

ภาคผนวก ง

ใบรับรองการสอบเทียบเครื่องมือ



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รายการเครื่องมือที่ใช้บริการตรวจวัด / ทดสอบ

Sample Name	Parameter	Equipment Name	ID No.	Calibrated Date	Next Cal	Freq. Calibra (Months)
Stack	Carbon Monoxide	Console Control Unit	BKX_F50408	12-Jul-22	12-Jan-23	6
Stack	Carbon Monoxide	Dry Gas	BKX_F50543	12-Jul-22	12-Jan-23	6
Stack	Carbon Monoxide	CO Analyzer	RYS_EK0034	11-May-22	11-May-23	12
Stack	Oxides of Nitrogen	Console Control Unit	BKX_F50408	12-Jul-22	12-Jan-23	6
Stack	Oxides of Nitrogen	Dry Gas	BKX_F50543	12-Jul-22	12-Jan-23	6
Stack	Oxides of Nitrogen	Vacuum Gauge	RYS_F50332	21-Sep-21	22-Mar-23	18
Stack	Oxides of Nitrogen	SPECTROPHOTOMETER	RYS_EK0037	27-Sep-22	27-Mar-24	18
Stack	Total Suspended Particulate	Console Control Unit	BKX_F50408	12-Jul-22	12-Jan-23	6
Stack	Total Suspended Particulate	Dry Gas	BKX_F50543	12-Jul-22	12-Jan-23	6
Stack	Total Suspended Particulate	Digital Balance	RYS_EK0003	23-Mar-22	23-Mar-23	12
Ambient	Total Suspended Particulate	High Volume	RYS_F50173	-	-	On site Calibration
Ambient	Total Suspended Particulate	High Volume	RYS_F50396	-	-	On site Calibration
Ambient	Total Suspended Particulate	High Volume	RYS_F50176	-	-	On site Calibration
Ambient	Total Suspended Particulate	Digital Balance	RYS_EK0003	23-Mar-22	23-Mar-23	12
Ambient	Nitrogen Dioxide	NO ₂ Analyzer	RYS_F50451	1-Jul-22	1-Jan-23	6
Ambient	Nitrogen Dioxide	NO ₂ Analyzer	RYS_F50453	1-Jul-22	1-Jan-23	6
Ambient	Nitrogen Dioxide	NO ₂ Analyzer	RYS_F50463	1-Jul-22	1-Jan-23	6
Ambient	Wind Speed / Wind Direction	Wind Speed / Wind Direction	BKX_F50141	7-Jun-21	6-Dec-22	18
Ambient	Wind Speed / Wind Direction	Wind Speed / Wind Direction	RYS_F50085	8-Oct-21	8-Apr-23	18
Ambient	Wind Speed / Wind Direction	Wind Speed / Wind Direction	RYS_F50138	31-Jan-22	29-Jul-23	18
Noise	Leq 24 hrs	Sound Calibrator	RYS_F50496	10-Jan-22	10-Jan-23	12
Noise	Leq 24 hrs	Sound Level Meter	RYS_F50016	11-Jul-22	11-Jul-23	12
Noise	Leq 24 hrs	Sound Level Meter	RYS_F50017	4-Oct-21	4-Oct-22	12
Noise	Leq 24 hrs	Sound Level Meter	RYS_F50495	10-Jan-22	10-Jan-23	12
Noise	Leq 5 min	Sound Calibrator	RYS_F50496	10-Jan-22	10-Jan-23	12
Noise	Leq 5 min	Sound Level Meter	RYS_F50016	11-Jul-22	11-Jul-23	12
Noise	Leq 5 min	Sound Level Meter	RYS_F50017	4-Oct-21	4-Oct-22	12
Noise	Leq 8 hrs	Sound Calibrator	RYS_F50496	10-Jan-22	10-Jan-23	12
Noise	Leq 8 hrs	Sound Level Meter	RYS_F50007	10-Jan-22	10-Jan-23	12
Noise	Leq 8 hrs	Sound Level Meter	RYS_F50011	11-Jul-22	11-Jul-23	12
Noise	Leq 8 hrs	Sound Level Meter	RYS_F50025	21-Jan-22	21-Jan-23	12
Noise	Leq 8 hrs	Sound Calibrator	RYS_F50213	26-Apr-22	26-Apr-23	12
Noise	Leq 8 hrs	Sound Level Meter	RYS_F50385	26-Aug-22	26-Aug-23	12
Noise	Leq 8 hrs	Sound Level Meter	RYS_F50387	18-Oct-22	18-Oct-23	12
Noise	Leq 8 hrs	Sound Level Meter	RYS_F50348	18-Oct-22	18-Oct-23	12
Noise	Leq 8 hrs	Sound Level Meter	RYS_F50495	10-Jan-22	10-Jan-23	12
Workplace	Total Dust	Field Rotameter	RYS_F50197	1-Jul-22	1-Oct-22	3
Workplace	Total Dust	Field Rotameter	RYS_F50198	1-Oct-22	1-Jan-23	3
Workplace	Total Dust	Digital Balance	RYS_EK0004	23-Mar-22	23-Mar-23	12
Workplace	Syrene	Field Rotameter	RYS_F50199	1-Jul-22	1-Oct-22	3
Workplace	Syrene	Field Rotameter	RYS_F50199	1-Oct-22	1-Jan-23	3
Workplace	Syrene	GC/MSD	BKX_EK0119	1-Oct-21	1-Apr-23	18
Workplace	Total Hydrocarbon	Total Hydrocarbon Analyzer	RYS_EK0038	18-Jan-22	18-Jan-23	12
Rayong Lab	pH at 25 °C	pH meter	RYS_EK0185	17-May-22	17-May-23	12
Rayong Lab	BOD 15 days at 20°C	BOD meter with Sensor	RYS_EK0032	14-Feb-22	13-Aug-23	18
Rayong Lab	BOD 15 days at 20°C	Incubator	RYS_EK0154	22-Apr-22	21-Oct-23	18
Rayong Lab	COD	SPECTROPHOTOMETER	RYS_EK0037	27-Sep-22	27-Mar-24	18
Rayong Lab	Total Suspended Solids	Electronic Balance	RYS_EK0002	23-Mar-22	23-Mar-23	12
Rayong Lab	Total Suspended Solids	Chamber Oven	RYS_EK0002	26-Oct-22	23-Mar-23	18
Rayong Lab	Total Dissolved Solids 180°C	Electronic Balance	RYS_EK0002	23-Mar-22	23-Mar-23	12
Rayong Lab	Total Dissolved Solids 180°C	Chamber Oven	RYS_EK0010	26-Oct-22	26-Apr-24	18
Rayong Lab	Oil & Grease	Electronic Balance	RYS_EK0002	23-Mar-22	23-Mar-23	12
Rayong Lab	Oil & Grease	Chamber Oven	RYS_EK0006	26-Oct-22	26-Apr-24	18
Rayong Lab	Oil & Grease	Water Bath	RYS_EK0001	26-Oct-22	26-Apr-24	18

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Sample Name	Parameter	Equipment Name	ID No.	Calibrated Date	Next Cal	Freq. Calibra (Months)
Rayong Lab	Temperature	pH Meter	RYS_F50420	14-May-22	14-Mar-23	12
Rayong Lab	Total Kjeldahl Nitrogen	Block Digestion Unit	RYS_EK0188	17-May-22	17-Mar-23	12
Rayong Lab	Total Kjeldahl Nitrogen	pH Meter	RYS_EK0183	17-May-22	17-Mar-23	12
Rayong Lab	Color (at pH 7.0)	SPECTROPHOTOMETER	RYS_EK0037	27-Sep-22	27-Mar-24	18
Rayong Lab	Chloride	SPECTROPHOTOMETER	RYS_EK0037	27-Sep-22	27-Mar-24	18
Rayong Lab	Formaldehyde	SPECTROPHOTOMETER	RYS_EK0037	27-Sep-22	27-Mar-24	18
Rayong Lab	Phenolic compounds	SPECTROPHOTOMETER	RYS_EK0037	27-Sep-22	27-Mar-24	18
Rayong Lab	Sulphide	Chamber (Cold Room)	RYS_EK0184	22-Feb-22	22-Feb-23	12
Rayong Lab	Conductivity	Conductivity meter	RYS_EK0029	23-Feb-22	23-Aug-23	18
Rayong Lab	Total Petroleum Hydrocarbon	Refluxor & Balance	RYS_EK0002	23-Mar-22	23-Mar-23	12
Rayong Lab	Total Petroleum Hydrocarbon	Hot Air Oven	RYS_EK0006	26-Oct-22	26-Apr-24	18
Rayong Lab	Total Petroleum Hydrocarbon	Water Bath	RYS_EK0001	26-Oct-22	26-Apr-24	18
Water Lab	Total Organic carbon	TOC Analyzer	BKX_EK0066	3-Oct-22	3-Oct-23	12
Water Lab	Oxyanion/Ionine Fluoride	GC/MSMS	BKX_EK0184	23-Nov-21	22-May-23	18
Water Lab	Hexavalent Chromium	Spectrophotometer	BKX_EK0118	16-Sep-22	16-Sep-23	12
Water Lab	Barium	KPAAS	BKX_EK0043	30-Sep-21	29-Mar-23	18
Water Lab	Barium	Hot Block	BKX_EK0054	7-Apr-22	7-Oct-23	18
Water Lab	Barium	Chamber (Cold Room)	BKX_EK0187	30-Jun-22	30-Dec-23	18
Water Lab	Lead	KPAAS	BKX_EK0043	30-Sep-21	29-Mar-23	18
Water Lab	Lead	Hot Block	BKX_EK0054	7-Apr-22	7-Oct-23	18
Water Lab	Lead	Chamber (Cold Room)	BKX_EK0187	30-Jun-22	30-Dec-23	18
Water Lab	Manganese	KPAAS	BKX_EK0043	30-Sep-21	29-Mar-23	18
Water Lab	Manganese	Hot Block	BKX_EK0054	7-Apr-22	7-Oct-23	18
Water Lab	Manganese	Chamber (Cold Room)	BKX_EK0187	30-Jun-22	30-Dec-23	18
Water Lab	Copper	KPAAS	BKX_EK0043	30-Sep-21	29-Mar-23	18
Water Lab	Copper	Hot Block	BKX_EK0054	7-Apr-22	7-Oct-23	18
Water Lab	Copper	Chamber (Cold Room)	BKX_EK0187	30-Jun-22	30-Dec-23	18
Water Lab	Nickel	KPAAS	BKX_EK0043	30-Sep-21	29-Mar-23	18
Water Lab	Nickel	Hot Block	BKX_EK0054	7-Apr-22	7-Oct-23	18
Water Lab	Nickel	Chamber (Cold Room)	BKX_EK0187	30-Jun-22	30-Dec-23	18
Water Lab	Arsenic	KPAAS	BKX_EK0043	30-Sep-21	29-Mar-23	18
Water Lab	Arsenic	Hot Block	BKX_EK0054	7-Apr-22	7-Oct-23	18
Water Lab	Arsenic	Chamber (Cold Room)	BKX_EK0187	30-Jun-22	30-Dec-23	18
Water Lab	Selenium	KPAAS	BKX_EK0043	30-Sep-21	29-Mar-23	18
Water Lab	Selenium	Hot Block	BKX_EK0054	7-Apr-22	7-Oct-23	18
Water Lab	Selenium	Chamber (Cold Room)	BKX_EK0187	30-Jun-22	30-Dec-23	18
Water Lab	Cadmium	KPAAS	BKX_EK0043	30-Sep-21	29-Mar-23	18
Water Lab	Cadmium	Hot Block	BKX_EK0054	7-Apr-22	7-Oct-23	18
Water Lab	Cadmium	Chamber (Cold Room)	BKX_EK0187	30-Jun-22	30-Dec-23	18
Water Lab	Zinc	KPAAS	BKX_EK0043	30-Sep-21	29-Mar-23	18
Water Lab	Zinc	Hot Block	BKX_EK0054	7-Apr-22	7-Oct-23	18
Water Lab	Zinc	Chamber (Cold Room)	BKX_EK0187	30-Jun-22	30-Dec-23	18
Water Lab	Invalent Chromium	KPAAS	BKX_EK0043	30-Sep-21	29-Mar-23	18
Water Lab	Invalent Chromium	Hot Block	BKX_EK0054	7-Apr-22	7-Oct-23	18
Water Lab	Invalent Chromium	Chamber (Cold Room)	BKX_EK0187	30-Jun-22	30-Dec-23	18
Water Lab	Mercury	DUO-CVM 5 CVMS	BKX_EK0023	6-Jun-22	5-Jun-23	12

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CONSOLE CONTROL UNIT CALIBRATION TEST REPORT

Calibration of Date: 12 Jul 22
 Next Cal Date: 12 Jan 23
 Console Control Meter Data:
 Calibration No: C-120722-BKX_F50408
 Dry Gas Meter No: BKX_F50408
 Console Serial No: 1500205
 Console Model No: XC-572-V
 Barometric Pressure (mm Hg):
 Relative Humidity (%):
 Temperature (°C):
 Reference Dry Gas Meter Data:
 Serial No:
 Model No:
 Correction Factor (ppm):
 Next Calibration Date:

ΔH (mm H ₂ O)	θ minutes	Reference Dry Gas Meter Calibration					Console Control Dry Gas Meter				
		Volumetric			T ₁ (°C)	Volumetric			T ₂ (°C)	Error (%)	
		Final	Initial	Total		Final	Initial	Total			
10	12.80	158.00	0.00	158.00	0.0	344.0	191.0	153.00	33.0	34.0	
15	9.60	158.00	0.00	158.00	0.0	511.4	358.0	153.40	33.0	34.0	
20	6.40	158.00	0.00	158.00	0.0	678.8	525.0	153.80	33.0	34.0	
30	4.80	158.00	0.00	158.00	0.0	846.2	693.0	153.20	33.0	34.0	
150	2.77	158.00	0.00	158.00	0.0	1055.5	893.0	153.40	32.0	32.0	

Y: Rate of reading difference to dry gas meter. Reference for individual count is 0.02 from pumpage.
 Δp: Delta pressure differential. It requires 10/21/24 mm of range 20 °C and 100 mm of mercury. max/CO. Reference for individual count is 1.0.
 Procedure: AS OF 8/2/2019 AS/17-11/15/2017

Calibrated by: Saksit Phansawat
 (Mr Saksit Phansawat)
 Field Scientist (S)
 Approved by: Nattapong Jengwarewong
 (Mr Nattapong Jengwarewong)
 Manager



DIGITAL TEMPERATURE CALIBRATION DATA SHEET

Calibration Date:	12-JUL-22	Ambient Temperature (°C)	30	
Calibration sheet No.:	C-120722-BKX_F50408	Relative Humidity (%):	70	
Digital Temperature ID	BKX_F50408	Reference Temperature ID	BKX_F50509	
Serial No.:	1302005	Serial No.:	7688004	
Model:	XC-572-V	Model:	FLUKE 714	
		Next Calibrate:	26 Jul 23	
Location	Reference Temperature °C	Digital Temperature °C	Error °C	Remark
Stack	0	0	0	
	25	24	-1	
	50	49	-1	
	100	98	-2	
	150	148	-2	
	200	197	-3	
	250	247	-3	
	300	297	-3	
	500	497	-3	
	1000	997	-3	
	1200	1197	-3	
	Probe	100	99	-1
125		124	-1	
150		149	-1	
Oven	100	99	-1	
	125	124	-1	
	150	149	-1	
Filter	100	100	0	
	125	125	0	
	150	148	-1	
Ext	0	0	0	
	10	11	1	
	20	21	1	
Meter	0	0	0	
	25	25	0	
	50	50	0	
AUX	0	0	0	
	25	25	0	
	50	50	0	

Calibrated by: Saksit Phansawat
 (Mr Saksit Phansawat)
 Field Scientist (S)
 Approved by: Nattapong Jengwarewong
 (Mr Nattapong Jengwarewong)
 Manager

Form 281-1008 (Rev. 05-10-19)



Pilot Tube Calibration Data

Pilot Tube Identification Number: BKK_FS0472 Calibration Date: 12 Jul 22
Lab test duct Number: 258-1-13-01 Standard Pilot ID: BKK_FS0441
Calibration Sheet No.: C-120722-BKK_FS0472 Cp Standard: 0.99

Type S Pilot Tube Coefficient Data					
	Type s pilot tube Leg A,B	Standard pilot tube (ΔP, mm.H ₂ O)	Type s pilot tube (ΔP, mm.H ₂ O)	Cp (s) Leg A	Cp (s) Leg B
Test 1	A	12.00	16.60	0.842	-
	B	12.00	16.60	-	0.842
Test 2	A	12.00	16.60	0.842	-
	B	12.00	16.60	-	0.842
Test 3	A	12.00	16.60	0.842	-
	B	12.00	16.60	-	0.842
Cp				0.842	0.842

$$Cp(S) = Cp \cdot \sqrt{\frac{\Delta P(Std)}{\Delta P(S)}}$$

$$Cp(A) - Cp(B) \text{ must BE } \leq 0.01$$

$$\text{Average deviation(A or B)} = \frac{\sum [Cp(s) - Cp(A \text{ or } B)]}{3} \text{ must BE } \leq 0.01$$

Calibrated by: Saksit Phaisanphisit Approved by: Nattapong Jengwareewong
(Mr.Saksit Phaisanphisit) (Mr.Nattapong Jengwareewong)
Field Scientist (4) Field Specialist(1)

Form 281-022-029 (12/01/02)



Pilot Tube Calibration Data

Pilot Tube Identification Number: BKK_FS0473 Calibration Date: 12 Jul 22
Lab test duct Number: 258-1-13-01 Standard Pilot ID: BKK_FS0441
Calibration Sheet No.: C-120722-BKK_FS0473 Cp Standard: 0.99

Type S Pilot Tube Coefficient Data					
	Type s pilot tube Leg A,B	Standard pilot tube (ΔP, mm.H ₂ O)	Type s pilot tube (ΔP, mm.H ₂ O)	Cp (s) Leg A	Cp (s) Leg B
Test 1	A	12.00	16.60	0.842	-
	B	12.00	16.60	-	0.842
Test 2	A	12.00	16.60	0.842	-
	B	12.00	16.60	-	0.842
Test 3	A	12.00	16.60	0.842	-
	B	12.00	16.60	-	0.842
Cp				0.842	0.842

$$Cp(S) = Cp \cdot \sqrt{\frac{\Delta P(Std)}{\Delta P(S)}}$$

$$Cp(A) - Cp(B) \text{ must BE } \leq 0.01$$

$$\text{Average deviation(A or B)} = \frac{\sum [Cp(s) - Cp(A \text{ or } B)]}{3} \text{ must BE } \leq 0.01$$

Calibrated by: Saksit Phaisanphisit Approved by: Nattapong Jengwareewong
(Mr.Saksit Phaisanphisit) (Mr.Nattapong Jengwareewong)
Field Scientist (4) Field Specialist(1)

Form 281-022-029 (12/01/02)



PROBE NOZZLE DIAMETER CALIBRATION DATA SHEET

Calibration Date: 12 Jul 22 Nozzle Set ID: BKK_FS0474
Calibration Sheet No.: C-120722-BKK_FS0474 Vernier Caliper ID: BKK_FS0626

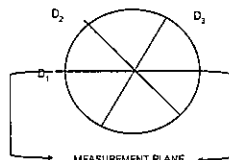
Nozzle ID #	Nozzle Diameter (cm)			HI - Lo ΔD	(D ₁ + D ₂ + D ₃) / 3 D _{avg}
	D ₁	D ₂	D ₃		
1	0.300	0.300	0.300	0.000	0.300
2	0.450	0.450	0.450	0.000	0.450
3	0.600	0.600	0.600	0.000	0.600
4	0.780	0.780	0.780	0.000	0.780
5	0.932	0.932	0.932	0.000	0.932
6	1.094	1.094	1.094	0.000	1.094
7	1.264	1.264	1.264	0.000	1.264

Where:

D₁, D₂, D₃ = Three different nozzle diameters at 60 degrees to each other, each measured the nearest 0.025 mm.

ΔD = Maximum distance between any two diameters, must be ≤ 0.100 mm.

D_{avg} = (D₁ + D₂ + D₃) / 3



Calibrated by: Saksit Phaisanphisit Approved by: Nattapong Jengwareewong
(Mr.Saksit Phaisanphisit) (Mr.Nattapong Jengwareewong)
Field Scientist (4) Field Specialist(1)

Form No. 09-281-022 (12/01/02)



DRY GAS METER CALIBRATION TEST REPORT

Calibration of Date: 12 Jul 22 Barometric Pressure (mm.Hg.): 756
Next Calibration Date: 12 Jan 23 Relative Humidity (%): 70.0
Temperature (°C): 30.0

Dry Gas Meter Data

Calibration Sheet No.: C-120722-BKK_FS0563

Dry Gas Meter No.: BKK_FS0563

Console Serial No.: 1606011

Model No.: XC-62-CV

Reference Dry Gas Meter Data

Serial No.: 1607009

Model No.: SK25EXSR-OC6

Correction Factor (Y): 1.0080

Next Calibration Date: 7 Oct 22

Reference Dry Gas Meter Calibration				Dry Gas Meter							Dry Gas Meter
Vr (liters)			Tr	Vm (liters)			Tl	Tc	Avg. Tm	Correction	
Final	Initial	Total	(°C)	Final	Initial	Total	(°C)	(°C)	(°C)	(Y)	
30.00	0.00	30.00	28.0	30.42	0.00	30.42	28.0	28.0	28.0	0.9855	
30.00	0.00	30.00	28.0	30.45	0.00	30.45	28.0	28.0	28.0	0.9911	
30.00	0.00	30.00	28.0	61.56	0.00	61.56	28.0	28.0	28.0	0.9871	
30.00	0.00	30.00	28.0	61.55	0.00	61.55	28.0	28.0	28.0	0.9872	
30.00	0.00	30.00	28.0	92.22	0.00	92.22	29.0	29.0	29.0	0.9916	
30.00	0.00	30.00	28.0	92.23	0.00	92.23	29.0	29.0	29.0	0.9918	
Avg:										0.9890	

Y = Ratio of reading of reference dry gas meter to dry gas meter; tolerance for individual ± 0.02 from average.

Calibrate by: [Signature] Approved by: Nattapong Jengwareewong
Mr.Warawut Pulpiw (Mr.Nattapong Jengwareewong)
Field Scientist (3) Field Specialist(1)

Form No. 281-022-016 (06/02/02)



DIGITAL TEMPERATURE CALIBRATION DATA SHEET

Calibration Date	12-Jul-22	Ambient Temperature (°C)	30
Calibration sheet No.:	C-120722-BKK_FS0563	Relative Humidity (%)	70
Digital Temperature ID:	BKK_FS0563	Reference Temperature ID:	BKK_FS0609
Console Serial No.:	1608011	Serial No.:	7888004
Model:	XC-62-CV	Model:	FLUKE 714
		Next Calibrate:	28 Jul 23

Location	Reference Temperature °C	Digital Temperature °C	Error °C	Remark
Stack	0	0	0	
	25	25	0	
	50	50	0	
	100	99	-1	
	150	149	-1	
	200	199	-1	
	250	248	-2	
	300	299	-1	
	500	499	-1	
	1000	999	-1	
	1200	1199	-1	
Probe	100	99	-1	
	125	124	-1	
	150	149	-1	
Filter	100	99	-1	
	125	124	-1	
	150	149	-1	
Exit	0	0	0	
	10	9	-1	
	20	19	-1	
Meter	0	0	0	
	25	24	-1	
	50	49	-1	
AUX	0	0	0	
	25	24	-1	
	50	49	-1	

Calibrated by: Saksit Phaisanphat
Mr. Saksit Phaisanphat
Field Scientist (4)

Approved by: Nattapon Jangwareang
(Mr. Nattapon Jangwareang)
Field Specialist (1)

Rev. 281-048 (02-09-02)



Rotameter Calibration Report

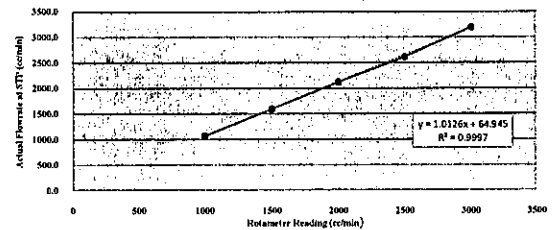
Calibration Date	12-Jul-22	Relative Humidity (%)	70.0
Rotameter ID	BKK_FS0563	Barometric Pressure (mmHg)	755
Calibration Sheet No.	C-120722-BKK_FS0563	Temperature (°C)	30.0

Primary Equipment Data

Brand	Blue	Model	Defender 520 M
Serial No.	129958	ID	KY0_FS0209

Calibration Data

Rotameter Reading (cc/min)	Actual Flowrate (cc/min)				Actual Flowrate at STP (cc/min)
	1	1	3	Avg.	
1000	1096.5	1095.9	1094.3	1095.6	1070.4
1500	1636.7	1639.6	1630.6	1635.6	1598.0
2000	2195.7	2165.7	2174.6	2178.3	2128.4
2500	2657.3	2592.6	2690.8	2640.2	2518.6
3000	3267.6	3283.4	3261.3	3270.8	3193.7



Calibrated by:

(Mr. Wararat Puangsri)
Field Scientist (3)

Approved by:

Nattapon Jangwareang
(Mr. Nattapon Jangwareang)
Field Specialist (1)

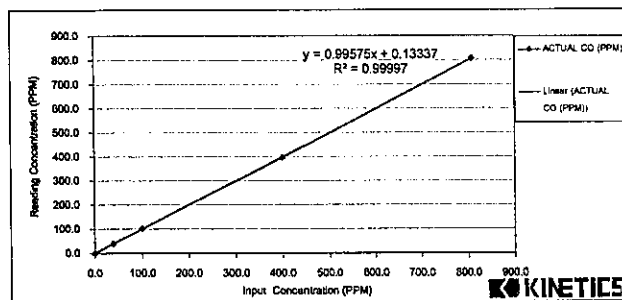
RYG_EN0034

MULTI POINT CALIBRATION REPORT

CUSTOMER NAME: ALS Laboratory Group (Thailand) Co. Ltd.		
EQUIPMENT NAME: CO Analyzer		
MANUFACTURER: Teledyne - API	MODEL: T300	SERIAL NO.: 1215
STANDARD GAS CONCENTRATION (PPM): 4512		CYLINDER NO.: C0745189
CYLINDER PRESSURE (psig): 1800		CERTIFIED DATE: Mar 10, 2021
CERTIFIED BY: AIRGAS SPECIALTY GASES		EXPIRED DATE: Mar 10, 2029

CALIBRATION RESULTS

POINT NO	CALIBRATION RESULTS			
	IDEAL (PPM)	ACTUAL CO (PPM)	ERROR CO (PPM)	% ERROR CO
ZERO	0.000	0.004	0.004	-
1	40,000	40,531	0.531	1.328
2	100,000	101,135	1,135	1.135
3	400,300	399,446	-854	-1.213
4	825,900	807,019	-1,881	-0.233
AVERAGE (%)				0.977



CALIBRATED BY: คุณกรรณ มาศินนาทกร	DATE: 11 พฤษภาคม 2565
คำสั่งการซื้อชุดทางเดินแก๊สเพิ่มเติม: คุณกรรณ มาศินนาทกร โทรศัพท์ 02-515-8997	
เลขที่ 388 ถนนศรีวิภาวนา แขวงจันทรมาน เขตดุสิต กรุงเทพมหานคร 10000 โทรศัพท์: 0-2515-8999 โทรสาร: 0-2515-8988 E-Mail: info@kinetics.co.th	



บริษัท ไคเนติกส์ คอร์ปอเรชั่น จำกัด

KINETICS CORPORATION LTD.

โรงงานผลิตเครื่องวัดมลพิษที่มีคุณภาพระดับโลกจากประเทศไทย

ลูกค้า / ผู้เช่า: ALS Laboratory Group (Thailand) Co. Ltd.

