³	-	mm
	Blockage ratio of test object ⁴	0.143	[-]

Preconditioning	24 hours at ambient conditions
Measurement Condition	The average values during measurement are (24.0)°C, (50.6) %RH and (1009.4) hPa.

TABULATION OF RESULTS:

The table on next page give the measured values.



Approved signature

Mr. Pinyas Booncharoen
Calibration Department Manager

Remarks:
¹ Nozzle cross section area of the wind tunnel
² Projected cross section area of the tested object include mounting pipe
³ Diameter of mounting pipe
⁴ Ratio: 1/1

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Page 2 of 2 Pages

MEASUREMENT RESULTS⁵

The wind direction sensor was calibrated against standard rotary encoder by comparison method. During calibration, the measurement was carried out at 45° intervals in clockwise and counter-clockwise directions after offset adjustment has been made. The flow speed of wind tunnel (usually 5 m/s) is kept constant while the sensor is rotated around its vertical axis. The results of calibration and associated measurement uncertainties are reported in the table below.

Air speed	D ₁ in	D ₂ in	Error	U (k=2)
m/s	Degree (°)	Degree (°)	Degree (°)	Degree (°)
5.00	0.000	0	0	0.58
	45.000	42	-3	0.74
	89.999	88	-2	0.68
	135.000	133	-2	0.68
	180.001	179	-1	0.68
	225.000	225	0	0.68
	270.000	271	1	0.68
	315.000	318	3	0.74

Remarks:

⁵ Calibration results only count for the tested instruments and measurement conditions during which calibration took place

¹ Direction of standard

² Direction of flow under calibration

End of Certificate of Calibration



Transfer Associates Co. Ltd.
43/14 15, 20/15 Rd.
Prachinburi 21120, Prachinburi, Bangkok
Tel: 046082111
Mobile: 08441399943
E-mail: jnac@transfer.co.th
Web site: www.jnac.co.th

Accredited calibration laboratory
ISO/IEC 17025:2017
NAC-155-115-17025
CALIBRATION 0367

Air speed measurement laboratory
Calibration services department

Certificate Number

CL-002-65

CERTIFICATE OF CALIBRATION

Page 1 of 2 Pages

MEASUREMENT ITEM	Cup anemometer
MANUFACTURER	Novelty
MODEL/TYPE	Sensor: WS-01T Data logger: 110-WS-2500-0
SERIAL NUMBER	Sensor: WSD-012 Data logger: A5509
ID NUMBER	RYG_F80608
CONDITION AS RECEIVED	New item
CUSTOMER	ALS Laboratory group (Thailand) co., Ltd. 104 Phatthanasak 40, Phatthanasak Rd., Khwaeng Suan Luang, Khet Suan Luang, Bangkok 10250 Thailand

RECEIVED DATE	09 Nov 2022
MEASUREMENT DATE	17 Nov 2022
ISSUE DATE	23 Nov 2022

ENVIRONMENTAL CONDITIONS:

Ambient condition in the laboratory are as follows:	
Temperature	23.0 ± 3.0 °C
Relative Humidity	55.0 ± 15.0 %RH
Atmospheric Pressure	1010 ± 10 hPa

PLACE OF CALIBRATION

Effel type wind tunnel of Transfer Associates Co., Ltd.

CALIBRATION CONDITIONS	Wind tunnel cross section area ¹	900	cm ²
	Win direction frontal area ²	100	cm ²
	Diameter of mounting pipe ³	-	mm
	Blockage ratio of test object ⁴	0.333	[-]

Preconditioning	24 hours at ambient conditions
Measurement Condition	The average values during measurement are (23.8)°C, (46.3) %RH and (1014.7) hPa.

TABULATION OF RESULTS:

The table on next page give the measured values.



Approved signature

Mr. Pinyas Booncharoen
Calibration Department Manager

Remarks:
¹ Nozzle cross section area of the wind tunnel
² Projected cross section area of the tested object include mounting pipe
³ Diameter of mounting pipe
⁴ Ratio: 1/1

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Certificate Number
CL-002-65

Page 2 of 2 Pages

MEASUREMENT RESULTS

The cup anemometer, Model Calibration (DUC) was checked at 10 m/s for 5 minutes prior to calibration being performed. The standard air velocity 0.5 m/s to 5 m/s was calculated by a standard air velocity transducer and above 5 m/s to 30 m/s was calculated by a pitot tube with precision differential pressure meter which was installed 40 mm and 300 mm respectively away from wind tunnel nozzle. DUC was installed at center of the test section. The calibration was carried out under both rising and falling air velocity in the range of 1 m/s to 30 m/s at calibration interval of 3 m/s. The results of calibration and associated measurement uncertainties are reported in the table below.

V _{ref} (m/s)	Temp. wind tunnel (°C)	Temp. room (°C)	V _{ref} (m/s)	Error (m/s)	U ₉₅ (%)
0.503	23.90	23.80	0.8	-0.2	0.15
2.035	23.70	23.60	1.8	-0.2	0.16
3.040	23.90	23.80	2.8	-0.2	0.19
4.194	23.60	23.50	3.8	0.4	0.20
5.01	23.70	23.60	4.8	-0.2	0.19
6.00	23.75	23.60	5.8	-0.2	0.17
7.08	23.80	23.60	6.8	-0.2	0.18
8.18	23.60	23.50	8.0	-0.2	0.20
9.10	23.80	23.80	8.9	-0.2	0.20
10.09	23.64	23.60	9.9	-0.2	0.21
11.15	23.56	23.60	10.9	-0.3	0.21
12.16	23.56	23.60	11.9	-0.3	0.21
13.20	23.52	23.60	12.9	-0.3	0.22
14.26	23.50	23.60	14.1	-0.2	0.22
15.25	23.58	23.60	15.0	-0.2	0.21
16.30	23.60	23.60	16.2	-0.1	0.24

Remark:

Calibration results only count for the tested circumstances and environmental conditions during which calibration took place.

* Velocity of standard

Velocity of this Under Calibration

PHOTO OF CALIBRATION SET-UP



Calibration set up of the cup anemometer calibration in the wind tunnel of Jaramate Associates Co., Ltd. The cup anemometer shown may differ from the calibrated one. Remark: The presentation of the set up is not true to scale due to imaging geometry.



63/14 15.6/35 36, Soi Petchkasem 7/1, Petchkasem Rd,
Wattana, Bangkok, Bangkok 10600 Thailand.
Tel: (66) 02-8680812#13 Fax: (66) 02-8680860 www.jramate.com



CERTIFICATE OF CALIBRATION

Certificate No. CL 107-65
Page 1 of 2

Equipment Name: Data Logger with Temperature Sensor

Manufacturer: Nivadya

Model: 110 WS 2500 D

Serial No: K5900

ID No: 110G 150508

Customer:

Name: A/S Laboratory group (Thailand) Co. Ltd

Address: 104 Phatthana 40, Phatthanasak Rd, Khwaeng Suan Yung, Khet Suan Yung, Bangkok

10250 Thailand.

Received date: 09 Nov 2022

Calibration date: 10 Nov 2022

Issue date: 23 Nov 2022

Reference Used During Calibration

1. Standard Temperature Probe Model: S15 100 A500.

Serial No: 616762 09, Due date: 23 Mar 2023

2. Digital Temperature Indicator Model: DII 1000 A MK

II, Serial No: 671407 09091 Due date: 29 Jul 2023

Calibration Condition

Temperature: (23.10) °C

Relative Humidity: (65.1) %

Calibration Procedure

The temperature calibration was done by in-house calibration method as WI CI 001 according to comparison method with standard digital temperature indicator and standard temperature probe. The temperature scale use was based on ITS 90.

Traceability

The measurement results are traceable to the international system of units (SI) through National Institute of Metrology (Thailand) (NIMT) Certificate number: 11000122, Certificate number: 11000122 22.

Calibrated by

Mr. Sornchai Thachai

Mr. Jiraporn Teekasomphol



Approved Signatory:

Mr. Panya Boonchaisarn

Calibration Department Manager

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Certificate No. CL 107-65
Page 2 of 2

Result of Calibration: * Without Adjustment With Adjustment

Calibration Range: 20 - 40 °C

Function:

This equipment was connected with temperature sensor Model: 10M00 5/R, U3051220.

Diameter: 12 mm Length: 10 mm

Immersion Depth (mm)	Standard Reading (°C)	DUC Reading (°C)	Error (°C)	Uncertainty (°C)
60	19.90	19.9	0.1	0.20
140	19.90	19.9	0.2	0.20
160	19.90	19.9	0.2	0.20
180	19.90	19.9	0.2	0.20
200	19.90	19.9	0.2	0.20
220	19.90	19.9	0.2	0.20
240	19.90	19.9	0.2	0.20
260	19.90	19.9	0.2	0.20
280	19.90	19.9	0.2	0.20
300	19.90	19.9	0.2	0.20
320	19.90	19.9	0.2	0.20
340	19.90	19.9	0.2	0.20
360	19.90	19.9	0.2	0.20
380	19.90	19.9	0.2	0.20
400	19.90	19.9	0.2	0.20

UNC: Unc Under Calibration

The reported expanded uncertainty = Unc (at 95% confidence level) multiplied by a coverage factor k = 2 providing a level of confidence of approximately 95%.

★ End of Certificate ★



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Wattana, Bangkok, Bangkok 10600 Thailand.
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CERTIFICATE OF CALIBRATION

Calibration No.: 14102112022
Page 1 of 1 Pages

Measurement Item

Humidity sensor

Model/Type: 110 WS 2500 D

Serial Number: A5019

ID No: 110G 150508

Customer:

A/S Laboratory group (Thailand) Co. Ltd

104 Phatthana 40, Phatthanasak Rd, Khwaeng Suan Yung, Khet Suan Yung, Bangkok

10250 Thailand

Environmental Condition

The measurement was carried out in an ambient temperature of (25.3) °C, and relative humidity of (65.1) %.

Measurement Method

Unc Under Calibration (DUC) was calibrated by comparison method with standard DUC hygrometer in the humidity gas exchanger chamber to determine the errors.

Traceability

This instrument was calibrated using standard equipment whose accuracy is traceable through National Institute of Standards and Technology to the International system of units (SI) via NIST Calibration, Inc. Certificate number 20214 101 Due date: Mar 14/2023

Measurement Date:

Nov 18, 2022

Issued Date: Nov 23, 2022

Measurement Results

This equipment was connected with indoor air quality probe and Displayed (DUC) on display. Model: 10M00, Serial number: U3051220

Calibration was performed in the range of 20%RH to 80%RH

The results of calibration are reported in table below.

Setpoint (%RH)	Standard Reading (%RH)	DUC Reading (%RH)	Error (%RH)	Uncertainty (%RH)
20	19.94	19.4	-0.5	0.57
50	50.31	47.1	-3.3	0.65
80	80.30	77.4	-2.9	0.57

Performed by

Mr. Sornchai Thachai

Mr. Jiraporn Teekasomphol



Approved Signatory:

Mr. Panya Boonchaisarn

Calibration Department Manager

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CERTIFICATE OF CALIBRATION

Certificate No. WD-5012022

Page 1 of 2 pages

Measurement Item : Cup anemometer with data logger
Manufacturer : Data logger: Houshine
Cup anemometer: Houshine
Model/Type : Data logger: 200-WS-25LB
Cup anemometer: WS-02P
Serial Number : Data logger: A5100
Cup anemometer:
ID No : Data logger: Ph01200220
Cup anemometer:
Customer : ALS laboratory group (Thailand) Co., Ltd.
104 Phothanban 40, Phothanban Rd, Khwaeng Buan Luang, Khet Suan Luang, Bangkok 10250
Thailand
Test Conditions : Wind tunnel: static test section area: 50.3 m²
Anemometer frontal area: 100 cm²
Diameter of mounting pipe: - mm
Backsight half of test object: 0.111 [1]
Test Conditions : Air temperature: 23.6 ±0.4 °C
Air pressure: 1014.5 ±0.4 hPa
Relative air humidity: 53.4 ±3.5 %RH
Calibration Procedure : Calibration are carried out in accordance with ISO 17025:2017 Performance Measurements of Geodetic Measuring Wind Tunnel.
MEMSNET Anemometer Calibration Procedure - Version 1.0005.
Traceability : This calibration documents the traceability to national standards, which include the unit of measurement, according to the international system of units (SI) through the traceability of the reference and (NIST).
Measurement Date : 24th Dec, 2022
Issued Date : 24th Dec, 2022

Calibrated by:
☒ Mr. Somchai Traisakul
☐ Mr. Chaitan Wattanasri



Approved Signatory:
Mr. Panyat Jiranalee
Certification Department Manager

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Walthapa, Bangkokyal, Bangkok 10600 Thailand.
Tel: (66) 02-8680812#13 Fax: (66) 02-8680860 www.jiranalee.com

Continuation of Certificate of Calibration Number

Certificate No. WD-5012022
Page 2 of 2 pages

Result of calibration: ☒ Without adjustment ☐ With adjustment
Calibration in the range of 1 - 10 m/s at a calibration interval of 1 m/s.
The results of calibration and associated measurement uncertainties are reported in the table below.

Wind Reading m/s	Wind Reading m/s	Error (m/s)	Uncertainty (m/s)
2.076	2.0	0.1	2.4
4.101	4.1	0.0	1.2
5.99	6.0	0.0	0.95
8.01	8.0	0.0	0.83
10.01	10.1	0.1	0.79
12.01	12.1	0.1	0.67
13.99	14.1	0.1	0.73
15.99	16.4	0.4	0.43
18.00	18.2	0.2	0.39
19.01	19.3	0.3	0.63
11.02	11.0	0.0	0.76
9.03	9.0	0.0	0.81
7.02	7.0	0.0	0.85
5.130	5.1	0.0	0.90
2.951	3.0	0.0	1.6
1.955	2.0	0.1	4.5

UUCI Unit Under Calibration

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

Appendix 1: Itemization

ID	Sensor	Manufacturer	Model/Type	Calibration Date	Certificate Report Number	Range
1	Pressure (mbar)	TECOT INC	05102140	Aug 07 2021	MA 0034291	0 - 30 mbar
2	Pressure Differential Pressure (mbar)	TECOT	25402000	Aug 07 2021	MA 0034291	0 - 30 mbar
3	Air velocity (m/s)	TECOT	05102140	Aug 07 2021	MA 0034291	0 - 30 m/s
4	Temperature	TECOT	05102140	Aug 07 2021	MA 0034291	0 - 100 °C
5	Relative Humidity	TECOT	05102140	Aug 07 2021	MA 0034291	0 - 100 %RH
6	Atmospheric pressure	TECOT	05102140	Aug 07 2021	MA 0034291	900 - 1100 mbar
7	Wind Tunnel	TECOT	05102140	Aug 07 2021	MA 0034291	0 - 30 m/s

End of Certificate of Calibration



63/14-15,67/35-36, Soi Petchkasem 7/71, Petchkasem Rd,
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Tel: (66) 02-8680812#13 Fax: (66) 02-8680860 www.jiranalee.com

CERTIFICATE OF CALIBRATION

Certificate No. WD-05012022

Page 1 of 2 pages

Measurement Item : Wind direction sensor with data logger
Manufacturer : Data logger: Houshine
Wind direction sensor: Houshine
Model/Type : Data logger: 200-WS-25LB
Wind direction sensor: WS-02P
Serial Number : Data logger: A5100
Wind direction sensor:
ID No : Data logger: Ph01200220
Wind direction sensor:
Customer : ALS laboratory group (Thailand) Co., Ltd.
104 Phothanban 40, Phothanban Rd, Khwaeng Buan Luang, Khet Suan Luang, Bangkok 10250
Thailand
Environmental Conditions : The measurement was carried out in an ambient temperature of (23.6) °C and relative humidity of (53.4) %RH.
Measurement Method : The wind direction sensor calibration according to calibration record with reference measurement standard has 2.0 m/s and the angle is 45° for each condition. The measurement were taken at 45° degrees in clockwise and counter-clockwise direction.
Note : The UUCI was warmed up for 1 hour prior to the calibration being performed.
Traceability : The measurement results are traceable to the international system of units (SI) through the traceability of the reference and (NIST).
Measurement Date : 24th Dec, 2022
Issued Date : 24th Dec, 2022

Performed by:
☒ Mr. Somchai Traisakul
☐ Mr. Chaitan Wattanasri



Approved Signatory:
Mr. Panyat Jiranalee
Certification Department Manager

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Continuation of Certificate of Calibration Number

Certificate No. WD-05012022
Page 2 of 2 pages

Result of calibration: ☐ Without adjustment ☒ With adjustment
Calibration in the range of 0 - 360 ° at a calibration interval of 45°
The results of calibration and associated measurement uncertainties are reported in the table below.

ID	Turning Direction	Nominal Angle (°)	Standard Reading (°)	UUCI Reading (°)	Error (°)	Uncertainty (°)
1	Clockwise	0/360	0	0	0	3.0
2		45	45	43	2	3.0
3		90	90	90	0	3.0
4		135	135	135	0	3.0
5		180	180	181	1	3.0
6	Counter Clockwise	225	225	225	0	3.0
7		270	270	273	3	3.0
8		315	315	316	1	3.0
9		0/360	0	0	0	3.0
10		45	45	43	2	3.0
11	Clockwise	90	90	90	0	3.0
12		135	135	135	0	3.0
13		180	180	181	1	3.0
14		225	225	225	0	3.0
15		270	270	273	3	3.0
16	Counter Clockwise	315	315	316	1	3.0
17		0/360	0	0	0	3.0
18		45	45	43	2	3.0
19		90	90	90	0	3.0
20		135	135	135	0	3.0

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

End of Certificate of Calibration





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CERTIFICATE OF CALIBRATION

Certificate No: CL-006-66
Page 1 of 2

Equipment Name: Data Logger with Temperature
Sensor
Manufacturer: Novolyx
Model: 110-WS-25DL-D
Serial No: A5789
ID No: RYG_FS0531

Customer
Name: ALS laboratory group (Thailand) Co., Ltd.
Address: 104 Phatthanakan 40, Phatthanakan Rd.,
Khwaeng Suan Luang, Khet Suan Luang, Bangkok
10250 Thailand.

Received date: 16 Jan 2023
Calibration date: 18 Jan 2023
Issue date: 20 Jan 2023

Reference Used During Calibration
1. Standard Temperature Probe Model: STS-100 A500,
Serial No: 661682-09, Due date: 23 Mar 2023
2. Digital Temperature Indicator Model: DTI-1000-A MK
II, Serial No: 671407-00591 Due date: 22 July 2023

Calibration Condition
Temperature: (23±3) °C
Relative Humidity: (55±15)%

Calibration Procedure
The temperature calibration was done by in-House
calibration method as WI-CL-001 according to
comparison method with standard digital temperature
indicator and standard temperature probe. The
temperature scale use was based on ITS-90.

Traceability
The measurement results are traceable to the
international system of units (SI) through National
Institute of Metrology Thailand (NIMT) Certificate
number: TI-0034-22, Certificate number: ER-0092-
22

Calibrated by
☐ Mr. Sorawit Thachalead
☒ Miss Jittaporn Lertsomphol



Approved Signatory:
Mr. Parinya Booncharoen
Calibration Department Manager

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Certificate No: CL-006-68
Page 2 of 2

Result of Calibration: ☒ Without Adjustment ☐ With Adjustment
Calibration Range: 20-40 °C

Function:
This equipment was connected with temperature sensor Model: HMP60 S/N: T0210901.

Dimension : Diameter 12 mm, Length 80 mm.

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
60	20.067	19.8	-0.3	0.099
60	25.058	24.6	-0.5	0.099
60	30.052	29.5	-0.6	0.099
60	35.047	34.5	-0.5	0.099
60	40.038	39.3	-0.7	0.099

UUC*: Unit Under Calibration
The reported expanded uncertainty is based on standard uncertainty multiplied by a coverage factor k=2 providing a level of
confidence of approximately 95%.

★ End of Certificate ★



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Wathapra, Bangkokhyal, Bangkok 10600 Thailand.
Tel: (66) 02-8680812#13 Fax: (66) 02-8680860 www.jiranelee.com

CERTIFICATE OF CALIBRATION

Calibration No.: RH-04012023
Page 1 of 1 Pages

Measurement Item : Relative humidity with data logger
Manufacturer : Novolyx
Model/Type : 110-WS-25DL-D
Serial Number : A5789
ID No : RYG_FS0531
Customer : ALS laboratory group (Thailand) Co., Ltd.
: 104 Phatthanakan 40, Phatthanakan Rd., Khwaeng Suan Luang, Khet Suan Luang, Bangkok
10250 Thailand.

Environmental Condition:
The measurement was carried out in an ambient temperature of (25±3)°C, and relative humidity of (50±10)%.

Measurement Method:
Unit Under Calibration (UUC) was calibrated by comparison method with standard thermo hygrometer in the humidity gen-
erator chamber to determine the errors.

Traceability:
This instrument was calibrated using standard equipment whose accuracy is traceability through National Institute of
Standards and Technology to the international system of units (SI) via MCS Calibration, Inc. Certificate number:
20314-101, Due date: Mar 14, 2023.

Measurement Date : Jan 18, 2023
Issue Date : Jan 20, 2023

Measurement Results:
This equipment was connected with indoor air quality probe and Displayed (LUT) on display. Model: HMP60, Serial num-
ber: T0210901.
Calibration was performed in the range of 20%RH to 80%RH
The results of calibration are reported in table below.

Determined (%RH)	Standard Reading (%RH)	UUC Reading (%RH)	Error (%RH)	Uncertainty (%RH)
20	20.03	18.0	-2.0	0.51
60	60.24	47.8	-12.4	0.51
80	80.19	77.3	-2.9	0.51

Performed by
☐ Mr. Sorawit Thachalead
☒ Miss Jittaporn Lertsomphol



Approved Signatory:
Mr. Parinya Booncharoen
Calibration Department Manager

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TION HAS BEEN OBTAINED IN WRITING FROM THE LABORATORY.



ROYA METER CALIBRATION RESULT JANUARY 2023

Rotameter ID.	Calibration Date	Regression Result	Coefficient (R ²)
BKK_FS0577	03 Jan 23	Y = 1.0259x - 0.8354	0.9997
BKK_FS0579	05 Jan 23	Y = 1.0005x + 0.2803	1.0000
BKK_FS0583	05 Jan 23	Y = 0.9976x + 1.2146	1.0000
BKK_FS0584	03 Jan 23	Y = 1.0104x - 0.3929	1.0000
BKK_FS0586	05 Jan 23	Y = 1.001x - 1.3619	0.9999
BKK_FS0587	03 Jan 23	Y = 1.0038x + 0.881	1.0000
BKK_FS0588	05 Jan 23	Y = 1.0015x - 0.6876	0.9999
BKK_FS0590	05 Jan 23	Y = 0.9958x + 1.7452	1.0000
BKK_FS0591	03 Jan 23	Y = 0.9877x + 64.54	0.9951
BKK_FS0593	03 Jan 23	Y = 0.9792x + 21.393	0.9972
BKK_FS0594	03 Jan 23	Y = 1.0455x - 43.344	0.9976
BKK_FS0595	05 Jan 23	Y = 0.9993x + 1.18	1.0000
BKK_FS0597	05 Jan 23	Y = 0.9768x + 22.288	0.9971
BKK_FS1004	03 Jan 23	Y = 0.9943x + 7.1619	0.9996
BKK_FS1005	03 Jan 23	Y = 1.0045x + 2.1167	0.9998
BKK_FS1006	03 Jan 23	Y = 1.0286x - 0.3852	0.9999
BKK_FS1008	03 Jan 23	Y = 1.0181x + 0.1282	0.9998
BKK_FS1009	05 Jan 23	Y = 1.0018x + 1.1293	1.0000
BKK_FS1011	03 Jan 23	Y = 1.0493x - 1.9344	0.9985
BKK_FS1012	03 Jan 23	Y = 1.0082x - 53.425	0.9999
BKK_FS1013	03 Jan 23	Y = 1.0058x - 9.701	1.0000
BKK_FS1014	05 Jan 23	Y = 0.9869x + 1.2643	0.9995
BKK_FS1015	05 Jan 23	Y = 1.004x - 0.7571	0.9999
BKK_FS1016	05 Jan 23	Y = 0.978x + 24.823	0.9973
BKK_FS1017	17 Jan 23	Y = 1.0022x + 0.4211	1.0000
BKK_FS1018	17 Jan 23	Y = 0.9893x + 5.6317	1.0000
BKK_FS1019	17 Jan 23	Y = 0.9859x - 11.574	0.9986
BKK_FS1020	03 Jan 23	Y = 1.0208x - 0.6221	0.9998
BKK_FS1021	03 Jan 23	Y = 0.992x - 44.599	0.9997
BKK_FS1022	03 Jan 23	Y = 1.0067x - 12.483	0.9999
BKK_FS1023	03 Jan 23	Y = 1.0013x + 0.5623	0.9993
BKK_FS1024	03 Jan 23	Y = 1.0036x - 50.787	0.9999
BKK_FS1025	03 Jan 23	Y = 0.974x + 27.034	0.9999
BKK_FS1026	05 Jan 23	Y = 0.9783x + 1.7075	0.9991
BKK_FS1027	05 Jan 23	Y = 1.145x - 90.325	0.9797
BKK_FS1028	05 Jan 23	Y = 0.9815x + 13.626	0.9989
BKK_FS1029	03 Jan 23	Y = 0.9706x + 3.6283	0.9951
BKK_FS1030	03 Jan 23	Y = 1.0197x - 52.982	0.9999
BKK_FS1031	03 Jan 23	Y = 0.9955x - 0.1581	1.0000



ROTA METER CALIBRATION RESULT JANUARY 2023

Rotameter ID.	Calibration Date	Regression Result	Coefficient (R ²)
BKK_FS1039	03 Jan 23	$Y = 1.0242x - 4.3007$	0.9986
BKK_FS1040	03 Jan 23	$Y = 1.0035x + 1.0705$	0.9998
BKK_FS1041	03 Jan 23	$Y = 0.9791x + 0.252$	1.0000
BKK_FS1042	03 Jan 23	$Y = 1.0185x - 3.7429$	0.9999
BKK_FS1043	03 Jan 23	$Y = 1.0038x + 2.961$	0.9999
BKK_FS1044	03 Jan 23	$Y = 1.0189x + 0.2969$	1.0000
BKK_FS1163	18 Jan 23	$Y = 1.0127x + 0.6332$	0.9996
BKK_FS1164	18 Jan 23	$Y = 1.2176x + 4.7376$	0.9952
BKK_FS1165	18 Jan 23	$Y = 1.0005x + 47.94$	1.0000
BKK_FS1166	18 Jan 23	$Y = 1.0348x - 35.641$	0.9996
BKK_FS1200	03 Jan 23	$Y = 1.0168x + 0.4034$	0.9997
BKK_FS1201	03 Jan 23	$Y = 0.7655x + 60.985$	0.9986
BKK_FS1202	03 Jan 23	$Y = 0.9593x + 87.615$	0.9958
RYG_FS0197	03 Jan 23	$Y = 1.0305x - 94.649$	0.9991
RYG_FS0198	03 Jan 23	$Y = 1.0103x - 19.254$	0.9999
RYG_FS0199	03 Jan 23	$Y = 0.9897x + 0.996$	0.9983

Review By : Wichan Choonharat
(Mr. Wichan Choonharat)
Enviro Field Services Manager

Approved By : (Mr. Sarayuth Uthranont)
(Mr. Sarayuth Uthranont)
Assistant General Manager

RYG_EN0004



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Dokmai Praveh Bangkok 10250
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Certificate of Calibration

Represent to Certificate of Calibration PTC07/22104

Certificate No.: PTC07/22104 Page: 1 of 3
Equipment: Digital Balance Condition: Normal
Manufacturer: Sartorius Serial No: 33108993
Model: NSE125P-100-DU ID No: RYG_EN0004
Type of Balance: Single Interval

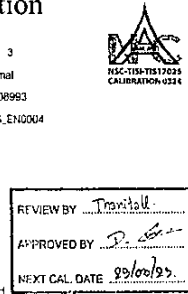
Customer: ALS Laboratory Group (Thailand) Co., Ltd.
616/10 Moo 5 T.Maenamkoo, A.Pluakdaeng,
Rayong 21140, Thailand

Environment Condition: Temperature 23.9 °C ± 0.3 °C
Humidity 58.1 %RH ± 4.4 %RH
Air density 1.17 kg/m³

Calibration Place: ALS Laboratory Group (Thailand) Co., Ltd.
616/10 Moo 5 T.Maenamkoo, A.Pluakdaeng,
Rayong 21140, Thailand

The Method used: In house method, PTC-Wi-07, base on Euramet cg 18
Traceability: This certificate is traceable to the SI units through Thai Calibration Service Co. Ltd
NSC-ONSC Accreditation No. Calibration 0189

Date Received: March 23, 2022
Calibration Date: March 23, 2022
Issued Date: March 25, 2022
Calibration By: Mr. Rungroj Mutakul



(Mr. Khongsak Kabin)
Reviewed By

(Mr. Keatsak Kerdto)
Approved By :
Laboratory Manager

This certificate is issued the units of measurement according to the International System of Units (SI). It provides traceability of measurement up international or national standard or other recognized national standard laboratories.
The measurement uncertainty stated in the expanded uncertainty which is obtained from the standard uncertainty multipliers by the coverage factor (k=2) to give a level of confidence of approximately 95%. It is determined in accordance with the Guide to Expression of Uncertainty in Measurement (GUM). The intent that the results relate only to the item calibrated.
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Certificate No.: PTC07/22104 Page: 2 of 3

