

ภาคผนวก ง

ใบรับรองเอกสารการสอบเทียบเครื่องมือตรวจวิเคราะห์



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รายการเครื่องมือที่ใช้ในการวิเคราะห์ / ทดสอบ

Sample Name	Parameter	Equipment Name	ID No.	Calibrated Date	Next Cal	Freq. Calibrate (Months)
Ambient	Nitrogen Dioxide	NO ₂ Analyzer	RYG_FS0252	1-Jul-23	1-Jan-24	6
Ambient	Nitrogen Dioxide	NO ₂ Analyzer	BKK_FS0735	1-Jul-23	1-Jan-24	6
Ambient	Nitrogen Dioxide	NO ₂ Analyzer	RYG_FS0459	1-Jul-23	1-Jan-24	6
Ambient	Nitrogen Dioxide	NO ₂ Analyzer	RYG_FS0463	1-Jul-23	1-Jan-24	6
Ambient	Sulfur Dioxide	SO ₂ Analyzer	RYG_FS0251	2-Jul-23	2-Jan-24	6
Ambient	Sulfur Dioxide	SO ₂ Analyzer	RYG_FS0260	2-Jul-23	2-Jan-24	6
Ambient	Sulfur Dioxide	SO ₂ Analyzer	RYG_FS0458	2-Jul-23	2-Jan-24	6
Ambient	Sulfur Dioxide	SO ₂ Analyzer	RYG_FS0462	2-Jul-23	2-Jan-24	6
Ambient	Particulate Matter (PM-10)	High Volume	RYG_FS0183	-	-	On site Calibration
Ambient	Particulate Matter (PM-10)	High Volume	RYG_FS0399	-	-	On site Calibration
Ambient	Particulate Matter (PM-10)	High Volume	RYG_FS0184	-	-	On site Calibration
Ambient	Particulate Matter (PM-10)	High Volume	RYG_FS0668	-	-	On site Calibration
Ambient	Particulate Matter (PM-10)	Digital Balance	RYG_EN0001	1-Mar-23	1-Mar-24	12
Ambient	Total Suspended Particulate	High Volume	RYG_FS0182	-	-	On site Calibration
Ambient	Total Suspended Particulate	High Volume	RYG_FS0178	-	-	On site Calibration
Ambient	Total Suspended Particulate	High Volume	RYG_FS0175	-	-	On site Calibration
Ambient	Total Suspended Particulate	High Volume	RYG_FS0661	-	-	On site Calibration
Ambient	Total Suspended Particulate	Digital Balance	RYG_EN0001	1-Mar-23	1-Mar-24	12
Ambient	Wind Speed / Wind Direction	Wind Speed / Wind Direction	RYG_FS0531	19-Jan-23	19-Jul-24	18
Stack (CEMs)	Oxides of Nitrogen	Analyzer , System calibration, Stand	-	-	-	-
Stack (CEMs)	Sulfur Dioxide	Analyzer , System calibration, Stand	-	-	-	-
Stack	Total Suspended Particulate	Console Control Unit	BKK_FS0518	13-Jul-23	13-Jan-24	6
Stack	Total Suspended Particulate	Flue gas Analyzer	RYG_FS0564	20-Jan-23	20-Jan-24	12
Stack	Total Suspended Particulate	Digital Balance	RYG_EN0003	1-Mar-23	1-Mar-24	12
Workplace	Sodium hydroxide as NaOH	Field Rotameter	BKK_FS1042	1-Jul-23	1-Oct-23	3
Workplace	Chlorine	Field Rotameter	RYG_FS0198	1-Jul-23	1-Oct-23	3
Workplace	Hydrogen Chloride	Field Rotameter	BKK_FS1042	1-Jul-23	1-Oct-23	3
Workplace	Hydrogen Chloride	Ion Chromatography	BKK_EN0069	12-Jan-23	12-Jan-24	12
Noise	Leq 24 hrs	Sound Calibrator	RYG_FS0216	20-Sep-23	20-Sep-24	12
Noise	Leq 24 hrs	Sound Level Meter	RYG_FS0437	19-Oct-23	19-Oct-24	12
Noise	Leq 8 hrs	Sound Calibrator	RYG_FS0496	17-Jan-23	17-Jan-24	12
Noise	Leq 8 hrs	Sound Level Meter	RYG_FS0020	13-Jan-23	13-Jan-24	12
Noise	Leq 8 hrs	Sound Level Meter	RYG_FS0022	25-Jan-23	25-Jan-24	12
Noise	Leq 8 hrs	Sound Level Meter	RYG_FS0023	13-Jan-23	13-Jan-24	12
Noise	Leq 8 hrs	Sound Level Meter	RYG_FS0024	16-Dec-22	16-Dec-23	12
Noise	Leq 8 hrs	Sound Level Meter	RYG_FS0025	25-Jan-23	25-Jan-24	12
Noise	Leq 8 hrs	Sound Level Meter	RYG_FS0026	25-Jan-23	25-Jan-24	12
Noise	Leq 8 hrs	Sound Level Meter	RYG_FS0027	13-Jan-23	13-Jan-24	12
Noise	Leq 8 hrs	Sound Level Meter	RYG_FS0029	20-Jun-23	20-Jun-24	12
Noise	Leq 8 hrs	Sound Level Meter	RYG_FS0030	25-Jan-23	25-Jan-24	12
Noise	Leq 8 hrs	Sound Calibrator	RYG_FS0496	17-Jan-23	17-Jan-24	12
Noise	Leq 8 hrs	Sound Level Meter	RYG_FS0007	13-Jan-23	13-Jan-24	12
Noise	Leq 8 hrs	Sound Level Meter	RYG_FS0012	16-Dec-22	16-Dec-23	12
Noise	Leq 8 hrs	Sound Level Meter	RYG_FS0017	3-Jan-23	3-Jan-24	12
Noise	Leq 8 hrs	Sound Level Meter	RYG_FS0018	3-Jan-23	3-Jan-24	12
Noise	Leq 8 hrs	Sound Level Meter	RYG_FS0023	13-Jan-23	13-Jan-24	12
Noise	Leq 8 hrs	Sound Level Meter	RYG_FS0026	25-Jan-23	25-Jan-24	12
Noise	Leq 8 hrs	Sound Level Meter	RYG_FS0027	13-Jan-23	13-Jan-24	12
Heat	Heat Stress	Heat Stress Monitor	RYG_FS0236	21-Nov-22	21-Nov-23	12
Heat	Heat Stress	Heat Stress Monitor	RYG_FS0356	02-Feb-23	2-Feb-24	12
Heat	Heat Stress	Heat Stress Monitor	RYG_FS0358	02-Feb-23	2-Feb-24	12
Heat	Heat Stress	Heat Stress Monitor	RYG_FS0359	02-Feb-23	2-Feb-24	12



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Sample Name	Parameter	Equipment Name	ID No.	Calibrated Date	Next Cal	Freq. Calibrate (Months)
Rayong Lab	BOD	DO meter with Sensor	RYG_EN0032	24-Jul-23	24-Jan-25	18
Rayong Lab	BOD	Incubator	RYG_EN0154	29-May-23	29-Nov-24	18
Rayong Lab	COD	Spectrophotometer	RYG_EN0037	18-Sep-23	18-Mar-25	18
Rayong Lab	Color (at Original pH)	Spectrophotometer	RYG_EN0037	18-Sep-23	18-Mar-25	18
Rayong Lab	Color (at pH 7.0)	Spectrophotometer	RYG_EN0037	18-Sep-23	18-Mar-25	18
Rayong Lab	Cyanide	SPECTROPHOTOMETER	RYG_EN0037	18-Sep-23	18-Mar-25	18
Rayong Lab	Formaldehyde	SPECTROPHOTOMETER	RYG_EN0037	18-Sep-23	18-Mar-25	18
Rayong Lab	Phenol	SPECTROPHOTOMETER	RYG_EN0037	18-Sep-23	18-Mar-25	18
Rayong Lab	pH at 25 °C	pH meter	RYG_EN0183	27-Feb-23	27-Feb-24	12
Rayong Lab	Oil & Grease	Electronic Balance	RYG_EN0002	1-Mar-23	1-Mar-24	12
Rayong Lab	Oil & Grease	Hot Air Oven	RYG_EN0006	20-Oct-22	20-Apr-24	18
Rayong Lab	Oil & Grease	Water Bath	RYG_EN0061	20-Oct-22	20-Apr-24	18
Rayong Lab	Sulfide	Chamber (Cold Room)	RYG_EN0184	25-Jan-23	25-Jul-24	12
Rayong Lab	Temperature	pH meter	RYG_FS0550	24-Jul-23	24-Jul-24	12
Rayong Lab	Total Dissolved Solids 180°C	Electronic Balance	RYG_EN0002	1-Mar-23	1-Mar-24	12
Rayong Lab	Total Dissolved Solids 180°C	Hot Air Oven	RYG_EN0010	20-Oct-22	20-Apr-24	18
Rayong Lab	Total Suspended Solids	Electronic Balance	RYG_EN0002	1-Mar-23	1-Mar-24	12
Rayong Lab	Total Suspended Solids	Hot Air Oven	RYG_EN0010	20-Oct-22	20-Apr-24	18
Rayong Lab	Total Kjeldahl Nitrogen	Block Digestion Unit	RYG_EN0188	15-Mar-23	15-Mar-24	12
Rayong Lab	Total Kjeldahl Nitrogen	pH Meter	RYG_EN0152	14-Dec-23	14-Dec-24	12
Rayong Lab	Ammonia Nitrogen	SPECTROPHOTOMETER	RYG_EN0037	18-Sep-23	18-Mar-25	18
Rayong Lab	Fluoride	pH ISE Meter	RYG_EN0152	14-Dec-23	14-Dec-24	12
Water Lab	Anionic Surfactant	Spectrophotometer	BKK_EN0018	15-Sep-23	15-Sep-24	12
Water Lab	Anionic Surfactant	Chamber (Cold Room)	BKK_EN0167	6-Dec-23	6-Jun-25	18
Water Lab	Arsenic	ICP-MS	BKK_EL0026	12-Dec-23	13-Jun-25	18
Water Lab	Arsenic	Hot Block	BKK_EL0054	22-Sep-23	22-Mar-25	18
Water Lab	Arsenic	Chamber (Cold Room)	BKK_EN0167	6-Dec-23	6-Jun-25	18
Water Lab	Barium	ICP-MS	BKK_EL0026	12-Dec-23	13-Jun-25	18
Water Lab	Barium	Hot Block	BKK_EL0054	22-Sep-23	22-Mar-25	18
Water Lab	Barium	Chamber (Cold Room)	BKK_EN0167	6-Dec-23	6-Jun-25	18
Water Lab	Cadmium	ICP-MS	BKK_EL0026	12-Dec-23	13-Jun-25	18
Water Lab	Cadmium	Hot Block	BKK_EL0054	22-Sep-23	22-Mar-25	18
Water Lab	Cadmium	Chamber (Cold Room)	BKK_EN0167	6-Dec-23	6-Jun-25	18
Water Lab	Copper	ICP-MS	BKK_EL0026	12-Dec-23	13-Jun-25	18
Water Lab	Copper	Hot Block	BKK_EL0054	22-Sep-23	22-Mar-25	18
Water Lab	Copper	Chamber (Cold Room)	BKK_EN0167	6-Dec-23	6-Jun-25	18
Water Lab	Hexavalent Chromium	Spectrophotometer	BKK_EN0018	15-Sep-23	15-Sep-24	12
Water Lab	Lead	ICP-MS	BKK_EL0026	12-Dec-23	13-Jun-25	18
Water Lab	Lead	Hot Block	BKK_EL0054	22-Sep-23	22-Mar-25	18
Water Lab	Lead	Chamber (Cold Room)	BKK_EN0167	6-Dec-23	6-Jun-25	18
Water Lab	Manganese	ICP-MS	BKK_EL0026	12-Dec-23	13-Jun-25	18
Water Lab	Manganese	Hot Block	BKK_EL0054	22-Sep-23	22-Mar-25	18
Water Lab	Manganese	Chamber (Cold Room)	BKK_EN0167	6-Dec-23	6-Jun-25	18
Water Lab	Mercury	DUO-CVAFS / CVAAS	BKK_EL0023	24-May-23	24-May-24	12
Water Lab	Nickel	ICP-MS	BKK_EL0026	12-Dec-23	13-Jun-25	18
Water Lab	Nickel	Hot Block	BKK_EL0054	22-Sep-23	22-Mar-25	18
Water Lab	Nickel	Chamber (Cold Room)	BKK_EN0167	6-Dec-23	6-Jun-25	18
Water Lab	Selenium	ICP-MS	BKK_EL0026	12-Dec-23	13-Jun-25	18
Water Lab	Selenium	Hot Block	BKK_EL0054	22-Sep-23	22-Mar-25	18
Water Lab	Selenium	Chamber (Cold Room)	BKK_EN0167	6-Dec-23	6-Jun-25	18
Water Lab	Trivalent Chromium	ICP-MS	BKK_EL0026	12-Dec-23	13-Jun-25	18
Water Lab	Trivalent Chromium	Hot Block	BKK_EL0054	22-Sep-23	22-Mar-25	18
Water Lab	Trivalent Chromium	Chamber (Cold Room)	BKK_EN0167	6-Dec-23	6-Jun-25	18
Water Lab	Zinc	ICP-MS	BKK_EL0026	12-Dec-23	13-Jun-25	18
Water Lab	Zinc	Hot Block	BKK_EL0054	22-Sep-23	22-Mar-25	18
Water Lab	Zinc	Chamber (Cold Room)	BKK_EN0167	6-Dec-23	6-Jun-25	18



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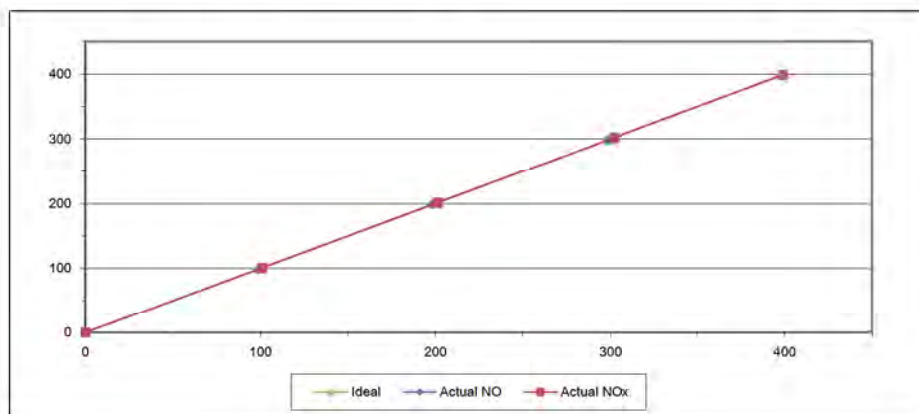
Sample Name	Parameter	Equipment Name	ID No.	Calibrated Date	Next Cal	Freq. Calibrate (Months)
Water Lab	Iron	ICP-MS	BKK_EL0026	12-Dec-23	13-Jun-25	18
Water Lab	Iron	Hot Block	BKK_EL0054	22-Sep-23	22-Mar-25	18
Water Lab	Iron	Chamber (Cold Room)	BKK_EN0167	6-Dec-23	6-Jun-25	18
Water Lab	Silver	ICP-MS	BKK_EL0026	12-Dec-23	13-Jun-25	18
Water Lab	Silver	Hot Block	BKK_EL0054	22-Sep-23	22-Mar-25	18
Water Lab	Silver	Chamber (Cold Room)	BKK_EN0167	6-Dec-23	6-Jun-25	18
Water Lab	Carbamate Pesticide	LC-MS/MS	BKK_FL0089	20-Jul-23	22-Jan-24	6
Water Lab	Organochlorine Pesticide	GC MSMS	BKK_EN0284	25-May-23	25-Nov-24	18
Water Lab	Organo Phosphate Pesticide	GC MSMS	BKK_EN0284	25-May-23	25-Nov-24	18
Water Lab	Pyrethroid Group Pesticides	GC MSMS	BKK_EN0284	25-May-23	25-Nov-24	18



MULTIPOINT CALIBRATION REPORT

Calibration Date	1-Jul-23	Equipment Name	NOx Analyzer
Manufacturer	Teledyne API	Model	T200
Serial No.	2198	Equipment ID	RYG_FS0252
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	98.80	-1.20	-1.20	101.00	1.00	1.00
2	200.00	198.00	-2.00	-1.00	201.30	1.30	0.65
3	300.00	298.10	-1.90	-0.63	302.30	2.30	0.77
4	400.00	398.20	-1.80	-0.45	398.80	-1.20	-0.30
AVERAGE (%)				-0.64			0.44



Calibrated By

(Mr. Jirawut Sakarn)
Field Environmental Scientist (3)

Approved By

(Mr. Sarayuth Jitranont)
Assistant General Manager

ALS Laboratory Group

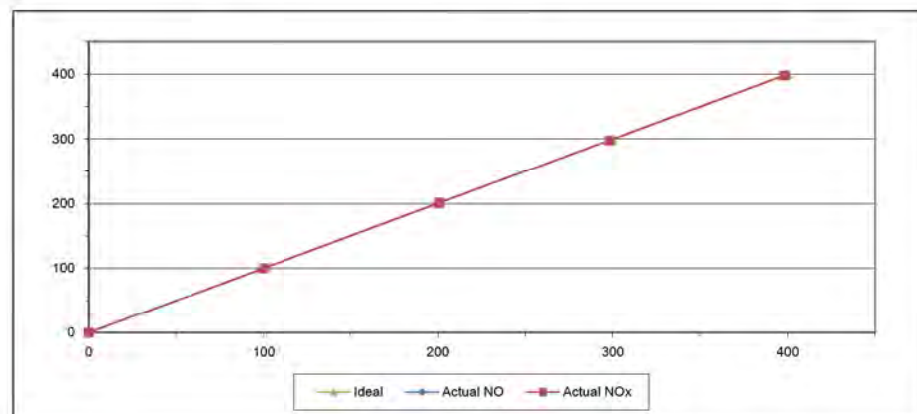
FORM NO : F 06.056 REVISION NO : - ISSUE DATE: 02/04/12



MULTIPOINT CALIBRATION REPORT

Calibration Date	1-Jul-23	Equipment Name	NOx Analyzer
Manufacturer	Teledyne API	Model	200E
Serial No.	1578	Equipment ID	BKK_FS0735
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	99.20	-0.80	-0.80	100.30	0.30	0.30
2	200.00	199.30	-0.70	-0.35	201.00	1.00	0.50
3	300.00	298.50	-1.50	-0.50	298.00	-2.00	-0.67
4	400.00	398.50	-1.50	-0.38	398.10	-1.90	-0.47
AVERAGE (%)				-0.38			-0.05



Calibrated By

(Mr. Jirawut Sakarn)
Field Environmental Scientist (3)

Approved By

(Mr. Sarayuth Jitranont)
Assistant General Manager

ALS Laboratory Group

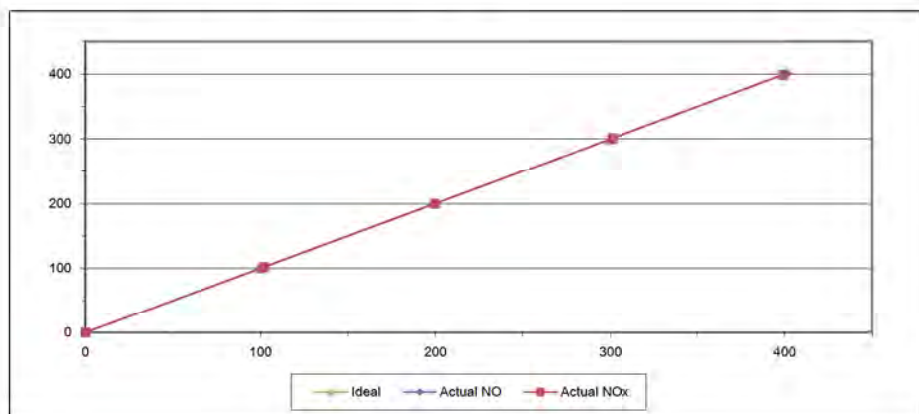
FORM NO : F 06.056 REVISION NO : - ISSUE DATE: 02/04/12



MULTIPOINT CALIBRATION REPORT

Calibration Date	1-Jul-23	Equipment Name	NOx Analyzer
Manufacturer	HORIBA	Model	APNA-370
Serial No.	NV0ER3YH	Equipment ID	RYG_FS0459
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	0.05	0.05	0.05	0.10	0.10	0.10
1	100.00	99.50	-0.50	-0.50	101.80	1.80	1.80
2	200.00	198.70	-1.30	-0.65	199.70	-0.30	-0.15
3	300.00	301.10	1.10	0.37	301.50	1.50	0.50
4	400.00	401.30	1.30	0.33	398.90	-1.10	-0.28
AVERAGE (%)				-0.08			0.39



Calibrated By

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

Approved By

(Mr. Sarayuth Jitranont)
Assistant General Manager

ALS Laboratory Group

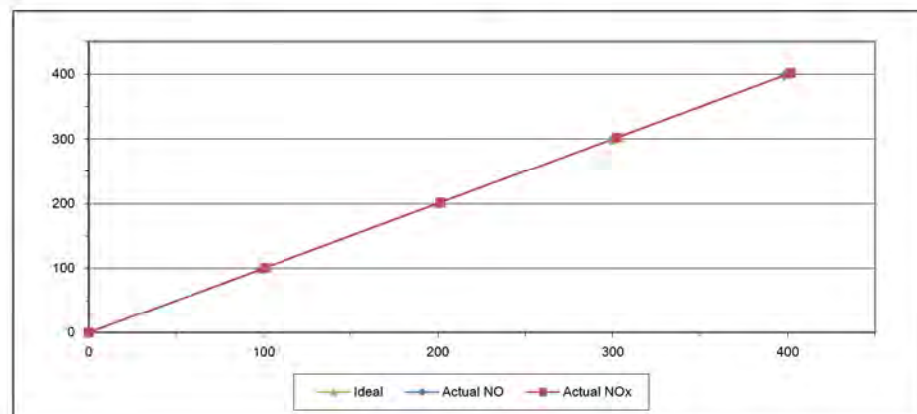
FORM NO : F 06.056 REVISION NO : - ISSUE DATE: 02/04/12



MULTIPOINT CALIBRATION REPORT

Calibration Date	1-Jul-23	Equipment Name	NOx Analyzer
Manufacturer	HORIBA	Model	APNA-370
Serial No.	R06K0177	Equipment ID	RYG_FS0463
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	98.80	-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	401.90	1.90	0.47
AVERAGE (%)				-0.18			0.66



Calibrated By

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

Approved By

(Mr. Sarayuth Jitranont)
Assistant General Manager

ALS Laboratory Group

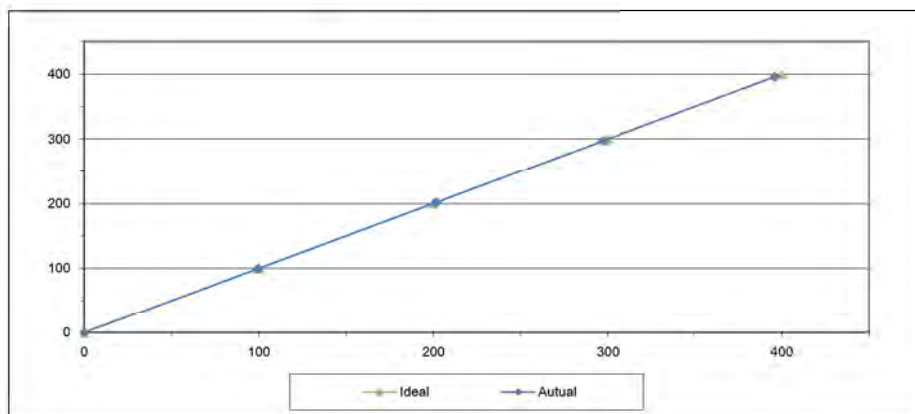
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MULTIPOINT CALIBRATION REPORT

Calibration Date	2-Jul-23	Equipment Name	SO2 Analyzer
Manufacturer	Teledyne API	Model	T100
Serial No.	1773	Equipment ID	RYG_FS0251
Calibrator Manufacturer	Teledyne API	Model	700
Serial No.	947		
Std. Gas Concentration (PPM)	56.3	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	Error	%Error
ZERO	0.00	0.10	0.10	0.10
1	100.00	99.60	-0.40	-0.40
2	200.00	201.80	1.80	0.90
3	300.00	297.20	-2.80	-0.93
4	400.00	396.00	-4.00	-1.00
AVERAGE (%)				-0.27



Calibrated By

(Mr. Jirawut Sakarn)
Field Environmental Scientist (3)

Approved By

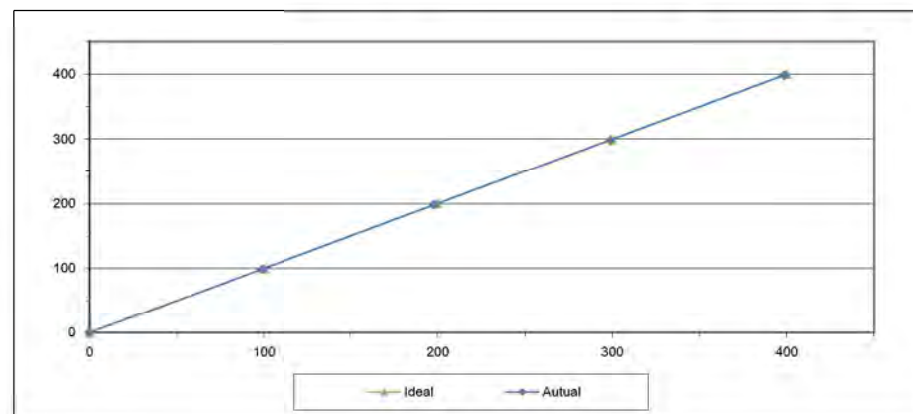
(Mr. Sarayuth Jitranont)
Assistant General Manager



MULTIPOINT CALIBRATION REPORT

Calibration Date	2-Jul-23	Equipment Name	SO2 Analyzer
Manufacturer	HORIBA	Model	APSA-370
Serial No.	8HC0DGJF	Equipment ID	RYG_FS0260
Calibrator Manufacturer	Teledyne API	Model	700
Serial No.	947		
Std. Gas Concentration (PPM)	56.3	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	Error	%Error
ZERO	0.00	0.10	0.10	0.10
1	100.00	99.10	-0.90	-0.90
2	200.00	198.00	-2.00	-1.00
3	300.00	299.00	-1.00	-0.33
4	400.00	398.50	-1.50	-0.38
AVERAGE (%)				-0.50



Calibrated By

(Mr. Jirawut Sakarn)
Field Environmental Scientist (3)

Approved By

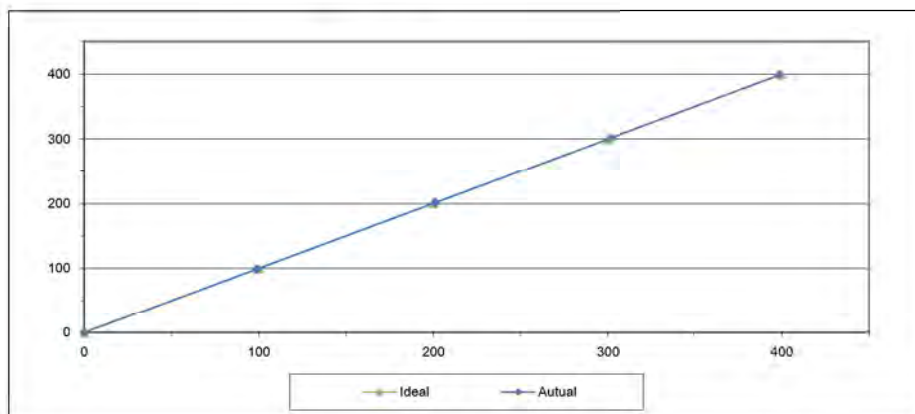
(Mr. Sarayuth Jitranont)
Assistant General Manager



MULTIPOINT CALIBRATION REPORT

Calibration Date	2-Jul-23	Equipment Name	SO2 Analyzer
Manufacturer	HORIBA	Model	APSA-370
Serial No.	PAUY0T7A	Equipment ID	RYG_FS0458
Calibrator Manufacturer	Teledyne API	Model	700
Serial No.	947		
Std. Gas Concentration (PPM)	56.3	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	Error	%Error
ZERO	0.00	0.10	0.10	0.10
1	100.00	98.90	-1.10	-1.10
2	200.00	201.10	1.10	0.55
3	300.00	302.30	2.30	0.77
4	400.00	398.60	-1.40	-0.35
AVERAGE (%)				-0.01



Calibrated By

(Mr. Jirawut Sakarn)
Field Environmental Scientist (3)

Approved By

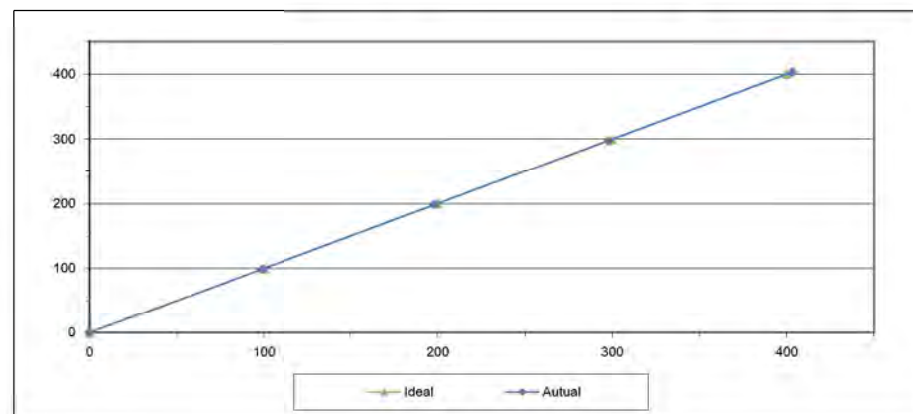
(Mr. Sarayuth Jitranont)
Assistant General Manager



MULTIPOINT CALIBRATION REPORT

Calibration Date	2-Jul-23	Equipment Name	SO2 Analyzer
Manufacturer	HORIBA	Model	APSA-370
Serial No.	XL29Y85B	Equipment ID	RYG_FS0462
Calibrator Manufacturer	Teledyne API	Model	700
Serial No.	947		
Std. Gas Concentration (PPM)	56.3	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	Error	%Error
ZERO	0.00	0.10	0.10	0.10
1	100.00	99.10	-0.90	-0.90
2	200.00	198.10	-1.90	-0.95
3	300.00	297.90	-2.10	-0.70
4	400.00	403.20	3.20	0.80
AVERAGE (%)				-0.33



Calibrated By

(Mr. Jirawut Sakarn)
Field Environmental Scientist (3)

Approved By

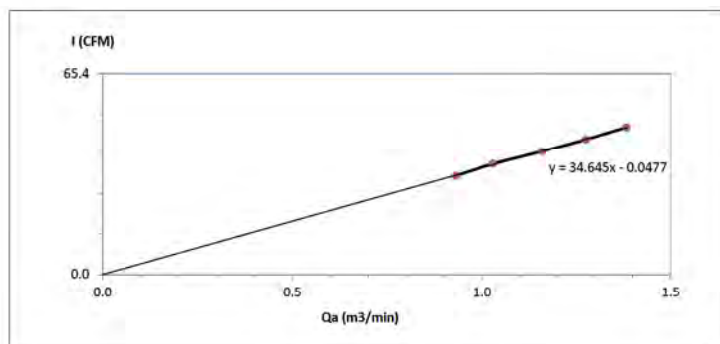
(Mr. Sarayuth Jitranont)
Assistant General Manager



High Volume Air Sampler Calibration Worksheet

Project Site : Global Power Synergy Public Company Limited
 Calibrate Location : วัดหนองเพน
 Calibrate Date : 10-Sep-23
 Calibration Sheet No.: C-100923-RYG_FS0183
 Calibrator ID: RYG_FS0206
 Calibrator Model : TE-5028A
 Calibrator S/N : 1543
 Barometric Pressure (mm Hg) : 755
 Temperature (°C) : 31
 High Volume ID : RYG_FS0183
 High Volume Model : TE-5009X
 High Volume S/N : 4791
 Calibrator Slope : 0.92345
 Calibrator Intercept : -0.0095

Test No.	Delta H ₂ O (inch)	Qa (m ³ /min)	I: Chart (CFM)	Linear Regression
1	1.8	0.931	32	Slope : 34.6448 Intercept : -0.0477 Correlation Coefficient : 0.9991
2	2.2	1.029	36	
3	2.8	1.159	40	
4	3.4	1.277	44	
5	4.0	1.384	48	



Calibrated by

ชัชชาติ สุขเปีย
 (Mr.Chatchai Sukpia)
 Field Scientist(1)

Approved by:

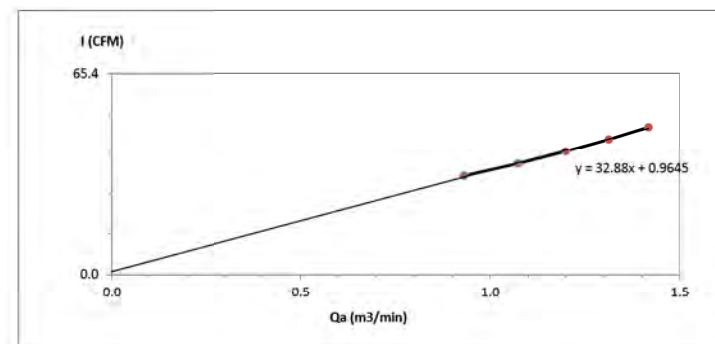
น. นพปง จันตารูปาน
 (Mr. Noppong Jantarupan)
 Enviro Field Coordinator Scientist (3)