วันที่ 11 พฤษภาคม 2565

รายชื่ออุปกรณ์ / เครื่องมือ: CO Analyzer

บริษัทผู้ผลิต: Teledyne API

หมายเลขอุปกรณ์ / เครื่องมือ: T300

หมายเลขอุปกรณ์ / เครื่องมือ: 1215

TEST VALUES

API MODEL T300		BEFORE	AFTER
1	RANGE 1 - 1000 PPM	100.0	100.0
2	STABILITY < 1 PPM	0.000	0.004
3	CO MEASURE 2500 - 4500 mV	3047.2	3579.0
4	CO REFERENCE 2000 - 4500 mV	2521.6	2959.4
5	PREASURE 25 - 35 in - Hg-A	29.7	29.5
6	SAMPLE FLOW 800 ± 10% cc/min	823	709
7	SAMPLE TEMP 48 ± 4 °C	44.7	44.8
8	BENCH TEMP 48 ± 2 °C	48.0	48.0
9	WHEEL TEMP 68 ± 2 °C	67.8	68.0
10	BOX TEMP AMBIENT ± 5 °C	34.3	35.5
11	PMT DRIVE 250 - 4750 mV	4160.7	4123.5
12	CO SLOPE 1.0 ± 0.3	0.863	0.859
13	CO OFFSET 0.0 ± 0.3	0.008	0.009
14	ELECTRICAL TEST PPM	0.421	0.377
15	CO READING (AMBIENT) PPM	39.184	39.992
16	VOLTAGE TEST +5 V +12 V +15 V -15 V	5.20 / 12.09 / 16.78 / -15.28	5.20 / 12.09 / 16.78 / -15.28
17	ZERO GAS 0.00 PPM	0.150	0.004
18	SPAN GAS 40.0 PPM	38.903	40.061

หมายเหตุ

ใช้แก๊สอ้างอิง Oxygen 2 ขั้ว, Span 1 ขั้ว, Sample Flow 1 ลิ้ว



บริษัท ไคเนติกส์ คอร์ปอเรชั่น จำกัด

(คุณกรรณ มาศินนาทกร)
ตัวแทนจำหน่าย (Signature)

สำหรับการซื้อเพิ่มเติมทางตัวแทนจำหน่าย กรุณาติดต่อ: คุณกรรณ มาศินนาทกร โทรศัพท์ 02-515-8997

เลขที่ 388 ถนนศรีวิภาวนา แขวงจันทรมาน เขตดุสิต กรุงเทพมหานคร 10000 โทรศัพท์: 0-2515-8999 โทรสาร: 0-2515-8988 E-Mail: info@kinetics.co.th



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES
53/44 PATTANAKARN ROAD 501 18 SUKUMVIT, SUKHUMVIT, BANGKOK 10259
TEL. 0-2717-3000-21 FAX. 0-2716-9414



Certificate of Calibration

Certificate No.: 21P3175
Page: 1 of 2

Equipment: Vacuum Gauge
Manufacturer: QualityWell
Model: FZ21A1VD
Serial No.: VG01
ID No.: RYG_FS0332
Condition As-Received: Used Item
Received Date: 15 September 2021
Calibration Date: 21 September 2021

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

Reference: 2109-0560WBC Submitted by: ALS Laboratory Group (Thailand) Co., Ltd.
Ambient Temperature: (23 ± 2) °C
Relative Humidity: (50 ± 15) %
Atmospheric Pressure: 1009 mbar
104 Phatthanakan 40, Phatthanakan Rd.,
Khwaeng Phatthanakan, Khel Suan Luang,
Bangkok 10250 Thailand

Procedure used: The calibration was conducted by direct comparison method against Pressure Measuring Instruments
Standard according to in-house calibration procedure CP-P06, using "DKD-R 5-1"; Calibration of Pressure
Gauges, Edition 03/2014 " as a guidelines.

Condition of this result of calibration

1. Reference standards Instruments:

Instrument	Model	Serial No.	Certificate No.	Due Date
1) Digital Pressure Gauge	15PSIXP21	156670	21P2929	03 Sep 2022

2. This instrument was installed in vertical orientation and center of the dial was used as the reference level.

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

4. Scale and conversion factor is 1 kPa = 0.2953 inHg

5. This instrument was used clean air as pressure media.

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

7. This Certification is traceable to the International System of Unit maintained at:
- National Institute of Metrology Thailand (NIMT)

REVIEW BY: *Phatthana P.*
APPROVED BY: *[Signature]*
NEXT CAL DATE: *21/3/23*

Calibrated by: Sukasri Khanakaw
Issue Date: 22 September 2021

Approved Signatory: *Attapol P.*
[] Phatthana Prabpai
[] Sura Suwananari
[x] Attapol Panurach

H 0268462



Cert No.: 21P3175
Page: 2 of 2

Result of calibration: Without adjustment
Function: Vacuum Pressure Measurement

Range: 0 inHg to -30 inHg
Scale Interval: 0.6 inHg (The Fifth Estimate)

Increasing Pressure	Applied Pressure (inHg)	0.00	-4.74	-9.77	-14.83	-19.74	-25.82
UUC* Indication (inHg)	0.0	-5.0	-10.0	-15.0	-20.0	-25.0	-30.0
Error (inHg)	0.00	-0.26	-0.23	-0.17	-0.26	-0.38	-0.38

Decreasing Pressure	Applied Pressure (inHg)	-25.84	-19.70	-14.78	-9.77	-4.73	0.00
UUC* Indication (inHg)	-26.0	-20.0	-15.0	-10.0	-5.0	0.0	
Error (inHg)	-0.38	-0.30	-0.24	-0.23	-0.27	0.00	

The uncertainty of measurement was ± 0.12 inHg

* UUC = Unit Under Calibration

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 %.

-00-

Attapol P.

a 1068739



Certificate of Calibration

Equipment: SPECTROPHOTOMETER
Model: DR9000
Serial No. (or ID.): 1627845 (RYG_EN0037)
Manufacturer: HACH
Condition: In Condition

Certificate No.: C08220484
Issued Date: 27 September 2022
Job No.: KSPR2212224
Page: 1 of 3

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

REVIEW BY: *N. Bangrat*
APPROVED BY: *[Signature]*
NEXT CAL DATE: *27/3/24*
3.2 %RH

Environment Conditions: Temperature 23.1 °C ±
Humidity 65.4 %RH ±

Calibration Place: ALS Laboratory Group (Thailand) Co., Ltd. (Rayong Branch) (Wat Chemistry)
616/10 Moo 5 T. Maenam Khu,
A. Pluakdeang, Rayong 21140, Thailand.

Calibration By: Mr. Chatchaphon Folthong

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. 91418 and 91435

The standard for Photometric Certificate No. 91441 and 101088

The standard for Stray light Certificate No. 101041 and 101040

The standard for Spectral resolution Certificate No. 101037

[Signature]
(Mr. Chatchaphon Folthong)
Person in charge

[Signature]
(Mr. Thakengkeat Pongngam)
Authorized signatory

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

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

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CALFM-C08-12: 30 JUL 2022



Certificate No.: C08220484 Page 2 of 3

Calibration Results: Without Adjustment

Wavelength Accuracy (nm), The spectral bandwidth of 8nm at 2 nm and UUC at 2 nm				
Standard Wavelength	Unit Under Calibration	Correction	Uncertainty	
418.81	418.4	0.21	0.14	
530.88	530.7	-0.04	0.14	
637.98	638.3	-0.32	0.14	
748.48	748.8	-0.32	0.14	
807.03	807.4	-0.37	0.13	
Photometric Accuracy (Absorbance)				
Wavelength	Standard absorbance	Unit Under Calibration	Correction	Uncertainty
420 nm	0.0000	0.000	0.0000	0.0045
	0.5606	0.563	-0.0026	0.0045
	0.7334	0.737	-0.0036	0.0045
	1.0534	1.067	-0.0036	0.0045
440 nm	0.0000	0.000	0.0000	0.0045
	0.5503	0.563	-0.0027	0.0045
	0.7179	0.720	-0.0021	0.0045
	1.0312	1.034	-0.0028	0.0045
455 nm	0.0000	0.000	0.0000	0.0045
	0.5024	0.506	-0.0036	0.0045
	0.8883	0.872	-0.0027	0.0045
	0.9804	0.984	-0.0036	0.0045
546.1 nm	0.0000	0.000	0.0000	0.0045
	0.6168	0.618	-0.0022	0.0045
	0.8903	0.891	-0.0007	0.0045
	0.9904	0.992	-0.0016	0.0045
590 nm	0.0000	0.000	0.0000	0.0045
	0.5525	0.554	-0.0015	0.0045
	0.7175	0.718	-0.0005	0.0045
	1.0301	1.031	-0.0009	0.0045
635 nm	0.0000	0.000	0.0000	0.0045
	0.5387	0.538	-0.0013	0.0045
	0.8847	0.885	-0.0003	0.0045
	0.9823	0.983	-0.0007	0.0045

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CALFM-C08-12: 30 JUL 2022



Certificate No.: C06220484 Page 3 of 3

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
	0.2896	0.292	-0.0025	0.0080
350 nm	0.0000	0.000	0.0000	0.0080
	0.6381	0.638	0.0001	0.0080

Spectral light *

Standard: cut-off	UUC: Wavelength (nm)	UUC: Transmission (NT)	Absorbance (A)
280.67 +/- 0.11 nm	280.7	2.1	1.678
381.94 +/- 0.11 nm	391.9	1.7	1.770

Spectral Resolution *

Nominal Concentration 0.02 % w/v	Peak	Trough	Ratio	SRW
Standard Wavelength (nm)	268.80	266.83	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

DKSH Technology Limited
2599 หมู่ 9 ต.บางนา-สวนหลวง ร.4 แขวงคลองเตย เขตคลองเตย กรุงเทพฯ 10110
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Phone: +66 (0) 2069-9773 Email: info@dkshcalibration.com Website: www.dkshcalibration.com

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CAL-FM-C06-13: 20 Jul 2022



ใบตรวจสอบสภาพเครื่องวัดสิ่งแวดล้อม

เลขที่ใบงาน: KSPR2212224

ชนิดเครื่องวัด: SPECTROPHOTOMETER

รุ่น: DR8000

หมายเลขเครื่อง: 1827845

ตรวจสอบ (รับ)		รายการตรวจสอบ	ตรวจสอบ (ส่ง)		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-นอกเครื่อง)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	3. สวิตช์ เปิด - ปิด เครื่อง (On-Off Switch)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	4. ปุ่มกด (Keypad)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	5. หน้าจอ (Display, Screen Contrast)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
Spectrophotometer					
<input type="checkbox"/>	<input type="checkbox"/>	6. แบตเตอรี่ (Battery Backup) >= 2.5 VDC	<input type="checkbox"/>	<input type="checkbox"/>	
<input type="checkbox"/>	<input type="checkbox"/>	7. ควบคุมความยาวคลื่น (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"/>	856.1 ± 0.66.1 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. ช่องใส่หลอดตัวอย่าง (Carousel Module)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
pH Meter and Conductivity Meter					
<input type="checkbox"/>	<input type="checkbox"/>	12. ชุดไฟฟ้า (Electrode and Connection Cable)	<input type="checkbox"/>	<input type="checkbox"/>	
<input type="checkbox"/>	<input type="checkbox"/>	13. ระดับสารละลายใน Electrode (Level KCl)	<input type="checkbox"/>	<input type="checkbox"/>	
<input type="checkbox"/>	<input type="checkbox"/>	14. ฝาปิดกันฝุ่น Electrode (Dust Protection Hood)	<input type="checkbox"/>	<input type="checkbox"/>	
<input type="checkbox"/>	<input type="checkbox"/>	15. ฐานยึดเครื่อง (Stand)	<input type="checkbox"/>	<input type="checkbox"/>	
Turbidimeter					
<input type="checkbox"/>	<input type="checkbox"/>	16. การควบคุมตัวอย่าง (No Sample)	<input type="checkbox"/>	<input type="checkbox"/>	
<input type="checkbox"/>	<input type="checkbox"/>	17. ชนิดการวัดค่าความขุ่น (>= 2.5 ไม่นับ 3.0)	<input type="checkbox"/>	<input type="checkbox"/>	
Automatic Diluter					
<input type="checkbox"/>	<input type="checkbox"/>	18. สภาพ Piston Burettes	<input type="checkbox"/>	<input type="checkbox"/>	
<input type="checkbox"/>	<input type="checkbox"/>	19. Function Rinsing and Dosing	<input type="checkbox"/>	<input type="checkbox"/>	
<input type="checkbox"/>	<input type="checkbox"/>	20. ระบบทำความสะอาดอุปกรณ์ภายใน	<input type="checkbox"/>	<input type="checkbox"/>	

เห็นด้วยหรือไม่:

Mr. Chaturaphon Polthong
Service Engineer

DKSH Technology Limited
2599 หมู่ 9 ต.บางนา-สวนหลวง ร.4 แขวงคลองเตย เขตคลองเตย กรุงเทพฯ 10110
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CAL-FM-R31-03: 20 Jul 2022



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Certificate of Calibration

Represent to Certificate of Calibration / PTC/07/22099

Certificate No.: PTC/07/22099 Page: 1 of 2
Equipment: Digital Balance Condition: Normal
Manufacturer: Sartorius Serial No: 31709562
Model: MSU2245-100-DU ID No: RYG_EN0003
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-ONSAC Accreditation No. Calibration D189

Date Received: March 23, 2022

Calibration Date: March 23, 2022

Issued Date: March 25, 2022

Calibration By: Mr. Rungroey Metakul

REVIEW BY: *Thawit*
APPROVED BY: *P. R.*
NEXT CAL DATE: 30/03/2023



Approved By: *(Signature)*
(Mr. Keattisak Kerdio)
Laboratory Manager

Reviewed By: *(Signature)*
(Mr. Krangsak Kiatan)
Reviewed By

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

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 effect that the results relate only to the items calibrated.

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Represent to Certificate of Calibration / PTC/07/22099

Certificate No.: PTC/07/22099

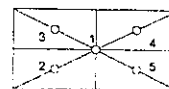
Page: 2 of 2

Measurement Results:

Without Adjustment:

Function Calibration: Non Adjustment

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



Eccentricity test 100 (g)				
Position (g)				
1	2	3	4	5
0.0000	0.0000	-0.0001	-0.0001	0.0001
Maximum deviation: 0.0001				

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

Determination of the standard deviation of weighing balance, Readability 0.0001 (g)

Nominal test value (g)	Standard Deviation
200	0.00007

Error of Indication: from nominal value, Readability 0.0001 (g)

Nominal Value (g)	Conventional Mass (g)	Indication (g)	Correction of Balance (g)	Uncertainty (g)	k
0	0.00000	0.0000	0.0000	0.00020	2.65
0.01	0.01000	0.0099	0.0001	0.00020	2.43
0.1	0.10000	0.1000	0.0000	0.00020	2.43
0.5	0.50000	0.5000	0.0000	0.00020	2.43
1	1.00000	1.0000	0.0000	0.00020	2.43
5	5.00001	5.0000	0.0000	0.00020	2.43
10	10.00000	10.0000	0.0000	0.00020	2.43
20	20.00003	20.0000	0.0000	0.00020	2.43
50	50.00004	50.0000	0.0000	0.00021	2.32
100	100.00004	99.9999	0.0001	0.00022	2.17
200	200.00011	200.0000	0.0001	0.00027	2.05

Note: Weight of adjust (g)

The End of Certificate

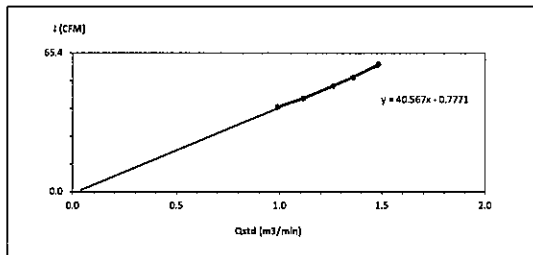
PENTACAL-PTC/07/22099



High Volume Air Sampler Calibration Worksheet

Project Site: Siam Styrene Monomer Co., Ltd. Barometric Pressure (mm Hg): 756
 Calibrate Location: นิคมอุตสาหกรรมอมตะนคร (นิคมอุตสาหกรรมอมตะนคร) Temperature (°C): 32
 Calibrate Date: 25-Oct-22 High Volume ID: RYG-FS0173
 Calibration Sheet No.: C-251022-RYG-FS0173 High Volume Model: TE-S170D
 Calibrator ID: RYG-FS0205 High Volume S/N: 4799
 Calibrator Model: TE-S028A Calibrator Slope: 1.50765
 Calibrator S/N: 1166 Calibrator Intercept: -0.02043

Test No.	Delta H ₂ O (Inch)	Q _{std} (m ³ /min)	I: Chart (CFM)	Linear Regression
1	2.2	0.9903	40	Slope: 40.5669 Intercept: -0.7771 Correlation Coefficient: 0.9975
2	2.8	1.1146	44	
3	3.6	1.2611	50	
4	4.2	1.3605	54	
5	5.0	1.4826	60	



Calibrated by: sitpawit.s
 (Mr. Sitpawit Suwannarat)
 Field Scientist (1)

Approved by: [Signature]
 (Mr. Noppong Juntarapan)
 Enviro Field Coordinator Scientist (3)

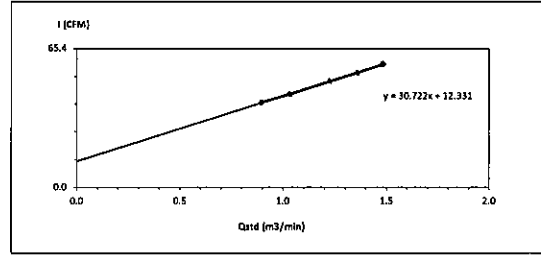
FORM NO: F-06-073 REVISION NO.: ISSUE DATE: 14/03/16



High Volume Air Sampler Calibration Worksheet

Project Site: Siam Styrene Monomer Co., Ltd. Barometric Pressure (mm Hg): 756
 Calibrate Location: นิคมอุตสาหกรรมอมตะนคร Temperature (°C): 32
 Calibrate Date: 25-Oct-22 High Volume ID: RYG-FS0396
 Calibration Sheet No.: C-251022-RYG-FS0396 High Volume Model: TE-S170D
 Calibrator ID: RYG-FS0205 High Volume S/N: 5688
 Calibrator Model: TE-S028A Calibrator Slope: 1.50765
 Calibrator S/N: 1166 Calibrator Intercept: -0.02043

Test No.	Delta H ₂ O (Inch)	Q _{std} (m ³ /min)	I: Chart (CFM)	Linear Regression
1	1.8	0.8977	40	Slope: 36.7217 Intercept: 12.3314 Correlation Coefficient: 0.9999
2	2.4	1.0334	44	
3	3.4	1.2262	50	
4	4.2	1.3605	54	
5	5.0	1.4826	58	



Calibrated by: sitpawit.s
 (Mr. Sitpawit Suwannarat)
 Field Scientist (1)

Approved by: [Signature]
 (Mr. Noppong Juntarapan)
 Enviro Field Coordinator Scientist (3)

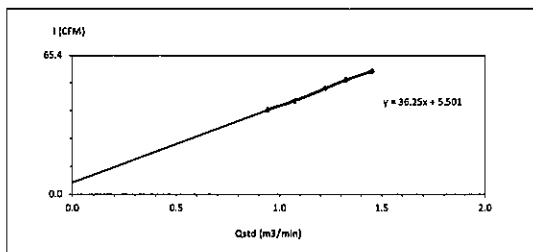
FORM NO: F-06-073 REVISION NO.: ISSUE DATE: 14/03/16



High Volume Air Sampler Calibration Worksheet

Project Site: Siam Polystyrene Co., Ltd. Barometric Pressure (mm Hg): 756
 Calibrate Location: นิคมอุตสาหกรรมอมตะนคร (นิคมอุตสาหกรรมอมตะนคร) Temperature (°C): 32
 Calibrate Date: 25-Oct-22 High Volume ID: RYG-FS0176
 Calibration Sheet No.: C-251022-RYG-FS0176 High Volume Model: TE-S170D
 Calibrator ID: RYG-FS0205 High Volume S/N: 4802
 Calibrator Model: TE-S028A Calibrator Slope: 1.50765
 Calibrator S/N: 1166 Calibrator Intercept: -0.02043

Test No.	Delta H ₂ O (Inch)	Q _{std} (m ³ /min)	I: Chart (CFM)	Linear Regression
1	2.0	0.9452	40	Slope: 36.2503 Intercept: 5.5010 Correlation Coefficient: 0.9990
2	2.6	1.0748	44	
3	3.4	1.2262	50	
4	4.0	1.3282	54	
5	4.8	1.4530	58	



Calibrated by: sitpawit.s
 (Mr. Sitpawit Suwannarat)
 Field Scientist (1)

Approved by: [Signature]
 (Mr. Noppong Juntarapan)
 Enviro Field Coordinator Scientist (3)

FORM NO: F-06-073 REVISION NO.: ISSUE DATE: 14/03/16



PENTA
CALIBRATION

RYG_EN0001
PENTA CALIBRATION CO., LTD.
 66/124 The Connect 33 Village Kanchanaphisek Road
 Dokmai Praveh Bangkok 10250
 Tel: +66 (0) 2069-8773
 www.pentalcal.com

Certificate of Calibration

Represent to Certificate of Calibration: PTC-07/22102

Certificate No.: PTC-07/22102 Page: 1 of 2
 Equipment: Digital Balance Condition: Normal
 Manufacturer: Sartorius Serial No: 25409664
 Model: LA1305-F ID No: RYG_EN0001
 Type of Balance: Single interval

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

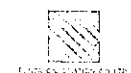
Environment Condition: Temperature 23.9 °C ± 0.3 °C
 Humidity 58.1 %RH ± 4.4 %RH
 Air density 1.17 kg/m³

Calibration Place: ALS Laboratory Group (Thailand) Co., Ltd.
 616/10 Moo 5 T. Maenamkoo, A. Phrakdaeng,
 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.
 , NSQ-ONSQ Accredited No. Calibration 0189

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

REVIEW BY: [Signature]
 APPROVED BY: [Signature]
 NEXT CAL. DATE: 25/03/23



[Signature]
 (Mr. Kriangsak Kalasin)
 Reviewed by

Approved By: [Signature]
 (Mr. Kriangsak Kalasin)
 Laboratory Manager

This certificate is issued the units of measurement according to the International System of Units (SI). It provides traceability of measurement to international or national standard or other recognized national standard laboratories.
 The measurement uncertainty stated 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 effect that the results relate only to the item calibrated.
 This calibration certificate shall not be reproduced except in full, without written approval from Penta Calibration Co., Ltd.

PTC-07/22102-1 (Rev. 001)



PENTA CALIBRATION CO., LTD.
66/124 The Connect 33 Village Kanchanaphisek Road
Dokmai Pratei Bangkok 10250
Tel: +66 (0) 2066-9773
www.pentalab.com

Represent to Certificate of Calibration PTC0722102

Certificate No.: PTC0722102

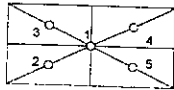
Page: 2 of 2

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	0.0000	-0.0001	0.0000	0.0000	0.0001
Maximum deviation:	0.0001				

Repeatability Test: Weight to be $1/2 \leq L_1 \leq$ Maximum capacity

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

Nominal test value (g)	Standard Deviation
100	0.00009

Error of indication: from nominal value, Readability 0.0001 (g)

Nominal Value (g)	Conventional Mass (g)	Indication (g)	Correction of Balance (g)	Uncertainty (g)	k
0	0.00000	0.0000	0.0000	0.00026	2.87
0.01	0.01000	0.0100	0.0000	0.00026	2.65
0.05	0.05000	0.0500	0.0000	0.00026	2.65
0.1	0.10000	0.1000	0.0000	0.00026	2.65
0.5	0.50000	0.4999	0.0001	0.00026	2.65
1	1.00000	0.9999	0.0001	0.00026	2.65
2	2.00000	1.9999	0.0001	0.00026	2.65
5	5.00001	5.0000	0.0000	0.00026	2.65
10	10.00000	10.0001	-0.0001	0.00026	2.65
20	20.00003	20.0001	-0.0001	0.00026	2.65
100	100.00004	100.0001	-0.0001	0.00027	2.16

Note: Weight of adjust (g)

The End of Certificate

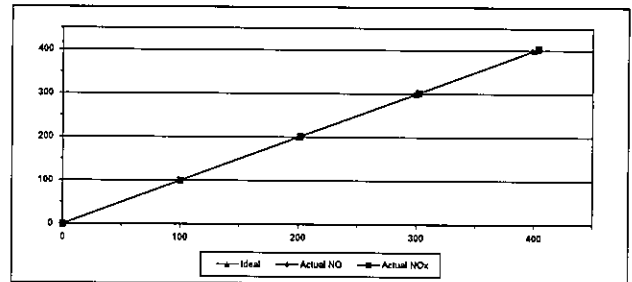
PTC0722102



MULTIPOINT CALIBRATION REPORT

Calibration Date	1-Jul-22	Equipment Name	NOx Analyzer
Manufacturer	HORIBA	Model	APNA-370
Serial No.	TB5HWM41	Equipment ID	RYG_F80481
Calibrator Manufacturer	Teledyne API	Model	700
Serial No.	947		
Std. Gas Concentration (PPM)	55.88	Cylinder No.	GN0027222
Cylinder Pressure (psi)	1800	Certified By	Airgas Inc.
Certified Date	9-Feb-22	Expired Date	9-Feb-30

Point	CALIBRATION RESULTS						
	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	100.10	0.10	0.10
2	200.00	201.00	1.00	0.50	201.40	1.40	0.70
3	300.00	298.30	-1.70	-0.57	302.10	2.10	0.70
4	400.00	398.40	-1.60	-0.40	403.50	3.50	0.88
AVERAGE (%)				-0.33			0.50



Calibrated By

Approved By

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

(Mr.Saranyuth Jitranont)
Assistant General Manager

ALS Laboratory Group

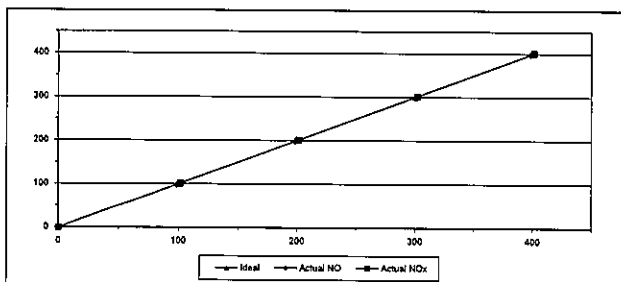
FORM NO.: F 06-056 REVISION NO.: ISSUE DATE: 02/04/12



MULTIPOINT CALIBRATION REPORT

Calibration Date	1-Jul-22	Equipment Name	NOx Analyzer
Manufacturer	HORIBA	Model	APNA-370
Serial No.	ALPOVDWY	Equipment ID	RYG_F80455
Calibrator Manufacturer	Teledyne API	Model	700
Serial No.	947		
Std. Gas Concentration (PPM)	55.88	Cylinder No.	GN0027222
Cylinder Pressure (psi)	1800	Certified By	Airgas Inc.
Certified Date	9-Feb-22	Expired Date	9-Feb-30

Point	CALIBRATION RESULTS						
	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	-1.40	-1.40	101.60	1.60	1.60
2	200.00	198.70	-1.30	-0.65	201.40	1.40	0.70
3	300.00	301.00	1.00	0.33	301.60	1.60	0.60
4	400.00	398.20	-1.80	-0.45	401.20	1.20	0.30
AVERAGE (%)				-0.41			0.68



Calibrated By

Approved By

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

(Mr.Saranyuth Jitranont)
Assistant General Manager

ALS Laboratory Group

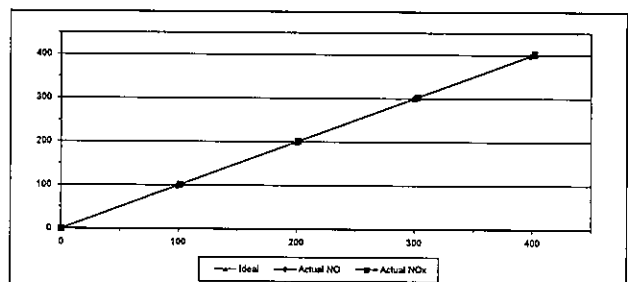
FORM NO.: F 06-056 REVISION NO.: ISSUE DATE: 02/04/12



MULTIPOINT CALIBRATION REPORT

Calibration Date	1-Jul-22	Equipment Name	NOx Analyzer
Manufacturer	HORIBA	Model	APNA-370
Serial No.	RO8K0177	Equipment ID	RYG_F80483
Calibrator Manufacturer	Teledyne API	Model	700
Serial No.	947		
Std. Gas Concentration (PPM)	55.88	Cylinder No.	GN0027222
Cylinder Pressure (psi)	1800	Certified By	Airgas Inc.
Certified Date	9-Feb-22	Expired Date	9-Feb-30

Point	CALIBRATION RESULTS						
	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	299.40	-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			0.68



Calibrated By

Approved By

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

(Mr.Saranyuth Jitranont)
Assistant General Manager

ALS Laboratory Group

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

CERTIFICATE OF CALIBRATION

Certificate No: WS-01062021
Page 1 of 2 pages

Measurement Item : Cup anemometer with data logger
Manufacturer : Data logger: Novalyx
Cup anemometer: Novalyx
Model/Type : Data logger: WS-25DL
Cup anemometer: WS-02P
Serial Number : Data logger: A4481
Cup anemometer: -
ID No : Data logger: BKH_F00141
Cup anemometer: -
Customer : ALE laboratory group (Thailand) Co., Ltd.
104 Phatthanasak 40, Phatthanasak Rd, Khwaeng Suan Luang, Khet Suan Luang, Bangkok 10250 Thailand
Test Conditions : Wind tunnel, cross test section area: 900 cm²
Anemometer probe area: 100 cm²
Diameter of mounting pipe: 1 mm
Blockage ratio of test object: 0.111 [-]
Test Conditions : Air temperature: 23.7 ±0.8 °C
Air pressure: 1010.2 ±0.4 hPa
Relative air humidity: 53.7 ±3.6 %RH
Calibration Procedure : Calibration was carried out based on:
ISO 9140-12-1 (D1), 2019-Project Performance Measurements of Gasdynamically Producing Wind Tunnels
MDS&CT Anemometer Calibration Procedure - Version 2, 2019.
Traceability : This calibration documents the traceable to national standard, which realize the unit of measurements according to the international system of units (SI) through National Institute of Technology Thailand (NIT).
Measurement Date : Jun 07, 2021
Issued Date : Jun 07, 2021

REVIEW BY: *Pankaj P.*
APPROVED BY: *[Signature]*
NEXT CAL DATE: 6/12/22

Calibrated by:
☒ Mr. Sorach Thachad
☐ Miss Orathai Watanthaya



Approved Signatory: *[Signature]*
Mr. Pankaj Boonchuen
Technical Support
and Calibration Manager

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

Continuation of Certificate of Calibration Number

Certificate No: WS-01062021
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.