Measurement Results:

Without Adjustment :

Function Calibration: Non Adjustment

Eccentric Error Weight to be 1/3, 1/2, or of Maximum capacity

Eccentricity test 50 (g)					
Position (g)					
1	2	3	4	5	
0.00000	0.00004	-0.00001	0.00000	0.00001	
Maximum deviation					0.00004

Repeatability Test Weight to be 1/2 ≤ L ≤ Maximum capacity

Determination of the standard deviation of weighing balance : Repeatability 0.00001 (g)

Nominal test value (g)	Standard Deviation
50	0.000007

Error of indication : from nominal value : Repeatability 0.00001 (g)

Nominal Value (g)	Conventional Mass (g)	Indication (g)	Correction of Balance (g)	Uncertainty (g)	k
0	0.000000	0.00000	0.00000	0.000070	2.05
0.01	0.010001	0.01000	0.00000	0.000022	2.17
0.05	0.050002	0.05000	0.00001	0.000022	2.17
0.1	0.099999	0.09999	0.00001	0.000022	2.17
0.5	0.500001	0.50001	-0.00001	0.000022	2.17
1	1.000004	0.99999	0.00001	0.000022	2.14
2	1.999995	1.99999	0.00001	0.000022	2.14
5	5.000015	4.99999	0.00002	0.000022	2.14
10	10.000004	10.00000	0.00000	0.000024	2.10
20	20.000029	20.00000	0.00003	0.000032	2.00
50	50.000043	49.99999	0.00005	0.000069	2.00

Note Weight of adjust (g)



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Represent to Certificate of Calibration PTC07/22104

Certificate No.: PTC07/22104 Page: 3 of 3

Measurement Results:

Without Adjustment :

Function Calibration: Non Adjustment

Eccentric Error Weight to be 1/3, 1/2, or of Maximum capacity

Eccentricity test 50 (g)					
Position (g)					
1	2	3	4	5	
0.0000	0.00006	0.00000	0.00000	0.00000	
Maximum deviation					0.0000

Repeatability Test Weight to be 1/2 ≤ L ≤ Maximum capacity

Determination of the standard deviation of weighing balance : Repeatability 0.0001 (g)

Nominal test value (g)	Standard Deviation
100	0.00000

Error of indication : from nominal value : Repeatability 0.0001 (g)

Nominal Value (g)	Conventional Mass (g)	Indication (g)	Correction of Balance (g)	Uncertainty (g)	k
55	55.00000	55.00000	0.00001	0.00013	2.00
70	70.00007	70.00000	0.00001	0.00013	2.00
75	75.00009	75.00000	0.00001	0.00014	2.00
80	80.00008	80.00000	0.00001	0.00014	2.00
85	85.00009	85.00000	0.00001	0.00015	2.00
90	90.00010	90.00000	0.00001	0.00015	2.00
95	95.00012	95.00000	0.00001	0.00016	2.00
100	100.00004	100.00000	0.00000	0.00014	2.00
110	110.00004	110.00000	0.00000	0.00015	2.00
120	120.00007	120.00000	0.00001	0.00016	2.00

Note Weight of adjust (g)

The End of Certificate



ROTA METER CALIBRATION RESULT APRIL 2023

Rotameter ID.	Calibration Date	Regression Result	Coefficient (R ²)
BKK_FS0577	03 Apr 23	$Y = 1.0246x - 1.1644$	0.9982
BKK_FS0579	03 Apr 23	$Y = 1.0313x - 0.8177$	0.9999
BKK_FS0583	03 Apr 23	$Y = 1.0023x - 0.0969$	0.9995
BKK_FS0584	03 Apr 23	$Y = 1.0025x + 2.25$	0.9999
BKK_FS0585	03 Apr 23	$Y = 0.9881x + 5.4452$	0.9993
BKK_FS0586	03 Apr 23	$Y = 0.9915x + 4.7452$	1.0000
BKK_FS0588	03 Apr 23	$Y = 1.0067x + 0.6738$	0.9998
BKK_FS0589	03 Apr 23	$Y = 0.9823x + 0.3286$	0.9996
BKK_FS0590	03 Apr 23	$Y = 0.9951x + 2.8786$	0.9999
BKK_FS0591	03 Apr 23	$Y = 0.9985x + 4.579$	1.0000
BKK_FS0592	03 Apr 23	$Y = 0.9975x + 3.6419$	1.0000
BKK_FS0593	03 Apr 23	$Y = 0.9968x + 16.005$	1.0000
BKK_FS0595	03 Apr 23	$Y = 0.9957x + 5.1368$	0.9999
BKK_FS0596	03 Apr 23	$Y = 1.017x - 14.044$	0.9967
BKK_FS0597	03 Apr 23	$Y = 1.0063x - 10.787$	1.0000
BKK_FS1004	01 Apr 23	$Y = 0.9943x + 7.1533$	0.9996
BKK_FS1005	01 Apr 23	$Y = 1.0035x + 3.1167$	0.9998
BKK_FS1006	01 Apr 23	$Y = 1.0273x - 0.4922$	0.9998
BKK_FS1007	03 Apr 23	$Y = 1.0452x - 1.5374$	0.9998
BKK_FS1009	03 Apr 23	$Y = 1.0351x - 1.3224$	0.9999
BKK_FS1010	03 Apr 23	$Y = 1.0108x - 0.0888$	1.0000
BKK_FS1011	03 Apr 23	$Y = 1.2946x - 6.6325$	0.9861
BKK_FS1012	03 Apr 23	$Y = 1.0976x - 27.969$	0.9996
BKK_FS1013	03 Apr 23	$Y = 1.0821x - 200.52$	0.9998
BKK_FS1017	03 Apr 23	$Y = 1.0333x + 7.0584$	0.9694
BKK_FS1018	03 Apr 23	$Y = 0.9551x - 18.832$	0.9997
BKK_FS1019	03 Apr 23	$Y = 1.0649x - 156.67$	0.9976
BKK_FS1020	03 Apr 23	$Y = 0.9511x + 0.0364$	0.9994
BKK_FS1021	03 Apr 23	$Y = 0.979x + 8.2333$	0.9992
BKK_FS1022	03 Apr 23	$Y = 0.9588x - 2.4905$	0.9997
BKK_FS1023	03 Apr 23	$Y = 1.0245x - 1.3878$	0.9996
BKK_FS1024	03 Apr 23	$Y = 0.7414x + 47.3$	0.9923
BKK_FS1025	03 Apr 23	$Y = 0.9997x + 5.4438$	1.0000
BKK_FS1026	03 Apr 23	$Y = 1.0172x - 0.9531$	1.0000
BKK_FS1027	03 Apr 23	$Y = 0.7331x + 49.317$	0.9921
BKK_FS1028	03 Apr 23	$Y = 0.9995x + 0.2124$	1.0000
BKK_FS1039	01 Apr 23	$Y = 1.025x - 3.795$	0.9994
BKK_FS1040	01 Apr 23	$Y = 1.0035x - 2.4295$	0.9998



ROTA METER CALIBRATION RESULT APRIL 2023

Rotameter ID.	Calibration Date	Regression Result	Coefficient (R ²)
BKK_FS1041	01 Apr 23	$Y = 1.0329x - 0.6769$	0.9999
BKK_FS1042	01 Apr 23	$Y = 1.0144x + 1.94$	0.9997
BKK_FS1043	01 Apr 23	$Y = 1.0038x - 1.539$	0.9999
BKK_FS1044	01 Apr 23	$Y = 1.0273x - 1.6922$	0.9998
BKK_FS1164	03 Apr 23	$Y = 0.9913x + 0.8537$	0.9997
BKK_FS1165	03 Apr 23	$Y = 1.0005x + 2.0857$	1.0000
BKK_FS1166	03 Apr 23	$Y = 1.0842x - 169.6$	0.9987
BKK_FS1200	03 Apr 23	$Y = 0.9452x + 5.2959$	0.9981
BKK_FS1201	03 Apr 23	$Y = 1.0045x - 1.8766$	1.0000
BKK_FS1202	03 Apr 23	$Y = 0.9768x + 26.572$	0.9973
RYG_FS0197	01 Apr 23	$Y = 1.0042x + 15.442$	0.9999
RYG_FS0198	01 Apr 23	$Y = 1.0081x - 13.26$	0.9999
RYG_FS0199	01 Apr 23	$Y = 1.0255x - 1.2364$	0.9999

Review By:

(Mr. Wichan Choonharat)

Enviro Field Services Manager

Approved By:

(Mr. Sarayuth Jitranont)

Assistant General Manager

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Agilent CrossLab Compliance Services

Certificate of System Qualification

GC-00

System ID: GC-6
Organization Name: ALS Laboratory Group (Thailand) Co., Ltd.
Organization Location: 104 Phatthanakan 40, Phatthanakan Rd., Suan Luang, Bangkok 10250
Date: October 21, 2021 10:05:40 AM
EQR Name: Agilent/Recommended
EQR Revision: GC-02.50
Overall Qualification Status: Pass

REVIEW BY: Suchada T.
APPROVED BY: Sarayuth J.
CAL DATE: 21 Apr 2023

System Inspection and Basic Safety and Operation

Name: 7890
Setpoint Status: Pass

Overall System Inspection and Basic Safety and Operation Test Status
Pass

Inlet Pressure Decay

Name: 7890
Front SSL
Setpoint Status: Pass
Pressure: 25.0 psi
Pressure Change: 0.0 psi / 5 minutes
Agilent Recommended: ≥ -2.0 and ≤ 0.5

Overall Inlet Pressure Decay Test Status
Pass

Inlet Pressure Accuracy

Name: 7890
Front SSL

Date: October 21, 2021 10:05:40 AM
System ID: GC-6

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Agilent CrossLab Compliance Services

Setpoint Status: Pass
Setpoint: 25.0 psi Actual: 24.9 psi
Accuracy: 0.1 psi
Agilent Recommended: ≤ 1.2

Overall Inlet Pressure Accuracy Test Status
Pass

Inlet Pressure Decay

Name: 7890
Back SSL
Setpoint Status: Pass
Pressure: 25.0 psi
Pressure Change: 0.0 psi / 5 minutes
Agilent Recommended: ≥ -2.0 and ≤ 0.5

Overall Inlet Pressure Decay Test Status
Pass

Inlet Pressure Accuracy

Name: 7890
Back SSL
Setpoint Status: Pass
Setpoint: 25.0 psi Actual: 24.9 psi
Accuracy: 0.1 psi
Agilent Recommended: ≤ 1.2

Overall Inlet Pressure Accuracy Test Status
Pass

Detector Flow Accuracy

Date: October 21, 2021 10:05:40 AM
System ID: GC-6

Name: 7890
Front FID

Setpoint Status: Pass

Flow Type: Fuel

Setpoint: 30.0 mL/min Measured Flow: 30.5 mL/min

Accuracy: 0.5 mL/min

Agilent Recommended: ≤ 10.0 % setpoint (3.0 mL/min)

Limit is percentage of setpoint or 0.5 mL/minute, whichever is largest.

Setpoint Status: Pass

Flow Type: Oxidizer

Setpoint: 400.0 mL/min Measured Flow: 394.0 mL/min

Accuracy: 6.0 mL/min

Agilent Recommended: ≤ 10.0 % setpoint (40.0 mL/min)

Limit is percentage of setpoint or 0.5 mL/minute, whichever is largest.

Setpoint Status: Pass

Flow Type: Makeup

Setpoint: 25.0 mL/min Measured Flow: 24.2 mL/min

Accuracy: 0.8 mL/min

Agilent Recommended: ≤ 10.0 % setpoint (2.5 mL/min)

Limit is percentage of setpoint or 0.5 mL/minute, whichever is largest.

Overall Detector Flow Accuracy Test Status

Pass

Detector Flow Accuracy

Name: 7890
Back FID

Date: October 21, 2021 10:05:40 AM
System ID: GC-6

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Setpoint Status: Pass

Flow Type: Fuel

Setpoint: 30.0 mL/min Measured Flow: 29.1 mL/min

Accuracy: 0.9 mL/min

Agilent Recommended: ≤ 10.0 % setpoint (3.0 mL/min)

Limit is percentage of setpoint or 0.5 mL/minute, whichever is largest.

Setpoint Status: Pass

Flow Type: Oxidizer

Setpoint: 400.0 mL/min Measured Flow: 397.3 mL/min

Accuracy: 2.7 mL/min

Agilent Recommended: ≤ 10.0 % setpoint (40.0 mL/min)

Limit is percentage of setpoint or 0.5 mL/minute, whichever is largest.

Setpoint Status: Pass

Flow Type: Makeup

Setpoint: 25.0 mL/min Measured Flow: 24.4 mL/min

Accuracy: 0.6 mL/min

Agilent Recommended: ≤ 10.0 % setpoint (2.5 mL/min)

Limit is percentage of setpoint or 0.5 mL/minute, whichever is largest.

Overall Detector Flow Accuracy Test Status

Pass

GC Oven Temperature Accuracy

Name: 7890

Date: October 21, 2021 10:05:40 AM
System ID: GC-6

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Setpoint Status: Pass

Zone: Oven

Setpoint/Actual: 230.0 / 231.5 °C

Accuracy: 1.5 °C

Agilent Recommended: ≥ -1.0 % setpoint in K (-5.0 °C)

≤ 1.0 % setpoint in K (5.0 °C)

Setpoint Status: Pass

Zone: Oven

Setpoint/Actual: 100.0 / 100.6 °C

Accuracy: 0.6 °C

Agilent Recommended: ≥ -1.0 % setpoint in K (-3.7 °C)

≤ 1.0 % setpoint in K (3.7 °C)

Overall GC Oven Temperature Accuracy Test Status

Pass

GC Oven Temperature Stability

Name: 7890

Setpoint Status: Pass

Setpoint/Average: 100.0 / 100.4667 °C

Temperature: 100.0 °C

Stability: 0.1 °C

Agilent Recommended: ≤ 0.5 °C

Overall GC Oven Temperature Stability Test Status

Pass

Scouting Run

Tested Combination: Front SSL / Front FID

Name: 7893A

Date: October 21, 2021 10:05:40 AM
System ID: GC-6

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Setpoint Status: Completed

Injection Volume on Column: 1.0 µL

Overall Scouting Run Status: Completed

Noise and Drift

Tested Combination: Front SSL / Front FID

Name: 7890

Setpoint Status: Pass

Base Signal: 12.7 pA

ASTM Noise: 0.06 pA

Drift: 0.10 pA/hr

Agilent Recommended: ≤ 0.10 pA

Status: Pass

Overall Noise and Drift Test Status

Pass

Injection Precision

Tested Combination: Front SSL / Front FID

Name: 7893A

Setpoint Status: Pass

Injection Volume on Column: 1.0 µL

Area RSD: 0.42 %

Retention Time RSD: 0.16 %

Agilent Recommended: ≤ 0.00 %

Overall Injection Precision Test Status

Pass

Signal to Noise

Date: October 21, 2021 10:05:40 AM
System ID: GC-6

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Tested Combination1 Front SSL / Front FID

Name: Injection Tower
7890

Setpoint Status: Pass

Signal to Noise: 1174861

Agilent Recommended: >= 300000

Overall Signal to Noise Test Status

Pass

Scouting Run

Tested Combination2 Back SSL / Back FID

Name: Injection Tower
7893A

Setpoint Status: Completed

Injection Volume on Column: 1.0 µL

Overall Scouting Run Status

Completed

Noise and Drift

Tested Combination2 Back SSL / Back FID

Name: 7890

Setpoint Status: Pass

Base Signal: 10.4 pA

ASTM Noise

pA

0.05

Agilent Recommended: <= 0.10

Status: Pass

Drift

pA/hr

0.00

Agilent Recommended: <= 2.50

Status: Pass

Date: October 21, 2021 10:05:40 AM
System ID: GC-6

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Overall Noise and Drift Test Status

Pass

Injection Precision

Tested Combination2 Back SSL / Back FID

Name: 7893A

Setpoint Status: Pass

Injection Volume on Column: 1.0 µL

Area RSD: 1.10 % Retention Time RSD: 0.12 %

Agilent Recommended: <= 3.00 <= 1.00

Overall Injection Precision Test Status

Pass

Signal to Noise

Tested Combination2 Back SSL / Back FID

Name: Injection Tower
7890

Setpoint Status: Pass

Signal to Noise: 805466

Agilent Recommended: >= 300000

Overall Signal to Noise Test Status

Pass

Date: October 21, 2021 10:05:40 AM
System ID: GC-6

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Instrument Details

Purpose

This section describes the as found system configuration.

Details

System

System ID: GC-6
Manufacturer: Agilent Technologies
Name: 7890
Flow Data Input: Manual Data
Temperature Data Input: Manual Data or Other Data Logging

Tested Combination1

Injection Technique: Injection Tower
Sampler Identifier: Sampler 2
Inlet: Front
Detector: Front
LTM Included?: No

Tested Combination2

Injection Technique: Injection Tower
Sampler Identifier: Sampler 3
Inlet: Back
Detector: Back
LTM Included?: No

Sampler 1

Manufacturer: Agilent Technologies
Type: Tray
Name: 7893A
Model Number: G4514A
Serial Number: CN15380030
Firmware Revision: A.11.01
Vial Heater: Not installedDate: October 21, 2021 10:05:40 AM
System ID: GC-6

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Sampler 2

Manufacturer: Agilent Technologies
Type: Injection Tower
Name: 7893A
Model Number: G4513A
Serial Number: CN10340103
Firmware Revision: A.10.09
Usage: Sample Injection
Location: Front
Syringe Volume (µL): 10

Sampler 3

Manufacturer: Agilent Technologies
Type: Injection Tower
Name: 7893A
Model Number: G4513A
Serial Number: CN16280128
Firmware Revision: A.10.09
Usage: Sample Injection
Location: Back
Syringe Volume (µL): 10

Mainframe 1

Manufacturer: Agilent Technologies
Name: 7800
Model Number: G3440A
Serial Number: CN11451066
Firmware Revision: Version 4.27
Component ID/Asset No: GC-6
Oven Type: StandardDate: October 21, 2021 10:05:40 AM
System ID: GC-6

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User Name: sunya.thongkham

System ID: GC-6

Host Name: ASBNCW7015

Print Date: October 21, 2021 10:05:40 AM

GC GC ALS CH1141196 Transaction log:

Time	Transaction State	Activity Performed	Optional Information
October 20, 2021 1:20:20 PM	Start	Execution	Detector Flow Accuracy - Front None FID - Type: Onliner - S: 400.0 mL/min - L: <= 10.0% setpoint
October 20, 2021 1:23:27 PM	Auto	Data	Detector Flow Accuracy - Front Manual Data Entry FID - Type: Onliner - S: 400.0 mL/min - L: <= 10.0% setpoint
October 20, 2021 1:25:26 PM	End	Execution	Detector Flow Accuracy - Front Run Count: 1 FID - Type: Onliner - S: 400.0 mL/min - L: <= 10.0% setpoint
October 20, 2021 1:25:31 PM	Start	Execution	Detector Flow Accuracy - Front None FID - Type: Makeup - S: 25.0 mL/min - L: <= 10.0% setpoint
October 20, 2021 1:27:40 PM	Auto	Data	Detector Flow Accuracy - Front Manual Data Entry FID - Type: Makeup - S: 25.0 mL/min - L: <= 10.0% setpoint
October 20, 2021 1:27:42 PM	End	Execution	Detector Flow Accuracy - Front Run Count: 1 FID - Type: Makeup - S: 25.0 mL/min - L: <= 10.0% setpoint
October 20, 2021 1:27:48 PM	Start	Execution	Detector Flow Accuracy - Back None FID - Type: Fuel - S: 30.0 mL/min - L: <= 10.0% setpoint
October 20, 2021 1:32:10 PM	Auto	Data	Detector Flow Accuracy - Back Manual Data Entry FID - Type: Fuel - S: 30.0 mL/min - L: <= 10.0% setpoint
October 20, 2021 1:32:12 PM	End	Execution	Detector Flow Accuracy - Back Run Count: 1 FID - Type: Fuel - S: 30.0 mL/min - L: <= 10.0% setpoint
October 20, 2021 1:32:14 PM	Start	Execution	Detector Flow Accuracy - Back None FID - Type: Onliner - S: 400.0 mL/min - L: <= 10.0% setpoint
October 20, 2021 1:34:13 PM	Auto	Data	Detector Flow Accuracy - Back Manual Data Entry FID - Type: Onliner - S: 400.0 mL/min - L: <= 10.0% setpoint

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Date: October 21, 2021 10:05:40 AM
System ID: GC-6

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User Name: sunya.thongkham

Host Name: ASBNCW7015

System ID: GC-6

Print Date: October 21, 2021 10:05:40 AM

GC GC ALS CH1141196 Transaction log:

Time	Transaction State	Activity Performed	Optional Information
October 20, 2021 1:34:48 PM	End	Execution	Detector Flow Accuracy - Back Run Count: 1 FID - Type: Onliner - S: 400.0 mL/min - L: <= 10.0% setpoint
October 20, 2021 1:34:48 PM	Start	Execution	Detector Flow Accuracy - Back None FID - Type: Makeup - S: 25.0 mL/min - L: <= 10.0% setpoint
October 20, 2021 1:36:33 PM	Auto	Data	Detector Flow Accuracy - Back Manual Data Entry FID - Type: Makeup - S: 25.0 mL/min - L: <= 10.0% setpoint
October 20, 2021 1:36:38 PM	End	Execution	Detector Flow Accuracy - Back Run Count: 1 FID - Type: Makeup - S: 25.0 mL/min - L: <= 10.0% setpoint
October 20, 2021 1:36:38 PM	Start	Execution	GC Oven Temperature Accuracy - 7800 - Temperature Oven - S: 230.0°C - L: >= 1.0 AND >= 1.0 % setpoint in K
October 20, 2021 2:04:31 PM	Auto	Data	GC Oven Temperature Accuracy - 7800 - Temperature Oven - S: 230.0°C - L: >= 1.0 AND >= 1.0 % setpoint in K
October 20, 2021 2:04:32 PM	End	Execution	GC Oven Temperature Accuracy - 7800 - Temperature Oven - S: 230.0°C - L: >= 1.0 AND >= 1.0 % setpoint in K
October 20, 2021 2:04:34 PM	Start	Execution	GC Oven Temperature Accuracy - 7800 - Temperature Oven - S: 230.0°C - L: >= 1.0 AND >= 1.0 % setpoint in K
October 20, 2021 2:04:34 PM	Auto	Data	GC Oven Temperature Accuracy - 7800 - Temperature Oven - S: 230.0°C - L: >= 1.0 AND >= 1.0 % setpoint in K

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Date: October 21, 2021 10:05:40 AM
System ID: GC-6

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User Name: sunya.thongkham
Host Name: ASBNCW7015

System ID: GC-6
Print Date: October 21, 2021 10:05:40 AM

GC GC ALS CH1141196 Transaction log:

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
October 20, 2021 2:10:49 PM	End	Execution	GC Oven Temperature Accuracy - 7800 - Temperature Oven - S: 100.0°C - L: >= 1.0 AND >= 1.0 % setpoint in K	Run Count: 1
October 20, 2021 2:10:51 PM	Start	Execution	GC Oven Temperature Stability - 7800 - Temperature Oven - S: 100.0°C - L: >= 0.5°C	None
October 20, 2021 2:31:30 PM	Auto	Data	GC Oven Temperature Stability - 7800 - Temperature Oven - S: 100.0°C - L: >= 0.5°C	Manual Data Entry
October 20, 2021 2:31:41 PM	End	Execution	GC Oven Temperature Stability - 7800 - Temperature Oven - S: 100.0°C - L: >= 0.5°C	Run Count: 1
October 20, 2021 2:31:44 PM	Start	Execution	GC Security Run - Injection Tower, Front SSI, Front FID - Part of System Preparation - No limits associated	None
October 20, 2021 2:43:06 PM	Auto	AcqClosed	Session	None
October 21, 2021 9:18:58 AM	Auto	AcqRestarted	Session	None
October 21, 2021 9:19:02 AM	Auto	SessionResumed	Session	None
October 21, 2021 9:19:06 AM	Start	Qualification	Session	OK
October 21, 2021 9:19:06 AM	Start	Execution	GC Security Run - Injection Tower, Front SSI, Front FID - Part of System Preparation - No limits associated	None
October 21, 2021 9:19:41 AM	Auto	AcqClosed	Session	None

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Date: October 21, 2021 10:05:40 AM
System ID: GC-6

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User Name: sunya.thongkham

Host Name: ASBNCW7015

System ID: GC-6

Print Date: October 21, 2021 10:05:40 AM

GC GC ALS CH1141196 Transaction log:

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
October 21, 2021 9:20:08 AM	Auto	AcqRestarted	Session	Name
October 21, 2021 9:20:09 AM	Auto	SessionResumed	Session	Name
October 21, 2021 9:20:13 AM	Start	Qualification	Session	OQ
October 21, 2021 9:20:13 AM	Start	Execution	GC Security Run - Injection Tower, Front SSI, Front FID - Part of System Preparation - No limits associated	Name
October 21, 2021 9:29:45 AM	Auto	Data	GC Security Run - Injection Tower, Front SSI, Front FID - Part of System Preparation - No limits associated	Data File Path: C:\chem32\DATA\AQGPV20\210QGPV2021_F_2021-10-20\15-48-01\GCOUT_7801.D\15-48
October 21, 2021 9:30:06 AM	End	Execution	GC Security Run - Injection Tower, Front SSI, Front FID - Part of System Preparation - No limits associated	Run Count: 1
October 21, 2021 9:30:08 AM	Start	Execution	House and Drain - Front FID - Detector FID - L (House) >= 0.10 µA - L (Drain) >= 2.50 pA/µA	Name
October 21, 2021 9:30:41 AM	Auto	Data	House and Drain - Front FID - Detector FID - L (House) >= 0.10 µA - L (Drain) >= 2.50 pA/µA	Data File Path: C:\chem32\DATA\AQGPV20\210QGPV2021_F_2021-10-20\15-48-01\GCOUT_7801.D\15-48
October 21, 2021 9:51:10 AM	End	Execution	House and Drain - Front FID - Detector FID - L (House) >= 0.10 µA - L (Drain) >= 2.50 pA/µA	Run Count: 1

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Date: October 21, 2021 10:05:40 AM
System ID: GC-6