High Volume Air Sampler Calibration Worksheet

Project Site : Global Power Synergy Public Company Limited
 Calibrate Location : วัดมาบขลุ่ด
 Calibrate Date : 10-Sep-23
 Calibration Sheet No.: C-100923-RYG_FS0399
 Calibrator ID: RYG_FS0206
 Calibrator Model : TE-5028A
 Calibrator S/N : 1543
 Barometric Pressure (mm Hg) : 755
 Temperature (°C) : 31
 High Volume ID : RYG_FS0399
 High Volume Model : TE-5009X
 High Volume S/N : 5683
 Calibrator Slope : 0.92345
 Calibrator Intercept : -0.0095

Test No.	Delta H ₂ O (inch)	Qa (m ³ /min)	I: Chart (CFM)	Linear Regression
1	1.8	0.931	32	Slope : 32.8797 Intercept : 0.9645 Correlation Coefficient : 0.9981
2	2.4	1.074	36	
3	3.0	1.200	40	
4	3.6	1.313	44	
5	4.2	1.418	48	

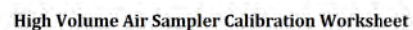


Calibrated by

ชัชชาติ สุขเปีย
 (Mr.Chatchai Sukpia)
 Field Scientist(1)

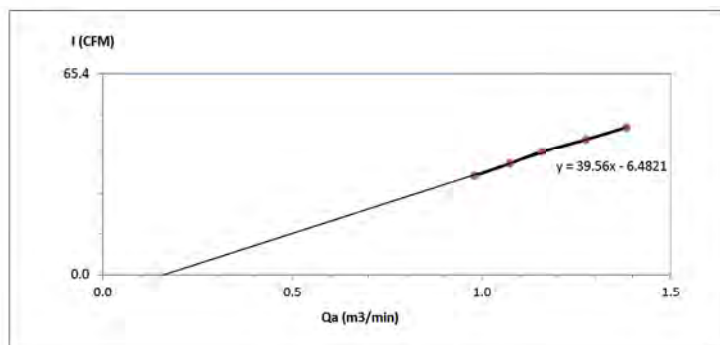
Approved by:

น. นพปง จันตารูปาน
 (Mr. Noppong Jantarupan)
 Enviro Field Coordinator Scientist (3)



Project Site :	Global Power Synergy Public Company Limited	Barometric Pressure (mm Hg) :	755
Calibrate Location :	วัดบางกอกใหญ่	Temperature (°C) :	31
Calibrate Date :	10-Sep-23	High Volume ID :	RYG_FS0184
CalibrationSheet No.:	C-100923-RYG_FS0184	High Volume Model :	TE-5009%
Calibrator ID:	RYG_FS0206	High Volume S/N :	4792
Calibrator Model :	TE-5028A	Calibrator Slope :	0.92345
Calibrator S/N :	1543	Calibrator Intercept:	-0.0095

Test No.	Delta H ₂ O (inch)	Qa (m ³ /min)	I : Chart (CFM)	Linear Regression	
1	2.0	0.981	32	Slope :	39.5596
2	2.4	1.074	36	Intercept :	-6.4821
3	2.8	1.159	40	Correlation Coefficient :	0.9982
4	3.4	1.277	44		
5	4.0	1.384	48		



Calibrated by

ชัชชาติ สุขเปีย
(Mr.Chatchai Sukpia)
Field Scientist(1)

Approved by :

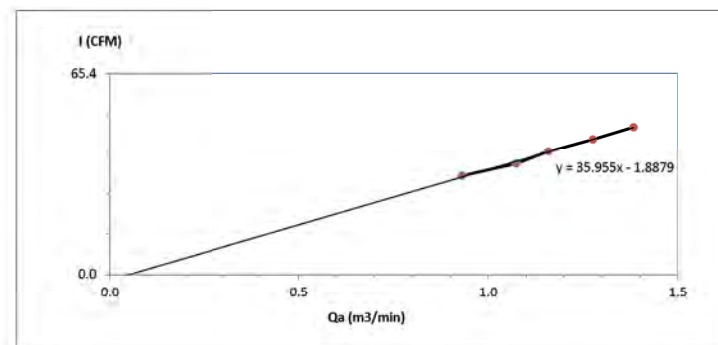
(Mr. Noppong Juntarupan)
Enviro Field Coordinator Scientist (3)



High Volume Air Sampler Calibration Worksheet

Project Site :	Global Power Synergy Public Company Limited	Barometric Pressure (mm Hg) :	755
Calibrate Location :	วัดโสมกวนาราม	Temperature (°C) :	31
Calibrate Date :	10-Sep-23	High Volume ID :	RYG_FS0668
CalibrationSheet No.:	C-100923-RYG_FS0668	High Volume Model :	TE-5009X
Calibrator ID:	RYG_FS0206	High Volume S/N :	6267
Calibrator Model :	TE-5028A	Calibrator Slope :	0.92345
Calibrator S/N :	1543	Calibrator Intercept :	-0.0095

Test No.	Delta H ₂ O (inch)	Qa (m ³ /min)	I: Chart (CFM)	Linear Regression	
1	1.8	0.931	32	Slope :	35.9548
2	2.4	1.074	36	Intercept :	-1.8879
3	2.8	1.159	40	Correlation Coefficient :	0.9977
4	3.4	1.277	44		
5	4.0	1.384	48		



Calibrated by

ชัชชาติ สุขเปีย
(Mr.Chatchai Sukpia)
Field Scientist(1)

Approved by _____

(Mr. Noppong Juntarupan)
Enviro Field Coordinator Scientist (3)

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



NSC-TISI-TIS 17025
CALIBRATION 0426

SARTORIUS

REVIEW BY *Thavita U.*
APPROVED BY *D. Chonchai*
NEXT CAL. DATE *01/03/24*

Certificate of Calibration

Model Number : LA130S-F Certificate No. : 23BCI0110
Description : Analytical Balance Issued Date : Friday, March 03, 2023
Serial Number : 25409664 Reference No. : 204833
ID No. : RYG_EN0001
Manufacturer : Sartorius Page No. : 1 of 2

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

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

Calibrated By : Mr.Chonchai Inthana
Calibration Date : Wednesday, March 01, 2023
Calibration Procedure No. : This calibration was conducted by
Using in-house calibration procedure number (WI-003)
Based on UKAS LAB 14 : 2019

Metrological data : Ambients Conditions:
Capacity : 150 g Readability : 0.0001 g Temperature : 24.2 °C ± 5.0 °C
Humidity : 60.0 % RH ± 10.0 % RH
Pressure : ±

Reasons for calibration

☐ New Installation ☐ Service / Repaired ☒ Re-calibration/ Maintenance

Equipment Condition: ☒ Good Operate ☐ Fair

Measurement Method UKAS Publication Ref :Lab 14

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

Traceability:

Model Number	Description	Traceability	Certificate No.	Due Date
YCS011-522-00	Sartorius weight set 1mg - 5000g E2,YCS011-522-00	SPC-RT	C02212565	14-Sep-2023
MHB-382SD	Humidity/Barometer/Temp Lutron MHB-382SD	DKSH	C19220444	5-Sep-2023

This certificate relate and apply this equipment only.

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

Mr.chonchai Inthana(Technical Manager)



Sartorius (Thailand) Co., Ltd.

129 Rama 9 Road, Huaykwang, Bangkok 10310
Tel: +66 2643 8361-6 Fax: +66 2643-8367, e-mail: service.thailand@sartorius.com

SARTORIUS

Certificate of Calibration

Model Number : LA130S-F Certificate No. : 23BCI0110
Description : Analytical Balance Issued Date : Friday, March 03, 2023
Serial Number : 25409664 Reference No. : 204833
ID No. : RYG_EN0001
Manufacturer : Sartorius Page No. : 2 of 2

Calibration Results : Without Adjustment

Repeatability

The reproducibility is the ability of a weighing instrument to display nearly identical readouts under constant test conditions when the same load within a measurement series is placed repeatedly on the weighing pan in the same manner. The standard deviation is used to express reproducibility quantitatively.

Nominal Value : (Low Load)	10.0000	100.0001
10 g	10.0000	100.0002
Tolerance	10.0001	100.0001
0.0001 g	10.0000	100.0000
	9.9999	100.0002
Nominal Value : (High Load)	10.0000	100.0001
100 g	10.0001	100.0001
Tolerance	10.0000	100.0001
0.0001 g	9.9999	100.0002
	9.9998	100.0001
Standard Deviation	0.00009	0.00006

Eccentricity (Off-center loading error)

The off-center loading error is yielded by the difference between the readout of the load, i.e. 1/3 or 1/4 of maximum capacity, placed in the middle of the weighing pan and between each of four additional measurement points (positions defined according to OIML R76).

Nominal value :	50	g
Tolerance	0.0004	g
		Difference
	1	-
	2	0.0000
	3	-0.0001
	4	0.0001
	5	0.0000
	6	-

Linearity

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

Tolerance		0.0002	g		
Nominal Value	Conventional Mass Value	Displayed Value	Deviation	Uncertainty	
(g)	(g)	(g)	(g)	(g)	
0.01	0.0100	0.0100	0.0000	0.00022	
0.05	0.0500	0.0500	0.0000	0.00023	
0.1	0.1000	0.1000	0.0000	0.00023	
0.5	0.5000	0.5000	0.0000	0.00023	
1	1.0000	1.0000	0.0000	0.00023	
2	2.0000	2.0000	0.0000	0.00023	
5	5.0000	5.0000	0.0000	0.00022	
10	10.0000	10.0001	0.0001	0.00024	
20	20.0000	20.0001	0.0001	0.00023	
100	100.0000	100.0002	0.0002	0.00026	

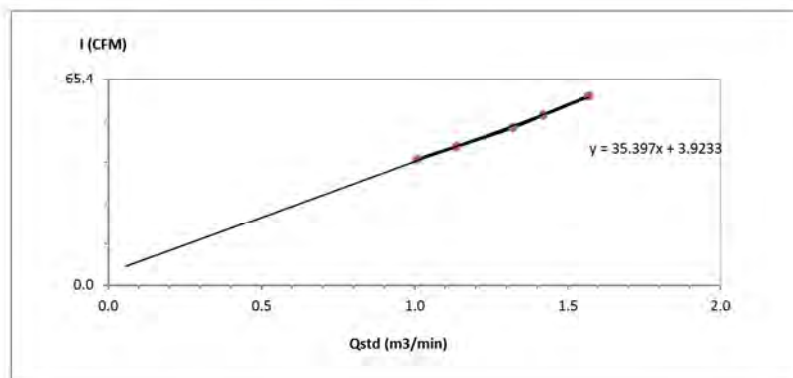
End of Report.



High Volume Air Sampler Calibration Worksheet

Project Site :	Global Power Synergy Public Company Limited	Barometric Pressure (mm Hg) :	755
Calibrate Location :	วัดหนองพลับ	Temperature (°C) :	31
Calibrate Date :	10 Sep 23	High Volume ID :	RYG FS0182
CalibrationSheet No.:	C-100923-RYG_FS0182	High Volume Model :	TE-5170D
Calibrator ID:	RYG FS0206	High Volume S/N :	5335
Calibrator Model :	TE-5028A	Calibrator Slope :	1.47433
Calibrator S/N :	1543	Calibrator Intercept :	-0.01503

Test No.	Delta H ₂ O (inch)	Q _{std} (m ³ /min)	I : Chart (CFM)	Linear Regression
1	2.2	1.0078	40	Slope : 35.3969 Intercept : 3.9233 Correlation Coefficient : 0.9983
2	2.8	1.1350	44	
3	3.8	1.3198	50	
4	4.4	1.4190	54	
5	5.4	1.5704	60	



Calibrated by

จตุรัสชัย

(Mr.Chatchai Sukpia)
Field Scientist(1)

Approved by :

น. นพปง จันทรูปาน

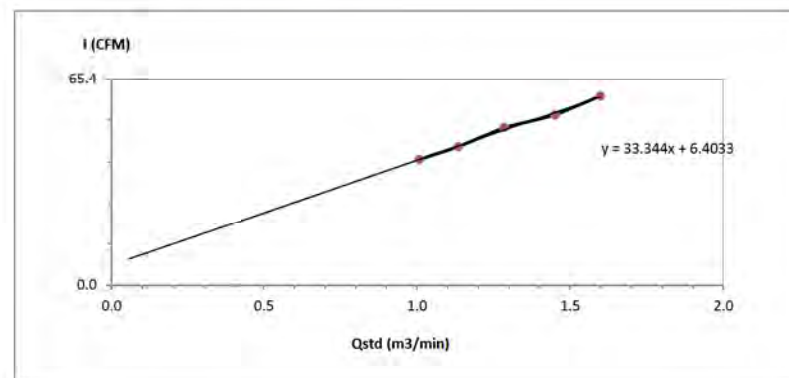
(Mr. Noppong Juntarupan)
Enviro Field Coordinator Scientist (3)



High Volume Air Sampler Calibration Worksheet

Project Site :	Global Power Synergy Public Company Limited	Barometric Pressure (mm Hg) :	755
Calibrate Location :	วัดมาบตาพุด	Temperature (°C) :	31
Calibrate Date :	10 Sep 23	High Volume ID :	RYG FS0178
CalibrationSheet No.:	C-100923-RYG_FS0178	High Volume Model :	TE-5170D
Calibrator ID:	RYG FS0206	High Volume S/N :	4804
Calibrator Model :	TE-5028A	Calibrator Slope :	1.47433
Calibrator S/N :	1543	Calibrator Intercept :	-0.01503

Test No.	Delta H ₂ O (inch)	Q _{std} (m ³ /min)	I : Chart (CFM)	Linear Regression
1	2.2	1.0078	40	Slope : 33.3443 Intercept : 6.4033 Correlation Coefficient : 0.9974
2	2.8	1.1350	44	
3	3.6	1.2850	50	
4	4.6	1.4506	54	
5	5.6	1.5990	60	



Calibrated by

จตุรัสชัย

(Mr.Chatchai Sukpia)
Field Scientist(1)

Approved by :

น. นพปง จันทรูปาน

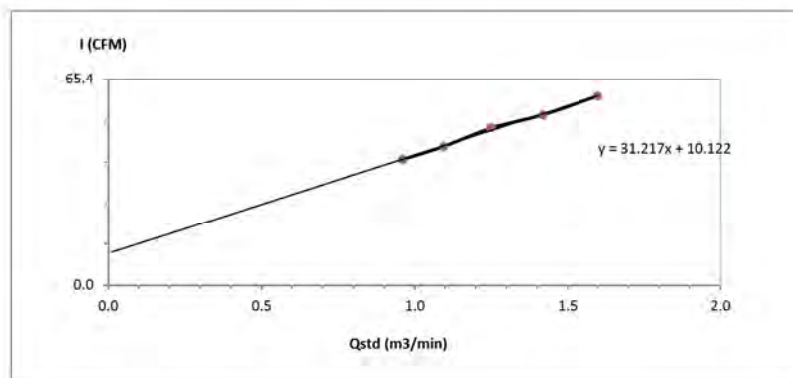
(Mr. Noppong Juntarupan)
Enviro Field Coordinator Scientist (3)



High Volume Air Sampler Calibration Worksheet

Project Site :	Global Power Synergy Public Company Limited	Barometric Pressure (mm Hg) :	755
Calibrate Location :	วัดช้างกลางคอกม้า	Temperature (°C) :	31
Calibrate Date :	10 Sep 23	High Volume ID :	RYG FS0175
CalibrationSheet No.:	C-100923-RYG_FS0175	High Volume Model :	TE-5170D
Calibrator ID:	RYG FS0206	High Volume S/N :	4801
Calibrator Model :	TE-5028A	Calibrator Slope :	1.47433
Calibrator S/N :	1543	Calibrator Intercept :	-0.01503

Test No.	Delta H ₂ O (inch)	Q _{std} (m ³ /min)	I : Chart (CFM)	Linear Regression
1	2.0	0.9616	40	Slope : 31.2172 Intercept : 10.1221 Correlation Coefficient : 0.9979
2	2.6	1.0943	44	
3	3.4	1.2492	50	
4	4.4	1.4190	54	
5	5.6	1.5990	60	



Calibrated by จตุรัสชัย
(Mr.Chatchai Sukpia)
Field Scientist(1)

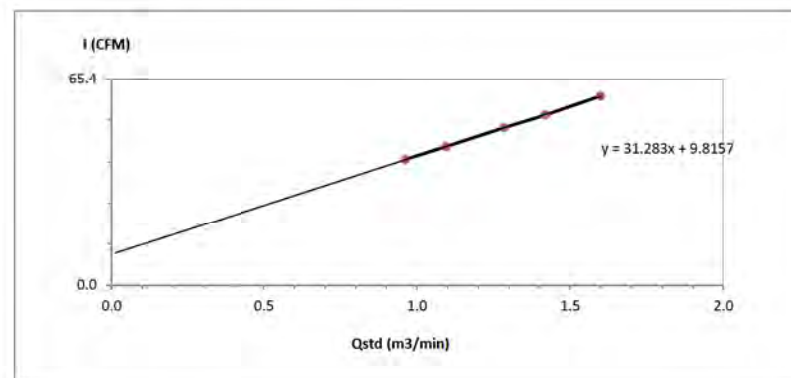
Approved by : น.นพปง จันทรูปาน
(Mr. Noppong Juntarupan)
Enviro Field Coordinator Scientist (3)



High Volume Air Sampler Calibration Worksheet

Project Site :	Global Power Synergy Public Company Limited	Barometric Pressure (mm Hg) :	755
Calibrate Location :	วัดโสมนัสราชวรวิหาร	Temperature (°C) :	31
Calibrate Date :	10 Sep 23	High Volume ID :	RYG FS0661
CalibrationSheet No.:	C-100923-RYG_FS0661	High Volume Model :	TE-5009X
Calibrator ID:	RYG FS0206	High Volume S/N :	6258
Calibrator Model :	TE-5028A	Calibrator Slope :	1.47433
Calibrator S/N :	1543	Calibrator Intercept :	-0.01503

Test No.	Delta H ₂ O (inch)	Q _{std} (m ³ /min)	I : Chart (CFM)	Linear Regression
1	2.0	0.9616	40	Slope : 31.2825 Intercept : 9.8157 Correlation Coefficient : 0.9998
2	2.6	1.0943	44	
3	3.6	1.2850	50	
4	4.4	1.4190	54	
5	5.6	1.5990	60	



Calibrated by จตุรัสชัย
(Mr.Chatchai Sukpia)
Field Scientist(1)

Approved by : น.นพปง จันทรูปาน
(Mr. Noppong Juntarupan)
Enviro Field Coordinator Scientist (3)

VIEW BY *Narain P*
APPROVED BY *[Signature]*
NEXT CAL. DATE *19/4/24*

Certificate Number
CL-013-66

Certificate Number

CL-013-66

Page 2 of 2 Pages

MEASUREMENT RESULTS⁵

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

Air speed	D ¹ _{std}	D ¹ _{unc}	Error	U (k=2)
m/s	Degree (°)	Degree (°)	Degree (°)	Degree (°)
	0.000	0	0	0.58
	45.000	43	-2	0.74
	90.000	88	-2	0.74
4.99	135.000	133	-2	0.74
	180.000	179	-1	0.74
	225.000	227	2	0.74
	270.000	272	2	0.74
	315.000	317	2	0.74

Remark:

⁵ Calibration results only count for the tested circumstances and environmental conditions during which calibration took place

⁴ Direction of standard

¹ Direction of Unit Under Calibration

End of Certificate of Calibration

CERTIFICATE OF CALIBRATION

Page 1 of 2 Pages

MEASUREMENT ITEM MANUFACTURER MODEL/TYPE

: Wind Direction Sensor

: Novallux

: Sensor: WS-02F

: Data logger: 110-WS-25DL-D

SERIAL NUMBER

: Sensor: WSD-014

: Data logger: AS789

ID NUMBER

: RYG_FS0531

CONDITION AS-RECEIVED

: Used item

CUSTOMER

: ALS laboratory group (Thailand) Co., Ltd.

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

RECEIVED DATE

: 16 Jan 2023

MEASUREMENT DATE

: 19 Jan 2023

ISSUE DATE

: 20 Jan 2023

ENVIRONMENTAL CONDITIONS:

Ambient condition in the laboratory are as follow:

Temperature : 23.0 ± 3.0 °C

Relative Humidity : 55.0 ± 15.0 %RH

Atmospheric Pressure : 1010 ± 10 hPa

PLACE OF CALIBRATION

: Eiffel-type wind tunnel of Jiranatee Associates Co., Ltd.

CALIBRATION CONDITION

: Wind tunnel cross-section area¹ 900 cm²

: Win direction frontal area² 129 cm²

: Diameter of mounting pipe³ - mm

: Blockage ratio of test object⁴ 0.143 [-]

Preconditioning

: 24 hours at ambient conditions.

Measurement Condition

: The average values during measurement are (23.6)°C, (46.6) %RH and (1014.9) hPa.

TABULATION OF RESULTS:

The table on next page give the measured values.

Calibrated by:

☒ Mr. Sorawit Thachalad

☐ Miss Jittrapa Lertsomphol

Approved signatory:

Mr. Parinya Booncharoen
Calibration Department Manager

Remark:

¹ Nozzle cross-section area of the wind tunnel

² Projected cross-section area of the tested object include mounting pipe

³ Diameter of mounting pipe

⁴ Ratio ² to ¹

Certificate Number

CL-013-66

CERTIFICATE OF CALIBRATION

Page 1 of 2 Pages

MEASUREMENT ITEM

: Cup anemometer

MANUFACTURER

: Novallnxx

MODEL/TYPE

: Sensor: WS-02F

Data logger: 110-WS-25DL-D

SERIAL NUMBER

: Sensor: WSD-014

Data logger: AS789

ID NUMBER

: RYG_FS0531

CONDITION AS-RECEIVED

: Used item

CUSTOMER

: ALS laboratory group (Thailand) co., ltd.
104 Phatthanakan 40, Phatthanakan Rd, Khwaeng Suan Luang,
Khet Suan Luang, Bangkok 10250 Thailand.

Calibration procedure:

The cup anemometer was calibrated against Standard air velocity transducer model: 8455-32 and pitot tube with precision differential pressure meter model: DPM2500 in an close test section of Eiffel-type wind tunnel with 900 cm² cross test section area. The WI-CL-007 based on IEC 61400-12-1, Wind energy generation systems – Part 12-1: Power performance measurements of electricity producing wind turbines, March 2017 was used as a calibration guideline.

Traceability:

This certificate provides a traceability of The measurement to recognized the national standards, and to realization of the international system of units (SI) through the NIMT (National Metrology Institute of Thailand) via Certificate number: MW-0052-21 and MW-0056-22

Uncertainty of Measurement:

The reported uncertainty of measurement is based on the standard uncertainty multiplied by a coverage factor k=2, Which for a normal distribution corresponds to a coverage probability of approximately 95%. The standard uncertainty has been determined in accordance with the GUM 'Evaluation of measurement data - Guide to the expression of uncertainty in measurement'

RECEIVED DATE

: 16 Jan 2023

MEASUREMENT DATE

: 18 Jan 2023

ISSUE DATE

: 20 Jan 2023

ENVIRONMENTAL CONDITIONS:

Ambient condition in the laboratory are as follow:

Temperature : 23.0 ± 3.0 °C
Relative Humidity : 55.0 ± 15.0 %RH
Atmospheric Pressure : 1010 ± 10 hPa

PLACE OF CALIBRATION

: Eiffel-type wind tunnel of Jiranatee Associates Co., Ltd.

CALIBRATION CONDITIONS

: Wind tunnel cross-section area¹ 900 cm²
Win direction frontal area² 100 cm²
Diameter of mounting pipe³ - mm
Blockage ratio of test object⁴ 0.111 [-]

Preconditioning

: 24 hours at ambient conditions.

Measurement Condition

: The average values during measurement are (23.7) °C, (44.5) %RH and (1018.3) hPa.

TABULATION OF RESULTS:

The table on next page give the measured values.

Calibrated by:

- ☒ Mr. Sorawit Thachalad
☐ Miss Jitraporn Lertsomphol

Approved signatory:

Mr. Parinya Booncharoen
Calibration Department Manager

Remark:

¹ Nozzle cross-section area of the wind tunnel

² Projected cross-section area of the tested object include mounting pipe

³ Diameter of mounting pipe

⁴ Ratio ² to ¹

Page 2 of 2 Pages

MEASUREMENT RESULTS⁵

The cup anemometer, Unit Under Calibration (UUC) was exercise at 10 m/s for 5 minutes prior to calibration being performed. The standard air velocity 0.5 m/s to 5 m/s was calculated by a standard air velocity transducer and above 5 m/s to 30 m/s was calculated by a pitot tube with precision differential pressure meter which was installed 40 mm and 300 mm respectively away from wind tunnel nozzle, UUC was installed at center of the test section. The calibration was carried out under both rising and falling air velocity in the range of 1 m/s to 16 m/s at calibration interval of 1 m/s. The results of calibration and associated measurement uncertainties are reported in the table below.

v_{ref} (m/s)	Temp. wind tunnel (°C)	Temp. room (°C)	v_{unc} ⁷ (m/s)	Error (m/s)	$U (k=2)$ (m/s)
0.983	23.60	23.70	0.7	-0.3	0.18
2.024	23.74	23.70	1.7	-0.3	0.16
3.044	23.50	23.70	2.9	-0.2	0.18
4.119	23.82	23.70	3.9	-0.2	0.19
5.02	23.50	23.70	4.9	-0.2	0.18
5.99	23.88	23.70	5.8	-0.2	0.18
7.08	23.50	23.70	6.9	-0.1	0.20
8.18	23.58	23.70	8.0	-0.2	0.18
9.11	23.50	23.70	9.0	-0.1	0.19
10.08	23.66	23.70	10.0	-0.1	0.25
11.15	23.32	23.70	11.0	-0.2	0.21
12.14	23.66	23.70	12.0	-0.2	0.20
13.20	23.32	23.70	13.2	0.0	0.25
14.25	23.50	23.70	14.3	-0.1	0.27
15.23	23.30	23.70	15.1	-0.2	0.27
16.29	23.40	23.70	16.2	-0.1	0.23

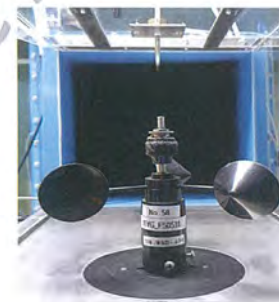
Remark:

⁵ Calibration results only count for the tested circumstances and environmental conditions during which calibration took place

⁶ Velocity of standard

⁷ Velocity of Unit Under Calibration

PHOTO OF CALIBRATION SET-UP



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

End of Certificate of Calibration

CERTIFICATE OF CALIBRATION

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

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

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

Reference Used During Calibration
1. Standard Temperature Probe Model: STS-100 A500,
Serial No.: 667682-09, Due date: 23 Mar 2023
2. Digital Temperature Indicator Model: DTI-1000-A MK
II, Serial No.: 671407-00591 Due date: 22 July 2023

Calibration Procedure

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

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

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

Traceability

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

Calibrated by

- ☐ Mr. Sorawit Thachalad
☒ Miss Jittraporn Lertsomphol



Approved Signatory:

25/mr
Mr. Parinya Booncharoen
Calibration Department Manager

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

Result of Calibration: ☒ Without Adjustment ☐ With Adjustment

Calibration Range: 20-40 °C

Function:

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

Dimension : Diameter 12 mm. Length 80 mm.

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

UUC*: Unit Under Calibration

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

*** End of Certificate ***



CERTIFICATE OF CALIBRATION

Calibration No. : RH-06012023

Page 1 of 1 Pages

Measurement Item : Relative humidity with data logger
Manufacturer : Novolyne
Model/Type : 110-WS-25DL-D
Serial Number : A5789
ID No. : RYG_PS0531
Customer : ALS laboratory group (Thailand) Co., Ltd.
104 Phatthanakan 40, Phatthanakan Rd., Khwaeng Suan Luang, Khet Suan Luang, Bangkok 10250 Thailand.

Environmental Condition:

The measurement was carried out in an ambient temperature of (25±3)°C, and relative humidity of (50±15)%.

Measurement Method:

Unit Under Calibration (UUC) was calibrated by comparison method with standard thermo hygrometer in the humidity generator chamber to determine the errors.

Traceability:

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

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

Measurement Results:

This equipment was connected with Indoor air quality probe and Displayed (UR) on display. Model: HMP60, Serial number: T0210901.

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

The results of calibration are reported in table below.

Determined (%RH)	Standard (Reading) (%RH)	UUC (Reading) (%RH)	Error (%RH)	Uncertainty ±(%RH)
20	20.03	18.0	-2.0	0.51
50	50.24	47.8	-2.4	0.51
80	80.19	77.3	-2.9	0.51

Performed by
☐ Mr. Sorawit Thachalad
☒ Miss Jitraporn Lertsomphol



Approved Signatory:
Mr. Parinya Booncharoen.
Calibration Department Manager



ANALYZER CALIBRATION DATA

Lot No. 23105879-1

Client : Global Power Synergy PCL. Location : Auxiliary Boiler 140
Date : 13 Sep 23 Test Operator : Sathaporn.T

O₂ ANALYZER
Model : TELEDYNE API 200EH Serial No. : 735
Span (%) : 25

	Cylinder Value (%)	Initial Analyzers Calibration Response (%)	Final Analyzers Calibration Response (%)	Difference (Percent of Span)
Zero Gas	0.00	0.01	0.04	0.12
Low-Level Gas	8.04	8.05	8.06	0.04
Span Gas	16.00	16.01	16.04	0.12

NO_x ANALYZER
Model : TELEDYNE API 200EH Serial No. : 735
Span (ppm) : 100

	Cylinder Value (ppm)	Initial Analyzers Calibration Response (ppm)	Final Analyzers Calibration Response (ppm)	Difference (Percent of Span)
Zero Gas	0.00	0.02	0.05	0.03
Low-Level Gas	54.96	54.95	54.95	0.00
Span Gas	82.51	82.50	82.48	0.02

SO₂ ANALYZER
Model : TELEDYNE API 100EH Serial No. : 410
Span (ppm) : 100

	Cylinder Value (ppm)	Initial Analyzers Calibration Response (ppm)	Final Analyzers Calibration Response (ppm)	Difference (Percent of Span)
Zero Gas	0.00	0.01	0.02	0.01
Low-Level Gas	55.55	55.54	55.54	0.00
Span Gas	79.76	79.75	79.75	0.00

CO ANALYZER
Model : TELEDYNE API 300EM Serial No. : 425
Span (ppm) : 100

	Cylinder Value (ppm)	Initial Analyzers Calibration Response (ppm)	Final Analyzers Calibration Response (ppm)	Difference (Percent of Span)
Zero Gas	0.00	0.02	0.03	0.01
Low-Level Gas	54.84	54.83	54.82	0.01
Span Gas	79.74	79.73	79.72	0.01

Calibrated by

Sathaporn Th.

(Mr.Sathaporn Thakaew)

Environmental Field Scientist (3)



Lot No. 23105879-1

SYSTEM CALIBRATION BIAS AND DRIFT DATA

Client : Global Power Synergy PCL. Location : Auxiliary Boiler 140
Date : 13 Sep 23 Test Operator : Sathaporn.T

O₂ ANALYZER
Cylinder Conc. (%) : 16.00 Span (%) : 25

	O ₂ Analyzer Calibration Response	Initial Values		Final Values		Drift (% of Span)
		System Calibration Response	System Cal Bias (% of Span)	System Calibration Response	System Cal Bias (% of Span)	
Zero Gas	0.01	0.04	0.12	0.05	0.16	0.04
Upscale Gas	16.01	16.04	0.12	16.04	0.12	0.00

NO_x ANALYZER
Cylinder Conc. (ppm) : 82.51 Span (ppm) : 100

	NO _x Analyzer Calibration Response	Initial Values		Final Values		Drift (% of Span)
		System Calibration Response	System Cal Bias (% of Span)	System Calibration Response	System Cal Bias (% of Span)	
Zero Gas	0.02	0.05	0.03	0.05	0.03	0.00
Upscale Gas	82.50	82.43	0.07	82.40	0.10	0.03

SO₂ ANALYZER
Cylinder Conc. (ppm) : 79.76 Span (ppm) : 100

	SO ₂ Analyzer Calibration Response	Initial Values		Final Values		Drift (% of Span)
		System Calibration Response	System Cal Bias (% of Span)	System Calibration Response	System Cal Bias (% of Span)	
Zero Gas	0.01	0.02	0.01	0.02	0.01	0.00
Upscale Gas	79.75	79.74	0.01	79.74	0.01	0.00

CO ANALYZER
Cylinder Conc. (ppm) : 79.74 Span (ppm) : 100

	CO Analyzer Calibration Response	Initial Values		Final Values		Drift (% of Span)
		System Calibration Response	System Cal Bias (% of Span)	System Calibration Response	System Cal Bias (% of Span)	
Zero Gas	0.02	0.03	0.01	0.04	0.02	0.01
Upscale Gas	79.73	79.70	0.03	79.70	0.03	0.00

Calibrated by

Sathaporn Th.