V _{ref} Reading m/s	V _{act} Reading m/s	Error (m/s)	Uncertainty (%)
2.065	2.0	-0.1	2.6
4.124	4.0	-0.1	1.2
6.99	6.0	0.0	1.0
8.00	8.0	0.0	0.74
9.96	10.1	0.1	0.60
11.96	12.2	0.2	0.67
14.02	14.4	0.4	0.45
16.03	16.6	0.6	0.36
18.01	18.3	0.3	0.6
19.99	19.3	-0.6	0.41
10.99	11.2	0.2	0.53
9.01	9.3	0.3	1.2
7.05	7.0	0.0	0.77
5.121	5.0	-0.1	0.98
3.046	3.0	0.0	1.6
1.068	1.0	-0.1	5.3

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%.

Appendix 1: Instrumentation

NO	Sensor	Manufacturer	Model/Type	Calibration Date	Certificate Report Number	Range
1	Flow static	TESTO INC.	0635/145	July 18, 2020	MW-0035-20	2 ~ 30 Pa
2	Pressure Differential Pressure MPPI	Zepac	DP42000	July 16, 2020	MW-0035-20	2 ~ 30 Pa
3	Air velocity transducer (hot wire)	TSI INC.	8455-12	July 20, 2020	MW-0035-20	0 ~ 5 m/s
4	Temperature	Zepac	DS1-TMP	March 30, 2021	DL-027-24	30 ~ 70 °C
5	Relative humidity	Zepac	DS1-TMP	March 30, 2021	RH-03032021	0 ~ 100 %RH
6	Atmospheric pressure	Zepac	DS1-TMP	March 30, 2021	BP-01632021	600 ~ 1100 hPa
7	Wind tunnel	ESCON	MP3300			C = 50 Hz

End of certificate of calibration



CERTIFICATE OF CALIBRATION

Certificate No: WD-01062021
Page 1 of 2 pages

Measurement Item : Wind direction sensor with data logger
Manufacturer : Data logger: Novalyx
Wind direction sensor: Novalyx
Model/Type : Data logger: WS-25DL
Wind direction sensor: WS-02P
Serial Number : Data logger: A4481
Wind direction sensor: -
ID No : Data logger: BKH_F00141
Wind direction sensor: -
Customer : ALE laboratory group (Thailand) Co., Ltd.
104 Phatthanasak 40, Phatthanasak Rd, Khwaeng Suan Luang, Khet Suan Luang, Bangkok 10250 Thailand
Environmental Condition : The measurement was carried out in an ambient temperature of 23±0.1°C and relative humidity of 40±10%
Measurement Method : The wind direction sensor calibration according to comparison method with reference single measurement electronic theodolite and the laser is used for axis control. The measurement were taken at 45° intervals in clockwise and counter-clockwise directions.
Note : The UUC 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 Certificate No. C0553-07-0046, Certificate No. WPS63/0046.
Measurement Date : Jun 07, 2021
Issued Date : Jun 07, 2021



Approved Signatory: *[Signature]*
Mr. Pankaj Boonchuen
Technical Support
and Calibration Manager

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Continuation of Certificate of Calibration Number

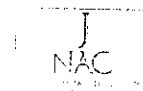
Certificate No: WD-01062021
Page 2 of 2 pages

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.

NO	Turning Direction	Nominal Angle (°)	Standard Reading (°)	UUC Reading (°)	Error (°)	Uncertainty ±(°)
1	Clockwise	0/360	0	0	0	3.0
2		45	45	42	-3	3.0
3		90	90	90	0	3.0
4		135	135	136	1	3.0
5		180	180	182	2	3.0
6		225	225	227	2	3.0
7		270	270	273	3	3.0
8		315	315	314	-1	3.0
9	Counter Clockwise	0/360	0	0	0	3.0
10		45	45	42	-3	3.0
11		90	90	90	0	3.0
12		135	135	136	1	3.0
13		180	180	182	2	3.0
14		225	225	227	2	3.0
15		270	270	273	3	3.0
16		315	315	314	-1	3.0

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 of Calibration



CERTIFICATE OF CALIBRATION

Certificate No: WS-01102021
Page 1 of 2 pages

Measurement Item : Cup anemometer with data logger.
Manufacturer : Data logger: Novaya
Cup anemometer: Novaya
Model/Type : Data logger: 230-WS-250L
Cup anemometer: WS-02F
Serial Number : Data logger: A4985
Cup anemometer: -
ID No : Data logger: R00_F00085
Cup anemometer: -
Customer : ALS laboratory group (Thailand) Co., Ltd.
104 Phatthanasri Rd, Phatthanasri Rd, Khwaeng San Luang, Khet San Luang, Bangkok 10200
Thailand
Test Conditions : Wind tunnel cross test section area: 900 cm²
Anemometer: Novaya, size: 100 cm²
Diameter of mounting pole: 1 cm
Blowage ratio of test object: 0.111 (-)
Test Conditions : Air temperature: 24.0 ±0.5 °C
Air pressure: 1026.1 ±0.4 hPa
Relative air humidity: 58.1 ±0.6 %RH
Calibration Procedure : Calibration was carried out using the:
ISO 61490-12-1 (DIN 2005) Flow Performance Measurements of Correctly Producing Wind
Tunnels
MACANIST Anemometer Calibration Procedure - Version 2.2.2021
Traceability : This calibration documents the traceable to metrology standard which render the unit of
measurements according to the international system of units (SI) through National Institute of
Metrology (Thailand) (NIMT)
Measurement Date : Oct 08, 2021
Issued Date : Oct 11, 2021

REVIEW BY *Haritorn T.*
APPROVED BY *Haritorn T.*
NEXT CAL DATE: 5/4/23



Approved Signature: *Haritorn T.*
Mr. Haritorn T. Jiranatee
Technical Support
and Calibration Manager

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Continuation of Certificate of Calibration Number

Certificate No: WS-01102021
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.

V _{ref} Reading m/s	V _{unc} Reading m/s	Error (m/s)	Uncertainty (%)
2.049	1.0	-0.1	2.7
4.103	4.0	-0.1	1.3
6.01	6.0	0.0	1.1
8.01	8.0	0.0	0.99
9.99	10.0	0.0	1.0
11.99	12.1	0.1	0.84
13.98	14.1	0.1	0.55
16.02	16.2	0.2	0.40
18.03	18.2	0.2	0.78
19.99	19.1	-0.1	0.61
11.02	11.0	0.0	1.1
9.02	9.0	0.0	0.75
7.02	7.0	0.0	0.84
5.147	5.0	-0.1	0.98
2.974	2.0	-0.1	1.7
1.013	0.9	-0.1	4.0

UUC1: 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: Instruments Data

NO	Sensor	Manufacturer	Model/Type	Calibration Date	Certificate Report Number	Range
1	PDA MAX	TESCO INC.	CS323145	Aug 07, 2021	MR-0034-21	2 - 30 m/s
2	Pressure Differential Pressure Meter	22245	DP02700	Aug 07, 2021	MR-0034-21	2 - 30 m/s
3	Air velocity transducer (hot wire)	TSI INC.	PS55-12	Aug 08, 2021	MR-0035-21	0 - 2 m/s
4	Temperature	Zigbee	DS18B20	Mar 30, 2021	CS-027-24	-30 - 70 °C
5	Relative humidity	Zigbee	DS18B20	Mar 30, 2021	MR-0035-2021	0 - 100 %RH
6	Anemometer pressure	22245	DP02700	Mar 30, 2021	DP01032021	500 - 1100 hPa
7	Wind tunnel	CECON	WINDT	-	-	0 - 50 m/s

End of certificate of calibration



CERTIFICATE OF CALIBRATION

Certificate No: WD-01102021
Page 1 of 2 pages

Measurement Item : Wind direction sensor with data logger.
Manufacturer : Data logger: Novaya
Wind direction sensor: Novaya
Model/Type : Data logger: 200-WS-250L
Wind direction sensor: WS-02F
Serial Number : Data logger: A4985
Wind direction sensor: -
ID No : Data logger: R00_F00085
Wind direction sensor: -
Customer : ALS laboratory group (Thailand) Co., Ltd.
104 Phatthanasri Rd, Phatthanasri Rd, Khwaeng San Luang, Khet San Luang, Bangkok 10200
Thailand
Environmental Conditions : The measurement was carried out in an ambient temperature of (24±2) °C and relative humidity of (40±10) %
Measurement Method : The wind direction sensor calibration according to comparison method with reference angle measurement. Methods: freeblade and
the sensor is used for this control. The measurements were taken at 45° intervals in clockwise and counterclockwise
directions.
Note: The UUC 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 Certificate No. 02563-07-0046,
Certificate No: KWS4/0026
Measurement Date : Oct 08, 2021
Issued Date : Oct 11, 2021



Approved Signature: *Haritorn T.*
Mr. Haritorn T. Jiranatee
Technical Support
and Calibration Manager

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OBTAINED IN WRITING FROM THE LABORATORY.

Continuation of Certificate of Calibration Number

Certificate No: WD-01102021
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 table below.

NO	Tuning Direction	Nominal Angle (°)	Standard Reading (°)	UUC [*] Reading (°)	Error (°)	Uncertainty (°)
1	Clockwise	0/360	359	359	-1	3.0
2		45	45	42	-3	3.0
3		90	90	88	-2	3.0
4		135	135	135	0	3.0
5		180	180	180	0	3.0
6		225	225	228	3	3.0
7	Counter Clockwise	270	270	273	3	3.0
8		315	315	318	3	3.0
9		0/360	359	359	-1	3.0
10		45	45	42	-3	3.0
11		90	90	88	-2	3.0
12		135	135	135	0	3.0
13	Clockwise	180	180	182	2	3.0
14		225	225	228	3	3.0
15		270	270	273	3	3.0
16		315	315	318	3	3.0

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 of Calibration



CERTIFICATE OF CALIBRATION

Certificate No. WD-0012022
Page 1 of 2 pages

Measurement Item : Cup anemometer with data logger
Manufacturer : Data logger: Novatek
Cup anemometer: Novatek
Model/Type : Data logger: 200-WS-25L3
Cup anemometer: WS-02P
Serial Number : Data logger: A5101
Cup anemometer:
ID No : Data logger: RYD-FS3324
Cup anemometer:
Customer : ALS laboratory group (Thailand) Co., Ltd.
104 Phrasathan 40, Phrasathan Rd, Kwang San Luang, Watt Chan Luang, Bangkok 10600
Thailand
Test Conditions : Wind tunnel cross test section area : 900 cm²
Anemometer frontal area : 100 cm²
Diameter of mounting pipe : mm
Repeatability of test object : 0.1%
Test Conditions : Air temperature : 22.0 ±0.5 °C
Air pressure : 1014.6 ±0.4 hPa
Relative humidity : 58.0 ±5.5 %
Calibration Procedure : Calibration was carried out base on:
ISO 9140-12.1.001 2003 Power Performance Measurements of Exchely Producing Wind
Turbines.
MEASUET Anemometer Calibration Procedure - Version 2, 2005
Traceability : The calibration documents the hierarchy to national standard which realize the unit of
measurements according to the international system of units (SI) through National Institute of
Metrology (NIM) (Thailand)
Measurement Date : JAN 26, 2022
Issued Date : JAN 31, 2022

REVIEW BY *Panaphon P.*
APPROVED BY *Mr. Panyas Booncharoen*
NEXT CAL DATE *24/3/23*

Calibrated by
☒ Mr. Panyas Booncharoen
☐ Mr. Chaiyaporn Wattaprasit



Approved Signatory
Mr. Panyas Booncharoen
Calibration Department Manager

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Continuation of Certificate of Calibration Number

Certificate No. WD-0012022
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

V _{ref} Reading m/s	V _{act} Reading m/s	Error (m/s)	Uncertainty (%)
2.078	2.0	-0.1	2.4
4.125	4.0	-0.1	1.5
6.00	5.8	-0.2	1.5
8.01	7.9	-0.1	1.0
10.00	9.8	-0.2	0.69
11.99	11.9	-0.1	0.67
14.00	13.6	-0.4	2.8
15.98	15.7	-0.3	1.2
17.99	17.8	-0.2	1.1
19.00	18.8	-0.2	1.0
21.01	20.8	-0.2	1.2
22.92	22.7	-0.3	0.90
24.92	24.7	-0.3	0.94
26.96	26.7	-0.3	1.1
28.96	28.7	-0.3	1.0
30.94	30.6	-0.3	1.0

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%

Appendix 3: Instrumentation

NO	Sensor	Manufacturer	Model/Type	Calibration Date	Certificate Report Number	Range
1	Pressure	TEDEA HUNTLEIGH	06302146	Aug 02, 2021	MA 003421	2 - 30 m/s
2	Pressure Differential Pressure Meter	Zepal	DPN2000	Aug 07, 2021	MA 003421	2 - 30 m/s
3	Air velocity transducer (hot wire)	TSI INC	8445-12	Aug 08, 2021	MA 003421	0 - 5 m/s
4	Temperature	Zepal	DSR-TMP	Mar 30, 2021	CL-027-04	-30 - 70°C
5	Relative humidity	Zepal	DSR-TMP	Mar 30, 2021	RL03032021	0 - 100 %RH
6	Atmospheric pressure	Zepal	DSR-TMP	Mar 30, 2021	RP01032021	200 - 1100 mPa
7	Wind tunnel	DISOM	MP3300	-	-	0 - 10 m/s

End of certificate of calibration



CERTIFICATE OF CALIBRATION

Certificate No. WD-0012022
Page 1 of 2 pages

Measurement Item : Wind direction sensor with data logger
Manufacturer : Data logger: Novatek
Wind direction sensor: Novatek
Model/Type : Data logger: 200-WS-25L3
Wind direction sensor: WS-02P
Serial Number : Data logger: A5101
Wind direction sensor:
ID No : Data logger: RYD-FS3324
Wind direction sensor:
Customer : ALS laboratory group (Thailand) Co., Ltd.
104 Phrasathan 40, Phrasathan Rd, Kwang San Luang, Watt Chan Luang, Bangkok 10600
Thailand
Environmental Condition : The measurement was carried out in an ambient temperature of (20±3) °C and relative humidity of (40±10) %
Measurement Method : The wind direction sensor calibration according to comparison method with reference angle measurement electronic theodolite and
the laser is used for axis control. The measurement was taken at 45° interval in clockwise and counterclockwise
directions
Note: The UUC 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 Certificate No. QP1086014, Certificate No.
WVS64/0025
Measurement Date : JAN 26, 2022
Issued Date : JAN 31, 2022

Performed by
☒ Mr. Panyas Booncharoen
☐ Mr. Chaiyaporn Wattaprasit



Approved Signatory
Mr. Panyas Booncharoen
Calibration Department Manager

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Continuation of Certificate of Calibration Number

Certificate No. WD-0012022
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 table below.

NO	Turning Direction	Nominal Angle (°)	Standard Reading (°)	UUC ¹ Reading (°)	Error (°)	Uncertainty (°)
1	Clockwise	0/360	0	1	1	3.0
2		45	45	45	0	3.0
3		90	90	91	1	3.0
4		135	135	134	-1	3.0
5		180	180	179	-1	3.0
6		225	225	225	0	3.0
7		270	270	272	2	3.0
8		315	315	319	4	3.0
9	Counterclockwise	0/360	0	1	1	3.0
10		45	45	45	0	3.0
11		90	90	91	1	3.0
12		135	135	134	-1	3.0
13		180	180	179	-1	3.0
14		225	225	225	0	3.0
15		270	270	272	2	3.0
16		315	315	319	4	3.0

UUC¹ 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



SITHIPORN ASSOCIATES CO.,LTD. CALIBRATION LABORATORY

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



Cert. No. : ACC22001
Pages : 1 of 3

Calibration Certificate

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

Condition As Found : GOOD

Customer : ALS LABORATORY GROUP (THAILAND) CO., LTD.
104 PHATTHANAKAN 40, PHATTHANAKAN ROAD,
KJWAENG 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 : 05 JANUARY 2022
Calibration Date : 10 JANUARY 2022
Date of Issue : 13 JANUARY 2022

REVIEW BY : *Nathorn P.*
APPROVED BY : *T. Petchurui*
NEXT CAL DATE : 10/1/23

Calibrated by : Nathorn Pisutpaisan

Approved by :

T. Petchurui
(Thanakul Petchurui)

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QF-TS12-04-04-020664

SITHIPORN ASSOCIATES CO.,LTD. CALIBRATION LABORATORY

Continuation of Calibration Certificate

Cert. No. : ACC22001
Job No. : VC65AC0040
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-0011-21	10-Feb-22
Digital Multimeter	33461A	MY53220104	EEL_BP_05/0264	10-Feb-22
Digital Multimeter	33461A	MY53220076	EEL_BP_03/0264	08-Feb-22
Digital Multimeter	33461A	MY60024273	1-15180725251-1	15-Sep-22
Programmable Attenuator	MAT-1070	62100114	1500-07774E	08-Mar-22
Condenser Microphone	4180	2977900	AA-1008-21	05-Feb-22
Measuring Amplifier	NA-42KA1	34560495	AA-3003-21	16-Feb-22
Audio Analyzer	AVR-3360A	V744B6069	EF-0010-21	10-Feb-22

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

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

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

QF-TS12-04-04-020664

T. Petchurui

SITHIPORN ASSOCIATES CO.,LTD. CALIBRATION LABORATORY

Continuation of Calibration Certificate

Cert. No. : ACC22001
Job No. : VC65AC0040
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	93.99	-0.01	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 (%)
0.28	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

T. Petchurui

SITHIPORN ASSOCIATES CO.,LTD. CALIBRATION LABORATORY

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



Cert. No. : ACL22162
Pages : 1 of 8

Calibration Certificate

Equipment : SOUND LEVEL METER
Manufacturer : RION
Model : NL-42/ Microphone UC-52 / Preamplifier NH-24
Serial No. : 01122567 / 143473 / 22605
ID No. : RYG_F50016

Condition As Found : GOOD

Customer : ALS LABORATORY GROUP (THAILAND) CO., LTD.
104 PHATTHANAKAN 40, PHATTHANAKAN ROAD,
KJWAENG 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 JULY 2022
Calibration Date : 11-18 JULY 2022
Date of Issue : 19 JULY 2022

REVIEW BY : *Nathorn P.*
APPROVED BY : *T. Petchurui*
NEXT CAL DATE : 11/1/23

Calibrated by : Nathorn Pisutpaisan

Approved by :

T. Petchurui
(Thanakul Petchurui)

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QF-TS12-04-04-020664

Continuation of Calibration Certificate

Cert. No. : ACL22162
Job No. : VC65AC0069
Pages : 2 of 8

Calibration Procedure : CP-AC-01

Calibration Method :

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

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

Condition of this result of calibration :

1. Reference Standard Instruments :

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

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

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

3.1 National Institute of Metrology (Thailand).

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

QF-TS12-04-04-020664

Continuation of Calibration Certificate

Cert. No. : ACL22162
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

QF-TS12-04-04-020664

Continuation of Calibration Certificate

Cert. No. : ACL22162
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)
15.7

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

Frequency Weighting	Measured value (dB)
A - weight	12.6
C - weight	18.7
Flat	24.5

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	0.2	0.2	0.2	± 1.5
1000	-0.1	-0.1	-0.1	± 1.0
8000	-1.0	-0.9	-0.9	± 5.0

QF-TS12-04-04-020664

Continuation of Calibration Certificate

Cert. No. : ACL22162
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)			
	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	0.0	0.0	±1.5
1000	0.0	0.0	0.0	±1.0
2000	0.0	0.0	0.0	±2.0
4000	0.0	0.0	0.0	±3.0
8000	0.0	0.1	0.1	±5.0

5. Frequency and time weightings at 1 kHz

5.1 Frequency weightings at 1 kHz

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

5.2 Time weighting at 1 kHz

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

6. Long - term stability

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

QF-TS12-04-04-020664

Continuation of Calibration Certificate

Cert. No. : ACL22162
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	0.0	±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	53.9	-0.1	±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	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. Petchurui

Continuation of Calibration Certificate

Cert. No. : ACL22162
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	107.9	-0.1	1.5; -5.0
	2	8	117.0	117.0	0.0	1.0; -2.5
	200	800	134.0	134.0	0.0	±1.0
Slow	2	8	108.0	108.0	0.0	1.5; -5.0
	200	800	127.6	127.6	0.0	±1.0
SEL	0.25	1	99.0	98.9	-0.1	1.5; -5.0
	2	8	108.0	108.0	0.0	1.0; -2.5
	200	800	128.0	128.1	0.1	±1.0

10. Peak C sound level

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

QF-TS12-04-04-020664

T. Petchurui

Continuation of Calibration Certificate

Cert. No. : ACL22162
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		
89.7	89.5	-0.2	±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. Petchurui

451-451/1 Sirinthorn Rd, Bangbunmu, Bangkok Bangkok 10700 THAILAND.
Tel:0-2435-8800 Fax:0-2433-1679 e-mail:calcenter@sithiporn.com http://www.sithiporn.comCert. No. : ACL221118
Pages : 1 of 8

Calibration Certificate

Equipment : SOUND LEVEL METER
Manufacturer : RION
Model : NL-42/ Microphone UC-52 / Preamplifier NH-24
Serial No. : 01122578 / 143486 / 22620
ID No. : RYG_FS0017

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 : 21 SEPTEMBER 2021
Calibration Date : 04-06 OCTOBER 2021
Date of Issue : 11 OCTOBER 2021

Calibrated by : Nathakorn Pisutpaisan

Approved by :

T. Petchurui
(Thanakul Petchurui)

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QF-TS12-04-04-020664

Continuation of Calibration Certificate

Cert. No. : ACL21118
Job No. : VC64AC0070
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-0012-21	10-Feb-22
Waveform Generator	33511B	MY52302742	EF-0011-21	10-Feb-22
Digital Multimeter	33461A	MY5320104	EEL.BP. 05/0264	10-Feb-22
Digital Multimeter	33461A	MY5320076	EEL.BP. 06/0264	08-Feb-22
Digital Multimeter	8846A	1997025	EEL.BP. 06/0264	05-Feb-22
Programmable Attenuator	MAT-1070	62100114	1500-07774E	08-Mar-22
Condenser Microphone	4180	2977900	AA-1008-21	05-Feb-22
Measuring Amplifier	NA-42KA1	34560495	AA-3003-21	16-Feb-22

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

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

3.1 National Institute of Metrology (Thailand).

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

QF-TS12-04-04-020664

T. Petch

Continuation of Calibration Certificate

Cert. No. : ACL21118
Job No. : VC64AC0070
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. Petch

Continuation of Calibration Certificate

Cert. No. : ACL21118
Job No. : VC64AC0070
Pages : 4 of 8

Result of calibration :

1. Absolute sensitivity

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

2. Self-generated noise

2.1 Normal test

Measured Value (dB)
17.9

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

Frequency Weighting	Measured value (dB)
A-weight	15.5
C-weight	20.9
Flat	26.3

3. Acoustical signal tests of frequency weightings

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

Frequency (Hz)	Flat	C-weight	A-weight	Acceptance Limits
125	0.1	0.1	0.1	± 1.5
1000	-0.1	-0.1	-0.1	± 1.0
8000	0.5	0.6	0.6	±5.0

QF-TS12-04-04-020664

T. Petch

Continuation of Calibration Certificate

Cert. No. : ACL21118
Job No. : VC64AC0070
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	-0.1	-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	0.1	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. Petch

Continuation of Calibration Certificate

Cert. No. : ACL21118
Job No. : VC64AC0070
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	84.1	0.1	±1.1
79.0	79.0	0.0	±1.1
74.0	74.1	0.1	±1.1
69.0	69.1	0.1	±1.1
64.0	64.0	0.0	±1.1
59.0	59.1	0.1	±1.1
54.0	54.0	0.0	±1.1
49.0	49.0	0.0	±1.1
44.0	44.0	0.0	±1.1
39.0	39.0	0.0	±1.1
34.0	34.1	0.1	±1.1
30.0	30.2	0.2	±1.1
29.0	29.2	0.2	±1.1
28.0	28.2	0.2	±1.1
27.0	27.3	0.3	±1.1
26.0	26.4	0.4	±1.1
25.0	25.5	0.5	±1.1

QF-TS12-04-04-020664

T. Petch

Continuation of Calibration Certificate

Cert. No. : ACL21118
Job No. : VC64AC0070
Pages : 7 of 8

8. Level linearity including the level range control

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

9. Tone burst response

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

10. Peak C sound level

Number of cycle in test signal	Anticipated Value (dB)	Measured Value, L _{peak} (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.0	0.0	-
One	136.4	136.4	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	133.1	0.1	-
Positive half cycle	135.4	135.2	-0.2	±2.0
Negative half cycle	135.4	135.2	-0.2	±2.0

QF-TS12-04-04-020664

T. Petch

Continuation of Calibration Certificate

Cert. No. : ACL21118
Job No. : VC64AC0070
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	89.6	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. Petch

451-451/1 Sirinthorn Rd, Bangbunru, Bangkok Bangkok 10700 THAILAND
Tel:0-2435-8600 Fax:0-2433-1679 e-mail:center@sithiporn.com http://www.sithiporn.com



Cert. No. : ACL23029
Pages : 1 of 8

Calibration Certificate

Equipment : SOUND LEVEL METER
Manufacturer : RION
Model : NL-42/ Microphone UC-52 / Preampifier NH-24
Serial No. : 00900074 / 188467 / 01736
ID No. : RYG_FS0495

Condition As Found : GOOD

Customer : ALS LABORATORY GROUP (THAILAND) CO., LTD.
104 PHATTHANAKAN 40, PHATTHANAKAN ROAD,
KHUWAENG 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 : 05 JANUARY 2022
Calibration Date : 10-12 JANUARY 2022
Date of Issue : 13 JANUARY 2022

REVIEW BY *Nathakorn P.*
APPROVED BY *T. Petch*
NEXT CAL DATE 10/1/23

Calibrated by : Nathakorn Pisutpaisan

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

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. : ACL22029
Job No. : VC65AC0040
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-0012-21	10-Feb-22
Waveform Generator	33511B	MY52302742	EF-0011-21	10-Feb-22
Digital Multimeter	33461A	MY53220104	EEL-BP_050264	10-Feb-22
Digital Multimeter	33461A	MY53220076	EEL-BP_030264	08-Feb-22
Digital Multimeter	34461A	MY60024273	I-15180725251-1	15-Sep-22
Programmable Attenuator	MAT-1070	62100114	1500-07774E	08-Mar-22
Condenser Microphone	4180	2977990	AA-1008-21	05-Feb-22
Measuring Amplifier	NA-42KAI	34560495	AA-3003-21	16-Feb-22

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

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

3.1 National Institute of Metrology (Thailand).

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

QF-TS12-04-04-020664

T. Bha.

Continuation of Calibration Certificate

Cert. No. : ACL22029
Job No. : VC65AC0040
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. Bha.

Continuation of Calibration Certificate

Cert. No. : ACL22029
Job No. : VC65AC0040
Pages : 4 of 8

Result of calibration :

1. Absolute sensitivity

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

2. Self-generated noise

2.1 Normal test

Measured Value (dB)
14.2

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

Frequency Weighting	Measured value (dB)
A-weight	10.8
C-weight	17.4
Flat	23.3

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	0.2	0.2	0.2	±1.5
1000	0.0	0.0	0.0	±1.0
8000	-0.8	-0.7	-0.7	±5.0

QF-TS12-04-04-020664

T. Bha.

Continuation of Calibration Certificate

Cert. No. : ACL22029
Job No. : VC65AC0040
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	-0.2	0.0	±2.0
125	-0.1	0.0	0.0	±1.5
250	0.0	0.0	-0.1	±1.5
500	0.0	0.0	-0.1	±1.5
1000	0.0	0.0	0.0	±1.0
2000	0.0	0.0	0.0	±2.0
4000	0.0	0.0	0.0	±3.0
8000	0.0	0.1	0.1	±5.0

5. Frequency and time weightings at 1 kHz

5.1 Frequency weightings at 1 kHz

Frequency Weighting	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits
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
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. Bha.

Continuation of Calibration Certificate

Cert. No. : ACL22029
Job No. : VC65AC0040
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	84.1	0.1	± 1.1
79.0	79.0	0.0	± 1.1
74.0	74.1	0.1	± 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	25.9	-0.1	± 1.1
25.0	24.9	-0.1	± 1.1

QT-TS12-04-04-020664

T. Petchur

Continuation of Calibration Certificate

Cert. No. : ACL22029
Job No. : VC65AC0040
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	128.1	0.1	± 1.0

10. Peak C sound level

Number of cycle in test signal	Anticipated Value (dB)	Measured Value, L _{peak} (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.0	0.0	-
One	136.4	135.8	-0.6	± 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-TS12-04-04-020664

T. Petchur

Continuation of Calibration Certificate

Cert. No. : ACL22029
Job No. : VC65AC0040
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	89.6	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

QT-TS12-04-04-020664

T. Petchur

451-451/1 Sirdhorn Rd, Banghumbun, Bangkok Bangkok 10700 THAILAND
Telo: 2435-8800 Fax: 2433-1679 e-mail: cal-center@sithiporn.com http://www.sithiporn.com



Cert. No. : ACL22022
Pages : 1 of 9

Calibration Certificate

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

Condition As Found : GOOD

Customer : ALS LABORATORY GROUP (THAILAND) CO., LTD.
164 PHATTANAKAN 40, PHATTANAKAN ROAD,
KHAENG 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 : 05 JANUARY 2022
Calibration Date : 10-12 JANUARY 2022
Date of Issue : 13 JANUARY 2022

REVIEW BY	Mankorn P.
APPROVED BY	T. Petchur
NEXT CAL. DATE	10/1/24

Calibrated by : Nathakorn Pisutpaisan

Approved by : T. Petchur
(Thanakul Petchurai)

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QT-TS12-04-04-020664

Continuation of Calibration Certificate

Cert. No. : ACL22022
Job No. : VC65AC0040
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 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-0012-21	10-Feb-22
Waveform Generator	33511B	MY52302742	EF-0011-21	10-Feb-22
Digital Multimeter	33461A	MY53220104	EEL.BP. 03/0264	10-Feb-22
Digital Multimeter	33461A	MY53220076	EEL.BP. 03/0264	08-Feb-22
Digital Multimeter	8846A	1997025	EEL.BP. 06/0264	05-Feb-22
Programmable Attenuator	MAT-1070	62100114	1500-07774E	08-Mar-22
Condenser Microphone	4180	2977900	AA-1008-21	05-Feb-22
Measuring Amplifier	NA-42KAI	34560495	AA-3003-21	16-Feb-22

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

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

3.1 National Institute of Metrology (Thailand).

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

QF-TS12-04-04-020664

T. R. R.

Continuation of Calibration Certificate

Cert. No. : ACL22022
Job No. : VC65AC0040
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	✓	-	0.3	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. R. R.