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User Name: surya.thangaswamy			System ID: GC-6	
Host Name: ABBK007015			Print Date: October 21, 2021 10:05:48 AM	
DG GC ALB CN11461066 Transaction log:				
Time	Transaction State	Activity Performed	Optional Information	
October 21, 2021 9:31:42 AM	Start	Injection Precision - Injection	None	
Tower: Front SSI, Front FID - GC - L (Area) == 3.00% - L (Ret. Time) == 1.00%				
October 21, 2021 9:32:55 AM	Audit	Data	Data New Path GC\\NEW\\P001_F 2021-10-20 16:55:16\\NEW\\P001_F\\001.D F001.AIR	
October 21, 2021 9:32:55 AM	Audit	Data	Data New Path GC\\NEW\\P001_F 2021-10-20 16:55:16\\NEW\\P001_F\\001.D F001.AIR	
October 21, 2021 9:32:55 AM	Audit	Data	Data New Path GC\\NEW\\P001_F 2021-10-20 16:55:16\\NEW\\P001_F\\001.D F001.AIR	
October 21, 2021 9:32:55 AM	Audit	Data	Data New Path GC\\NEW\\P001_F 2021-10-20 16:55:16\\NEW\\P001_F\\001.D F001.AIR	
October 21, 2021 9:32:55 AM	Audit	Data	Data New Path GC\\NEW\\P001_F 2021-10-20 16:55:16\\NEW\\P001_F\\001.D F001.AIR	
October 21, 2021 9:32:55 AM	Audit	Data	Data New Path GC\\NEW\\P001_F 2021-10-20 16:55:16\\NEW\\P001_F\\001.D F001.AIR	
October 21, 2021 9:32:55 AM	Audit	Data	Data New Path GC\\NEW\\P001_F 2021-10-20 16:55:16\\NEW\\P001_F\\001.D F001.AIR	
October 21, 2021 9:32:55 AM	Audit	Data	Data New Path GC\\NEW\\P001_F 2021-10-20 16:55:16\\NEW\\P001_F\\001.D F001.AIR	
October 21, 2021 9:32:55 AM	Audit	Data	Data New Path GC\\NEW\\P001_F 2021-10-20 16:55:16\\NEW\\P001_F\\001.D F001.AIR	
October 21, 2021 9:32:55 AM	Audit	Data	Data New Path GC\\NEW\\P001_F 2021-10-20 16:55:16\\NEW\\P001_F\\001.D F001.AIR	
October 21, 2021 9:32:55 AM	Audit	Data	Data New Path GC\\NEW\\P001_F 2021-10-20 16:55:16\\NEW\\P001_F\\001.D F001.AIR	
October 21, 2021 9:32:55 AM	Audit	Data	Data New Path GC\\NEW\\P001_F 2021-10-20 16:55:16\\NEW\\P001_F\\001.D F001.AIR	
October 21, 2021 9:32:55 AM	Audit	Data	Data New Path GC\\NEW\\P001_F 2021-10-20 16:55:16\\NEW\\P001_F\\001.D F001.AIR	
October 21, 2021 9:32:55 AM	Audit	Data	Data New Path GC\\NEW\\P001_F 2021-10-20 16:55:16\\NEW\\P001_F\\001.D F001.AIR	
October 21, 2021 9:32:55 AM	Audit	Data	Data New Path GC\\NEW\\P001_F 2021-10-20 16:55:16\\NEW\\P001_F\\001.D F001.AIR	
October 21, 2021 9:32:55 AM	Audit	Data	Data New Path GC\\NEW\\P001_F 2021-10-20 16:55:16\\NEW\\P001_F\\001.D F001.AIR	
October 21, 2021 9:32:55 AM	Audit	Data	Data New Path GC\\NEW\\P001_F 2021-10-20 16:55:16\\NEW\\P001_F\\001.D F001.AIR	
October 21, 2021 9:32:55 AM	Audit	Data	Data New Path GC\\NEW\\P001_F 2021-10-20 16:55:16\\NEW\\P001_F\\001.D F001.AIR	
October 21, 2021 9:32:55 AM	Audit	Data	Data New Path GC\\NEW\\P001_F 2021-10-20 16:55:16\\NEW\\P001_F\\001.D F001.AIR	
October 21, 2021 9:32:55 AM	Audit	Data	Data New Path GC\\NEW\\P001_F 2021-10-20 16:55:16\\NEW\\P001_F\\001.D F001.AIR	
October 21, 2021 9:32:55 AM	Audit	Data	Data New Path GC\\NEW\\P001_F 2021-10-20 16:55:16\\NEW\\P001_F\\001.D F001.AIR	
October 21, 2021 9:32:55 AM	Audit	Data	Data New Path GC\\NEW\\P001_F 2021-10-20 16:55:16\\NEW\\P001_F\\001.D F001.AIR	
October 21, 2021 9:32:55 AM	Audit	Data	Data New Path GC\\NEW\\P001_F 2021-10-20 16:55:16\\NEW\\P001_F\\001.D F001.AIR	
October 21, 2021 9:32:55 AM	Audit	Data	Data New Path GC\\NEW\\P001_F 2021-10-20 16:55:16\\NEW\\P001_F\\001.D F001.AIR	
October 21, 2021 9:32:55 AM	Audit	Data	Data New Path GC\\NEW\\P001_F 2021-10-20 16:55:16\\NEW\\P001_F\\001.D F001.AIR	
October 21, 2021 9:32:55 AM	Audit	Data	Data New Path GC\\NEW\\P001_F 2021-10-20 16:55:16\\NEW\\P001_F\\001.D F001.AIR	
October 21, 2021 9:32:55 AM	Audit	Data	Data New Path GC\\NEW\\P001_F 2021-10-20 16:55:16\\NEW\\P001_F\\001.D F001.AIR	
October 21, 2021 9:32:55 AM	Audit	Data	Data New Path GC\\NEW\\P001_F 2021-10-20 16:55:16\\NEW\\P001_F\\001.D F001.AIR	
October 21, 2021 9:32:55 AM	Audit	Data	Data New Path GC\\NEW\\P001_F 2021-10-20 16:55:16\\NEW\\P001_F\\001.D F001.AIR	
October 21, 2021 9:32:55 AM	Audit	Data	Data New Path GC\\NEW\\P001_F 2021-10-20 16:55:16\\NEW\\P001_F\\001.D F001.AIR	
October 21, 2021 9:32:55 AM	Audit	Data	Data New Path GC\\NEW\\P001_F 2021-10-20 16:55:16\\NEW\\P001_F\\001.D F001.AIR	
October 21, 2021 9:32:55 AM	Audit	Data	Data New Path GC\\NEW\\P001_F 2021-10-20 16:55:16\\NEW\\P001_F\\001.D F001.AIR	
October 21, 2021 9:32:55 AM	Audit	Data	Data New Path GC\\NEW\\P001_F 2021-10-20 16:55:16\\NEW\\P001_F\\001.D F001.AIR	
October 21, 2021 9:32:55 AM	Audit	Data	Data New Path GC\\NEW\\P001_F 2021-10-20 16:55:16\\NEW\\P001_F\\001.D F001.AIR	
October 21, 2021 9:32:55 AM	Audit	Data	Data New Path GC\\NEW\\P001_F 2021-10-20 16:55:16\\NEW\\P001_F\\001.D F001.AIR	
October 21, 2021 9:32:55 AM	Audit	Data	Data New Path GC\\NEW\\P001_F 2021-10-20 16:55:16\\NEW\\P001_F\\001.D F001.AIR	
October 21, 2021 9:32:55 AM	Audit	Data	Data New Path GC\\NEW\\P001_F 2021-10-20 16:55:16\\NEW\\P001_F\\001.D F001.AIR	
October 21, 2021 9:32:55 AM	Audit	Data	Data New Path GC\\NEW\\P001_F 2021-10-20 16:55:16\\NEW\\P001_F\\001.D F001.AIR	
October 21, 2021 9:32:55 AM	Audit	Data	Data New Path GC\\NEW\\P001_F 2021-10-20 16:55:16\\NEW\\P001_F\\001.D F001.AIR	
October 21, 2021 9:32:55 AM	Audit	Data	Data New Path GC\\NEW\\P001_F 2021-10-20 16:55:16\\NEW\\P001_F\\001.D F001.AIR	
October 21, 2021 9:32:55 AM	Audit	Data	Data New Path GC\\NEW\\P001_F 2021-10-20 16:55:16\\NEW\\P001_F\\001.D F001.AIR	
October 21, 2021 9:32:55 AM	Audit	Data	Data New Path GC\\NEW\\P001_F 2021-10-20 16:55:16\\NEW\\P001_F\\001.D F001.AIR	
October 21, 2021 9:32:55 AM	Audit	Data	Data New Path GC\\NEW\\P001_F 2021-10-20 16:55:16\\NEW\\P001_F\\001.D F001.AIR	
October 21, 2021 9:32:55 AM	Audit	Data	Data New Path GC\\NEW\\P001_F 2021-10-20 16:55:16\\NEW\\P001_F\\001.D F001.AIR	
October 21, 2021 9:32:55 AM	Audit	Data	Data New Path GC\\NEW\\P001_F 2021-10-20 16:55:16\\NEW\\P001_F\\001.D F001.AIR	
October 21, 2021 9:32:55 AM	Audit	Data	Data New Path GC\\NEW\\P001_F 2021-10-20 16:55:16\\NEW\\P001_F\\001.D F001.AIR	
October 21, 2021 9:32:55 AM	Audit	Data	Data New Path GC\\NEW\\P001_F 2021-10-20 16:55:16\\NEW\\P001_F\\001.D F001.AIR	
October 21, 2021 9:32:55 AM	Audit	Data	Data New Path GC\\NEW\\P001_F 2021-10-20 16:55:16\\NEW\\P001_F\\001.D F001.AIR	
October 21, 2021 9:32:55 AM	Audit	Data	Data New Path GC\\NEW\\P001_F 2021-10-20 16:55:16\\NEW\\P001_F\\001.D F001.AIR	
October 21, 2021 9:32:55 AM	Audit	Data	Data New Path GC\\NEW\\P001_F 2021-10-20 16:55:16\\NEW\\P001_F\\001.D F001.AIR	
October 21, 2021 9:32:55 AM	Audit	Data	Data New Path GC\\NEW\\P001_F 2021-10-20 16:55:16\\NEW\\P001_F\\001.D F001.AIR	
October 21, 2021 9:32:55 AM	Audit	Data	Data New Path GC\\NEW\\P001_F 2021-10-20 16:55:16\\NEW\\P001_F\\001.D F001.AIR	
October 21, 2021 9:32:55 AM	Audit	Data	Data New Path GC\\NEW\\P001_F 2021-10-20 16:55:16\\NEW\\P001_F\\001.D F001.AIR	
October 21, 2021 9:32:55 AM	Audit	Data	Data New Path GC\\NEW\\P001_F 2021-10-20 16:55:16\\NEW\\P001_F\\001.D F001.AIR	
October 21, 2021 9:32:55 AM	Audit	Data	Data New Path GC\\NEW\\P001_F 2021-10-20 16:55:16\\NEW\\P001_F\\001.D F001.AIR	
October 21, 2021 9:32:55 AM	Audit	Data	Data New Path GC\\NEW\\P001_F 2021-10-20 16:55:16\\NEW\\P001_F\\001.D F001.AIR	
October 21, 2021 9:32:55 AM	Audit	Data	Data New Path GC\\NEW\\P001_F 2021-10-20 16:55:16\\NEW\\P001_F\\001.D F001.AIR	
October 21, 2021 9:32:55 AM	Audit	Data	Data New Path GC\\NEW\\P001_F 2021-10-20 16:55:16\\NEW\\P001_F\\001.D F001.AIR	
October 21, 2021 9:32:55 AM	Audit	Data	Data New Path GC\\NEW\\P001_F 2021-10-20 16:55:16\\NEW\\P001_F\\001.D F001.AIR	
October 21, 2021 9:32:55 AM	Audit	Data	Data New Path GC\\NEW\\P001_F 2021-10-20 16:55:16\\NEW\\P001_F\\001.D F001.AIR	
October 21, 2021 9:32:55 AM	Audit	Data	Data New Path GC\\NEW\\P001_F 2021-10-20 16:55:16\\NEW\\P001_F\\001.D F001.AIR	
October 21, 2021 9:32:55 AM	Audit	Data	Data New Path GC\\NEW\\P001_F 2021-10-20 16:55:16\\NEW\\P001_F\\001.D F001.AIR	
October 21, 2021 9:32:55 AM	Audit	Data	Data New Path GC\\NEW\\P001_F 2021-10-20 16:55:16\\NEW\\P001_F\\001.D F001.AIR	
October 21, 2021 9:32:55 AM	Audit	Data	Data New Path GC\\NEW\\P001_F 2021-10-20 16:55:16\\NEW\\P001_F\\001.D F001.AIR	
October 21, 2021 9:32:55 AM	Audit	Data	Data New Path GC\\NEW\\P001_F 2021-10-20 16:55:16\\NEW\\P001_F\\001.D F001.AIR	
October 21, 2021 9:32:55 AM	Audit	Data	Data New Path GC\\NEW\\P001_F 2021-10-20 16:55:16\\NEW\\P001_F\\001.D F001.AIR	
October 21, 2021 9:32:55 AM	Audit	Data	Data New Path GC\\NEW\\P001_F 2021-10-20 16:55:16\\NEW\\P001_F\\001.D F001.AIR	
October 21, 2021 9:32:55 AM	Audit	Data	Data New Path GC\\NEW\\P001_F 2021-10-20 16:55:16\\NEW\\P001_F\\001.D F001.AIR	
October 21, 2021 9:32:55 AM	Audit	Data	Data New Path GC\\NEW\\P001_F 2021-10-20 16:55:16\\NEW\\P001_F\\001.D F001.AIR	
October 21, 2021 9:32:55 AM	Audit	Data	Data New Path GC\\NEW\\P001_F 2021-10-20 16:55:16\\NEW\\P001_F\\001.D F001.AIR	
October 21, 2021 9:32:55 AM	Audit	Data	Data New Path GC\\NEW\\P001_F 2021-10-20 16:55:16\\NEW\\P001_F\\001.D F001.AIR	
October 21, 2021 9:32:55 AM	Audit	Data	Data New Path GC\\NEW\\P001_F 2021-10-20 16:55:16\\NEW\\P001_F\\001.D F001.AIR	
October 21, 2021 9:32:55 AM	Audit	Data	Data New Path GC\\NEW\\P001_F 2021-10-20 16:55:16\\NEW\\P001_F\\001.D F001.AIR	
October 21, 2021				

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Date: October 21, 2021 10:05:48 AM
System ID: GC-6

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User Name: surya.thangaswamy		System ID: GC-6	
Host Name: ABBK007015		Print Date: October 21, 2021 10:05:48 AM	
DQ GC ALB CN11461066 Transaction log:			
Time	Transaction State	Activity Performed	Optional Information
October 21, 2021 9:32:57 AM	End	Injection Precision - Injection	Run Count: 1
Tower: Front SSI, Front FID - GC - L (Area) == 3.00% - L (Ret. Time) == 1.00%			
October 21, 2021 9:32:57 AM	Start	Signal to Host - Injection	None
Tower: Front SSI, Front FID - Detector FID - L == 300000			
October 21, 2021 9:34:51 AM	Audit	Data	Data New Path
Tower: Front SSI, Front FID - Detector FID - L == 300000			
C:\chem\21-GC\AQCP\VD 21AQCP\2021_8\2021-10-20 15:51-1654G02\MS_FIG1.D - FID101 - - -			
October 21, 2021 9:34:51 AM	End	Injection Precision - Injection	Run Count: 1
Tower: Front SSI, Front FID - Detector FID - L == 300000			
October 21, 2021 9:34:51 AM	Start	GC Scouting Run - Injection	None
Tower: Back SSI, Back FID - Part of System Preparation - No limits associated			
October 21, 2021 9:35:04 AM	Audit	Data	Data New Path
Tower: Back SSI, Back FID - Detector FID - L == 300000			
C:\chem\21-GC\AQCP\VD 21AQCP\2021_8\2021-10-20 15:51-1654G02_1_B001.D\MS_FIG101 - - -			
October 21, 2021 9:35:04 AM	End	Injection Precision - Injection	Run Count: 9
Tower: Back SSI, Back FID - Part of System Preparation - No limits associated			
October 21, 2021 9:35:32 AM	Start	Injection Precision - Injection	None
Tower: Back SSI, Back FID - Detector FID - L (Area) == 3.00% - L (Ret. Time) == 1.00%			

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Date: October 21, 2021 10:05:48 AM
System ID: GC-6

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User Name: surya.thangaswamy		System ID: GC-6	
Host Name: ABBK007015		Print Date: October 21, 2021 10:05:48 AM	
DG GC ALB CN11461066 Transaction log:			
Time	Transaction State	Activity Performed	Optional Information
October 21, 2021 9:36:36 AM	Audit	Data	Data New Path Detector FID - L (Area) == 3.00% - L (Ret. Time) == 1.00% 21-10-15-45-00-PRF_C_0001-10 FID20-CH
October 21, 2021 9:36:36 AM	End	Injection Precision - Injection	Run Count: 1
October 21, 2021 9:36:36 AM	Start	Injection Precision - Injection	None
October 21, 2021 9:36:36 AM	Audit	Data	Data New Path Detector FID - L (Area) == 3.00% - L (Ret. Time) == 1.00% 21-10-15-45-00-PRF_C_0001-10 FID20-CH
October 21, 2021 9:36:36 AM	Audit	Data	Data New Path Detector FID - L (Area) == 3.00% - L (Ret. Time) == 1.00% 21-10-15-45-00-PRF_C_0001-10 FID20-CH
October 21, 2021 9:36:36 AM	Audit	Data	Data New Path Detector FID - L (Area) == 3.00% - L (Ret. Time) == 1.00% 21-10-15-45-00-PRF_C_0001-10 FID20-CH
October 21, 2021 9:36:36 AM	Audit	Data	Data New Path Detector FID - L (Area) == 3.00% - L (Ret. Time) == 1.00% 21-10-15-45-00-PRF_C_0001-10 FID20-CH
October 21, 2021 9:36:36 AM	Audit	Data	Data New Path Detector FID - L (Area) == 3.00% - L (Ret. Time) == 1.00% 21-10-15-45-00-PRF_C_0001-10 FID20-CH
October 21, 2021 9:36:36 AM	Audit	Data	Data New Path Detector FID - L (Area) == 3.00% - L (Ret. Time) == 1.00% 21-10-15-45-00-PRF_C_0001-10 FID20-CH
October 21, 2021 9:36:36 AM	Audit	Data	Data New Path Detector FID - L (Area) == 3.00% - L (Ret. Time) == 1.00% 21-10-15-45-00-PRF_C_0001-10 FID20-CH
October 21, 2021 9:36:36 AM	Audit	Data	Data New Path Detector FID - L (Area) == 3.00% - L (Ret. Time) == 1.00% 21-10-15-45-00-PRF_C_0001-10 FID20-CH
October 21, 2021 9:36:36 AM	Audit	Data	Data New Path Detector FID - L (Area) == 3.00% - L (Ret. Time) == 1.00% 21-10-15-45-00-PRF_C_0001-10 FID20-CH
October 21, 2021 9:36:36 AM	Audit	Data	Data New Path Detector FID - L (Area) == 3.00% - L (Ret. Time) == 1.00% 21-10-15-45-00-PRF_C_0001-10 FID20-CH
October 21, 2021 9:36:36 AM	Audit	Data	Data New Path Detector FID - L (Area) == 3.00% - L (Ret. Time) == 1.00% 21-10-15-45-00-PRF_C_0001-10 FID20-CH
October 21, 2021 9:36:36 AM	Audit	Data	Data New Path Detector FID - L (Area) == 3.00% - L (Ret. Time) == 1.00% 21-10-15-45-00-PRF_C_0001-10 FID20-CH
October 21, 2021 9:36:36 AM	Audit	Data	Data New Path Detector FID - L (Area) == 3.00% - L (Ret. Time) == 1.00% 21-10-15-45-00-PRF_C_0001-10 FID20-CH
October 21, 2021 9:36:36 AM	Audit	Data	Data New Path Detector FID - L (Area) == 3.00% - L (Ret. Time) == 1.00% 21-10-15-45-00-PRF_C_0001-10 FID20-CH
October 21, 2021 9:36:36 AM	Audit	Data	Data New Path Detector FID - L (Area) == 3.00% - L (Ret. Time) == 1.00% 21-10-15-45-00-PRF_C_0001-10 FID20-CH
October 21, 2021 9:36:36 AM	Audit	Data	Data New Path Detector FID - L (Area) == 3.00% - L (Ret. Time) == 1.00% 21-10-15-45-00-PRF_C_0001-10 FID20-CH
October 21, 2021 9:36:36 AM	Audit	Data	Data New Path Detector FID - L (Area) == 3.00% - L (Ret. Time) == 1.00% 21-10-15-45-00-PRF_C_0001-10 FID20-CH
October 21, 2021 9:36:36 AM	Audit	Data	Data New Path Detector FID - L (Area) == 3.00% - L (Ret. Time) == 1.00% 21-10-15-45-00-PRF_C_0001-10 FID20-CH
October 21, 2021 9:36:36 AM	Audit	Data	Data New Path Detector FID - L (Area) == 3.00% - L (Ret. Time) == 1.00% 21-10-15-45-00-PRF_C_0001-10 FID20-CH
October 21, 2021 9:36:36 AM	Audit	Data	Data New Path Detector FID - L (Area) == 3.00% - L (Ret. Time) == 1.00% 21-10-15-45-00-PRF_C_0001-10 FID20-CH
October 21, 2021 9:36:36 AM	Audit	Data	Data New Path Detector FID - L (Area) == 3.00% - L (Ret. Time) == 1.00% 21-10-15-45-00-PRF_C_0001-10 FID20-CH
October 21, 2021 9:36:36 AM	Audit	Data	Data New Path Detector FID - L (Area) == 3.00% - L (Ret. Time) == 1.00% 21-10-15-45-00-PRF_C_0001-10 FID20-CH
October 21, 2021 9:36:36 AM	Audit	Data	Data New Path Detector FID - L (Area) == 3.00% - L (Ret. Time) == 1.00% 21-10-15-45-00-PRF_C_0001-10 FID20-CH
October 21, 2021 9:36:36 AM	Audit	Data	Data New Path Detector FID - L (Area) == 3.00% - L (Ret. Time) == 1.00% 21-10-15-45-00-PRF_C_0001-10 FID20-CH
October 21, 2021 9:36:36 AM	Audit	Data	Data New Path Detector FID - L (Area) == 3.00% - L (Ret. Time) == 1.00% 21-10-15-45-00-PRF_C_0001-10 FID20-CH
October 21, 2021 9:36:36 AM	Audit	Data	Data New Path Detector FID - L (Area) == 3.00% - L (Ret. Time) == 1.00% 21-10-15-45-00-PRF_C_0001-10 FID20-CH
October 21, 2021 9:36:36 AM	Audit	Data	Data New Path Detector FID - L (Area) == 3.00% - L (Ret. Time) == 1.00% 21-10-15-45-00-PRF_C_0001-10 FID20-CH
October 21, 2021 9:36:36 AM	Audit	Data	Data New Path Detector FID - L (Area) == 3.00% - L (Ret. Time) == 1.00% 21-10-15-45-00-PRF_C_0001-10 FID20-CH
October 21, 2021 9:36:36 AM	Audit	Data	Data New Path Detector FID - L (Area) == 3.00% - L (Ret. Time) == 1.00% 21-10-15-45-00-PRF_C_0001-10 FID20-CH
October 21, 2021 9:36:36 AM	Audit	Data	Data New Path Detector FID - L (Area) == 3.00% - L (Ret. Time) == 1.00% 21-10-15-45-00-PRF_C_0001-10 FID20-CH
October 21, 2021 9:36:36 AM	Audit	Data	Data New Path Detector FID - L (Area) == 3.00% - L (Ret. Time) == 1.00% 21-10-15-45-00-PRF_C_0001-10 FID20-CH
October 21, 2021 9:36:36 AM	Audit	Data	Data New Path Detector FID - L (Area) == 3.00% - L (Ret. Time) == 1.00% 21-10-15-45-00-PRF_C_0001-10 FID20-CH
October 21, 2021 9:36:36 AM	Audit	Data	Data New Path Detector FID - L (Area) == 3.00% - L (Ret. Time) == 1.00% 21-10-15-45-00-PRF_C_0001-10 FID20-CH
October 21, 2021 9:36:36 AM	Audit	Data	Data New Path Detector FID - L (Area) == 3.00% - L (Ret. Time) == 1.00% 21-10-15-45-00-PRF_C_0001-10 FID20-CH
October 21, 2021 9:36:36 AM	Audit	Data	Data New Path Detector FID - L (Area) == 3.00% - L (Ret. Time) == 1.00% 21-10-15-45-00-PRF_C_0001-10 FID20-CH
October 21, 2021 9:36:36 AM	Audit	Data	Data New Path Detector FID - L (Area) == 3.00% - L (Ret. Time) == 1.00% 21-10-15-45-00-PRF_C_0001-10 FID20-CH
October 21, 2021 9:36:36 AM	Audit	Data	Data New Path Detector FID - L (Area) == 3.00% - L (Ret. Time) == 1.00% 21-10-15-45-00-PRF_C_0001-10 FID20-CH
October 21, 2021 9:36:36 AM	Audit	Data	Data New Path Detector FID - L (Area) == 3.00% - L (Ret. Time) == 1.00% 21-10-15-45-00-PRF_C_0001-10 FID20-CH
October 21, 2021 9:36:36 AM	Audit	Data	Data New Path Detector FID - L (Area) == 3.00% - L (Ret. Time) == 1.00% 21-10-15-45-00-PRF_C_0001-10 FID20-CH
October 21, 2021 9:36:36 AM	Audit	Data	Data New Path Detector FID - L (Area) == 3.00% - L (Ret. Time) == 1.00% 21-10-15-45-00-PRF_C_0001-10 FID20-CH
October 21, 2021 9:36:36 AM	Audit	Data	Data New Path Detector FID - L (Area) == 3.00% - L (Ret. Time) == 1.00% 21-10-15-45-00-PRF_C_0001-10 FID20-CH
October 21, 2021 9:36:36 AM	Audit	Data	Data New Path Detector FID - L (Area) == 3.00% - L (Ret. Time) == 1.00% 21-10-15-45-00-PRF_C_0001-10 FID20-CH
October 21, 2021 9:36:36 AM	Audit	Data	Data New Path Detector FID - L (Area) == 3.00% - L (Ret. Time) == 1.00% 21-10-15-45-00-PRF_C_0001-10 FID20-CH
October 21, 2021 9:36:36 AM	Audit	Data	Data New Path Detector FID - L (Area) == 3.00% - L (Ret. Time) == 1.00% 21-10-15-45-00-PRF_C_0001-10 FID20-CH
October 21, 2021 9:36:36 AM	Audit	Data	Data New Path Detector FID - L (Area) == 3.00% - L (Ret. Time) == 1.00% 21-10-15-45-00-PRF_C_0001-10 FID20-CH
October 21, 2021 9:36:36 AM	Audit	Data	Data New Path Detector FID - L (Area) == 3.00% - L (Ret. Time) == 1.00% 21-10-15-45-00-PRF_C_0001-10 FID20-CH
October 21, 2021 9:36:36 AM	Audit	Data	Data New Path Detector FID - L (Area) == 3.00% - L (Ret. Time) == 1.00% 21-10-15-45-00-PRF_C_0001-10 FID20-CH
October 21, 2021 9:36:36 AM	Audit	Data	Data New Path Detector FID - L (Area) == 3.00% - L (Ret. Time) == 1.00% 21-10-15-45-00-PRF_C_0001-10 FID20-CH
October 21, 2021 9:36:36 AM	Audit	Data	Data New Path Detector FID - L (Area) == 3.00% - L (Ret. Time) == 1.00% 21-10-15-45-00-PRF_C_0001-10 FID20-CH
October 21, 2021 9:36:36 AM	Audit	Data	Data New Path Detector FID - L (Area) == 3.00% - L (Ret. Time) == 1.00% 21-10-15-45-00-PRF_C_0001-10 FID20-CH
October 21, 2021 9:36:36 AM	Audit	Data	Data New Path Detector FID - L (Area) == 3.00% - L (Ret. Time) == 1.00% 21-10-15-45-00-PRF_C_0001-10 FID20-CH
October 21, 2021 9:36:36 AM	Audit	Data	Data New Path Detector FID - L (Area) == 3.00% - L (Ret. Time) == 1.00% 21-10-15-45-00-PRF_C_0001-10 FID20-CH
October 21, 2021 9:36:36 AM	Audit	Data	Data New Path Detector FID - L (Area) == 3.00% - L (Ret. Time) == 1.00% 21-10-15-45-00-PRF_C_0001-10 FID20-CH
October 21, 2021 9:36:36 AM	Audit	Data	Data New Path Detector FID - L (Area) == 3.00% - L (Ret. Time) == 1.00% 21-10-15-45-00-PRF_C_0001-10 FID20-CH
October 21, 2021 9:36:36 AM	Audit	Data	Data New Path Detector FID - L (Area) == 3.00% - L (Ret. Time) == 1.00% 21-10-15-45-00-PRF_C_0001-10 FID20-CH
October 21, 2021 9:36:36 AM	Audit	Data	Data New Path Detector FID - L (Area) == 3.00% - L (Ret. Time) == 1.00% 21-10-15-45-00-PRF_C_0001-10 FID20-CH
October 21, 2021 9:36:36 AM	Audit	Data	Data New Path Detector FID - L (Area) == 3.00% - L (Ret. Time) == 1.00% 21-10-15-45-00-PRF_C_0001-10 FID20-CH
October 21, 2021 9:36:36 AM	Audit	Data	Data New Path Detector FID - L (Area) == 3.00% - L (Ret. Time) == 1.00% 21-10-15-45-00-PRF_C_0001-10 FID20-CH
October 21, 2021 9:36:36 AM	Audit	Data	Data New Path Detector FID - L (Area) == 3.00% - L (Ret. Time) == 1.00% 21-10-15-45-00-PRF_C_0001-10 FID20-CH
October 21, 2021 9:36:36 AM	Audit	Data	Data New Path Detector FID - L (Area) == 3.00% - L (Ret. Time) == 1.00% 21-10-15-45-00-PRF_C_0001-10 FID20-CH
October 21, 2021 9:36:36 AM	Audit	Data	Data New Path Detector FID - L (Area) == 3.00% - L (Ret. Time) == 1.00% 21-10-15-45-00-PRF_C_0001-10 FID20-CH
October 21, 2021 9:36:36 AM	Audit	Data	Data New Path Detector FID - L (Area) == 3.00% - L (Ret. Time) == 1.00% 21-10-15-45-00-PRF_C_0001-10 FID20-CH
October 21, 2021 9:36:36 AM	Audit	Data	Data New Path Detector FID - L (Area) == 3.00% - L (Ret. Time) == 1.00% 21-10-15-45-00-PRF_C_0001-10 FID20-CH
October 21, 2021 9:36:36 AM	Audit	Data	Data New Path Detector FID - L (Area) == 3.00% - L (Ret. Time) == 1.00% 21-10-15-45-00-PRF_C_0001-10 FID20-CH
October 21, 2021 9:36:36 AM	Audit	Data	Data New Path Detector FID - L (Area) == 3.00% - L (Ret. Time) == 1.00% 21-10-15-45-00-PRF_C_0001-10 FID20-CH
October 21, 2021 9:36:36 AM	Audit		

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Date: October 21, 2021 10:05:48 AM
System ID: GC-6

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User Name: surya.thangaswamy
Host Name: ABBK007015

System ID: GC-6

Print Date: October 21, 2021 10:05:48 AM

DG GC ALB CN11461066 Transaction log:

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
October 21, 2021 9:36:37 AM	Audit	Data	Injection Precision - Injection	Data New Path Tower: Back SSI, Back FID - GC - L (Area) == 3.00% - L (Ret. Time) == 1.00%
October 21, 2021 9:36:37 AM	Audit	Data	Injection Precision - Injection	Data New Path Tower: Back SSI, Back FID - GC - L (Area) == 3.00% - L (Ret. Time) == 1.00%
October 21, 2021 9:36:37 AM	End	Injection Precision - Injection	Run Count: 1	
October 21, 2021 9:36:37 AM	Start	Injection Precision - Injection	None	
October 21, 2021 9:36:37 AM	Audit	Data	Data New Path	Data New Path Tower: Back SSI, Back FID - GC - L (Area) == 3.00% - L (Ret. Time) == 1.00%
October 21, 2021 9:36:37 AM	End	Injection Precision - Injection	Run Count: 1	
October 21, 2021 9:36:37 AM	End	Injection Precision - Injection	Run Count: 1	
October 21, 2021 9:36:37 AM	End	Injection Precision - Injection	Run Count: 1	
October 21, 2021 9:36:37 AM	End	Injection Precision - Injection	Run Count: 1	
October 21, 2021 9:36:37 AM	End	Injection Precision - Injection	Run Count: 1	
October 21, 2021 9:36:37 AM	End	Injection Precision - Injection	Run Count: 1	
October 21, 2021 9:36:37 AM	End	Injection Precision - Injection	Run Count: 1	
October 21, 2021 9:36:37 AM	End	Injection Precision - Injection	Run Count: 1	
October 21, 2021 9:36:37 AM	End	Injection Precision - Injection	Run Count: 1	
October 21, 2021 9:36:37 AM	End	Injection Precision - Injection	Run Count: 1	
October 21, 2021 9:36:37 AM	End	Injection Precision - Injection	Run Count: 1	
October 21, 2021 9:36:37 AM	End	Injection Precision - Injection	Run Count: 1	
October 21, 2021 9:36:37 AM	End	Injection Precision - Injection	Run Count: 1	
October 21, 2021 9:36:37 AM	End	Injection Precision - Injection	Run Count: 1	
October 21, 2021 9:36:37 AM	End	Injection Precision - Injection	Run Count: 1	
October 21, 2021 9:36:37 AM	End	Injection Precision - Injection	Run Count: 1	
October 21, 2021 9:36:37 AM	End	Injection Precision - Injection	Run Count: 1	
October 21, 2021 9:36:37 AM	End	Injection Precision - Injection	Run Count: 1	
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October 21, 2021 9:36:37 AM	End	Injection Precision - Injection	Run Count: 1	
October 21, 2021 9:36:37 AM	End	Injection Precision - Injection	Run Count: 1	
October 21, 2021 9:36:37 AM	End	Injection Precision - Injection	Run Count: 1	
October 21, 2021 9:36:37 AM	End	Injection Precision - Injection	Run Count: 1	
October 21, 2021 9:36:37 AM	End	Injection Precision - Injection	Run Count: 1	</

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Date: October 21, 2021 10:05:48 AM
System ID: GC-6

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Certificate of System Qualification
GC-00

System ID: CN11461068
Organization Name: ALS Laboratory Group (Thailand) Co., Ltd.
Organization Location: 104 Soi 40 Phatthanakan Rd, Khwang Suan Luang, Khet Suan Luang, Bangkok 10250

Date: April 21, 2023 3:26:38 PM
EQP Name: Agilent Recommended
EQP Revision: GC.02.52
Overall Qualification Status: Pass

REVIEW BY: *Jude K.*
APPROVED BY: *Thanyaporn M.*
NEXT CAL DATE: 01 Oct 24

CDS Logon Verification - GC

Logon: Saengulhai Tanak

Overall CDS Logon Verification - GC Test Status

Pass

System Inspection and Basic Safety and Operation

Name: 7890

Setpoint Status: Pass

Overall System Inspection and Basic Safety and Operation Test Status

Pass

Inlet Pressure Decay

Name: 7890
Front SSL

Setpoint Status: Pass
Pressure: 25.0 psi

Pressure Change: -0.1 psi / 5 minutes
Agilent Recommended: ≥ -2.0 and ≤ 0.5

Date: April 21, 2023 3:26:38 PM
System ID: CN11461068

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Overall Inlet Pressure Decay Test Status

Pass

Inlet Pressure Accuracy

Name: 7890

Front SSL

Setpoint Status: Pass

Setpoint Actual
Inlet Pressure: 25.0 psi 25.2 psi

Accuracy: 0.2 psi
Agilent Recommended: ≤ 1.2

Overall Inlet Pressure Accuracy Test Status

Pass

Inlet Pressure Decay

Name: 7890

Back SSL

Setpoint Status: Pass

Pressure: 25.0 psi

Pressure Change: 0.0 psi / 5 minutes
Agilent Recommended: ≥ -2.0 and ≤ 0.5

Overall Inlet Pressure Decay Test Status

Pass

Inlet Pressure Accuracy

Name: 7890

Back SSL

Date: April 21, 2023 3:26:38 PM
System ID: CN11461068

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Setpoint Status: Pass
Setpoint Actual
Inlet Pressure: 25.0 psi 24.8 psi
Accuracy: 0.2 psi
Agilent Recommended: ≤ 1.2

Overall Inlet Pressure Accuracy Test Status

Pass

Detector Flow Accuracy

Name: 7890
Front FID

Setpoint Status: Pass
Flow Type: Fuel

Setpoint: 30.0 mL/min Measured Flow: 28.8 mL/min

Accuracy: 1.1 mL/min
Agilent Recommended: ≤ 10.0 % setpoint (3.0 mL/min)

Limit is percentage of setpoint or 0.5 mL/min, whichever is largest.

Setpoint Status: Pass
Flow Type: Oxidizer

Setpoint: 400.0 mL/min Measured Flow: 400 mL/min

Accuracy: 0.0 mL/min
Agilent Recommended: ≤ 10.0 % setpoint (40.0 mL/min)

Limit is percentage of setpoint or 0.5 mL/min, whichever is largest.

Setpoint Status: Pass
Flow Type: Makeup

Setpoint: 25.0 mL/min Measured Flow: 24.9 mL/min

Accuracy: 0.1 mL/min
Agilent Recommended: ≤ 10.0 % setpoint (2.5 mL/min)

Limit is percentage of setpoint or 0.5 mL/min, whichever is largest.

Date: April 21, 2023 3:26:38 PM
System ID: CN11461068

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Overall Detector Flow Accuracy Test Status

Pass

Detector Flow Accuracy

Name: 7890

Back FID

Setpoint Status: Pass

Flow Type: Fuel

Setpoint: 30.0 mL/min Measured Flow: 30.7 mL/min

Accuracy: 0.7 mL/min
Agilent Recommended: ≤ 10.0 % setpoint (3.0 mL/min)

Limit is percentage of setpoint or 0.5 mL/min, whichever is largest.

Setpoint Status: Pass
Flow Type: Oxidizer

Setpoint: 400.0 mL/min Measured Flow: 398 mL/min

Accuracy: 1.0 mL/min
Agilent Recommended: ≤ 10.0 % setpoint (40.0 mL/min)

Limit is percentage of setpoint or 0.5 mL/min, whichever is largest.

Setpoint Status: Pass
Flow Type: Makeup

Setpoint: 25.0 mL/min Measured Flow: 24.8 mL/min

Accuracy: 0.4 mL/min
Agilent Recommended: ≤ 10.0 % setpoint (2.5 mL/min)

Limit is percentage of setpoint or 0.5 mL/min, whichever is largest.

Overall Detector Flow Accuracy Test Status

Pass

GC Oven Temperature Accuracy

Name: 7890

Date: April 21, 2023 3:26:38 PM
System ID: CN11461068

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Setpoint Status: **Pass**

Zone:

Oven

Setpoint/Actual

Temperature:

230.0

230.6

°C

Accuracy:

0.6

°C

Agilent Recommended:

≤ 1.0

% setpoint in K

(

-5.0

°C)

≤ 1.0

% setpoint in K

(

5.0

°C)

Setpoint Status:

Pass

Zone:

Oven

Setpoint/Actual

Temperature:

100.0

100.9

°C

Accuracy:

0.9

°C

Agilent Recommended:

≤ 1.0

% setpoint in K

(

-3.7

°C)

≤ 1.0

% setpoint in K

(

3.7

°C)

Overall GC Oven Temperature Accuracy Test Status

Pass

GC Oven Temperature Stability

Name:

7890

Setpoint Status:

Pass

Setpoint/Average

Temperature:

100.0

100.833

°C

Stability:

0.1

°C

Agilent Recommended:

≤ 0.5

Overall GC Oven Temperature Stability Test Status

Pass

Scouting Run

Tested Combination1

Front

SSL

/ Front

FID

Name:

Injection Tower

7893A

Date:

April 21, 2023 3:26:38 PM

System ID:

CN11461066

Setpoint Status:

Completed

Injection Volume on Column:

1.0

µL

Overall Scouting Run Status

Completed

Noise and Drift

Tested Combination1

Front

SSL

/ Front

FID

Name:

7890

Setpoint Status:

Pass

Base Signal:

22.7

pA

ASTM Noise

pA

0.08

Agilent Recommended:

≤ 0.10

Drift

pA/hr

0.05

Agilent Recommended:

≤ 2.50

Overall Noise and Drift Test Status

Pass

Injection Precision

Tested Combination1

Front

SSL

/ Front

FID

Name:

7893A

Setpoint Status:

Pass

Injection Volume on Column:

1.0

µL

Area RSD:

0.32

%

Retention Time RSD:

0.87

%

Agilent Recommended:

≤ 3.00

≤ 1.00

Overall Injection Precision Test Status

Pass

Signal to Noise

Date:

April 21, 2023 3:26:38 PM

System ID:

CN11461066

Tested Combination1

Front

SSL

/ Front

FID

Name:

Injection Tower

7890

Setpoint Status:

Pass

Signal to Noise:

721755

Agilent Recommended:

≥ 300000

Overall Signal to Noise Test Status

Pass

Scouting Run

Tested Combination2

Back

SSL

/ Back

FID

Name:

Injection Tower

7893A

Setpoint Status:

Completed

Injection Volume on Column:

1.0

µL

Overall Scouting Run Status

Completed

Noise and Drift

Tested Combination2

Back

SSL

/ Back

FID

Name:

7890

Setpoint Status:

Pass

Base Signal:

22.8

pA

ASTM Noise

pA

0.07

Agilent Recommended:

≤ 0.10

Drift

pA/hr

0.09

Agilent Recommended:

≤ 2.50

Status:

Pass

Date:

April 21, 2023 3:26:38 PM

System ID:

CN11461066

Overall Noise and Drift Test Status

Pass

Injection Precision

Tested Combination2

Back

SSL

/ Back

FID

Name:

7893A

Setpoint Status:

Pass

Injection Volume on Column:

1.0

µL

Area RSD:

1.28

%

Retention Time RSD:

0.83

%

Agilent Recommended:

≤ 3.00

≤ 1.00

Overall Injection Precision Test Status

Pass

Signal to Noise

Tested Combination2

Back

SSL

/ Back

FID

Name:

Injection Tower

7890

Setpoint Status:

Pass

Signal to Noise:

2404356

Agilent Recommended:

≥ 300000

Overall Signal to Noise Test Status

Pass

Date:

April 21, 2023 3:26:38 PM

System ID:

CN11461066

Instrument Details

Purpose

This section describes the as found system configuration.

Details

System

System ID	CN11461088
Manufacturer	Agilent Technologies
Name	7890
Flow Data Input	Manual Data
Temperature Data Input	Manual Data or Other Data Logging

Tested Combination1

Injection Technique	Injection Tower
Sampler Identifier	Sampler 2
Inlet	Front
Detector	Front
LTM Included?	No

Tested Combination2

Injection Technique	Injection Tower
Sampler Identifier	Sampler 3
Inlet	Back
Detector	Back
LTM Included?	No

Sampler 1

Manufacturer	Agilent Technologies
Type	Tray
Name	7693A
Model Number	G4514A
Serial Number	CN15380030
Firmware Revision	A.11.01
Vial Heater	Not installed

Date: April 21, 2023 3:26:38 PM
System ID: CN11461088

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Sampler 2

Manufacturer	Agilent Technologies
Type	Injection Tower
Name	7693A
Model Number	G4513A
Serial Number	CN16280128
Firmware Revision	A.10.09
Usage	Sample Injection
Location	Front
Syringe Volume (µL)	10

Sampler 3

Manufacturer	Agilent Technologies
Type	Injection Tower
Name	7693A
Model Number	G4513A
Serial Number	CN10940103
Firmware Revision	A.10.09
Usage	Sample Injection
Location	Back
Syringe Volume (µL)	10

Mainframe 1

Manufacturer	Agilent Technologies
Name	7890
Model Number	G3440A
Serial Number	CN11461066
Firmware Revision	Version 4.27
Oven Type	Standard

Date: April 21, 2023 3:26:38 PM
System ID: CN11461096

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Inlet 1

Manufacturer	Agilent Technologies
Name	7890
Type	SSL
Location	Front
Carrier Gas	Helium
Control Type	Electronic Pressure Control (EPC)
Purged Inlet	Yes

Inlet 2

Manufacturer	Agilent Technologies
Name	7890
Type	SSL
Location	Back
Carrier Gas	Helium
Control Type	Electronic Pressure Control (EPC)
Purged Inlet	Yes

Detector 1

Manufacturer	Agilent Technologies
Name	7890
Type	FID
Adapter	Capillary
Control Type	Electronic Pressure Control (EPC)
Location	Front
Makeup Gas	Nitrogen

Detector 2

Manufacturer	Agilent Technologies
Name	7890
Type	FID
Adapter	Capillary
Control Type	Electronic Pressure Control (EPC)
Location	Back
Makeup Gas	Nitrogen

Date: April 21, 2023 3:26:38 PM
System ID: CN11461085

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Electronic Signature

Purpose

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

Details

Full Name of Signer: Saenguthai Tarak
Logged On User Name: saenguthai.tarak@non.agilent.com
Signature Creation Date: April 21, 2023
Reason for Signature: Executed protocol and published this original version of document

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Date: April 21, 2023 3:26:38 PM
System ID: CN11461089

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User Name: khangphat.lark
Host Name: LAPTOP-Q239KQNVSystem ID: CN11481066
Print Date: April 21, 2023 3:28:40 PM

GC-4_BULK_ENH197_ALB Transaction log 1

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
Apr 21, 2023 11:21:36 AM	Auth	Session Created	Session	None
Apr 21, 2023 11:21:36 AM	Start	Configuration	Session	None
Apr 21, 2023 11:21:36 AM	Auth	Endorsement	Learning	User is Nonce/otp and does not require an unlock code
Apr 21, 2023 11:22:34 AM	Auth	Exp/Access	Session	EOP details for primary technique [06] File path: [PhotoPharmaGC\Configure\SWMS3.A306.02.32.apg] EOP File Name: [GC-02.55.apg], EOP Name: [AgilentRecommendedProbe col Revision-3GC-02.52]
Apr 21, 2023 11:22:36 AM	End	Configuration	Session	None
Apr 21, 2023 11:22:14 AM	Start	Qualification	Session	OO
Apr 21, 2023 11:22:14 AM	Start	Execution	CO2 Logon Verification - GC :	None + Qualitative Test
Apr 21, 2023 11:23:14 AM	End	Execution	CO2 Logon Verification - GC :	Run Count: 1 + Qualitative Test
Apr 21, 2023 11:23:16 AM	Start	Execution	System Inspection and Basic Safety and Operation - T800 :	None Qualitative Test - No response associated
Apr 21, 2023 11:23:25 AM	End	Execution	System Inspection and Basic Safety and Operation - T800 :	Run Count: 1 Qualitative Test - No response associated
Apr 21, 2023 11:23:37 AM	Start	Execution	Initial Pressure Decay - Front :	None BSL - Pressure Controlled Inlet - S: 25.0 psi - L: >= 2.0 psi and = 0.5 psi

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Date: April 21, 2023 3:28:39 PM
System ID: CN11481066

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User Name: khangphat.lark
Host Name: LAPTOP-Q239KQNVSystem ID: CN11481066
Print Date: April 21, 2023 3:28:40 PM

GC-4_BULK_ENH197_ALB Transaction log 1

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
Apr 21, 2023 11:24:01 AM	End	Execution	Initial Pressure Decay - Front :	Run Count: 1 BSL - Pressure Controlled Inlet - S: 25.0 psi - L: >= 2.0 psi and = 0.5 psi
Apr 21, 2023 11:24:04 AM	Start	Execution	Initial Pressure Accuracy - Front :	None BSL - Pressure Controlled Inlet - S: 25.0 psi - L: >= 1.2 psi
Apr 21, 2023 11:24:08 AM	End	Execution	Initial Pressure Accuracy - Front :	Run Count: 1 BSL - Pressure Controlled Inlet - S: 25.0 psi - L: >= 1.2 psi
Apr 21, 2023 11:24:11 AM	Start	Execution	Initial Pressure Decay - Back :	None BSL - Pressure Controlled Inlet - S: 25.0 psi - L: >= 2.0 psi and = 0.5 psi
Apr 21, 2023 11:24:43 AM	End	Execution	Initial Pressure Decay - Back :	Run Count: 1 BSL - Pressure Controlled Inlet - S: 25.0 psi - L: >= 2.0 psi and = 0.5 psi
Apr 21, 2023 11:24:43 AM	Start	Execution	Initial Pressure Accuracy - Back :	None BSL - Pressure Controlled Inlet - S: 25.0 psi - L: >= 1.2 psi
Apr 21, 2023 11:24:51 AM	End	Execution	Initial Pressure Accuracy - Back :	Run Count: 1 BSL - Pressure Controlled Inlet - S: 25.0 psi - L: >= 1.2 psi
Apr 21, 2023 11:24:53 AM	Start	Execution	Detector Flow Accuracy - Front :	None FID - Type: Fuel - S: 30.0 mL/min - L: >= 10.0% septair
Apr 21, 2023 11:25:29 AM	Auth	Date	Detector Flow Accuracy - Front :	Manual Data Entry FID - Type: Fuel - S: 30.0 mL/min - L: >= 10.0% septair
Apr 21, 2023 11:25:35 AM	End	Execution	Detector Flow Accuracy - Front :	Run Count: 1 FID - Type: Fuel - S: 30.0 mL/min - L: >= 10.0% septair

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Date: April 21, 2023 3:26:30 PM
System ID: CN11481066

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User Name: khangphat.lark
Host Name: LAPTOP-Q239KQNVSystem ID: CN11481066
Print Date: April 21, 2023 3:28:40 PM

GC-4_BULK_ENH197_ALB Transaction log 1

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
Apr 21, 2023 11:25:29 AM	Start	Execution	Detector Flow Accuracy - Front :	None FID - Type: Oxidizer - S: 400.0 mL/min - L: >= 10.0% septair
Apr 21, 2023 11:25:43 AM	Auth	Date	Detector Flow Accuracy - Front :	Manual Data Entry FID - Type: Oxidizer - S: 400.0 mL/min - L: >= 10.0% septair
Apr 21, 2023 11:25:42 AM	End	Execution	Detector Flow Accuracy - Front :	Run Count: 1 FID - Type: Oxidizer - S: 400.0 mL/min - L: >= 10.0% septair
Apr 21, 2023 11:26:44 AM	Start	Execution	Detector Flow Accuracy - Front :	None FID - Type: Makeup - S: 25.0 mL/min - L: >= 10.0% septair
Apr 21, 2023 11:26:01 AM	Auth	Date	Detector Flow Accuracy - Front :	Manual Data Entry FID - Type: Makeup - S: 25.0 mL/min - L: >= 10.0% septair
Apr 21, 2023 11:26:04 AM	End	Execution	Detector Flow Accuracy - Front :	Run Count: 1 FID - Type: Makeup - S: 25.0 mL/min - L: >= 10.0% septair
Apr 21, 2023 11:26:05 AM	Start	Execution	Detector Flow Accuracy - Back :	None FID - Type: Fuel - S: 30.0 mL/min - L: >= 10.0% septair
Apr 21, 2023 11:26:18 AM	Auth	Date	Detector Flow Accuracy - Back :	Manual Data Entry FID - Type: Fuel - S: 30.0 mL/min - L: >= 10.0% septair
Apr 21, 2023 11:26:22 AM	End	Execution	Detector Flow Accuracy - Back :	Run Count: 1 FID - Type: Fuel - S: 30.0 mL/min - L: >= 10.0% septair
Apr 21, 2023 11:26:24 AM	Start	Execution	Detector Flow Accuracy - Back :	None FID - Type: Oxidizer - S: 400.0 mL/min - L: >= 10.0% septair
Apr 21, 2023 11:26:38 AM	Auth	Date	Detector Flow Accuracy - Back :	Manual Data Entry FID - Type: Oxidizer - S: 400.0 mL/min - L: >= 10.0% septair

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Date: April 21, 2023 3:28:38 PM
System ID: CN11481066

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User Name: khangphat.lark
Host Name: LAPTOP-Q239KQNVSystem ID: CN11481066
Print Date: April 21, 2023 3:28:40 PM

GC-4_BULK_ENH197_ALB Transaction log 1

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
Apr 21, 2023 11:26:43 AM	End	Execution	Detector Flow Accuracy - Back :	Run Count: 1 FID - Type: Oxidizer - S: 400.0 mL/min - L: >= 10.0% septair
Apr 21, 2023 11:26:45 AM	Start	Execution	Detector Flow Accuracy - Back :	None FID - Type: Makeup - S: 25.0 mL/min - L: >= 10.0% septair
Apr 21, 2023 11:27:01 AM	Auth	Date	Detector Flow Accuracy - Back :	Manual Data Entry FID - Type: Makeup - S: 25.0 mL/min - L: >= 10.0% septair
Apr 21, 2023 11:27:09 AM	End	Execution	Detector Flow Accuracy - Back :	Run Count: 1 FID - Type: Makeup - S: 25.0 mL/min - L: >= 10.0% septair
Apr 21, 2023 11:27:07 AM	Start	Execution	GC Oven Temperature Accuracy - T800 - Temperature :	None Oven - S: 250.0°C - L: >= 1.0 AND <= 1.0 % septair in K
Apr 21, 2023 11:27:32 AM	Auth	Date	GC Oven Temperature Accuracy - T800 - Temperature :	Manual Data Entry Oven - S: 250.0°C - L: >= 1.0 AND <= 1.0 % septair in K
Apr 21, 2023 11:27:35 AM	End	Execution	GC Oven Temperature Accuracy - T800 - Temperature :	Run Count: 1 Oven - S: 250.0°C - L: >= 1.0 AND <= 1.0 % septair in K
Apr 21, 2023 11:27:37 AM	Start	Execution	GC Oven Temperature Accuracy - T800 - Temperature :	None Oven - S: 100.0°C - L: >= 1.0 AND <= 1.0 % septair in K
Apr 21, 2023 11:27:54 AM	Auth	Date	GC Oven Temperature Accuracy - T800 - Temperature :	Manual Data Entry Oven - S: 100.0°C - L: >= 1.0 AND <= 1.0 % septair in K

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Date: April 21, 2023 3:28:38 PM
System ID: CN11481066

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User Name: seungjuhl@ark
Hostname: LAPTOP-G03SKQWYSystem ID: CN11481066
Print Date: April 21, 2023 3:26:49 PM

GC-8_BKF_ENH137_AL8 Transaction Log 1

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
April 21, 2023 11:27:57 AM	End	Execution	GC Oven Temperature Accuracy - 7800 - Temperature : Oven - 8: 100.0°C - L - <= -1.0 A/D <= 1.5 % expected in K	Run Count: 1
April 21, 2023 11:27:59 AM	Start	Execution	GC Oven Temperature Stability - 7800 - Temperature : Oven - 8: 100.0°C - L - <= 0.5°C	None
April 21, 2023 11:28:07 AM	Auto	Data	GC Oven Temperature Stability - 7800 - Temperature : Oven - 8: 100.0°C - L - <= 0.5°C	Manual Data Entry
April 21, 2023 11:28:19 AM	End	Execution	GC Oven Temperature Stability - 7800 - Temperature : Oven - 8: 100.0°C - L - <= 0.5°C	Run Count: 1
April 21, 2023 11:28:12 AM	Start	Execution	GC Bypassing Run - Injection Tower, Front BSL, Front FID - Part of System Preparation - No limits associated	None
April 21, 2023 11:30:21 AM	Auto	Data	GC Bypassing Run - Injection Tower, Front BSL, Front FID - Part of System Preparation - No limits associated	None
April 21, 2023 11:30:24 AM	End	Execution	GC Bypassing Run - Injection Tower, Front BSL, Front FID - Part of System Preparation - No limits associated	Run Count: 1
April 21, 2023 11:31:07 AM	Start	Execution	Noise and Drift - Front FID - Detector FID - L (Noise) <= 0.10 pA - L (Drift) <= 2.00 pA/Hz	None

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Date: April 21, 2023 3:28:58 PM
System ID: CN11481066

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User Name: seungjuhl@ark
Hostname: LAPTOP-G03SKQWYSystem ID: CN11481066
Print Date: April 21, 2023 3:28:49 PM

GC-8_BKF_ENH137_AL8 Transaction Log 1

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
April 21, 2023 11:31:49 AM	Auto	Data	Noise and Drift - Front FID - Detector FID - L (Noise) <= 0.10 pA - L (Drift) <= 2.00 pA/Hz	Data File Path: C:\Users\Public\Documents\CrossLab\GCData\GC_8_AL8_2023-04-20\GC_8_2023-04-20_14-36-08\Front.FID.D\FID1A.ch
April 21, 2023 11:32:09 AM	End	Execution	Noise and Drift - Front FID - Detector FID - L (Noise) <= 0.10 pA - L (Drift) <= 2.00 pA/Hz	Run Count: 1
April 21, 2023 11:32:03 AM	Start	Execution	Injection Prediction - Injection Tower, Front BSL, Front FID - GC - L (Area) <= 3.00% - L (Ret. Time) <= 1.00%	None
April 21, 2023 11:32:23 AM	Start	Execution	Injection Prediction - Injection Tower, Front BSL, Front FID - GC - L (Area) <= 3.00% - L (Ret. Time) <= 1.00%	None
April 21, 2023 11:33:55 AM	Auto	Data	Injection Prediction - Injection Tower, Front BSL, Front FID - GC - L (Area) <= 3.00% - L (Ret. Time) <= 1.00%	Data File Path: C:\Users\Public\Documents\CrossLab\GCData\GC_8_AL8_2023-04-20\GC_8_2023-04-20_14-36-08\Front.FID.D\FID1A.ch
April 21, 2023 11:33:59 AM	Auto	Data	Injection Prediction - Injection Tower, Front BSL, Front FID - GC - L (Area) <= 3.00% - L (Ret. Time) <= 1.00%	Data File Path: C:\Users\Public\Documents\CrossLab\GCData\GC_8_AL8_2023-04-20\GC_8_2023-04-20_14-36-08\Front.FID.D\FID1A.ch

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Date: April 21, 2023 3:28:38 PM
System ID: CN11481066

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User Name: seungjuhl@ark
Hostname: LAPTOP-G03SKQWYSystem ID: CN11481066
Print Date: April 21, 2023 3:26:40 PM

GC-8_BKF_ENH137_AL8 Transaction Log 1

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
April 21, 2023 11:33:58 AM	Auto	Data	Injection Prediction - Injection Tower, Front BSL, Front FID - GC - L (Area) <= 3.00% - L (Ret. Time) <= 1.00%	Data File Path: C:\Users\Public\Documents\CrossLab\GCData\GC_8_AL8_2023-04-20\GC_8_2023-04-20_14-36-08\Front.FID.D\FID1A.ch
April 21, 2023 11:33:59 AM	Auto	Data	Injection Prediction - Injection Tower, Front BSL, Front FID - GC - L (Area) <= 3.00% - L (Ret. Time) <= 1.00%	Data File Path: C:\Users\Public\Documents\CrossLab\GCData\GC_8_AL8_2023-04-20\GC_8_2023-04-20_14-36-08\Front.FID.D\FID1A.ch
April 21, 2023 11:33:59 AM	Auto	Data	Injection Prediction - Injection Tower, Front BSL, Front FID - GC - L (Area) <= 3.00% - L (Ret. Time) <= 1.00%	Data File Path: C:\Users\Public\Documents\CrossLab\GCData\GC_8_AL8_2023-04-20\GC_8_2023-04-20_14-36-08\Front.FID.D\FID1A.ch
April 21, 2023 11:35:59 AM	Auto	Data	Injection Prediction - Injection Tower, Front BSL, Front FID - GC - L (Area) <= 3.00% - L (Ret. Time) <= 1.00%	Data File Path: C:\Users\Public\Documents\CrossLab\GCData\GC_8_AL8_2023-04-20\GC_8_2023-04-20_14-36-08\Front.FID.D\FID1A.ch
April 21, 2023 11:35:00 AM	End	Execution	Injection Prediction - Injection Tower, Front BSL, Front FID - GC - L (Area) <= 3.00% - L (Ret. Time) <= 1.00%	Run Count: 1
April 21, 2023 11:36:04 AM	Start	Execution	Signal to Noise - Injection Tower, Front BSL, Front FID - Detector FID - L <= 30000	None

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Date: April 21, 2023 3:26:35 PM
System ID: CN11481066

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User Name: seungjuhl@ark
Hostname: LAPTOP-G03SKQWYSystem ID: CN11481066
Print Date: April 21, 2023 3:28:40 PM