(Mr.Sathaporn Thakaew)

Environmental Field Scientist (3)

FORM NO.: F 06-062 REVISION NO.: 2 ISSUE DATE: 3/06/19

ALS Laboratory Group



EMISSION TEST RESULT

Client	Global Power Synergy PCL.	Run #	1
Date	13 Sep 23	Location	Auxiliary Boiler 140
Start Time	10:00	Test Operator	Sathaporn.T
SO ₂ Analyzer Model	TELEDYNE API 100EH	Finish Time	10:20
NO _x /O ₂ Analyzer Model	TELEDYNE API 200EH	Serial No.	410
CO/CO ₂ Analyzer Model	TELEDYNE API 300EM	Serial No.	735
		Serial No.	425

Time (min)	O ₂ (%)	CO ₂ (%)	NO _x (ppm)	SO ₂ (ppm)	CO (ppm)	Remark
10:00	8.01	6.86	34.11	0.01	0.19	
10:01	8.00	6.89	34.16	0.03	0.21	
10:02	7.98	6.84	34.26	0.03	0.17	
10:03	8.02	6.87	34.25	0.01	0.17	
10:04	8.03	6.82	34.26	0.02	0.14	
10:05	8.08	6.82	34.22	0.03	0.16	
10:06	8.14	6.80	34.14	0.00	0.26	
10:07	8.15	6.94	34.14	0.00	0.36	
10:08	8.00	6.97	34.23	0.00	0.25	
10:09	7.93	6.94	34.33	0.03	0.20	
10:10	7.95	6.92	34.42	0.00	0.21	
10:11	7.94	6.91	34.44	0.05	0.29	
10:12	7.99	6.81	34.37	0.03	0.29	
10:13	8.07	6.94	34.31	0.04	0.30	
10:14	7.99	7.00	34.26	0.03	0.24	
10:15	7.95	6.94	34.32	0.04	0.24	
10:16	7.95	6.91	34.34	0.03	0.25	
10:17	7.92	6.96	34.36	0.04	0.25	
10:18	7.92	6.95	34.36	0.04	0.39	
10:19	7.94	6.98	34.29	0.05	0.35	
10:20	7.96	6.87	34.37	0.05	0.38	
Average	7.99	6.90	34.28	0.03	0.25	

Sathaporn Th.

(Mr.Sathaporn Thakaew)

Environmental Field Scientist (3)

FORM NO.: F 06-062 REVISION NO.: 2 ISSUE DATE: 3/06/19

ALS Laboratory Group



EMISSION TEST RESULT

Client	Global Power Synergy PCL.	Run #	2
Date	13 Sep 23	Location	Auxiliary Boiler 140
Start Time	10:21	Test Operator	Sathaporn.T
SO ₂ Analyzer Model	TELEDYNE API 100EH	Finish Time	10:41
NO _x /O ₂ Analyzer Model	TELEDYNE API 200EH	Serial No.	410
CO/CO ₂ Analyzer Model	TELEDYNE API 300EM	Serial No.	735
		Serial No.	425

Time (min)	O ₂ (%)	CO ₂ (%)	NO _x (ppm)	SO ₂ (ppm)	CO (ppm)	Remark
10:21	8.05	6.92	34.40	0.05	0.21	
10:22	7.99	6.84	34.39	0.00	0.30	
10:23	7.94	6.99	34.40	0.03	0.30	
10:24	7.96	6.92	34.40	0.01	0.24	
10:25	7.96	6.85	34.41	0.03	0.21	
10:26	7.97	6.86	34.36	0.05	0.27	
10:27	8.03	6.83	34.32	0.03	0.22	
10:28	8.07	6.89	34.33	0.02	0.27	
10:29	8.02	6.90	34.41	0.04	0.30	
10:30	7.98	7.00	34.48	0.03	0.31	
10:31	7.87	6.90	34.44	0.05	0.19	
10:32	7.93	6.92	34.41	0.01	0.18	
10:33	7.96	6.86	34.37	0.02	0.18	
10:34	7.98	6.89	34.38	0.04	0.14	
10:35	7.99	6.86	34.38	0.01	0.29	
10:36	8.01	6.91	34.38	0.04	0.25	
10:37	8.00	7.01	34.30	0.05	0.17	
10:38	7.91	6.99	34.31	0.02	0.27	
10:39	7.90	6.97	34.36	0.04	0.28	
10:40	7.94	6.97	34.38	0.03	0.28	
10:41	7.90	6.97	34.42	0.05	0.35	
Average	7.97	6.92	34.38	0.03	0.25	

Sathaporn Th.

(Mr.Sathaporn Thakaew)

Environmental Field Scientist (3)



EMISSION TEST RESULT

Client	Global Power Synergy PCL.	Run #	3
Date	13 Sep 23	Location	Auxiliary Boiler 140
Start Time	10:42	Test Operator	Sathaporn.T
SO ₂ Analyzer Model	TELEDYNE API 100EH	Finish Time	11:02
NO _x /O ₂ Analyzer Model	TELEDYNE API 200EH	Serial No.	410
CO/CO ₂ Analyzer Model	TELEDYNE API 300EM	Serial No.	735
		Serial No.	425

Time (min)	O ₂ (%)	CO ₂ (%)	NO _x (ppm)	SO ₂ (ppm)	CO (ppm)	Remark
10:42	7.92	6.90	34.45	0.06	0.23	
10:43	7.96	6.98	34.53	0.03	0.34	
10:44	7.96	6.88	34.53	0.08	0.19	
10:45	7.96	6.91	34.57	0.06	0.19	
10:46	7.96	6.92	34.57	-0.02	0.26	
10:47	7.98	6.91	34.59	0.07	0.23	
10:48	7.93	6.97	34.58	0.04	0.20	
10:49	7.90	6.97	34.58	0.02	0.21	
10:50	7.89	7.00	34.68	0.05	0.18	
10:51	7.90	6.99	34.79	0.04	0.14	
10:52	7.89	6.96	34.85	0.05	0.27	
10:53	7.93	7.01	34.80	0.03	0.18	
10:54	7.91	6.97	34.78	0.06	0.21	
10:55	7.90	6.95	34.79	0.02	0.31	
10:56	7.96	6.94	34.78	0.04	0.25	
10:57	7.95	6.96	34.70	0.03	0.31	
10:58	7.92	6.94	34.72	0.02	0.38	
10:59	7.98	6.88	34.73	0.05	0.34	
11:00	8.07	6.96	34.69	0.05	0.41	
11:01	7.99	6.89	34.67	0.05	0.34	
11:02	8.00	6.86	34.72	0.00	0.32	
Average	7.94	6.94	34.67	0.04	0.26	

Sathaporn Th.

(Mr.Sathaporn Thakaew)

Environmental Field Scientist (3)



Lot No. 23105880-1

ANALYZER CALIBRATION DATA

Client : Global Power Synergy PCL. Location : Auxiliary Boiler 70 Ton # 1
Date : 14 Sep 23 Test Operator : Sathaporn.T

O₂ ANALYZER
Model : TELEDYNE API 200EH Serial No. : 735
Span (%) : 25

	Cylinder Value (%)	Initial Analyzers Calibration Response (%)	Final Analyzers Calibration Response (%)	Difference (Percent of Span)
Zero Gas	0.00	0.01	0.02	0.04
Low-Level Gas	8.04	8.05	8.06	0.04
Span Gas	16.00	16.01	16.02	0.04

NO_x ANALYZER
Model : TELEDYNE API 200EH Serial No. : 735
Span (ppm) : 100

	Cylinder Value (ppm)	Initial Analyzers Calibration Response (ppm)	Final Analyzers Calibration Response (ppm)	Difference (Percent of Span)
Zero Gas	0.00	0.01	0.02	0.01
Low-Level Gas	54.96	54.95	54.95	0.00
Span Gas	82.51	82.50	82.49	0.01

SO₂ ANALYZER
Model : TELEDYNE API 100EH Serial No. : 410
Span (ppm) : 100

	Cylinder Value (ppm)	Initial Analyzers Calibration Response (ppm)	Final Analyzers Calibration Response (ppm)	Difference (Percent of Span)
Zero Gas	0.00	0.01	0.01	0.00
Low-Level Gas	55.55	55.54	55.54	0.00
Span Gas	79.76	79.75	79.75	0.00

CO ANALYZER
Model : TELEDYNE API 300EM Serial No. : 425
Span (ppm) : 100

	Cylinder Value (ppm)	Initial Analyzers Calibration Response (ppm)	Final Analyzers Calibration Response (ppm)	Difference (Percent of Span)
Zero Gas	0.00	0.02	0.03	0.01
Low-Level Gas	54.84	54.83	54.82	0.01
Span Gas	79.74	79.73	79.73	0.00

Calibrated by

Sathaporn Th.

(Mr.Sathaporn Thakaew)

Environmental Field Scientist (3)

FORM NO.: F 06-062 REVISION NO.: 2 ISSUE DATE: 3/06/19

ALS Laboratory Group



Lot No. 23105880-1

SYSTEM CALIBRATION BIAS AND DRIFT DATA

Client : Global Power Synergy PCL. Location : Auxiliary Boiler 70 Ton # 1
Date : 14 Sep 23 Test Operator : Sathaporn.T

O₂ ANALYZER
Cylinder Conc. (%) : 16.00 Span (%) : 25

	O ₂ Analyzer Calibration Response	Initial Values		Final Values		Drift (% of Span)
		System Calibration Response	System Cal Bias (% of Span)	System Calibration Response	System Cal Bias (% of Span)	
Zero Gas	0.01	0.03	0.08	0.03	0.08	0.00
Upscale Gas	16.01	16.02	0.04	16.04	0.12	0.08

NO_x ANALYZER
Cylinder Conc. (ppm) : 82.51 Span (ppm) : 100

	NO _x Analyzer Calibration Response	Initial Values		Final Values		Drift (% of Span)
		System Calibration Response	System Cal Bias (% of Span)	System Calibration Response	System Cal Bias (% of Span)	
Zero Gas	0.01	0.02	0.01	0.03	0.02	0.01
Upscale Gas	82.50	82.46	0.04	82.46	0.04	0.00

SO₂ ANALYZER
Cylinder Conc. (ppm) : 79.76 Span (ppm) : 100

	SO ₂ Analyzer Calibration Response	Initial Values		Final Values		Drift (% of Span)
		System Calibration Response	System Cal Bias (% of Span)	System Calibration Response	System Cal Bias (% of Span)	
Zero Gas	0.01	0.01	0.00	0.01	0.00	0.00
Upscale Gas	79.75	79.74	0.01	79.74	0.01	0.00

CO ANALYZER
Cylinder Conc. (ppm) : 79.74 Span (ppm) : 100

	CO Analyzer Calibration Response	Initial Values		Final Values		Drift (% of Span)
		System Calibration Response	System Cal Bias (% of Span)	System Calibration Response	System Cal Bias (% of Span)	
Zero Gas	0.02	0.02	0.00	0.03	0.01	0.01
Upscale Gas	79.73	79.71	0.02	79.71	0.02	0.00

Calibrated by

Sathaporn Th.

(Mr.Sathaporn Thakaew)

Environmental Field Scientist (3)

FORM NO.: F 06-062 REVISION NO.: 2 ISSUE DATE: 3/06/19

ALS Laboratory Group



EMISSION TEST RESULT

Client	Global Power Synergy PCL.	Run #	1
Date	14 Sep 23	Location	Auxiliary Boiler 70 Ton # 1
Start Time	10:30	Test Operator	Sathaporn.T
SO ₂ Analyzer Model	TELEDYNE API 100EH	Finish Time	10:50
NO _x /O ₂ Analyzer Model	TELEDYNE API 200EH	Serial No.	410
CO/CO ₂ Analyzer Model	TELEDYNE API 300EM	Serial No.	735
		Serial No.	425

Time (min)	O ₂ (%)	CO ₂ (%)	NO _x (ppm)	SO ₂ (ppm)	CO (ppm)	Remark
10:30	4.26	9.41	35.63	0.23	0.32	
10:31	4.26	9.32	35.64	0.23	0.30	
10:32	4.43	9.18	35.71	0.17	0.28	
10:33	4.75	9.11	36.06	0.19	0.22	
10:34	4.88	9.14	36.55	0.22	0.30	
10:35	4.93	9.05	36.96	0.21	0.27	
10:36	4.92	9.03	37.15	0.19	0.31	
10:37	4.94	9.01	37.19	0.23	0.25	
10:38	4.96	9.06	37.33	0.20	0.34	
10:39	4.98	8.99	37.60	0.21	0.33	
10:40	4.98	9.00	37.77	0.22	0.39	
10:41	4.97	9.15	37.77	0.21	0.29	
10:42	4.95	9.05	37.70	0.19	0.29	
10:43	4.95	9.02	37.58	0.19	0.31	
10:44	4.97	9.01	37.62	0.21	0.32	
10:45	4.97	8.97	37.70	0.19	0.32	
10:46	4.98	9.01	37.80	0.19	0.25	
10:47	4.96	9.09	37.87	0.18	0.22	
10:48	4.96	9.07	37.88	0.19	0.29	
10:49	4.96	8.98	37.92	0.19	0.31	
10:50	4.97	9.09	37.82	0.23	0.21	
Average	4.85	9.09	37.20	0.20	0.29	

Sathaporn Th.

(Mr.Sathaporn Thakaew)

Environmental Field Scientist (3)



EMISSION TEST RESULT

Client	Global Power Synergy PCL.	Run #	2
Date	14 Sep 23	Location	Auxiliary Boiler 70 Ton # 1
Start Time	10:51	Test Operator	Sathaporn.T
SO ₂ Analyzer Model	TELEDYNE API 100EH	Finish Time	11:11
NO _x /O ₂ Analyzer Model	TELEDYNE API 200EH	Serial No.	410
CO/CO ₂ Analyzer Model	TELEDYNE API 300EM	Serial No.	735
		Serial No.	425

Time (min)	O ₂ (%)	CO ₂ (%)	NO _x (ppm)	SO ₂ (ppm)	CO (ppm)	Remark
10:51	4.96	9.08	37.68	0.21	0.28	
10:52	4.96	9.10	37.71	0.21	0.35	
10:53	4.96	8.92	37.87	0.24	0.26	
10:54	4.98	8.95	38.03	0.22	0.32	
10:55	5.00	9.04	38.12	0.21	0.21	
10:56	4.98	9.08	38.00	0.20	0.27	
10:57	4.96	9.06	37.80	0.21	0.27	
10:58	4.97	9.05	37.76	0.20	0.30	
10:59	4.98	9.03	37.81	0.23	0.35	
11:00	4.98	9.05	37.92	0.21	0.33	
11:01	4.99	9.01	38.05	0.23	0.36	
11:02	4.99	9.00	38.10	0.21	0.34	
11:03	4.98	8.95	38.16	0.21	0.41	
11:04	5.00	9.04	38.20	0.21	0.30	
11:05	5.00	9.06	37.92	0.21	0.29	
11:06	4.99	9.04	37.62	0.25	0.37	
11:07	4.98	9.09	37.43	0.21	0.36	
11:08	4.96	9.00	37.51	0.22	0.26	
11:09	4.96	9.07	37.62	0.21	0.29	
11:10	4.95	9.07	37.65	0.22	0.32	
11:11	4.95	9.08	37.59	0.23	0.27	
Average	4.98	9.04	37.84	0.22	0.31	

Sathaporn Th.

(Mr.Sathaporn Thakaew)

Environmental Field Scientist (3)



EMISSION TEST RESULT

Client	Global Power Synergy PCL.	Run #	3
Date	14 Sep 23	Location	Auxiliary Boiler 70 Ton # 1
Start Time	11:12	Test Operator	Sathaporn.T
SO ₂ Analyzer Model	TELEDYNE API 100EH	Serial No.	410
NO _x /O ₂ Analyzer Model	TELEDYNE API 200EH	Serial No.	735
CO/CO ₂ Analyzer Model	TELEDYNE API 300EM	Serial No.	425

Time (min)	O ₂ (%)	CO ₂ (%)	NO _x (ppm)	SO ₂ (ppm)	CO (ppm)	Remark
11:12	4.95	9.12	37.52	0.19	0.30	
11:13	4.94	9.03	37.44	0.19	0.28	
11:14	4.94	9.08	37.32	0.21	0.32	
11:15	4.96	9.04	37.38	0.23	0.37	
11:16	4.96	9.01	37.60	0.17	0.36	
11:17	4.97	9.09	37.64	0.21	0.33	
11:18	4.96	9.06	37.58	0.21	0.41	
11:19	4.94	9.08	37.46	0.22	0.34	
11:20	4.94	9.06	37.27	0.21	0.30	
11:21	4.94	9.12	37.23	0.20	0.30	
11:22	4.93	9.07	37.24	0.22	0.33	
11:23	4.93	9.00	37.36	0.25	0.28	
11:24	4.94	9.02	37.51	0.20	0.26	
11:25	4.95	8.99	37.69	0.22	0.32	
11:26	4.94	9.06	37.63	0.20	0.36	
11:27	4.95	8.97	37.64	0.20	0.34	
11:28	4.98	9.11	37.80	0.21	0.33	
11:29	4.97	9.01	37.81	0.23	0.33	
11:30	4.97	9.04	37.92	0.21	0.30	
11:31	4.98	8.97	38.11	0.23	0.37	
11:32	4.98	9.05	38.19	0.21	0.31	
Average	4.95	9.05	37.59	0.21	0.33	

Sathaporn Th.

(Mr.Sathaporn Thakaew)

Environmental Field Scientist (3)



Lot No. 23105881-1

ANALYZER CALIBRATION DATA

Client	Global Power Synergy PCL.	Location	Auxiliary Boiler 70 Ton # 2
Date	12 Sep 23	Test Operator	Sathaporn.T
O ₂ ANALYZER			
Model	TELEDYNE API 200EH	Serial No.	735
Span (%)	25		

	Cylinder Value (%)	Initial Analyzers Calibration Response (%)	Final Analyzers Calibration Response (%)	Difference (Percent of Span)
Zero Gas	0.00	0.01	0.03	0.08
Low-Level Gas	8.04	8.05	8.06	0.04
Span Gas	16.00	16.01	16.03	0.08

NO _x ANALYZER			
Model	TELEDYNE API 200EH	Serial No.	735
Span (ppm)	100		

	Cylinder Value (ppm)	Initial Analyzers Calibration Response (ppm)	Final Analyzers Calibration Response (ppm)	Difference (Percent of Span)
Zero Gas	0.00	0.01	0.03	0.02
Low-Level Gas	54.96	54.95	54.95	0.00
Span Gas	82.51	82.50	82.48	0.02

SO ₂ ANALYZER			
Model	TELEDYNE API 100EH	Serial No.	410
Span (ppm)	100		

	Cylinder Value (ppm)	Initial Analyzers Calibration Response (ppm)	Final Analyzers Calibration Response (ppm)	Difference (Percent of Span)
Zero Gas	0.00	0.01	0.01	0.00
Low-Level Gas	55.55	55.54	55.54	0.00
Span Gas	79.76	79.75	79.75	0.00

CO ANALYZER			
Model	TELEDYNE API 300EM	Serial No.	425
Span (ppm)	100		

	Cylinder Value (ppm)	Initial Analyzers Calibration Response (ppm)	Final Analyzers Calibration Response (ppm)	Difference (Percent of Span)
Zero Gas	0.00	0.02	0.04	0.02
Low-Level Gas	54.84	54.83	54.82	0.01
Span Gas	79.74	79.73	79.72	0.01

Calibrated by

Sathaporn Th.

(Mr.Sathaporn Thakaew)

Environmental Field Scientist (3)



Lot No. 23105881-1

SYSTEM CALIBRATION BIAS AND DRIFT DATA

Client : Global Power Synergy PCL. Location : Auxiliary Boiler 70 Ton # 2
Date : 12 Sep 23 Test Operator : Sathaporn.T

O₂ ANALYZER
Cylinder Conc. (%) : 16.00 Span (%) : 25

	O ₂ Analyzer Calibration Response	Initial Values		Final Values		Drift (% of Span)
		System Calibration Response	System Cal Bias (% of Span)	System Calibration Response	System Cal Bias (% of Span)	
Zero Gas	0.01	0.03	0.08	0.05	0.16	0.08
Upscale Gas	16.01	16.04	0.12	16.04	0.12	0.00

NO_x ANALYZER
Cylinder Conc. (ppm) : 82.51 Span (ppm) : 100

	NO _x Analyzer Calibration Response	Initial Values		Final Values		Drift (% of Span)
		System Calibration Response	System Cal Bias (% of Span)	System Calibration Response	System Cal Bias (% of Span)	
Zero Gas	0.01	0.05	0.04	0.05	0.04	0.00
Upscale Gas	82.50	82.43	0.07	82.41	0.09	0.02

SO₂ ANALYZER
Cylinder Conc. (ppm) : 79.76 Span (ppm) : 100

	SO ₂ Analyzer Calibration Response	Initial Values		Final Values		Drift (% of Span)
		System Calibration Response	System Cal Bias (% of Span)	System Calibration Response	System Cal Bias (% of Span)	
Zero Gas	0.01	0.01	0.00	0.01	0.00	0.00
Upscale Gas	79.75	79.74	0.01	79.74	0.01	0.00

CO ANALYZER
Cylinder Conc. (ppm) : 79.74 Span (ppm) : 100

	CO Analyzer Calibration Response	Initial Values		Final Values		Drift (% of Span)
		System Calibration Response	System Cal Bias (% of Span)	System Calibration Response	System Cal Bias (% of Span)	
Zero Gas	0.02	0.04	0.02	0.04	0.02	0.00
Upscale Gas	79.73	79.70	0.03	79.70	0.03	0.00

Calibrated by

Sathaporn Th.

(Mr.Sathaporn Thakaew)

Environmental Field Scientist (3)

FORM NO : F 06-062 REVISION NO.: 2 ISSUE DATE: 3/06/19

ALS Laboratory Group



EMISSION TEST RESULT

Client	Global Power Synergy PCL.	Run #	1
Date	12 Sep 23	Location	Auxiliary Boiler 70 Ton # 2
Start Time	10:20	Test Operator	Sathaporn.T
SO ₂ Analyzer Model	TELEDYNE API 100EH	Finish Time	10:40
NO _x /O ₂ Analyzer Model	TELEDYNE API 200EH	Serial No.	410
CO/CO ₂ Analyzer Model	TELEDYNE API 300EM	Serial No.	735
		Serial No.	425

Time (min)	O ₂ (%)	CO ₂ (%)	NO _x (ppm)	SO ₂ (ppm)	CO (ppm)	Remark
10:20	3.86	9.70	30.42	0.28	5.77	
10:21	3.86	9.73	30.47	0.25	5.98	
10:22	3.86	9.77	30.45	0.27	5.83	
10:23	3.85	9.79	30.40	0.22	5.88	
10:24	3.85	9.76	30.33	0.23	5.63	
10:25	3.85	9.77	30.28	0.22	5.83	
10:26	3.85	9.72	30.26	0.22	5.78	
10:27	3.86	9.72	30.36	0.24	5.68	
10:28	3.85	9.68	30.42	0.23	6.09	
10:29	3.86	9.77	30.32	0.23	5.55	
10:30	3.87	9.72	30.31	0.27	5.96	
10:31	3.85	9.69	30.32	0.22	5.74	
10:32	3.86	9.77	30.29	0.25	5.65	
10:33	3.84	9.72	30.37	0.20	5.40	
10:34	3.85	9.70	30.44	0.21	5.50	
10:35	3.87	9.84	30.42	0.17	5.08	
10:36	3.85	9.72	30.39	0.18	4.89	
10:37	3.84	9.71	30.37	0.18	4.78	
10:38	3.86	9.73	30.40	0.18	5.13	
10:39	3.86	9.73	30.49	0.19	5.31	
10:40	3.86	9.74	30.50	0.21	5.44	
Average	3.86	9.73	30.38	0.22	5.57	

Sathaporn Th.

(Mr.Sathaporn Thakaew)

Environmental Field Scientist (3)

FORM NO.: F 06-062 REVISION NO.: 2 ISSUE DATE: 3/06/19

ALS Laboratory Group



EMISSION TEST RESULT

Client	Global Power Synergy PCL.	Run #	2
Date	12 Sep 23	Location	Auxiliary Boiler 70 Ton # 2
Start Time	10:41	Test Operator	Sathaporn.T
SO ₂ Analyzer Model	TELEDYNE API 100EH	Finish Time	11:01
NO _x /O ₂ Analyzer Model	TELEDYNE API 200EH	Serial No.	410
CO/CO ₂ Analyzer Model	TELEDYNE API 300EM	Serial No.	735
		Serial No.	425

Time (min)	O ₂ (%)	CO ₂ (%)	NO _x (ppm)	SO ₂ (ppm)	CO (ppm)	Remark
10:41	3.84	9.71	30.37	0.20	5.55	
10:42	3.87	9.71	30.36	0.20	5.57	
10:43	3.85	9.71	30.42	0.23	5.57	
10:44	3.84	9.79	30.42	0.18	5.54	
10:45	3.86	9.69	30.37	0.16	5.74	
10:46	3.84	9.77	30.37	0.17	5.83	
10:47	3.84	9.70	30.39	0.16	5.52	
10:48	3.86	9.81	30.37	0.18	5.29	
10:49	3.83	9.71	30.31	0.17	5.59	
10:50	3.85	9.73	30.32	0.19	5.90	
10:51	3.84	9.76	30.22	0.14	6.27	
10:52	3.81	9.72	30.18	0.15	6.20	
10:53	3.82	9.79	30.17	0.17	5.23	
10:54	3.82	9.78	30.24	0.16	5.75	
10:55	3.83	9.76	30.25	0.20	5.91	
10:56	3.84	9.79	30.20	0.18	5.58	
10:57	3.84	9.75	30.25	0.16	5.47	
10:58	3.83	9.68	30.32	0.19	5.08	
10:59	3.83	9.78	30.31	0.16	5.72	
11:00	3.82	9.74	30.34	0.17	5.38	
11:01	3.83	9.74	30.32	0.17	4.88	
Average	3.84	9.74	30.31	0.18	5.60	

Sathaporn Th.

(Mr.Sathaporn Thakaew)

Environmental Field Scientist (3)



EMISSION TEST RESULT

Client	Global Power Synergy PCL.	Run #	3
Date	12 Sep 23	Location	Auxiliary Boiler 70 Ton # 2
Start Time	11:02	Test Operator	Sathaporn.T
SO ₂ Analyzer Model	TELEDYNE API 100EH	Finish Time	11:22
NO _x /O ₂ Analyzer Model	TELEDYNE API 200EH	Serial No.	410
CO/CO ₂ Analyzer Model	TELEDYNE API 300EM	Serial No.	735
		Serial No.	425

Time (min)	O ₂ (%)	CO ₂ (%)	NO _x (ppm)	SO ₂ (ppm)	CO (ppm)	Remark
11:02	3.84	9.72	30.26	0.14	5.39	
11:03	3.85	9.76	30.32	0.14	5.55	
11:04	3.86	9.73	30.44	0.15	5.80	
11:05	3.85	9.70	30.50	0.17	5.52	
11:06	3.84	9.72	30.56	0.17	5.76	
11:07	3.84	9.70	30.62	0.17	5.55	
11:08	3.82	9.83	30.60	0.18	4.83	
11:09	3.80	9.72	30.58	0.17	5.06	
11:10	3.81	9.73	30.53	0.18	5.49	
11:11	3.83	9.67	30.51	0.16	5.82	
11:12	3.83	9.71	30.47	0.14	5.54	
11:13	3.83	9.73	30.47	0.17	5.38	
11:14	3.83	9.81	30.60	0.16	5.49	
11:15	3.82	9.75	30.72	0.16	5.46	
11:16	3.83	9.70	30.76	0.18	5.08	
11:17	3.83	9.75	30.66	0.15	5.22	
11:18	3.83	9.78	30.60	0.16	5.82	
11:19	3.83	9.70	30.55	0.16	5.69	
11:20	3.84	9.80	30.55	0.19	5.16	
11:21	3.84	9.73	30.65	0.19	5.32	
11:22	3.84	9.80	30.78	0.18	5.65	
Average	3.83	9.74	30.56	0.17	5.46	

Sathaporn Th.

(Mr.Sathaporn Thakaew)

Environmental Field Scientist (3)

CERTIFICATE OF ANALYSIS

Grade of Product: EPA Protocol

Part Number: E04NI99E15A021C Reference Number: 160-402020199-1
Cylinder Number: CC709609 Cylinder Volume: 144.4 CF
Laboratory: 124 - Plumsteadville - PA Cylinder Pressure: 2015 PSIG
PGVP Number: A12021 Valve Outlet: 660
Gas Code: CO,NO,NOX,SO2,BALN Certification Date: Feb 22, 2021

Expiration Date: Feb 22, 2029

Certification performed in accordance with "EPA Traceability Protocol for Assay and Certification of Gaseous Calibration Standards (May 2012)" document EPA 600/R-12/531, using the assay procedures listed. Analytical Methodology does not require correction for analytical interference. This cylinder has a total analytical uncertainty as stated below with a confidence level of 95%. There are no significant impurities which affect the use of this calibration mixture. All concentrations are on a mole/mole basis unless otherwise noted.

Do Not Use This Cylinder below 100 psig, i.e. 0.7 megapascals.

ANALYTICAL RESULTS

Component	Requested Concentration	Actual Concentration	Protocol Method	Total Relative Uncertainty	Assay Dates
NOX	55.00 PPM	54.96 PPM	G1	+/- 1.4% NIST Traceable	02/15/2021, 02/22/2021
CARBON MONOXIDE	55.00 PPM	54.84 PPM	G1	+/- 0.7% NIST Traceable	02/15/2021
NITRIC OXIDE	55.00 PPM	54.69 PPM	G1	+/- 1.1% NIST Traceable	02/15/2021, 02/22/2021
SULFUR DIOXIDE	55.00 PPM	55.55 PPM	G1	+/- 1.0% NIST Traceable	02/15/2021, 02/22/2021
NITROGEN	Balance				

CALIBRATION STANDARDS

Type	Lot ID	Cylinder No	Concentration	Uncertainty	Expiration Date
NTRM	14060753	CC434455	49.88 PPM CARBON MONOXIDE/NITROGEN	+/- 0.6%	Feb 13, 2026
PRM	12386	D685025	9.91 PPM AIR/NITROGEN DIOXIDE	2.0%	Feb 20, 2020
NTRM	200611-04	CC707968	49.82 PPM NITRIC OXIDE/NITROGEN	+/- 1.0%	Feb 02, 2025
GMIS	124206889	CC323707	4.028 PPM NITROGEN DIOXIDE/NITROGEN	2.1%	Aug 15, 2021
NTRM	0141709	KAL003190	49.67 PPM SULFUR DIOXIDE/NITROGEN	+/- 1.0%	Jun 20, 2022

The SRM, PRM or RGM noted above is only in reference to the GMIS used in the assay and not part of the analysis.

ANALYTICAL EQUIPMENT

Instrument/Make/Model	Analytical Principle	Last Multipoint Calibration
Nicolet iS50 FTIR AUP2010245 CO	FTIR	Feb 04, 2021
Nicolet iS50 FTIR AUP2010245 NO	FTIR	Feb 11, 2021
Nicolet iS50 FTIR AUP2010245 NO2	FTIR	Feb 22, 2021
Nicolet iS50 FTIR AUP2010245 SO2	FTIR	Feb 18, 2021

Triad Data Available Upon Request

NOTES:

Gross Weight: 28.8 Kg
Net Weight: 4.8 Kg



Michael A. Kuhn
Approved for Release

CERTIFICATE OF ANALYSIS

Grade of Product: EPA Protocol

Part Number: E04NI99E3HA0002 Reference Number: 160-402138465-1
Cylinder Number: ND11222 Cylinder Volume: 247.2 Cubic Feet
Laboratory: 124 - Plumsteadville - PA Cylinder Pressure: 2215 PSIG
PGVP Number: A12021 Valve Outlet: 660
Gas Code: CO,NO,NOX,SO2,BALN Certification Date: Jul 15, 2021

Expiration Date: Jul 15, 2029

Certification performed in accordance with "EPA Traceability Protocol for Assay and Certification of Gaseous Calibration Standards (May 2012)" document EPA 600/R-12/531, using the assay procedures listed. Analytical Methodology does not require correction for analytical interference. This cylinder has a total analytical uncertainty as stated below with a confidence level of 95%. There are no significant impurities which affect the use of this calibration mixture. All concentrations are on a mole/mole basis unless otherwise noted.

Do Not Use This Cylinder below 100 psig, i.e. 0.7 megapascals.

ANALYTICAL RESULTS

Component	Requested Concentration	Actual Concentration	Protocol Method	Total Relative Uncertainty	Assay Dates
NOX	80.00 PPM	82.51 PPM	G1	+/- 1.4% NIST Traceable	07/08/2021, 07/15/2021
CARBON MONOXIDE	80.00 PPM	79.74 PPM	G1	+/- 0.5% NIST Traceable	07/08/2021
NITRIC OXIDE	80.00 PPM	82.51 PPM	G1	+/- 1.4% NIST Traceable	07/08/2021, 07/15/2021
SULFUR DIOXIDE	80.00 PPM	79.76 PPM	G1	+/- 1.0% NIST Traceable	07/08/2021, 07/15/2021
NITROGEN	Balance				

CALIBRATION STANDARDS

Type	Lot ID	Cylinder No	Concentration	Uncertainty	Expiration Date
NTRM	11010139	KAL004538	97.31 PPM CARBON MONOXIDE/NITROGEN	+/- 0.4%	Oct 04, 2022
PRM	12386	D685025	9.91 PPM AIR/NITROGEN DIOXIDE	2.0%	Feb 20, 2020
NTRM	200610-50	CC733426	98.61 PPM NITRIC OXIDE/NITROGEN	+/- 0.9%	Oct 06, 2026
GMIS	124206889	CC323707	4.028 PPM NITROGEN DIOXIDE/NITROGEN	2.1%	Aug 15, 2021
NTRM	16010224	KAL003838	97.69 PPM SULFUR DIOXIDE/NITROGEN	+/- 0.8%	Dec 23, 2021

The SRM, PRM or RGM noted above is only in reference to the GMIS used in the assay and not part of the analysis.