Continuation of Calibration Certificate

Cert. No. : ACL22022
Job No. : VC65AC0040
Pages : 4 of 9

Result of calibration :

1. Absolute sensitivity

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

2. Self-generated noise

2.1 Normal test

Measured Value (dB)
24.6

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

Frequency Weighting	Measured value (dB)
A-weight	23.5
C-weight	25.6
Flat	30.6

3. Acoustical signal tests of frequency weightings

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

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)			
	Flat	C-weight	A-weight	Acceptance Limits
125	0.0	0.1	0.0	± 1.5
1000	0.0	0.0	0.0	± 1.0
8000	0.6	0.8	0.7	± 5.0

QF-TS12-04-04-020664

T. R. R.

Continuation of Calibration Certificate

Cert. No. : ACL22022
Job No. : VC65AC0040
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	0.0	±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	0.1	0.1	0.0	±2.0
4000	0.1	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. R. R.

Continuation of Calibration Certificate

Cert. No. : ACL22022
Job No. : VC65AC0040
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

T. P. K.

Continuation of Calibration Certificate

Cert. No. : ACL22022
Job No. : VC65AC0040
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	Tone burst duration, T _b (ms)	Cycle	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Weighting	0.25	1	108.0	107.9	-0.1	1.5 ; -3.0
	2	8	117.0	117.0	0.0	1.0 ; -2.5
	200	800	134.0	134.0	0.0	±1.0
Fast	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
Slow	2	8	108.0	108.0	0.0	1.0 ; -2.5
	200	800	128.0	128.0	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
	0.25	1	99.0	98.9	-0.1	1.5 ; -5.0

QF-TS12-04-04-020664

T. P. K.

Continuation of Calibration Certificate

Cert. No. : ACL22022
Job No. : VC65AC0040
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		
89.4	89.3	-0.1	±1.5

QF-TS12-04-04-020664

T. P. K.

Continuation of Calibration Certificate

Cert. No. : ACL22022
Job No. : VC65AC0040
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. P. K.

SITHIPORN ASSOCIATES CO.,LTD. CALIBRATION LABORATORY

451-451/1 Sindhorn Rd., Bangsumru, Bangkok 10700 THAILAND.
Tel:0-2435-8600 Fax:0-2433-1579 e-mail:cal-center@sithiporn.com http://www.sithiporn.com



Cert. No. : ACL22157
Pages : 1 of 9

Calibration Certificate

Equipment : SOUND LEVEL METER
Manufacturer : RION
Model : NL-21/ Microphone UC-52 / Preamplifier NH-21
Serial No. : 00376363 / 172443 / 23141
ID No. : RYG_PS0011

Condition As Found : GOOD

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

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

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

REVIEW BY : *Natthakorn P.*
APPROVED BY : *T. Petchumai*
NEXT CAL. DATE : 11/14/23

Calibrated by : Natthakorn Pisutpaisan

Approved by :

T. Petchumai
(Thanukul Petchumai)

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

SITHIPORN ASSOCIATES CO.,LTD. CALIBRATION LABORATORY

Continuation of Calibration Certificate

Cert. No. : ACL22157
Job No. : VC65AC0069
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 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 Instrument's 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.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	EP-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. Petchumai

SITHIPORN ASSOCIATES CO.,LTD. CALIBRATION LABORATORY

Continuation of Calibration Certificate

Cert. No. : ACL22157
Job No. : VC65AC0069
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	✓	-	0.3	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. Petchumai

SITHIPORN ASSOCIATES CO.,LTD. CALIBRATION LABORATORY

Continuation of Calibration Certificate

Cert. No. : ACL22157
Job No. : VC65AC0069
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)
22.2

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

Frequency Weighting	Measured value (dB)
A-weight	21.1
C-weight	20.7
Flat	20.5

3. Acoustical signal tests of frequency weightings

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

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)			
	Flat	C-weight	A-weight	Acceptance Limits
125	0.7	0.8	0.7	± 1.5
1000	-0.2	-0.2	-0.2	± 1.0
8000	-0.3	-0.1	-0.1	± 1.0

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T. Petchumai

Continuation of Calibration Certificate

Cert. No. : ACL22157
Job No. : VC65AC0069
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	-0.2	-0.2	-0.1	±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	0.0	±1.5
1000	0.0	0.0	0.0	±1.0
2000	0.1	0.1	0.1	±2.0
4000	0.1	0.1	0.1	±3.0
8000	0.0	0.2	0.3	±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	94.1	0.1	±0.2
Flat	94.1	0.1	±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. Pich.

Continuation of Calibration Certificate

Cert. No. : ACL22157
Job No. : VC65AC0069
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	134.9	-0.1	±1.1
134.0	133.9	-0.1	±1.1
133.0	132.9	-0.1	±1.1
132.0	131.9	-0.1	±1.1
131.0	130.9	-0.1	±1.1
129.0	128.9	-0.1	±1.1
124.0	123.9	-0.1	±1.1
119.0	118.9	-0.1	±1.1
114.0	113.9	-0.1	±1.1
109.0	108.9	-0.1	±1.1
104.0	103.9	-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	43.9	-0.1	±1.1
39.0	38.9	-0.1	±1.1

QF-TS12-04-04-020664

T. Pich.

Continuation of Calibration Certificate

Cert. No. : ACL22157
Job No. : VC65AC0069
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	94.1	0.1	±0.5
100	94.0	94.1	0.1	±0.5
90	94.0	94.1	0.1	±0.5

Level linearity on each level range

Range	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
130	43.0	42.9	-0.1	±0.5
120	33.0	33.0	0.0	±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	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	108.0	0.0	1.0 ; -2.5
	200	800	128.0	127.9	-0.1	±1.0

QF-TS12-04-04-020664

T. Pich.

Continuation of Calibration Certificate

Cert. No. : ACL22157
Job No. : VC65AC0069
Pages : 8 of 9

10. Peak C sound level

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

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

11. Overload indication

Measured value (dB)		Deviated Value (dB)	Acceptance Limits (dB)
Positive one-half cycle	Negative one-half cycle	Value (dB)	Limits (dB)
89.5	89.2		
		-0.3	±1.5

QF-TS12-04-04-020664

T. Pich.

Continuation of Calibration Certificate

Cert. No. : ACL22157
Job No. : VC65AC0069
Pages : 9 of 9

12. High level stability

Frequency	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

QI-TS12-04-04-020664

451-451/1 Sindhorn 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. : ACL221054
Pages : 1 of 8

Calibration Certificate

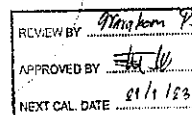
Equipment : SOUND LEVEL METER
Manufacturer : RION
Model : NL-42/ Microphone UC-52 / Preamplifier NH-24
Serial No. : 00233184 / 144837 / 23232
ID No. : RVG_FS0025

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



Calibrated by : Nathakorn Pisutpaian

Approved by :

T. Petchurai
(Thanakul Petchurai)

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QI-TS12-04-04-020664

Continuation of Calibration Certificate

Cert. No. : ACL221054
Job No. : VC65AC0043
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-0012-21	10-Feb-22
Waveform Generator	33511B	MY52302742	EF-0011-21	10-Feb-22
Digital Multimeter	33461A	MY53220104	EEL.BP. 05/0264	10-Feb-22
Digital Multimeter	33461A	MY53220076	EEL.BP. 03/0264	08-Feb-22
Digital Multimeter	34461A	MY60024273	I-15180725251-1	15-Sep-22
Programmable Attenuator	MAT-1070	62100114	1500-07774E	08-Mar-22
Condenser Microphone	4180	2977900	AA-1008-21	05-Feb-22
Measuring Amplifier	NA-42KA1	34560495	AA-3003-21	16-Feb-22

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

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

3.1 National Institute of Metrology (Thailand).

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

QI-TS12-04-04-020664

Continuation of Calibration Certificate

Cert. No. : ACL221054
Job No. : VC65AC0043
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

QI-TS12-04-04-020664

Continuation of Calibration Certificate

Cert. No. : ACL22054
Job No. : VC65AC0043
Pages : 4 of 8

Result of calibration :

1. Absolute sensitivity

Reference Acoustic Signal (dB)	Measured Value (dB)	Deviation (dB)	Acceptance Limit (dB)
93.9 (93.9)	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	10.8
C - weight	17.0
Flat	22.8

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	0.2	0.2	0.2	± 1.5
1000	0.0	0.0	0.0	± 1.0
8000	-0.9	-0.8	-0.8	±5.0

QF-TS12-04-04-020664

T. P. A.

Continuation of Calibration Certificate

Cert. No. : ACL22054
Job No. : VC65AC0043
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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	-0.1	0.0	±2.0
125	0.0	0.0	0.0	±1.5
250	0.0	0.0	0.0	±1.5
500	0.0	0.0	0.0	±1.5
1000	0.0	0.0	0.0	±1.0
2000	0.0	0.0	0.0	±2.0
4000	0.0	0.0	0.0	±3.0
8000	0.0	0.1	0.1	±5.0

5. Frequency and time weightings at 1 kHz

5.1 Frequency weightings at 1 kHz

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

5.2 Time weighting at 1 kHz

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

6. Long - term stability

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

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T. P. A.

Continuation of Calibration Certificate

Cert. No. : ACL22054
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7. Level linearity on the reference level range

Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
137.0	137.0	0.0	± 1.1
136.0	136.0	0.0	± 1.1
135.0	135.0	0.0	± 1.1
134.0	134.0	0.0	± 1.1
133.0	133.0	0.0	± 1.1
132.0	131.9	-0.1	± 1.1
131.0	130.9	-0.1	± 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	27.1	0.1	± 1.1
26.0	26.1	0.1	± 1.1
25.0	25.1	0.1	± 1.1

QF-TS12-04-04-020664

T. P. A.

Continuation of Calibration Certificate

Cert. No. : ACL22054
Job No. : VC65AC0043
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, Th (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, Lepeak (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	135.2	-0.2	±2.0

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T. P. A.

Continuation of Calibration Certificate

Cert. No. : ACL22054
Job No. : VC65AC0043
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	SLM Display at initial (dB)	SLM Display at final (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Weighting				
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 Sirdinthorn 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. : ACC22013
Pages : 1 of 3

Calibration Certificate

Equipment : SOUND CALIBRATOR
Manufacturer : RION
Model : NC-74
Serial No. : 34178121
ID No. : RYQ_FS0213

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) %

REVIEW BY	<i>Hanham P.</i>
APPROVED BY	<i>T. Petchur</i>
NEXT CAL DATE	26/4/23

Received Date : 22 APRIL 2022
Calibration Date : 26 APRIL 2022
Date of Issue : 29 APRIL 2022

Calibrated by : Nathakorn Pisupeisan

Approved by :

T. Petchur
(Thanakul Petchurai)

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QF-TS12-04-04-020664

Continuation of Calibration Certificate

Cert. No. : ACC22013
Job No. : VC65AC0054
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).

QF-TS12-04-04-020664

Continuation of Calibration Certificate

Cert. No. : ACC22013
Job No. : VC65AC0054
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	94.11	0.11	0.14	0.40

2. Frequency

Specified Frequency (Hz)	Measured value (Hz)	Deviated value (%)	Uncertainty (%)	Tolerance limit (%)
1000	1003.1	0.3	0.1	1.0

3. Total distortion

Measured value (%)	Uncertainty (%)	Tolerance limit (%)
2.02	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

SITHIPORN ASSOCIATES CO.,LTD. CALIBRATION LABORATORY

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



Cert. No. : ACL22183
Pages : 1 of 8

Calibration Certificate

Equipment : SOUND LEVEL METER
Manufacturer : RION
Model : NL-42/ Microphone UC-52 / Preamplifier NH-24
Serial No.: 01073423 / 169513 / 73684
ID No.: RYG_FS0386

Condition As Found : GOOD

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

REVIEW BY: *Nathakorn P.*
APPROVED BY: *T. Petchur*
NEXT CAL. DATE: 26/8/23

Calibrated by : Nathakorn Pisu-paisan

Approved by :

(Thanakul Petchur)

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QF-TS12-04-04-020664

SITHIPORN ASSOCIATES CO.,LTD. CALIBRATION LABORATORY

Continuation of Calibration Certificate

Cert. No. : ACL22183
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	✓	-	0.3	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

SITHIPORN ASSOCIATES CO.,LTD. CALIBRATION LABORATORY

Continuation of Calibration Certificate

Cert. No. : ACL22183
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	12.6
C-weight	18.6
Flat	24.5

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	0.2	0.2	0.3	± 1.5
1000	0.1	0.1	0.1	± 1.0
8000	1.5	1.5	1.6	±5.0

QF-TS12-04-04-020664

SITHIPORN ASSOCIATES CO.,LTD. CALIBRATION LABORATORY

Continuation of Calibration Certificate

Cert. No. : ACL22183
Job No. : VC65AC0077
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	0.0	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	0.0	±2.0
4000	0.0	0.0	0.0	±3.0
8000	0.0	0.1	0.1	±5.0

5. Frequency and time weightings at 1 kHz

5.1 Frequency weightings at 1 kHz

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

5.2 Time weighting at 1 kHz

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

6. Long-term stability

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

QF-TS12-04-04-020664

Continuation of Calibration Certificate

Cert. No. : ACL22183
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	137.0	0.0	±1.1
136.0	136.0	0.0	±1.1
135.0	135.0	0.0	±1.1
134.0	134.0	0.0	±1.1
133.0	133.0	0.0	±1.1
132.0	132.0	0.0	±1.1
131.0	131.0	0.0	±1.1
129.0	129.0	0.0	±1.1
124.0	124.0	0.0	±1.1
119.0	119.0	0.0	±1.1
114.0	114.0	0.0	±1.1
109.0	109.0	0.0	±1.1
104.0	104.0	0.0	±1.1
99.0	99.0	0.0	±1.1
94.0	94.0	0.0	±1.1
89.0	89.0	0.0	±1.1
84.0	84.0	0.0	±1.1
79.0	79.0	0.0	±1.1
74.0	74.0	0.0	±1.1
69.0	69.0	0.0	±1.1
64.0	64.0	0.0	±1.1
59.0	59.0	0.0	±1.1
54.0	54.0	0.0	±1.1
49.0	49.0	0.0	±1.1
44.0	44.0	0.0	±1.1
39.0	39.0	0.0	±1.1
34.0	34.0	0.0	±1.1
30.0	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	25.9	-0.1	±1.1
25.0	24.8	-0.2	±1.1

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Continuation of Calibration Certificate

Cert. No. : ACL22183
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	108.0	0.0	1.5; -3.0
	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; -3.0
	200	800	127.6	127.6	0.0	±1.0
	0.25	1	99.0	98.9	-0.1	1.5; -3.0
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, Lpeak (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.0	0.0	-
One	136.4	135.8	-0.6	±3.0

Number of cycle in test signal	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.1	0.1	-
Positive half cycle	135.4	135.2	-0.2	±2.0
Negative half cycle	135.4	135.2	-0.2	±2.0

QF-TS12-04-04-020664

Continuation of Calibration Certificate

Cert. No. : ACL22183
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		
89.7	89.5	-0.2	±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 Sindhorn Rd, Bangbunru, Bangplud Bangkok 10700 THAILAND.
Tel:0-2435-8800 Fax:0-2433-1679 e-mail:cal-center@sithiporn.com http://www.sithiporn.comCert. No. : ACL22234
Pages : 1 of 8

Calibration Certificate

Equipment : SOUND LEVEL METER
Manufacturer : RION
Model : NL-42/ Microphone UC-52 / Preamplifier NH-24
Serial No. : 01073608 / 172153 / 85748
ID No. : RYG_FS0387

Condition As Found : GOOD

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

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

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

Calibrated by : Nathakorn Pisutpaisan

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

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QF-TS12-04-04-020664

Continuation of Calibration Certificate

Cert. No. : ACL22234
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-0008-22	07-Feb-23
Condenser Microphone	4180	2977900	AA-1013-22	24-Feb-23
Measuring Amplifier	NA-42KAJ	34560495	AA-3005-22	22-Feb-23

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

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

3.1 National Institute of Metrology (Thailand).

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

QF-TS12-04-04-020664

T. Petch

Continuation of Calibration Certificate

Cert. No. : ACL22234
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. Petch

Continuation of Calibration Certificate

Cert. No. : ACL22234
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	23.8

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	0.4	0.3	0.4	± 1.5
1000	0.0	0.0	0.0	± 1.0
8000	-1.0	-0.9	-0.9	± 5.0

QF-TS12-04-04-020664

T. Petch

Continuation of Calibration Certificate

Cert. No. : ACL22234
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4. Electrical signal tests of frequency weightings

Weighing network response with relative to 1 kHz

Frequency (Hz)	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	0.1	0.1	±5.0

5. Frequency and time weightings at 1 kHz

5.1 Frequency weightings at 1 kHz

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

5.2 Time weighting at 1 kHz

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

6. Long - term stability

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

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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	84.1	0.1	±1.1
79.0	79.0	0.0	±1.1
74.0	74.1	0.1	±1.1
69.0	69.0	0.0	±1.1
64.0	64.0	0.0	±1.1
59.0	59.1	0.1	±1.1
54.0	54.0	0.0	±1.1
49.0	49.0	0.0	±1.1
44.0	44.0	0.0	±1.1
39.0	39.0	0.0	±1.1
34.0	34.0	0.0	±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	24.8	-0.2	±1.1

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T. Petchur

Continuation of Calibration Certificate

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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	134.0	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	128.1	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	136.2	-0.2	±3.0

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

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T. Petchur

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11. Overload indication

Measured value (dB)		Deviated Value (dB)	Acceptance Limits (dB)
Positive one-half cycle	Negative one-half cycle		
119.6	89.7	-29.9	±1.5

12. High level stability

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

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

End of Calibration Certificate

QF-TS12-04-04-020664

T. Petchur

451-451/1 Srinthorn 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. : ACL22235
Pages : 1 of 8

Calibration Certificate

Equipment : SOUND LEVEL METER
Manufacturer : RION
Model : NL-42 / Microphone UC-52 / Preamplifier NH-24
Serial No. : 01173609 / 172170 / 74021
ID No. : RYG_FS0388

Condition As Found : GOOD

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

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

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

Calibrated by : Nuthakorn Pichutpaian

Approved by : T. Petchur
(Thanakul Petchurai)

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

QF-TS12-04-04-020664

Continuation of Calibration Certificate

Cert. No. : ACL22235
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-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).

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T. Petch.

Continuation of Calibration Certificate

Cert. No. : ACL22235
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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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T. Petch.

Continuation of Calibration Certificate

Cert. No. : ACL22235
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Result of calibration :

1. Absolute sensitivity

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

2. Self-generated noise

2.1 Normal test

Measured Value (dB)
15.1

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

Frequency Weighting	Measured value (dB)
A - weight	12.0
C - weight	18.0
Flat	23.7

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	0.3		± 1.5
1000	0.0	0.0	0.0		± 1.0
8000	-0.6	-0.5	-0.5		±5.0

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T. Petch.

Continuation of Calibration Certificate

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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)				Acceptance Limits
	Flat	C-weight	A-weight		
63	-0.1	-0.1	-0.1		±2.0
125	0.0	0.0	0.0		±1.5
250	0.0	0.0	0.0		±1.5
500	0.0	0.0	0.0		±1.5
1000	0.0	0.0	0.0		±1.0
2000	0.0	0.0	0.0		±2.0
4000	0.0	0.0	0.0		±3.0
8000	0.0	0.1	0.1		±5.0

5. Frequency and time weightings at 1 kHz

5.1 Frequency weightings at 1 kHz

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

5.2 Time weighting at 1 kHz

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

6. Long - term stability

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

QF-TS12-04-04-020664

T. Petch.

Continuation of Calibration Certificate

Cert. No. : ACL22235
Job No. : VC65AC0088
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7. Level linearity on the reference level range

Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
137.0	137.0	0.0	±1.1
136.0	136.0	0.0	±1.1
135.0	135.0	0.0	±1.1
134.0	134.0	0.0	±1.1
133.0	133.0	0.0	±1.1
132.0	132.0	0.0	±1.1
131.0	131.0	0.0	±1.1
129.0	129.0	0.0	±1.1
124.0	124.0	0.0	±1.1
119.0	119.0	0.0	±1.1
114.0	114.0	0.0	±1.1
109.0	109.0	0.0	±1.1
104.0	104.0	0.0	±1.1
99.0	99.0	0.0	±1.1
94.0	94.0	0.0	±1.1
89.0	89.0	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	53.9	-0.1	±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	26.8	-0.2	±1.1
26.0	25.8	-0.2	±1.1
25.0	24.8	-0.2	±1.1

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T. Pich.

Continuation of Calibration Certificate

Cert. No. : ACL22235
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 Weighing	Tone burst duration, T _b (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, C _{peak} (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.0	0.0	-
One	136.4	135.6	-0.8	±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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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 Weighing	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. Pich.



ROTA METER CALIBRATION RESULT JULY 2022

Rotameter ID.	Calibration Date	Regression Result	Coefficient (R ²)
BKK_FS0577	01 Jul 22	$Y = 1.0202x + 0.1976$	1.0000
BKK_FS0579	01 Jul 22	$Y = 1.0078x + 0.4789$	0.9988
BKK_FS0583	01 Jul 22	$Y = 1.016x + 0.3922$	1.0000
BKK_FS0584	01 Jul 22	$Y = 1.0036x + 2.2282$	0.9997
BKK_FS0585	01 Jul 22	$Y = 1.0189x - 5.6478$	0.9997
BKK_FS0586	01 Jul 22	$Y = 1.0095x - 1.1524$	0.9995
BKK_FS0587	01 Jul 22	$Y = 1.013x - 3.6510$	0.9996
BKK_FS0588	01 Jul 22	$Y = 1.0154x + 4.8357$	0.9999
BKK_FS0589	01 Jul 22	$Y = 0.9918x + 4.8069$	0.9999
BKK_FS0590	01 Jul 22	$Y = 1.0038x - 0.4857$	0.9996
BKK_FS0591	01 Jul 22	$Y = 0.9705x - 52.174$	0.9986
BKK_FS0592	01 Jul 22	$Y = 0.9846x - 37.842$	0.9985
BKK_FS0593	01 Jul 22	$Y = 0.9767x - 58.445$	0.9988
BKK_FS0594	01 Jul 22	$Y = 0.9602x - 82.87$	0.9989
BKK_FS0595	01 Jul 22	$Y = 1.0248x - 98.182$	0.9999
BKK_FS0596	01 Jul 22	$Y = 0.9843x - 28.806$	0.9981
BKK_FS0597	01 Jul 22	$Y = 0.9602x - 61.553$	0.9978
BKK_FS1004	01 Jul 22	$Y = 0.9896x + 17.89$	0.9990
BKK_FS1005	01 Jul 22	$Y = 1.0082x + 2.4571$	0.9999
BKK_FS1006	01 Jul 22	$Y = 1.168x - 5.566$	0.9997
BKK_FS1007	01 Jul 22	$Y = 0.9917x + 1.6592$	1.0000
BKK_FS1008	01 Jul 22	$Y = 1.0132x + 0.7207$	1.0000
BKK_FS1009	01 Jul 22	$Y = 1.0132x + 1.1633$	0.9980
BKK_FS1010	01 Jul 22	$Y = 1.0033x + 0.5758$	0.9999
BKK_FS1011	01 Jul 22	$Y = 1.0234x + 0.1759$	0.9996
BKK_FS1012	01 Jul 22	$Y = 1.0106x - 2.0048$	0.9997
BKK_FS1013	01 Jul 22	$Y = 0.9877x - 35.851$	0.9997
BKK_FS1014	01 Jul 22	$Y = 1.0021x + 0.3148$	0.9988
BKK_FS1015	01 Jul 22	$Y = 0.9994x + 1.788$	1.0000
BKK_FS1016	01 Jul 22	$Y = 1.0105x - 80.258$	0.9988
BKK_FS1017	01 Jul 22	$Y = 0.9955x + 0.640$	1.0000
BKK_FS1018	01 Jul 22	$Y = 1.0011x + 1.1786$	1.0000
BKK_FS1019	01 Jul 22	$Y = 1.0023x - 68.424$	0.9999
BKK_FS1020	01 Jul 22	$Y = 1.0547x - 0.686$	0.9996
BKK_FS1021	01 Jul 22	$Y = 1.018x - 3.3288$	0.9996
BKK_FS1022	01 Jul 22	$Y = 0.9932x - 57.035$	0.9986
BKK_FS1023	01 Jul 22	$Y = 1.0094x + 0.0717$	0.9989
BKK_FS1024	01 Jul 22	$Y = 1.0042x + 0.4088$	0.9997
BKK_FS1025	01 Jul 22	$Y = 1.0132x - 88.507$	0.9996



ROTA METER CALIBRATION RESULT JULY 2022

Rotameter ID.	Calibration Date	Regression Result	Coefficient (R ²)
BKK_FS1026	01 Jul 22	$Y = 1.0018x + 1.0776$	0.9997
BKK_FS1027	01 Jul 22	$Y = 1.0053x + 0.231$	0.9995
BKK_FS1028	01 Jul 22	$Y = 0.9792x - 60.312$	0.9982
BKK_FS1029	01 Jul 22	$Y = 0.9935x + 0.8234$	1.0000
BKK_FS1030	01 Jul 22	$Y = 1.0039x + 0.515$	0.9999
BKK_FS1031	01 Jul 22	$Y = 1.009x - 79.295$	0.9988
BKK_FS1039	01 Jul 22	$Y = 0.9879x + 7.3524$	0.9996
BKK_FS1040	01 Jul 22	$Y = 0.9704x + 88.338$	0.9987
BKK_FS1041	01 Jul 22	$Y = 1.0645x - 1.7878$	0.9999
BKK_FS1042	01 Jul 22	$Y = 0.9983x + 3.8282$	0.9998
BKK_FS1043	01 Jul 22	$Y = 1.0069x - 6.8919$	1.0000
BKK_FS1044	01 Jul 22	$Y = 1.0355x - 0.6214$	0.9987
BKK_FS1161	01 Jul 22	$Y = 1.0126x + 0.7738$	0.9999
BKK_FS1162	01 Jul 22	$Y = 0.9994x + 2.6357$	0.9995
BKK_FS1163	01 Jul 22	$Y = 0.977x - 55.03$	0.9987
BKK_FS1184	01 Jul 22	$Y = 0.9914x + 0.8427$	0.9997
BKK_FS1185	01 Jul 22	$Y = 0.9893x + 6.5919$	0.9988
BKK_FS1168	01 Jul 22	$Y = 1.0031x - 77.881$	0.9996
BKK_FS1200	01 Jul 22	$Y = 1.0313x - 0.4602$	0.9985
BKK_FS1201	01 Jul 22	$Y = 1.0045x + 0.15$	0.9996
BKK_FS1202	01 Jul 22	$Y = 0.9702x - 44.156$	0.9994
RYG_FS0197	01 Jul 22	$Y = 1.0038x - 0.179$	0.9999
RYG_FS0198	01 Jul 22	$Y = 0.9971x + 16.648$	0.9999
RYG_FS0199	01 Jul 22	$Y = 1.0832x - 2.6367$	1.0000

Review By:

Wichan Choonharat

(Mr. Wichan Choonharat)
Enviro Field Services Manager

Approved By:

(Mr. Sarayuth Jitrantoni)