GC-8_BKF_ENH137_AL8 Transaction Log 1

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
April 21, 2023 11:35:28 AM	Auto	Data	Signal to Noise - Injection Tower, Front BSL, Front FID - Detector FID - L <= 30000	Data File Path: C:\Users\Public\Documents\CrossLab\GCData\GC_8_AL8_2023-04-20\GC_8_2023-04-20_14-36-08\Front.FID.D\FID1A.ch
April 21, 2023 11:36:00 AM	End	Execution	Signal to Noise - Injection Tower, Front BSL, Front FID - Detector FID - L <= 30000	Run Count: 1
April 21, 2023 11:36:59 AM	Start	Execution	GC Bypassing Run - Injection Tower, Back BSL, Back FID - Part of System Preparation - No limits associated	None
April 21, 2023 11:38:36 AM	Auto	Data	GC Bypassing Run - Injection Tower, Back BSL, Back FID - Part of System Preparation - No limits associated	Data File Path: C:\Users\Public\Documents\CrossLab\GCData\GC_8_AL8_2023-04-20\GC_8_2023-04-20_14-36-08\Back.FID.D\FID2B.ch
April 21, 2023 11:37:30 AM	End	Execution	GC Bypassing Run - Injection Tower, Back BSL, Back FID - Part of System Preparation - No limits associated	Run Count: 1
April 21, 2023 11:37:32 AM	Start	Execution	Noise and Drift - Back FID - Detector FID - L (Noise) <= 0.10 pA - L (Drift) <= 2.00 pA/Hz	None

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Date: April 21, 2023 3:28:38 PM
System ID: CN11481066

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User Name: kangkai@lab
Host Name: LAPTOP-G33R0K0VSystem ID: CN11451068
Print Date: April 21, 2023 3:26:40 PM

GC-4_B0K_ENT127_ALB Transaction log:

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
Apr 21, 2023 11:38:08 AM	Auto	Data	None and Det - Back FID -> Detector FID - L (Shut) => 0.10 psi - L (Det) => 2.80 psi/hr	Data Res Path: C:\Users\Public\Documents\hms\hms\GC-4_B0K_ENT127_ALB_2023-04-20\GC-4_2023-04-20.D\FID 28.0h
Apr 21, 2023 11:38:21 AM	End	Execution	None and Det - Back FID -> Detector FID - L (Shut) => 0.10 psi - L (Det) => 2.80 psi/hr	Run Count: 1
Apr 21, 2023 11:38:33 AM	Start	Execution	Injection Precision - Injection Tower, Back SSI, Back FID -> GC - L (Ave) => 3.00% - L (Rel. Time) => 1.00%	None
Apr 21, 2023 11:38:51 AM	Start	Execution	Injection Precision - Injection Tower, Back SSI, Back FID -> GC - L (Ave) => 3.00% - L (Rel. Time) => 1.00%	None
Apr 21, 2023 11:40:17 AM	Auto	Data	Injection Precision - Injection Tower, Back SSI, Back FID -> GC - L (Ave) => 3.00% - L (Rel. Time) => 1.00%	Data Res Path: C:\Users\Public\Documents\hms\hms\GC-4_B0K_ENT127_ALB_2023-04-20\GC-4_2023-04-20.D\FID 28.0h
Apr 21, 2023 11:42:17 AM	Auto	Data	Injection Precision - Injection Tower, Back SSI, Back FID -> GC - L (Ave) => 3.00% - L (Rel. Time) => 1.00%	Data Res Path: C:\Users\Public\Documents\hms\hms\GC-4_B0K_ENT127_ALB_2023-04-20\GC-4_2023-04-20.D\FID 28.0h

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Date: April 21, 2023 3:26:38 PM
System ID: CN11451068

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User Name: kangkai@lab
Host Name: LAPTOP-G33R0K0VSystem ID: CN11451068
Print Date: April 21, 2023 3:26:45 PM

GC-4_B0K_ENT127_ALB Transaction log:

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
Apr 21, 2023 11:40:17 AM	Auto	Data	Injection Precision - Injection Tower, Back SSI, Back FID -> GC - L (Ave) => 3.00% - L (Rel. Time) => 1.00%	Data Res Path: C:\Users\Public\Documents\hms\hms\GC-4_B0K_ENT127_ALB_2023-04-20\GC-4_2023-04-20.D\FID 28.0h
Apr 21, 2023 11:42:17 AM	Auto	Data	Injection Precision - Injection Tower, Back SSI, Back FID -> GC - L (Ave) => 3.00% - L (Rel. Time) => 1.00%	Data Res Path: C:\Users\Public\Documents\hms\hms\GC-4_B0K_ENT127_ALB_2023-04-20\GC-4_2023-04-20.D\FID 28.0h
Apr 21, 2023 11:42:21 AM	Auto	Data	Injection Precision - Injection Tower, Back SSI, Back FID -> GC - L (Ave) => 3.00% - L (Rel. Time) => 1.00%	Data Res Path: C:\Users\Public\Documents\hms\hms\GC-4_B0K_ENT127_ALB_2023-04-20\GC-4_2023-04-20.D\FID 28.0h
Apr 21, 2023 11:42:31 AM	Auto	Data	Injection Precision - Injection Tower, Back SSI, Back FID -> GC - L (Ave) => 3.00% - L (Rel. Time) => 1.00%	Data Res Path: C:\Users\Public\Documents\hms\hms\GC-4_B0K_ENT127_ALB_2023-04-20\GC-4_2023-04-20.D\FID 28.0h
Apr 21, 2023 11:42:38 AM	End	Execution	Injection Precision - Injection Tower, Back SSI, Back FID -> GC - L (Ave) => 3.00% - L (Rel. Time) => 1.00%	Run Count: 1
Apr 21, 2023 11:43:33 AM	Start	Execution	Signal to Noise - Injection Tower, Back SSI, Back FID -> Detector FID - L (Ave) => 30000	None

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Date: April 21, 2023 3:26:38 PM
System ID: CN11451068

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User Name: kangkai@lab
Host Name: LAPTOP-G33R0K0VSystem ID: CN11451068
Print Date: April 21, 2023 3:26:46 PM

GC-4_B0K_ENT127_ALB Transaction log:

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
Apr 21, 2023 11:42:33 AM	Auto	Data	Signal to Noise - Injection Tower, Back SSI, Back FID -> Detector FID - L (Ave) => 30000	Data Res Path: C:\Users\Public\Documents\hms\hms\GC-4_B0K_ENT127_ALB_2023-04-20\GC-4_2023-04-20.D\FID 28.0h
Apr 21, 2023 11:42:50 AM	End	Execution	Signal to Noise - Injection Tower, Back SSI, Back FID -> Detector FID - L (Ave) => 30000	Run Count: 1
Apr 21, 2023 11:42:53 AM	End	Qualification	Session	QC
Apr 21, 2023 11:42:53 AM	Start	Reporting	Session	None
Apr 21, 2023 12:01:47 PM	Auto	AcqClosed	Session	None
Apr 21, 2023 12:05:07 PM	Auto	AcqRestarted	Session	None
Apr 21, 2023 12:16:16 PM	Auto	SessionValidated	Session	None
Apr 21, 2023 12:19:21 PM	Start	Qualification	Session	QC
Apr 21, 2023 12:30:56 PM	Auto	AcqRestarted	Session	None
Apr 21, 2023 12:31:00 PM	Auto	SessionValidated	Session	None
Apr 21, 2023 12:31:07 PM	Start	Qualification	Session	QC
Apr 21, 2023 3:25:43 PM	Auto	Reporting	Session	Report Generated: Certificate

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Date: April 21, 2023 3:26:38 PM
System ID: CN11451068

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SITHIPHORN ASSOCIATES CO., LTD.
CALIBRATION LABORATORY451-451/1 Sirdhohm Rd, Bangbunnu, Bangkok Bangkok 10700 THAILAND
Tel: 0-2435-8600 Fax: 0-2433-1679 e-mail: cal-center@sithiphorn.com http://www.sithiphorn.comCert. No.: ACC23085
Pages: 1 of 3

Calibration Certificate

Equipment: SOUND CALIBRATOR
Manufacturer: RION
Model: NC-75
Serial No.: 35002736
ID No.: RYG_FS0496

Condition As Found: GOOD

Customer: ALS LABORATORY GROUP (THAILAND) CO., LTD.
164 PIATTHANAKAN 40, PIATTHANAKAN ROAD,
KHUWAENG PIATTHANAKAN, KHET SUAN LUANG,
BANGKOK, 10250 THAILAND.

Location:
Ambient Temperature: (23.0 ± 2) °C
Pressure: (101.3 ± 3) kPa
Relative Humidity: (50.0 ± 20) %

Received Date: 06 JANUARY 2023
Calibration Date: 17 JANUARY 2023
Date of Issue: 19 JANUARY 2023

Calibrated by: Nathakorn Pitsupaisan

Approved by: T. Petchai-
(Thunakul Petchai)

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.

Continuation of Calibration Certificate

Cert. No. : ACC23005
Job No. : VC66AC0024
Pages : 2 of 3

Calibration Procedure : CP-AC-03

Calibration Method :

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

Condition of this result of calibration :

1. Reference Standard Instruments :

Instrument	Model	Serial No.	Cert. No.	Due Date
Waveform Generator	33511B	MY52302742	EF-0008-22	04-Feb-23
Digital Multimeter	33461A	MY53220104	EEL-BP_04/0265	09-Feb-23
Digital Multimeter	33461A	MY53220076	EEL-BP_03/0265	09-Feb-23
Digital Multimeter	33461A	MY60024273	EEL-BP_05/0265	09-Feb-23
Programmable Attenuator	MAT-1070	62100114	EF-0009-22	07-Feb-23
Condenser Microphone	4180	2977900	AA-1013-22	24-Feb-23
Measuring Amplifier	NA-42KAI	34560495	AA-3005-22	22-Feb-23
Audio Analyzer	AVR-3360A	V744B6069	EF-0010-22	07-Feb-23

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

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

3.1 National Institute of Metrology (Thailand).

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

QP-TS12-04-04-020664

T. Petchum

Continuation of Calibration Certificate

Cert. No. : ACC23005
Job No. : VC66AC0024
Pages : 3 of 3

Result of calibration :

1. Sound pressure level

Specified sound pressure level (dB)	Measured value (dB)	Deviated value (dB)	Uncertainty (dB)	Tolerance limit (dB)
94	93.98	-0.02	0.14	0.40

2. Frequency

Specified Frequency (Hz)	Measured value (Hz)	Deviated value (%)	Uncertainty (%)	Tolerance limit (%)
1000	1000.0	0.0	0.1	1.0

3. Total distortion

Measured value (%)	Uncertainty (%)	Tolerance limit (%)
0.35	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-TS12-04-04-020664

T. Petchum

451-451/1 Sirinthorn Rd., Bangbunru, Bangkok 10709 THAILAND.
Tel: 0-2435-8800 Fax: 0-2433-1679 e-mail: center@sithiporn.com http://www.sithiporn.com



Cert. No. : ACL22160
Pages : 1 of 8

Calibration Certificate

Equipment : SOUND LEVEL METER
Manufacturer : RION
Model : NH-42/ Microphone UC-52 / Pre-amplifier NH-24
Serial No. : 00472132 / 169445 / 72466
ID No. : RYG_FS0304

Condition As Found : GOOD

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

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

Received Date : 06 JULY 2022
Calibration Date : 11-18 JULY 2022
Date of Issue : 19 JULY 2022

Calibrated by : Nathakorn Pisutpaisan

Approved by : T. Petchum
(Thunakul Petchum)

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.

QP-TS12-04-04-020664

Continuation of Calibration Certificate

Cert. No. : ACL22160
Job No. : VC66AC0069
Pages : 2 of 8

Calibration Procedure : CP-AC-01

Calibration Method :

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

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

Condition of this result of calibration :

1. Reference Standard Instruments :

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

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

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

3.1 National Institute of Metrology (Thailand).

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

QP-TS12-04-04-020664

T. Petchum

Continuation of Calibration Certificate

Cert. No. : ACL22160
Job No. : VC65AC0069
Pages : 3 of 8

Summary of Measurement Result:

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

QT-TS12-04-04-020664

T P.L.A.

Continuation of Calibration Certificate

Cert. No. : ACL22160
Job No. : VC65AC0069
Pages : 4 of 8

Result of calibration:

1. Absolute sensitivity

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

2. Self-generated noise

2.1 Normal test

Measured Value (dB)
14.2

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

Frequency Weighting	Measured value (dB)
A-weight	9.9
C-weight	16.3
Flat	22.1

3. Acoustical signal tests of frequency weightings

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

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)			Acceptance Limits
	Flat	C-weight	A-weight	
125	0.2	0.2	0.2	±1.5
1000	-0.1	-0.1	-0.1	±1.0
8000	-1.1	-1.1	-1.1	±5.0

QT-TS12-04-04-020664

T P.L.A.

Continuation of Calibration Certificate

Cert. No. : ACL22160
Job No. : VC65AC0069
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)			Acceptance Limits
	Flat	C-weight	A-weight	
63	0.0	0.0	0.0	±2.0
125	0.1	0.1	0.1	±1.5
250	0.0	0.0	0.0	±1.5
500	0.0	0.1	0.0	±1.5
1000	0.0	0.0	0.0	±1.0
2000	0.0	0.1	0.0	±2.0
4000	0.0	0.1	0.0	±3.0
8000	0.0	0.1	0.1	±5.0

5. Frequency and time weightings at 1 kHz

5.1 Frequency weightings at 1 kHz

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

5.2 Time weighting at 1 kHz

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

6. Long-term stability

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

QT-TS12-04-04-020664

T P.L.A.

Continuation of Calibration Certificate

Cert. No. : ACL22160
Job No. : VC65AC0069
Pages : 6 of 8

7. Level linearity on the reference level range

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

QT-TS12-04-04-020664

T P.L.A.

Continuation of Calibration Certificate

Cert. No. : ACL22160
Job No. : VC65AC0069
Pages : 7 of 8

8. Level linearity including the level range control

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

9. Tone burst response

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

10. Peak C sound level

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

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

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Continuation of Calibration Certificate

Cert. No. : ACL22160
Job No. : VC65AC0069
Pages : 8 of 8

11. Overload indication

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

12. High level stability

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

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

End of Calibration Certificate

QF-TS12-04-04-020664

SITHIPORN ASSOCIATES CO.,LTD.
CALIBRATION LABORATORY

451-451/7 Sithiporn Rd, Bangbunni, Bangkok 10700 THAILAND.
Tel: 0-2435-8800 Fax: 0-2433-1679 e-mail: cal-center@sithiporn.com http://www.sithiporn.com



Cert. No. : ACC23009
Pages : 1 of 3

Calibration Certificate

Equipment : SOUND CALIBRATOR
Manufacturer : RION
Model : NC-74
Serial No. : 34178121
ID No. : RYG_FS0213

Condition As Found : GOOD

Customer : ALS LABORATORY GROUP (THAILAND) CO., LTD.
164 PHATTANAKAN 40, PHATTANAKAN ROAD,
KHUWAENG PHATTANAKAN, 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 : 24 JANUARY 2023
Calibration Date : 26 JANUARY 2023
Date of Issue : 27 JANUARY 2023

Calibrated by : Nathakorn Petchumai

Approved by : T. Petchumai
(Thanakul Petchumai)

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QF-TS12-04-04-020664

Continuation of Calibration Certificate

Cert. No. : ACC23009
Job No. : VC66AC0031
Pages : 2 of 3

Calibration Procedure : CP-AC-03

Calibration Method :

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

Condition of this result of calibration :

1. Reference Standard Instruments :

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

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

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

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

QF-TS12-04-04-020664

Continuation of Calibration Certificate

Cert. No. : ACC23009
Job No. : VC66AC0031
Pages : 3 of 3

Result of calibration :

1. Sound pressure level

Specified sound pressure level (dB)	Measured value (dB)	Deviated value (dB)	Uncertainty (dB)	Tolerance limit (dB)
94	94.16	0.16	0.14	0.40

2. Frequency

Specified Frequency (Hz)	Measured value (Hz)	Deviated value (%)	Uncertainty (%)	Tolerance limit (%)
1000	1003.2	0.3	0.1	1.0

3. Total distortion

Measured value (%)	Uncertainty (%)	Tolerance limit (%)
1.97	0.10	3.0

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

End of Calibration Certificate

QF-TS12-04-04-020664



451-451/1 Sirinthorn Rd, Bangbunru, Bangplud Bangkok 10700 THAILAND.
Tel:0-2435-8800 Fax:0-2431-1679 e-mail:cal-center@sithiporn.com http://www.sithiporn.com

Cert. No. : ACL22182
Pages : 1 of 8

Calibration Certificate

Equipment : SOUND LEVEL METER
Manufacturer : RION
Model : NL-42/Microphone UC-52 / Preamplifier NH-24
Serial No. : 00873109 / 171842 / 73485
ID No. : RYG_FS0384

Condition As Found : GOOD

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

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

Received Date : 22 AUGUST 2022
Calibration Date : 26-31 AUGUST 2022
Date of Issue : 02 SEPTEMBER 2022

Calibrated by : Nathakorn Pisutpaisan

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

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Continuation of Calibration Certificate

Cert. No. : ACL22182
Job No. : VC65AC0077
Pages : 2 of 8

Calibration Procedure : CP-AC-01

Calibration Method :

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

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

Condition of this result of calibration :

1. Reference Standard Instruments :

Instrument	Model	Serial No.	Cert. No.	Due Date
Waveform Generator	33210A	MY48017076	EF-0007-22	04-Feb-23
Waveform Generator	33511B	MY52302742	EF-0008-22	04-Feb-23
Digital Multimeter	33461A	MY53220104	EEL-0P_040265	09-Feb-23
Digital Multimeter	33461A	MY53220076	EEL-0P_030265	09-Feb-23
Digital Multimeter	34461A	MY60024273	EEL-0P_050265	09-Feb-23
Programmable Attenuator	MAT-1070	62100114	EF-0009-22	07-Feb-23
Condenser Microphone	4180	2977900	AA-1013-22	24-Feb-23
Measuring Amplifier	NA-42KAJ	34560495	AA-3005-22	22-Feb-23

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

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

3.1 National Institute of Metrology (Thailand).

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

QF-TS12-04-04-020664

Continuation of Calibration Certificate

Cert. No. : ACL22182
Job No. : VC65AC0077
Pages : 3 of 8

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				
125 Hz	✓	-	0.3	0.6
1000 Hz	✓	-	0.3	0.6
8000 Hz	✓	-	0.4	0.7
4. Electrical signal tests of frequency weightings				
For 10 Hz to 4 kHz	✓	-	0.3	0.6
For > 4 kHz to 10 kHz	✓	-	0.3	0.7
For > 10 kHz to 20 kHz	-	-	-	1.0
5. Frequency and time weightings at 1 kHz	✓	-	0.2	0.2
6. Long-term stability	✓	-	0.1	0.1
7. Level linearity on the reference level range	✓	-	0.2	0.3
8. Level linearity including the level range control	✓	-	0.2	0.3
9. Tone burst response	✓	-	0.2	0.3
10. Peak C sound level	✓	-	0.2	0.35
11. Overload indication	✓	-	0.2	0.25
12. High level stability	✓	-	0.1	0.1

QF-TS12-04-04-020664

Continuation of Calibration Certificate

Cert. No. : ACL22182
Job No. : VC65AC0077
Pages : 4 of 8

Result of calibration:

1. Absolute sensitivity

Reference Acoustic Signal (dB)	Measured Value (dB)	Deviation (dB)	Acceptance Limits (dB)
93.9 (93.95)	93.9	0.0	±0.5

2. Self-generated noise

2.1 Normal test

Measured Value (dB)
16.5

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

Frequency Weighting	Measured value (dB)
A-weight	11.2
C-weight	17.6
Flat	23.3

3. Acoustical signal tests of frequency weightings

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

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)			
	Flat	C-weight	A-weight	Acceptance Limits
125	0.4	0.5	0.5	± 1.5
1000	0.0	0.0	0.0	± 1.0
8000	-2.4	-2.4	-2.4	±5.0

QF-TS12-04-04-020664

Continuation of Calibration Certificate

Cert. No. : ACL22182
Job No. : VC65AC0077
Pages : 5 of 8

4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

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

5. Frequency and time weightings at 1 kHz

5.1 Frequency weightings at 1 kHz

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

5.2 Time weighting at 1 kHz

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

6. Long-term stability

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

QF-TS12-04-04-020664

Continuation of Calibration Certificate

Cert. No. : ACL22182
Job No. : VC65AC0077
Pages : 6 of 8

7. Level linearity on the reference level range

Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
137.0	137.1	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
124.0	124.0	0.0	± 1.1
119.0	119.1	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	29.9	-0.1	± 1.1
29.0	28.9	-0.1	± 1.1
28.0	28.0	0.0	± 1.1
27.0	27.0	0.0	± 1.1
26.0	26.0	0.0	± 1.1
25.0	24.9	-0.1	± 1.1

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Continuation of Calibration Certificate

Cert. No. : ACL22182
Job No. : VC65AC0077
Pages : 7 of 8

8. Level linearity including the level range control

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

9. Tone burst response

Time Weighting	Tone burst duration, Tb (ms)	Cycle	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Fast	0.25	1	108.0	107.9	-0.1	1.5; -5.0
	2	8	117.0	116.9	-0.1	1.0; -2.5
	200	800	134.0	134.0	0.0	±1.0
Slow	2	8	108.0	108.0	0.0	1.5; -5.0
	200	800	127.6	127.6	0.0	±1.0
SEL	0.25	1	99.0	98.9	-0.1	1.5; -5.0
	2	8	108.0	108.0	0.0	1.0; -2.5
	200	800	128.0	128.0	0.0	±1.0

10. Peak C sound level

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

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Continuation of Calibration Certificate

Cert. No. : ACL22182
Job No. : VC65AC0077
Pages : 8 of 8

11. Overload indication

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

12. High level stability

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

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

End of Calibration Certificate

QP-TS12-04-04-020664



451-451/1 Sirinthorn Rd, Bangburu, Bangkok 10700 THAILAND.
Tel: 0-2435-8800 Fax: 0-2431-1679 e-mail: cal-center@sithiporn.com http://www.sithiporn.com

Cert. No. : ACL22237
Pages : 1 of 8

Calibration Certificate

Equipment : SOUND LEVEL METER
Manufacturer : RION
Model : NL-42/Microphone UC-52 / Preamplifier NH-24
Serial No. : 01173611 / 172173 / 74023
ID No. : RYQ_FS0390

Condition As Found : GOOD

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

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

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

Calibrated by : Nathakorn Pisutpaisan

Approved by :

T. Petchurai
(Thunakul Petchurai)

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QP-TS12-04-04-020664

Continuation of Calibration Certificate

Cert. No. : ACL22237
Job No. : VC65AC0088
Pages : 2 of 8

Calibration Procedure : CP-AC-01

Calibration Method :

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

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

Condition of this result of calibration :

1. Reference Standard Instruments :

Instrument	Model	Serial No.	Cert. No.	Due Date
Waveform Generator	33210A	MY48017076	ET-0007-22	04-Feb-23
Waveform Generator	33511B	MY52102742	ET-0008-22	04-Feb-23
Digital Multimeter	33461A	MY53220104	EEL-DP_04-0265	09-Feb-23
Digital Multimeter	33461A	MY53230076	EEL-DP_03-0265	09-Feb-23
Digital Multimeter	34461A	MY60024373	EEL-DP_05-0265	09-Feb-23
Programmable Attenuator	MAT-1070	62100114	IF-0009-22	07-Feb-23
Condenser Microphone	4180	2977900	AA-1013-22	24-Feb-23
Measuring Amplifier	NA-42KAL	34560495	AA-3005-22	22-Feb-23

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

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

3.1 National Institute of Metrology (Thailand).

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

QP-TS12-04-04-020664

Continuation of Calibration Certificate

Cert. No. : ACL22237
Job No. : VC65AC0088
Pages : 3 of 8

Summary of Measurement Result:

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

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Continuation of Calibration Certificate

Cert. No. : ACL22237
Job No. : VC65AC0088
Pages : 4 of 8

Result of calibration:

1. Absolute sensitivity

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

2. Self-generated noise

2.1 Normal test

Measured Value (dB)
15.4

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

Frequency Weighting	Measured value (dB)
A-weight	12.0
C-weight	18.1
Flat	23.9

3. Acoustical signal tests of frequency weightings

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

Frequency (Hz)	Flat	C-weight	A-weight	Acceptance Limits
125	0.5	0.4	0.5	± 1.5
1000	0.0	0.0	0.0	± 1.0
8000	-0.2	-0.2	-0.1	±5.0

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T. Rth.

Continuation of Calibration Certificate

Cert. No. : ACL22237
Job No. : VC65AC0088
Pages : 5 of 8

4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

Frequency (Hz)	Flat	C-weight	A-weight	Acceptance Limits
63	-0.1	0.0	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	0.1	0.0	±1.5
1000	0.0	0.0	0.0	±1.0
2000	0.0	0.1	0.0	±2.0
4000	0.0	0.0	0.0	±3.0
8000	0.0	0.1	0.1	±5.0

5. Frequency and time weightings at 1 kHz

5.1 Frequency weightings at 1 kHz

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

5.2 Time weighting at 1 kHz

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

6. Long-term stability

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

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T. Rth.

Continuation of Calibration Certificate

Cert. No. : ACL22237
Job No. : VC65AC0088
Pages : 6 of 8

7. Level linearity on the reference level range

Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
137.0	137.0	0.0	± 1.1
136.0	136.0	0.0	± 1.1
135.0	135.0	0.0	± 1.1
134.0	134.0	0.0	± 1.1
133.0	133.0	0.0	± 1.1
132.0	132.0	0.0	± 1.1
131.0	131.0	0.0	± 1.1
129.0	129.0	0.0	± 1.1
124.0	124.0	0.0	± 1.1
119.0	119.0	0.0	± 1.1
114.0	114.0	0.0	± 1.1
109.0	109.0	0.0	± 1.1
104.0	104.0	0.0	± 1.1
99.0	99.0	0.0	± 1.1
94.0	94.0	0.0	± 1.1
89.0	89.0	0.0	± 1.1
84.0	84.0	0.0	± 1.1
79.0	79.0	0.0	± 1.1
74.0	74.0	0.0	± 1.1
69.0	69.0	0.0	± 1.1
64.0	64.0	0.0	± 1.1
59.0	59.0	0.0	± 1.1
54.0	54.0	0.0	± 1.1
49.0	49.0	0.0	± 1.1
44.0	44.0	0.0	± 1.1
39.0	38.9	-0.1	± 1.1
34.0	33.9	-0.1	± 1.1
30.0	29.9	-0.1	± 1.1
29.0	28.9	-0.1	± 1.1
28.0	27.9	-0.1	± 1.1
27.0	26.9	-0.1	± 1.1
26.0	25.9	-0.1	± 1.1
25.0	24.9	-0.1	± 1.1

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T. Rth.

Continuation of Calibration Certificate

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Job No. : VC65AC0088
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8. Level linearity including the level range control

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

9. Tone burst response

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

10. Peak C sound level

Number of cycle in test signal	Anticipated Value (dB)	Measured Value, Lepeak (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.0	0.0	-
One	136.4	135.4	-1.0	±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	135.2	-0.2	±2.0
Negative half cycle	135.4	135.2	-0.2	±2.0

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T. Rth.

Continuation of Calibration Certificate

Cert. No. : ACL22237
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11. Overload indication

Measured value (dB)		Deviated Value	Acceptance Limits
Positive one-half cycle	Negative one-half cycle	(dB)	(dB)
89.6	89.6	0.0	±1.5

12. High level stability

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

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

End of Calibration Certificate

QF-TS12-04-04-020664

T. Petchum



451-451/1 Sirinhor Rd, Bangbunru, Bangplud Bangkok 10700 THAILAND.
Tel:0-2435-6800 Fax:0-2433-1679 e-mail:cal-center@sithiporn.com http://www.sithiporn.com

Cert. No. : ACL22194
Pages : 1 of 8

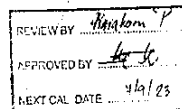
Calibration Certificate

Equipment : SOUND LEVEL METER
Manufacturer : RION
Model : NL-42/Microphone UC-52 / Preamplifier NH-24
Serial No. : 00597168 / 179117 / 87524
ID No. : RYG_FS0438

Condition As Found : GOOD

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

Location :
Ambient Temperature : (23.0 ± 3) °C
Pressure : (101.3 ± 3) kPa
Relative Humidity : (50.0 ± 20) %
Received Date : 06 SEPTEMBER 2022
Calibration Date : 07-09 SEPTEMBER 2022
Date of Issue : 14 SEPTEMBER 2022



Calibrated by : Nithakorn Pisutpaian

Approved by : T. Petchum
(Thonakul Petchum)

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

QF-TS12-04-04-020664

Continuation of Calibration Certificate

Cert. No. : ACL22194
Job No. : VC65AC0081
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Calibration Procedure : CP-AC-01

Calibration Method :

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

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

Condition of this result of calibration :

1. Reference Standard Instruments :

Instrument	Model	Serial No.	Cert. No.	Due Date
Waveform Generator	33210A	MY48017076	EF-0007-22	04-Feb-23
Waveform Generator	33511B	MY52302742	EF-0008-22	04-Feb-23
Digital Multimeter	33461A	MY5320104	EEL-0P_040265	09-Feb-23
Digital Multimeter	33461A	MY5320076	EEL-0P_050265	09-Feb-23
Digital Multimeter	34461A	MY60024273	EEL-0P_050265	09-Feb-23
Programmable Attenuator	MAT-1070	62100114	EF-0009-22	07-Feb-23
Condenser Microphone	4180	2977900	AA-1013-22	24-Feb-23
Measuring Amplifier	NA-42KA1	34560495	AA-3005-22	22-Feb-23

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

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

3.1 National Institute of Metrology (Thailand).

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

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T. Petchum

Continuation of Calibration Certificate

Cert. No. : ACL22194
Job No. : VC65AC0081
Pages : 3 of 8

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				
125 Hz	✓	-	0.3	0.6
1000 Hz	✓	-	0.3	0.6
8000 Hz	✓	-	0.3	0.7
4. Electrical signal tests of frequency weightings				
For 10 Hz to 4 kHz	✓	-	0.3	0.6
For > 4 kHz to 10 kHz	✓	-	0.3	0.7
For > 10 kHz to 20 kHz	-	-	-	1.0
5. Frequency and time weightings at 1 kHz	✓	-	0.2	0.2
6. Long-term stability	✓	-	0.1	0.1
7. Level linearity on the reference level range	✓	-	0.2	0.3
8. Level linearity including the level range control	✓	-	0.2	0.3
9. Tone burst response	✓	-	0.2	0.3
10. Peak C sound level	✓	-	0.2	0.35
11. Overload indication	✓	-	0.2	0.25
12. High level stability	✓	-	0.1	0.1

QF-TS12-04-04-020664

T. Petchum

Continuation of Calibration Certificate

Cert. No. : ACL22194
Job No. : VC65AC0081
Pages : 4 of 8

Result of calibration:

1. Absolute sensitivity

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

2. Self-generated noise

2.1 Normal test

Measured Value (dB)
15.1

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

Frequency Weighting	Measured value (dB)
A-weight	11.6
C-weight	18.1
Flat	23.8

3. Acoustical signal tests of frequency weightings

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

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)			
	Flat	C-weight	A-weight	Acceptance Limits
125	0.1	0.2	0.2	±1.5
1000	0.0	0.0	0.0	±1.0
8000	1.7	1.8	1.8	±5.0

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T. Reth.