ANALYTICAL EQUIPMENT

Instrument/Make/Model	Analytical Principle	Last Multipoint Calibration
Nicolet iS50 FTIR AUP2010245 CO	FTIR	Jun 24, 2021
Nicolet iS50 FTIR AUP2010245 NO	FTIR	Jul 01, 2021
Nicolet iS50 FTIR AUP2010245 NO2	FTIR	Jun 30, 2021
Nicolet iS50 FTIR AUP2010245 SO2	FTIR	Jul 09, 2021

Triad Data Available Upon Request

NOTES:

Gross Weight: 48.0 Kg
Net Weight: 7.8 Kg



Michael A. Kuhn
Approved for Release

CERTIFICATE OF ANALYSIS

Customer Detail:

ALS Laboratory Group (Thailand)

Production Order Number: 90145553

Material Number: 478100-J-44

Certification Date: 07-Dec-2017

Expiry Date: 07-Dec-2025

Cylinder Description:

STEEL 47 L

The measurement of this reference material is traceable to SI through the reference standard which is traceable to Swiss National Standard of Mass. The Assay of this Standard has been performed in accordance with the EPA Traceability Protocol EPA-600/R-12/531 for the Assay and specified. The reported uncertainty is based on a standard uncertainty multiplied by coverage factor k=2, providing a level of confidence of approximately 95%.

Certificate Number:

3982/17

Analyst:

Anissae.T.

ARISSARA THONGNURL

Cylinder Number:

14465

Nominal Cylinder Content:

6.520 M³

Approve:

Sukanya

SUKANYA KAMUTHARAT

Nominal Pressure:

145.0 Bar

Valve Outlet:

CGA 590 BRASS

To Re-Order Please Quote:

478100-J-44

Comment:

- It is recommended that this product be not used below 5% of actual contents or should not be used when its gas pressure is below 150psig.
- Other impurities that detect by analytical condition of this mixture shall be report if it is more than 10% of minimum minor component.
- Keep and use in well-ventilated and secure area.

CERTIFICATE OF ANALYSIS

Analytical Result

Component	Request Concentration	Certified Concentration	Certified Uncertainty	Method	Assay Date
Oxygen	8.00 %	8.04 %	± 1% relative	(2) I-PB-354	04-Dec-2017
In Nitrogen					

Reference Standard used in Assay

Reference Standard	Cylinder No.	Concentration	Expired Date
Oxygen	113553SG	9.976± 0.02 %	26-Mar-2018
In Nitrogen			

Analytical Instruments used in Assay

Instrument/Make/Model	Analytical Principle	Last Multipoint Calibration
Servomex 4100 O2 Analyzer	Paramagnetic	04-Dec-2017

Method of Analysis

- Gas Chromatograph
- Paramagnetic Oxygen Analyser
- Electrochemical Oxygen Analyser
- Electrochemical Moisture Analyser
- Total Hydrocarbon Analyser
- Other specified

Cylinder Number 14465

Production Order Number 90145553

Certification Date: 07-Dec-2017

Expiration Date: 07-Dec-2025

CERTIFICATE OF ANALYSIS

Customer Detail: ALS Laboratory Group (Thailand)		Production Order Number: 90145554 Material Number: 557200-J-44 Certification Date: 07-Dec-2017 Expiry Date: 07-Dec-2025	
Cylinder Description: STEEL 47 L			
The measurement of this reference material is traceable to SI through the reference standard which is traceable to Swiss National Standard of Mass. The Assay of this Standard has been performed in accordance with the EPA Traceability Protocol EPA-600/R-12/531 for the Assay and Certification of Gaseous Calibration Standards using procedure GL-1. The results are expressed on a mole/mole basis, unless otherwise specified. The reported uncertainty is based on a standard uncertainty multiplied by coverage factor k=2, providing a level of confidence of approximately 95%.			
Certificate Number: 3977/17	Analyst: <i>Ansara T.</i> ARISSARA THONGNURL		
Cylinder Number: 94892			
Nominal Cylinder Content: 6.560 M³	Approve: <i>Sukanya</i> SUKANYA KAMUTHARAT		
Nominal Pressure: 145.0 Bar			
Valve Outlet: CGA 590 BRASS	To Re-Order Please Quote: 557200-J-44		
Comment:	<ul style="list-style-type: none"> It is recommended that this product be not used below 5% of actual contents or should not be used when its gas pressure is below 150psig. Other impurities that detect by analytical condition of this mixture shall be report if it is more than 10% of minimum minor component. Keep and use in well-ventilated and secure area. 		

CERTIFICATE OF ANALYSIS

Analytical Result					
Component	Request Concentration	Certified Concentration	Certified Uncertainty	Method	Assay Date
Oxygen	16.0 %	16.0 %	± 1% relative	(2) I-PB-354	04-Dec-2017
In Nitrogen					
Reference Standard used in Assay					
Reference Standard	Cylinder No.	Concentration	Expired Date		
Oxygen	113553SG	9.976± 0.02 %	26-Mar-2018		
In Nitrogen					
Analytical Instruments used in Assay					
Instrument/Make/Model	Analytical Principle	Last Multipoint Calibration			
Servomex 4100 O2 Analyzer	Paramagnetic	04-Dec-2017			
Method of Analysis 1. Gas Chromatograph 2. Paramagnetic Oxygen Analyser 3. Electrochemical Oxygen Analyser 4. Electrochemical Moisture Analyser 5. Total Hydrocarbon Analyser 6. Other specified					
Cylinder Number 94892 Production Order Number 90145554			Certification Date: 07-Dec-2017 Expiration Date: 07-Dec-2025		



CONSOLE CONTROL UNIT CALIBRATION TEST REPORT

Calibration of Date : 13-Jul-23 Barometric Pressure (mmHg) : 752
 Next Cal. Date : 13-Jan-24 Relative Humidity (%) : 56.6
 Temperature (C°) : 31.0

Console Control Meter Data
 Calibration No. : C-130723-BKK_FS518
 Dry Gas Meter ID : BKK_FS0518
 Serial No. : 1504025
 Model No. : XC-572-V

Reference Dry Gas Meter Data
 Reference Dry Gas Meter ID : BKK_FS0629
 Serial No. : 1607009
 Correction Factor (Y) : 1.0000
 Next Calibration Date : 9 Dec 23

ΔH (mm H ₂ O)	Θ Minutes	Reference Dry Gas Meter Calibration					Console Control , Drygas Meter							Dry Gas Meter Correction Factor (Y)	Orifice Calibration Factor ΔH ₀
		Vr (Liters)			Tr (°C)	Vm (Liters)			Ti (°C)	To (°C)	Avg.Tm (°C)				
		Final	Initial	Total		Final	Initial	Total							
15	12.10	150.22	0.00	150.22	30.0	426310.0	426156.0	152.00	31.0	31.0	31.0	0.9901	44.9658		
25	9.32	150.20	0.00	150.20	30.0	426470.0	426317.0	153.00	31.0	31.0	31.0	0.9825	44.4940		
50	6.51	150.23	0.00	150.23	31.0	426632.0	426480.0	152.00	32.0	32.0	32.0	0.9868	43.5435		
100	4.59	150.40	0.00	150.40	31.0	426798.0	426646.0	152.00	32.0	32.0	32.0	0.9831	43.1951		
150	3.75	150.20	0.00	150.20	32.0	426973.0	426820.0	153.00	32.0	32.0	32.0	0.9675	43.6487		
Avg												0.9820	43.9734		

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

ΔH₀ : Orifice pressure differential that equates to 21.24 l/m of air @ 25 C and 760 mm of mercury , mmH₂O ; tolerance for individual values ± 5.08 from average

Procedure: 40 CFR 60,APP A,METH, SEC 5.3 & 7

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

Approved by: Nattaporn Jengwareewong
 (Mr.Nattaporn Jengwareewong)
 Field Specialist(1)

FORM NO.: F 06-024 REVISION NO.: 2 ISSUE DATE: 30 Jun 22

Pitot Tube Calibration Data

Pitot Tube Identification Number : BKK_FS0522 Calibration Date : 13 Jul 23
 Lab test duct Number : 258-1-13-01 Standard Pitot ID : BKK_FS0441
 Calibration Sheet No. : C-130723-BKK_FS0522 Cp Standard : 0.99

Type S Pitot Tube Coefficient Data					
	Type s pitot tube Leg A,B	Standard pitot tube (ΔP, mm.H ₂ O)	Type s pitot tube (ΔP, mm.H ₂ O)	Cp (s) Leg A	Cp (s) Leg B
Test 1	A	12.00	17.00	0.840	-
	B	12.00	17.00	-	0.840
Test 2	A	12.00	17.00	0.840	-
	B	12.00	17.00	-	0.840
Test 3	A	12.00	16.80	0.845	-
	B	12.00	16.80	-	0.845
Cp				0.842	0.842

$$Cp(S) = Cp_{std} \sqrt{\frac{\Delta P_{std}}{\Delta P(s)}}$$

$$\left[\bar{Cp}_{(A)} - \bar{Cp}_{(B)} \right] \text{ must BE } \leq 0.01$$

$$\sum [Cp(s) - Cp(A \text{ or } B)]$$

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

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

Approved by: Nattaporn Jengwareewong
 (Mr.Nattaporn Jengwareewong)
 Specialist (1)



Pitot Tube Calibration Data

Pitot Tube Identification Number : BKK_FS0523 Calibration Date : 13 Jul 23
 Lab test duct Number : 258-1-13-01 Standard Pitot ID : BKK_FS0441
 Calibration Sheet No. : C-130723-BKK_FS0523 Cp Standard : 0.99

Type S Pitot Tube Coefficient Data					
	Type s pitot tube Leg A,B	Standard pitot tube (ΔP, mm.H ₂ O)	Type s pitot tube (ΔP, mm.H ₂ O)	Cp (s) Leg A	Cp (s) Leg B
Test 1	A	12.00	17.00	0.840	-
	B	12.00	17.00	-	0.840
Test 2	A	12.00	17.00	0.840	-
	B	12.00	17.00	-	0.840
Test 3	A	12.00	16.80	0.845	-
	B	12.00	16.80	-	0.845
Cp				0.842	0.842

$$Cp(S) = Cp_{std} \sqrt{\frac{\Delta P(std)}{\Delta P(s)}}$$

$$\left[\bar{Cp}_{(A)} - \bar{Cp}_{(B)} \right] \text{ must BE } \leq 0.01$$

$$\sum [Cp(s) - Cp(A \text{ or } B)]$$

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

Calibrated by : Saksit Phaisanphiset

(Mr. Saksit Phaisanphiset)

Field Scientist (4)

Approved by : Nattapon Jengwareewong

(Mr. Nattapol Jengwareewong)

Specialist (1)



DIGITAL TEMPERATURE CALIBRATION DATA SHEET

Calibration Date : 13 Jul 23	Ambient Temperature (°C) 29
Calibration sheet No. : C-130723-BKK_FS0519	Relative Humidity (%) : 60
Digital Temperature ID : BKK_FS0519	Reference Temperature ID BKK_FS1144
Serial No. : 1504025	Serial No. : 201090006013
Model : XC-572-V	Model : Digicon-CC-VT-MS
Next Calibrate : 14 Aug 24	

Location	Reference Temperature °C	Digital Temperature °C	Error °C	MPE	Pass / Fail
Stack	0	0	0	±3	Pass
	25	25	0	±3	Pass
	50	50	0	±3	Pass
	100	100	0	±3	Pass
	150	150	0	±3	Pass
	200	200	0	±3	Pass
	250	250	0	±3	Pass
	300	300	0	±3	Pass
	500	500	0	±3	Pass
	100	100	0	±3	Pass
Probe	120	120	0	±3	Pass
	140	140	0	±3	Pass
Oven	100	100	0	±3	Pass
	120	120	0	±3	Pass
	140	140	0	±3	Pass
	100	100	0	±3	Pass
Filter	120	120	0	±3	Pass
	140	140	0	±3	Pass
Exit	0	0	0	±3	Pass
	10	10	0	±3	Pass
Meter	20	20	0	±3	Pass
	0	0	0	±3	Pass
	25	25	0	±3	Pass
AUX	50	50	0	±3	Pass
	0	0	0	±3	Pass
	25	25	0	±3	Pass
	50	50	0	±3	Pass

MPE : (Maximum permissible error of measurement) ค่าความผิดพลาดสูงสุดของการวัดที่ยอมรับได้

Calibrated by : Saksit Phaisanphiset

Mr. Saksit Phaisanphiset

Field Scientist (4)

Approved by : Nattapon Jengwareewong

Mr. Nattapol Jengwareewong

Specialist (1)



PROBE NOZZLE DIAMETER
CALIBRATION DATA SHEET

Calibration Date	13 Jul 23	Nozzle Set ID.:	BKK_FS0524
Calibration Sheet No.:	C-130723-BKK_FS0524	Vernier Caliper ID.:	BKK_FS1123

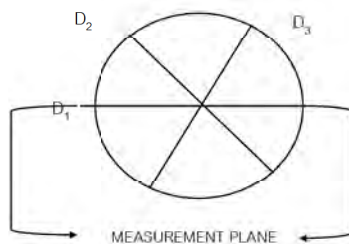
Nozzle ID #	Nozzle Diameter (cm.)			Hi - Lo ΔD	$(D_1 + D_2 + D_3) / 3$ D_{avg}
	D_1	D_2	D_3		
1	0.318	0.318	0.318	0.000	0.318
2	0.472	0.474	0.475	0.003	0.474
3	0.632	0.635	0.634	0.003	0.634
4	0.792	0.792	0.792	0.000	0.792
5	0.952	0.952	0.952	0.000	0.952
6	1.091	1.110	1.092	0.019	1.098
7	1.256	1.262	1.262	0.006	1.260
8	1.601	1.598	1.600	0.003	1.600

Where:

D_1, D_2, D_3 = There 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} = $(D_1 + D_2 + D_3) / 3$



Calibrated by: Saksit Phaisanphiset

(Mr. Saksit Phaisanphiset)
Field Scientist (4)

Approved by: Nattapon Jengwareewong

(Mr. Nattapon Jengwareewong)
Field Specialist (1)

FORM NO.: F-06-026 / REVISION NO.: - / DATE DATE: 30/1/03



Calibration Certificate



Certificate No: G 660018

Date of issue: 23-Jan-23

REVIEW BY: Hanaborn P.
APPROVED BY: ht
NEXT CAL. DATE: 20/1/24

Instrument description : Flue gas Analyzer
Instrument model : Testo 350 New
Instrument serial no. : 62985049
ID no. or control no. : RYG_FS0564
Manufacturer : Testo SE & Co. KGaA
Probe description : -
Probe model : -
Probe serial : -
Customer name : ALS LABORATORY GROUP (THAILAND) CO.,LTD.
Customer address : 104 Phatthanakan 40, Phatthanakan Road, Khwaeng Phatthanakan, Khet Suan Luang, Bangkok, 10250 Thailand
Total pages of certificate : 3 Pages
Receiving no. : L-230152
Receiving date. : 19-Jan-23
Parameter of calibration : Gas Calibration(Oxygen 2.498,10.04,21.02 %vol, Carbon Monoxide 80.14,309.9,1003 ppm, Nitrogen Dioxide 30.34,80.96,202.2 ppm, Nitric Oxide 30.08,150.9,320.6 ppm, Sulphur Dioxide 50.04,100.8,601.1 ppm)

Condition of UUC. : Used

Ambient condition : All of the Measurement were carried out the stabilized laboratory
Temperature : 23 ± 5 °C
Humidity : 55 ± 15 %RH

Calibration place : 17/121 Soi Ngamwongwan 47 Yaek 48, Toongsonghong, Laksi, Bangkok 10210

Calibration procedure no. : WI-CL-28-C

The calibration certificate expanded uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by coverage factor $k=2$, which for a normal distribution corresponds to a coverage probability of approximately 95%.

This certificate is applied only to item under test Environmental condition.

This Calibration Certificate may not be reproduced other than in full except with the permission of the issuing laboratory. Calibration certificates without signature and seal not valid.

This calibration certificate documents are traceability to national standards, which realize measurement according to the International System of Units (SI).

Date of calibration : 20-Jan-23

Jawad

Mr. Sedtawut Nueathong
Calibration Technician

D. Wuttan

Mrs. Nongluck Wongsettee
Technical Manager

Standard References (Table 1)

Standard	Certificate No.	Vendor	Due date
Oxygen (O ₂) 2.498 % Vol	4219/21	Linde	30-Sep-25
Oxygen (O ₂) 10.04 % Vol	CG-0153-21	Nimt	18-Nov-26
Oxygen (O ₂) 21.02 % Vol	CG-0041-22	Nimt	10-Feb-27
Carbon monoxide (CO) 80.14 ppm	CG-0040-22	Nimt	14-Feb-27
Carbon monoxide (CO) 309.9 ppm	2803/21	Linde	22-Jun-23
Carbon monoxide (CO) 1003 ppm	2583/22	Linde	09-Aug-24
Nitrogen Dioxide (NO ₂) 30.34 ppm	2703/22	Linde	22-Aug-24
Nitrogen Dioxide (NO ₂) 80.96 ppm	2041/22	Linde	26-Jun-24
Nitrogen Dioxide (NO ₂) 202.2 ppm	3239/21	Linde	20-Jul-23
Nitric Oxide (NO) 30.08 ppm	CG-0089-22	Nimt	13-Jun-24
Nitric Oxide (NO) 150.9 ppm	2857/21	Linde	27-Jun-23
Nitric Oxide (NO) 320.6 ppm	2944/21	Linde	02-Jul-23
Sulphur Dioxide (SO ₂) 50.04 ppm	3205/21	Linde	25-Jul-23
Sulphur Dioxide (SO ₂) 100.8 ppm	3507/22	Linde	09-Nov-24
Sulphur Dioxide (SO ₂) 601.1 ppm	3204/21	Linde	20-Jul-23

Measured room conditions

Temperature : 22.8 °C Humidity : 58.5 %RH Pressure : 1013.5 mbar

Calibration conditions

Gas Temperature : 23 °C Flow rate : 1,200 ml/min Gas pressure : 1021.4 mbar

Calibration Results Before Adjustment (Table 2)

Parameter of Standard	Standard Values	Mean of UUC	Error	Uncertainty (±)
O ₂ (%Vol)	2.498	2.45	-0.048	0.20
O ₂ (%Vol)	10.04	9.89	-0.15	0.40
O ₂ (%Vol)	21.02	21.16	0.14	0.80
CO (ppm)	80.14	82	1.86	3.0
CO (ppm)	309.9	313	13.1	6.0
CO (ppm)	1003	1014	11	12
NO ₂ (ppm)	30.34	21.9	-8.44	8.0
NO ₂ (ppm)	80.96	55.3	-25.66	8.0
NO ₂ (ppm)	202.2	154.8	-47.4	12
NO (ppm)	30.08	27	-3.08	8.0
NO (ppm)	150.9	145	-5.9	8.0
NO (ppm)	320.6	304	-16.6	12
SO ₂ (ppm)	50.04	50	-0.04	6.0
SO ₂ (ppm)	100.8	100	-0.8	6.0
SO ₂ (ppm)	601.1	598	-3.1	13

Calibration Results After Adjustment (Table 3)

Parameter of Standard	Standard Values	Mean of UUC	Error	Uncertainty (±)
O ₂ (%Vol)	2.498	2.45	-0.048	0.20
O ₂ (%Vol)	10.04	9.89	-0.15	0.40
O ₂ (%Vol)	21.02	21.16	0.14	0.80
CO (ppm)	80.14	82	1.86	3.0
CO (ppm)	309.9	313	3.1	6.0
CO (ppm)	1003	1014	11	12
NO ₂ (ppm)	30.34	31.2	0.86	8.0
NO ₂ (ppm)	80.96	82.7	1.74	8.0
NO ₂ (ppm)	202.2	205.6	3.4	12
NO (ppm)	30.08	32	1.90	8.0
NO (ppm)	150.9	153	2.1	8.0
NO (ppm)	320.6	322	1.4	12
SO ₂ (ppm)	50.04	50	-0.04	6.0
SO ₂ (ppm)	100.8	100	-0.8	6.0
SO ₂ (ppm)	601.1	598	-3.1	13

Remark : 1 cmol/mol = 1 %vol , 1 μmol/mol = 1 ppm.

End of Report

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



SARTORIUS

REVIEW BY *Thawat*
APPROVED BY *D. [Signature]*
NEXT CAL. DATE *01/03/24*

Certificate of Calibration

Model Number : MSE224S-100-DU Certificate No. : 23BCI0115
Description : Analytical Balance Issued Date : Friday, March 03, 2023
Serial Number : 0031709552 Reference No. : 204833
ID No. : RYG_EN0003
Manufacturer : Sartorius Page No. : 1 of 2

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

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

Calibrated By : Mr.Chonchai Inthana Calibration Procedure No. : This calibration was conducted by
Calibration Date : Wednesday, March 01, 2023 Using in-house calibration procedure number (WI-003)
Based on UKAS LAB 14 : 2019

Metrological data : Ambients Conditions:
Capacity : 220 g Readability : 0.0001 g Temperature : 23.0 °C ± 5.0 °C
Humidity : 56.0 % RH ± 10.0 % RH
Pressure : ±

Reasons for calibration

☐ New Installation ☐ Service / Repaired ☒ Re-calibration/ Maintenance

Equipment Condition: ☒ Good Operate ☐ Fair

Measurement Method UKAS Publication Ref :Lab 14

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

Traceability:

Model Number	Description	Traceability	Certificate No.	Due Date
YCS011-522-00	Sartorius weight set 1mg - 5000g E2,YCS011-522-00	SPC-RT	C02212565	14-Sep-2023
MHB-382SD	Humidity/Barometer/Temp Lutron MHB-382SD	DKSH	C19220444	5-Sep-2023

This certificate relate and apply this equipment only.

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

Chonchai Inthana
Mr.chonchai Inthana(Technical Manager)

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Sartorius (Thailand) Co., Ltd.

129 Rama 9 Road, Huaykwang, Bangkok 10310
Tel: +66 2643 8361-6 Fax: +66 2643-8367, e-mail: service.thailand@sartorius.com

SARTORIUS

Certificate of Calibration

Model Number : MSE224S-100-DU Certificate No. : 23BCI0115
Description : Analytical Balance Issued Date : Friday, March 03, 2023
Serial Number : 0031709552 Reference No. : 204833
ID No. : RYG_EN0003
Manufacturer : Sartorius Page No. : 2 of 2

Calibration Results : Without Adjustment

Repeatability

The reproducibility is the ability of a weighing instrument to display nearly identical readouts under constant test conditions when the same load within a measurement series is placed repeatedly on the weighing pan in the same manner. The standard deviation is used to express reproducibility quantitatively.

Nominal Value : (Low Load)	20.0000	200.0000
20 g	20.0001	200.0000
Tolerance	20.0000	200.0001
0.0001 g	20.0000	200.0000
	20.0000	200.0001
Nominal Value : (High Load)	20.0001	200.0001
200 g	20.0000	200.0001
Tolerance	20.0000	200.0000
0.0001 g	20.0000	200.0001
	20.0000	200.0001
Standard Deviation	0.00004	0.00005

Eccentricity (Off-center loading error)

The off-center loading error is yielded by the difference between the readout of the load, i.e. 1/3 or 1/4 of maximum capacity, placed in the middle of the weighing pan and between each of four additional measurement points (positions defined according to OIML R76).

Nominal value :	100	g
Tolerance	0.0004	g
Difference		
1	-	
2	0.0001	
3	0.0000	
4	0.0000	
5	0.0001	
6	-	

Linearity

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

Tolerance	0.0002	g		
Nominal Value	Conventional Mass Value	Displayed Value	Deviation	Uncertainty
(g)	(g)	(g)	(g)	(g)
0.01	0.0100	0.0100	0.0000	0.00013
0.05	0.0500	0.0500	0.0000	0.00013
0.1	0.1000	0.1000	0.0000	0.00013
0.5	0.5000	0.5000	0.0000	0.00014
1	1.0000	1.0000	0.0000	0.00014
5	5.0000	5.0000	0.0000	0.00014
10	10.0000	10.0000	0.0000	0.00014
20	20.0000	20.0000	0.0000	0.00024
50	50.0000	50.0000	0.0000	0.00015
100	100.0000	100.0000	0.0000	0.00019
200	200.0000	200.0001	0.0001	0.00032

End of Report.



ROTA METER CALIBRATION RESULT JULY 2023

Rotameter ID.	Calibration Date	Regression Result	Coefficient (R ²)
BKK_FS0577	03 Jul 23	Y = 1.2484x - 0.6741	0.9931
BKK_FS0579	03 Jul 23	Y = 1.0997x - 0.4918	1.0000
BKK_FS0583	01 Jul 23	Y = 1.0068x + 1.6459	0.9998
BKK_FS0584	01 Jul 23	Y = 0.9804x + 9.469	0.9999
BKK_FS0585	07 Jul 23	Y = 1.0248x + 0.8333	0.9996
BKK_FS0586	01 Jul 23	Y = 0.9907x + 11.074	1.0000
BKK_FS0587	07 Jul 23	Y = 0.986x + 17.77	0.9993
BKK_FS0588	01 Jul 23	Y = 0.9751x + 9.8452	0.9999
BKK_FS0589	03 Jul 23	Y = 1.0174x + 0.0381	1.0000
BKK_FS0590	01 Jul 23	Y = 1.0127x - 3.4333	1.0000
BKK_FS0591	03 Jul 23	Y = 1.0452x - 51.824	0.9998
BKK_FS0592	07 Jul 23	Y = 1.0003x + 14.344	1.0000
BKK_FS0593	01 Jul 23	Y = 1.0386x - 41.415	0.9997
BKK_FS0594	07 Jul 23	Y = 1.0025x + 6.32	0.9999
BKK_FS0595	01 Jul 23	Y = 1.0871x - 114.97	0.9985
BKK_FS0596	03 Jul 23	Y = 1.038x - 51.974	0.9993
BKK_FS0597	01 Jul 23	Y = 1.0059x - 9.9086	1.0000
BKK_FS1004	01 Jul 23	Y = 1.0186x + 6.731	0.9998
BKK_FS1005	01 Jul 23	Y = 0.9922x + 13.993	0.9970
BKK_FS1006	01 Jul 23	Y = 1.1747x - 3.1235	0.9991
BKK_FS1007	07 Jul 23	Y = 1.0737x + 0.8677	0.9997
BKK_FS1008	07 Jul 23	Y = 1.0446x + 1.2153	0.9999
BKK_FS1009	01 Jul 23	Y = 1.1044x - 0.8245	1.0000
BKK_FS1010	03 Jul 23	Y = 1.2271x - 2.0139	1.0000
BKK_FS1011	03 Jul 23	Y = 1.261x - 1.7003	1.0000
BKK_FS1012	03 Jul 23	Y = 0.9978x - 3.7238	0.9990
BKK_FS1013	03 Jul 23	Y = 1.0245x - 28.65	0.9999
BKK_FS1014	01 Jul 23	Y = 1.3135x - 7.0966	0.9961
BKK_FS1015	01 Jul 23	Y = 0.9802x + 3.8214	0.9999
BKK_FS1016	01 Jul 23	Y = 1.0726x - 85.581	0.9995
BKK_FS1020	01 Jul 23	Y = 1.1161x - 1.1986	1.0000
BKK_FS1021	01 Jul 23	Y = 0.9566x + 16.524	0.9987
BKK_FS1022	01 Jul 23	Y = 1.0712x - 89.51	0.9990
BKK_FS1023	01 Jul 23	Y = 1.3791x - 8.8721	0.9944
BKK_FS1024	01 Jul 23	Y = 0.9449x + 11.421	0.9993
BKK_FS1025	01 Jul 23	Y = 1.0477x - 41.116	1.0000
BKK_FS1026	01 Jul 23	Y = 1.3389x - 4.918	1.0000
BKK_FS1027	01 Jul 23	Y = 0.9852x + 1.5233	1.0000
BKK_FS1028	01 Jul 23	Y = 1.0281x - 19.897	0.9996



ROTA METER CALIBRATION RESULT JULY 2023

Rotameter ID.	Calibration Date	Regression Result	Coefficient (R ²)
BKK_FS1029	01 Jul 23	Y = 1.3382x - 8.9776	0.9941
BKK_FS1030	01 Jul 23	Y = 0.9818x + 2.3476	0.9995
BKK_FS1031	01 Jul 23	Y = 1.0526x - 64.415	0.9997
BKK_FS1039	01 Jul 23	Y = 0.998x + 14.823	0.9997
BKK_FS1040	01 Jul 23	Y = 1.0041x - 2.7552	0.9999
BKK_FS1041	01 Jul 23	Y = 1.116x - 1.0078	0.9999
BKK_FS1042	01 Jul 23	Y = 1.0209x + 3.56	0.9980
BKK_FS1043	01 Jul 23	Y = 1.0039x - 5.0143	0.9999
BKK_FS1044	01 Jul 23	Y = 1.0807x + 0.9837	0.9998
BKK_FS1164	03 Jul 23	Y = 1.0589x + 4.6061	0.9996
BKK_FS1165	03 Jul 23	Y = 0.9809x + 7.5262	0.9981
BKK_FS1166	03 Jul 23	Y = 1.0567x - 50.446	0.9999
BKK_FS1200	03 Jul 23	Y = 1.3634x - 1.3816	0.9991
BKK_FS1201	03 Jul 23	Y = 1.0388x - 7.0524	0.9999
BKK_FS1202	03 Jul 23	Y = 1.0518x - 59.531	0.9998
RYG_FS0197	01 Jul 23	Y = 1.0087x - 3.2838	0.9999
RYG_FS0198	01 Jul 23	Y = 0.9877x + 36.487	0.9999
RYG_FS0199	01 Jul 23	Y = 1.0299x - 0.367	0.9992
PHK_FS0027	13 Jul 23	Y = 1.1219x - 2.2432	0.9984
PHK_FS0028	13 Jul 23	Y = 1.0341x - 6.7967	0.9999
PHK_FS0029	13 Jul 23	Y = 0.9977x + 8.7829	0.9999
SGK_FS0135	14 Jul 23	Y = 0.9877x + 11.513	0.9974
SGK_FS0138	13 Jul 23	Y = 1.0571x - 1.1565	0.9991
SGK_FS0139	13 Jul 23	Y = 0.9801x + 8.6267	0.9997
SGK_FS0140	13 Jul 23	Y = 0.9978x + 11.644	1.0000
SGK_FS0141	13 Jul 23	Y = 1.1349x - 2.2867	0.9990
SGK_FS0142	13 Jul 23	Y = 0.9915x + 11.403	0.9994
SGK_FS0143	13 Jul 23	Y = 1.0054x - 4.0648	1.0000

Review By :

Wichan Choonharat

(Mr. Wichan Choonharat)

Enviro Field Services Manager

Approved By :

Mr. Sarayuth Jitranont

(Mr. Sarayuth Jitranont)

Assistant General Manager



Certificate of Calibration

ICS-2100: Anion (ID#659)

This certificate is to verify that instrument below are calibrated

by Archemica Lab Co., Ltd.

ICS-2100 S/N: 15010977

AS-HV S/N: 5450A36659

For

ALS Laboratory Group (Thailand) Co., Ltd.

Operator Signature: _____

Date: Jan 12, 2023

(Mr. Nutdanai Laekhwan)

Application Chemist

REVIEW BY Aulcharawan S.
APPROVED BY Sararat M.
NEXT CAL. DATE 12 Jan 24

SITHIPHORN ASSOCIATES CO.,LTD. CALIBRATION LABORATORY

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



Cert. No. : ACC23005

Pages : 1 of 3

Calibration Certificate

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

Condition As Found : GOOD

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

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

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

Calibrated by : Nathakorn Pisutpaisan

Approved by :

T. Petchur
(Thanakul Petchurai)

REVIEW BY Nathakorn P.
APPROVED BY [Signature]
NEXT CAL. DATE 17/1/24

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Continuation of Calibration Certificate

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

Calibration Procedure : CP-AC-03

Calibration Method :

This equipment was calibrated by based on IEC-60942-2003 Standard.

The sound pressure level, frequency and total distortion of the sound calibrator was measured using the reference microphone.