(Mr. Sarayuth Jitrantoni)
Assistant General Manager



ROTA METER CALIBRATION RESULT OCTOBER 2022

Rotameter ID.	Calibration Date	Regression Result	Coefficient (R ²)
BKK_FS0577	01 Oct 22	$Y = 1.0202x + 0.1976$	1.0000
BKK_FS0579	01 Oct 22	$Y = 1.0078x + 0.4789$	0.9998
BKK_FS0583	01 Oct 22	$Y = 1.016x + 0.3922$	1.0000
BKK_FS0584	01 Oct 22	$Y = 1.0036x + 2.2282$	0.9997
BKK_FS0585	01 Oct 22	$Y = 1.0189x + 5.6476$	0.9997
BKK_FS0586	01 Oct 22	$Y = 1.0095x + 1.1524$	0.9995
BKK_FS0587	01 Oct 22	$Y = 1.013x + 3.6919$	0.9996
BKK_FS0588	01 Oct 22	$Y = 1.0154x + 4.8357$	0.9999
BKK_FS0589	01 Oct 22	$Y = 0.9916x + 4.8069$	0.9999
BKK_FS0590	01 Oct 22	$Y = 1.0038x - 0.4857$	0.9998
BKK_FS0591	01 Oct 22	$Y = 0.9705x + 52.174$	0.9998
BKK_FS0592	01 Oct 22	$Y = 0.9648x - 37.642$	0.9985
BKK_FS0593	01 Oct 22	$Y = 0.9767x - 58.445$	0.9985
BKK_FS0594	01 Oct 22	$Y = 0.9602x + 62.87$	0.9999
BKK_FS0595	01 Oct 22	$Y = 1.0249x - 68.182$	0.9999
BKK_FS0596	01 Oct 22	$Y = 0.9843x - 28.805$	0.9991
BKK_FS0597	01 Oct 22	$Y = 0.9802x + 61.653$	0.9978
BKK_FS1004	01 Oct 22	$Y = 0.9762x + 11.724$	0.9998
BKK_FS1005	01 Oct 22	$Y = 1.0081x + 1.5143$	1.0000
BKK_FS1006	01 Oct 22	$Y = 1.0068x - 2.9327$	0.9999
BKK_FS1007	01 Oct 22	$Y = 0.9917x + 1.8592$	1.0000
BKK_FS1008	01 Oct 22	$Y = 1.0132x + 0.7207$	1.0000
BKK_FS1009	01 Oct 22	$Y = 1.0132x + 1.1633$	0.9980
BKK_FS1010	01 Oct 22	$Y = 1.0033x + 0.5758$	0.9999
BKK_FS1011	01 Oct 22	$Y = 1.0234x + 0.1759$	0.9996
BKK_FS1012	01 Oct 22	$Y = 1.0106x - 2.0048$	0.9997
BKK_FS1013	01 Oct 22	$Y = 0.9877x + 35.851$	0.9997
BKK_FS1014	01 Oct 22	$Y = 1.0021x + 0.3148$	0.9988
BKK_FS1015	01 Oct 22	$Y = 0.9994x + 1.786$	1.0000
BKK_FS1016	01 Oct 22	$Y = 1.0105x - 80.256$	0.9998
BKK_FS1017	01 Oct 22	$Y = 0.9995x + 0.649$	1.0000
BKK_FS1018	01 Oct 22	$Y = 1.0011x + 1.1786$	1.0000
BKK_FS1019	01 Oct 22	$Y = 1.0023x - 68.424$	0.9996
BKK_FS1020	01 Oct 22	$Y = 1.0547x - 0.866$	0.9988
BKK_FS1021	01 Oct 22	$Y = 1.018x - 3.3286$	0.9988
BKK_FS1022	01 Oct 22	$Y = 0.9932x - 57.035$	0.9986
BKK_FS1023	01 Oct 22	$Y = 1.0094x + 0.0717$	0.9999
BKK_FS1024	01 Oct 22	$Y = 1.0042x + 0.4086$	0.9997
BKK_FS1025	01 Oct 22	$Y = 1.0132x - 88.507$	0.9996

RYG_EN0004



ROTA METER CALIBRATION RESULT OCTOBER 2022

Rotameter ID.	Calibration Date	Regression Result	Coefficient (R ²)
BKK_FS1026	01 Oct 22	$Y = 1.0018x + 1.0776$	0.9997
BKK_FS1027	01 Oct 22	$Y = 1.0053x + 0.231$	0.9995
BKK_FS1028	01 Oct 22	$Y = 0.9792x - 60.312$	0.9982
BKK_FS1029	01 Oct 22	$Y = 0.9935x + 0.8234$	1.0000
BKK_FS1030	01 Oct 22	$Y = 1.0039x + 0.515$	0.9999
BKK_FS1031	01 Oct 22	$Y = 1.009x - 79.295$	0.9988
BKK_FS1039	01 Oct 22	$Y = 0.9867x + 7.5048$	0.9999
BKK_FS1040	01 Oct 22	$Y = 0.9936x + 32.694$	0.9998
BKK_FS1041	01 Oct 22	$Y = 1.067x - 1.999$	1.0000
BKK_FS1042	01 Oct 22	$Y = 1.0019x + 2.1571$	1.0000
BKK_FS1043	01 Oct 22	$Y = 1.1569x - 66.476$	0.8412
BKK_FS1044	01 Oct 22	$Y = 1.0315x - 0.9374$	0.9999
BKK_FS1161	01 Oct 22	$Y = 1.0126x + 0.7738$	0.9999
BKK_FS1162	01 Oct 22	$Y = 0.9994x + 2.6357$	0.9995
BKK_FS1183	01 Oct 22	$Y = 0.977x - 55.03$	0.9987
BKK_FS1164	01 Oct 22	$Y = 0.9914x + 0.8427$	0.9997
BKK_FS1165	01 Oct 22	$Y = 0.9893x + 6.5919$	0.9988
BKK_FS1166	01 Oct 22	$Y = 1.0031x - 77.881$	0.9996
BKK_FS1200	01 Oct 22	$Y = 1.0313x - 0.4602$	0.9985
BKK_FS1201	01 Oct 22	$Y = 1.0045x + 0.15$	0.9996
BKK_FS1202	01 Oct 22	$Y = 0.9702x - 44.156$	0.9994
RYG_FS0197	01 Oct 22	$Y = 1.0038x - 0.179$	0.9999
RYG_FS0198	01 Oct 22	$Y = 0.9964x + 21.757$	1.0000
RYG_FS0199	01 Oct 22	$Y = 1.0577x - 1.7486$	1.0000

Review By:

Wichan Choonharat

(Mr. Wichan Choonharat)
Enviro Field Services Manager

Approved By:

(Mr. Sarayuth Jitrantoni)

(Mr. Sarayuth Jitrantoni)
Assistant General Manager



PENTA
CALIBRATION

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Tel : +66 (0) 2099-9773
www.pentacal.com

Certificate of Calibration

Represent to Certificate of Calibration ,PTC/07/22104

Certificate No.: PTC/07/22104 Page: 1 of 3
Equipment: Digital Balance Condition: Normal
Manufacturer: Sartorius Serial No: 33108993
Model: MSE125P-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 Metakul



REVIEW BY: *Thawitell*
APPROVED BY: *P. Kerdito*
NEXT CAL DATE: 09/09/23



Approved By: *(Mr. Keattisak Kerdito)*
Laboratory Manager

This certificate is issued the units of measurement according to the International System of Units (SI). It provides traceability of measurement to international or national standard or other recognized national standard laboratories.
The measurement uncertainty stated 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 the Expression of Uncertainty in Measurement (GUM). The effect that the result refers only to the item calibrated.
This calibration certificate shall not be reproduced except in full, without written approval from Penta Calibration Co., Ltd.

Represent to Certificate of Calibration PTC07/22104

Certificate No.: PTC07/22104

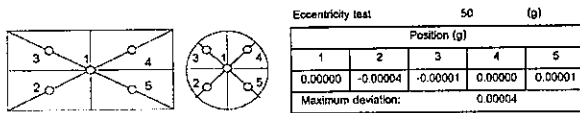
Page: 2 of 3

Measurement Results:

Without Adjustment:

Function Calibration: Non Adjustment

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



Repeatability Test: Weight to be 1/2 ≤ L₁ ≤ Maximum capacity

Determination of the standard deviation of weighing balance, Readability 0.00001 (g)

Nominal test value (g)	Standard Deviation
50	0.00007

Error of Indication: from nominal value, Readability 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	0.000020	2.65
0.01	0.010001	0.01000	0.00000	0.000022	2.17
0.05	0.050002	0.04999	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	1.999999	1.99999	0.00001	0.000022	2.14
5	5.000015	4.99999	0.00002	0.000023	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)

PTC/MS/07/02 21th/200

Represent to Certificate of Calibration PTC07/22104

Certificate No.: PTC07/22104

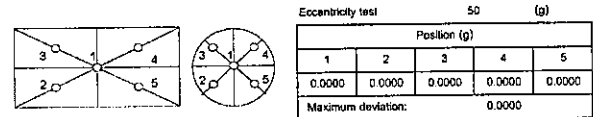
Page: 3 of 3

Measurement Results:

Without Adjustment:

Function Calibration: Non Adjustment

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



Repeatability Test: Weight to be 1/2 ≤ L₁ ≤ Maximum capacity

Determination of the standard deviation of weighing balance, Readability 0.0001 (g)

Nominal test value (g)	Standard Deviation
100	0.00000

Error of Indication: from nominal value, Readability 0.0001 (g)

Nominal Value (g)	Conventional Mass (g)	Indication (g)	Correction of Balance (g)	Uncertainty (g)	k
65	65.00006	65.00000	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

PTC/MS/07/02 21th/200

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Agilent CrossLab Compliance Services

Certificate of System Qualification

GC-00 • GCMS-00

System ID: GM-2
Organization Name: ALS Laboratory Group (Thailand) Co., Ltd.
Organization Location: 104 Phatthanakan 40, Phatthanakan Rd., Khlongseng Suan Luang, Khet Suan Luang, Bangkok 10250
Date: October 1, 2021 1:10:17 PM
EQP Name: Agilent/Recommended, Agilent/Recommended
EQP Revision: GC.02.51, GCMS.07.51
Overall Qualification 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 Accuracy

Name: 7890
Front MM
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

GC Oven Temperature Accuracy

Name: 7890

Date: October 1, 2021 1:10:17 PM
System ID: GM-2

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Agilent CrossLab Compliance Services

Setpoint Status: Pass
Zone: Oven
Setpoint/Actual: 230.0 / 230.5 °C
Accuracy: 0.6 °C
Agilent Recommended: >= -1.0 °C setpoint in K (-5.0 °C)
<= 1.0 °C setpoint in K (5.0 °C)

Setpoint Status: Pass
Zone: Oven
Setpoint/Actual: 100.0 / 101.5 °C
Accuracy: 1.5 °C
Agilent Recommended: >= -1.0 °C setpoint in K (-3.7 °C)
<= 1.0 °C 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 / 101.5 °C
Stability: 0.0 °C
Agilent Recommended: <= 0.5

Overall GC Oven Temperature Stability Test Status

Pass

Log Amp

Tested Combination: Front MM / External SQ
Name: 5975C Inert XL with TAD
Setpoint Status: Pass

Date: October 1, 2021 1:10:17 PM
System ID: GM-2

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Overall Log Amp Test Status

Pass

RPFA

Tested Combination1 Front MMI / External SQ

Name: 5975C Inert XL with TAD

Setpoint Status: Pass

Amu: 1050 m/z Drift After Five Minutes: RPPA Voltage: 451 mV

Agilent Recommended: >= -100 and <= 100 <= 1100

Overall RPPA Test Status

Pass

Tune EI

Tested Combination1 Front MMI / External SQ

Name: 5975C Inert XL with TAD

Setpoint Status: Pass

Filament: 1

Setpoint Status: Pass

Filament: 2

Overall Tune EI Test Status

Pass

Scouting Run

Tested Combination1 Front MMI / External SQ

Name: Injection Tower

Source: 7693A

Source: EI - Inert

Date: October 1, 2021 1:10:17 PM

System ID: GM-2

Setpoint Status:

Completed

Injection Volume on Column:

1.0 µL

Overall Scouting Run Status

Completed

Signal to Noise EI

Tested Combination1 Front MMI / External SQ

Name: 5975C Inert XL with TAD

Source: EI - Inert Filament: 1

Setpoint Status: Pass

Signal to Noise: 619

Agilent Recommended: >= 320

Source: EI - Inert Filament: 2

Setpoint Status: Pass

Signal to Noise: 647

Agilent Recommended: >= 320

Overall Signal to Noise EI Test Status

Pass

Injection Precision

Tested Combination1 Front MMI / External SQ

Name: 7693A

Source: EI - Inert

Setpoint Status: Pass

Injection Volume on Column: 1.0 µL

Area RSD: 4.75 % Retention Time RSD: 0.02 %

Agilent Recommended: <= 5.00 <= 1.00

Overall Injection Precision Test Status

Pass

Date: October 1, 2021 1:10:17 PM

System ID: GM-2

Mass Ratio Precision

Tested Combination1 Front MMI / External SQ

Name: Injection Tower

Source: 7693A

Source: EI - Inert

Setpoint Status: Pass

Injection Volume on Column: 1.0 µL

Area Mass 1 Abundance's

RSD: 4.75 %

Agilent Recommended: <= 5.00

Pass

Overall Mass Ratio Precision Test Status

Pass

Date: October 1, 2021 1:10:17 PM

System ID: GM-2

Instrument Details

Purpose

This section describes the as found system configuration.

Details

System

System ID	GM-2
Manufacturer	Agilent Technologies
Name	7690
Flow Data Input	Manual Data
Temperature Data Input	Manual Data or Other Data Logging

Tested Combination1

Injection Technique	Injection Tower
Inlet	Front
Detector	External
LTM Included?	No

Sampler 1

Manufacturer	Agilent Technologies
Type	Injection Tower
Name	7693A
Model Number	G4513A
Serial Number	CN10120123
Firmware Revision	A.10.08
Usage	Sample Injection
Location	Front
Syringe Volume (µL)	10

Date: October 1, 2021 1:10:17 PM

System ID: GM-2

Sampler 2

Manufacturer Agilent Technologies
Type Tray
Name 7693A
Model Number G4514A
Serial Number CN10080069
Firmware Revision A.10.16
Vial Heater Not Installed

Mainframe 1

Manufacturer Agilent Technologies
Name 7890
Model Number G3440A
Serial Number CN10141048
Firmware Revision A.01.16
Oven Type Standard

Inlet 1

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

Detector 1

Manufacturer Agilent Technologies
Name Mass Spectrometer
Type Mass Spectrometer
Location External

Date: October 1, 2021 1:16:17 PM
System ID: GM-2

Mass Spectrometer 1

Manufacturer Agilent Technologies
Type SQ
Name 5875C Inert XL with TAD
Serial Number US10163217
Firmware Revision 5.02.12
High Vacuum System Turbo Pump
Scoping Run Standard OFN Std

MS EI Source 1

Manufacturer Agilent Technologies
Source Type EI - Inert
Number of filaments 2

Date: October 1, 2021 1:10:17 PM
System ID: GM-2

Electronic Signature

Purpose

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Details

Full Name of Signer: Supasak Nimsongtham
Logged On User Name: supasak.nimsongtham@agilent.com
Signature Creation Date: October 1, 2021
Reason for Signature: Executed protocol and published this original version of document

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Date: October 1, 2021 1:16:17 PM
System ID: GM-2

User Name: supasak.nimsongtham
Host Name: ECG11164K2
System ID: GM-2
Print Date: October 1, 2021 1:16:19 PM

ALB_0M2 Transaction Log:

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
October 1, 2021 12:42:37 PM	Start	Session Created	Session	None
October 1, 2021 12:42:37 PM	Start	Configuration	Session	None
October 1, 2021 12:42:37 PM	Audit	Entitlement	Licensing	User is Field Engineer and does not require an unlock code
October 1, 2021 12:44:21 PM	Audit	Exported	Session	EOP Details for primary technique (GC1) - File path: Protocol\Packaging\GC1\Config\lms02.516c.02.51.eop EOP File Name: GC1.02.51.eop, EOP Name: [AgilentRecommended] EOP Details for hyperparameter technique (GC4h) - File path: Protocol\Packaging\GC4h\Config\lms02.516c.02.51.eop EOP File Name: GC4h.02.51.eop, EOP Name: [AgilentRecommended]
October 1, 2021 12:44:24 PM	End	Configuration	Session	None
October 1, 2021 12:44:25 PM	Start	Qualification	Session	QQ
October 1, 2021 12:44:25 PM	Start	Execution	System Inspection and Basic Safety and Operation - 7890 - Qualitative Test - No suspects associated	None

Date: October 1, 2021 1:10:17 PM
System ID: GM-2

User Name: supasakulnongtham		System ID: GM-2	
Hostname: SC01115HNC		Print Date: October 1, 2021 1:10:19 PM	
ALB_GM2 Transaction log:			
Time	Transaction State	Activity Performed	Optional Information
October 1, 2021 12:47:36 PM	End	Execution	System Inspection and Seal: Safety and Operation - T900 - Qualitative Test - No septum associated. Run Count: 1
October 1, 2021 12:47:37 PM	Start	Execution	Intel Pressure Accuracy - Front MMV - Pressure Confirmed Inlet - S: 25.0 psi - L: <= 1.0 psi
October 1, 2021 12:47:42 PM	End	Execution	Intel Pressure Accuracy - Front MMV - Pressure Confirmed Inlet - S: 25.0 psi - L: <= 1.0 psi
October 1, 2021 12:47:44 PM	Start	Execution	GC Oven Temperature Accuracy - T980 - Temperature : Oven - S: 230.0°C - L: >= -1.0 AND <= 1.0 % septum in K
October 1, 2021 12:48:04 PM	Auto	Data	GC Oven Temperature Accuracy - T980 - Temperature : Oven - S: 230.0°C - L: >= -1.0 AND <= 1.0 % septum in K
October 1, 2021 12:48:05 PM	End	Execution	GC Oven Temperature Accuracy - T980 - Temperature : Oven - S: 230.0°C - L: >= -1.0 AND <= 1.0 % septum in K
October 1, 2021 12:48:07 PM	Start	Execution	GC Oven Temperature Accuracy - T980 - Temperature : Oven - S: 230.0°C - L: >= -1.0 AND <= 1.0 % septum in K
October 1, 2021 12:48:34 PM	Auto	Data	GC Oven Temperature Accuracy - T980 - Temperature : Oven - S: 230.0°C - L: >= -1.0 AND <= 1.0 % septum in K
October 1, 2021 12:48:36 PM	End	Execution	GC Oven Temperature Accuracy - T980 - Temperature : Oven - S: 230.0°C - L: >= -1.0 AND <= 1.0 % septum in K

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Date: October 1, 2021 1:10:17 PM
System ID: GM-2

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User Name: supasakulnongtham
 Hostname: SC01115HNC

System ID: GM-2
 Print Date: October 1, 2021 1:16:19 PM

ALB_GM2 Transaction log:

Time	Transaction State	Activity Performed	Optional Information
October 1, 2021 12:48:36 PM	Start	Execution	GC Oven Temperature Stability - T990 - Temperature : Oven - S: 100.0°C - L: <= 0.5°C
October 1, 2021 12:49:34 PM	Auto	Data	GC Oven Temperature Stability - T990 - Temperature : Oven - S: 100.0°C - L: <= 0.5°C
October 1, 2021 12:49:36 PM	End	Execution	GC Oven Temperature Stability - T990 - Temperature : Oven - S: 100.0°C - L: <= 0.5°C
October 1, 2021 12:49:37 PM	Start	Execution	Log Amp - 58750 Inlet XL with TAD B0 - Source: EI - Inlet
October 1, 2021 12:49:47 PM	End	Execution	Log Amp - 58750 Inlet XL with TAD B0 - Source: EI - Inlet
October 1, 2021 12:49:48 PM	Start	Execution	RPPA - 58750 Inlet XL with TAD B0 - Source: EI - Inlet
October 1, 2021 12:50:23 PM	End	Execution	RPPA - 58750 Inlet XL with TAD B0 - Source: EI - Inlet
October 1, 2021 12:54:26 PM	Start	Execution	Turn EI - 58750 Inlet XL with TAD B0 - Source: EI - Inlet
October 1, 2021 12:50:48 PM	End	Execution	Turn EI - 58750 Inlet XL with TAD B0 - Source: EI - Inlet
October 1, 2021 12:50:50 PM	Start	Execution	Turn EI - 58750 Inlet XL with TAD B0 - Source: EI - Inlet
October 1, 2021 12:50:59 PM	End	Execution	Turn EI - 58750 Inlet XL with TAD B0 - Source: EI - Inlet

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Date: October 1, 2021 1:10:17 PM
System ID: GM-2

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User Name: supasakulnongtham		System ID: GM-2	
Hostname: SC01115HNC		Print Date: October 1, 2021 1:10:19 PM	
ALB_GM2 Transaction log:			
Time	Transaction State	Activity Performed	Optional Information
October 1, 2021 12:51:01 PM	Start	Execution	Scouting Run - Injection Tower, Front MMV, SQ - Source: EI - Inlet-Part of GCMS System Preparation
October 1, 2021 12:51:16 PM	Auto	Data	Scouting Run - Injection Tower, Data File Path: Front MMV, SQ - Source: EI - Inlet-Part of GCMS System Preparation E:\GM2002021\SCOUTING RUN001.D\DATA.MS
October 1, 2021 12:51:42 PM	Auto	Data	Scouting Run - Injection Tower, Data File Path: Front MMV, SQ - Source: EI - Inlet-Part of GCMS System Preparation E:\GM2002021\SCOUTING RUN001.D\DATA.MS
October 1, 2021 12:52:42 PM	Auto	Data	Scouting Run - Injection Tower, Data File Path: Front MMV, SQ - Source: EI - Inlet-Part of GCMS System Preparation E:\GM2002021\SCOUTING RUN001.D\DATA.MS
October 1, 2021 12:53:25 PM	End	Execution	Scouting Run - Injection Tower, Front MMV, SQ - Source: EI - Inlet-Part of GCMS System Preparation Run Count: 1
October 1, 2021 12:53:37 PM	Start	Execution	Signal to Helix EI - Injection Tower, Front MMV, SQ - Source: EI - Inlet using Parameter 1 - L: >= 320
October 1, 2021 12:53:46 PM	Auto	Data	Signal to Helix EI - Injection Tower, Front MMV, SQ - Source: EI - Inlet using Parameter 1 - L: >= 320 Data File Path: E:\GM2002021\SHF_1\OFF_01\DATA.MS
October 1, 2021 12:53:56 PM	End	Execution	Signal to Helix EI - Injection Tower, Front MMV, SQ - Source: EI - Inlet using Parameter 1 - L: >= 320 Run Count: 1

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Date: October 1, 2021 1:10:17 PM
System ID: GM-2

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User Name: supasakulnongtham

Hostname: SC01115HNC

System ID: GM-2

Print Date: October 1, 2021 1:10:19 PM

ALB_GM2 Transaction log:

Time	Transaction State	Activity Performed	Optional Information
October 1, 2021 12:53:39 PM	Start	Execution	Signal to Helix EI - Injection Tower, Front MMV, SQ - Source: EI - Inlet using Parameter 2 - L: >= 320
October 1, 2021 12:54:04 PM	Auto	Data	Signal to Helix EI - Injection Tower, Front MMV, SQ - Source: EI - Inlet using Parameter 2 - L: >= 320
October 1, 2021 12:54:22 PM	End	Execution	Signal to Helix EI - Injection Tower, Front MMV, SQ - Source: EI - Inlet using Parameter 2 - L: >= 320
October 1, 2021 12:54:26 PM	Start	Execution	Injection Precision - Injection Tower, Front MMV, SQ - Source: EI - Inlet (Area): <= 0.05% - L (Rel. Time): <= 1.00%
October 1, 2021 12:54:37 PM	Auto	Data	Injection Precision - Injection Tower, Front MMV, SQ - Source: EI - Inlet (Area): <= 0.05% - L (Rel. Time): <= 1.00%
October 1, 2021 12:54:37 PM	Auto	Data	Injection Precision - Injection Tower, Front MMV, SQ - Source: EI - Inlet (Area): <= 0.05% - L (Rel. Time): <= 1.00%
October 1, 2021 12:54:37 PM	Auto	Data	Injection Precision - Injection Tower, Front MMV, SQ - Source: EI - Inlet (Area): <= 0.05% - L (Rel. Time): <= 1.00%
October 1, 2021 12:54:37 PM	Auto	Data	Injection Precision - Injection Tower, Front MMV, SQ - Source: EI - Inlet (Area): <= 0.05% - L (Rel. Time): <= 1.00%

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Date: October 1, 2021 1:10:17 PM
System ID: GM-2

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Page 7/7

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TEST REPORT

TEST RESULTS

PFM (X)	IDEAL (Y)	ACTUAL CH4 (Y)	ACTUAL H2O (Y)
0.000	0	0	0
10.000	10	10	10
20.000	20	20	20
30.000	30	30	30
40.000	40	40	40

REVIEW BY Theriffall
APPROVED BY D. [Signature]
NEXT CAL. DATE 14/1/2023

DATE: 4/1/65
NAC: 4/1/65
STRANATE ASSOCIATES Co., LTD.

ติดต่อขอข้อมูลทางวิศวกรรมเพิ่มเติม กรุณาติดต่อ: วิศวกรผู้จัดการขาย โทร 02-868-0812 N 15,16, E4441 : Engineer@kanatee.com
โทร 53-66 15-67/33-35 แฟกซ์โทรเลข 7371 และเว็บไซต์: บริษัท วิศวกร วิศวกร 1960 โทร 02-8680812-13 โทรสาร 02-858-1629

CHECK LIST

TEST VALUES

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

ผลการดำเนินการ
- เว้นระยะ เว้นสถานที่สามารถดำเนินการตรวจวัดได้ตามปกติ



1. **ข้อมูลทั่วไป**
 1.1 **ชื่อโครงการ** : โครงการพัฒนาระบบบริหารจัดการข้อมูลเชิงพื้นที่ (Geospatial Information Management System)



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES
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TEL. 0-2717-3000-21 FAX. 0-2719-9484



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

Certificate of Calibration

Equipment: pH Meter
Manufacturer: Mettler Toledo
Model: Seven Compact S220
Serial No.: C104059460
ID No.: RYG_EN0183
Condition As-Received: Used Item
Received Date: 16 March 2022
Calibration Date: 17 March 2022
Reference: 2203-0611DSC-4
Submitted by: ALS Laboratory Group (Thailand) Co., Ltd.
Rayong Branch
618/10 Moo 5 T.Maenam Khu,
A.Pluakdeang, 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

REVIEW BY: N. Banjit
APPROVED BY: D. Chai
NEXT CAL DATE: 17/10/23

Calibrated by: Warakorn Lomgagrakul

Approved by: M. L.
Approved Signatory

() Malee Bulkruea
() Salilip Meangmai
() Warakorn Lomgagrakul

Issue Date: 22 March 2022

The Uncertainties are for a confidence probability of approximately 95%

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A 0037307



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

Condition of this calibration result

1. Reference Standard Instrument: -

Instrument	Serial No.	ID No.	Cert. No.	Due Date
1) Document Process Calibrator	54030049	130RC115	21E2662	25 Aug 2022
2) Ref. Standard Thermometer	4982054	110RC044	21H201	26 Oct 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	788995	01 Jan 2024
pH 6.882	CPA chem	781017	02 Aug 2022
pH 10.015	CPA chem	766824	04 Sep 2022

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

Calibration Results

Function: mV Measurement

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

Unit Under Calibration	Nominal Value	Standard Voltage Input	Actual Reading		Uncertainty of Measurement (mV)	Coverage factor k
			mV	pH		
pH Meter	4.000	177.48	177.4	4.000	0.058	2.00
S/N: C104059460	7.000	0.00	-0.1	7.000	0.058	2.00
	10.000	-177.48	-177.5	10.000	0.058	2.00

a 1100955



Cert.No.: 22CH405
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 (±)	Coverage factor k
pH Electrode S/N: 1453404	4.008	4.010	177.7	0.0045	2.00
	6.982	6.986	3.6	0.0084	2.00
	10.015	10.010	-172.9	0.0073	2.05

Function: Temperature Measurement

(*) Without adjustment

This equipment was connected with Temperature Probe;

- Model: InLab Expert Pro-ISM
- Serial No.: 1453404
- 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 (± °C)	Coverage factor k
25.0	25.002	24.9	-0.102	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 %.

-00-

a 1100954



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



Certificate of Calibration

Certificate No.: 22E958
Page: 1 of 2

Equipment: pH Meter
Manufacturer: Mettler Toledo
Model: SevenCompact S220
Serial No.: C104059460
ID No.: RYG_EN0183
Condition As-Received: Used Item
Received Date: 16 March 2022
Calibration Date: 21 March 2022
Reference: 2203-0611DSC
Ambient Temperature: (23 ± 2) °C
Relative Humidity: (50 ± 10) %

Submitted by: ALS Laboratory Group (Thailand) Co., Ltd. Rayong Branch
618/10 Moo 5 T.Maenam Khu, A.Pluakdeang, 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	6440007	21E1444	07 May 2022

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 Certification is traceable to the International System of Unit maintained at:

- National Institute of Metrology (Thailand) (NIMT)

REVIEW BY: N. Banjit
APPROVED BY: D. Chai
NEXT CAL DATE: 9/10/23

Calibrated by: Pongsorn Boonyaporn
Issue Date: 22 March 2022

Approved Signatory: P. Phalinee Prabpai
| Nuntawat Khanchai
| Ponnthippa Tamayakul

B 0284414



Cert. No.: 22E986
Page.: 2 of 2

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

Function:	DC voltage measurement	Range:	2000	mV
	Standard Value	UUC* Reading	Error	Uncertainty
	(mV)	(mV)	(mV)	(± µV)
	-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	200.0	0.0	72

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

*UUC= Unit Under Calibration.

-000-

a 1101070



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Cert.No.: 22TW34
Page.: 1 of 2

Certificate of Testing

Equipment : DO Meter
Manufacturer : YSI
Model : 5000-115V
Serial No. : 15E102798
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)
616/10 Moo 5 T.Maenam Khu, A.Piuaekdaeng,
Rayong 21140, Thailand
Laboratory Condition : Temperature (25 ± 5) °C
Humidity (50 ± 20) %
Test Procedure : In - house method : CP-CH9
by Comparison Technique with Azide Modification Method
Tested by : Walalak Sinihean
Approved by : Saithip
Approved Signatory
() Malee Butkruea
(✓) Saithip Maengmai
() Warakorn Lemgagatrakul
Issue Date : 18 February 2022

REVIEW BY	<u>N. B. B. B.</u>
APPROVED BY	<u>D. S.</u>
NEXT CAL. DATE	<u>15/8/23</u>

B 0281285



Cert.No.: 22TW34
Page.: 2 of 2

Result : Dissolved Oxygen Meter Adjustment With Air 100 %
Dissolved Oxygen Probe No.: 15E100464

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

-000-

Saithip
a 1094744



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534/4 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG BANGKOK 10250
TEL. 0-2717-3000 FAX. 0-2719-9484



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

Certificate of Calibration

Equipment : DO Meter with Sensor
Manufacturer : YSI
Model : 5000-115V
Serial No. : 15E102798
ID No. : RYG_EN0032
Submitted by : ALS Laboratory Group (Thailand) Co., Ltd. (Rayong Branch)
616/10 Moo 5 T.Maenam Khu, A.Piuaekdaeng,
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 : Malee
Approved Signatory
() Pornthippa Tameyskul
(✓) Malee Butkruea
() Suwit Imjai
Issue Date : 21 February 2022

The Uncertainties are for a confidence probability of approximately 95%

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Approval of the head of Corporate Services 3 : Equipment Calibration and Testing Services

A 0038008



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

Cert. No.: 22LM12
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	1523	2188030	21H1273	22 Nov 2022

- This certificate is valid only to the item calibrated on date and place of calibration.
- 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.: 15E100464

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 %.