Continuation of Calibration Certificate

Cert. No. : ACL22194
Job No. : VC65AC0081
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4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz

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

5. Frequency and time weightings at 1 kHz

5.1 Frequency weightings at 1 kHz

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

5.2 Time weighting at 1 kHz

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

6. Long-term stability

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

QF-TS12-04-04-020664

T. Reth.

Continuation of Calibration Certificate

Cert. No. : ACL22194
Job No. : VC65AC0081
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7. Level linearity on the reference level range

Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
137.0	137.0	0.0	±1.1
136.0	136.0	0.0	±1.1
135.0	135.1	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	129.0	0.0	±1.1
124.0	124.0	0.0	±1.1
119.0	119.1	0.1	±1.1
114.0	114.1	0.1	±1.1
109.0	109.0	0.0	±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
29.0	29.0	0.0	±1.1
28.0	27.9	-0.1	±1.1
27.0	26.9	-0.1	±1.1
26.0	25.9	-0.1	±1.1
25.0	24.9	-0.1	±1.1

QF-TS12-04-04-020664

T. Reth.

Continuation of Calibration Certificate

Cert. No. : ACL22194
Job No. : VC65AC0081
Pages : 7 of 8

8. Level linearity including the level range control

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

9. Tone burst response

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

10. Peak C sound level

Number of cycle in test signal	Anticipated Value (dB)	Measured Value, Lepeak (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.0	0.0	-
One	136.4	136.3	-0.1	±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

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T. Reth.

Continuation of Calibration Certificate

Cert. No. : ACL22194
Job No. : VC65AC0081
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11. Overload indication

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

12. High level stability

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

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

End of Calibration Certificate

QP-TS12-04-04-020664



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

Cert. No. : ACL22181
Pages : 1 of 8

Calibration Certificate

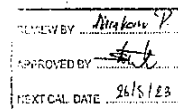
Equipment : SOUND LEVEL METER
Manufacturer : RION
Model : NL-42 / Microphone UC-52 / Preamplifier NH-24
Serial No. : 00873057 / 171591 / 73333
ID No. : RYO_FS0381

Condition As Found : GOOD

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

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

Received Date : 22 AUGUST 2022
Calibration Date : 26-31 AUGUST 2022
Date of Issue : 02 SEPTEMBER 2022



Calibrated by : Nakhorn Pisupaisan

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

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QP-TS12-04-04-020664

Continuation of Calibration Certificate

Cert. No. : ACL22181
Job No. : VC65AC0077
Pages : 2 of 8

Calibration Procedure : CP-AC-01

Calibration Method :

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

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

Condition of this result of calibration :

1. Reference Standard Instruments :

Instrument	Model	Serial No.	Cert. No.	Due Date
Waveform Generator	33210A	MY48017076	EP-0007-22	04-Feb-23
Waveform Generator	33511B	MY52302742	EP-0008-22	04-Feb-23
Digital Multimeter	33461A	MY53220104	EEL-DP_04/0265	09-Feb-23
Digital Multimeter	33461A	MY53220076	EEL-DP_03/0265	09-Feb-23
Digital Multimeter	33461A	MY60024273	EEL-DP_05/0265	09-Feb-23
Programmable Attenuator	MAT-1070	62106114	EP-0009-22	07-Feb-23
Condenser Microphone	4180	2977900	AA-1013-22	24-Feb-23
Measuring Amplifier	NA-42KAJ	34560495	AA-3005-22	22-Feb-23

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

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

3.1 National Institute of Metrology (Thailand).

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

QP-TS12-04-04-020664

Continuation of Calibration Certificate

Cert. No. : ACL22181
Job No. : VC65AC0077
Pages : 3 of 8

Summary of Measurement Result :

Parameter	Pass	Fail	Uncertainty (dB)	Maximum-permitted uncertainty of measurement (dB)
1. Absolute sensitivity	✓	-	0.2	N/A
2. Self-generated noise	✓	-	0.2	N/A
3. Acoustical signal tests of frequency weightings				
125 Hz	✓	-	0.3	0.6
1000 Hz	✓	-	0.3	0.6
8000 Hz	✓	-	0.4	0.7
4. Electrical signal tests of frequency weightings				
For 10 Hz to 4 kHz	✓	-	0.3	0.6
For > 4 kHz to 10 kHz	✓	-	0.3	0.7
For > 10 kHz to 20 kHz	-	-	-	1.0
5. Frequency and time weightings at 1 kHz	✓	-	0.2	0.2
6. Long-term stability	✓	-	0.1	0.1
7. Level linearity on the reference level range	✓	-	0.2	0.3
8. Level linearity including the level range control	✓	-	0.2	0.3
9. Tone burst response	✓	-	0.2	0.3
10. Peak C sound level	✓	-	0.2	0.35
11. Overload indication	✓	-	0.2	0.25
12. High level stability	✓	-	0.1	0.1

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Continuation of Calibration Certificate

Cert. No. : ACL22181
Job No. : VC65AC0077
Pages : 4 of 8

Result of calibration:

1. Absolute sensitivity

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

2. Self-generated noise

2.1 Normal test

Measured Value (dB)
15.4

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

Frequency Weighting	Measured value (dB)
A-weight	12.0
C-weight	18.3
Flat	24.0

3. Acoustical signal tests of frequency weightings

Meter free-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	0.2	0.2	0.2	± 1.5
1000	0.0	0.0	0.0	± 1.0
8000	0.2	0.2	0.2	± 5.0

QF-TS12-04-04-020664

Continuation of Calibration Certificate

Cert. No. : ACL22181
Job No. : VC65AC0077
Pages : 5 of 8

4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

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

5. Frequency and time weightings at 1 kHz

5.1 Frequency weightings at 1 kHz

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

5.2 Time weighting at 1 kHz

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

6. Long-term stability

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

QF-TS12-04-04-020664

Continuation of Calibration Certificate

Cert. No. : ACL22181
Job No. : VC65AC0077
Pages : 6 of 8

7. Level linearity on the reference level range

Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
137.0	137.1	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
124.0	124.1	0.1	± 1.1
119.0	119.1	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	99.0	0.0	± 1.1
94.0	94.0	0.0	± 1.1
89.0	89.0	0.0	± 1.1
84.0	84.0	0.0	± 1.1
79.0	79.0	0.0	± 1.1
74.0	74.0	0.0	± 1.1
69.0	69.0	0.0	± 1.1
64.0	64.0	0.0	± 1.1
59.0	59.0	0.0	± 1.1
54.0	54.0	0.0	± 1.1
49.0	49.0	0.0	± 1.1
44.0	44.0	0.0	± 1.1
39.0	39.0	0.0	± 1.1
34.0	34.0	0.0	± 1.1
30.0	29.9	-0.1	± 1.1
29.0	28.9	-0.1	± 1.1
28.0	28.0	0.0	± 1.1
27.0	26.9	-0.1	± 1.1
26.0	25.9	-0.1	± 1.1
25.0	25.0	0.0	± 1.1

QF-TS12-04-04-020664

Continuation of Calibration Certificate

Cert. No. : ACL22181
Job No. : VC65AC0077
Pages : 7 of 8

8. Level linearity including the level range control

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

9. Tone burst response

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

10. Peak C sound level

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

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

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Continuation of Calibration Certificate

Cert. No. : ACL22181
Job No. : VC65AC0077
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11. Overload indication

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

12. High level stability

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

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

End of Calibration Certificate

QF-TS12-04-04-020664

451-451/1 Sirdinbom Rd, Bangbunna, Bangkok 10700 THAILAND
Tel: 0-2435-8800 Fax: 0-2433-1079 e-mail: cal-center@sithiporn.com http://www.sithiporn.com



Cert. No. : ACL23038
Pages : 1 of 9

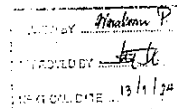
Calibration Certificate

Equipment : SOUND LEVEL METER
Manufacturer : RION
Model : NL-21/ Microphone UC-52 / Preamplifier NH-21
Serial No. : 00465461 / 108081 / 19513
ID No. : RYO_FS0007

Condition As Found : GOOD

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

Location :
Ambient Temperature : (23.0 ± 3) °C
Pressure : (101.3 ± 3) kPa
Relative Humidity : (50.0 ± 20) %
Received Date : 06 JANUARY 2023
Calibration Date : 13-18 JANUARY 2023
Date of Issue : 19 JANUARY 2023



Calibrated by : Nathakorn Pisutpaisan

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

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

QF-TS12-04-04-020664

Continuation of Calibration Certificate

Cert. No. : ACL23038
Job No. : VC66AC0024
Pages : 2 of 9

Calibration Procedure : CP-AC-02

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 Anechoic chamber and Reference Standard Instruments.

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

Condition of this result of calibration :

1. Reference Standard Instruments :

Instrument	Model	Serial No.	Cert. No.	Exp. Date
Waveform Generator	33210A	MY48017076	IF-0007-22	04-Feb-23
Waveform Generator	33511D	MY52302742	IF-0008-22	04-Feb-23
Digital Multimeter	33461A	MY53220104	EEL-BP_04/0265	09-Feb-23
Digital Multimeter	33461A	MY53220076	EEL-BP_03/0265	09-Feb-23
Digital Multimeter	8846A	MY60024273	EEL-BP_05/0265	09-Feb-23
Programmable Attenuator	MAT-1070	62100114	EE-0009-22	07-Feb-23
Condenser Microphone	4180	2977900	AA-1013-22	24-Feb-23
Measuring Amplifier	NA-42KA1	34560495	AA-3005-22	22-Feb-23

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

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

3.1 National Institute of Metrology (Thailand).

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

QF-TS12-04-04-020664

Continuation of Calibration Certificate

Cert. No. : ACL23038
Job No. : VC66AC0024
Pages : 3 of 9

Summary of Measurement Result :

Parameter	Pass	Fail	Uncertainty (dB)	Maximum-permitted uncertainty of measurement (dB)
1. Absolute sensitivity	✓	-	0.2	N/A
2. Self-generated noise	✓	-	0.2	N/A
3. Acoustical signal tests of frequency weightings				
125 Hz	✓	-	0.3	0.6
1000 Hz	✓	-	0.3	0.6
8000 Hz	✓	-	0.4	0.7
4. Electrical signal tests of frequency weightings				
For 10 Hz to 4 kHz	✓	-	0.3	0.6
For > 4 kHz to 10 kHz	✓	-	0.3	0.7
For > 10 kHz to 20 kHz	-	-	-	1.0
5. Frequency and time weightings at 1 kHz	✓	-	0.2	0.2
6. Long-term stability	✓	-	0.1	0.1
7. Level linearity on the reference level range	✓	-	0.2	0.3
8. Level linearity including the level range control	✓	-	0.2	0.3
9. Tone burst response	✓	-	0.2	0.3
10. Peak C sound level	✓	-	0.2	0.35
11. Overload indication	✓	-	0.2	0.25
12. High level stability	✓	-	0.1	0.1

QF-TS12-04-04-020664

Continuation of Calibration Certificate

Cert. No. : ACL23038
Job No. : VC66AC0024
Pages : 4 of 9

Result of calibration:

1. Absolute sensitivity

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

2. Self-generated noise

2.1 Normal test

Measured Value (dB)
23.5

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

Frequency Weighting	Measured value (dB)
A-weight	22.2
C-weight	21.6
Flat	22.2

3. Acoustical signal tests of frequency weightings

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

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)			
	Flat	C-weight	A-weight	Acceptance Limits
125	0.2	0.2	0.2	±1.5
1000	0.0	0.0	0.0	±1.0
8000	0.1	0.2	0.2	±5.0

QF-TS12-04-04-020664

Continuation of Calibration Certificate

Cert. No. : ACL23038
Job No. : VC66AC0024
Pages : 5 of 9

4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

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

5. Frequency and time weightings at 1 kHz

5.1 Frequency weightings at 1 kHz

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

5.2 Time weighting at 1 kHz

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

6. Long-term stability

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

QF-TS12-04-04-020664

Continuation of Calibration Certificate

Cert. No. : ACL23038
Job No. : VC66AC0024
Pages : 6 of 9

7. Level linearity on the reference level range

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

QF-TS12-04-04-020664

Continuation of Calibration Certificate

Cert. No. : ACL23038
Job No. : VC66AC0024
Pages : 7 of 9

8. Level linearity including the level range control

Range	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
130	94.0	94.0	0.0	±0.5
120	94.0	94.0	0.0	±0.5
110	94.0	94.0	0.0	±0.5
100	94.0	94.0	0.0	±0.5
90	94.0	94.0	0.0	±0.5

Level linearity on each level range

Range	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
130	43.0	43.0	0.0	±0.5
120	33.0	32.6	-0.4	±0.5

9. Tone burst response

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

QF-TS12-04-04-020664

Continuation of Calibration Certificate

Cert. No. : ACL23038
Job No. : VC66AC0024
Pages : 8 of 9

10. Peak C sound level

Number of cycle in test signal	Anticipated Value (dB)	Measured Value, Lepeak (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.0	0.0	-
One	136.4	135.9	-0.5	±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	135.0	-0.4	±2.0
Negative half cycle	135.4	135.0	-0.4	±2.0

11. Overload indication

Measured value (dB)		Deviated Value (dB)	Acceptance Limits (dB)
Positive one-half cycle	Negative one-half cycle	Value (dB)	Limits (dB)
89.4	89.3		
		-0.1	±1.5

QF-TS12-04-04-020664

T. Petchum

Continuation of Calibration Certificate

Cert. No. : ACL23038
Job No. : VC66AC0024
Pages : 9 of 9

12. High level stability

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

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

End of Calibration Certificate

QF-TS12-04-04-020664

T. Petchum

SITHIPORN ASSOCIATES CO.,LTD.
CALIBRATION LABORATORY

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



Cert. No. : ACL22231
Pages : 1 of 8

Calibration Certificate

Equipment : SOUND LEVEL METER
Manufacturer : RION
Model : NL-42/ Microphone UC-52 / Preamplifier NH-24
Serial No. : 00472126 / 176915 / 88180
ID No. : RYG, FS0301

Condition As Found : GOOD

Customer : AJS LABORATORY GROUP (THAILAND) CO., LTD.
104 PHATTANAKAN 4B, PHATTANAKAN ROAD,
KHUANG PHATTANAKAN, KHET SUAN LUANG,
BANGKOK, 10250 THAILAND.

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

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

Calibrated by : Nathakorn Pisutpaian

Approved by :

T. Petchum
(Thanakul Petchum)

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QF-TS12-04-04-020664

SITHIPORN; SITHIPORN ASSOCIATES CO.,LTD.
associates CALIBRATION LABORATORY

Continuation of Calibration Certificate

Cert. No. : ACL22231
Job No. : VC65AC0088
Pages : 2 of 8

Calibration Procedure : CP-AC-01

Calibration Method :

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

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

Condition of this result of calibration :

1. Reference Standard Instruments :

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

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

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

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

QF-TS12-04-04-020664

T. Petchum

Continuation of Calibration Certificate

Cert. No. : ACL22231
Job No. : VC65AC0088
Pages : 3 of 8

Summary of Measurement Result:

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

QF-TS12-04-04-020664

T. Pth.

Continuation of Calibration Certificate

Cert. No. : ACL22231
Job No. : VC65AC0088
Pages : 4 of 8

Result of calibration:

1. Absolute sensitivity

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

2. Self-generated noise

2.1 Normal test

Measured Value (dB)
14.6

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

Frequency Weighting	Measured value (dB)
A-weight	9.9
C-weight	16.7
Flat	22.5

3. Acoustical signal tests of frequency weightings

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

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)			
	Flat	C-weight	A-weight	Acceptance Limits
125	-7.6	-7.6	-7.3	± 1.5
1000	0.5	0.5	0.5	± 1.0
8000	-5.1	-5.1	-5.1	± 5.0

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T. Pth.

Continuation of Calibration Certificate

Cert. No. : ACL22231
Job No. : VC65AC0088
Pages : 5 of 8

4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

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

5. Frequency and time weightings at 1 kHz

5.1 Frequency weightings at 1 kHz

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

5.2 Time weighting at 1 kHz

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

6. Long-term stability

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

QF-TS12-04-04-020664

T. Pth.

Continuation of Calibration Certificate

Cert. No. : ACL22231
Job No. : VC65AC0088
Pages : 6 of 8

7. Level linearity on the reference level range

Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
137.0	137.0	0.0	± 1.1
136.0	136.0	0.0	± 1.1
135.0	135.0	0.0	± 1.1
134.0	134.0	0.0	± 1.1
133.0	133.0	0.0	± 1.1
132.0	131.9	-0.1	± 1.1
131.0	131.0	0.0	± 1.1
129.0	129.0	0.0	± 1.1
124.0	124.0	0.0	± 1.1
119.0	119.0	0.0	± 1.1
114.0	114.0	0.0	± 1.1
109.0	109.0	0.0	± 1.1
104.0	104.0	0.0	± 1.1
99.0	99.0	0.0	± 1.1
94.0	94.0	0.0	± 1.1
89.0	89.0	0.0	± 1.1
84.0	84.0	0.0	± 1.1
79.0	79.0	0.0	± 1.1
74.0	74.0	0.0	± 1.1
69.0	69.0	0.0	± 1.1
64.0	64.0	0.0	± 1.1
59.0	59.0	0.0	± 1.1
54.0	54.0	0.0	± 1.1
49.0	49.0	0.0	± 1.1
44.0	44.0	0.0	± 1.1
39.0	39.0	0.0	± 1.1
34.0	34.0	0.0	± 1.1
30.0	30.0	0.0	± 1.1
29.0	29.0	0.0	± 1.1
28.0	28.0	0.0	± 1.1
27.0	27.0	0.0	± 1.1
26.0	25.9	-0.1	± 1.1
25.0	24.9	-0.1	± 1.1

QF-TS12-04-04-020664

T. Pth.

Continuation of Calibration Certificate

Cert. No. : ACL22231
Job No. : VC65AC0088
Pages : 7 of 8

8. Level linearity including the level range control

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

9. Tone burst response

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

10. Peak C sound level

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

QT-TS12-04-04-02064

T. P. P.

Continuation of Calibration Certificate

Cert. No. : ACL22231
Job No. : VC65AC0088
Pages : 8 of 8

11. Overload indication

Measured value (dB)		Deviated Value (dB)	Acceptance Limits (dB)
Positive one-half cycle	Negative one-half cycle	0.0	±1.5
89.6	89.6		

12. High level stability

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

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

End of Calibration Certificate

QT-TS12-04-04-02064

T. P. P.



63/14-15,67/35-36, Sol Petchkasem 7/7/1, Petchkasem Rd.
Watthepa, Bangkhuyai, Bangkok 10600 Thailand.
Tel: (66) 02-8680812#13 Fax: (66) 02-8680860 www.jirantee.com



CERTIFICATE OF CALIBRATION

Certificate No. : CL-041-65
Page 1 of 2

Equipment Name: Digital thermometer with RTD
Manufacturer: Delta OHM
Model: HD32-2
Serial No: 20032242
ID No: RYG_F50522

Customer:
Name: AIS laboratory group (thailand) Co.,Ltd.
Address: 104 Phatthanakan 40, Phatthanakan Rd, Khwaeng Suan Luang, Rhet Suan Luang, Bangkok 10250 Thailand.

Received date: 25 FEB 2022
Calibration date: 7 MAR 2022
Issue date: 10 MAR 2022

Reference Used During Calibration
1. Standard Temperature Probe Model: STS 100 A500, Serial No: 667682 09, Due date: 25 Mar 2022
2. Digital Temperature Indicator Model: DTI 1000 A MK II, Serial No.: 671407-00593 Due date: 04 June 2022

Calibration Condition
Temperature: (23±3) °C
Relative Humidity: (55±15) %

Calibration Procedure
The temperature calibration was done by in-house calibration method as NIST 800-1 according to comparison method with standard digital temperature indicator and standard temperature probe. The temperature scale use was based on ITS-90

Traceability
The measurement results are traceable to the international system of units (SI) through National Institute of Metrology Thailand (NIMT) Certificate number: TT-0036-21, Certificate number: ER-0032-21

REVIEW BY: *[Signature]*
APPROVED BY: *[Signature]*
NEXT CAL DATE: 3/3/25

Calibrated by
Mr. Soran Thacholad
Miss Orathai Winitawong



Approved Signatory: *[Signature]*
Mr. Pannisa Booncharoen
Calibration Department Manager



63/14-15,67/35-36, Sol Petchkasem 7/7/1, Petchkasem Rd.
Watthepa, Bangkhuyai, Bangkok 10600 Thailand.
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Certificate No. : CL-041-65
Page 2 of 2

Result of Calibration: ☒ Without Adjustment ☐ With Adjustment

Calibration Range: 20 - 40 °C

Function:

Table 1: This equipment was connected with wet bulb probe Model: HP3201.2 S/N 21001206
Dimension: Diameter 14 mm, Length 170 mm.

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
30	20.058	20.0	0.1	0.099
30	25.046	25.0	0.0	0.099
30	30.045	30.0	0.0	0.099
30	35.020	35.0	0.0	0.099
30	39.999	40.0	0.0	0.099

Table 2: This equipment was connected with temperature probe Model: TP3207.2 S/N 21001796
Dimension: Diameter 14 mm, Length 150 mm

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
70	20.058	20.2	1.0	0.099
70	25.046	25.0	0.0	0.099
70	30.032	29.7	0.3	0.099
70	35.011	34.6	0.4	0.099
70	40.000	39.5	0.5	0.099

Table 3: This equipment was connected with Glue thermometer probe Model: TP3276.2 S/N 21001250
Dimension: Diameter 8 mm, Length 170 mm.

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
110	20.058	20.0	-0.1	0.099
110	25.046	25.0	0.0	0.099
110	30.031	30.0	0.0	0.099
110	35.020	35.0	0.0	0.099
110	40.000	40.0	0.0	0.099

UUC: Unit Under Calibration

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



63/14-16,67/35-36, Soi Petchkasem 7/71, Petchkasem Rd,
Wattapra, Bangkok, Bangkok 10600 Thailand.
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CERTIFICATE OF CALIBRATION

Certificate No.: CL-036-66
Page 1 of 2

Equipment Name: Heat Stress Monitor
Manufacturer: Delta OHM
Model: HD32.2
Serial No: 15006714
ID No: RYG_FS0219

Customer
Name: ALS laboratory group (thailand) Co., Ltd.
Address: 104 Phatthanakan 40, Phatthanakan Rd.,
Khweng Suam Luang, 10th Suam Luang, Bangkok
10250 Thailand.

Received date: 07 Feb 2023
Calibration date: 14 Feb 2023
Issue date: 14 Feb 2023

Reference Used During Calibration
1. Standard Temperature Probe Model: STS-400 A500,
Serial No.: 667682-09, Due date: 23 Mar 2023
2. Digital Temperature Indicator Model: DTI-1009-A MK
II, Serial No.: 671407-00591 Due date: 22 July 2023

Calibration Condition
Temperature: (23±3) °C
Relative Humidity: (65±15)%

Calibration Procedure
The temperature calibration was done by In-House
calibration method as WH-CL-001 according to
comparison method with standard digital temperature
indicator and standard temperature probe. The
temperature scale use was based on ITS-90.

Traceability
The measurement results are traceable to the
International system of units (SI) through National
Institute of Metrology (NIMT) Certificate
number: TT-0034-22, Certificate number: ER-0092-
22

Calibrated by
☐ Mr. Sorawit Thachalad
☒ Miss Jitraporn Lertsomphol

Approved Signatory
Mr. Parinya Booncharoen
Calibration Department Manager

THIS CERTIFICATE REPORT MAY NOT BE REPRODUCED EXCEPT IN FULL UNLESS PERMISSION FOR REPRODUC-
TION HAS BEEN OBTAINED IN WRITING FROM THE LABORATORY.

63/14-15,67/35-36, Soi Petchkasem 7/71, Petchkasem Rd,
Wattapra, Bangkok, Bangkok 10600 Thailand.
Tel: (66) 02-86081213 Fax: (66) 02-860860 www.jrnatse.com

CERTIFICATE OF CALIBRATION

Certificate No.: CL-036-66
Page 2 of 2

Result of Calibration: ☒ Without Adjustment ☐ With Adjustment
Calibration Range: 20 ~ 40 °C
Function:

Table 1: This equipment was connected with wet bulb probe Model: HP3201.2 S/N: 22035263.
Dimension: Diameter 14 mm, Length 170 mm.

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
60	20.062	20.4	0.3	0.099
60	25.060	25.4	0.3	0.099
60	30.051	30.4	0.3	0.099
60	35.050	35.4	0.3	0.099
60	40.048	40.4	0.4	0.099

Table 2: This equipment was connected with temperature probe Model: TP3207.2 S/N: 15015491.
Dimension: Diameter 14 mm, Length 150 mm.

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
70	20.062	20.5	0.4	0.099
70	25.060	25.3	0.2	0.099
70	30.051	30.2	0.1	0.099
70	35.050	35.1	0.0	0.099
70	40.048	40.1	0.1	0.099

Table 3: This equipment was connected with Globe thermometer probe Model: TP3276.2 S/N: 17023217.
Dimension: Diameter 8 mm, Length 170 mm.

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
110	20.062	20.3	0.2	0.099
110	25.060	25.3	0.2	0.099
110	30.051	30.3	0.2	0.099
110	35.050	35.3	0.2	0.099
110	40.048	40.3	0.3	0.099

UUC* : Unit Under Calibration
The reported expanded uncertainty is based on standard uncertainty multiplied by a coverage factor k=2
providing a level of confidence of approximately 95%.

★ End of Certificate ★

TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
CORPORATE SERVICES & EQUIPMENT CALIBRATION AND TESTING SERVICES
514 PATTANAKARN ROAD SOI 19, SUANLUANG, SUANLUANG BANGKOK 10250
TEL: 0217-500027 FAX: 0217-51485

Certificate of Calibration

Cert. No.: 22CH1733
Page: 1 of 3

Equipment : pH Meter
Manufacturer : Mettler Toledo
Model : SevenExcellence
Serial No. : B834291445
ID No. : RYG_EN0152
Condition As-Received: Used Item
Received Date : 21 December 2022
Calibration Date : 22 December 2022
Reference : 2212-0602DSC-1
Submitted by : ALS Laboratory Group (Thailand) Co., Ltd.
Rayong Branch
616/10 Moo 5 T.Moenm Khu,
A.Pluakdaeng, Rayong 21140, Thailand

Ambient Temperature : (25 ± 2.5) °C
Relative Humidity : (50 ± 15) %
Calibration Procedure : In-house method :
- CP-CH5 by direct measurement with standard
voltage calibrator and direct measurement with
certified reference material (CRM)
- CP-CH8 by comparison with standard thermometer

Calibrated by : Warakorn Lemgagrakul

Approved by :
Approved Signatory

Issue Date : 26 December 2022

The Uncertainties are for a confidence probability of approximately 95%
This certificate may not be reproduced unless in full, except with the prior written
Approval of the head of Corporate Services & Equipment Calibration and Testing Services.