Condition of this result of calibration :

1. Reference Standard Instruments :

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

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

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

3.1 National Institute of Metrology (Thailand).

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

Continuation of Calibration Certificate

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

Result of calibration :

1. Sound pressure level

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

2. Frequency

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

3. Total distortion

Measured value (%)	Uncertainty (%)	Tolerance limit (%)
0.35	0.10	3.0

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

End of Calibration Certificate

T. Petcha

T. Petcha

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:cal-center@sithiporn.com http://www.sithiporn.com



Cert. No. : ACL23047
Pages : 1 of 8

Calibration Certificate

Equipment : SOUND LEVEL METER
Manufacturer : RION
Model : NL-42/ Microphone UC-52 / Preamplifier NH-24
Serial No.: 01222716 / 143832 / 22763
ID No.: RYG_FS0020

Condition As Found : GOOD

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

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

Received Date : 06 JANUARY 2023
Calibration Date : 13-18 JANUARY 2023
Date of Issue : 19 JANUARY 2023



Calibrated by : Nathakorn Pisutpaisan

Approved by :

T. Petchurai
(Thanakul Petchurai)

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SITHIPORN ASSOCIATES CO.,LTD. CALIBRATION LABORATORY

Continuation of Calibration Certificate

Cert. No. : ACL23047
Job No. : VC66AC0024
Pages : 2 of 8

Calibration Procedure : CP-AC-01

Calibration Method :

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

Condition of this result of calibration :

1. Reference Standard Instruments :

Instrument	Model	Serial No.	Cert. No.	Due Date
Waveform Generator	33210A	MY48017076	EF-0007-22	04-Feb-23
Waveform Generator	33511B	MY52302742	EF-0008-22	04-Feb-23
Digital Multimeter	33461A	MY53220104	EEL.BP. 04/0265	09-Feb-23
Digital Multimeter	33461A	MY53220076	EEL.BP. 03/0265	09-Feb-23
Digital Multimeter	34461A	MY60024273	EEL.BP. 05/0265	09-Feb-23
Programmable Attenuator	MAT-1070	62100114	EF-0009-22	07-Feb-23
Condenser Microphone	4180	2977900	AA-1013-22	24-Feb-23
Measuring Amplifier	NA-42KAI	34560495	AA-3005-22	22-Feb-23

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

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

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

T. Petchurai

Continuation of Calibration Certificate

Cert. No. : ACL23047
Job No. : VC66AC0024
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

Continuation of Calibration Certificate

Cert. No. : ACL23047
Job No. : VC66AC0024
Pages : 4 of 8

Result of calibration :

1. Absolute sensitivity

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

2. Self-generated noise

2.1 Normal test

Measured Value (dB)
15.1

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

Frequency Weighting	Measured value (dB)
A - weight	11.6
C - weight	17.9
Flat	23.8

3. Acoustical signal tests of frequency weightings

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

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)			
	Flat	C-weight	A-weight	Acceptance Limits
125	0.5	0.5	0.5	± 1.5
1000	0.1	0.1	0.1	± 1.0
8000	-1.3	-1.2	-1.2	±5.0

Continuation of Calibration Certificate

Cert. No. : ACL23047
Job No. : VC66AC0024
Pages : 5 of 8

4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

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

5. Frequency and time weightings at 1 kHz

5.1 Frequency weightings at 1 kHz

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

5.2 Time weighting at 1 kHz

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

6. Long - term stability

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

Continuation of Calibration Certificate

Cert. No. : ACL23047
Job No. : VC66AC0024
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	135.1	0.1	± 1.1
134.0	134.1	0.1	± 1.1
133.0	133.0	0.0	± 1.1
132.0	132.0	0.0	± 1.1
131.0	131.0	0.0	± 1.1
129.0	129.0	0.0	± 1.1
124.0	124.0	0.0	± 1.1
119.0	119.1	0.1	± 1.1
114.0	114.0	0.0	± 1.1
109.0	109.0	0.0	± 1.1
104.0	104.1	0.1	± 1.1
99.0	99.0	0.0	± 1.1
94.0	94.0	0.0	± 1.1
89.0	89.0	0.0	± 1.1
84.0	84.0	0.0	± 1.1
79.0	79.0	0.0	± 1.1
74.0	74.0	0.0	± 1.1
69.0	69.0	0.0	± 1.1
64.0	64.0	0.0	± 1.1
59.0	59.0	0.0	± 1.1
54.0	54.0	0.0	± 1.1
49.0	49.0	0.0	± 1.1
44.0	44.0	0.0	± 1.1
39.0	39.0	0.0	± 1.1
34.0	34.0	0.0	± 1.1
30.0	29.9	-0.1	± 1.1
29.0	28.9	-0.1	± 1.1
28.0	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

Continuation of Calibration Certificate

Cert. No. : ACL23047
Job No. : VC66AC0024
Pages : 7 of 8

8. Level linearity including the level range control

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

9. Tone burst response

Time Weighting	Tone burst duration, Tb (ms)	Cycle	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Fast	0.25	1	108.0	107.9	-0.1	1.5 ; -5.0
	2	8	117.0	116.9	-0.1	1.0 ; -2.5
	200	800	134.0	134.0	0.0	±1.0
Slow	2	8	108.0	107.9	-0.1	1.5 ; -5.0
	200	800	127.6	127.6	0.0	±1.0
SEL	0.25	1	99.0	98.8	-0.2	1.5 ; -5.0
	2	8	108.0	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	135.4	-1.0	±3.0

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

Continuation of Calibration Certificate

Cert. No. : ACL23047
Job No. : VC66AC0024
Pages : 8 of 8

11. Overload indication

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

12. High level stability

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

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

End of Calibration Certificate

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:cal-center@sithiporn.com http://www.sithiporn.com



Cert. No. : ACL23086
Pages : 1 of 8

Calibration Certificate

Equipment : SOUND LEVEL METER
Manufacturer : RION
Model : NL-42/ Microphone UC-52 / Preamplifier: NH-24
Serial No.: 01222723 / 143841 / 22770
ID No.: RYG_FS0022

Condition As Found : GOOD

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

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

Received Date : 24 JANUARY 2023
Calibration Date : 25-26 JANUARY 2023
Date of Issue : 27 JANUARY 2023

Calibrated by : Nathakorn Pisutpaisan

Approved by :

T. Petchurai
(Thanakul Petchurai)

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SITHIPORN SITHIPORN ASSOCIATES CO.,LTD. associates CALIBRATION LABORATORY

Continuation of Calibration Certificate

Cert. No. : ACL23086
Job No. : VC66AC0031
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	FF-0009-22	07-Feb-23
Condenser Microphone	4180	2977900	AA-1013-22	24-Feb-23
Measuring Amplifier	NA-42KAI	34560495	AA-3005-22	22-Feb-23

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

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

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

T. Petchurai

Continuation of Calibration Certificate

Cert. No. : ACL23086
Job No. : VC66AC0031
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

Continuation of Calibration Certificate

Cert. No. : ACL23086
Job No. : VC66AC0031
Pages : 4 of 8

Result of calibration :

1. Absolute sensitivity

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

2. Self-generated noise

2.1 Normal test

Measured Value (dB)
15.1

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

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

3. Acoustical signal tests of frequency weightings

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

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

Continuation of Calibration Certificate

Cert. No. : ACL23086

Job No. : VC66AC0031

Pages : 5 of 8

4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

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

Continuation of Calibration Certificate

Cert. No. : ACL23086

Job No. : VC66AC0031

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	38.9	-0.1	± 1.1
34.0	33.9	-0.1	± 1.1
30.0	29.9	-0.1	± 1.1
29.0	28.9	-0.1	± 1.1
28.0	27.9	-0.1	± 1.1
27.0	26.9	-0.1	± 1.1
26.0	25.9	-0.1	± 1.1
25.0	24.8	-0.2	± 1.1

Continuation of Calibration Certificate

Cert. No. : ACL23086
Job No. : VC66AC0031
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	136.1	-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	135.2	-0.2	±2.0
Negative half cycle	135.4	135.2	-0.2	±2.0

Continuation of Calibration Certificate

Cert. No. : ACL23086
Job No. : VC66AC0031
Pages : 8 of 8

11. Overload indication

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

12. High level stability

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

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

End of Calibration Certificate

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:cal-center@sithiporn.com http://www.sithiporn.com



Cert. No. : ACL23048
Pages : 1 of 8

Calibration Certificate

Equipment : SOUND LEVEL METER
Manufacturer : RION
Model : NL-42/ Microphone UC-52 / Preamplifier NH-24
Serial No.: 01222724 / 143842 / 22771
ID No.: RYG_FS0023

Condition As Found : GOOD

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

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

Received Date : 06 JANUARY 2023
Calibration Date : 13-18 JANUARY 2023
Date of Issue : 19 JANUARY 2023



Calibrated by : Nathakorn Pisutpaisan

Approved by :

T. Petchurai
(Thanakul Petchurai)

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SITHIPORN ASSOCIATES CO.,LTD. CALIBRATION LABORATORY

Continuation of Calibration Certificate

Cert. No. : ACL23048
Job No. : VC66AC0024
Pages : 2 of 8

Calibration Procedure : CP-AC-01

Calibration Method :

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

Condition of this result of calibration :

1. Reference Standard Instruments :

Instrument	Model	Serial No.	Cert. No.	Due Date
Waveform Generator	33210A	MY48017076	EF-0007-22	04-Feb-23
Waveform Generator	33511B	MY52302742	EF-0008-22	04-Feb-23
Digital Multimeter	33461A	MY53220104	EEL.BP. 04/0265	09-Feb-23
Digital Multimeter	33461A	MY53220076	EEL.BP. 03/0265	09-Feb-23
Digital Multimeter	34461A	MY60024273	EEL.BP. 05/0265	09-Feb-23
Programmable Attenuator	MAT-1070	62100114	EF-0009-22	07-Feb-23
Condenser Microphone	4180	2977900	AA-1013-22	24-Feb-23
Measuring Amplifier	NA-42KAI	34560495	AA-3005-22	22-Feb-23

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

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

3.1 National Institute of Metrology (Thailand).

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

Continuation of Calibration Certificate

Cert. No. : ACL23048
Job No. : VC66AC0024
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

Continuation of Calibration Certificate

Cert. No. : ACL23048
Job No. : VC66AC0024
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	11.2
C - weight	17.6
Flat	23.4

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	-0.1	-0.1	-0.1	± 1.0
8000	-0.8	-0.8	-0.7	±5.0

Continuation of Calibration Certificate

Cert. No. : ACL23048
Job No. : VC66AC0024
Pages : 5 of 8

4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

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

Continuation of Calibration Certificate

Cert. No. : ACL23048
Job No. : VC66AC0024
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	48.9	-0.1	± 1.1
44.0	43.9	-0.1	± 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	28.8	-0.2	± 1.1
28.0	27.9	-0.1	± 1.1
27.0	26.8	-0.2	± 1.1
26.0	25.9	-0.1	± 1.1
25.0	24.8	-0.2	± 1.1

Continuation of Calibration Certificate

Cert. No. : ACL23048
Job No. : VC66AC0024
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, Lcpeak (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	135.2	-0.2	±2.0
Negative half cycle	135.4	135.2	-0.2	±2.0

Continuation of Calibration Certificate

Cert. No. : ACL23048
Job No. : VC66AC0024
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	89.7	0.1	±1.5

12. High level stability

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

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

End of Calibration Certificate

SITHIPORN ASSOCIATES CO.,LTD. CALIBRATION LABORATORY

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Tel.0-2435-8800 Fax.0-2433-1679 e-mail:cal-center@sithiporn.com http://www.sithiporn.com



Cert. No. : ACL22295

Pages : 1 of 8

Calibration Certificate

Equipment : SOUND LEVEL METER
Manufacturer : RION
Model : NL-42/ Microphone UC-52 / Preamplifier NH-24
Serial No.: 00233183 / 144835 / 23230
ID No.: RYG_FS0024

Condition As Found : GOOD

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

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

Received Date : 07 DECEMBER 2022
Calibration Date : 16-20 DECEMBER 2022
Date of Issue : 21 DECEMBER 2022



Calibrated by : Nathakorn Pisutpaisan

Approved by :

T. Petchurai
(Thanakul Petchurai)

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SITHIPORN ASSOCIATES CO.,LTD. CALIBRATION LABORATORY

Continuation of Calibration Certificate

Cert. No. : ACL22295
Job No. : VC66AC0016
Pages : 2 of 8

Calibration Procedure : CP-AC-01

Calibration Method :

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

Condition of this result of calibration :

1. Reference Standard Instruments :

Instrument	Model	Serial No.	Cert. No.	Due Date
Waveform Generator	33210A	MY48017076	EF-0007-22	04-Feb-23
Waveform Generator	33511B	MY52302742	EF-0008-22	04-Feb-23
Digital Multimeter	33461A	MY53220104	EEL.BP. 04/0265	09-Feb-23
Digital Multimeter	33461A	MY53220076	EEL.BP. 03/0265	09-Feb-23
Digital Multimeter	34461A	MY60024273	EEL.BP. 05/0265	09-Feb-23
Programmable Attenuator	MAT-1070	62100114	EF-0009-22	07-Feb-23
Condenser Microphone	4180	2977900	AA-1013-22	24-Feb-23
Measuring Amplifier	NA-42KAI	34560495	AA-3005-22	22-Feb-23

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

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

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

T. Petchurai

Continuation of Calibration Certificate

Cert. No. : ACL22295
Job No. : VC66AC0016
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

Continuation of Calibration Certificate

Cert. No. : ACL22295
Job No. : VC66AC0016
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)
19.3

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

Frequency Weighting	Measured value (dB)
A - weight	14.8
C - weight	20.6
Flat	26.5

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)			Acceptance Limits
	Flat	C-weight	A-weight	
125	-0.1	-0.1	-0.1	± 1.5
1000	-0.1	-0.1	-0.1	± 1.0
8000	0.3	0.4	0.4	±5.0

Continuation of Calibration Certificate

Cert. No. : ACL22295
Job No. : VC66AC0016
Pages : 5 of 8

4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)			
	Flat	C-weight	A-weight	Acceptance Limits
63	0.0	0.0	0.0	±2.0
125	0.0	0.0	0.0	±1.5
250	0.0	0.0	-0.1	±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

Continuation of Calibration Certificate

Cert. No. : ACL22295
Job No. : VC66AC0016
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	43.9	-0.1	± 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	25.9	-0.1	± 1.1
25.0	24.8	-0.2	± 1.1

Continuation of Calibration Certificate

Cert. No. : ACL22295
Job No. : VC66AC0016
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	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

T. Petch.

Continuation of Calibration Certificate

Cert. No. : ACL22295
Job No. : VC66AC0016
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

T. Petch.

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:cal-center@sithiporn.com http://www.sithiporn.com



Cert. No. : ACL23077

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.: RYG_FS0025

Condition As Found : GOOD

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

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

Received Date : 24 JANUARY 2023
Calibration Date : 25-26 JANUARY 2023
Date of Issue : 27 JANUARY 2023



Calibrated by : Nathakorn Pisutpaisan

Approved by :

T. Petchur
(Thanakul Petchurai)

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

SITHIPORN ASSOCIATES CO.,LTD. CALIBRATION LABORATORY

Continuation of Calibration Certificate

Cert. No. : ACL23077
Job No. : VC66AC0031
Pages : 2 of 8

Calibration Procedure : CP-AC-01

Calibration Method :

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

Condition of this result of calibration :

1. Reference Standard Instruments :

Instrument	Model	Serial No.	Cert. No.	Due Date
Waveform Generator	33210A	MY48017076	EF-0007-22	04-Feb-23
Waveform Generator	33511B	MY52302742	EF-0008-22	04-Feb-23
Digital Multimeter	33461A	MY53220104	EEL.BP. 04/0265	09-Feb-23
Digital Multimeter	33461A	MY53220076	EEL.BP. 03/0265	09-Feb-23
Digital Multimeter	34461A	MY60024273	EEL.BP. 05/0265	09-Feb-23
Programmable Attenuator	MAT-1070	62100114	EF-0009-22	07-Feb-23
Condenser Microphone	4180	2977900	AA-1013-22	24-Feb-23
Measuring Amplifier	NA-42KAI	34560495	AA-3005-22	22-Feb-23

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

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

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

T. Petchur

Continuation of Calibration Certificate

Cert. No. : ACL23077
Job No. : VC66AC0031
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

Continuation of Calibration Certificate

Cert. No. : ACL23077
Job No. : VC66AC0031
Pages : 4 of 8

Result of calibration :

1. Absolute sensitivity

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

2. Self-generated noise

2.1 Normal test

Measured Value (dB)
14.2

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

Frequency Weighting	Measured value (dB)
A - weight	10.8
C - weight	17.1
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)			Acceptance Limits
	Flat	C-weight	A-weight	
125	0.2	0.2	0.2	± 1.5
1000	0.0	0.0	0.0	± 1.0
8000	-1.0	-0.9	-0.8	±5.0

Continuation of Calibration Certificate

Cert. No. : ACL23077
Job No. : VC66AC0031
Pages : 5 of 8

4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

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

5. Frequency and time weightings at 1 kHz

5.1 Frequency weightings at 1 kHz

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

5.2 Time weighting at 1 kHz

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

6. Long - term stability

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

Continuation of Calibration Certificate

Cert. No. : ACL23077
Job No. : VC66AC0031
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	104.1	0.1	± 1.1
99.0	99.0	0.0	± 1.1
94.0	94.0	0.0	± 1.1
89.0	89.0	0.0	± 1.1
84.0	84.0	0.0	± 1.1
79.0	79.0	0.0	± 1.1
74.0	74.0	0.0	± 1.1
69.0	69.0	0.0	± 1.1
64.0	64.0	0.0	± 1.1
59.0	59.0	0.0	± 1.1
54.0	54.0	0.0	± 1.1
49.0	49.0	0.0	± 1.1
44.0	44.0	0.0	± 1.1
39.0	39.0	0.0	± 1.1
34.0	34.0	0.0	± 1.1
30.0	29.9	-0.1	± 1.1
29.0	29.0	0.0	± 1.1
28.0	27.9	-0.1	± 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

Continuation of Calibration Certificate

Cert. No. : ACL23077
Job No. : VC66AC0031
Pages : 7 of 8

8. Level linearity including the level range control

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

9. Tone burst response

Time Weighting	Tone burst duration, Tb (ms)	Cycle	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Fast	0.25	1	108.0	108.0	0.0	1.5 ; -5.0
	2	8	117.0	117.0	0.0	1.0 ; -2.5
	200	800	134.0	134.1	0.1	±1.0
Slow	2	8	108.0	108.0	0.0	1.5 ; -5.0
	200	800	127.6	127.6	0.0	±1.0
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	132.9	-0.1	-
Positive half cycle	135.4	135.1	-0.3	±2.0
Negative half cycle	135.4	135.1	-0.3	±2.0

Continuation of Calibration Certificate

Cert. No. : ACL23077
Job No. : VC66AC0031
Pages : 8 of 8

11. Overload indication

Measured value (dB)		Deviated Value (dB)	Acceptance Limits (dB)
Positive one-half cycle	Negative one-half cycle		
89.5	89.7	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

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:cal-center@sithiporn.com http://www.sithiporn.com



Cert. No. : ACL23082

Pages : 1 of 8

Calibration Certificate

Equipment : SOUND LEVEL METER
Manufacturer : RION
Model : NL-42/ Microphone UC-52 / Preamplifier NH-24
Serial No.: 00734220 / 145272 / 34370
ID No.: RYG_FS0026

Condition As Found : GOOD

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

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

Received Date : 24 JANUARY 2023
Calibration Date : 25-26 JANUARY 2023
Date of Issue : 27 JANUARY 2023

Calibrated by : Nathakorn Pisutpaisan

Approved by :

T. Petchurai
(Thanakul Petchurai)

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

SITHIPORN ASSOCIATES CO.,LTD. CALIBRATION LABORATORY

Continuation of Calibration Certificate

Cert. No. : ACL23082

Job No. : VC66AC0031

Pages : 2 of 8

Calibration Procedure : CP-AC-01

Calibration Method :

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

Condition of this result of calibration :

1. Reference Standard Instruments :

Instrument	Model	Serial No.	Cert. No.	Due Date
Waveform Generator	33210A	MY48017076	EF-0007-22	04-Feb-23
Waveform Generator	33511B	MY52302742	EF-0008-22	04-Feb-23
Digital Multimeter	33461A	MY53220104	EEL.BP. 04/0265	09-Feb-23
Digital Multimeter	33461A	MY53220076	EEL.BP. 03/0265	09-Feb-23
Digital Multimeter	34461A	MY60024273	EEL.BP. 05/0265	09-Feb-23
Programmable Attenuator	MAT-1070	62100114	EF-0009-22	07-Feb-23
Condenser Microphone	4180	2977900	AA-1013-22	24-Feb-23
Measuring Amplifier	NA-42KAI	34560495	AA-3005-22	22-Feb-23

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

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

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

T. Petchurai

Continuation of Calibration Certificate

Cert. No. : ACL23082
Job No. : VC66AC0031
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

Continuation of Calibration Certificate

Cert. No. : ACL23082
Job No. : VC66AC0031
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)
15.6

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

Frequency Weighting	Measured value (dB)
A - weight	12.0
C - weight	18.3
Flat	24.1

3. Acoustical signal tests of frequency weightings

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

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)			Acceptance Limits
	Flat	C-weight	A-weight	
125	0.2	0.2	0.2	± 1.5
1000	-0.1	-0.1	-0.1	± 1.0
8000	-1.6	-1.5	-1.5	±5.0

Continuation of Calibration Certificate

Cert. No. : ACL23082
Job No. : VC66AC0031
Pages : 5 of 8

4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

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

5. Frequency and time weightings at 1 kHz

5.1 Frequency weightings at 1 kHz

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

5.2 Time weighting at 1 kHz

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

6. Long - term stability

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

Continuation of Calibration Certificate

Cert. No. : ACL23082
Job No. : VC66AC0031
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	135.1	0.1	± 1.1
134.0	134.1	0.1	± 1.1
133.0	133.0	0.0	± 1.1
132.0	132.0	0.0	± 1.1
131.0	131.0	0.0	± 1.1
129.0	129.0	0.0	± 1.1
124.0	124.0	0.0	± 1.1
119.0	119.1	0.1	± 1.1
114.0	114.0	0.0	± 1.1
109.0	109.0	0.0	± 1.1
104.0	104.1	0.1	± 1.1
99.0	99.0	0.0	± 1.1
94.0	94.0	0.0	± 1.1
89.0	89.0	0.0	± 1.1
84.0	84.0	0.0	± 1.1
79.0	79.0	0.0	± 1.1
74.0	74.0	0.0	± 1.1
69.0	69.0	0.0	± 1.1
64.0	64.0	0.0	± 1.1
59.0	59.0	0.0	± 1.1
54.0	54.0	0.0	± 1.1
49.0	49.0	0.0	± 1.1
44.0	44.0	0.0	± 1.1
39.0	39.0	0.0	± 1.1
34.0	33.9	-0.1	± 1.1
30.0	29.9	-0.1	± 1.1
29.0	28.9	-0.1	± 1.1
28.0	27.9	-0.1	± 1.1
27.0	26.9	-0.1	± 1.1
26.0	25.9	-0.1	± 1.1
25.0	24.8	-0.2	± 1.1

Continuation of Calibration Certificate

Cert. No. : ACL23082
Job No. : VC66AC0031
Pages : 7 of 8

8. Level linearity including the level range control

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

9. Tone burst response

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

10. Peak C sound level

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

Continuation of Calibration Certificate

Cert. No. : ACL23082
Job No. : VC66AC0031
Pages : 8 of 8

11. Overload indication

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

12. High level stability

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

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

End of Calibration Certificate

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:cal-center@sithiporn.com http://www.sithiporn.com



Cert. No. : ACL23041

Pages : 1 of 8

Calibration Certificate

Equipment : SOUND LEVEL METER
Manufacturer : RION
Model : NL-42/ Microphone UC-52 / Preamplifier NH-24
Serial No.: 00734221 / 145286 / 34371
ID No.: RYG_FS0027

Condition As Found : GOOD

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

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

Received Date : 06 JANUARY 2023
Calibration Date : 13-18 JANUARY 2023
Date of Issue : 19 JANUARY 2023

Calibrated by : Nathakorn Pisutpaisan

Approved by :

T. Petchur
(Thanakul Petchurai)

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

SITHIPORN ASSOCIATES CO.,LTD. CALIBRATION LABORATORY

Continuation of Calibration Certificate

Cert. No. : ACL23041
Job No. : VC66AC0024
Pages : 2 of 8

Calibration Procedure : CP-AC-01

Calibration Method :

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

Condition of this result of calibration :

1. Reference Standard Instruments :

Instrument	Model	Serial No.	Cert. No.	Due Date
Waveform Generator	33210A	MY48017076	EF-0007-22	04-Feb-23
Waveform Generator	33511B	MY52302742	EF-0008-22	04-Feb-23
Digital Multimeter	33461A	MY53220104	EEL.BP. 04/0265	09-Feb-23
Digital Multimeter	33461A	MY53220076	EEL.BP. 03/0265	09-Feb-23
Digital Multimeter	34461A	MY60024273	EEL.BP. 05/0265	09-Feb-23
Programmable Attenuator	MAT-1070	62100114	EF-0009-22	07-Feb-23
Condenser Microphone	4180	2977900	AA-1013-22	24-Feb-23
Measuring Amplifier	NA-42KAI	34560495	AA-3005-22	22-Feb-23

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

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

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

T. Petchur

Continuation of Calibration Certificate

Cert. No. : ACL23041
Job No. : VC66AC0024
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

Continuation of Calibration Certificate

Cert. No. : ACL23041
Job No. : VC66AC0024
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)
17.1

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

Frequency Weighting	Measured value (dB)
A - weight	13.4
C - weight	19.6
Flat	25.5

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	0.4	0.4	0.4	± 1.5
1000	0.1	0.1	0.1	± 1.0
8000	1.5	1.6	1.6	±5.0

Continuation of Calibration Certificate

Cert. No. : ACL23041
Job No. : VC66AC0024
Pages : 5 of 8

4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

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

5. Frequency and time weightings at 1 kHz

5.1 Frequency weightings at 1 kHz

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

5.2 Time weighting at 1 kHz

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

Continuation of Calibration Certificate

Cert. No. : ACL23041
Job No. : VC66AC0024
Pages : 6 of 8

7. Level linearity on the reference level range

Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
137.0	137.0	0.0	± 1.1
136.0	136.0	0.0	± 1.1
135.0	135.0	0.0	± 1.1
134.0	134.0	0.0	± 1.1
133.0	133.0	0.0	± 1.1
132.0	132.0	0.0	± 1.1
131.0	131.0	0.0	± 1.1
129.0	129.0	0.0	± 1.1
124.0	124.0	0.0	± 1.1
119.0	119.0	0.0	± 1.1
114.0	114.0	0.0	± 1.1
109.0	109.0	0.0	± 1.1
104.0	104.0	0.0	± 1.1
99.0	99.0	0.0	± 1.1
94.0	94.0	0.0	± 1.1
89.0	89.0	0.0	± 1.1
84.0	84.0	0.0	± 1.1
79.0	79.0	0.0	± 1.1
74.0	74.0	0.0	± 1.1
69.0	69.0	0.0	± 1.1
64.0	64.0	0.0	± 1.1
59.0	59.0	0.0	± 1.1
54.0	54.0	0.0	± 1.1
49.0	49.0	0.0	± 1.1
44.0	44.0	0.0	± 1.1
39.0	38.9	-0.1	± 1.1
34.0	33.9	-0.1	± 1.1
30.0	29.9	-0.1	± 1.1
29.0	28.9	-0.1	± 1.1
28.0	27.9	-0.1	± 1.1
27.0	26.9	-0.1	± 1.1
26.0	25.9	-0.1	± 1.1
25.0	24.8	-0.2	± 1.1

Continuation of Calibration Certificate

Cert. No. : ACL23041
Job No. : VC66AC0024
Pages : 7 of 8

8. Level linearity including the level range control

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

9. Tone burst response

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

T. Petch

Continuation of Calibration Certificate

Cert. No. : ACL23041
Job No. : VC66AC0024
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

T. Petch

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:cal-center@sithiporn.com http://www.sithiporn.com



Cert. No. : ACL23196

Pages : 1 of 8

Calibration Certificate

Equipment : SOUND LEVEL METER
Manufacturer : RION
Model : NL-42/ Microphone UC-52 / Preamplifier NH-24
Serial No.: 00734223 / 169439 / 72460
ID No.: RYG_FS0029

Condition As Found : GOOD

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

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

Received Date : 15 JUNE 2023
Calibration Date : 20-22 JUNE 2023
Date of Issue : 23 JUNE 2023



Calibrated by : Nathakorn Pisutpaisan

Approved by :

T. Petchur
(Thanakul Petchurai)

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SITHIPORN ASSOCIATES CO.,LTD. CALIBRATION LABORATORY

Continuation of Calibration Certificate

Cert. No. : ACL23196
Job No. : VC66AC0066
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-0009-23	07-FEB-24
Waveform Generator	33511B	MY52302742	EF-0010-23	07-FEB-24
Digital Multimeter	33461A	MY53220104	EEL.BP 30/0266	13-FEB-24
Digital Multimeter	33461A	MY53220076	EEL.BP 29/0266	13-FEB-24
Digital Multimeter	34461A	MY60024273	EEL.BP 31/0266	14-FEB-24
Programmable Attenuator	MAT-1070	62100114	EF-0011-23	08-FEB-24
Condenser Microphone	4180	2977900	AA-1001-23	14-FEB-24
Measuring Amplifier	NA-42KAI	34560495	AA-3002-23	14-FEB-24

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

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

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

T. Petchur

Continuation of Calibration Certificate

Cert. No. : ACL23196
Job No. : VC66AC0066
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	✓	-	0.1	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

Note : Pass/Fail evaluation for each parameter, will be considered together from the acceptance limit and the Maximum-permitted uncertainty of measurement.

Continuation of Calibration Certificate

Cert. No. : ACL23196
Job No. : VC66AC0066
Pages : 4 of 8

Result of calibration :

1. Absolute sensitivity

Reference Acoustic Signal (dB)	Measured Value (dB)	Deviation (dB)	Acceptance Limit (dB)
93.9 (93.98)	93.9	0.0	±0.3

2. Self-generated noise

2.1 Normal test

Measured Value (dB)
14.3

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

Frequency Weighting	Measured value (dB)
A - weight	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)			Acceptance Limits
	Flat	C-weight	A-weight	
125	0.5	0.5	0.5	± 1.5
1000	0.0	0.0	0.0	± 1.0
8000	-2.1	-2.1	-2.1	±5.0

Continuation of Calibration Certificate

Cert. No. : ACL23196
Job No. : VC66AC0066
Pages : 5 of 8

4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)			
	Flat	C-weight	A-weight	Acceptance Limits
63	-0.1	-0.1	-0.1	±2.0
125	0.0	0.0	0.0	±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	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
A - weight	94.0	94.0	0.0	± 0.2
C - weight	94.0	94.0	0.0	± 0.2
Flat	94.0	94.0	0.0	± 0.2

5.2 Time weighting at 1 kHz

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

G. Petch

Continuation of Calibration Certificate

Cert. No. : ACL23196
Job No. : VC66AC0066
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	132.9	-0.1	± 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	27.0	0.0	± 1.1
26.0	26.0	0.0	± 1.1
25.0	24.9	-0.1	± 1.1

G. Petch

Continuation of Calibration Certificate

Cert. No. : ACL23196
Job No. : VC66AC0066
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, Lcpeak (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.0	0.0	±3.0
One	136.4	135.7	-0.7	±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	±2.0
Positive half cycle	135.4	135.1	-0.3	±2.0
Negative half cycle	135.4	135.1	-0.3	±2.0

Continuation of Calibration Certificate

Cert. No. : ACL23196
Job No. : VC66AC0066
Pages : 8 of 8

11. Overload indication

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

12. High level stability

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

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

End of Calibration Certificate

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:cal-center@sithiporn.com http://www.sithiporn.com



Cert. No. : ACL23083

Pages : 1 of 8

Calibration Certificate

Equipment : SOUND LEVEL METER
Manufacturer : RION
Model : NL-42/ Microphone UC-52 / Preamplifier NH-24
Serial No.: 00734225 / 157777 / 22653
ID No.: RYG_FS0030

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 \pm 3) °C
Pressure : (101.3 \pm 3) kPa
Relative Humidity : (50.0 \pm 20) %

Received Date : 24 JANUARY 2023
Calibration Date : 25-26 JANUARY 2023
Date of Issue : 27 JANUARY 2023



Calibrated by : Nathakorn Pisutpaisan

Approved by :

T. Petchurai
(Thanakul Petchurai)

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SITHIPORN ASSOCIATES CO.,LTD. CALIBRATION LABORATORY

Continuation of Calibration Certificate

Cert. No. : ACL23083
Job No. : VC66AC0031
Pages : 2 of 8

Calibration Procedure : CP-AC-01

Calibration Method :

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

Condition of this result of calibration :

1. Reference Standard Instruments :

Instrument	Model	Serial No.	Cert. No.	Due Date
Waveform Generator	33210A	MY48017076	EF-0007-22	04-Feb-23
Waveform Generator	33511B	MY52302742	EF-0008-22	04-Feb-23
Digital Multimeter	33461A	MY53220104	EEL.BP. 04/0265	09-Feb-23
Digital Multimeter	33461A	MY53220076	EEL.BP. 03/0265	09-Feb-23
Digital Multimeter	34461A	MY60024273	EEL.BP. 05/0265	09-Feb-23
Programmable Attenuator	MAT-1070	62100114	EF-0009-22	07-Feb-23
Condenser Microphone	4180	2977900	AA-1013-22	24-Feb-23
Measuring Amplifier	NA-42KAI	34560495	AA-3005-22	22-Feb-23

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

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

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

T. Petchurai

Continuation of Calibration Certificate

Cert. No. : ACL23083
Job No. : VC66AC0031
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

Continuation of Calibration Certificate

Cert. No. : ACL23083
Job No. : VC66AC0031
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)
19.1

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

Frequency Weighting	Measured value (dB)
A - weight	13.1
C - weight	19.1
Flat	24.9

3. Acoustical signal tests of frequency weightings

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

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)			Acceptance Limits
	Flat	C-weight	A-weight	
125	0.3	0.3	0.3	± 1.5
1000	0.0	0.0	0.0	± 1.0
8000	-1.1	-1.1	-1.0	±5.0

Continuation of Calibration Certificate

Cert. No. : ACL23083
Job No. : VC66AC0031
Pages : 5 of 8

4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)			Acceptance Limits
	Flat	C-weight	A-weight	
63	0.0	-0.1	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	0.1	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

Continuation of Calibration Certificate

Cert. No. : ACL23083
Job No. : VC66AC0031
Pages : 6 of 8

7. Level linearity on the reference level range

Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
137.0	137.0	0.0	± 1.1
136.0	136.0	0.0	± 1.1
135.0	135.0	0.0	± 1.1
134.0	134.0	0.0	± 1.1
133.0	133.0	0.0	± 1.1
132.0	132.0	0.0	± 1.1
131.0	131.0	0.0	± 1.1
129.0	129.0	0.0	± 1.1
124.0	124.0	0.0	± 1.1
119.0	119.0	0.0	± 1.1
114.0	114.0	0.0	± 1.1
109.0	109.0	0.0	± 1.1
104.0	104.0	0.0	± 1.1
99.0	99.0	0.0	± 1.1
94.0	94.0	0.0	± 1.1
89.0	89.0	0.0	± 1.1
84.0	84.0	0.0	± 1.1
79.0	79.0	0.0	± 1.1
74.0	74.0	0.0	± 1.1
69.0	69.0	0.0	± 1.1
64.0	64.0	0.0	± 1.1
59.0	59.0	0.0	± 1.1
54.0	54.0	0.0	± 1.1
49.0	49.0	0.0	± 1.1
44.0	44.0	0.0	± 1.1
39.0	38.9	-0.1	± 1.1
34.0	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