-00-

a 1095714



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
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TEL. 0-2717-3010-21 FAX: 0-2719-9454



Certificate of Calibration

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

Equipment : Low Temp. Incubator

Manufacturer : Memmert

Model : IPP750

Serial No. : VB15.0084

ID No. : RYG_EN0154

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

Location : BOD Room

Received Order : 22 April 2022

Calibration Date : 22 April 2022

Ambient Temperature : (26 ± 10) °C

Relative Humidity : (50 ± 30) %

Calibrated by : Man Pattanapongpalboon

Approved by :
Approved Signatory

() Ponthipha Tameyakul
(✓) Malee Butkruae
() Sowit Imjai

Issue Date : 3 May 2022

The Uncertainties are for a confidence probability of approximately 95 %

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Approval of the head of Corporate Services 3: Equipment Calibration and Testing Services

A 0040735



Equipment : Low Temp. Incubator
Condition As-Received : Used Item
Reference : 2204-0146OC-1

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

Procedure Used :-

Calibration were conducted using calibration procedure CP-OT02 according to direct measurement.
The temperature scale used was based on ITS-90.

Condition of this result of calibration

1. Reference standard Instrument:-

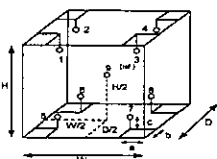
Instrument	Model	Serial No.	Cert. No.	Due Date
1) Data Acquisition	34970A	MY44031769	21LM12	02 Sep 2022

- This certificate is valid only to the item calibrated on date and place of calibration.
- 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		
	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 : 2204-0146OC-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)								
	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	20.069	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 %.

-00-

a 1106484



PENTA CALIBRATION CO., LTD.
66/124 The Connect 33 Village Kanchanaphisek Road
Dokmai Prawat Bangkok 10250
Tel: +66 (0) 2069-9773
www.pentalcal.com

Certificate of Calibration

Represent to Certificate of Calibration :PTC/07/22103

Certificate No.: PTC/07/22103 Page: 1 of 2
Equipment: Digital Balance Condition: Normal
Manufacturer: Sartorius Serial No: 26207038
Model: MSE224S-100-DU ID No: RYG_EN0002
Type of Balance: Single Interval



REVIEW BY Thantak
APPROVED BY D. E.
NEXT CAL. DATE 29/10/25

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. Rungrat Metakul



Thantak
(Mr. Khangsak Kalasri)
Reviewed by

Approved By: (Mr. Keattisak Kerdlo)
Laboratory Manager

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

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 effect that the results relate only to the items calibrated.

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PTC-ANC-04-02 2 Feb 2020



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Represent to Certificate of Calibration :PTC/07/22103

Certificate No.: PTC/07/22103

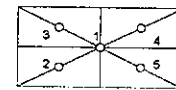
Page: 2 of 2

Measurement Results:

Without Adjustment:

Function Calibration: Non Adjustment

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



Eccentricity test 100 (g)				
Position (g)				
1	2	3	4	5
0.0000	0.0000	-0.0002	0.0002	0.0002
Maximum deviation:				0.0002

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

Determination of the standard deviation of weighing balance., Readability 0.0001 (g)

Nominal test value (g)	Standard Deviation
200	0.00003

Error of Indication: from nominal value., Readability 0.0001 (g)

Nominal Value (g)	Conventional Mass (g)	Indication (g)	Correction of Balance (g)	Uncertainty (g)	k
0	0.00000	0.0000	0.0000	0.000086	2.16
0.01	0.01000	0.0100	0.0000	0.00010	2.06
0.1	0.10000	0.1000	0.0000	0.00010	2.06
1	1.00000	1.0000	0.0000	0.00010	2.06
2	2.00000	1.9999	0.0001	0.00010	2.06
5	5.00001	5.0000	0.0000	0.00010	2.06
10	10.00000	10.0000	0.0000	0.00010	2.06
20	20.00003	19.9999	0.0001	0.00011	2.05
50	50.00004	49.9999	0.0001	0.00012	2.00
100	100.00004	100.0001	-0.0001	0.00017	2.00
200	200.00011	200.0000	0.0001	0.00027	2.00

Note: Weight of adjust (g)

The End of Certificate

PTC-TAC-01-01 24 Feb 2020



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SARAJITANAKARN ROAD 1018, SUKUMVIT, SUKUMVIT BANGKOK 10250
TEL: 0-2713-3040-21 FAX: 0-2713-0344



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. Pluakdaeng,
Rayong 21140 Thailand

Location: Oven Room

Received Order: 20 October 2022

Calibration Date: 20 October 2022

Ambient Temperature: (26 ± 10) °C

Relative Humidity: (50 ± 30) %

Calibrated by: Man Pattanapongpaiboon

Approved by: (Signature)
Approved Signatory

() Pornthipha Tameyukul
() Mahee Bulkrud
() Suwil Injai

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 3. Equipment Calibration and Testing Services

A 0046908



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

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

Calibration were conducted using calibration procedure CP-QT02 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	MY49023932	22LM97	29 Jul 2023

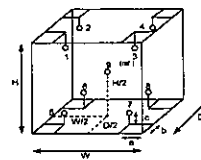
2. This certificate is valid only to the item calibrated on date and place of calibration.

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

Result of Calibration: () Without Adjustment

Function of UUC*: Temperature Source

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 = 0.48 m
Capacity = 0.11 m³

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

Ref. Std. ID No.: @ Calibration Point		
Position	(180) °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 k
104.0	104.0	104.0	0.076	0.52	0.60	0.42	2
180.0	180.0	180.0	0.13	0.88	1.2	1.1	2

Calibration Point (°C)

Position	Measured Temperature (°C)								
	1	2	3	4	5	6	7	8	9 (ref.)
104.0	103.768	103.734	103.723	103.600	104.215	104.131	104.132	103.740	103.747
180.0	178.723	179.359	179.439	179.488	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 1132465

RYG_EN0006



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND)-JAPAN
 CORPORATE SERVICES & EQUIPMENT CALIBRATION AND TESTING SERVICES
 534/4 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG BANGKOK 10250
 TEL: 0-2717-9006-27 FAX: 0-2719-9184



Cert. No.: 22TM1492
 Page: 1 of 3

Certificate of Calibration

Equipment: Hot Air Oven
 Manufacturer: Memmert
 Model: UM 400
 Serial No.: b495.0899
 ID No.: RYG_EN0006
 Submitted by: ALS Laboratory Group (Thailand) Co., Ltd. (Rayong Branch)
 618/10 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 ± 10) °C
 Relative Humidity: (50 ± 30) %

Calibrated by: Preecha Hsieh

Approved by:
 Approved Signatory

() Pornthippa Tameyakul
 (✓) Malee Bulkruea
 () Suwit Injai

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
 Procedure Used: -

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

Calibration were conducted using calibration procedure CP-QT02 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

- Reference standard Instrument:-

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

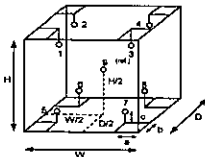
2. This certificate is valid only to the item calibrated on date and place of calibration.

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:

Dimension of Chamber:
 a = 5.0 cm
 b = 5.0 cm
 c = 5.0 cm
 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

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a 1132473



Equipment: Hot Air Oven
 Condition As-Received: Used Item
 Reference: 2210-03760C-1
 Result of Calibration: (*) Without Adjustment
 Function of UUC*: Temperature Source
 Fresh air setting: Close

Cert. No.: 22TM1492
 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
70.0	70.0	70.0	0.079	0.47	0.77	0.42	2

Calibration Point (°C)	Measured Temperature (°C)								
Position	1	2	3	4	5	6	7	8	9 (ref.)
70.0	70.262	69.995	70.079	70.177	70.664	70.039	70.688	70.149	70.328

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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TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
CORPORATE SERVICES & EQUIPMENT CALIBRATION AND TESTING SERVICES
534/4 PATTANAKARN ROAD SOI 19, SUANLUANG, SUANLUANG BANGKOK 10250
TEL. 0-2719-3000-27 FAX 0-2719-9884



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

Certificate of Calibration

Equipment : Water Bath
Manufacturer : Memmert
Model : WNB22
Serial No. : L513.0648
ID No. : RYG_EN0061
Submitted by : ALS Laboratory Group (Thailand) Co., Ltd. (Rayong Branch)
616/10 Moo 5, T. Maenam Khu,
A. Phukdaeng,
Rayong 21140, Thailand
Location : Wat Chemistry Lab
Received Order : 20 October 2022
Calibration Date : 20 October 2022
Ambient Temperature : (26 ± 10) °C
Relative Humidity : (50 ± 30) %
Calibrated by : Praecha Hahib
Approved by :
() Pornthip Tameyakul
() Malee Butkruea
() Suwit Injai

REVIEW BY:
APPROVED BY:
NEXT CAL. DATE: 30/04/24

Issue Date : 2 November 2022

The Uncertainties are for a confidence probability of approximately 95%

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

A 0046506



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

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

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

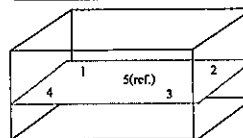
2. This certificate is valid only to the item calibrated on date and place of calibration.

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

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a 1132471



Equipment : Water Bath
Condition As-Received : Used Item
Reference : 2210-03760C-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)				
			1	2	3	4	5 (ref.)
85.0	85.0	85.0	84.527	84.563	84.628	84.516	84.580

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 %.

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TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
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TEL. 0-2719-3000-27 FAX 0-2719-9884



Cert. No.: 22CH377
Page: 1 of 2

Certificate of Calibration

Equipment : pH Meter
Manufacturer : Mettler Toledo
Model : Seven2Go
Serial No. : B531256371
ID No. : RYG_FS0420
Condition As-Received : Used Item
Received Date : 11 March 2022
Calibration Date : 14 March 2022
Reference : 2203-0495DSC-1
Submitted by : ALS Laboratory Group (Thailand) Co., Ltd. Rayong Branch
616/10 Moo 5 T. Maenam Khu,
A. Phukdaeng, 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)
Calibrated by : Warekorn Lomgagrakul
Approved by :
() Malee Butkruea
() Sathip Mongmai
() Warekorn Lomgagrakul
Issue Date : 17 March 2022

REVIEW BY:
APPROVED BY:
NEXT CAL. DATE: 14/03/23

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 0039308



Cert. No.: 22CH377
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	21E2682	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	766820	23 Sep 2023
pH 6.993	CPA chem	766822	04 Sep 2022
pH 10.015	CPA chem	766824	04 Sep 2022

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	4.00	177.46	177	4.00	0.58	2.00	
S/N: B531256371	7.00	0.00	0	7.00	0.58	2.00	
	10.00	-177.46	-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	4.008	4.01	181	0.0079	2.00
S/N: 1311407	6.983	6.98	7	0.0093	2.00
	10.015	10.01	-171	0.0092	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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534 PATTANA ROAD 5th FLOOR, SUKUMVIT, BANGKOK 10250
TEL: 0-2715-3990-27 FAX: 0-2715-9144



Cert. No.: 22LM41
Page: 1 of 2

Certificate of Calibration

Equipment: pH Meter with Sensor
Manufacturer: Mettler Toledo
Model: Seven2Go
Serial No.: B531256371
ID No.: RYG_F80420
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: 11 March 2022
Calibrated Date: 15 March 2022
Ambient Temperature: (26 ± 10) °C
Relative Humidity: (50 ± 30) %
AC Line Voltage: (220 ± 22) V
Calibrated by: Molise Butkrua
Approved by:
() Ponthippa Tameyakul
(✓) Suwit Injai
Issue Date: 17 March 2022

The Uncertainties are for a confidence probability of approximately 95%

This certificate may only be reproduced when fully signed by the person in charge
Approval of the National Institute of Metrology (NIMT) is required for the use of this certificate

A 0039307



Equipment: pH Meter with Sensor
Condition As-Received: Used Item
Reference: 2203-0495DSC-2

Cert. No.: 22LAM1
Page: 2 of 2

Procedure Used :-

Calibration were conducted using in-house calibration procedure GP-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	2188080	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: 1311407

Calibration Point (°C)	Immersion Depth (mm)	Standard Temperature (°C)	UUC* Reading (°C)	Error (°C)	Uncertainty (± °C)	Coverage Factor k
25.0	100	25.009	25.4	0.391	0.16	2.00
30.0	100	30.008	30.5	0.492	0.16	2.00
40.0	100	39.997	40.6	0.603	0.16	2.00
50.0	100	49.997	50.5	0.603	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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SPC Calibration Center

SERT
Part of DKSH Group
RYG-EN0188

Certificate of Calibration

Equipment: Block Digestion Unit
Model: KT-20s
Serial No. (or ID.): 5720210009/5770200073
Manufacturer: Gerhardt
Condition: In Condition
Certificate No.: C25220011
Issued Date: 16 March 2022
Job No.: KSPR2203623
Page: 1 of 3
Digestion Block: 20 holes

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

Environment Condition: Temperature: 24 °C ± 0.5 °C
Humidity: 67 %RH ± 2.2 %RH
Voltage: 226 VAC ± 1.7 VAC

Calibration Place: ALS Laboratory Group (Thailand) Co., Ltd. (Rayong Branch)
(Wet Chemistry Lab)
616/10 Moo 5 T. Maenam Khu. A. Pluakdaeng,
Rayong 21140, Thailand.

Calibration By: Mr. Worachai Hongkaew

Calibration Date: 17 March 2022

The Method used: In house method, base on by comparison with standard

Traceability: This certificate is traceable to the SI Units maintained by National Institute of Metrology (NIMT), Thailand through N.M. Technical Center Laboratory (NTL)
Certificate No.: TC21/0075

REVIEW BY:
APPROVED BY:
NEXT CAL. DATE: 17/3/23

(Mr. Worachai Hongkaew)
Person in charge

SERT
บริษัท เอสอาร์ที จำกัด
SPC RT Co., Ltd.

(Mr. Udon Srichanao)
Authorized signatory

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

SPC RT CO., LTD.
114/10 Moo 5 T. Maenam Khu. A. Pluakdaeng, Rayong 21140
Branch Office: 114/10 Moo 5 T. Maenam Khu. A. Pluakdaeng, Rayong 21140
Tel: 0-2185-4333 Fax: 0-2185-4334 E-mail: info@spc-rt.com Website: www.spc-rt.com

SPCC-FM-C29-06: 23 Nov 2020

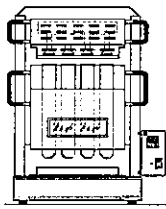
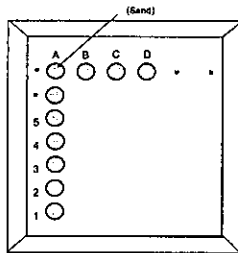


Fig. 1.: Front view



Location of standard

Fig. 2.: Digestion block

Definitions

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

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

Calibration Results:

Without adjustment

Locations	Desired (°C)	Setting (°C)	Indicating (°C)	Measured Temperature (°C)	Correction of UUC (°C)	Uncertainty (± °C)
A1	380	380	380	378.6	-1.4	1.5
A2				382.2	2.2	1.5
A3				380.2	0.2	1.5
A4				381.5	1.5	1.5
A5				381.2	1.2	1.5
B1				378.8	-1.2	1.5
B2				381.8	1.8	1.5
B3				378.4	-0.6	1.5
B4				382.1	2.1	1.5
B5				380.9	0.9	1.5
C1				378.2	-1.8	1.5
C2				380.0	0.0	1.5
C3				377.4	-2.6	1.5
C4				381.8	1.8	1.5
C5				382.3	2.3	1.5
D1				379.7	-0.3	1.5
D2				378.3	-1.7	1.5
D3				378.8	-1.2	1.5
D4				378.0	-1.0	1.5
D5				378.4	-0.6	1.5

The End of Certificate

ฉบับนี้ใช้ได้จนถึงวันที่ 15/03/2023
SPC Calibration Center
เลขที่ 00003 1184 ซอย นวมินทร์ 37 แขวงคลองจั่น เขตจตุจักร กรุงเทพมหานคร 10260
Branch 00003 1184 ซอย นวมินทร์ 37 แขวงคลองจั่น เขตจตุจักร กรุงเทพมหานคร 10260 Thailand
Tel: 0 2465 4333 Ext: 3300-3308 Fax: 0 2465 4424 E-mail: info@spcc-th.com Website: www.spcc-th.com

SPCC-FM-C29-06 23 Nov 2020

ใบตรวจสอบสภาพเครื่องควบคุมอุณหภูมิ

เลขที่ใบงาน: KSPR2203623

ชื่อเครื่อง: Block Digestion Unit รุ่น: KT-20s
หมายเลขเครื่อง: 5720210009/5770200073

ตรวจสอบ (รับ)		รายการตรวจเช็ค	ตรวจสอบ (ส่ง)		หมายเหตุ
17 Mar 2022			17 Mar 2022		
ปกติ	ไม่ปกติ		ปกติ	ไม่ปกติ	
		General			
<input checked="" type="checkbox"/>	<input type="checkbox"/>	1. สายไฟ	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	2. การทำงาน Main Switch	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	3. การทำงาน Selector Key	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	4. การแสดงผล Display	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	5. สลัก Hole	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input type="checkbox"/>	<input type="checkbox"/>	6. สลักฝาปิด	<input type="checkbox"/>	<input type="checkbox"/>	ไม่ได้
<input checked="" type="checkbox"/>	<input type="checkbox"/>	7. สลักตัวเครื่อง	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	8. สลักตรวจสอบ ณ สถานที่ตั้งเครื่อง	<input checked="" type="checkbox"/>	<input type="checkbox"/>	

ชื่อคนรับ:

Mr. Worachai Hongkaew
Service Engineer

ฉบับนี้ใช้ได้จนถึงวันที่ 15/03/2023
SPC Calibration Center
เลขที่ 00003 1184 ซอย นวมินทร์ 37 แขวงคลองจั่น เขตจตุจักร กรุงเทพมหานคร 10260
Branch 00003 1184 ซอย นวมินทร์ 37 แขวงคลองจั่น เขตจตุจักร กรุงเทพมหานคร 10260 Thailand
Tel: 0 2465 4333 Ext: 3300-3308 Fax: 0 2465 4424 E-mail: info@spcc-th.com Website: www.spcc-th.com

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RYG_EN0184



Metrological Center

SCI ECO Services Company Limited

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

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

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

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



Certificate No. T220384101 "Substitute for Calibration Certificate Number T220384" Page 1 of 4

Certificate of Calibration

Equipment : Chamber (Cold Room)

Manufacturer : MODULAR

Model : IREVC0HCOO

Serial No. : C00351459

Customer Code : RYG_EN0184

ID No. : T1939A5

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

616/10 Moo 5 T.Maenam Khu,

A.Pluakdaeng, Rayong 21140

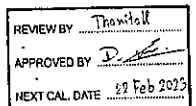
Customer Location : Laboratory

Date of Receipt : 18 February 2022

Calibrated By : Boopchai Suriyawong (Site Calibration Manager)

Approved By :  / Sujar Naknakred (Site Calibration Manager)

Date of Issue : 18 MAR 2022



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

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

FM-114 117 01-02-64

Certificate No. T220384101

Page 2 of 4

Calibration Report

Equipment : Chamber (Cold Room)
Date of Calibration : 22 February 2022
Environment : Temperature : 23.2-24.3 °C
Line Voltage : 221.8-227.2 V
Relative Humidity : 55 - 65 %RH

Condition of this results of calibration :

1. This equipment was calibrated by insert 16 standard thermocouples type T into its chamber , the other one standard thermocouples type T use for ambient temperature measurement . The calibration was done in according to W1-T20 (based on ASTM E145-94 (Reapproved 2001) and AS2853-1986).
All data show below were final values and the initial data from customer request . The temperature scale used was based on ITS - 90 .

2. Reference Standard Instrument :

Instrument	Model	Instrument No.	Certificate No.	Due Date
TC	TYPE T	TN141-TN150	T210743	21 April 2022
TC	TYPE T	TN151-TN160	T210743	21 April 2022
DATA LOGGER	34970A	T150	T210743	21 April 2022

3. This certificate is traceable to :

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

4. Condition of calibrated item : good

Equipment Description :

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

5. Adjustment :

(X) without adjustment () after adjustment

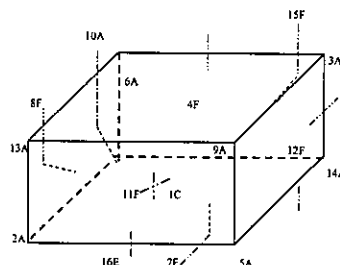
Approved By: _____

TM-L15 117-15-05-63

Certificate No. T220384101

Page 3 of 4

Calibration Report



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

1C = TN141	12F = TN152
2A = TN142	13A = TN153
3A = TN143	14A = TN154
4F = TN144	15F = TN155
5A = TN145	16E = TN156
6A = TN146	
7F = TN147	
8F = TN148	
9A = TN149	
10A = TN150	
11F = TN151	

Approved By: _____

TM-L15 117-15-05-63

Certificate No. T220384101

Page 4 of 4

Calibration Report

Measurement Results

Calibration Point	Average Standard Reading at each position (°C)									
	TN141	TN142	TN143	TN144	TN145	TN146	TN147	TN148	TN149	TN150
3.0	2.80	2.96	2.98	2.97	3.16	3.29	2.95	3.14	3.10	3.45
	TN151	TN152	TN153	TN154	TN155	TN156				
	3.04	3.19	3.03	3.34	3.21	3.11				

Chamber (Cold Room)			Temperature Distribution				
Setting (°C)	Reading (°C)		Average (°C)	Stability (±°C)	Uniformity (°C)	Uncertainty (±°C)	Coverage Factor k
	Min, Max	Average					
3.0	2.7, 4.1	3.5	3.11	1.30	1.30	2.00	2.05

* The Assessed uncertainty exclude "uniformity"
The calibration result apply only the above calibrated item.
The result of test was found accurate as shown on date and place of test only.
The reported expanded uncertainty is based on a standard uncertainty multiplied by a coverage factor k which for a t-distribution, providing a level of confidence of approximately 95 % .

Approved By: _____

TM-L15 117-15-05-63



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
CORPORATE SERVICES & EQUIPMENT CALIBRATION AND TESTING SERVICES
594-4 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG BANGKOK 10250
TEL. 0-2217-8901-27 FAX 0-2219-9084

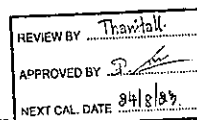


RYG_EN0029

Cert.No.: 22CH283
Page.: 1 of 2

Certificate of Calibration

Equipment : Conductivity Meter
Manufacturer : Mettler Toledo
Model : S230
Serial No. : B241407147
ID No. : RYG_EN0029
Condition As-Received : Used Item
Received Date : 22 February 2022
Calibration Date : 23 February 2022
Reference : 2202-0732DSC-1
Submitted by : ALS Laboratory Group (Thailand) Co.,Ltd. (Rayong Branch)
616/10 Moo 5 T.Maenam Khu, A.Piuaikdaeng,
Rayong 21140, Thailand
Ambient Temperature : (25 ± 2.5) °C
Relative Humidity : (50 ± 15) %
Calibration Procedure : In-house method :
- CP-CH8 : based on direct measurement by
using certified reference material (CRM)
Calibrated by : Waialak Sirthean
Approved by : _____
(/) Malce Butkuea
() Saitthip Moangmai
() Warakom Lemgagrakul
Issue Date : 25 February 2022



The Uncertainties are for a confidence probability of approximately 95%

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

A 0038145



Cert.No.: 22CH283

Page: 2 of 2

Condition of this result of calibration

1. Reference Standard Instrument :-

Instrument	Serial No.	ID No.	Certificate No.	Due date
1) Thermometer	9549224	130RC003	21451	15 Apr 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 :-

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

Conductivity Solution	Manufacturer	Lot No.	Exp. date
84.000 µS/cm	CPA Chem	754034	28 June 2022
1413.0 µS/cm	CPA Chem	786815	04 Sep 2022
12.880 mS/cm	CPA Chem	761022	02 Aug 2022

- Control Conductivity calibration solution temperature by Water bath (25±0.1) °C

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

Calibration results

Function : Conductivity Measurement

(*) After Adjustment at 1413.0 µS/cm

Conductivity Electrode Serial No.: 5821441030

Standard Conductivity Solution	Before Adjustment UUC* Reading	After Adjustment UUC* Reading	Uncertainty of Measurement (±)	Coverage factor k
84.000 µS/cm	82.4 µS/cm	84.4 µS/cm	0.62 µS/cm	2.00
1413.0 µS/cm	1375 µS/cm	1413 µS/cm	9.2 µS/cm	2.00
12.880 mS/cm	12.54 mS/cm	12.81 mS/cm	0.066 mS/cm	2.00

Remark : UUC* = Unit Under Calibration

Cell constant = 0.555238 cm⁻¹

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 1090534

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MTCO : L-1002/2022

Report No. : ALS-799/02

ASI Maintenance Report

Instrument : Automatic Sample Injector Measuring : Vial 40 mL
Model : ASH- 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

REVIEW BY : Nickola N.
APPROVED BY : Sinlue P
NEXT CAL. DATE : 3/10/23

Ambient Condition : Temperature 25.4 ± 5 °C

Humidifier 60 ± 15 %RH

Maintenance By : Peerapong Sangpan
(Mr. Peerapong Sangpan)
Technician

Approved By : N. Phongsomsak
(Mr. Nipon Phongsomsak)
Technician Manager

User Name : Sinlue P
(Mr. Sinlue Phongsomsak)

SHIMADZU ANALYZER
1/3

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MTCO : L-1002/2022

Report No. : ALS-799/02

Maintenance Sheet

Customer : ALS Laboratory Date : 03 / 10 / 2022
Model : ASH- 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 : Peerapong Sangpan
(Mr. Peerapong Sangpan)
Technician

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MTCO : 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 Depending on condition
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) Sparge 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.	631-41660-03	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 sparge type)*	N/A		Depending on condition
13.	631-41660-01	Flare Pipe 1.1x0.6x600mm* (for Double Needle 24mL, 40mL)	N/A		Depending on condition

*Note: needed parts depending on installed needle types!

Inspection by : Peerapong Sangpan
(Mr. Peerapong Sangpan)
Technician

SHIMADZU ANALYZER
3/3

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MTOC : L-1001/2022

Report No. : ALS-416/02

TOC-L Maintenance Report

Instrument : Total Organic Carbon Analyzer Measuring : TC O ~ 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 : Vichula N.
APPROVED BY : Sinlue P.
NEXT CAL DATE : 5/10/23

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

Maintenance By : Peerapong Sangpan
(Mr. Peerapong Sangpan)
Technician

Approved By : [Signature]
(Mr. Nipon Phungsomsak)
Technician Manager

User Name : Sinlue P.
(Supervisor)

SHIMADZU ANALYZER

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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.	Tubes			
	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.		
4.	Check if outlet flow is in proper conditions	O.K.		
	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

SHIMADZU ANALYZER

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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) Criteria : R ² = 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 Criteria : Accuracy %Recovery 10% or less	5.477 - 0.4414 = 5.0366 ppm	Pass

Inspection by : Peerapong Sangpan
(Mr. Peerapong Sangpan)
Technician

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บริษัท ออโตเมชั่น เซอร์วิส จำกัด

Automation Service Co., Ltd.