Condition of this calibration result

1. Reference Standard Instrument :-
Instrument Serial No. ID No. Cert. No. Due Date
1) Document Process Calibrator 54030049 130RC116 22E2769 24 Aug 2023
2) Ref. Standard Thermometer 4802054 110RC044 2211306 27 Oct 2023
This certification is traceable to the International System of Unit maintained at:-
- Traceable to National Institute of Metrology (Thailand), NIMT

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

Buffer Solution	Manufacturer	Lot No.	Exp. date
pH 4.006	CPA chem	826588	09 July 2024
pH 6.867	CPA chem	823322	20 June 2023
pH 10.008	CPA chem	826590	09 July 2023

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

Calibration Results
Function : mV Measurement
Performing standard curve by Fluke at pH (4.7,10)

Unit Under Calibration	Nominal Value	Standard Voltage Input		Actual Reading		Uncertainty of Measurement (±mV)	Coverage factor k
		mV	pH	mV	pH		
pH Meter S/N: B834291445	4.000	177.48	177.3	4.000	0.058	2.00	
	7.000	0.00	-0.1	7.000	0.058	2.00	
	10.000	-177.48	-177.5	10.000	0.058	2.00	

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Cert.No.: 22CH1733
Page: 3 of 3

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 (mV)	Uncertainty of pH measurement (\pm)	Coverage factor k
pH Electrode S/N: 1475518	4.008 6.967 10.008	4.011 6.990 10.014	155.2 10.4 -155.5	0.0052 0.0088 0.0072	2.06 2.00 2.00

Function: Temperature Measurement

(*) Without adjustment

This equipment was connected with Temperature Probe:

- Model: InLab Expert Pro-ISM
- Serial No.: 1475518
- Dimension of probe:
- Length: 120 mm.
- Diameter: 12 mm.
- Immersion Depth: 100 mm.

Calibration Point (°C)	Standard Temperature (°C)	UUC* Reading (°C)	Error (°C)	Uncertainty of measurement (\pm °C)	Coverage factor k
25.0	25.001	24.9	-0.101	0.13	2.00

Remark: - 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 %.

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CORPORATE SERVICES & EQUIPMENT CALIBRATION AND TESTING SERVICES
5344 PATTANAKARN ROAD SUITE 101, SUANLUANG, SUANLUANG, BANGKOK 10250
TEL: 0-2713-3890-24 FAX: 0-2719-9184



Certificate of Calibration

Certificate No.: 22E4080
Page: 1 of 2

Equipment: pH Meter
Manufacturer: Metro Toledo
Model: SevenExcellence
Serial No.: B034291445
ID No.: RYG_EN0152
Condition As-Received: Used Item

Received Date: 21 December 2022
Calibration Date: 23 December 2022

Reference: 2212-0602DSC Submitted by: ALS Laboratory Group (Thailand) Co., Ltd. Rayong Branch
Ambient Temperature: (23 \pm 2) °C
Relative Humidity: (50 \pm 10) %
816/10 Moo 5, T.Maenam Khu, A.Pluekdeang,
Rayong 21140, Thailand

Procedure used: Calibration were conducted using in-house calibration Procedure CP-E17 According to direct measurement method with Multi-Product Calibrator.

Condition of this result of calibration

1 Reference standards instruments:

Instrument	Model	Serial No.	Certificate No.	Due Date
1) Multi-Product Calibrator	5500A	6315011	22E1431	05 May 2023

2 This result of calibration was made on requested at the point specified by customer.

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

4 This Calibration is traceable to the International System of Unit maintained at:
National Institute of Metrology (NIMT)

Calibrated by: Wutthachon Wongchukrane Approved Signatory:
Issue Date: 25 December 2022
[x] Phatinee Phatsoel
[] Nuntawat Khanchai
[] Ponnitipon Tanoyakul

0304803



Cert. No.: 22E4080
Page: 2 of 2

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

Function: DC voltage measurement

Standard Value (mV)	UUC* Reading (mV)	Error (mV)	Uncertainty (\pm μ V)
-200.0000	-200.0	0.0	72
-150.0000	-150.0	0.0	69
-100.0000	-100.0	0.0	65
-50.0000	-50.0	0.0	62
0.0000	0.0	0.0	58
50.0000	50.0	0.0	62
100.0000	100.0	0.0	65
150.0000	150.0	0.0	69
200.0000	199.9	-0.1	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 %

*UUC= Unit Under Calibration.

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Certificate of Calibration

Equipment: SPECTROPHOTOMETER
Model: DR6000
Serial No. (or ID): 1627845 (RYG_EN0037)
Manufacturer: HACH
Condition: In Condition

Certificate No.: C06220484
Issued Date: 27 September 2022
Job No.: KSPR2212224
Page: 1 of 3

Customer: ALS Laboratory Group (Thailand) Co., Ltd. (Rayong Branch)
816/10 Moo 5 T.Maenam Khu,
A.Pluekdeang, Rayong 21140, Thailand.

REVIEW BY:
APPROVED BY:
NEK/CAL/DATE: 27/9/24

Environment Condition: Temperature 23.1 °C \pm
Humidity 85.4 %RH \pm 3.2 %RH

Calibration Place: ALS Laboratory Group (Thailand) Co., Ltd. (Rayong Branch) (Wet Chemistry)
816/10 Moo 5 T.Maenam Khu,
A.Pluekdeang, Rayong 21140, Thailand.

Calibration By: Mr. Chittaphon Falthong
Calibration Date: 27 September 2022
The Method used: In house method, CAL-WI-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. 81418 and 81435
The standard for Photometric Certificate No. 81441 and 101088
The standard for Stray light Certificate No. 101041 and 101040
The standard for Spectral resolution Certificate No. 101037

(Mr. Chittaphon Falthong)
Person in charge

(Mr. Thalenglaet Pongnong)
Authorized signatory

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

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

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

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DKSH Technology Limited
2525 Sukhumvit Road, Bangkok, Thailand, 10110
Phone: +66 2888 7800 Email: info@dksh.com Website: www.dksh.com

Delivering Growth - In Asia and Beyond.

CAL/FA-C06-13: 20 Jul 2022

Calibration Results:
Without Adjustment

Wavelength Accuracy (nm), The spectral bandwidth of Std at 2 nm and UUC at 2 nm				
Standard Wavelength	Unit Under Calibration	Correction	Uncertainty	
418.61	418.4	0.21	0.14	
536.66	536.7	-0.04	0.14	
637.96	638.3	-0.32	0.14	
748.48	748.8	-0.32	0.14	
807.03	807.4	-0.37	0.18	
Photometric Accuracy (Absorbance)				
Wavelength	Standard Absorbance	Unit Under Calibration	Correction	Uncertainty
420 nm	0.0000	0.000	0.0000	0.0045
	0.5806	0.583	-0.0025	0.0045
	0.7334	0.737	-0.0036	0.0045
440 nm	1.0634	1.067	-0.0036	0.0045
	0.0000	0.000	0.0000	0.0045
	0.5503	0.563	-0.0127	0.0045
485 nm	0.7179	0.720	-0.0021	0.0045
	1.0312	1.034	-0.0028	0.0045
	0.0000	0.000	0.0000	0.0045
546.1 nm	0.5024	0.506	-0.0036	0.0045
	0.6865	0.672	-0.0147	0.0045
	0.9604	0.964	-0.0036	0.0045
590 nm	0.0000	0.000	0.0000	0.0045
	0.5188	0.519	-0.0022	0.0045
	0.8903	0.891	-0.0007	0.0045
635 nm	0.9904	0.992	-0.0016	0.0045
	0.0000	0.000	0.0000	0.0045
	0.6526	0.654	-0.0016	0.0045
656.1 nm	0.7175	0.718	-0.0005	0.0045
	1.0301	1.031	-0.0009	0.0045
	0.0000	0.000	0.0000	0.0045
685 nm	0.5387	0.538	-0.0013	0.0045
	0.6847	0.686	-0.0003	0.0045
	0.9823	0.983	-0.0007	0.0045

Unit Under Calibration: Spectrophotometer
 DKSH Technology Limited
 2823 Sukhumvit Road, Bangkok, Thailand 10110
 Phone: +66 2088 7900 Email: info@dksh.com Website: www.dksh.com

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Calibration Results:
Without Adjustment

Photometric Accuracy (Absorbance)				
Wavelength	Standard absorbance	Unit Under Calibration	Correction	Uncertainty
235 nm	0.0000	0.000	0.0000	0.0080
	0.7423	0.744	-0.0017	0.0083
257 nm	0.0000	0.000	0.0000	0.0080
	0.8609	0.861	-0.0001	0.0084
313 nm	0.0000	0.000	0.0000	0.0080
	0.2895	0.292	-0.0025	0.0080
350 nm	0.0000	0.000	0.0000	0.0080
	0.8381	0.838	0.0001	0.0080
Sirey Light *				
Standard: cut-off	UUC: Wavelength (nm)	UUC: Transmission (NT)	Absorbance (A)	
280.87 +/- 0.11 nm	280.7	2.1	1.678	
391.94 +/- 0.11 nm	391.9	1.7	1.770	
Spectral Resolution *				
Nominal Concentration 0.02 % w/v	Peak	Trough	Ratio	SSW
Standard Wavelength (nm)	268.80	268.53	1.39	2.00
UUC: Wavelength (nm)	268.2	266.1		
Std Absorbance (A)	0.4810	0.3178		
Absorbance (A)	0.373	0.288		

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

The End of Certificate

Unit Under Calibration: Spectrophotometer
 DKSH Technology Limited
 2823 Sukhumvit Road, Bangkok, Thailand 10110
 Phone: +66 2088 7900 Email: info@dksh.com Website: www.dksh.com

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ใบตรวจสอบสภาพเครื่องวัดสิ่งแวดล้อม

เลขที่ใบงาน: KSPR2212224

ชนิดเครื่องมือ: SPECTROPHOTOMETER รุ่น: DM8000 หมายเลขเครื่อง: 1827845

ตรวจสอบ (วัน)		รายการตรวจเช็ค	ตรวจสอบ (ค่า)		หมายเหตุ
27 Sep 2022			27 Sep 2022		
ปกติ	ไม่ปกติ		ปกติ	ไม่ปกติ	
General					
<input checked="" type="checkbox"/>	<input type="checkbox"/>	1. ความสมบูรณ์เครื่อง	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	2. ความสะอาด (ช่องใส่ตัวอย่าง, ภายใน-แขนหลอด)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	3. สวิตช์ เปิด - ปิด เครื่อง (On-Off Switch)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	4. ปุ่มกด (Keypad)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	5. หน้าจอ (Display, Screen Contrast)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
Spectrophotometer					
<input type="checkbox"/>	<input type="checkbox"/>	6. แบตเตอรี่ (Battery Backup) >= 2.6 VDC	<input type="checkbox"/>	<input type="checkbox"/>	
<input type="checkbox"/>	<input type="checkbox"/>	7. ควบคุมเลือกความยาวคลื่น (Wavelength Control)	<input type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	8. ความยาวคลื่น (Wavelength Check)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	656.1 นา 656.1 nm
<input checked="" type="checkbox"/>	<input type="checkbox"/>	9. แหล่งกำเนิดแสง (UV < 3,000 hour)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	10. แหล่งกำเนิดแสง (Visible < 5,000 hour)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	11. รถวิ่งภายในห้อง (Carousel Module)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
pH Meter and Conductivity Meter					
<input type="checkbox"/>	<input type="checkbox"/>	12. อิเล็กโทรด (Electrode and Connection Cable)	<input type="checkbox"/>	<input type="checkbox"/>	
<input type="checkbox"/>	<input type="checkbox"/>	13. ระบบการหมุนเวียน Electrode (Level KCl)	<input type="checkbox"/>	<input type="checkbox"/>	
<input type="checkbox"/>	<input type="checkbox"/>	14. ฝาปิดป้องกัน Electrode (Dust Protection Hood)	<input type="checkbox"/>	<input type="checkbox"/>	
<input type="checkbox"/>	<input type="checkbox"/>	15. ขาตั้งอิเล็กโทรด (Stand)	<input type="checkbox"/>	<input type="checkbox"/>	
Turbidimeter					
<input type="checkbox"/>	<input type="checkbox"/>	16. ค่าความขุ่นไม่มี (No Sample)	<input type="checkbox"/>	<input type="checkbox"/>	
<input type="checkbox"/>	<input type="checkbox"/>	17. ขั้วไฟฟ้าวัดค่าความขุ่น (>= 2.5 ไมครอน 3.0)	<input type="checkbox"/>	<input type="checkbox"/>	
Automatic Diluter					
<input type="checkbox"/>	<input type="checkbox"/>	18. สวิตช์ Piston Burette	<input type="checkbox"/>	<input type="checkbox"/>	
<input type="checkbox"/>	<input type="checkbox"/>	19. Function Rinsing and Dosing	<input type="checkbox"/>	<input type="checkbox"/>	
<input type="checkbox"/>	<input type="checkbox"/>	20. ระบบการผสมและควบคุมการไหล	<input type="checkbox"/>	<input type="checkbox"/>	

ผู้ตรวจสอบหน้า:

Mr. Chaturphon Folthong
Service Engineer

Unit Under Calibration: Spectrophotometer
 DKSH Technology Limited
 2823 Sukhumvit Road, Bangkok, Thailand 10110
 Phone: +66 2088 7900 Email: info@dksh.com Website: www.dksh.com

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

Carl No.: 22TW34
Page: 1 of 2

Certificate of Testing

Equipment:	DO Meter
Manufacturer:	YSI
Model:	5000-115V
Serial No.:	15E102796
ID No.:	RYG_EN0032
Received Date:	11 February 2022
Test Date:	14 February 2022
Reference:	2202-0404DSC-4
Submitted by:	ALS Laboratory Group (Thailand) Co., Ltd. (Rayong Branch) 615/10 Moo 5 T. Maenam Khu. A Phrakdaeng, Rayong 21140, Thailand
Laboratory Condition:	Temperature (25 ± 5) °C Humidity (50 ± 20) %
Test Procedure:	In-house method : CP-CH9 by Comparison Technique with Azido Modification Method
Tested by:	Waleak Sirithean
Approved by:	 Approved Signatory
Issue Date:	18 February 2022

() Maice Butkuea
() Salhip Meangmai
() Warakorn Longagtrakul

0281285



Cert.No.: 221W34
Page: 2 of 2

Result : Dissolved Oxygen Meter Adjustment With Air 100 %
Dissolved Oxygen Probe No.: 15E100454

Titration Method (Azide Modification Method) (mg/L)	DO Meter Reading (mg/L)	Standard Deviation (mg/L)
8.02	8.02	0.0084

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

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TEL: 0 2717 9800-27 FAX: 0 2719 9884



Cert. No.: 22LM12
Page: 1 of 2

Certificate of Calibration

Equipment : DO Meter with Sensor
Manufacturer : YSI
Model : 5000-115V
Serial No. : 15E102786
ID No. : RYG_EN0032
Submitted by : ALS Laboratory Group (Thailand) Co., Ltd. (Rayong Branch)
616/10 Moo 5 T. Maenam Khu, A. Phusikdaeng,
Rayong 21140, Thailand
Location : TPA On Site Calibration Laboratory
Received Order : 11 February 2022
Calibrated Date : 21 February 2022
Ambient Temperature : (26 ± 10) °C
Relative Humidity : (50 ± 30) %
AC Line Voltage : (220 ± 22) V
Calibrated by : Kunchit Promprai

Approved by :
Approved Signatory

() Pornthipha Tameyskul
(✓) Malee Bulkruea
() Suwit Imjai

Issue Date : 21 February 2022

The Uncertainties are for a confidence probability of approximately 95%

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A 0038008



Equipment : DO Meter with Sensor
Condition As-Received : Used Item
Reference : 2202-0404DSC-5
Procedure Used :-

Cert. No.: 22LM12
Page: 2 of 2

Calibration were conducted using in-house calibration procedure CP-OT01 according to comparison with Industrial Platinum Resistance Thermometer (IPRT) into Temperature Bath.
The temperature scale used was based on ITS-90.

Condition of this result of calibration

1. Reference standard instrument:-

Instrument	Model	Serial No.	Cert. No.	Due Date
1) Digital Thermometer	1523	2186080	2111273	22 Nov 2022

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

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

Result of Calibration :- (*) Without Adjustment

Function : Temperature measurement.

This instrument was connected with temperature sensor, S/N: 15E100454

Calibration Point (°C)	Immersion Depth (mm)	Standard Temperature (°C)	UUC [*] Reading (°C)	Error (°C)	Uncertainty (± °C)	Coverage Factor k
20.00	45	20.001	19.88	-0.121	0.15	2.00

UUC^{*} : Unit Under Calibration

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

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Malee

a 1095714



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TEL: 0 2717 9800-27 FAX: 0 2719 9884



Cert. No.: 22TM317
Page: 1 of 3

Certificate of Calibration

Equipment : Low Temp. Incubator
Manufacturer : Mammert
Model : IPP750
Serial No. : VB18 0084
ID No. : RYG_EN0154
Submitted by : ALS Laboratory Group (Thailand) Co., Ltd.
(Rayong Branch)
616/10 Moo 5 T. Maenam Khu,
A. Phusikdaeng, Rayong 21140, Thailand
BOD Room
Location :
Received Order : 22 April 2022
Calibration Date : 22 April 2022
Ambient Temperature : (26 ± 10) °C
Relative Humidity : (50 ± 30) %
Calibrated by : Man Pattanapongpaiboon

Approved by :
Approved Signatory

() Pornthipha Tameyskul
(✓) Malee Bulkruea
() Suwit Imjai

Issue Date : 3 May 2022

The Uncertainties are for a confidence probability of approximately 95%

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A 0040735



Equipment : Low Temp. Incubator
 Condition As-Received : Used Item
 Reference : 2204-01480C-1
 Procedure Used :-

Cert. No.: 22TM317
 Page: 2 of 3

Calibration were conducted using calibration procedure CP-0702 according to direct measurement
 The temperature scale used was based on ITS-90.

Condition of this result of calibration

1. Reference standard instrument:-

Instrument : Model : Serial No. : Cert. No. : Due Date :
 1) Data Acquisition : 34970A : MY44031768 : 21LM12 : 02 Sep 2022

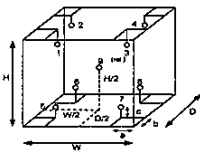
2. This certificate is valid only to the item calibrated on date and place of calibration.

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

Result of Calibration :- () Without Adjustment

Function of UUC :- Temperature Source

Fresh air setting : Close



Probe Installation Details : Dimension of Chamber :
 a = 10 cm 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		
Parameter	Beginning	Finished
Temp. (°C)	25	25
REL.Humid. (%)	54	58
AC Supply (Volt)	221	223

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

a 1106485



Equipment : Low Temp. Incubator
 Condition As-Received : Used Item
 Reference : 2204-01480C-1
 Result of Calibration :- () Without Adjustment
 Function of UUC :- Temperature Source
 Fresh air setting : Close

Cert. No.: 22TM317
 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
20.0	20.0	20.0	0.022	0.20	0.22	0.30	2

Calibration Point (°C)	Measured Temperature (°C)								
	Position								
20.0	1	2	3	4	5	6	7	8	9 (ref.)
20.0	20.209	20.174	20.199	20.110	20.075	20.062	20.027	20.068	20.030

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

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

-09-

a 1106484

RYG_EN0002

Sartorius (Thailand) Co., Ltd.
 129 Rama 9 Road, Huaywang, Huaywang, Bangkok 10310
 Tel : +66 2643 8361-6, e-mail : service.thailand@sartorius.com



SARTORIUS

Certificate of Calibration

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

Model Number : MSE224S-100-DU Certificate No. : 23BC0112
 Description : Analytical Balance Issued Date : Friday, March 03, 2023
 Serial Number : 0026207038 Reference No. : 204833
 ID No. : RYG_EN0002
 Manufacturer : Sartorius Page No. : 1 of 2

Customer Name : ALS Laboratory Group (Thailand) Co., Ltd. (Rayong Branch)
 616/10 Moo 5 T.Maenam Khu, A.Pluak Daeng, Rayong 21140, Thailand.

Calibrated Place : ALS Laboratory Group (Thailand) Co., Ltd. (Balance Room)
 616/10 Moo 5 T.Maenam Khu, A.Pluak Daeng, Rayong 21140, Thailand.

Calibrated By : Mr Chonchai Inthana

Calibration Date : Wednesday, March 01, 2023

Calibration Procedure No. : This calibration was conducted by Using in-house calibration procedure number (V8-003) Based on UKAS LAB 14, 2019

Metrological data :

Capacity : 220 g Readability : 0.0001 g

Ambients Conditions:

Temperature : 23.6 °C ± 5.0 °C
 Humidity : 60.0 % RH ± 10.0 % RH
 Pressure : ±

Reasons for calibration

☐ New Installation ☐ Service / Repaired ☐ In calibration / Maintenance

Equipment Condition: ☒ Good Operate ☐ Fail

Measurement Method UKAS Publication Ref: Lab 14

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

Traceability:

Model Number	Description	Traceability	Certificate No.	Due Date
YC5011-522-00	Sartorius weight set 1mg, 5000g E2 YC5011-522-00	SPC-RT	C02212595	14-Sep-2023
MHB-382SD	Humidity/Balometer/Temp. Lubon MHB-382SD	DKSH	C19220444	5-Sep-2023

This certificate relate and apply this equipment only
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[Signature]
 Mr Chonchai Inthana (Technical Manager)
 S T A M P

Sartorius (Thailand) Co., Ltd.
 129 Rama 9 Road, Huaywang, Huaywang, Bangkok 10310
 Tel : +66 2643 8361-6 Fax : +66 2643 8367, e-mail : service.thailand@sartorius.com

SARTORIUS

Certificate of Calibration

Model Number : MSE224S-100-DU Certificate No. : 23BC0112
 Description : Analytical Balance Issued Date : Friday, March 03, 2023
 Serial Number : 0026207038 Reference No. : 204833
 ID No. : RYG_EN0002
 Manufacturer : Sartorius Page No. : 2 of 2

Calibration Results : Without Adjustment

Repeatability			Eccentricity (Off-center loading error)		
The repeatability is the ability of a weighing instrument to display nearly identical results under constant test conditions when the same load within a measurement range is placed repeatedly on the weighing pan in the same manner. The standard deviation is used to express reproducibly quantitatively.			The off-center loading error is created by the difference between the result of the load 1e 1/5 or 1/4 of maximum capacity placed in the middle of the weighing pan and between each of four additional measurement points (positions defined according to OIML R111).		
Nominal Value : (Low Load)	20.0000	199.9999	Nominal value :	100 g	
20 g	20.0000	200.0000	Tolerance	0.0004 g	
0.0001 g	20.0000	199.9999			Difference
	20.0000	200.0000			1
	20.0000	199.9999			2
Nominal Value : (High Load)	20.0000	199.9999			3
200 g	19.9999	200.0000			4
	20.0000	200.0000			5
0.0001 g	20.0000	199.9999			6
	20.0000	200.0000			
Standard Deviation	0.00003	0.00003			

Linearity

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

Tolerance		0.0002 g		
Nominal Value	Conventional Mass Value	Displayed Value	Deviation	Uncertainty
(g)	(g)	(g)	(g)	(g)
0.01	0.0100	0.0100	0.0000	0.00014
0.05	0.0500	0.0500	0.0000	0.00014
0.1	0.1000	0.1000	0.0000	0.00014
0.5	0.5000	0.5000	0.0000	0.00014
1	1.0000	1.0000	0.0000	0.00014
5	5.0000	5.0000	0.0000	0.00014
10	10.0000	10.0000	0.0000	0.00014
20	20.0000	20.0000	0.0000	0.00014
50	50.0000	50.0000	0.0000	0.00014
100	100.0000	99.9999	-0.0001	0.00019
200	200.0000	200.0000	0.0000	0.00032

End of Report



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TEL: 0-2717-9460-2 FAX: 0-2719-9464



Cert. No.: 22TM1517
Page: 1 of 3

Certificate of Calibration

Equipment: Hot Air Oven

Manufacturer: Memmert

Model: UFE 500

Serial No.: G511.1572

ID No.: RYG_EN0010

Submitted by: ALS Laboratory Group (Thailand) Co., Ltd. (Rayong Branch)
616/10 Moo 5 T. Maenam Khu,
A. Phukdaeng,
Rayong 21140 Thailand

Location: Oven Room

Received Order: 20 October 2022

Calibration Date: 20 October 2022

Ambient Temperature: $(26 \pm 10) ^\circ\text{C}$

Relative Humidity: $(50 \pm 30) \%$

Calibrated by: Man Pattanapongpaiboon

Approved by:
Approved Signatory

() Pornthippa Tameyakul
(x) Malice Butkuea
() Suwit Imjai

Issue Date: 2 November 2022

The Uncertainties are for a confidence probability of approximately 95%

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

A 0046908



Equipment: Hot Air Oven
Condition As-Received: Used Item
Reference: 2210-03760C-2

Cert. No.: 22TM1517
Page: 2 of 3

Procedure Used :-

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

The temperature scale used was based on ITS-90.

Condition of this result of calibration

1. Reference standard instrument:-

Instrument	Model	Serial No.	Cert. No.	Due Date
1) Data Acquisition	34972A	MY40023892	22LM97	29 Jul 2023

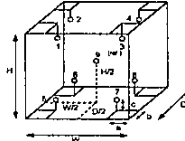
2. This certificate is valid only to the item calibrated on date and place of calibration.

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

Result of Calibration: () Without Adjustment

Function of UUC*: Temperature Source

Fresh air setting: Close



Probe Installation Details: Dimension of Chamber:
a = 5.0 cm D = 0.40 m
b = 5.0 cm W = 0.56 m
c = 5.0 cm H = 0.46 m
Capacity = 0.11 m³

Environment during calibration		
	Beginning	Finished
Temp. (°C)	25	25
REL Humid. (%)	54	59
AC Supply (Volt)	223	225

Ref. Std. ID No.: 0 Calibration Point		
Position:	(150) °C	(104) °C
1	21-16TC-01	20-16RTD-01
2	21-16TC-02	20-16RTD-02
3	21-16TC-03	20-16RTD-03
4	21-16TC-04	20-16RTD-04
5	21-16TC-05	22-16RTD-05
6	21-16TC-06	20-16RTD-06
7	21-16TC-07	20-16RTD-07
8	21-16TC-08	22-16RTD-08
9 (ref.)	21-16TC-09	22-16RTD-09

a 1132466



Equipment: Hot Air Oven
Condition As-Received: Used Item
Reference: 2210-03760C-2
Result of Calibration: () Without Adjustment
Function of UUC*: Temperature Source
Fresh air setting: Close

Cert. No.: 22TM1517
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
104.0	104.0	104.0	0.076	0.52	0.50	0.42	2
180.0	180.0	180.0	0.13	0.88	1.2	1.1	2

Calibration Point (°C)	Measured Temperature (°C)								
	Position								
	1	2	3	4	5	6	7	8	9 (ref.)
104.0	103.768	103.734	103.723	103.800	104.215	104.131	104.132	103.740	103.747
180.0	179.723	179.359	179.439	179.469	180.361	180.114	180.131	180.243	179.605

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

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

Overall Variation: The Difference of the maximum and minimum measured temperatures throughout observation UUC*: Unit Under Calibration

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

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

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a 1132455



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Cert. No.: 22TM1402
Page: 1 of 3

Certificate of Calibration

Equipment: Hot Air Oven

Manufacturer: Memmert

Model: UM 400

Serial No.: b495.0390

ID No.: RYG_EN0005

Submitted by: ALS Laboratory Group (Thailand) Co., Ltd. (Rayong Branch)
616/10 Moo 5, T. Maenam Khu,
A. Phukdaeng,
Rayong 21140, Thailand

Location: Oven Room

Received Order: 20 October 2022

Calibration Date: 20 October 2022

Ambient Temperature: $(26 \pm 10) ^\circ\text{C}$

Relative Humidity: $(50 \pm 30) \%$

Calibrated by: Preecha Hiahb

Approved by:
Approved Signatory

() Pornthippa Tameyakul
(x) Malice Butkuea
() Suwit Imjai

Issue Date: 2 November 2022

The Uncertainties are for a confidence probability of approximately 95%

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A 0046905



Equipment : Hot Air Oven
Condition As-Received : Used Item
Reference : 2210-03760C-1

Cert. No.: 22TM1492
Page : 2 of 3

Procedure Used :-

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

The temperature scale used was based on ITS-90.

Condition of this result of calibration

1. Reference standard Instrument:-

Instrument : Model : Serial No. : Cert. No. : Due Date :
1) Data Acquisition : 34970A : MY44035217 : 21LM30 : 23 Dec 2022

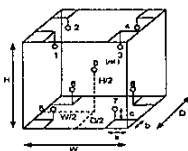
2. This certificate is valid only to the item calibrated on date and place of calibration.