Continuation of Calibration Certificate

Cert. No. : ACL23083
Job No. : VC66AC0031
Pages : 7 of 8

8. Level linearity including the level range control

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

9. Tone burst response

Time Weighting	Tone burst duration, Tb (ms)	Cycle	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Fast	0.25	1	108.0	107.9	-0.1	1.5 ; -5.0
	2	8	117.0	117.0	0.0	1.0 ; -2.5
	200	800	134.0	134.1	0.1	±1.0
Slow	2	8	108.0	108.0	0.0	1.5 ; -5.0
	200	800	127.6	127.6	0.0	±1.0
SEL	0.25	1	99.0	98.9	-0.1	1.5 ; -5.0
	2	8	108.0	108.0	0.0	1.0 ; -2.5
	200	800	128.0	128.1	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	133.1	0.1	-
Positive half cycle	135.4	135.2	-0.2	±2.0
Negative half cycle	135.4	135.2	-0.2	±2.0

Continuation of Calibration Certificate

Cert. No. : ACL23083
Job No. : VC66AC0031
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	137.1	-0.1	±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

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:cal-center@sithiporn.com http://www.sithiporn.com



Cert. No. : ACL23038
Pages : 1 of 9

Calibration Certificate

Equipment : SOUND LEVEL METER
Manufacturer : RION
Model : NL-21/ Microphone UC-52 / Preamplifier NH-21
Serial No.: 00465461 / 108081 / 19513
ID No.: RYG_FS0007

Condition As Found : GOOD

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

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

Received Date : 06 JANUARY 2023
Calibration Date : 13-18 JANUARY 2023
Date of Issue : 19 JANUARY 2023

Calibrated by : Nathakorn Pisutpaisan

Approved by :

T. Petchurai
(Thanakul Petchurai)

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SITHIPORN ASSOCIATES CO.,LTD. CALIBRATION LABORATORY

Continuation of Calibration Certificate

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

Calibration Procedure : CP-AC-02

Calibration Method :

This equipment was calibrated by based on IEC-61672-3 (2013) Standard for sound level meter (SLM).
The SLM had tests 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	8846A	MY60024273	EEL.BP. 05/0265	09-Feb-23
Programmable Attenuator	MAT-1070	62100114	EF-0009-22	07-Feb-23
Condenser Microphone	4180	2977900	AA-1013-22	24-Feb-23
Measuring Amplifier	NA-42KAI	34560495	AA-3005-22	22-Feb-23

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

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

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

T. Petchurai

Continuation of Calibration Certificate

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

Summary of Measurement Result :

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

Continuation of Calibration Certificate

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

Result of calibration :

1. Absolute sensitivity

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

2. Self-generated noise

2.1 Normal test

Measured Value (dB)
23.5

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

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

3. Acoustical signal tests of frequency weightings

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

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

Continuation of Calibration Certificate

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

4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

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

5. Frequency and time weightings at 1 kHz

5.1 Frequency weightings at 1 kHz

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

5.2 Time weighting at 1 kHz

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

6. Long - term stability

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

Continuation of Calibration Certificate

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

7. Level linearity on the reference level range

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

Continuation of Calibration Certificate

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

8. Level linearity including the level range control

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

Level linearity on each level range

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

9. Tone burst response

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

Continuation of Calibration Certificate

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

10. Peak C sound level

Number of cycle in test signal	Anticipated Value (dB)	Measured Value, Lcpeak (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

Continuation of Calibration Certificate

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

12. High level stability

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

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

End of Calibration Certificate

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: cal-center@sithiporn.com http://www.sithiporn.com



Cert. No. : ACL22296
Pages : 1 of 9

Calibration Certificate

Equipment : SOUND LEVEL METER
Manufacturer : RION
Model : NL-21/ Microphone UC-52 / Preamplifier NH-21
Serial No.: 00376364 / 71486 / 23142
ID No.: RYG_FS0012

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 : 07 DECEMBER 2022
Calibration Date : 16-20 DECEMBER 2022
Date of Issue : 21 DECEMBER 2022

Calibrated by : Nathakorn Pisutpaisan

Approved by :

T. Petchur
(Thanakul Petchurai)



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Continuation of Calibration Certificate

Cert. No. : ACL22296
Job No. : VC66AC0016
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-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	8846A	MY60024273	EEL.BP. 05/0265	09-Feb-23
Programmable Attenuator	MAT-1070	62100114	EF-0009-22	07-Feb-23
Condenser Microphone	4180	2977900	AA-1013-22	24-Feb-23
Measuring Amplifier	NA-42KAI	34560495	AA-3005-22	22-Feb-23

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

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

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

Continuation of Calibration Certificate

Cert. No. : ACL22296
Job No. : VC66AC0016
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

Continuation of Calibration Certificate

Cert. No. : ACL22296
Job No. : VC66AC0016
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)
24.0

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

Frequency Weighting	Measured value (dB)
A - weight	22.2
C - weight	21.9
Flat	21.6

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

Continuation of Calibration Certificate

Cert. No. : ACL22296
Job No. : VC66AC0016
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	0.0	0.0	±2.0
125	-0.1	0.0	0.0	±1.5
250	-0.1	0.0	0.0	±1.5
500	-0.1	0.0	0.0	±1.5
1000	0.0	0.0	0.0	±1.0
2000	0.0	0.1	0.1	±2.0
4000	0.0	0.1	0.1	±3.0
8000	0.0	0.2	0.2	±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	94.1	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

Continuation of Calibration Certificate

Cert. No. : ACL22296
Job No. : VC66AC0016
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

Continuation of Calibration Certificate

Cert. No. : ACL22296
Job No. : VC66AC0016
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	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	108.0	0.0	1.5 ; -5.0
	2	8	117.0	117.0	0.0	1.0 ; -2.5
	200	800	134.0	134.0	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

Continuation of Calibration Certificate

Cert. No. : ACL22296
Job No. : VC66AC0016
Pages : 8 of 9

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	135.1	-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		
89.4	89.2	-0.2	±1.5

Continuation of Calibration Certificate

Cert. No. : ACL22296
Job No. : VC66AC0016
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

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:cal-center@sithiporn.com http://www.sithiporn.com



Cert. No. : ACL23008
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,
KHWANG PHATTHANAKAN, KHET SUAN LUANG,
BANGKOK, 10250 THAILAND.

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

Received Date : 14 DECEMBER 2022
Calibration Date : 03-05 JANUARY 2023
Date of Issue : 06 JANUARY 2023



Calibrated by : Nathakorn Pisutpaisan

Approved by :

T. Petchurai
(Thanakul Petchurai)

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SITHIPORN ASSOCIATES CO.,LTD. CALIBRATION LABORATORY

Continuation of Calibration Certificate

Cert. No. : ACL23008
Job No. : VC66AC0021
Pages : 2 of 8

Calibration Procedure : CP-AC-01

Calibration Method :

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

Condition of this result of calibration :

1. Reference Standard Instruments :

Instrument	Model	Serial No.	Cert. No.	Due Date
Waveform Generator	33210A	MY48017076	EF-0007-22	04-Feb-23
Waveform Generator	33511B	MY52302742	EF-0008-22	04-Feb-23
Digital Multimeter	33461A	MY53220104	EEL_BP. 04/0265	09-Feb-23
Digital Multimeter	33461A	MY53220076	EEL_BP. 03/0265	09-Feb-23
Digital Multimeter	34461A	MY60024273	EEL_BP. 05/0265	09-Feb-23
Programmable Attenuator	MAT-1070	62100114	EF-0009-22	07-Feb-23
Condenser Microphone	4180	2977900	AA-1013-22	24-Feb-23
Measuring Amplifier	NA-42KAI	34560495	AA-3005-22	22-Feb-23

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

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

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

T. Petchurai

Continuation of Calibration Certificate

Cert. No. : ACL23008
Job No. : VC66AC0021
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

Continuation of Calibration Certificate

Cert. No. : ACL23008
Job No. : VC66AC0021
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)
17.1

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

Frequency Weighting	Measured value (dB)
A - weight	16.6
C - weight	22.6
Flat	28.1

3. Acoustical signal tests of frequency weightings

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

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)			
	Flat	C-weight	A-weight	Acceptance Limits
125	0.1	0.2	0.2	± 1.5
1000	0.0	0.0	0.0	± 1.0
8000	0.6	0.7	0.7	±5.0

Continuation of Calibration Certificate

Cert. No. : ACL23008
Job No. : VC66AC0021
Pages : 5 of 8

4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

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

Continuation of Calibration Certificate

Cert. No. : ACL23008
Job No. : VC66AC0021
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	132.9	-0.1	± 1.1
132.0	131.9	-0.1	± 1.1
131.0	131.0	0.0	± 1.1
129.0	129.0	0.0	± 1.1
124.0	124.0	0.0	± 1.1
119.0	119.0	0.0	± 1.1
114.0	114.0	0.0	± 1.1
109.0	109.0	0.0	± 1.1
104.0	104.0	0.0	± 1.1
99.0	99.0	0.0	± 1.1
94.0	94.0	0.0	± 1.1
89.0	89.0	0.0	± 1.1
84.0	84.0	0.0	± 1.1
79.0	79.0	0.0	± 1.1
74.0	74.0	0.0	± 1.1
69.0	69.0	0.0	± 1.1
64.0	64.0	0.0	± 1.1
59.0	59.0	0.0	± 1.1
54.0	54.0	0.0	± 1.1
49.0	49.0	0.0	± 1.1
44.0	44.0	0.0	± 1.1
39.0	39.0	0.0	± 1.1
34.0	34.0	0.0	± 1.1
30.0	30.0	0.0	± 1.1
29.0	28.9	-0.1	± 1.1
28.0	28.0	0.0	± 1.1
27.0	27.0	0.0	± 1.1
26.0	26.0	0.0	± 1.1
25.0	25.0	0.0	± 1.1

Continuation of Calibration Certificate

Cert. No. : ACL23008
Job No. : VC66AC0021
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	136.3	-0.1	±3.0

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

Continuation of Calibration Certificate

Cert. No. : ACL23008
Job No. : VC66AC0021
Pages : 8 of 8

11. Overload indication

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

12. High level stability

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

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

End of Calibration Certificate

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:cal-center@sithiporn.com http://www.sithiporn.com



Cert. No. : ACL23009
Pages : 1 of 8

Calibration Certificate

Equipment : SOUND LEVEL METER
Manufacturer : RION
Model : NL-42/ Microphone UC-52 / Preamplifier: NH-24
Serial No.: 01122579 / 172172 / 74022
ID No.: RYG_FS0018

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 \pm 3) °C
Pressure : (101.3 \pm 3) kPa
Relative Humidity : (50.0 \pm 20) %

Received Date : 14 DECEMBER 2022
Calibration Date : 03-05 JANUARY 2023
Date of Issue : 06 JANUARY 2023

Calibrated by : Nathakorn Pisutpaisan

Approved by :

T. Petchur
(Thanakul Petchurai)

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SITHIPORN ASSOCIATES CO.,LTD. CALIBRATION LABORATORY

Continuation of Calibration Certificate

Cert. No. : ACL23009
Job No. : VC66AC0021
Pages : 2 of 8

Calibration Procedure : CP-AC-01

Calibration Method :

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

Condition of this result of calibration :

1. Reference Standard Instruments :

Instrument	Model	Serial No.	Cert. No.	Due Date
Waveform Generator	33210A	MY48017076	EF-0007-22	04-Feb-23
Waveform Generator	33511B	MY52302742	EF-0008-22	04-Feb-23
Digital Multimeter	33461A	MY53220104	EEL.BP. 04/0265	09-Feb-23
Digital Multimeter	33461A	MY53220076	EEL.BP. 03/0265	09-Feb-23
Digital Multimeter	34461A	MY60024273	EEL.BP. 05/0265	09-Feb-23
Programmable Attenuator	MAT-1070	62100114	EF-0009-22	07-Feb-23
Condenser Microphone	4180	2977900	AA-1013-22	24-Feb-23
Measuring Amplifier	NA-42KAI	34560495	AA-3005-22	22-Feb-23

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

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

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

Continuation of Calibration Certificate

Cert. No. : ACL23009
Job No. : VC66AC0021
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

Continuation of Calibration Certificate

Cert. No. : ACL23009
Job No. : VC66AC0021
Pages : 4 of 8

Result of calibration :

1. Absolute sensitivity

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

2. Self-generated noise

2.1 Normal test

Measured Value (dB)
15.1

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

Frequency Weighting	Measured value (dB)
A - weight	12.0
C - weight	20.1
Flat	26.6

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)			Acceptance Limits
	Flat	C-weight	A-weight	
125	0.0	0.1	0.1	± 1.5
1000	0.0	0.0	0.0	± 1.0
8000	0.1	0.1	0.1	±5.0

Continuation of Calibration Certificate

Cert. No. : ACL23009
Job No. : VC66AC0021
Pages : 5 of 8

4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

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

5. Frequency and time weightings at 1 kHz

5.1 Frequency weightings at 1 kHz

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

5.2 Time weighting at 1 kHz

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

6. Long - term stability

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

Continuation of Calibration Certificate

Cert. No. : ACL23009
Job No. : VC66AC0021
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	135.1	0.1	± 1.1
134.0	134.1	0.1	± 1.1
133.0	133.0	0.0	± 1.1
132.0	132.0	0.0	± 1.1
131.0	131.0	0.0	± 1.1
129.0	129.0	0.0	± 1.1
124.0	124.0	0.0	± 1.1
119.0	119.1	0.1	± 1.1
114.0	114.1	0.1	± 1.1
109.0	109.0	0.0	± 1.1
104.0	104.1	0.1	± 1.1
99.0	99.0	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	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

Continuation of Calibration Certificate

Cert. No. : ACL23009
Job No. : VC66AC0021
Pages : 7 of 8

8. Level linearity including the level range control

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

9. Tone burst response

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

10. Peak C sound level

Number of cycle in test signal	Anticipated Value (dB)	Measured Value, L _{peak} (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.0	0.0	-
One	136.4	136.3	-0.1	±3.0

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

Continuation of Calibration Certificate

Cert. No. : ACL23009
Job No. : VC66AC0021
Pages : 8 of 8

11. Overload indication

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

12. High level stability

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

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

End of Calibration Certificate

CERTIFICATE OF CALIBRATION

Certificate No. : CL-162-65
Page 1 of 2

Equipment Name: Heat Stress Monitor
Manufacturer: Delta OHM
Model: HD32.2
Serial No: 15030244
ID No: RYG_FS0236

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

Received date: 15 Nov 2022
Calibration date: 21 Nov 2022
Issue date: 23 Nov 2022

Reference Used During Calibration

1.Standard Temperature Probe Model: STS-100 A500,
Serial No.: 667682-09, Due date: 23 Mar 2023
2.Digital Temperature Indicator Model: DTI-1000-A MK
II, Serial No.: 671407-00591 Due date: 22 July 2023

Calibration Condition

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

Calibration Procedure

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

Traceability

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

REVIEW BY	<i>Nirakorn P.</i>
APPROVED BY	<i>[Signature]</i>
NEXT CAL. DATE	21/11/23

Calibrated by
☒ Mr. Sorawit Thachalad
☐ Miss Jitraporn Lertsomphol



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

Certificate No. : CL-162-65
Page 2 of 2

Result of Calibration: ☒ Without Adjustment ☐ With Adjustment

Calibration Range: 20 - 40 °C

Function:

Table 1: This equipment was connected with wet bulb probe Model: HP3201.2 S/N: 20030506.

Dimension: Diameter 14 mm. Length 170 mm.

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
30	20.062	20.1	0.0	0.099
30	25.050	25.1	0.1	0.099
30	30.044	30.1	0.1	0.099
30	35.035	35.1	0.1	0.099
30	40.031	40.1	0.1	0.099

Table 2: This equipment was connected with temperature probe Model: TP3207.2 S/N: 15033223.

Dimension: Diameter 14 mm. Length 150 mm.

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
70	20.064	20.1	0.0	0.099
70	25.049	24.9	0.1	0.099
70	30.042	29.7	-0.3	0.099
70	35.035	34.5	-0.5	0.099
70	40.032	39.4	-0.6	0.099

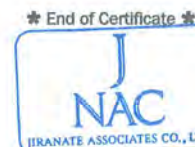
Table 3: This equipment was connected with Globe thermometer probe Model: TP3276.2 S/N: 17009684.

Dimension: Diameter 8 mm. Length 170 mm.

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
110	20.064	20.0	-0.1	0.099
110	25.050	25.0	-0.1	0.099
110	30.042	30.0	0.0	0.099
110	35.034	35.0	0.0	0.099
110	40.031	40.0	0.0	0.099

UUC* : Unit Under Calibration

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



CERTIFICATE OF CALIBRATION

Certificate No. : CL-012-66
Page 1 of 2

Equipment Name: Heat Stress Monitor
Manufacturer.: Delta OHM
Model: HD32.2
Serial No: 18018311
ID No: RYG_FS0356

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

Received date: 23 Jan 2023
Calibration date: 02 Feb 2023
Issue date: 06 Feb 2023

Reference Used During Calibration
1. Standard Temperature Probe Model: STS-100 A500,
Serial No.: 667682-09, Due date: 23 Mar 2023
2. Digital Temperature Indicator Model: DTI-1000-A MK
II, Serial No.: 671407-00591 Due date: 22 July 2023

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

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

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

REVIEW BY *Parinya P.*
APPROVED BY *[Signature]*
NEXT CAL. DATE *2/2/24*

Calibrated by
☒ Mr. Sorawit Thachalad
☐ Miss Jitraporn Lertsomphol



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

Certificate No. : CL-012-66
Page 2 of 2

Result of Calibration: ☒ Without Adjustment ☐ With Adjustment

Calibration Range: 20 - 40 °C

Function:

Table 1: This equipment was connected with wet bulb probe Model: HP3201.2 S/N: 18021466.
Dimension: Diameter 14 mm. Length 170 mm.

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
60	20.055	20.0	-0.1	0.099
60	25.048	25.0	0.0	0.099
60	30.039	30.0	0.0	0.099
60	35.030	35.0	0.0	0.099
60	40.016	40.0	0.0	0.099

Table 2: This equipment was connected with temperature probe Model: TP3207.2 S/N: 18021258.
Dimension: Diameter 14 mm. Length 150 mm.

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
70	20.057	20.2	0.1	0.099
70	25.048	25.1	0.1	0.099
70	30.039	30.0	0.0	0.099
70	35.029	35.0	0.0	0.099
70	40.015	39.9	-0.1	0.099

Table 3: This equipment was connected with Globe thermometer probe Model: TP3276.2 S/N: 18020493.
Dimension: Diameter 8 mm. Length 170 mm.

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
110	20.056	20.1	0.0	0.099
110	25.047	25.1	0.1	0.099
110	30.039	30.1	0.1	0.099
110	35.028	35.1	0.1	0.099
110	40.015	40.1	0.1	0.099

UUC* : Unit Under Calibration

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

* End of Certificate *



CERTIFICATE OF CALIBRATION

Certificate No. : CL-014-66
Page 1 of 2

Equipment Name: Heat Stress Monitor
Manufacturer: Delta OHM
Model: HD32.2
Serial No: 18018313
ID No: RYG_FS0358

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

Received date: 23 Jan 2023
Calibration date: 02 Feb 2023
Issue date: 06 Feb 2023

Reference Used During Calibration
1. Standard Temperature Probe Model: STS-100 A500,
Serial No.: 667682-09, Due date: 23 Mar 2023
2. Digital Temperature Indicator Model: DTI-1000-A MK
II, Serial No.: 671407-00591 Due date: 22 July 2023

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

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

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

REVIEW BY *Marakorn P.*
APPROVED BY *[Signature]*
NEXT CAL. DATE *2/2/24*

Calibrated by
☒ Mr. Sorawit Thachalad
☐ Miss Jitraporn Lertsomphol



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

Certificate No.: CL-014-66
Page 2 of 2

Result of Calibration: ☒ Without Adjustment ☐ With Adjustment

Calibration Range: 20 – 40 °C

Function:

Table 1: This equipment was connected with wet bulb probe Model: HP3201.2 S/N: 18021467,
Dimension: Diameter 14 mm. Length 170 mm.

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
60	20.055	20.1	0.0	0.099
60	25.048	25.1	0.1	0.099
60	30.039	30.1	0.1	0.099
60	35.029	35.1	0.1	0.099
60	40.018	40.1	0.1	0.099

Table 2: This equipment was connected with temperature probe Model: TP3207.2 S/N: 18021270,
Dimension: Diameter 14 mm. Length 150 mm.

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
70	20.051	20.2	0.1	0.099
70	25.051	25.1	0.0	0.099
70	30.039	30.0	0.0	0.099
70	35.029	35.0	0.0	0.099
70	40.021	39.9	-0.1	0.099

Table 3: This equipment was connected with Globe thermometer probe Model: TP3276.2 S/N: 18020497,
Dimension: Diameter 8 mm. Length 170 mm.

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
110	20.053	20.1	0.0	0.099
110	25.050	25.1	0.1	0.099
110	30.038	30.1	0.1	0.099
110	35.029	35.1	0.1	0.099
110	40.020	40.1	0.1	0.099

UUC* : Unit Under Calibration

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

* End of Certificate *



CERTIFICATE OF CALIBRATION

Certificate No. : CL-015-66
Page 1 of 2

Equipment Name: Heat Stress Monitor
Manufacturer.: Delta OHM
Model: HD32.2
Serial No: 18018314
ID No: RYG_FS0359

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

Received date: 23 Jan 2023
Calibration date: 02 Feb 2023
Issue date: 06 Feb 2023

Reference Used During Calibration
1. Standard Temperature Probe Model: STS-100 A500,
Serial No.: 667682-09, Due date: 23 Mar 2023
2. Digital Temperature Indicator Model: DTI-1000-A MK
II, Serial No.: 671407-00591 Due date: 22 July 2023

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

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

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

REVIEW BY	<i>Phangkorn P.</i>
APPROVED BY	<i>[Signature]</i>
NEXT CAL. DATE	2/2/24

Calibrated by
☒ Mr. Sorawit Thachalad
☐ Miss Jitraporn Lertsomphol



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

Certificate No. : CL-015-66
Page 2 of 2

Result of Calibration: ☒ Without Adjustment ☐ With Adjustment

Calibration Range: 20 – 40 °C

Function:

Table 1: This equipment was connected with wet bulb probe Model: HP3201.2 S/N: 18021465.
Dimension: Diameter 14 mm. Length 170 mm.

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
60	20.061	20.0	-0.1	0.099
60	25.048	25.0	0.0	0.099
60	30.045	30.0	0.0	0.099
60	35.030	35.0	0.0	0.099
60	40.021	40.0	0.0	0.099

Table 2: This equipment was connected with temperature probe Model: TP3207.2 S/N: 18021262.
Dimension: Diameter 14 mm. Length 150 mm.

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
70	20.062	20.1	0.0	0.099
70	25.048	24.9	-0.1	0.099
70	30.040	29.9	-0.1	0.099
70	35.032	34.8	-0.2	0.099
70	40.021	39.8	-0.2	0.099

Table 3: This equipment was connected with Globe thermometer probe Model: TP3276.2 S/N: 20008280.
Dimension: Diameter 8 mm. Length 170 mm.

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
110	20.060	20.0	-0.1	0.099
110	25.050	25.1	0.1	0.099
110	30.039	30.1	0.1	0.099
110	35.032	35.1	0.1	0.099
110	40.022	40.1	0.1	0.099

UUC* : Unit Under Calibration

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

* End of Certificate *








TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
CORPORATE SERVICES 3 : EQUIPMENT CALIBRATION AND TESTING SERVICES

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

Cert.No.: 23TW168
Page.: 1 of 2

Certificate of Testing

Equipment : DO Meter
Manufacturer : YSI
Model : 5000-115V
Serial No. : 15E102796
ID No. : RYG_EN0032
Received Date : 21 July 2023
Test Date : 24 July 2023
Reference : 2307-0713DSC-1
Submitted by : ALS Laboratory Group (Thailand) Co.,Ltd.
Rayong Branch
616/10 Moo 5, T.Maenam Khu, A.Pluakdaeng,
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 Sirithean
Approved by : 
Approved Signatory
() Malee Butkruea
(✓) Saithip Meangmai
() Warakorn Lernagatrakul
Issue Date : 26 July 2023

REVIEW BY 
APPROVED BY 
NEXT CAL. DATE 24/01/25



Cert.No.: 23TW168
Page.: 2 of 2

Condition of this result of calibration

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

Instruments	Serial No.	ID No.	Certificate No.	Due Date
1) Burette	-	130BU10	23CG1172	22 Mar 2025
2) Balance	1126143764	140RC004	22MM50	20 Sep 2023

2. Standard Material :-

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

Result : Dissolved Oxygen Meter Adjustment With Air 100 %

Dissolved Oxygen Probe No.: 15E100464

Titration Method (Azide Modification Method) (mg/L)	DO Meter Reading (mg/L)	Standard Deviation (mg/L)
8.18	8.17	0.0055

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

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TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES
534/4 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG BANGKOK 10250
TEL. 0-2717-3000-29 FAX. 0-2719-9484



Cert. No.: 23LM125
Page.: 1 of 2

Certificate of Calibration

Equipment : DO Meter with Sensor
Manufacturer : YSI
Model : 5000-115V
Serial No. : 15E102796
ID No. : RYG_EN0032
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 : 25 July 2023
Calibrated Date : 27 July 2023
Ambient Temperature : (26 ± 10) °C
Relative Humidity : (50 ± 30) %
AC Line Voltage : (220 ± 22) V

Calibrated by : Preecha Hlahib

Approved by : 
Approved Signatory

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

Issue Date : 31 July 2023

The Uncertainties are for a confidence probability of approximately 95%

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



Equipment : DO Meter with Sensor
Condition As-Received : Used Item
Reference : 2307-0713DSC-2
Procedure Used :-

Cert. No.: 23LM125
Page.: 2 of 2

Calibration were conducted using in-house calibration procedure CP-OT01 according to comparison with Industrial Platinum Resistance Thermometer (IPRT) into Temperature Bath.

The temperature scale used was based on ITS-90.

Condition of this result of calibration

1. Reference standard instrument:-

<u>Instrument</u>	<u>Serial No.</u>	<u>Cert. No.</u>	<u>Traceable</u>	<u>Due Date</u>
1) Digital Thermometer	2188080	221285	TPA	21 Oct 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.

Remark : TPA : Technology Promotion Association (Thailand - Japan)

Result of Calibration :- (*) Without Adjustment

Function : Temperature measurement.

This instrument was connected with temperature sensor, S/N.: 1228475367

<u>Calibration Point</u> (°C)	<u>Immersion Depth</u> (mm)	<u>Standard Temperature</u> (°C)	<u>UUC* Reading</u> (°C)	<u>Error</u> (°C)	<u>Uncertainty</u> (± °C)	<u>Coverage Factor</u> <i>k</i>
20.00	100	20.011	19.91	-0.101 °	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 %.

-o-o-

A 0053616

a 1159515



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES
534/4 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG BANGKOK 10250
TEL. 0-2717-3000-29 FAX. 0-2719-9484



Cert. No.: 23TM962
Page : 1 of 3

Certificate of Calibration

Equipment : Low Temp. Incubator
Manufacturer : Memmert
Model : IPP750
Serial No. : V818.0084
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 : 29 May 2023
Calibration Date : 29 May 2023
Ambient Temperature : $(26 \pm 10) ^\circ\text{C}$
Relative Humidity : $(50 \pm 30) \%$

Calibrated by : Man Pattanapongpaiboon

Approved by :

Approved Signatory

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

Issue Date : 7 June 2023

The Uncertainties are for a confidence probability of approximately 95%

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



Equipment : Low Temp. Incubator
Condition As-Received : Used Item
Reference : 2305-0398OC-2
Procedure Used :-

Cert. No.: 23TM962
Page : 2 of 3

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

The temperature scale used was based on ITS-90.

Condition of this result of calibration

1. Reference standard instrument:-

Instrument	Model	Serial No.	Cert. No.	Due Date
1) Data Acquisition	34972A	MY57013711	22LM93	02 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.

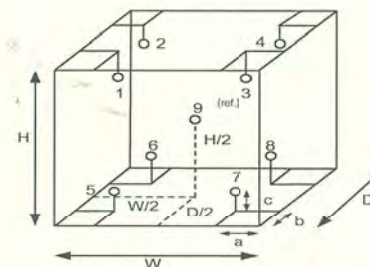
Result of Calibration :- (*) Without Adjustment

Function of UUC* : Temperature Source

Fresh air setting : Close

Environment during calibration

	Beginning	Finished
Temp. (°C)	23	23
REL.Humid. (%)	54	56
AC Supply (Volt)	223	222



Probe Installation Details :

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

Dimension of Chamber :

D = 0.60 m
W = 1.0 m
H = 1.2 m
Capacity = 0.75 m³

Position :	Ref. Std. ID No.:
1	18-18RTD-01
2	18-18RTD-02
3	18-18RTD-03
4	18-18RTD-04
5	18-18RTD-05
6	18-18RTD-10
7	18-18RTD-07
8	22-18RTD-08
9 (ref.)	18-18RTD-09

A 0054967

a 1165130



Equipment : Low Temp. Incubator
 Condition As-Received : Used Item
 Reference : 2305-0898OC-2
 Result of Calibration :- (*) Without Adjustment
 Function of UUC* : Temperature Source
 Fresh air setting : Close

Cert. No.: 23TM962

Page : 3 of 3

Calibration Point (°C)	UUC* Setting (°C)	UUC* Reading (°C)	Temperature stability (± °C)	Temperature uniformity (°C)	Overall Variation (°C)	Coverage Factor k
20.0	20.0	20.0	0.019	0.72	1.0	2

Calibration Point (°C)	Measured Temperature (°C)									Uncertainty (± °C)
	Position									
	1	2	3	4	5	6	7	8	9 (ref.)	
20.0	19.547	19.780	19.487	19.529	19.408	20.139	20.112	20.406	20.116	0.30

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 %.

-oOo-

Signature

a 1165129



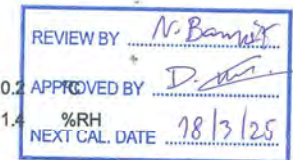
Certificate of Calibration

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

Certificate No.: C06230441
 Issued Date: 19 September 2023
 Job No.: WO-00005382
 Page: 1 of 3

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

Environment Condition: Temperature 23.9 °C ± 0.2
 Humidity 65.3 %RH ± 1.4



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

Calibration By: Mr.Nattapat Rungueang
 Calibration Date: 18 September 2023
 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 Stama Scientific Limited.