829/829/1 ถนนพหลโยธิน 30 แขวงจตุจักร เขตจตุจักร กรุงเทพมหานคร 10250
829/829/1 Soi Pathayakorn 30, Pathayakorn Rd., Suanluang, Suanluang, Bangkok 10250
โทรศัพท์ (Tel.) 0 2319 9994 โทรสาร (Fax) 0 2319 9999 เว็บไซต์ : www.automation.co.th

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	Halogen 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

SHIMADZU ANALYZER

ศูนย์บริการลูกค้า (Industry Automation Division)
F 0-2318-4961 E-mail : ats@automation.co.th
ศูนย์บริการลูกค้า (Office Automation Division)
F 0-2318-0200 E-mail : marketing-qa@automation.co.th

สาขาบริการ Rayong Branch 4/4
1115 หมู่ 4 ตำบลบ้านใหม่ อำเภอวังจันทร์ จังหวัดระยอง 21150
1115 Muang Muang, Rayong 21150
Tel : 038-892-152 Fax : 038-892-345

สาขาบริการ Lampun Branch
1225 หมู่ 4 ตำบลบ้านใหม่ อำเภอวังจันทร์ จังหวัดระยอง 21000
1225 Muang Muang, Lampun 21000
Tel./Fax : 038-581-876

TOC-Control L Report

2012_10_20_001_7540236

Test Information

Instrument Options
Catalyst TOC/AS/IC User
Regula Sensivity

Cal. Curve

Sample Name UNKID
Sample ID UNKID
Conc. Curve TC 1 - 20 ppm 2012_10_20_14_04_24 ml
Status Completed

Conc 0.000mg/L

Time	Area	Conc	Area	Conc
1.033	0.000	0.000	0.000	0.000
1.040	0.000	0.000	0.000	0.000
1.047	0.000	0.000	0.000	0.000

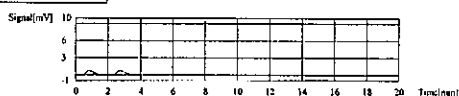
Add Adj 0.000%
Mean Area 1.373
SD Area 0.0000
CV Area 0.0%



Conc 0.1000mg/L

Time	Area	Conc	Area	Conc
1.033	0.000	0.100	0.000	0.100
1.040	0.000	0.100	0.000	0.100
1.047	0.000	0.100	0.000	0.100

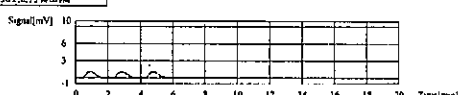
Add Adj 0.000%
Mean Area 2.159
SD Area 0.0000
CV Area 0.0%



Conc 0.5000mg/L

Time	Area	Conc	Area	Conc
1.033	0.000	0.500	0.000	0.500
1.040	0.000	0.500	0.000	0.500
1.047	0.000	0.500	0.000	0.500

Add Adj 0.000%
Mean Area 2.159
SD Area 0.0000
CV Area 0.0%



Conc 1.000mg/L

Time	Area	Conc	Area	Conc
1.033	0.000	1.000	0.000	1.000
1.040	0.000	1.000	0.000	1.000
1.047	0.000	1.000	0.000	1.000

Add Adj 0.000%
Mean Area 2.159
SD Area 0.0000
CV Area 0.0%



10/20/2012 7:41:33 PM

TOC-Control L Report

2012_10_20_001_7540236

Test Information

Instrument Options
Catalyst TOC/AS/IC User
Regula Sensivity

Sample

Sample Name UNKID
Sample ID UNKID
Conc. Curve TC 1 - 20 ppm 2012_10_20_14_04_24 ml
Status Completed

Conc 5.000mg/L

Time	Area	Conc	Area	Conc
1.033	0.000	5.000	0.000	5.000
1.040	0.000	5.000	0.000	5.000
1.047	0.000	5.000	0.000	5.000

Add Adj 0.000%
Mean Area 3.78
SD Area 0.0000
CV Area 0.0%



Conc 10.00mg/L

Time	Area	Conc	Area	Conc
1.033	0.000	10.00	0.000	10.00
1.040	0.000	10.00	0.000	10.00
1.047	0.000	10.00	0.000	10.00

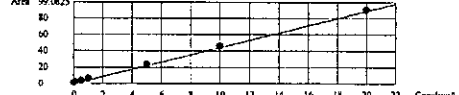
Add Adj 0.000%
Mean Area 48.16
SD Area 0.0000
CV Area 0.0%



Conc 20.00mg/L

Time	Area	Conc	Area	Conc
1.033	0.000	20.00	0.000	20.00
1.040	0.000	20.00	0.000	20.00
1.047	0.000	20.00	0.000	20.00

Add Adj 0.000%
Mean Area 48.16
SD Area 0.0000
CV Area 0.0%



Conc 50.00mg/L

Time	Area	Conc	Area	Conc
1.033	0.000	50.00	0.000	50.00
1.040	0.000	50.00	0.000	50.00
1.047	0.000	50.00	0.000	50.00

Add Adj 0.000%
Mean Area 48.16
SD Area 0.0000
CV Area 0.0%



10/20/2012 7:41:33 PM

TOC-Control L Report

2012_10_20_001_7540236

Test Information

Instrument Options
Catalyst TOC/AS/IC User
Regula Sensivity

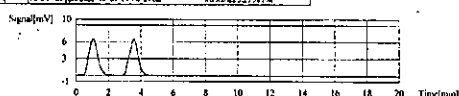
Sample

Sample Name TC 1
Sample ID UNKID
Conc. Curve TC 1 - 20 ppm 2012_10_20_14_04_24 ml
Status Completed

Conc 0.000mg/L

Time	Area	Conc	Area	Conc
1.033	0.000	0.000	0.000	0.000
1.040	0.000	0.000	0.000	0.000
1.047	0.000	0.000	0.000	0.000

Mean Area 24.23
Mean Conc 0.000mg/L



10/20/2012 7:42:31 PM

TOC-Control L Report

2012_10_20_001_7540236

Test Information

Instrument Options
Catalyst TOC/AS/IC User
Regula Sensivity

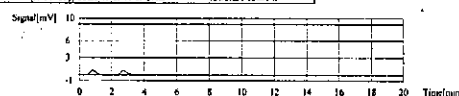
Sample

Sample Name Water
Sample ID UNKID
Conc. Curve TC 1 - 20 ppm 2012_10_20_14_04_24 ml
Status Completed

Conc 0.000mg/L

Time	Area	Conc	Area	Conc
1.033	0.000	0.000	0.000	0.000
1.040	0.000	0.000	0.000	0.000
1.047	0.000	0.000	0.000	0.000

Mean Area 1.854
Mean Conc 0.000mg/L



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Certificate of System Qualification

GC-OQ + GCMS-OQ

 REVIEW BY MLC
 APPROVED BY KLAL

 System ID: GM-10
 Organization Name: ALS Laboratory Group (Thailand) Co., Ltd.
 Organization Location: 104 Pathanakarn Rd., Kwang Suan Luang, Khet Suan Luang, Bangkok 10250

 Date: November 23, 2021 1:12:35 PM
 EQP Name: AgilentRecommended, AgilentRecommended
 EQP Revision: GC.02.52, GCMS.02.51
 Overall Qualification Status: Pass

CDS Logon Verification - GC

Logon: Nanthawadee.Somboon

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 Accuracy

 Name: 7890
 Front MMI
 Setpoint Status: Pass

Setpoint	Actual
Inlet Pressure: 25.0 psi	24.9 psi

 Accuracy: 0.1 psi
 Agilent Recommended: <= 1.2

 Date: November 23, 2021 1:12:35 PM
 System ID: GM-10

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Overall Inlet Pressure Accuracy Test Status

Pass

GC Oven Temperature Accuracy

 Name: 7890
 Setpoint Status: Pass
 Zone: Oven

Setpoint/Actual
Temperature: 230.0 229.8 °C

 Accuracy: -0.2 °C
 Agilent Recommended: >= -1.0 °C % setpoint in K (-5.0 °C)
 <= 1.0 °C % setpoint in K (5.0 °C)
 Setpoint Status: Pass
 Zone: Oven

Setpoint/Actual
Temperature: 100.0 99.8 °C

 Accuracy: -0.2 °C
 Agilent Recommended: >= -1.0 °C % setpoint in K (-3.7 °C)
 <= 1.0 °C % 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 99.78333 °C

 Stability: 0.1 °C
 Agilent Recommended: <= 0.5

Overall GC Oven Temperature Stability Test Status

Pass

 Date: November 23, 2021 1:12:35 PM
 System ID: GM-10

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Tune EI

Tested Combination	Front	MMI	/ External	TQ
Name:	7000D			
Setpoint Status:	Pass			
Filament:	1			
Setpoint Status:	Pass			
Filament:	2			

Overall Tune EI Test Status

Pass

Scouting Run

Tested Combination	Front	MMI	/ External	TQ
Name:	Injection Tower			
Source:	EI - Extractor			
Setpoint Status:	Completed			
Injection Volume on Column:	1.0 uL			

Overall Scouting Run Status

Completed

Instrument Detection Limit

Tested Combination	Front	MMI	/ External	TQ
Name:	Injection Tower			
Source:	EI - Extractor			

 Date: November 23, 2021 1:12:35 PM
 System ID: GM-10

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Setpoint Status:

Pass

Injection Volume on Column:

1.0 uL

Minimum RSD:

5.70 %

Agilent Recommended:

<= 12.00 %

Status:

Pass

Instrument Detection Limit:

1.04800 pg

Agilent Recommended:

<= 4.03800 pg

Status:

Pass

Overall Instrument Detection Limit Test Status

Pass

Mass Ratio Precision

Tested Combination	Front	MMI	/ External	TQ
Name:	Injection Tower			
Source:	EI - Extractor			
Setpoint Status:	Pass			
Injection Volume on Column:	1.0 uL			
Area Mass 1	Abundance's			
RSD:	4.07 %			
Agilent Recommended:	<= 5.00 %			
Status:	Pass			
Mass Ratio	2.66 %			
Status:	Pass			

Overall Mass Ratio Precision Test Status

Pass

 Date: November 23, 2021 1:12:35 PM
 System ID: GM-10

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Instrument Details

Purpose

This section describes the as found system configuration.

Details

System

System ID	GM-10
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
Inlet	Front
Detector	External
LTM Included?	No

Sampler 1

Manufacturer	Agilent Technologies
Type	Injection Tower
Name	7893A
Model Number	G4513A
Serial Number	CN18180003
Firmware Revision	A.11.03
Usage	Sample Injection
Location	Front
Syringe Volume (µL)	10

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System ID: GM-10

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Sampler 2

Manufacturer	Agilent Technologies
Type	Trey
Name	7893A
Model Number	G4514A
Serial Number	CN18170137
Firmware Revision	A.11.03
Vial Heater	Not Installed

Mainframe 1

Manufacturer	Agilent Technologies
Name	7890
Model Number	G3442B
Serial Number	CN18153080
Firmware Revision	B.02.05
Oven Type	Standard

Inlet 1

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

Detector 1

Manufacturer	Agilent Technologies
Name	Mass Spectrometer
Type	Mass Spectrometer
Location	External

Date: November 23, 2021 1:12:35 PM
System ID: GM-10

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Mass Spectrometer 1

Manufacturer	Agilent Technologies
Type	TQ
Name	7000D
Serial Number	US1828U108
Firmware Revision	G.7000.085A
High Vacuum System	Turbo Pump
Scouting Run Standard	OFN Std

MS EI Source 1

Manufacturer	Agilent Technologies
Source Type	EI - Extractor
Number of filaments	2

Date: November 23, 2021 1:12:35 PM
System ID: GM-10

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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:	Januwat Channarong
Logged On User Name:	januwat.channarong@agilent.com
Signature Creation Date:	November 23, 2021
Reason for Signature:	Executed protocol and published this original version of document

Regulatory Disclaimer

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

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System ID: GM-10

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Print Date: November 23, 2021 1:12:38 PM

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Print Date: November 23, 2021 1:12:30 PM

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Print Date: November 23, 2021 1:12:35 PM

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System Id: GM-10
Print Date: November 23, 2021 1:12:34 PM

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User Name: jaruwat.channarong
Hostname: ASBK00V255

System ID: GM-10
Print Date: November 23, 2021 1:12:38 PM

ALS_GM10 Transaction log:

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
November 23, 2021 10:45:30 AM	Audit	Data	Instrument Detection Limit - Injection Tower, Front MM, TQ: D:\MassHunter\GCMS1\data - Source: EI - Extractor - RSD L (Area) <= 12.00% - RSD L (Ret. Time) <= 1.00%	Data File Path: D:\MassHunter\GCMS1\data - Source: EI - Extractor - RSD L (Area) <= 12.00% - RSD L (Ret. Time) <= 1.00%
November 23, 2021 10:45:38 AM	Audit	Data	Instrument Detection Limit - Injection Tower, Front MM, TQ: D:\MassHunter\GCMS1\data - Source: EI - Extractor - RSD L (Area) <= 12.00% - RSD L (Ret. Time) <= 1.00%	Data File Path: D:\MassHunter\GCMS1\data - Source: EI - Extractor - RSD L (Area) <= 12.00% - RSD L (Ret. Time) <= 1.00%
November 23, 2021 10:45:50 AM	Audit	Data	Instrument Detection Limit - Injection Tower, Front MM, TQ: D:\MassHunter\GCMS1\data - Source: EI - Extractor - RSD L (Area) <= 12.00% - RSD L (Ret. Time) <= 1.00%	Data File Path: D:\MassHunter\GCMS1\data - Source: EI - Extractor - RSD L (Area) <= 12.00% - RSD L (Ret. Time) <= 1.00%
November 23, 2021 10:45:59 AM	Audit	Data	Instrument Detection Limit - Injection Tower, Front MM, TQ: D:\MassHunter\GCMS1\data - Source: EI - Extractor - RSD L (Area) <= 12.00% - RSD L (Ret. Time) <= 1.00%	Data File Path: D:\MassHunter\GCMS1\data - Source: EI - Extractor - RSD L (Area) <= 12.00% - RSD L (Ret. Time) <= 1.00%
November 23, 2021 10:45:59 AM	Audit	Data	Instrument Detection Limit - Injection Tower, Front MM, TQ: D:\MassHunter\GCMS1\data - Source: EI - Extractor - RSD L (Area) <= 12.00% - RSD L (Ret. Time) <= 1.00%	Data File Path: D:\MassHunter\GCMS1\data - Source: EI - Extractor - RSD L (Area) <= 12.00% - RSD L (Ret. Time) <= 1.00%
November 23, 2021 10:45:59 AM	Audit	Data	Instrument Detection Limit - Injection Tower, Front MM, TQ: D:\MassHunter\GCMS1\data - Source: EI - Extractor - RSD L (Area) <= 12.00% - RSD L (Ret. Time) <= 1.00%	Data File Path: D:\MassHunter\GCMS1\data - Source: EI - Extractor - RSD L (Area) <= 12.00% - RSD L (Ret. Time) <= 1.00%

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Date: November 23, 2021 1:12:35 PM
System ID: GM-10

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User Name: jaruwat.channarong
Hostname: ASBK00V255

System ID: GM-10
Print Date: November 23, 2021 1:12:38 PM

ALS_GM10 Transaction log:

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
November 23, 2021 10:45:30 AM	Audit	Data	Instrument Detection Limit - Injection Tower, Front MM, TQ: D:\MassHunter\GCMS1\data - Source: EI - Extractor - RSD L (Area) <= 12.00% - RSD L (Ret. Time) <= 1.00%	Data File Path: D:\MassHunter\GCMS1\data - Source: EI - Extractor - RSD L (Area) <= 12.00% - RSD L (Ret. Time) <= 1.00%
November 23, 2021 10:45:38 AM	End	Execution	Instrument Detection Limit - Injection Tower, Front MM, TQ: D:\MassHunter\GCMS1\data - Source: EI - Extractor - RSD L (Area) <= 12.00% - RSD L (Ret. Time) <= 1.00%	Run Count: 1
November 23, 2021 10:47:03 AM	Start	Execution	Mass Ratio Precision - Injection Tower, Front MM, TQ: D:\MassHunter\GCMS1\data - Source: EI - Extractor - L (RSD) <= 5.00%	
November 23, 2021 10:47:29 AM	Audit	Data	Mass Ratio Precision - Injection Tower, Front MM, TQ: D:\MassHunter\GCMS1\data - Source: EI - Extractor - L (RSD) <= 5.00%	Data File Path: D:\MassHunter\GCMS1\data - Source: EI - Extractor - L (RSD) <= 5.00%
November 23, 2021 10:47:29 AM	Audit	Data	Mass Ratio Precision - Injection Tower, Front MM, TQ: D:\MassHunter\GCMS1\data - Source: EI - Extractor - L (RSD) <= 5.00%	Data File Path: D:\MassHunter\GCMS1\data - Source: EI - Extractor - L (RSD) <= 5.00%
November 23, 2021 10:47:29 AM	Audit	Data	Mass Ratio Precision - Injection Tower, Front MM, TQ: D:\MassHunter\GCMS1\data - Source: EI - Extractor - L (RSD) <= 5.00%	Data File Path: D:\MassHunter\GCMS1\data - Source: EI - Extractor - L (RSD) <= 5.00%
November 23, 2021 10:47:29 AM	Audit	Data	Mass Ratio Precision - Injection Tower, Front MM, TQ: D:\MassHunter\GCMS1\data - Source: EI - Extractor - L (RSD) <= 5.00%	Data File Path: D:\MassHunter\GCMS1\data - Source: EI - Extractor - L (RSD) <= 5.00%
November 23, 2021 10:47:29 AM	Audit	Data	Mass Ratio Precision - Injection Tower, Front MM, TQ: D:\MassHunter\GCMS1\data - Source: EI - Extractor - L (RSD) <= 5.00%	Data File Path: D:\MassHunter\GCMS1\data - Source: EI - Extractor - L (RSD) <= 5.00%

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Date: November 23, 2021 1:12:35 PM
System ID: GM-10

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User Name: jaruwat.channarong
Hostname: ASBK00V255

System ID: GM-10
Print Date: November 23, 2021 1:12:38 PM

ALS_GM10 Transaction log:

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
November 23, 2021 10:47:29 AM	Audit	Data	Mass Ratio Precision - Injection Tower, Front MM, TQ: D:\MassHunter\GCMS1\data - Source: EI - Extractor - L (RSD) <= 5.00%	Data File Path: D:\MassHunter\GCMS1\data - Source: EI - Extractor - L (RSD) <= 5.00%
November 23, 2021 10:48:02 AM	End	Execution	Mass Ratio Precision - Injection Tower, Front MM, TQ: D:\MassHunter\GCMS1\data - Source: EI - Extractor - L (RSD) <= 5.00%	Run Count: 1
November 23, 2021 10:48:07 AM	End	Qualification	Session	DO
November 23, 2021 10:48:07 AM	Start	Reporting	Session	None
November 23, 2021 1:01:43 PM	Audit	AcqCheck	Session	None
November 23, 2021 1:03:30 PM	Audit	AcqRestarted	Session	None
November 23, 2021 1:03:32 PM	Audit	SessionReloaded	Session	None
November 23, 2021 1:03:37 PM	Start	Qualification	Session	DO
November 23, 2021 1:11:56 PM	Audit	Reporting	Session	Report Generated: Certificate

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Date: November 23, 2021 1:12:35 PM
System ID: GM-10

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Bare Scientific Co., Ltd.
958 U Chu Liang Building Floor 7 Ramat Road
Siom Bangkok Bangkok Thailand 10500
Tel: 02-6324300 Fax: 02-6375496-7
www.barescientific.com



Certificate of Calibration

Number of Page(s) 1 of 3

Certificate No. BSOC-UV-30722
Equipment UV/Vis Spectrophotometer
Model UV-1800
Manufacturer Shimadzu
Serial No. A11454608533CD
ID No. BKK_EN0018
Date of receipt 16 September 2022
Date of calibration 16 September 2022
Date of issue 23 September 2022

REVIEW BY *Siribol P.*
APPROVED BY *Mr. A.*
NEXT CAL. DATE *16/9/23*

Customer name ALS Laboratory Group (Thailand) Co., Ltd.
Address 104 Soi Phatthanakan 40, Phatthanakan Road, Phatthanakan, Suan Luang, Bangkok 10250

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

Equipment condition Good Operation

Calibration Location Organic Prep

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

Traceability Wavelength Accuracy is traceable to certificate No. 95917 and 95918
Photometric Accuracy is traceable to certificate No. 95924 and 95937
Stray Light is traceable to certificate No. 85908
The above certificate are traceable to SI unit through Starna Scientific Ltd.
(UKAS accredited calibration laboratory NO. 0659)

Calibrated by Mr. Waruth Jangphung

Approved by

Mr. Kanchit Choothep
Technical Manager

The above results are valid exclusively for the calibrated item(s) as mention in this report / certificate.
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Tel : 02-6324300 Fax : 02-6375496-7
www.barscientific.com



Certificate of Calibration

Certificate No. BSCC-UV-307/22 Number of Page(s) 2 of 3

Calibration Results:

1.Wavelength Accuracy

Certified Wavelength (nm)	UUC (nm)	Error (nm)	Uncertainty (±nm)
241.70	241.65	-0.05	0.18
334.02	333.92	-0.10	0.18
418.53	418.46	-0.07	0.18
572.99	572.96	-0.03	0.18
879.41	879.17	-0.24	0.18

2.Photometric Accuracy (UV)

Wavelength (nm)	Certified Absorbance (A)	UUC (A)	Error (A)	Uncertainty (±A)
235	0.0000	0.0000	0.0000	0.0075
	0.7467	0.7461	-0.0006	0.0075
257	0.0000	0.0000	0.0000	0.0075
	0.8662	0.8647	-0.0015	0.0075
313	0.0000	0.0000	0.0000	0.0075
	0.2904	0.2911	0.0007	0.0075
350	0.0000	0.0000	0.0000	0.0075
	0.6429	0.6426	-0.0003	0.0075

*CNR = Customer not request

The above results are valid exclusively for the calibrated item(s) as mention in this report / certificate.
Advertising the report / Certificate and publicity of the results are prohibited and also shall not be reproduced
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FM-UV-708-02 Rev.01 (2301/03)



Bara Scientific Co., Ltd.
968 U Chu Liang Building Floor7 Ramad Road
Siam Bangkok Bangkok Thailand 10500
Tel : 02-6324300 Fax : 02-6375496-7
www.barscientific.com



Certificate of Calibration

Certificate No. BSCC-UV-307/22 Number of Page(s) 3 of 3

Calibration Results:

3.Photometric Accuracy (Visible)

Wavelength (nm)	Certified Absorbance (A)	UUC (A)	Error (A)	Uncertainty (±A)
420.0	0.0000	0.0000	0.0000	0.0042
	0.5783	0.5777	-0.0006	0.0042
	0.7628	0.7635	0.0007	0.0046
	1.0206	1.0230	0.0024	0.0042
440.0	0.0000	0.0000	0.0000	0.0042
	0.5621	0.5618	-0.0003	0.0042
	0.7455	0.7460	0.0005	0.0048
	0.9685	1.0005	0.0020	0.0042
465.0	0.0000	0.0000	0.0000	0.0042
	0.5227	0.5219	-0.0008	0.0042
	0.6880	0.6884	0.0004	0.0051
	0.9487	0.9503	0.0016	0.0042
546.1	0.0000	0.0000	0.0000	0.0042
	0.5207	0.5199	-0.0008	0.0042
	0.6973	0.6971	-0.0002	0.0049
	0.9959	0.9964	0.0005	0.0042
580.0	0.0000	0.0000	0.0000	0.0042
	0.5544	0.5534	-0.0010	0.0042
	0.7253	0.7242	-0.0011	0.0050
	1.0942	1.0943	0.0001	0.0042
635.0	0.0000	0.0000	0.0000	0.0042
	0.5616	0.5606	-0.0010	0.0042
	0.6927	0.6921	-0.0006	0.0053
	1.0881	1.0885	0.0004	0.0042

*CNR = Customer not request

4.Stray Light*

Standard cut-off wavelength (nm)	Wavelength (nm)	Unit Under Calibration(UUC)	Transmission (%T)	Absorbance (A)
200 66±0.11nm	200 30	0.9505	2.0229	

The Stray light transmission reference is less than 1.0%T and Stray light absorbance reference is greater than 2.00A
*Stray Light not NSC-ONSC Accredited.

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

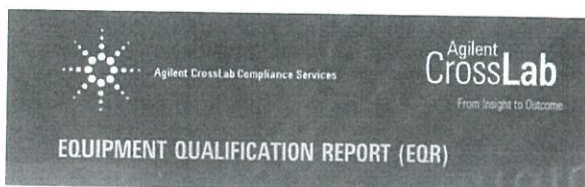
End of Certificate

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FM-UV-708-02 Rev.01 (2301/03)

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Agilent CrossLab Compliance Services



Agilent CrossLab Compliance

Qualification Type: ICPMS-QQ
System ID: JP15471169
EQP Name: AgilentRecommended
EQP Revision: ICPMS.02.50
EQP Publish Date: March 2020
Date: September 30, 2021 4:07:18 PM
Report Type: Report
Org. Name: ALS Laboratory Group (Thailand) Co.,Ltd.
Org. Location: 104 Phattanakam 40, Suan Luang, Bangkok 10250.

REVIEW BY: *Sapana H.*
APPROVED BY: *Sapana H.*
NEXT CAL. DATE: 29 March 2023

Date: September 30, 2021 4:07:18 PM
System ID: JP15471169

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Agilent CrossLab Compliance Services

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Integrated Sample Introduction System (ISIS) Check : ISIS3	10
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Date: September 30, 2021 4:07:18 PM
System ID: JP15471169

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Test Summary

Purpose

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

Details

Test	Status	Runs
Autosampler Check : SPS4	Pass	1
Integrated Sample Introduction System (ISIS) Check : ISIS3	Pass	1
Autotune : G8403A	Pass	1
Background (No Gas Mode) : G8403A	Pass	1
Background (Gas Mode) : G8403A	Pass	1
20-Minute Stability (No Gas Mode) : G8403A	Pass	1

Overall Qualification Status

Pass

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Service Details

Purpose

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

General Details

Service Order No./Request:	6004837154
EQP Name:	AgilentRecommended
EQP Revision:	ICPMS 02.50
Report Type:	Report

Organization Details

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

Local Contact Details

Name:	Chatchanal Komarakul.
Job Title:	Manager
Qualification Location:	Laboratory

Operator Details

Name:	Panithip Kumsathain
Job Title:	Field Service Engineer.

Data Acquisition Details

Acquisition Software Name:	MassHunter
Acquisition Software Revision:	C.01.04

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

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Instrument Details

Purpose

This section describes the as found system configuration.

Details

ICP-MS 1

Manufacturer	Agilent Technologies
Name	7900
Model Number	G8403A
Installed Options	#100H: Standard Package with Hydrogen option
Detector Type	SQ
Nebulizer	Mira Mist (G3181)
Spray Chamber	Quartz
Torch	Quartz
Sampling Cone	Ni
Skimmer Cone	Ni
Serial Number	JP15471169
Firmware Revision	C.01.04

ISIS 1

Manufacturer	Agilent Technologies
Name	ISIS3
Model Number	G8411A
Type	Peristaltic pump system
Serial Number	JP15510227

Autosampler 1

Manufacturer	Agilent Technologies
Name	SPS4
Model Number	G8410A
Serial Number	AU15430722

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Chiller 1

Manufacturer	Agilent Technologies
Name	Chiller
Model Number	G3292A
Serial Number	3U1510713

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Calculation Formulas

Purpose

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

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

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System ID: JP15471169

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Protocol Details

Purpose

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

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

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Autosampler Check

Purpose

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

Selfpoint

Results	Criteria	Observed Result	Expected Result	Status
---------	----------	-----------------	-----------------	--------

After the self test, is probe in the home position?

Yes	Yes	Pass
-----	-----	------

As commanded, is the probe positioned at vial 2?

Yes	Yes	Pass
-----	-----	------

Selfpoint Status:

Pass

Run: 1

Overall Autosampler Check Test Status

Pass

Date: September 30, 2021 4:07:18 PM
System ID: JP15471169

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Integrated Sample Introduction System (ISIS) Check

Purpose

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

Selfpoint

Results	Criteria	Observed Result	Expected Result	Status
---------	----------	-----------------	-----------------	--------

As commanded, does the pump rotate?

Yes	Yes	Pass
-----	-----	------

As commanded, do the valves load and inject?

Yes	Yes	Pass
-----	-----	------

Selfpoint Status:

Pass

Run: 1

Overall Integrated Sample Introduction System (ISIS) Check Test Status

Pass

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Autotune

Purpose

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

Setpoint

Results

Peakwidth Mass 7

Agilent Recommended:

	0.719	AMU
>=	0.65	
<=	0.82	

Status:

Pass

Peakwidth Mass 89

Agilent Recommended:

	0.750	AMU
>=	0.65	
<=	0.80	

Status:

Pass

Peakwidth Mass 205

Agilent Recommended:

	0.713	AMU
>=	0.65	
<=	0.82	

Status:

Pass

Mass Axis 7

Agilent Recommended:

	7.05	AMU
>=	6.9	
<=	7.1	

Status:

Pass

Mass Axis 89

Agilent Recommended:

	88.95	AMU
>=	88.9	
<=	89.1	

Status:

Pass

Mass Axis 205

Agilent Recommended:

	205.00	AMU
>=	204.0	
<=	205.1	

Status:

Pass

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Mass 7 Sensitivity No Gas

Agilent Recommended:

	54.28	Mcps/ppm
>=	25.5	

Status:

Pass

Mass 89 Sensitivity No Gas

Agilent Recommended:

	207.16	Mcps/ppm
>=	127.5	

Status:

Pass

Mass 205 Sensitivity No Gas

Agilent Recommended:

	203.77	Mcps/ppm
>=	70.5	

Status:

Pass

Mass 89 Sensitivity He

Agilent Recommended:

	28.38	Mcps/ppm
>=	23.8	

Status:

Pass

Mass 89 Sensitivity H2

Agilent Recommended:

	129.27	Mcps/ppm
>=	68	

Status:

Pass

Oxide Ratio 156/140

Agilent Recommended:

	1.047	%
<=	1.38	

Status:

Pass

Doubly Charged Species Ratio 70/140

Agilent Recommended:

	1.482	%
<=	2.3	

Status:

Pass

Setpoint Status:

Pass

Runs: 1

Overall Autotune Test Status

Pass

Date: September 30, 2021 4:07:16 PM
System ID: JP15471169

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Background (No Gas Mode)

Purpose

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

Setpoint

Conditions

Masses:

7	AMU
89	AMU
205	AMU

Measurements and Results

Masses (AMU):

Measured Value:

Agilent Recommended:

Status:

	7		89		205	
	3.200		3.300		6.900	cps
<=	6.0		4.5		11.5	
Pass		Pass		Pass		

Setpoint Status:

Pass

Runs: 1

Overall Background (No Gas Mode) Test Status

Pass

Date: September 30, 2021 4:07:16 PM
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Background (Gas Mode)

Purpose

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

Setpoint

Gas Mode: Helium

Conditions

Mass:

78 AMU

Integration Time:

1.0 sec

Cycles:

20

Measurements and Results

Mass (AMU):

Measured Value:

Agilent Recommended:

Status:

	78	
	42.8500	cps
<=	115	
Pass		

Setpoint Status:

Pass

Runs: 1

Overall Background (Gas Mode) Test Status

Pass

Date: September 30, 2021 4:07:16 PM
System ID: JP15471169

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20-Minute Stability (No Gas Mode)

Purpose

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

Setpoint

Conditions

Mode:	Spectrum
Masses:	7, 9, 59, 89, 149, 205
Integration Time:	9.99 sec
Peak Pattern:	3 points/peak
Repetitions:	20
Sweeps/Replicates:	100

Measurements and Results

Masses (AMU):	7	89	205
Stability RSD:	0.06400	0.51495	0.73011 %
Agilent Recommended:	<= 2.3	<= 2.3	<= 2.3
Status:	Pass	Pass	Pass

Setpoint Status: Pass Run: 1

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

Pass

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Declaration of Change Control

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

Date: September 30, 2021 4:07:18 PM
System ID: JP15471169

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Attachments

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

Location	Category	Document Name	Page
EQR	General	Certificate of System Qualification	18
EQR	General	Operator's training certificate and qualifications	19
EQR	General	Certificate of Qualification for ACE	20
EQR	General	Certificate of Qualification for ACE	21
EQR	General	Tune reports	22
EQR	General	Test Report	25
EQR	General	Test Report	27
EQR	General	Test Report	29

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System ID: JP15471169

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General

Document Name: Certificate of System Qualification



Agilent Compliance Engine Self Qualification

Date: September 14, 2021 4:58:15 PM
Drive Serial #: ACA229C9 Platform Revision: ACE 3.51

Indicators of qualification reports for each specific technique included are also available upon request. They provide additional details on the general report from the broader summary and are structured by the internal algorithms challenged during the process. There is not a one-to-one relationship between algorithms and QC program tests because some algorithms are used by several tests and across multiple internal hardware components of the qualified systems.