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

Result of Calibration :- (*) Without Adjustment

Function of UUC* : Temperature Source

Fresh air setting : Close



Probe Installation Details :

a = 5.0 cm
b = 5.0 cm
c = 5.0 cm
Dimension of Chamber :
D = 0.33 m
W = 0.40 m
H = 0.40 m
Capacity = 0.053 m³

Environment during calibration		
	Beginning	Finished
Temp. (°C)	28	29
REL Humid. (%)	43	47
AC Supply (Volt)	220	221

Position :	Ref. Std. ID No.:
1	18-10RTD-01
2	18-10RTD-02
3	18-10RTD-03
4	18-10RTD-04
5	18-10RTD-05
6	18-10RTD-06
7	18-10RTD-07
8	18-10RTD-08
9 (ref.)	18-10RTD-09

a 1132473



Equipment : Hot Air Oven
Condition As-Received : Used Item
Reference : 2210-03760C-1

Cert. No.: 22TM1492
Page : 3 of 3

Result of Calibration :-

Function of UUC* : Temperature Source

Fresh air setting : Close

Calibration Point (°C)	UUC* Setting (°C)	UUC* Reading (°C)	Temperature stability (± °C)	Temperature uniformity (°C)	Overall Variation (°C)	Uncertainty (± °C)	Coverage Factor
70.0	70.0	70.0	0.079	0.47	0.77	0.42	2

Calibration Point (°C)	Measured Temperature (°C)								
	Position								
70.0	1	2	3	4	5	6	7	8	9 (ref.)
	70.262	69.895	70.078	70.177	70.854	70.039	70.688	70.149	70.326

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

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

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

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

UUC* : Unit Under Calibration

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

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

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a 1132472

RYG_EN0061



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334/4 PATTANAKARN ROAD 501 B.R. MAEUNG, SUKUMVIT 11, BANGKOK 10250
TEL. 0-2713-3099-27 FAX. 0-2719-5483



Cert. No.: 22TM1491
Page : 1 of 3

Certificate of Calibration

Equipment : Water Bath

Manufacturer : Memmert

Model : WNB22

Serial No. : L513.0548

ID No. : RYG_EN0061

Submitted by : ALS Laboratory Group (Thailand) Co., Ltd. (Rayong Branch)
616/10 Moo 5, T. Maenam Khu.
A. Phuekdeang,
Rayong 21140, Thailand

Location : Wet Chemistry Lab

Received Order : 20 October 2022

Calibration Date : 20 October 2022

Ambient Temperature : (26 ± 10) °C

Relative Humidity : (50 ± 30) %

Calibrated by : Preecha Hahib

Approved by :
Approved Signatory

() Pornthipha Tameyakul
(/) Mahee Butkruea
() Suwit Imjai

Issue Date : 2 November 2022

The Uncertainties are for a confidence probability of approximately 95%

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

A 0045906



Equipment : Water Bath
Condition As-Received : Used Item
Reference : 2210-03760C-4

Cert. No.: 22TM1491
Page : 2 of 3

Procedure Used :-

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

Thermometer (IPRT).

The temperature scale used was based on ITS-90.

Condition of this result of calibration

1. Reference standard Instrument:-

Instrument : Model : Serial No. : Cert. No. : Due Date :
1) Data Acquisition : 34970A : MY44035217 : 21LM30 : 23 Dec 2022

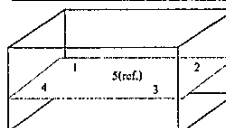
2. This certificate is valid only to the item calibrated on date and place of calibration.

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

Result of Calibration :- (*) Without Adjustment

Function of UUC* : Temperature Source

	Environmental		AC Voltage Supply
	(°C)	(%R.H.)	(Volt)
Beginning of Calibration	24	53	222
Finished of Calibration	24	50	221



Front

Position :	Ref. Std. S/N.:
1	N37P300726
2	N37P300727
3	N37P300728
4	N37P300729
5 (ref.)	N37P300730

Melu.

a 1132471



Equipment : Water Bath
 Condition As-Received : Used Item
 Reference : Z210-03760C-4
 Result of Calibration : (°) Without Adjustment
 Function of UUC* : Temperature Source

Cert. No.: 22TM1491
 Page: 3 of 3

Calibration point (°C)	UUC* Setting (°C)	UUC* Reading (°C)	Average* Standard Reading (°C)				
			Position				
			1	2	3	4	5 (ref.)
85.0	85.0	85.0	84.527	84.563	84.528	84.516	84.560

Calibration point (°C)	Uniformity (°C)	Stability (± °C)	Uncertainty (± °C)	Coverage Factor k
85.0	0.12	0.081	0.18	2

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

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

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

UUC* : Unit Under Calibration

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

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

-00-

a 1132470



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
 CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES
 534 PATTANAKARN ROAD MOO 10, SUANLUNG, SUANLUNG BANGKOK 10250
 TEL: 0-2717-90027 FAX: 0-2719-9484



Cert.No.: 22CH1084
 Page: 1 of 2

Certificate of Calibration

Equipment : pH Meter
 Manufacturer : Mettler Toledo
 Model : SevenGo
 Serial No. : C129171462
 ID No. : RYG_FS0549
 Condition As-Received : Used Item
 Received Date : 17 August 2022
 Calibration Date : 19 August 2022
 Reference : 2208-0023DSC-1
 Submitted by : ALS Laboratory Group (Thailand) Co., Ltd. Rayong Branch
 616/10 Moo 5 T. Maenam Khu, A. Pluakdaeng, Rayong 21140, Thailand
 Ambient Temperature : (25 ± 2.5) °C
 Relative Humidity : (50 ± 15) %
 Calibration Procedure : In-house method :
 - CP-CHS by direct measurement with standard voltage calibrator and direct measurement with certified reference material (CRM)
 Calibrated by : Warakorn Lemgagrakul
 Approved by :
 Approved Signatory
 () Malee Butkuea
 () Saibhip Maengmai
 () Warakorn Lemgagrakul
 Issue Date : 22 August 2022

The Uncertainties are for a confidence probability of approximately 95%

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A 0044346



Cert. No.: 22CH1084
 Page: 2 of 2

Condition of this calibration result

1. Reference Standard Instrument :-

Instrument	Serial No.	ID No.	Cert. No.	Due Date
1) Document Process Calibrator	54030049	130RC116	21E2862	25 Aug 2022

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

- Traceable to National Institute of Metrology (Thailand), NIMT

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

Buffer Solution	Manufacturer	Lot No.	Exp. date
pH 4.008	CPA chem	623320	20 June 2024
pH 6.985	CPA chem	794122	14 Feb 2023
pH 10.008	CPA chem	823323	20 June 2023

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

Calibration Results

Function : mV Measurement

Performing standard curve by Fluke at pH (4.7,10)

Unit Under Calibration	Nominal Value	Standard Voltage Input	Actual Reading		Uncertainty of Measurement (±mV)	Coverage factor k
	pH	mV	mV	pH		
pH Meter S/N: C129171492	4.00	177.48	178	4.00	0.58	2.00
	7.00	0.00	0	7.00	0.58	2.00
	10.00	-177.48	-178	10.00	0.58	2.00

Function : pH Measurement

Performing three buffers standard curve by using buffer nominal pH (4.7,10)

Unit Under Calibration	Standard pH Buffer Solution	Actual pH Reading	Actual mV Reading (mV)	Uncertainty of pH measurement (±)	Coverage factor k
pH Electrode S/N: 1231783	4.008	4.01	171	0.0086	2.05
	6.985	7.00	-2	0.011	2.00
	10.008	10.00	-174	0.0082	2.00

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

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 TEL: 0-2717-90027 FAX: 0-2719-9484



Cert. No.: 22LM112
 Page: 1 of 2

Certificate of Calibration

Equipment : pH Meter with Sensor
 Manufacturer : Mettler Toledo
 Model : SevenGo
 Serial No. : C129171492
 ID No. : RYG_FS0549
 Submitted by : ALS Laboratory Group (Thailand) Co., Ltd.
 (Rayong Branch)
 616/10 Moo 5 T. Maenam Khu, A. Pluakdaeng, Rayong 21140 Thailand
 Location : TPA On Site Calibration Laboratory
 Received Order : 17 August 2022
 Calibrated Date : 19 August 2022
 Ambient Temperature : (26 ± 10) °C
 Relative Humidity : (50 ± 30) %
 AC Line Voltage : (220 ± 22) V
 Calibrated by : Kunchit Promprat
 Approved by :
 Approved Signatory
 () Ponthipha Tameyakul
 () Malee Butkuea
 () Suwit Injai
 Issue Date : 24 August 2022

The Uncertainties are for a confidence probability of approximately 95%

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A 0044522



Equipment : pH Meter with Sensor
Condition As-Received : Used Item
Reference : 2208-0623DSC-3

Cert. No.: 22UM112
Page: 2 of 2

Procedure Used :-

Calibration were conducted using In-house calibration procedure CP-OT01 according to comparison with Industrial Platinum Resistance Thermometer (IPRT) into Temperature Bath.
The temperature scale used was based on ITS-90.

Condition of this result of calibration

1. Reference standard instrument:-

Instrument	Model	Serial No.	Cert. No.	Due Date
1) Digital Thermometer	1502A	A52847	2111144	20 Oct 2022

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

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

Result of Calibration :- () Without Adjustment

Function : Temperature measurement.

This instrument was connected with temperature sensor, S/N.: 1231763

Calibration Point (°C)	Immersion Depth (mm)	Standard Temperature (°C)	UUC* Reading (°C)	Error (°C)	Uncertainty (± °C)	Coverage Factor k
25.0	120	24.999	25.1	0.101	0.16	2.00
30.0	120	30.001	30.1	0.099	0.16	2.00
40.0	120	40.004	40.1	0.096	0.16	2.00
50.0	120	50.003	50.1	0.097	0.16	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 %.

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a 1122902

METTLER TOLEDO

Certificate Number CPH-0167-22

Calibration Certificate Seven2Go™ pH/mV meter S2

Customer

Company: ALE LABORATORY GROUP (THAILAND)
Address: 515/19 Moo 5, T. Maemurak, A. Phakding, RAYONG 21140
Customer ID number: 321003073
Customer representative:

Instrument

Type: Seven2Go™ pH/mV S2
Instrument Serial Number: C22110514
Internal Identification:
Firmware version: 1.01

Technical specifications

Measuring Range: -1900 to 1999.5 mV
Resolution: 0.1 mV
Limit of Error: ± 1 mV
Temperature range MTC: -5 to 105 °C
Temperature range ATC: -5 to 105 °C
Resolution: 0.1 °C
Limit of Error: ± 0.3 °C

Procedure Statement

METTLER TOLEDO Seven2Go Service Manual Section B (Date: Rev. 002/2021) will be used as reference documentation to adjust and verify the measurement indicated in the "Type" and "Serial number" section. The measurement results of this calibration were obtained at ambient conditions.

REVIEW BY	Tanagit
APPROVED BY	Supt S
NEXT CAL DATE	16 July 2023

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Page 1 of 1

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METTLER TOLEDO

Certificate Number CPH-0167-22

Certification Tools

Certified digital voltmeter
Manufacturer: HANNA HI 9811A
Type: HI 9811A
Serial number: US36021161
Certificate number: F13214136
Date of Certification: EXTENDED 2021

Certified Temperature Resistors
Manufacturer: METTLER TOLEDO
Type: 21302410
Serial number: A297
Certificate number: 0.9611
Date of Certification: 2022.7.2022

Designation	Nominal value	Certified value
NTC 30 ± 0.1 °C	30.100 ± 0.01	30.100 ± 0.01
NTC 30 ± 0.1 °C	30.100 ± 0.01	30.100 ± 0.01
NTC 30 ± 0.1 °C	30.100 ± 0.01	30.100 ± 0.01
NTC 30 ± 0.1 °C	30.100 ± 0.01	30.100 ± 0.01
NTC 30 ± 0.1 °C	30.100 ± 0.01	30.100 ± 0.01

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METTLER TOLEDO

Certificate Number CPH-0167-22

Certification Measurements

Designation	Certified value	Measured value	Max. Tolerance	Passed / Failed
plmV Sensor Input				
-1900 mV	-1900.0 mV	-1900.0 mV	± 1 mV	Passed
-1000 mV	-1000.0 mV	-1000.0 mV	± 1 mV	Passed
-500 mV	-500.0 mV	-500.0 mV	± 1 mV	Passed
-100 mV	-100.0 mV	-100.0 mV	± 1 mV	Passed
0 mV	0.0 mV	0.0 mV	± 1 mV	Passed
100 mV	100.0 mV	100.0 mV	± 1 mV	Passed
500 mV	500.0 mV	500.0 mV	± 1 mV	Passed
1000 mV	1000.0 mV	1000.0 mV	± 1 mV	Passed
1900 mV	1900.0 mV	1900.0 mV	± 1 mV	Passed

Designation	Nominal value	Measured value	Max. Tolerance	Passed / Failed
Temperature Sensor Input				
NTC 30 ± 0.1 °C	30.1 °C	30.1 °C	± 0.3 °C	Passed
NTC 30 ± 0.1 °C	30.1 °C	30.1 °C	± 0.3 °C	Passed
NTC 30 ± 0.1 °C	30.1 °C	30.1 °C	± 0.3 °C	Passed
NTC 30 ± 0.1 °C	30.1 °C	30.1 °C	± 0.3 °C	Passed
NTC 30 ± 0.1 °C	30.1 °C	30.1 °C	± 0.3 °C	Passed

Summary of Certification

Certification of instrument **Passed**

The instrument referred to in this certificate has fulfilled the criteria of the certificate. This is indicated by the notation Passed in the column above.

Remarks:

Certification of the instrument was performed by:

Name: Phatima Manthornakul Function: Service Technician

Company: METTLER TOLEDO

Date: July 21, 2022 Signature: *[Signature]*

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Page 1 of 1

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Mettler-Toledo (Thailand) Limited

METTLER TOLEDO

Performance Test

Attachment to Certificate No. CPH-0157-02

pH Electrode

Type: InLab Expert Go-ISM SN: 2103768

Certified standards used

Standard 1:	Type: pH Buffer	Manufacturer: METTLER TOLEDO	Exp. date: Jun-24
	Nominal value: pH (25.00 °C):	4.01	Lot No. 1H15AG
Standard 2:	Type: pH Buffer	Manufacturer: METTLER TOLEDO	Exp. date: Jan-24
	Nominal value: pH (25.00 °C):	7.00	Lot No. 1H15SD
Standard 3:	Type: pH Buffer	Manufacturer: METTLER TOLEDO	Exp. date: May-24
	Nominal value: pH (25.00 °C):	9.20	Lot No. 1H15SA
Standard 4:	Type: Radox Solution	Manufacturer: METTLER TOLEDO	Exp. date: -
	Nominal value: pH (25.00 °C):	-	Lot No. -

Adjustment

Set Calibration Buffer		25 (25 °C) 4.00, 6.01, 7.00, 9.21, 11.00					
Select Calibration Mode		3-Point calibration		2-Point calibration		3-Point calibration	
3-Point Calibration		°C	pH	°C	pH	°C	pH
Cal 1		ATC 25.4	4.01	ATC 25.0	-	ATC 25.0	-
Cal 2		ATC 25.3	7.00	ATC 25.0	-	ATC 25.0	-
Offset (mV)		0		-		-	
Slope % (per mV/pH)		99.8		-		-	
Cal 3		ATC 25.4	9.21	-		-	
Slope % (per mV/pH)		99.8		-		-	

Measurements

Before adjustment				After adjustment					
Buffer Values		Measured	Difference	Buffer Values		Measured	Difference		
pH	°C	pH	pH	pH	°C	pH	pH		
4.01	25.4	ATC	3.98	-0.05	4.01	25.4	ATC	4.01	0.00
7.00	25.2	ATC	6.95	-0.05	7.00	25.4	ATC	6.99	-0.01
9.20	25.4	ATC	9.13	-0.07	9.20	25.4	ATC	9.21	0.01

Note: The difference result of calibrated electrode should be within ± 0.05 pH

Remarks

Place: Chemical room Calibration Date: July 27, 2022
Service Specialist: Prascha Manoonysart Signature: *[Signature]*

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REV 06 / Version: 15 Jul 2022

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Automation Service Co.,Ltd.

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929 92911 301 Patsungam Rd., Patungam, Suanlung, Bangkok 10200
โทรสาร (Fax) 0 2319 9994 โทรสาร (Fax) 0 2319 9996 website : www.automation.co.th

MTOC : L-1002/2022

Report No. : ALS-799/02

ASI Maintenance Report

Instrument : Automatic Sample Injector Measuring : Vial 40 mL
Model : ASI-L Place of Installation : -
Serial No. : H57415200799 Department : LABORATORY
Manufacture : Shimadzu

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

Date of Maintenance : 03 / 10 / 2022

Ambient Condition : Temperature 25.4 \pm 5 °C
Humidifier 60 \pm 15 %RH

Maintenance By : *[Signature]*
(Mr. Peerapong Sangpan)
Technician

Approved By : *[Signature]*
(Mr. Nipon Phungsoomsak)
Technician Manager

User Name : *[Signature]*
(Ms. Sinlek Puengseng)

SHIMADZU ANALYZER
1/3

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MTOC : L-1002/2022

Report No. : ALS-799/02

Maintenance Sheet

Customer : ALS Laboratory Date : 03 / 10 / 2022
Model : ASI-L Serial No. : H57415200799

Item	Carry out maintenance work	Result	Exchange	Comment
1.	Arm Drive section	O.K.		
	Check Arm Drive Belt for wear and tension	O.K.		
	Check grease of Screw Arm Drive	O.K.		
2.	Rinse pump (only ASI-V 24mL, 40mL)	O.K.		
	Check pump rate (>40mL/min)	O.K.		
	Check pump and tube connection for leakage	O.K.		
	Check if outlet flow is in proper condition	O.K.		
3.	Check and if necessary exchange consumable, Maintenance parts	O.K.		See appropriate list of maintenance parts
4.	Check Stirrer (When installed)	O.K.		
5.	Verify ASI function via mechanical check	O.K.		

Inspection by : *[Signature]*
(Mr. Peerapong Sangpan)
Technician

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MTOC : L-1002/2022

Report No. : ALS-799/02

List of Consumable, Maintenance parts

Pos.	Part Number	Part Name	Result	Exchange	Recommended Interval
1.	017-27021-01	Grease Paste, Lubricant 100g	O.K.		1 time per year
2.	032-22661-02	Belt, 60S2m596, Arm Drive	O.K.		1 time per year
3.	034-03067-02	Spring, F-642, Arm Drive	O.K.		Depending on condition
4.	042-00405-11	Pump Head, for ASI Rinse Pump (only ASI-V 24mL, 40mL)	O.K.		After 300 h of operating
5.	638-41448-01	Std. Needle Type1 24mL, 40mL* (for tube 2, 1x1, 6), Spurge needle	N/A		Depending on condition
6.	638-41448-02	Std. Needle Type1 125mL* (for tube 2, 1x1, 6)	N/A		Depending on condition
7.	631-41600-03	Flare Pipe 2x1.5x700mm* (for Standard Needle Type1 24mL, 40mL, 125mL)	N/A		Depending on condition (may cut to origin length 600mm)
8.	638-41450-01	Needle for Suspended Particles, 0.8mm (only ASI-V 24mL, 40mL)	N/A		Depending on condition
9.	638-41450-01	Std. Needle Type2 125mL* (for tube 1, 4x0.9)	N/A		Depending on condition
10.	638-41472-01	Std. Needle Type2 24mL, 40mL* (for tube 1, 4x0.9)	O.K.		Depending on condition
11.	631-41660-02	Flare Pipe 1.4x0.9x600mm* (for Suspended + Needle Type2)	O.K.		Depending on condition
12.	638-41449-01	Double Needle, only 24mL, 40mL (simultaneous spurge type)*	N/A		Depending on condition
13.	631-41660-01	Flare Pipe 1.1x0.8x600mm* (for Double Needle 24mL, 40mL)	N/A		Depending on condition

*Note: needed parts depending on installed needle types!

Inspection by : *[Signature]*
(Mr. Peerapong Sangpan)
Technician

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MTOC: L-1001/2022

Report No.: ALS-416/02

TOC-L Maintenance Report

Instrument : Total Organic Carbon Analyzer Measuring : TC 0 - 30000 mg/L
Model : TOC-LCSH Place of Installation :
Serial No. : H54425300416 Department : LABORATORY
Manufacture : Shimadzu

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

Date of Maintenance : 03 / 10 / 2022

REVIEW BY : Vichuda N.
APPROVED BY : Sirlok P.
NEXT CAL DATE : 11/01/23

Ambient Condition : Temperature 25.4 ± 5 °C
Humidifier 60 ± 15 %RH

Maintenance By : Peerapong Sangpan
(Mr. Peerapong Sangpan)
Technician

Approved By : N. Phongsomak
(Mr. Nipon Phongsomak)
Technician Manager

User Name : Sirlok P.
(Supervisor)

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MTOC: L-1001/2022

Report No.: ALS-416/02

Maintenance Sheet

Customer : ALS Laboratory Date : 03 / 10 / 2022
Model : TOC-LCSH Serial No. : H54425300416

Item	Carry out maintenance work	Result	Exchange	Comment
1.	Check functionality of the device			
	Check furnace temperature (Standard cat. 680 °C / for TN cat. 720 °C)	O.K.		
	Check dehumidifier temperature (± 1 °C)	O.K.		
	Check the entire flow line related to leakage	O.K.		
	Check baseline status (OK)	O.K.		
	Check carrier gas pressure (200 ± 10 kPa)	O.K.		
	Check carrier gas flow rate (150 mL/min)	O.K.		
2.	Tubos			
	Check all tubing for contamination, if necessary clean them	O.K.		
	Check all tubing for tight connection	O.K.		
3.	Container and Drainage			
	Fill up humidifier with pure water to max. level	O.K.		
	Check filling of dilution water and acid container	O.K.		
	Rinse Drain Pot. after wards refill again with pure water	O.K.		
	Check if outlet flow is in proper conditions	O.K.		
4.	TC and IC Injection			
	Clean injector Block	O.K.		
	Check injector Block for wear	O.K.		
	Check injection tube adjustment	O.K.		
	Check injection for leakage	O.K.		
	Check injection for clogging	O.K.		
5.	IC Measurement (N-type)			
	Check acidification in syringe			
	Check sparging in syringe			
6.	Eye check of 8-Port valve, for sample residues or moist spots that indicate possible leakage	O.K.		
7.	Check and if necessary exchange consumable, Maintenance parts	O.K.		See list of consumable, maintenance parts

Inspection by : Peerapong Sangpan
(Mr. Peerapong Sangpan)
Technician

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MTOC: L-1001/2022

Report No.: ALS-416/02

Item	Carry out maintenance work	Result	Exchange	Comment
8.	Due to instrument condition, clean the instrument inside and outside.	O.K.		
9.	After checking the system and exchanging of consumable and maintenance parts a new 1-3 point calibration have to be done.	O.K.		Addition test 1.
10.	After wards the calibration perform check sample measurement.	O.K.		Addition test 2.

Addition test

Test no.	Test conditions	Meas. value	Result
1.	Calibration TC standard solution at 0, 0.1, 0.5, 1, 5, 10, 20 Injection volume 50 µL No. of measurement 2 times (Max.3)		Attachment : ALS-416/02 Page 1/4 - 2/4
	Criteria : R² = 0.995 or more	1.0000	Pass
2.	Measurement of reagent water and TC standard solution at 5.0 mg/L injection volume 50 µL No. of measurement 2 times (Max.3) and calculate accuracy by Meas. of TC standard - Meas. of Reagent water		Attachment : ALS-416/02 Page 3/4 - 4/4
	Criteria : Accuracy %Recovery 10% or less	5.477 - 0.4414 = 5.0356 ppm	Pass

Inspection by : Peerapong Sangpan
(Mr. Peerapong Sangpan)
Technician

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MTOC: L-1001/2022

Report No.: ALS-416/02

List of Consumable, Maintenance parts

Pos.	Part Number	Part Name	Result	Exchange	Recommended Interval
1.	036-11209-84	O-ring, 4D P10A (Viton , for TC/IC Slider)	O.K.	✓	1 time per year, Depending on condition
2.	036-11219-84	O-ring, 4D P20 (for sealing TC-Combustion tube)	O.K.	✓	1 time per year, Depending on condition
3.	638-15025	O-ring, P1FE (for TC/IC Slider)	O.K.		1 time per year, Depending on condition
4.	630-00105-01	Platinum net, (2pcs-set) (to support catalyst)	O.K.		6 month same time as catalyst exchange
5.	630-00557	Silica Wool (to support catalyst)	O.K.		6 month same time as catalyst exchange
6.	630-00992	Hologen Scrubber	O.K.	✓	6 month
7.	630-00996	High Sensitivity TC Catalyst (When installed)	N/A		Depending on condition
8.	638-60116	Regular Catalyst (33g) (When installed)	O.K.	✓	6 month
9.	638-56251-01	8-Port valve rotor	O.K.		1 time per year
10.	638-41323	TC-Combustion Tube	O.K.		6 month same time as catalyst exchange
11.	631-43404-01	Packing, gasket slider (for TC-Injection tube)	O.K.		1 time per year, Depending on condition
12.	638-59296	Syringe 5mL	O.K.		Depending on condition
13.	638-59296-01	Plunger Tip (for syringe 5mL)	O.K.	✓	6 month
14.	042-00405-11	IC reagent supply pump head	O.K.		1 time per year
15.	630-00999	CO2-Absorber (for cell space purge)	O.K.	✓	1 time per year
16.	630-00964	Molecular Sieves 13x	O.K.		1 time per year

Note. Table indicates the guidelines replacement periods when NPOC measurement is performed on sample that are comparatively as clean as tap water, use standard catalyst and at a rate of about 500 sample per month (operating five days a week)

Inspector By : Peerapong Sangpan
(Mr. Peerapong Sangpan)
Technician

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TOC-Control L Report

10/10/2022 10:14:06 AM

Instrument Information

Instrument Options
Catalyst

TOC-ASI LC Line
Reggie Sensitivity

Cal Curve

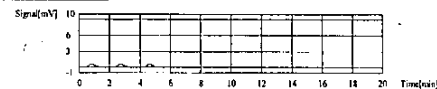
Sample Name
Sample ID
Cal Curve
Status

Unlabeled
TOC-1 20 ppm 2022-10-01_14_06_24
Completed

Conc: 0.020mg/L

Time	Area	Height	Width	Area%	Height%	Width%
1.14	1.00	1.00	1.00	100.00	100.00	100.00

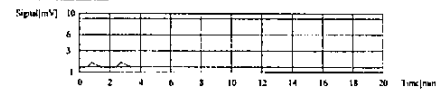
Area: 1.00
Mean Area: 1.00
SD Area: 0.00
CV Area: 0.00%



Conc: 0.100mg/L

Time	Area	Height	Width	Area%	Height%	Width%
1.14	10.00	10.00	1.00	100.00	100.00	100.00

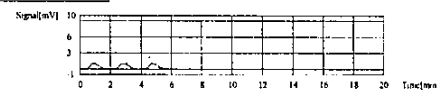
Area: 10.00
Mean Area: 10.00
SD Area: 0.00
CV Area: 0.00%



Conc: 0.500mg/L

Time	Area	Height	Width	Area%	Height%	Width%
1.14	50.00	50.00	1.00	100.00	100.00	100.00

Area: 50.00
Mean Area: 50.00
SD Area: 0.00
CV Area: 0.00%



Conc: 1.000mg/L

Time	Area	Height	Width	Area%	Height%	Width%
1.14	100.00	100.00	1.00	100.00	100.00	100.00

Area: 100.00
Mean Area: 100.00
SD Area: 0.00
CV Area: 0.00%



TOC-Control L Report

10/10/2022 10:14:06 AM

Instrument Information

Instrument Options
Catalyst

TOC-ASI LC Line
Reggie Sensitivity

Cal Curve

Sample Name
Sample ID
Cal Curve
Status

Unlabeled
TOC-1 20 ppm 2022-10-01_14_06_24
Completed

Conc: 0.020mg/L

Time	Area	Height	Width	Area%	Height%	Width%
1.14	1.00	1.00	1.00	100.00	100.00	100.00

Area: 1.00
Mean Area: 1.00
SD Area: 0.00
CV Area: 0.00%



Conc: 0.100mg/L

Time	Area	Height	Width	Area%	Height%	Width%
1.14	10.00	10.00	1.00	100.00	100.00	100.00

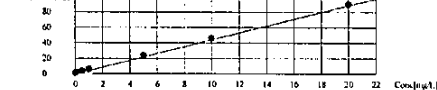
Area: 10.00
Mean Area: 10.00
SD Area: 0.00
CV Area: 0.00%



Conc: 0.500mg/L

Time	Area	Height	Width	Area%	Height%	Width%
1.14	50.00	50.00	1.00	100.00	100.00	100.00

Area: 50.00
Mean Area: 50.00
SD Area: 0.00
CV Area: 0.00%



Conc: 1.000mg/L

Time	Area	Height	Width	Area%	Height%	Width%
1.14	100.00	100.00	1.00	100.00	100.00	100.00

Area: 100.00
Mean Area: 100.00
SD Area: 0.00
CV Area: 0.00%



TOC-Control L Report

10/10/2022 10:14:06 AM

Instrument Information

Instrument Options
Catalyst

TOC-ASI LC Line
Reggie Sensitivity

Sample

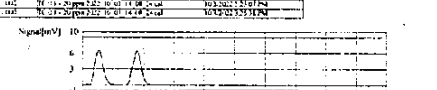
Sample Name
Sample ID
Origin
Status
CNA Result

Unlabeled
TOC-1 20 ppm 2022-10-01_14_06_24
Completed

Conc: 0.020mg/L

Time	Area	Height	Width	Area%	Height%	Width%
1.14	1.00	1.00	1.00	100.00	100.00	100.00

Area: 1.00
Mean Area: 1.00
SD Area: 0.00
CV Area: 0.00%



TOC-Control L Report

10/10/2022 10:14:06 AM

Instrument Information

Instrument Options
Catalyst

TOC-ASI LC Line
Reggie Sensitivity

Sample

Sample Name
Sample ID
Origin
Status
CNA Result

Unlabeled
TOC-1 20 ppm 2022-10-01_14_06_24
Completed

Conc: 0.020mg/L

Time	Area	Height	Width	Area%	Height%	Width%
1.14	1.00	1.00	1.00	100.00	100.00	100.00

Area: 1.00
Mean Area: 1.00
SD Area: 0.00
CV Area: 0.00%