The standard for Wavelength Certificate No. 111583 and 111584
 The standard for Photometric Certificate No. 9114984 and 111588
 The standard for Stray light Certificate No. 111586 and 111585
 The standard for Spectral resolution Certificate No. 111587

Signature
 (Mr. Nattapat Rungueang)
 Person in charge

Signature
 (Mr. Nitinun Srihawan)
 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 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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 Phone: +66 2639 7000 Email: info.calibration@dksh.com Website: www.dksh.com/scientific-thailand

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CAL-FM-C06-15: 12 Sep 2022

Calibration Results:

Without Adjustment

Wavelength Accuracy (nm), The spectral bandwidth of Std at 2 nm and UUC at 2 nm

Standard Wavelength	Unit Under Calibration	Correction	Uncertainty
418.61	418.3	0.31	0.13
536.66	536.6	0.06	0.13
637.98	638.3	-0.32	0.13
748.48	748.7	-0.22	0.13
807.03	807.4	-0.37	0.13

Photometric Accuracy (Absorbance)

Wavelength	Standard absorbance	Unit Under Calibration	Correction	Uncertainty
	0.0000	0.000	0.0000	0.0045
420 nm	0.2930	0.289	0.0040	0.0045
	0.5168	0.519	-0.0022	0.0045
	1.0298	1.029	0.0008	0.0045
	0.0000	0.000	0.0000	0.0045
440 nm	0.2867	0.283	0.0037	0.0045
	0.5073	0.509	-0.0017	0.0045
	1.0083	1.007	0.0013	0.0045
	0.0000	0.000	0.0000	0.0045
465 nm	0.2516	0.250	0.0016	0.0045
	0.4595	0.462	-0.0025	0.0045
	0.9334	0.933	0.0004	0.0045
	0.0000	0.000	0.0000	0.0045
546.1 nm	0.2461	0.245	0.0011	0.0045
	0.4652	0.466	-0.0008	0.0045
	0.9468	0.946	0.0008	0.0045
	0.0000	0.000	0.0000	0.0045
590 nm	0.2594	0.259	0.0004	0.0045
	0.5040	0.505	-0.0010	0.0045
	1.0032	1.002	0.0012	0.0045
	0.0000	0.000	0.0000	0.0045
635 nm	0.2579	0.257	0.0009	0.0045
	0.4971	0.497	0.0001	0.0045
	0.9720	0.971	0.0010	0.0045

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
	0.7355	0.737	-0.0015	0.0080
257 nm	0.0000	0.000	0.0000	0.0080
	0.8574	0.857	0.0004	0.0080
313 nm	0.0000	0.000	0.0000	0.0080
	0.2864	0.290	-0.0036	0.0080
350 nm	0.0000	0.000	0.0000	0.0080
	0.6374	0.637	0.0004	0.0080

Stray light *

Standard: cut-off	UUC: Wavelength (nm)	UUC: Transmission (%T)	Absorbance (A)
260.62 +/- 0.11 nm	260.6	1.3	1.886
391.44 +/- 0.11 nm	391.4	1.3	1.886

Spectral Resolution *

Nominal Concentration 0.02 % v/v	Peak	Trough	Ratio	SBW
Standard Wavelength (nm)	268.66	266.69	1.38	2.00
UUC: Wavelength (nm)	268.2	266.1		
Std Absorbance (A)	0.4566	0.2780		
Absorbance (A)	0.413	0.300		

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

The End of Certificate



ใบตรวจสอบสภาพเครื่องวัดสิ่งแวดล้อม

เลขที่ใบงาน: WO-00005382

ชนิดเครื่องมือ: SPECTROPHOTOMETER รุ่น: DR6000

หมายเลขเครื่อง: 1627845

ตรวจสอบ (รับ)		รายการตรวจเช็ค	ตรวจสอบ (ส่ง)		หมายเหตุ
18 Sep 2023			18 Sep 2023		
ปกติ	ไม่ปกติ		ปกติ	ไม่ปกติ	
		General			
<input checked="" type="checkbox"/>	<input type="checkbox"/>	1. ความสมบูรณ์เครื่อง	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	2. ความสะอาด (ช่องใส่ตัวอย่าง, ภายใน-นอกเครื่อง)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	3. สวิทช์ ปิด – เปิด เครื่อง (On-Off Switch)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	4. ปุ่มกด (Keypad)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	5. หน้าจอ (Display, Screen Contrast)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
		Spectrophotometer			
<input type="checkbox"/>	<input type="checkbox"/>	6. แรงดันไฟฟ้า (Battery Backup) ≥ 2.5 VDC	<input type="checkbox"/>	<input type="checkbox"/>	
<input type="checkbox"/>	<input type="checkbox"/>	7. ตัวหมุนเลือกความยาวคลื่น (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"/>	*
<input checked="" type="checkbox"/>	<input type="checkbox"/>	9. แหล่งกำเนิดแสง (UV $< 3,000$ hour)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	9.2 Hours
<input checked="" type="checkbox"/>	<input type="checkbox"/>	10. แหล่งกำเนิดแสง (Visible $< 5,000$ hour)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	741.5 Hours
<input checked="" type="checkbox"/>	<input type="checkbox"/>	11. ช่องวัดหลายตัวอย่าง (Carousel Module)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
		pH Meter and Conductivity Meter			
<input type="checkbox"/>	<input type="checkbox"/>	12. อิเล็กโทรด (Electrode and Connection Cable)	<input type="checkbox"/>	<input type="checkbox"/>	
<input type="checkbox"/>	<input type="checkbox"/>	13. ระดับสารละลายใน Electrode (Level KCl)	<input type="checkbox"/>	<input type="checkbox"/>	
<input type="checkbox"/>	<input type="checkbox"/>	14. ฝาปิดกันปลาย Electrode (Dust Protection Hood)	<input type="checkbox"/>	<input type="checkbox"/>	
<input type="checkbox"/>	<input type="checkbox"/>	15. ขาจับอิเล็กโทรด (Stand)	<input type="checkbox"/>	<input type="checkbox"/>	
		Turbidimeter			
<input type="checkbox"/>	<input type="checkbox"/>	16. ค่าความขุ่นที่ต่ำสุด (No Sample)	<input type="checkbox"/>	<input type="checkbox"/>	
<input type="checkbox"/>	<input type="checkbox"/>	17. ระดับการส่องสว่างของแสง (≥ 2.5 ไมเกิน 3.0)	<input type="checkbox"/>	<input type="checkbox"/>	
		Automatic titrator			
<input type="checkbox"/>	<input type="checkbox"/>	18. สภาพ Piston Burettes	<input type="checkbox"/>	<input type="checkbox"/>	
<input type="checkbox"/>	<input type="checkbox"/>	19. Function Rinsing and Dosing	<input type="checkbox"/>	<input type="checkbox"/>	
<input type="checkbox"/>	<input type="checkbox"/>	20. ระบบท่อสายยางและอุปกรณ์ประกอบ	<input type="checkbox"/>	<input type="checkbox"/>	

เพิ่มเต็ม/ข้อแนะนำ: *656.1nm=656.1nm

*486.0nm=485.5nm

Mr.Nattapat Rungueang

Service Engineer

บริษัท เทคโนโลยี จำกัด
DKSH Technology Limited
2533 ถนนสุขุมวิท แขวงบางจาก เขตพระโขนง กรุงเทพมหานคร 10260
2533 Sukhumvit Road, Bangchak, Phraekhanong, Bangkok 10260
Phone: +66 2639 7000 Email: info.calibration@dksh.com Website: www.dksh.com/scientific-thailand

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CAL-FM-R31-03: 20 Jul 2022



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TEL. 0-2717-3000-29 FAX. 0-2719-9484



Cert.No.: 23CH275


Page.: 1 of 3

Certificate of Calibration

Equipment : pH Meter
Manufacturer : Mettler Toledo
Model : SevenCompact S220
Serial No. : C104059460
ID No. : RYG_EN0183
Condition As-Received: Used Item
Received Date : 24 February 2023
Calibration Date : 27 February 2023
Reference : 2302-0886DSC-2
Submitted by : ALS Laboratory Group (Thailand) Co.,Ltd.
(Rayong Branch)
616/10 Moo 5, T.Maenam Khu, A.Pluakdaeng,
Rayong 21140, Thailand

Ambient Temperature : $(25 \pm 2.5) ^\circ\text{C}$
Relative Humidity : $(50 \pm 15) \%$
Calibration Procedure : In - house method :
- CP-CH5 by direct measurement with standard voltage calibrator and direct measurement with certified reference material (CRM)
- CP-CH8 by comparison with standard thermometer

Calibrated by : Walalak Sirithean

Approved by : 
Approved Signatory

() Malee Butkruea
(✓) Saithip Meangmai
() Warakorn Lernagtrakul

Issue Date : 28 February 2023
The Uncertainties are for a confidence probability of approximately 95%

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A 0051538



Cert.No.: 23CH275
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	130RC116	22E2769	24 Aug 2023
2) Ref. Standard Thermometer	4982054	110RC044	22I1306	27 Oct 2023

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

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

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

Buffer Solution	Manufacturer	Lot No.	Exp. date
pH 4.008	CPA chem	826588	09 July 2024
pH 6.987	CPA chem	826589	09 July 2023
pH 10.010	CPA chem	863835	28 Dec 2023

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

Calibration Results

Function : mV Measurement

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

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

Saitrip

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Cert.No.: 23CH275
Page.: 3 of 3

Calibration Results

Function : pH Measurement

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

Unit Under Calibration	Standard pH Buffer Solution	Actual pH Reading	Actual mV Reading (mV)	Uncertainty of pH measurement (\pm)	Coverage factor k
pH Electrode S/N.: 1453404	4.008	4.008	179.1	0.0046	2.00
	6.987	6.988	4.7	0.0084	2.00
	10.010	10.013	-172.4	0.0069	2.00

Function : Temperature Measurement

(*) Without adjustment

This equipment was connected with Temperature Probe;

- Model : InLabExpert 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 (\pm °C)	Coverage factor k
25.0	25.001	24.8	-0.201	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 %.

-o0o-

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a 1149924



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



Certificate of Calibration

Certificate No. : 23E753
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: 24 February 2023
Calibration Date: 28 February 2023

Reference: 2302-0886DSC
Ambient Temperature: (23 ± 2) °C
Relative Humidity: (50 ± 10) %
Submitted by: ALS Laboratory Group (Thailand) Co.,Ltd. (Rayong Branch)
616/10 Moo 5, T.Maenam Khu, A.Pluakdaeng,
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	22E1670	18 May 2023

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

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

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

-National Institute of Metrology Thailand (NIMT)

Calibrated by : Wutchareeporn Wongchutikrane
Issue Date : 02 March 2023

Approved Signatory :
[] Phalinee Prabpaipal
[x] Nuntawat Khamchai
[] Pornthippa Tameyakul



Cert. No.: 23E753
Page.: 2 of 2

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

Function:	DC voltage measuremer	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	99.9	-0.1	65	
	150.0000	149.9	-0.1	69	
	200.0000	199.9	-0.1	72	

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

UUC* = Unit Under Calibration.

-o0o-

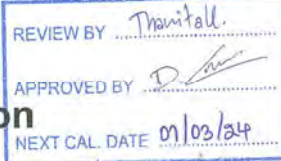
B 0309672

a 1150477

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



SARTORIUS



Certificate of Calibration

Model Number : MSE224S-100-DU Certificate No. : 23BCI0112
Description : Analytical Balance Issued Date : Friday, March 03, 2023
Serial Number : 0026207038 Reference No. : 204833
ID No. : RYG_EN0002
Manufacturer : Sartorius Page No. : 1 of 2

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

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

Calibrated By : Mr.Chonchai Inthana Calibration Procedure No. : This calibration was conducted by
Calibration Date : Wednesday, March 01, 2023 Using in-house calibration procedure number (WI-003)
Based on UKAS LAB 14 : 2019

Metrological data : Ambients Conditions:
Capacity : 220 g Readability : 0.0001 g Temperature : 23.6 °C ± 5.0 °C
Humidity : 60.0 % RH ± 10.0 % RH
Pressure : ±

Reasons for calibration

☐ New Installation ☐ Service / Repaired ☒ Re-calibration/ Maintenance

Equipment Condition: ☒ Good Operate ☐ Fair

Measurement Method UKAS Publication Ref :Lab 14

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

Traceability:

Model Number	Description	Traceability	Certificate No.	Due Date
YCS011-522-00	Sartorius weight set 1mg - 5000g E2,YCS011-522-00	SPC-RT	C02212565	14-Sep-2023
MHB-382SD	Humidity/Barometer/Temp Lutron MHB-382SD	DKSH	C19220444	5-Sep-2023

This certificate relate and apply this equipment only

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

Mr.chonchai Inthana(Technical Manager)



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

SARTORIUS

Certificate of Calibration

Model Number : MSE224S-100-DU Certificate No. : 23BCI0112
Description : Analytical Balance Issued Date : Friday, March 03, 2023
Serial Number : 0026207038 Reference No. : 204833
ID No. : RYG_EN0002
Manufacturer : Sartorius Page No. : 2 of 2

Calibration Results : Without Adjustment

Repeatability

The reproducibility is the ability of a weighing instrument to display nearly identical readouts under constant test conditions when the same load within a measurement series is placed repeatedly on the weighing pan in the same manner. The standard deviation is used to express reproducibility quantitatively.

Nominal Value : (Low Load)	20.0000	199.9999
20 g	20.0000	200.0000
Tolerance	20.0000	199.9999
0.0001 g	20.0000	200.0000
	20.0000	199.9999
Nominal Value : (High Load)	20.0000	199.9999
200 g	19.9999	200.0000
Tolerance	20.0000	200.0000
0.0001 g	20.0000	199.9999
	20.0000	200.0000
Standard Deviation	0.00003	0.00005

Eccentricity (Off-center loading error)

The off-center loading error is yielded by the difference between the readout of the load, i.e. 1/3 or 1/4 of maximum capacity, placed in the middle of the weighing pan and between each of four additional measurement points (positions defined according to OIML R76).

Nominal value :	100	g
Tolerance	0.0004	g
		Difference
	1	-
	2	-0.0001
	3	-0.0001
	4	0.0001
	5	0.0002
	6	-

Linearity

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

Tolerance	0.0002	g			
Nominal Value	Conventional Mass Value	Displayed Value	Deviation	Uncertainty	
(g)	(g)	(g)	(g)	(g)	
0.01	0.0100	0.0100	0.0000	0.00014	
0.05	0.0500	0.0500	0.0000	0.00014	
0.1	0.1000	0.1000	0.0000	0.00014	
0.5	0.5000	0.5000	0.0000	0.00014	
1	1.0000	1.0000	0.0000	0.00014	
5	5.0000	5.0000	0.0000	0.00014	
10	10.0000	10.0001	0.0001	0.00014	
20	20.0000	20.0000	0.0000	0.00024	
50	50.0000	50.0000	0.0000	0.00015	
100	100.0000	99.9999	-0.0001	0.00019	
200	200.0000	200.0000	0.0000	0.00032	

End of Report.



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TEL. 0-2717-3000-27 FAX. 0-2719-9484



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)
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 : $(26 \pm 10) ^\circ\text{C}$
Relative Humidity : $(50 \pm 30) \%$
Calibrated by : Preecha Hlahib
Approved by :
() Pornthippa Tameyakul
(✓) Malee Butkruea
() Suwit Imjai
Issue Date : 2 November 2022



The Uncertainties are for a confidence probability of approximately 95%

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



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-OT02 according to direct measurement method with Data Acquisition which connected with Resistance Temperature Detector (RTD).

The temperature scale used was based on ITS-90.

Condition of this result of calibration

1. Reference standard instrument:-

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

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

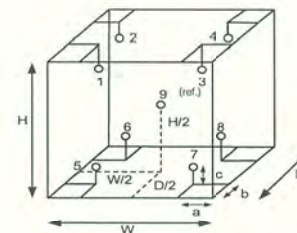
3. This certification is traceable to the International System of Unit.

Result of Calibration :- (*) Without Adjustment

Function of UUC* : Temperature Source

Fresh air setting : Close

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



Probe Installation Details :

a = 5.0 cm
b = 5.0 cm
c = 5.0 cm

Dimension of Chamber :

D = 0.33 m
W = 0.40 m
H = 0.40 m
Capacity = 0.053 m³

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

Malee



Equipment : Hot Air Oven
 Condition As-Received : Used Item
 Reference : 2210-0376OC-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 %.

-o0o-

Malu.

a 1132472

RYG_EN0061



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
 CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES
 534/4 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG BANGKOK 10250
 TEL. 0-2717-3000-27 FAX. 0-2719-9484



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. Pluakdaeng,
 Rayong 21140, Thailand
 Location : Wet Chemistry Lab
 Received Order : 20 October 2022
 Calibration Date : 20 October 2022
 Ambient Temperature : (26 ± 10) °C
 Relative Humidity : (50 ± 30) %

Calibrated by : Preecha Hlahib

Approved by :
 Approved Signatory

() Ponthippa Tameyakul
 (/) Malee Butkruea
 () Suwit Imjai

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 3 : Equipment Calibration and Testing Services.

A 0046906



Equipment : Water Bath
Condition As-Received : Used Item
Reference : 2210-0376OC-4
Cert. No.: 22TM1491
Page : 2 of 3

Procedure Used :-

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

The temperature scale used was based on ITS-90.

Condition of this result of calibration

1. Reference standard instrument:-

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

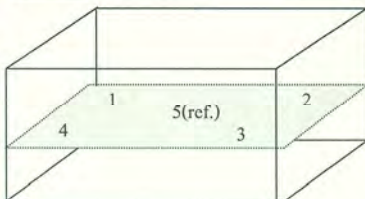
2. This certificate is valid only to the item calibrated on date and place of calibration.

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

Result of Calibration :- (*) Without Adjustment

Function of UUC* : Temperature Source

	Environmental		AC Voltage Supply
	(°C)	(%R.H.)	
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

Malu

a 1132471



Equipment : Water Bath
Condition As-Received : Used Item
Reference : 2210-0376OC-4
Cert. No.: 22TM1491
Page : 3 of 3
Result of Calibration :- (*) Without Adjustment
Function of UUC* : Temperature Source

Calibration point (°C)	UUC* Setting (°C)	UUC* Reading (°C)	Average* Standard Reading (°C)				
			Position				
			1	2	3	4	5 (ref.)
85.0	85.0	85.0	84.527	84.563	84.628	84.516	84.580

Calibration point (°C)	Uniformity (°C)	Stability (± °C)	Uncertainty (± °C)	Coverage Factor <i>k</i>
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 %.

-o0o-

Malu

a 1132470



Metrological Center

SCI ECO Services Company Limited

33/2 Moo 3, T.Banpa, A.Kaengkhoi, 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.com



NSC-TISI-TIS 17025
CALIBRATION 0244



Metrological Center

SCI ECO Services Company Limited

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



NSC-TISI-TIS 17025
CALIBRATION 0244

Certificate No. T230116

Page 2 of 4

Certificate No. T230116

Page 1 of 4

Certificate of Calibration

Equipment : Chamber (Cooling Room)

Manufacturer : MODULAR

Model : IREVCOHCOO

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

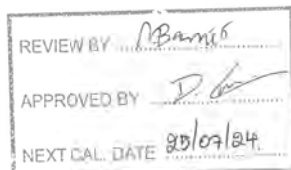
Customer Location : Laboratory

Date of Receipt : 23 January 2023

Calibrated By : Atiphong Rongrat (Technician)

Approved By : Boonchai Suriyawong / Boonchai Suriyawong (Site Calibration Manager)

Date of Issue : 07 FEB 2023



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

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

FM-L14118/31-08-64

Calibration Report

Equipment : Chamber (Cooling Room)

Date of Calibration : 25 January 2023

Environment : Temperature : 23.4-24.9 °C

Line Voltage : 221.4-230.2 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 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	TN141-TN150	T222123	5 October 2023
TC	TYPE T	TN151-TN160	T222123	5 October 2023
DATA LOGGER	34970A	T150	T222123	5 October 2023

3. This certificate is traceable to :

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

4. Condition of calibrated item : good

Equipment Description :

Time Constant 1 Hour - Minute At 3 °C

Fresh Air Damper ☐ Open ☐ Min ☐ Medium ☐ Max

☐ Close

☒ Not Available

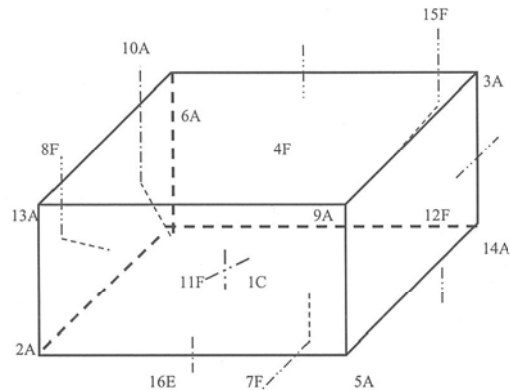
5. Adjustment :

(X) without adjustment () after adjustment

Approved By. Boonchai Suriyawong

FM-L15 I17/15-05-63

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. Jim Kim

Calibration Report

Measurement Results

Calibration Point	Average Standard Reading at each position (°C)											
	TN141	TN142	TN143	TN144	TN145	TN146	TN147	TN148	TN149	TN150	TN151	TN152
3.0	3.03	3.16	3.15	3.19	3.45	3.47	3.21	3.35	3.54	3.45	3.24	3.34
	TN153	TN154	TN155	TN156								
	3.28	3.22	3.28	3.21								

Chamber (Cooling Room)			Temperature Distribution			
Setting (°C)	Reading (°C)		Stability (+°C)	Uniformity (°C)	Uncertainty (± °C)	Coverage Factor <i>k</i>
	Min , Max	Average				
3.0	2.8 , 4.1	3.5	1.20	1.20	1.90	2.07

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. Jim Kim






TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
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TEL. 0-2717-3000-29 FAX. 0-2719-9484



Cert.No.: 23CH915
Page.: 1 of 2

Certificate of Calibration

Equipment : pH Meter
Manufacturer : Mettler Toledo
Model : Seven2Go S2
Serial No. : C129171496
ID No. : RYG_FS0550
Condition As-Received: Used Item
Received Date : 21 July 2023
Calibration Date : 24 July 2023
Reference : 2307-0713DSC-3
Submitted by : ALS Laboratory Group (Thailand) Co.,Ltd. Rayong Branch
616/10 Moo 5, T.Maenam Khu, A.Pluakdaeng,
Rayong 21140, Thailand
Ambient Temperature : (25 ± 2.5) °C
Relative Humidity : (50 ± 15) %
Calibration Procedure : In - house method :
- CP-CH5 by direct measurement with standard
voltage calibrator and direct measurement
with certified reference material (CRM)
Calibrated by : Warakorn Lernagatrakul
Approved by : 
Approved Signatory
() Malee Butkruea
(✓) Saithip Meangmal
() Warakorn Lernagatrakul
Issue Date : 26 July 2023

REVIEW BY 
APPROVED BY 
NEXT CAL. DATE 24/07/24

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.



Cert. No.: 23CH915
Page.: 2 of 2

Condition of this calibration result

1. Reference Standard Instrument : -

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

This certification is traceable to the International System of Unit maintained through:-
- Technology Promotion Association (Thailand - Japan)

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	863832	28 Dec 2024
pH 6.986	CPA chem	863833	28 Dec 2023
pH 10.010	CPA chem	863835	28 Dec 2023

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

Calibration Results

Function : mV Measurement

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

Unit Under Calibration	Nominal Value	Standard Voltage Input	Actual Reading		Uncertainty of Measurement (±mV)	Coverage factor k
	pH	mV	mV	pH		
pH Meter	4.00	177.48	177	4.00	0.58	2.00
S/N.: C129171496	7.00	0.00	0	7.00	0.58	2.00
	10.00	-177.48	-177	10.00	0.58	2.00

Function : pH Measurement

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

Unit Under Calibration	Standard pH Buffer Solution	Actual pH Reading	Actual mV Reading (mV)	Uncertainty of pH measurement (±)	Coverage factor k
pH Electrode S/N.: 3184175	4.008	4.01	185	0.0079	2.00
	6.986	6.99	12	0.011	2.00
	10.010	10.01	-166	0.0095	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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534/4 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG BANGKOK 10250
TEL. 0-2717-3000-29 FAX. 0-2719-9484



Cert. No.: 23LM126

Page.: 1 of 2

Certificate of Calibration

Equipment : pH Meter with Sensor
Manufacturer : Mettler Toledo
Model : Seven2Go S2
Serial No. : C129171496
ID No. : RYG_FS0550
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 : 25 July 2023
Calibrated Date : 27 July 2023
Ambient Temperature : (26 ± 10) °C
Relative Humidity : (50 ± 30) %
AC Line Voltage : (220 ± 22) V

Calibrated by : Preecha Hlahib

Approved by : 
Approved Signatory

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

Issue Date : 31 July 2023

The Uncertainties are for a confidence probability of approximately 95%

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



Equipment : pH Meter with Sensor
Condition As-Received : Used Item
Reference : 2307-0713DSC-4

Cert. No.: 23LM126

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	Serial No.	Cert. No.	Traceable	Due Date
1) Digital Thermometer	2188080	221285	TPA	21 Oct 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.

Remark : TPA : Technology Promotion Association (Thailand - Japan)

Result of Calibration :- (*) Without Adjustment

Function : Temperature measurement.

This instrument was connected with temperature sensor, S/N.: 3184175

Calibration Point (°C)	Immersion Depth (mm)	Standard Temperature (°C)	UUC* Reading (°C)	Error (°C)	Uncertainty (± °C)	Coverage Factor k
25.0	100	25.007	25.3	0.293	0.16	2.00
30.0	100	30.004	30.4	0.396	0.16	2.00
40.0	100	40.005	40.4	0.395	0.16	2.00
50.0	100	50.009	50.4	0.391	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 %.

-o0o-



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
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TEL. 0-2717-3000-27 FAX. 0-2719-9484



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 : $(26 \pm 10) ^\circ\text{C}$
Relative Humidity : $(50 \pm 30) \%$
Calibrated by : Man Pattanapongpaiboon

Approved by :
Approved Signatory

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

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 3 : Equipment Calibration and Testing Services.

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



Equipment : Hot Air Oven
Condition As-Received : Used Item
Reference : 2210-0376OC-2
Procedure Used :-

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

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

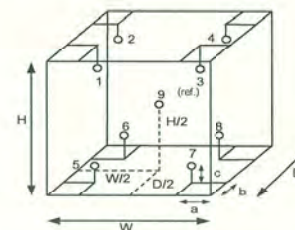
2. This certificate is valid only to the item calibrated on date and place of calibration.

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



Environment during calibration		
	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

Probe Installation Details :

a = 5.0 cm
b = 5.0 cm
c = 5.0 cm

Dimension of Chamber :

D = 0.40 m
W = 0.56 m
H = 0.48 m
Capacity = 0.11 m³



Equipment : Hot Air Oven
Condition As-Received : Used Item
Reference : 2210-0376OC-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)	Measured Temperature (°C)								
	Position								
	1	2	3	4	5	6	7	8	9 (ref.)
104.0	103.768	103.734	103.723	103.800	104.215	104.131	104.132	103.740	103.747
180.0	179.723	179.359	179.439	179.489	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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Maku .

RYG_EN0188

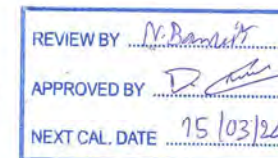


Certificate of Calibration

Equipment: Block Digestion Unit
Model: KT-20s
Serial No. (or ID.): 5720210009/5770200073
Manufacturer: Gerhardt
Condition: In Condition
Certificate No.: C29230010
Issued Date: 18 March 2023
Job No.: KSPR2304362
Page: 1 of 4
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: 25 °C ± 0.5 °C
Humidity: 65 %RH ± 3.7 %RH
Voltage: 231 VAC ± 3.1 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. Nakarin Ruenros

Calibration Date: 15 March 2023

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.: TC22/0080

Signature of Mr. Nakarin Ruenros

(Mr. Nakarin Ruenros)
Person in charge

Signature of Mr. Udon Srichana

(Mr. Udon Srichana)
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 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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DKSH Technology Limited
2533 สุขุมวิท 21 ถนนสุขุมวิท แขวงคลองเตย เขตคลองเตย กรุงเทพมหานคร 10260
Phone: +66 2639 7000 Email: info.calibration@dksh.com Website: www.dksh.com/scientific-thailand

Delivering Growth - In Asia and Beyond.

CAL-FM-C29-07: 20 Jul 2022

a 1132465

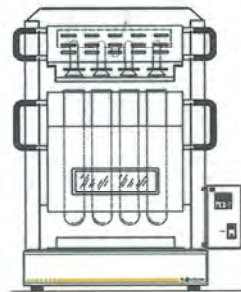
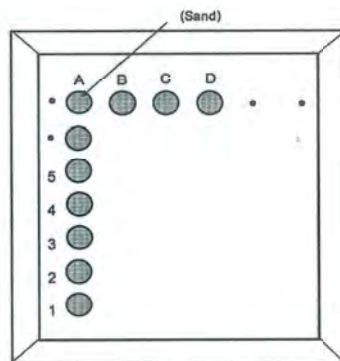


Fig. 1.: Front view



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: Before adjustment

Locations	Desired (°C)	Setting (°C)	Indicating (°C)	Measured Temperature (°C)	Correction of UUC. (°C)	Uncertainty (± °C)
A1	380	380	380	375.1	-4.9	1.5
A2				374.3	-5.7	1.5
A3				374.6	-5.4	1.5
A4				376.3	-3.7	1.5
A5				373.2	-6.8	1.5
B1				374.4	-5.6	1.5
B2				374.3	-5.7	1.5
B3				374.6	-5.4	1.5
B4				375.2	-4.8	1.5
B5				375.1	-4.9	1.5
C1				373.5	-6.5	1.5
C2				372.8	-7.2	1.5
C3				372.1	-7.9	1.5
C4				372.2	-7.8	1.5
C5				374.5	-5.5	1.5
D1				374.7	-5.3	1.5
D2				375.3	-4.7	1.5
D3				375.5	-4.5	1.5
D4				375.8	-4.2	1.5
D5				375.1	-4.9	1.5

**Calibration Results:
After adjustment**

Locations	Desired (°C)	Setting (°C)	Indicating (°C)	Measured Temperature (°C)	Correction of UUC. (°C)	Uncertainty (± °C)
A1	380	380	380	379.0	-1.0	1.5
A2				378.7	-1.3	1.5
A3				379.4	-0.6	1.5
A4				379.2	-0.8	1.5
A5				379.2	-0.8	1.5
B1				379.8	-0.2	1.5
B2				379.2	-0.8	1.5
B3				379.5	-0.5	1.5
B4				378.9	-1.1	1.5
B5				379.1	-0.9	1.5
C1				379.1	-0.9	1.5
C2				377.7	-2.3	1.5
C3				378.4	-1.6	1.5
C4				378.2	-1.8	1.5
C5				378.0	-2.0	1.5
D1				379.5	-0.5	1.5
D2				378.7	-1.3	1.5
D3				379.7	-0.3	1.5
D4				379.5	-0.5	1.5
D5				379.4	-0.6	1.5

The End of Certificate

ใบตรวจสอบสภาพเครื่องควบคุมอุณหภูมิ

เลขที่ใบงาน: KSPR2304362

ชนิดเครื่องมือ: Block Digestion Unit

รุ่น: KT-20s

หมายเลขเครื่อง: 5720210009/5770200073

ตรวจสอบ (รับ)		รายการตรวจเช็ค	ตรวจสอบ (ส่ง)		หมายเหตุ
15 Mar 2023			15 Mar 2023		
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. สภาพ Hole	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input type="checkbox"/>	<input type="checkbox"/>	6. สภาพฝาปิด	<input type="checkbox"/>	<input type="checkbox"/>	ไม่มี
<input checked="" type="checkbox"/>	<input type="checkbox"/>	7. สภาพตัวเครื่อง	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	8. สภาพแวดล้อม ณ สถานที่ตั้งเครื่อง	<input checked="" type="checkbox"/>	<input type="checkbox"/>	

ขอแนะนำ :

Mr. Nakarin Ruenros
Service Engineer



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



Certificate of Calibration

Certificate No. : 23E3924
Page : 1 of 2

Equipment : pH Meter
Manufacturer: Mettler Toledo
Model : SevenExcellence
Serial No.: B834291445
ID No.: RYG_EN0152
Condition As-Received: Used Item
Received Date: 08 December 2023
Calibration Date: 14 December 2023
Reference: 2312-0151DSC
Ambient Temperature: (23 ± 2) °C
Relative Humidity: (50 ± 10) %
Submitted by: ALS Laboratory Group (Thailand) Co.,Ltd. Rayong Branch
616/10 Moo 5, T.Maenam Khu, A.Pluakdaeng,
Rayong 21140, Thailand

Procedure used: Calibration were conducted using calibration procedure No. CP-E17 according to EURAMET cg-15.

Condition of this result of calibration

1.Reference standards instruments :

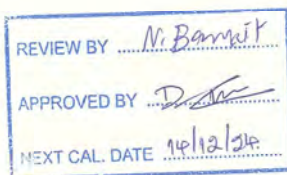
Instrument	Model	Serial No.	Certificate No.	Due Date
1) Multi-Product Calibrator	5502A	2435802	EE-0041-23	26 Apr 2024

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 through:-

-National Institute of Metrology Thailand (NIMT)



Calibrated by : Napachanok Prasomsosiri
Issue Date : 15 December 2023

Approved Signatory :
[] Phalinee Prabpaipal
[x] Nuntawet Khamchai
[] Pongsagorn Boonyaporn

B 0331106



Cert. No.: 23E3924

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	-199.9	0.1	68
-150.0000	-150.0	0.0	65
-100.0000	-100.0	0.0	63
-50.0000	-50.0	0.0	61
0.0000	0.0	0.0	58
50.0000	50.0	0.0	61
100.0000	100.0	0.0	63
150.0000	150.0	0.0	65
200.0000	199.9	-0.1	68

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

UUC*= Unit Under Calibration.

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TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES
534/4 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG BANGKOK 10250
TEL. 0-2717-3000-29 FAX. 0-2719-9484



Cert.No.: 23CH1574
Page.: 1 of 3

Certificate of Calibration

Equipment : pH Meter
Manufacturer : Mettler Toledo
Model : SevenExcellence
Serial No. : B834291445
ID No. : RYG_EN0152
Condition As-Received: Used Item
Received Date : 08 December 2023
Calibration Date : 15 December 2023
Reference : 2312-0151DSC-3
Submitted by : ALS Laboratory Group (Thailand) Co.,Ltd. Rayong Branch
616/10 Moo 5, T.Maenam Khu, A.Pluakdaeng,
Rayong 21140, Thailand
Ambient Temperature : (25 ± 2.5) °C
Relative Humidity : (50 ± 15) %
Calibration Procedure : In - house method :
- CP-CH5 by direct measurement with standard
voltage calibrator and direct measurement with
certified reference material (CRM)
- CP-CH8 by comparison with standard thermometer

Calibrated by : Warakorn Lerngagtrakul

Approved by :

Approved Signatory

() Saithip Meangmai
() Warakorn Lerngagtrakul
(☒) Ponpan Paipim

Issue Date : 19 December 2023

The Uncertainties are for a confidence probability of approximately 95%

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



Cert.No.: 23CH1574
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	130RC116	23E2802	27 Aug 2024
2) Ref. Standard Thermometer	4982054	110RC044	23I908	26 July 2024

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

- Technology Promotion Association (Thailand-Japan)

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	913598	14 July 2025
pH 6.986	CPA chem	931959	01 Oct 2024
pH 9.997	CPA chem	940106	02 Nov 2024

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

Calibration Results

Function : mV Measurement

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

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



Cert.No.: 23CH1574
Page.: 3 of 3

Calibration Results

Function : pH Measurement

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

Unit Under Calibration	Standard pH Buffer Solution	Actual pH Reading	Actual mV Reading (mV)	Uncertainty of pH measurement (\pm)	Coverage factor k
pH Electrode	4.008	4.013	184.1	0.0045	2.00
S/N.: 3225368	6.986	6.998	8.7	0.0084	2.00
	9.997	10.002	-164.7	0.0088	2.11

Function : Temperature Measurement

(*) Without adjustment

This equipment was connected with Temperature Probe;

- Model : InLab®Expert Pro-ISM

- Serial No. : 3225368

Dimension of probe;

- Length : 120 mm

- Diameter : 12 mm

- Immersion Depth : 100 mm

Calibration Point (°C)	Standard Temperature (°C)	UUC* Reading (°C)	Error (°C)	Uncertainty of measurement (\pm °C)	Coverage factor k
25.0	25.003	24.3	-0.703	0.13	2.00

Remark : - UUC* = Unit Under Calibration

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

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RL

a 1193851



Bara Scientific
Solutions of Success

Bara Scientific Co., Ltd.