Technique Type	Tests Completed	Result
Atomic Absorption	7	Conforms
Capillary Electrophoresis	10	Conforms
Dissolution	6	Conforms
Emission Spectroscopy	3	Conforms
Gas Chromatography - GC/MS	17	Conforms
Gas Chromatography	20	Conforms
Gas Permeation Chromatography	9	Conforms
ICP-MS	8	Conforms
Infrared Spectroscopy	7	Conforms
Liquid Chromatography	17	Conforms
Liquid Chromatography - LC/MS	8	Conforms
Microfluidics	13	Conforms
Sample Preparation - Gas Chromatography	9	Conforms
Sample Preparation - Liquid Chromatography	6	Conforms
Supercritical Fluid Chromatography	16	Conforms
Software	8	Conforms
UV-Vis Spectrophotometer	13	Conforms

Overall Qualification Status

Conforms

Date: September 30, 2021 4:07:18 PM
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Document Name: Operator's training certificate and qualifications



Certificate of Completion

Learner Name:	Parthap Kousadhin
Title Of Course:	AN-CB-ICPMS-2-438-AcAgilent7900 ICPMS FSE update training
Completion Date:	June 7, 2014
Certified By Company:	Learning at Agilent

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

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

Date: September 30, 2021 4:07:18 PM
System ID: JP10471169

Document Name: Certificate of Qualification for ACE



Certificate of Completion

Lesson Name:	Podcast: Kuratshain
Title Of Course:	AN-CB-SB-II-500-A: ACE 3.X User Update Training
Completion Date:	July 7, 2020
Certified By Company:	Learning at Agilent

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

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

Date: September 30, 2021 4:07:18 PM
SystemID: JP15471189

Document Name: Certificate of Qualification for ACE



Certificate of Completion

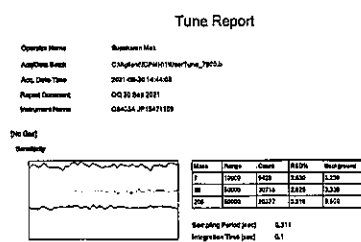
<p>Licensee Name:</p> <p>Title Of Course:</p> <p>Completion Date:</p> <p>Certified the Coursework:</p>	<p><u>Prashant Kousathash</u></p> <p><u>AN-GC-SDMS-2-025-D: CrowLab Compliance Hardware Specific Delivery for Agile/ICP-MS Systems</u></p> <p><u>October 31, 2020</u></p> <p><u>Learning at Asilent</u></p>
--	---

All Service and Summer training candidates have the following specific instructions:

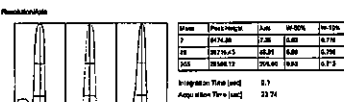
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Date: September 30, 2021 4:27:18 PM
System ID: JP15471169

Document Name: Tune reports



Cable/Coaxial Cables	
Cable	1081540 1,547.1
Coaxial Cable	201140 1,483.9



These Procedures

Physical Parameters					
Process Mode	—	Injection Gas	1.00 L/min	Methoxy Gas	0.10 L/min
RF Power	1550 W	Quartz Gas	—	Airflow Gas	630 L/min
RF Matching	1.00 V	Pressure	0.14 mT	Pressure Gas	11.0 L/min
Sample Depth	9.0 mm	ΔC/Temp	2 °C		
Laser Parameters					
EXT301	0.0 V	Omega Lens	0.1 V	Defocus	12.6 V
EXT32	-0.015 V	Cell Entrance	-0.1 V	Phase Shift	-0 V
Omega Bias	40 V	Cell Exit	-0.1 V		
Cell Parameters					
Use Gas	No	3rd Gas Flow	—	Energy Disposition	0.0 V
	0.0 mT		0.0 V		

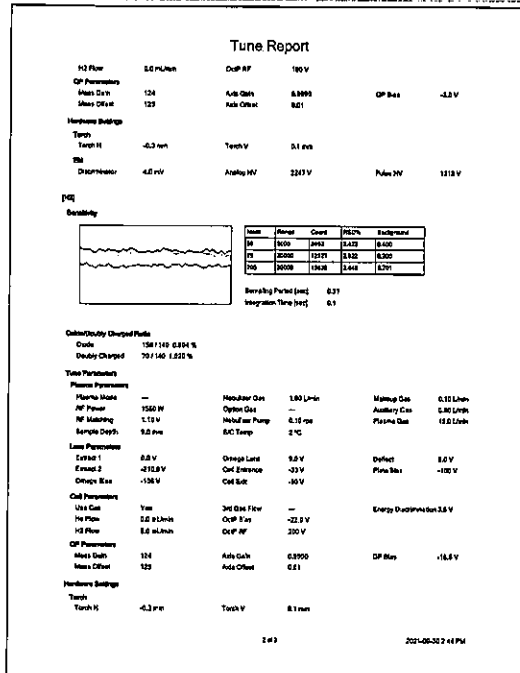
143

7771 09 70 3/4 00

Date: September 30, 2021 4:07:18 PM
System ID: JP15471169

Document Name:

Tune reports

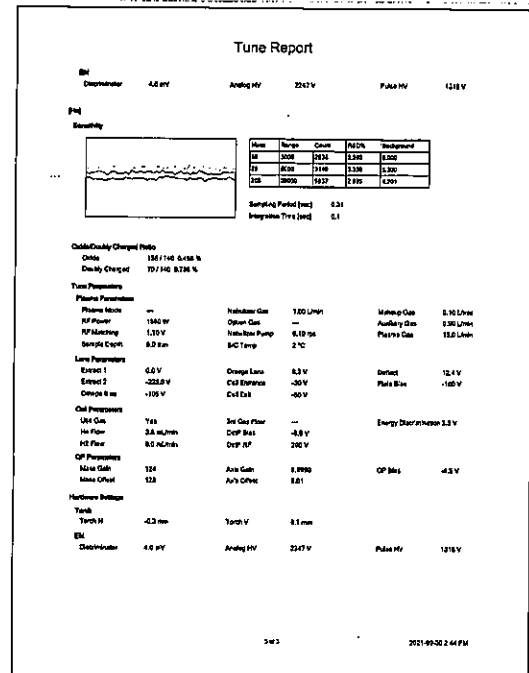


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Document Name:

Tune reports



Date: September 30, 2021 4:07:18 PM
System ID: JP15471169

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General

Document Name:

Test Report

Batch Summary Report

Batch Folder: C:\MSDCHEM\20210930
Analyte File: 80_H2_Batch_01
Test Day: 2021-09-30 14:23:39

Run	Analyte File	Batch Folder	Sample Name	Time	Level	Duration
1	80_H2_Batch_01	C:\MSDCHEM\20210930	80_H2_Batch_01	14:23:39	100.00	1.0000

Page 1 / 2 2021-09-30 14:23:39

Date: September 30, 2021 4:07:18 PM
System ID: JP15471169

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Document Name:

Test Report

Batch Summary Report

Analyte Table

Run	Analyte File	Batch Folder	Sample Name	Time	Level	Duration
1	80_H2_Batch_01	C:\MSDCHEM\20210930	80_H2_Batch_01	14:23:39	100.00	1.0000

Page 2 / 2 2021-09-30 14:23:39

Date: September 30, 2021 4:07:18 PM
System ID: JP15471169

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General

Document Name: Test Report

Batch Summary Report

Batch Folder: D:\Agilent Services\Q030 Sep 2021\B01 H2 Health
Analysis File: B01 H2 new batch\bin
Tune Step: #1 H2

Seq	Acq. Date/Time	Data File	Sample Name	Type	Level	Duration
1	2021-09-30 15:16:56	150102.D	B01 H2	Sample		1.0000

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2021-09-30 15:16:31

Date: September 30, 2021 4:07:18 PM
System ID: JP15471169

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Document Name: Test Report

Batch Summary Report

Analysis Table

Seq	Sample Name	Sample Name
1	B01 H2	2.1500

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2021-09-30 15:16:31

Date: September 30, 2021 4:07:18 PM
System ID: JP15471169

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General

Document Name: Test Report

Batch Summary Report

Batch Folder: D:\Agilent Services\Q030 Sep 2021\B01 H2 Health
Analysis File: B01 H2 new batch\bin
Tune Step: #1 H2

Seq	Acq. Date/Time	Data File	Sample Name	Type	Level	Duration
1	2021-09-30 15:17:54	150102.D	B01 H2	Sample		1.0000

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2021-09-30 15:16:42

Date: September 30, 2021 4:07:18 PM
System ID: JP15471169

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Document Name: Test Report

Batch Summary Report

Analysis Table

Seq	Sample Name	Sample Name	Sample Name	Sample Name	Sample Name	Sample Name	Sample Name
1	B01 H2	6.15400	7.32182	8.49411	9.11491	9.41814	9.73011

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2021-09-30 15:16:43

Date: September 30, 2021 4:07:18 PM
System ID: JP15471169

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Electronic Signature

Purpose

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

Details

Full Name of Signer: Panthep Kuresethain
 Logged On User Name: panthep_kuresethain@agilent.com
 Signature Creation Date: September 30, 2021
 Reason for Signature: Executed protocol and published this original version of document

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

Warranty

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Date: September 30, 2021 4:07:18 PM
 System ID: JP15471168

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User Name: panthep_kuresethain System ID: JP15471168
 Username: ASDKRW315 Print Date: September 30, 2021 4:07:22 PM

ALB DQHW 7502 20Sep21 Transaction log:

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
September 30, 2021 3:59:07 PM	Audit	SessionCreated	Session	None
September 30, 2021 3:59:07 PM	Start	Configuration	Session	None
September 30, 2021 3:59:37 PM	Audit	Enrollment	Licensing	User is Root Engineer and does not require an unlock code
September 30, 2021 3:59:50 PM	Audit	Equipment	Session	EOP Awaits for primary technique (SPM) - File path: [ProtocolPacks\Agilent\Conf\unifera02.501\plate 02.50.1\up], EOP File Name: [plate 02.50.1.up], EOP Name: [Agilent\rootcommand]
September 30, 2021 3:59:54 PM	End	Configuration	Session	None
September 30, 2021 3:59:57 PM	Start	Qualification	Session	OQ
September 30, 2021 3:59:57 PM	Start	Execution	Autosampler Check : SPM:	None
September 30, 2021 3:59:57 PM	End	Execution	Autosampler Check : SPM:	Run Count: 1
September 30, 2021 3:59:57 PM	Start	Execution	Autosampler Check : SPM:	None
September 30, 2021 3:59:57 PM	End	Execution	Autosampler Check : SPM:	Run Count: 1
September 30, 2021 3:59:57 PM	Start	Execution	Integrated Sample Introduction System (ISIS) Check : (ISIS)	None
September 30, 2021 3:59:57 PM	End	Execution	Integrated Sample Introduction System (ISIS) Check : (ISIS)	Run Count: 1

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Date: September 30, 2021 4:07:18 PM
 System ID: JP15471168

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User Name: panthep_kuresethain System ID: JP15471168
 Username: ASDKRW315 Print Date: September 30, 2021 4:07:22 PM

ALB DQHW 7502 20Sep21 Transaction log:

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
September 30, 2021 3:59:10 PM	Start	Execution	Autosampler Autosampler 1	None
September 30, 2021 3:59:58 PM	End	Execution	Autosampler Autosampler 1	Run Count: 1
September 30, 2021 3:59:58 PM	Start	Execution	Background (No Gas Mode) : G4403A: No Gas Mode Background 1	None
September 30, 2021 3:59:58 PM	End	Execution	Background (No Gas Mode) : G4403A: No Gas Mode Background 1	Run Count: 1
September 30, 2021 3:59:58 PM	Start	Execution	Background (Gas Mode) : G4403A: Gas Mode Background Helium	None
September 30, 2021 3:59:58 PM	End	Execution	Background (Gas Mode) : G4403A: Gas Mode Background Helium	Run Count: 1
September 30, 2021 3:59:58 PM	Start	Execution	Background (Gas Mode) : G4403A: Gas Mode Background Hydrogen	None
September 30, 2021 3:59:58 PM	End	Execution	Background (Gas Mode) : G4403A: Gas Mode Background Hydrogen	Run Count: 1
September 30, 2021 3:59:58 PM	Start	Execution	Background (Gas Mode) : G4403A: Gas Mode Background Hydrogen	None
September 30, 2021 3:59:58 PM	End	Execution	Background (Gas Mode) : G4403A: Gas Mode Background Hydrogen	Run Count: 1
September 30, 2021 3:59:58 PM	Start	Execution	20 Minute Stability (No Gas Mode) : G4403A: 20 Minute Stability (No Gas Mode) 1	None
September 30, 2021 3:59:58 PM	End	Execution	20 Minute Stability (No Gas Mode) : G4403A: 20 Minute Stability (No Gas Mode) 1	Run Count: 1
September 30, 2021 3:59:58 PM	End	Qualification	Session	OQ
September 30, 2021 3:59:58 PM	Start	Reporting	Session	None

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Date: September 30, 2021 4:07:18 PM
 System ID: JP15471168

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User Name: panthep_kuresethain System ID: JP15471168
 Username: ASDKRW315 Print Date: September 30, 2021 4:07:22 PM

ALB DQHW 7502 20Sep21 Transaction log:

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
September 30, 2021 4:00:37 PM	Audit	Reporting	Session	Report Generated : Certificate
September 30, 2021 4:03:17 PM	Audit	Reporting	Session	Report Generated : Report
September 30, 2021 4:03:29 PM	Start	Qualification	Session	OQ
September 30, 2021 4:04:08 PM	End	Qualification	Session	OQ
September 30, 2021 4:04:08 PM	Start	Reporting	Session	None
September 30, 2021 4:04:28 PM	Audit	Reporting	Session	Report Generated : Certificate
September 30, 2021 4:04:28 PM	Audit	Reporting	Session	Report Generated : Report

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Date: September 30, 2021 4:07:18 PM
 System ID: JP15471168

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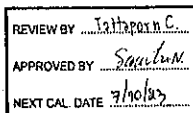


Certificate No. T220730

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Certificate of Calibration

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



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

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

FM-L13 108/30-05-57



Certificate No. T220730

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Calibration Report

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

Condition of this results of calibration :

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

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

2. Reference Standard Instrument :

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

3. This certificate is traceable to :

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

4. Condition of calibrated item : good

Equipment Description :

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

5. Adjustment :

() without adjustment (X) after adjustment

Approved By: [Signature]

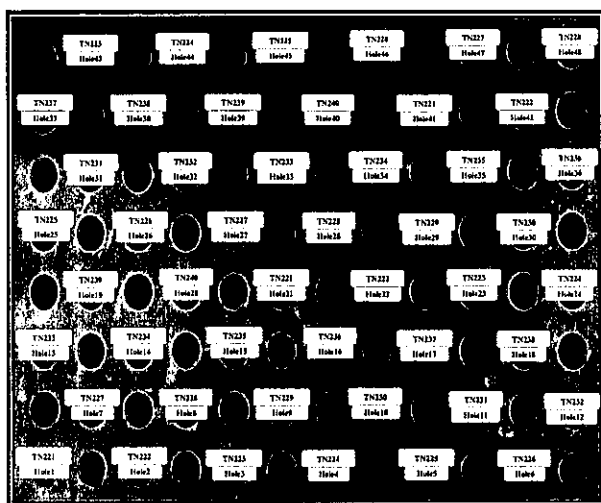
FM-L13 108/30-05-57



Certificate No. T220730

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Calibration Report



FRONT CONTROL

Approved By: [Signature]

FM-L13 108/30-05-57



Certificate No. T220730

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Calibration Report

Measurement Results

Calibration Point	Average Standard Reading at each position (°C)					
R1 Hole1-Hole6	TN221	TN222	TN223	TN224	TN225	TN226
CAL POINT	Max	93.60	93.82	94.05	94.20	94.36
	Min	93.07	93.26	93.51	93.66	93.82
	Average	93.33	93.54	93.78	93.93	94.09
R2 Hole7-Hole12	TN227	TN228	TN229	TN230	TN231	TN232
	Max	94.59	94.79	94.63	94.55	94.82
	Min	94.05	94.25	94.08	93.97	94.26
	Average	94.32	94.52	94.36	94.26	94.54
R3 Hole13-Hole18	TN233	TN234	TN235	TN236	TN237	TN238
	Max	95.03	94.54	94.78	94.84	95.06
	Min	94.46	93.98	94.20	94.28	94.49
	Average	94.74	94.26	94.49	94.56	94.78
R4 Hole19-Hole24	TN239	TN240	TN221	TN222	TN223	TN224
	Max	94.89	94.82	95.73	95.83	95.73
	Min	94.33	94.26	95.51	95.62	95.51
	Average	94.61	94.54	95.62	95.73	95.62
R5 Hole25-Hole30	TN225	TN226	TN227	TN228	TN229	TN230
	Max	96.28	96.39	96.37	96.54	96.19
	Min	96.01	96.10	96.02	96.20	95.89
	Average	96.15	96.24	96.20	96.37	96.04
R6 Hole31-Hole36	TN231	TN232	TN233	TN234	TN235	TN236
	Max	96.84	96.97	97.03	96.48	96.33
	Min	96.53	96.65	96.71	96.08	95.98
	Average	96.68	96.81	96.87	96.28	96.16
R7 Hole37-Hole42	TN237	TN238	TN239	TN240	TN221	TN222
	Max	96.46	96.15	96.19	96.06	96.93
	Min	96.13	95.94	95.83	95.72	96.64
	Average	96.30	95.99	96.02	95.89	96.80
R8 Hole43-Hole48	TN223	TN224	TN225	TN226	TN227	TN228
	Max	96.91	96.58	96.13	96.19	96.34
	Min	96.53	96.21	95.80	95.87	96.03
	Average	96.73	96.40	95.96	96.03	96.18

Approved By: [Signature]

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Certificate No. T220730

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Calibration Report

Measurement Results		Average Standard Reading at each position (°C)					
Calibration Point		TN221	TN222	TN223	TN224	TN225	TN226
R1 Hole1-Hole6	Max	104.47	104.63	104.79	105.31	105.47	105.46
	Min	104.15	104.27	104.45	104.98	105.14	105.20
	Average	104.31	104.46	104.62	105.15	105.31	105.33
R2 Hole7-Hole12	Max	105.55	105.73	105.65	105.84	105.97	106.07
	Min	105.28	105.43	105.35	105.52	105.68	105.83
	Average	105.42	105.58	105.50	105.68	105.82	105.95
R3 Hole13-Hole18	Max	106.14	106.06	105.81	106.03	105.81	105.87
	Min	105.85	105.81	105.55	105.80	105.53	105.64
	Average	106.00	105.94	105.68	105.92	105.67	105.75
R4 Hole19-Hole24	Max	105.88	105.60	104.44	104.51	104.28	104.78
	Min	105.61	105.37	104.27	104.35	104.12	104.61
	Average	105.74	105.48	104.35	104.43	104.20	104.69
R5 Hole25-Hole30	Max	104.94	104.93	104.97	105.08	104.68	104.69
	Min	104.77	104.75	104.76	104.90	104.51	104.49
	Average	104.85	104.84	104.86	104.99	104.60	104.59
R6 Hole31-Hole36	Max	105.44	105.45	105.61	104.55	104.84	104.42
	Min	105.37	105.27	105.44	104.76	104.66	104.25
	Average	105.36	105.36	105.53	104.65	104.75	104.33
R7 Hole37-Hole42	Max	105.17	104.70	104.59	104.51	105.22	105.53
	Min	105.00	104.35	104.41	104.35	105.04	105.37
	Average	105.08	104.62	104.50	104.43	105.13	105.45
R8 Hole43-Hole48	Max	105.61	105.45	105.10	104.77	104.87	105.02
	Min	105.44	105.28	104.92	104.60	104.70	104.85
	Average	105.53	105.37	105.01	104.69	104.79	104.93

Approved By:

FM-L13 10K/30-05-57



Certificate No. T220730

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Calibration Report

Measurement Results:

HEATING BLOCK			Temperature Distribution	
Setting (°C)	Reading (°C)		Stability (±°C)	Uncertainty (±°C)
	Min, Max	Average		
100.0	100.0, 100.4	100.1	0.29	0.83
105.0	105.0, 105.4	105.1	0.20	0.79

* The quoted uncertainty exclude "uniformity"

The calibration result apply only the above calibrated item.

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

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

Approved By:

FM-L13 10K/30-05-57

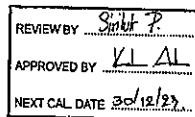


Certificate No. T221644

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Certificate of Calibration

Equipment : Chamber (Cold Room)
Manufacturer : KOLDTECH
Model : KM 320
Serial No. : TBN-1012061/05
Customer Code : BKK_EN0167
ID No. : T2463A3
Customer : ALS Laboratory Group (Thailand) Co.,Ltd.
104 Phatthanakan 40, Phatthanakan Rd., Khwaeng Phatthanakan,
Khet Suan Luang, Bangkok 10250
Customer Location : Environmental Laboratory
Date of Receipt : 27 June 2022
Calibrated By : Sujjar Naknakred (Site Calibration Manager)
Approved By : / Boonchai Suriyawong (Site Calibration Manager)
Date of Issue : 04 JUL 2022



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

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

FM-L14 11/7/01-02-64



Certificate No. T221644

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Calibration Report

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

Condition of this results of calibration :

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

2. Reference Standard Instrument :

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

3. This certificate is traceable to :

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

4. Condition of calibrated item : good

Equipment Description :

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

5. Adjustment :

() without adjustment (X) after adjustment

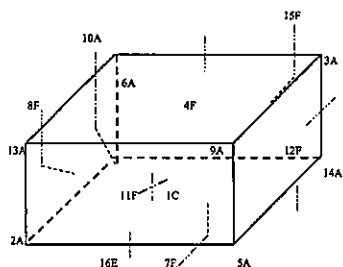
Approved By:

FM-L15 11/7/15-05-63

Certificate No. T221644

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Calibration Report



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

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

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

Approved By:

FM-L15 117/15-05-63

Certificate No. T221644

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Calibration Report

Measurement Results:

Calibration Point	Average Standard Reading at each position (°C)									
	TN161	TN162	TN163	TN164	TN165	TN166	TN167	TN168	TN169	TN170
3	2.71	2.82	2.75	2.89	2.95	3.68	3.02	2.96	3.03	2.85
	TN171	TN172	TN173	TN174	TN175	TN176				
	2.97	3.02	2.89	3.04	2.97	3.33				

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

* The quoted uncertainty exclude " uniformity "

The calibration result apply only the above calibrated item.

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

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

Approved By:

FM-L15 117/15-05-63

analytikjena

REVIEW BY	Sudarat N.
APPROVED BY	Sudarat N.
NEXT CAL DATE	9/06/2023

Maintenance Protocol

Atomic Fluorescence Spectrometer
mercur DUO /
mercur DUO plus

analytikjena

Serial No.: K190A0143 Customer No.: 004-002
Date: 6/06/2022 Carried out by: Mr. Sudarat N.

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

Company	บริษัท ไทยพาณิชย์ จำกัด (มหาชน)
User	นางสาว สุวิมล
Department	Lab
Street	101 ถนนวิภาวดีรังสิต แขวงจตุจักร กรุงเทพฯ
Zip Code, City	17000 กรุงเทพมหานคร 10250
Country	Thailand
Phone	
Fax	
E-mail	

Maintenance works basic unit

lightness visual check inside the Mercur ☒

visual check if gold-traps are broken ☒

visual check if spectrometer is contaminated ☒

visual check of the fluorescence cell ☒

visual check of the absorption cell, incl. window ☒

reactor cleaning ☒

check pump-hose, if necessary change it ☒

check swivel drive (SEV) ☒

check drying-hose, output gas-liquid-separator ☒

test Bubble-Sensor ☒

check gas flows ☒

check volume flows, reagents ☒

recording stray light values ☒

measurement with 30 ng/l ☒

Maintenance works Autosampler

Serial No.: 52 1102 250

lubricate the dosing-winding (Teflon-grease-spray) ☒

clean the dosing cylinder, if necessary exchange it ☒

lubricate the winding system of the height drive with some drops of oil ☒

check the toothed belt ☒

check the position of the mechanical stopper (height: 13mm) ☒

check the pump rate of mixing pump (<14s AS52, typ.7s/<20s AS52S, typ.10s) ☒

check the pump rate of washing cup ☒

check the electrical hose connections for good contact ☒

check the connectors of the magnetic valves ☒

check the dosing hose for buckling, if necessary exchange it ☒

Device parameter	nominal value	actual value
visual check general lightness inside the Mercur	o.k.: <input checked="" type="checkbox"/>	changed: <input type="checkbox"/>
visual check Goldtraps (Goldtraps 2 / NG)	o.k.: <input checked="" type="checkbox"/>	changed: <input type="checkbox"/>
visual check spectrometer		
Fluorescence cell	o.k.: <input checked="" type="checkbox"/>	changed: <input type="checkbox"/>
Absorption cell, incl. window	o.k.: <input checked="" type="checkbox"/>	changed: <input type="checkbox"/>
lens	o.k.: <input checked="" type="checkbox"/>	changed: <input type="checkbox"/>
Swivel drive (SEV)	o.k.: <input checked="" type="checkbox"/>	changed: <input type="checkbox"/>
check pump hoses	o.k.: <input checked="" type="checkbox"/>	changed: <input type="checkbox"/>
check hoses and hose connectors	o.k.: <input checked="" type="checkbox"/>	changed: <input type="checkbox"/>
check and clean reactor	o.k.: <input checked="" type="checkbox"/>	changed: <input type="checkbox"/>
check drying hose output Gas-liquid-separator	o.k.: <input checked="" type="checkbox"/>	changed: <input type="checkbox"/>
check bubble-sensor	o.k.: <input checked="" type="checkbox"/>	not o.k.: <input type="checkbox"/>
Check gasflow		
Argon pressure valve 4	1.2 – 1.5 bar	1.5 bar
Valve 1	10 Nl/h or 0.156 Nl/min	0.166
Valve 2	50 Nl/h or 0.833 Nl/min	0.831
Valve 3	5 Nl/h or 0.083 Nl/min	0.084
Valve 4	10 Nl/h or 0.166 Nl/min	0.167
Check liquidflow		
Acid	2.5 ml/min ± 1 ml	2.5 ml/min
Red-agent	2.5 ml/min ± 1 ml	2.5 ml/min
Sample	10 ml/min ± 2 ml	10 ml/min
Adventitious light - values (V) from file		
100	0	0
200	0	0
300	0	0
350	0	1
400	1	3
450	4	7
500	9	17
550	19	36
575	25	51
600	35	91

Device parameter	nominal value	actual value
Analytical parameters Fluorescence cell		
Conditions: max conc.: 10 µg/L PMT-voltage: 369 V		
Blank-solution without enrichment / FBR 30 ng/L	Int > 0.0015 RSD < 3 %	Int: 0.0003 Int: 0.0053 RSD: 1.02 %
Conditions: max conc.: 1.7 µg/L PMT-voltage: 352 V		
Blank-solution with enrichment / FBR 30 ng/L	Int > 0.008 RSD < 3 % Fok.-factor (Int ₂ / Int ₁) > 3.5	Int: 0.0040 Int: 0.0242 RSD: 0.57 % 4.206
Analytical parameters Absorption cell		
Blank-solution without enrichment / FBR 100 ng/L	Ext. > 0.0012 RSD < 5 %	Ext: 0.0016 Ext: 0.0043 RSD: 3.32 %
Comments		

M. Sathai Pak-on
Signature Technician

Bangkok, 6/04/2022
Place, Date (DD/MM/YYYY)

Samir Wundram
Signature Customer

6/04/2022
Place, Date (DD/MM/YYYY)