968 U Chu Liang Building Floor7 Rama4 Road
Silom Bangrak Bangkok Thailand 10500
Tel : 02-6324300 Fax : 02-6375496-7
www.barascientific.com



Certificate of Calibration

Number of Page(s) 1 of 3

Certificate No. BSCC-UV-367/23
Equipment UV/Vis Spectrophotometer
Model UV-1800
Manufacturer Shimadzu
Serial No. A11454908533CD
ID No. BKK_EN0018
Date of receipt 15 September 2023
Date of calibration 15 September 2023
Date of issue 22 September 2023

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

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

Temperature (23.4 - 24.7) °C (On site)
Humidity (55.5 - 61.2) %RH (On site)

Equipment condition Good Operation

Calibration Location Organic Prep

Calibration Procedure In-house method WI-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. 95937 and 95924
Stray Light is traceable to certificate No. 95908
The above certificate are traceable to SI unit through Starna Scientific Ltd.
(UKAS accredited calibration laboratory NO. 0659)

Calibrated by Mr. Wanchana Janloey

Approved by

Mr. Kanchit Choothep
Technical Manager

The above results are valid exclusively for the calibrated item(s) as mention in this report / certificate.
Advertising the report / Certificate and publicity of the results are prohibited and also shall not be reproduced
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Bara Scientific Co., Ltd.
968 U Chu Liang Building Floor7 Rama4 Road
Silom Bangrak Bangkok Thailand 10500
Tel : 02-6324300 Fax : 02-6375496-7
www.barascientific.com



Certificate of Calibration

Certificate No. **BSCC-UV-367/23**

Number of Page(s) **2 of 3**

Calibration Results:

1.Wavelength Accuracy

Certified Wavelength (nm)	UUC (nm)	Error (nm)	Uncertainty (\pm nm)
241.70	241.67	-0.03	0.18
334.02	334.03	0.01	0.18
418.53	418.59	0.06	0.18
572.99	573.14	0.15	0.18
879.41	879.21	-0.20	0.18

2.Photometric Accuracy (UV)

Wavelength (nm)	Certified Absorbance (A)	UUC (A)	Error (A)	Uncertainty (\pm A)
235	0.0000	0.0000	0.0000	0.0075
	0.7467	0.7460	-0.0007	0.0075
257	0.0000	0.0000	0.0000	0.0075
	0.8662	0.8646	-0.0016	0.0075
313	0.0000	0.0000	0.0000	0.0075
	0.2904	0.2908	0.0004	0.0075
350	0.0000	0.0001	0.0001	0.0075
	0.6429	0.6415	-0.0014	0.0075

*CNR = Customer not request

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968 U Chu Liang Building Floor7 Rama4 Road
Silom Bangrak Bangkok Thailand 10500
Tel : 02-6324300 Fax : 02-6375496-7
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Certificate of Calibration

Certificate No. **BSCC-UV-367/23**

Number of Page(s) **3 of 3**

Calibration Results:

3.Photometric Accuracy (Visible)

Wavelength (nm)	Certified Absorbance (A)	UUC (A)	Error (A)	Uncertainty (\pm A)
420.0	0.0000	0.0000	0.0000	0.0042
	0.5783	0.5793	0.0010	0.0042
	0.7628	0.7624	-0.0004	0.0042
	1.0206	1.0216	0.0010	0.0042
440.0	0.0000	0.0000	0.0000	0.0042
	0.5621	0.5625	0.0004	0.0042
	0.7455	0.7452	-0.0003	0.0042
	0.9985	0.9989	0.0004	0.0042
465.0	0.0000	0.0000	0.0000	0.0042
	0.5227	0.5229	0.0002	0.0042
	0.6880	0.6873	-0.0007	0.0042
	0.9487	0.9486	-0.0001	0.0042
546.1	0.0000	0.0000	0.0000	0.0042
	0.5207	0.5211	0.0004	0.0042
	0.6973	0.6960	-0.0013	0.0042
	0.9959	0.9944	-0.0015	0.0042
590.0	0.0000	0.0000	0.0000	0.0042
	0.5544	0.5538	-0.0006	0.0042
	0.7253	0.7236	-0.0017	0.0042
	1.0942	1.0925	-0.0017	0.0042
635.0	0.0000	0.0000	0.0000	0.0042
	0.5616	0.5612	-0.0004	0.0042
	0.6927	0.6909	-0.0018	0.0042
	1.0881	1.0866	-0.0015	0.0042

*CNR = Customer not request

4.Stray Light*

Standard cut-off wavelength (nm)	Unit Under Calibration(UUC)		
	Wavelength (nm)	Transmission (%T)	Absorbance (A)
200.96 \pm 0.11nm	200.55	0.9770	2.0104

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

*Stray Light not NSC-ONSC Accredited.

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

End of Certificate

The above results are valid exclusively for the calibrated item(s) as mention in this report / certificate.
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Metrology

SCI ECO Services Company Limited

33/2 Moo 3, T.Banpa, A.Kaengkhoi, 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.com



Certificate No. T232160

Page 1 of 4

Certificate of Calibration

Equipment : Chamber (Cooling 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 : Laboratory

Date of Receipt : 29 November 2023

Calibrated By : Atiphong Rongrat (Technician)

Approved By : Boonchai Suriyawong (Site Calibration Manager)

Date of Issue : 09 JAN 2024

REVIEW BY	<u>Boonchai Suriyawong</u>
APPROVED BY	<u>Boonchai Suriyawong</u>
NEXT CAL. DATE	06/06/25

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 Metrology.



Metrology

SCI ECO Services Company Limited

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Certificate No. T232160

Page 2 of 4

Calibration Report

Equipment : Chamber (Cooling Room)

Date of Calibration : 6 December 2023

Environment : Temperature : 23.4-24.9 °C

Line Voltage : 221.4-230.2 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 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	T230773	10 April 2024
TC	TYPE T	TN171-TN180	T230773	10 April 2024
DATA LOGGER	34970A	T149	T230773	10 April 2024

3. This certificate is traceable to :

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

4. Condition of calibrated item : good

Equipment Description :

Time Constant 1 Hour 30 Minute At 3 °C

Fresh Air Damper ☐ Open ☐ Min ☐ Medium ☐ Max

☐ Close

☒ Not Available

5. Adjustment :

(X) without adjustment

() after adjustment

Approved By. Boonchai Suriyawong



Metrology

SCI ECO Services Company Limited

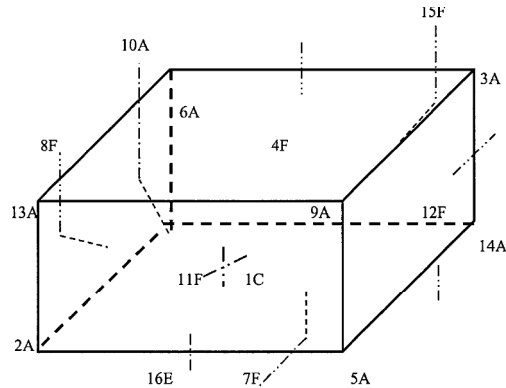
33/2 Moo 3, T.Banpa, A.Kaengkhoi, Saraburi 18110, Thailand.



Certificate No. T232160

Page 3 of 4

Calibration Report



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

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

Approved By. _____



Metrology

SCI ECO Services Company Limited

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Certificate No. T232160

Page 4 of 4

Calibration Report

Measurement Results

Calibration Point	Average Standard Reading at each position (°C)											
	TN161	TN162	TN163	TN164	TN165	TN166	TN167	TN168	TN169	TN170	TN171	TN172
3.0	2.83	3.34	2.95	3.46	3.45	3.76	3.25	3.46	3.39	3.50	3.58	3.42
	TN173	TN174	TN175	TN176								
	3.33	3.39	3.15	3.43								

Chamber (Cooling Room)			Temperature Distribution				
Setting (°C)	Reading (°C)		Average (°C)	Stability (± °C)	Uniformity (°C)	Uncertainty (± °C)	Coverage Factor <i>k</i>
	Min, Max	Average					
3.0	2.8, 4.1	3.5	3.36	1.10	2.00	1.90	2.09

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. _____



Agilent Technologies (Thailand) Limited
U CHU LIANG BLDG. 22/F UNIT A.D
968 RAMA 4 ROAD, SILOM, BANGRAK
Bangkok 10500 Thailand

Tel: +662 637 6363
Fax: +662 632 4334
Email: ccc-smt@agilent.com
Website: www.agilent.com/chem

Service Confirmation Number: 6905338201

Service Confirmation Date: 12.12.2023

Customer Contact:

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

Invoice To:

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

Delivery Site:

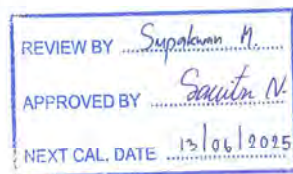
ALS Laboratory Group (Thailand) Co
Ltd
Head Office
104 Phatthanakan 40 Phatthanakan Rd
Khwaeng Phatthanakan Khet Suan

Location:

Room
Bldg
Lab
Dept

SERVICE REPORT

Customer Purchase Order Number:	Customer Number: 70371013
Service Request:	Service Request Date:
Service Order: 6006041263	Service Confirmation: 6905338201



Direct Inquiries to:

Contact Name: Customer Contact Center
Contact E-mail: ccc-smt@agilent.com
Contact Telephone: +662 637 6363
Contact Fax: +662 632 4334

Service Instrument:

Model Number	Model Description	Serial Number	System Handle	Parent Asset
SYS-IM-7700-E	ICPMS 7700 System Enhanced		ICP MS 7700 (HPLC)	
G1315A	1260 Thermostatted Column Compartment	DEACN12300	ICP MS 7700 (HPLC)	SYS-IM-7700-E
G1329B	1260 Standard Autosampler	DEAAC11098	ICP MS 7700 (HPLC)	SYS-IM-7700-E
G1311B	1260 Quaternary Pump	DEAB704380	ICP MS 7700 (HPLC)	SYS-IM-7700-E
G3281A	Agilent 7700x ICP-MS	JP12091612	ICP MS 7700 (HPLC)	SYS-IM-7700-E

Service Items:

Item	Service/Part #	Description	Qty	Entitlement	Service Start	Service End
1000	EQO	Enterprise Operational Qualification	1.00	Agreement Entitlement 100 % covered	12.12.2023	12.12.2023
1010	5185-5850	ICP-MS Checkout Solutions	1.00	Agreement Entitlement 100 % covered		

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968 Rama 4 Road, Silom, Bangrak,
Bangkok 10500 Thailand
Tax ID : 0105542068218

Citibank N.A. Bangkok Branch
399 Interchange 21 Building, Sukhumvit Road, Klongtoey Nau
Sub-district, Wattana District, Bangkok 10110 Thailand
Acc. No: 012-4452-007
THB-Krung Thai Bank PC.
Siam Square Br., 416/1-2 Rama I Rd., Pathumwan, BKK 10330
Thailand

ORIGINAL

Service Confirmation Number: 6905338201
Service Confirmation Date: 12.12.2023

Service Information:

Problem Description: WU-OQ-IM/HPLC-7700-5001143313		
Service Provided: Perform OQ Hardware control test CSD logon, Autosample, ISIS, Auto tune, BG and Stability. After done the instrument BKK_EL0026 calibrated pass all.		
Service Overview Code: Reason Code: Scheduled Service Diagnosis Code: Scheduled Service Resolution Code: Scheduled Service		
Reported Hours: 6.0	Travel Hours: 1.0	
Customer Field Service Representative Name: Panthep Kurasathain	Customer Field Service Representative Signature: 	Date: 12 Dec 2023
Customer Name: Supakwan Mak	Customer Signature: 	Date: 12 Dec 2023
Additional Comments:		



Metrological Center

SCI ECO Services Company Limited

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

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

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

Certificate No. T231676

Page 1 of 6

Certificate of Calibration

Equipment : HEATING BLOCK

Manufacturer : Environmental Express

Model : SC 196

Serial No. : 6974CECW3285

Customer Code : BKK_EL0054

ID No. : T5306A3

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


104 Phatthanakan 40, Phatthanakan Rd., Khwaeng Phatthanakan,

Khet Suan Luang, Bangkok 10250

Customer Location : Acid Digestion Lab

Date of Receipt : 13 September 2023

Calibrated By : Sane Musikawan (Site Calibration Manager)

Approved By :  / Sujjar Naknakred (Site Calibration Manager)

Date of Issue : 26 SEP 2023

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

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



Metrological Center

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

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

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

Certificate No. T231676

Page 2 of 6

Calibration Report

Equipment : HEATING BLOCK
Date of Calibration : 22 September 2023
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 20 standard thermocouples type T into its chamber , the other one standard thermocouples type T use for ambient temperature measurement . The calibration was done in according to WI-T20.

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

2. Reference Standard Instrument :

Instrument	Model	Instrument No.	Certificate No.	Due Date
TC	TYPE T	TN21-TN30	T230014	17 January 2024
TC	TYPE T	TN31-TN40	T230014	17 January 2024
DATA LOGGER	34970A	T151	T230014	17 January 2024

3. This certificate is traceable to :

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

4. Condition of calibrated item : good

Equipment Description :

Time Constant 2 Hour 20 Minute At 95 °C
Fresh Air Damper ☐ Open ☐ Min ☐ Medium ☐ Max
☐ Close
☒ Not Available

5. Adjustment :

() without adjustment

(X) after adjustment

Approved By. _____



Metrological Center

SCI ECO Services Company Limited

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

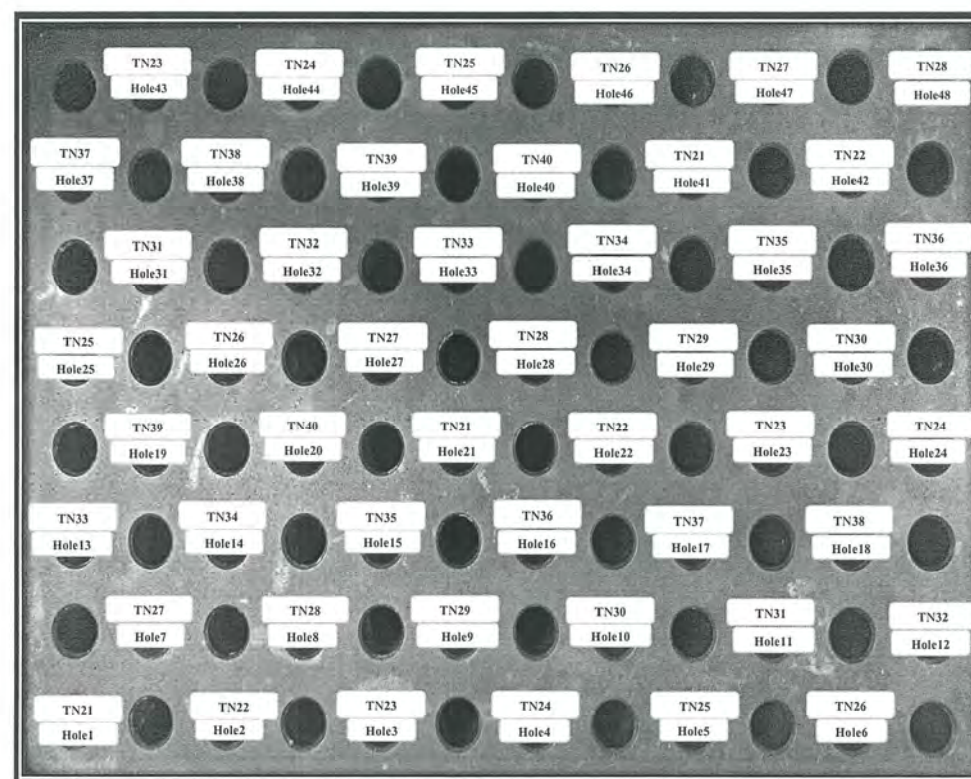
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Certificate No. T231676

Page 3 of 6

Calibration Report



FRONT CONTROL

Approved By. _____



Metrological Center

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E-Mail : calibrate@scg.co.th


Certificate No T231676

Page 4 of 6

Calibration Report

Measurement Results

Calibration Point		Average Standard Reading at each position (°C)					
R1 Hole1-Hole6		TN21	TN22	TN23	TN24	TN25	TN26
CAL POINT	Max	95.01	94.41	95.20	95.41	94.51	95.17
	Min	94.57	93.95	94.75	94.92	94.00	94.72
	Average	94.79	94.18	94.98	95.17	94.26	94.95
R2 Hole7-Hole12		TN27	TN28	TN29	TN30	TN31	TN32
	Max	95.36	95.43	95.19	95.16	95.35	94.97
	Min	94.94	94.95	94.72	94.71	94.90	94.57
	Average	95.15	95.19	94.96	94.94	95.13	94.77
R3 Hole13-Hole18		TN33	TN34	TN35	TN36	TN37	TN38
	Max	95.37	95.50	95.22	95.21	95.33	95.31
	Min	94.99	95.09	94.78	94.82	94.88	94.96
	Average	95.18	95.30	95.00	95.02	95.11	95.13
R4 Hole19-Hole24		TN39	TN40	TN21	TN22	TN23	TN24
	Max	95.59	94.42	94.52	94.24	94.63	94.67
	Min	95.21	94.06	94.13	93.88	94.28	94.27
	Average	95.40	94.24	94.33	94.06	94.45	94.47
R5 Hole25-Hole30		TN25	TN26	TN27	TN28	TN29	TN30
	Max	95.19	95.38	92.93	95.30	95.14	95.03
	Min	94.83	95.03	92.56	94.95	94.79	94.70
	Average	95.01	95.20	92.75	95.12	94.96	94.87
R6 Hole31-Hole36		TN31	TN32	TN33	TN34	TN35	TN36
	Max	94.63	94.90	94.77	94.31	94.24	93.87
	Min	94.24	94.55	94.44	93.98	93.92	93.56
	Average	94.43	94.72	94.60	94.14	94.08	93.71
R7 Hole37-Hole42		TN37	TN38	TN39	TN40	TN21	TN22
	Max	94.30	94.44	94.04	93.81	94.89	95.35
	Min	93.95	94.05	93.67	93.48	94.39	94.90
	Average	94.13	94.24	93.86	93.65	94.64	95.12
R8 Hole43-Hole48		TN23	TN24	TN25	TN26	TN27	TN28
	Max	95.99	95.63	95.28	95.29	95.45	94.87
	Min	95.57	95.15	94.82	94.84	94.99	94.48
	Average	95.78	95.39	95.05	95.07	95.22	94.68

Approved By. 

FM-L13 108/30-05-57



Metrological Center

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Certificate No T231676

Page 5 of 6

Calibration Report

Measurement Results

Calibration Point		Average Standard Reading at each position (°C)					
R1 Hole1-Hole6		TN21	TN22	TN23	TN24	TN25	TN26
CAL POINT	Max	105.23	104.32	105.43	105.25	104.44	105.27
	Min	104.94	103.95	105.15	105.04	104.11	104.96
	Average	105.09	104.13	105.29	105.15	104.28	105.12
R2 Hole7-Hole12		TN27	TN28	TN29	TN30	TN31	TN32
	Max	105.30	105.12	105.18	105.22	105.12	105.16
	Min	105.11	104.92	104.96	105.00	104.92	104.97
	Average	105.20	105.02	105.07	105.11	105.02	105.06
R3 Hole13-Hole18		TN33	TN34	TN35	TN36	TN37	TN38
	Max	105.37	105.63	105.02	104.80	104.69	105.19
	Min	105.17	105.37	104.75	104.59	104.50	105.00
	Average	105.27	105.50	104.88	104.69	104.60	105.09
R4 Hole19-Hole24		TN39	TN40	TN21	TN22	TN23	TN24
	Max	105.31	104.43	106.41	104.71	105.63	105.82
	Min	105.08	104.22	106.15	104.41	105.37	105.56
	Average	105.19	104.33	106.28	104.56	105.50	105.69
R5 Hole25-Hole30		TN25	TN26	TN27	TN28	TN29	TN30
	Max	104.95	106.26	103.34	105.78	105.59	105.87
	Min	104.67	105.96	103.08	105.56	105.36	105.68
	Average	104.81	106.11	103.21	105.67	105.48	105.77
R6 Hole31-Hole36		TN31	TN32	TN33	TN34	TN35	TN36
	Max	104.75	104.86	104.80	105.20	104.50	104.39
	Min	104.54	104.63	104.59	105.00	104.32	104.18
	Average	104.65	104.75	104.69	105.10	104.41	104.28
R7 Hole37-Hole42		TN37	TN38	TN39	TN40	TN21	TN22
	Max	104.30	104.90	104.85	104.65	104.88	104.85
	Min	104.09	104.72	104.66	104.49	104.63	104.52
	Average	104.19	104.81	104.75	104.57	104.76	104.68
R8 Hole43-Hole48		TN23	TN24	TN25	TN26	TN27	TN28
	Max	105.71	105.85	105.39	105.61	105.42	105.19
	Min	105.45	105.61	105.14	105.27	105.18	104.94
	Average	105.58	105.73	105.27	105.44	105.30	105.07

Approved By. 

FM-L13 108/30-05-57



Metrological Center
SCI ECO Services Company Limited

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

BKK_EL0023

analytikjena
An Endress+Hauser Company

REVIEW BY	<u>Oranon T.</u>
APPROVED BY	<u>Savitri N.</u>
NEXT CAL. DATE	<u>24.10.24</u>

Certificate No. T231676

Page 6 of 6

Calibration Report

Measurement Results:

HEATING BLOCK			Temperature Distribution	
Setting (°C)	Reading (°C)		Stability (± °C)	Uncertainty (± °C)
	Min , Max	Average		
100.0	100.3 , 100.5	100.4	0.26	0.81
107.0	107.0 , 107.1	107.1	0.19	0.78

* 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. _____

Maintenance Protocol

Atomic Fluorescence Spectrometer
mercur DUO /
mercur DUO plus

Serial-No.: K170A0143 Customer-No.: _____
Date: 24 May 2023 Carried out by: Srichai Fak-on

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

Company	บริษัท เอแอลเอส แลบบอราทอรี กรุ๊ป (ประเทศไทย) จำกัด
User	
Department	ห้องแล็บปฏิบัติการ
Street	104 ซอย 40 ถนนพัฒนาการ แขวงสวนหลวง เขตสวนหลวง
Zip Code, City	กรุงเทพมหานคร 10250
Country	ประเทศไทย
Phone	
Fax	
E-mail	

Maintenance works basic unit

tightness visual check inside the Mercur	<input checked="" type="checkbox"/>
visual check if gold-traps are broken	<input checked="" type="checkbox"/>
visual check if spectrometer is contaminated	<input checked="" type="checkbox"/>
visual check of the fluorescence cell	<input checked="" type="checkbox"/>
visual check of the absorption cell, incl. window	<input checked="" type="checkbox"/>
reactor cleaning	<input checked="" type="checkbox"/>
check pump-hose, if necessary change it	<input checked="" type="checkbox"/>
check swivel drive (SEV)	<input checked="" type="checkbox"/>
check drying-hose, output: gas-liquid-separator	<input checked="" type="checkbox"/>
test Bubble-Sensor	<input checked="" type="checkbox"/>
check gas flows	<input checked="" type="checkbox"/>
check volume flows, reagents	<input checked="" type="checkbox"/>
recording stray light values	<input checked="" type="checkbox"/>
measurement with 30 ng/l	<input checked="" type="checkbox"/>

Maintenance works Autosampler

Serial No.: 701 739

lubricate the dosing-winding (Teflon-grease-spray)	<input checked="" type="checkbox"/>
clean the dosing cylinder, if necessary exchange it	<input checked="" type="checkbox"/>
lubricate the winding system of the height drive with some drops of oil	<input checked="" type="checkbox"/>
check the toothed belt	<input checked="" type="checkbox"/>
check the position of the mechanical stopper (height: 13mm)	<input checked="" type="checkbox"/>
check the pump rate of mixing pump (<14s AS52, typ.7s/<20s AS52S, typ.10s)	<input checked="" type="checkbox"/>
check the pump rate of washing cup	<input checked="" type="checkbox"/>
check the electrical hose connections for good contact	<input checked="" type="checkbox"/>
check the connectors of the magnetic valves	<input checked="" type="checkbox"/>
check the dosing hose for buckling, if necessary exchange it	<input checked="" type="checkbox"/>

Device parameter	nominal value	actual value
visual check general tightness inside the Mercur	o.k.: <input checked="" type="checkbox"/>	changed: <input type="checkbox"/>
visual check Goldtraps	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-seperator	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 0.166 NL/min	0.163 NL/min
Valve 2	50 Nl/h or 0.833 NL/min	0.403 NL/min
Valve 3	5 Nl/h or 0.083 NL/min	0.140 NL/min
Valve 4	10 Nl/h or 0.166 NL/min	0.108 NL/min
Check liquidflow		
Acid	2.5ml/min ± 1 ml	2.5 ml/min
Red.-agent	2.5ml/min ± 1 ml	2.5 ml/min
Sample	10ml/min ± 2 ml	10 ml/min
Adventitious light - values	(V)	from file
100	0	0
200	0	0
300	0	0
350	0	0
400	0	0
450	2	2
500	5	5
550	10	10
575	15	14
600	20	20

Device parameter	nominal value	actual value
Analytical parameters Fluorescence cell		
Conditions.: max.conc.: 10µg/L PMT-voltage: ...360.....V		
Blank-solution without enrichment / FBR 30 ng/L	Int > 0.0015 RSD < 3 %	Int ...0.00024... Int ₁ ...0.00172... RSD 0.45.....%
Conditions.: max.conc.: 1.7µg/L PMT-voltage: ...352.....V		
Blank-solution with enrichment / FBR 30 ng/L	Int > 0.008 RSD < 3 %	Int ...0.00370... Int ₂ ...0.01060... RSD 2.38.....%
Fok.- factor (Int ₂ / Int ₁)	> 3.5	6.16
Analytical parameters Absorption cell		
Blank-solution without enrichment / FBR 100 ng/L	Ext. > 0.0012 RSD < 5 %	Ext. 0.00093... Ext. 0.00449... RSD 2.58.....%
Comments		

Srichai Pakan.
Signature Technician

24 May 2023
Place, Date (DD/MM/YYYY)

Orawan T.
Signature Customer

24 May 2023
Place, Date (DD/MM/YYYY)

QC parameters

QC type	Conc. check		
QC check samp. 1	---	QC check samp. 2	---
Conc.	---	Conc.	---
Error limit	---	Error limit	---
Rep. measurement	off	Reaction	flag + continue
QC std.1 no.	1(30.000 ng/L)	QC std.2 no.	1(30.000 ng/L)
QC std.1 limit	± 50.00%	QC std.2 limit	± 50.00%
QC std. act.	flag + continue		
Expect. blank abs.	0.0100± 0.0100	Reaction	flag + continue
QC precision	off	Reaction	off
		QC Recal.factor	Off

Calibration settings

Calib. meth	Standard calib.	Calibr. unit	ng/L
No. standards	1	Conversion fac.	1000000
Type of standards	---	Standard prep.	Premixed
		Blank correct.	---
		Recalib. std. no.	---
Output unit	µg/L	Conversion fac.	1000
Calib. stat.	Mean	Meas. cycles	3
		Blind cycles	1
Stock sol. 1	---	Stock sol. 2	---
Stock sol. 3	---	Stock sol. 4	---
Type of cal. curve	linear	Intercept	calculated
Weighted cal.	off	Grubbs stat.	off
Check of cal. curve	no outlier test		

Sample statistics

Stat. mode	Mean	Meas. cycles	2
Confid. level	95.4 %	Blind cycles	1
Grubbs stat.	---		

Calibration standards

No	Name	State	Pos	Conc./ ng/L	Ints	SD	RSD/%
1	Cal-Zero	(--)	79	0.000	H: 0.000249 A: 0.004274	0.000132 0.001698	53.13 39.72
2	Cal-Std1	(--)	80	30.000	H: 0.001720 A: 0.02172	0.000007 0.000023	0.459 0.107

Hg

Calibration function 1

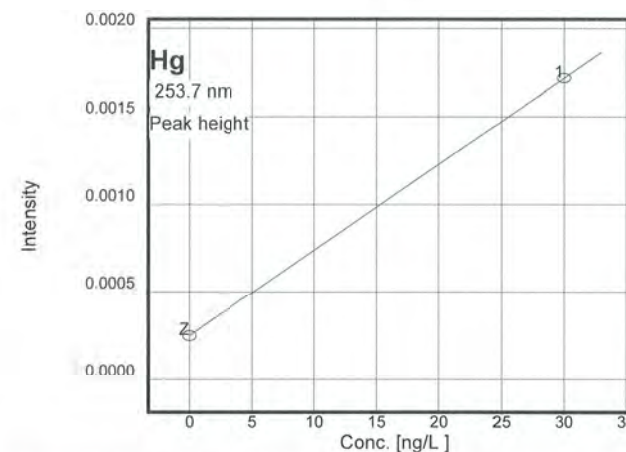
5/24/2023 12:44 Calibration (Peak height)

Ints=k1+k2*conc

k1=0.000249 k2=0.000049

Recal. factor: ---

Slope	0.00005 Ints/(ng/L)	R2-adjusted	1.0000
sc0	1.00000 ng/L		
Lower limit	0 ng/L	Upper limit	33.0 ng/L
Detection limit	---	Deter. limit	---

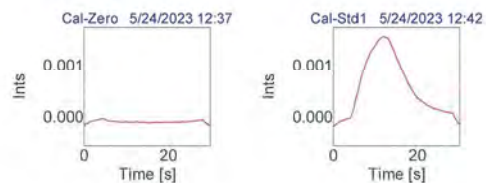


Measurements and events (sorted by time)

Hg	Without enrichment / FBR 30ng/L_PM 24052023					5/24/2023	12:35
ID	Conc.	Ints	BG	SD	RSD/%	Int. type	Time
Cal-Zero		0.000143				PKH	12:37
		0.000397					12:38
		0.000207					12:40
	0ng/L	0.000249		0.0001324	53.13		12:40
Cal-Std1		0.001720				PKH	12:42
		0.001712					12:43
		0.001728					12:44
	30.00ng/L	0.001720		0.000007897	0.459		12:44
Calibration	Calibration function: 01						12:44

Peak plots

Hg



Mercur

Report file: C:\WinAAS\TMP\2023\May\Pro_033
 Program version: 4.7.10.0 Printed on: 5/24/2023 14:01
 Recording started on 5/24/2023 13:37 GMT+7.0
 Operator: PSU,OTA
 Laboratory: ALS-BKK
 Code: II_Hg095_2023

Remarks:
 Food,water

Method parameters

Hg

Method Enrichment / FER 30ng/L PM_24052023
 Created on 5/24/2023 Time 13:36
 Program ---

Parameters Mercur Technique: Hg fluorescence

Line	253.7 nm		
Lamp type	Hg-LP		
Integr. mode	Peak height	Integr. time	40 s
PMT	352 V		
AZ time	5 s	Peak smoothing	12/11
Delay	0 s		

Working mode	Enr. w/o reload.	System cleaning	Off
FBR technique	off	Wash time acid	10 s
Pump speed	3	Soaking time	20 s
Sample load time	10 s	Gas load time	10 NL/h
Reaction time	10 s		
Waiting time AZ	10 s	Gas AZ wait	10 NL/h
Purge time1	30 s		
Purge time2	15 s	Gas wash time2	5 NL/h
Purge time3	20 s		
Heat.time coll.1	20 s	Cool. time coll.1	30 s

QC parameters

QC type	Conc. check		
QC check samp. 1	---	QC check samp. 2	---
Conc.	---	Conc.	---
Error limit	---	Error limit	---
Rep. measurement	off	Reaction	flag + continue
QC std.1 no.	1(30,000 ng/L)	QC std.2 no.	1(30,000 ng/L)
QC std.1 limit	± 50.00%	QC std.2 limit	± 50.00%
QC std. act.	flag + continue		
Expect. blank abs.	0.0100± 0.0100	Reaction	flag + continue
QC precision	off	Reaction	off
		QC Recal.factor	Off

Calibration settings

Calib. meth	Standard calib.	Calibr. unit	ng/L
No. standards	1	Conversion fac.	1000000
Type of standards	---	Standard prep.	Premixed
		Blank correct.	---
		Recalib. std. no.	---
Output unit	µg/L	Conversion fac.	1000
Calib. stat.	Mean	Meas. cycles	3
		Blind cycles	1
Stock sol. 1	---	Stock sol. 2	---
Stock sol. 3	---	Stock sol. 4	---
Type of cal. curve	linear	Intercept	calculated
Weighted cal.	off	Grubbs stat.	off
Check of cal. curve	no outlier test		

Sample statistics

Stat. mode	off	Meas. cycles	1
Confid. level	95.4 %	Blind cycles	1
Grubbs stat.	---		

Calibration standards

No	Name	State	Pos	Conc./ ng/L	Ints	SD	RSD/%
1	Cal-Zero	(--)	##	0.000	H: 0.003700 A: 0.02531	0.000081 0.000153	2.192 0.607
2	Cal-Std1	(--)	##	30.000	H: 0.01060 A: 0.06689	0.000253 0.002766	2.386 4.136

Mercur

Calibration function 1

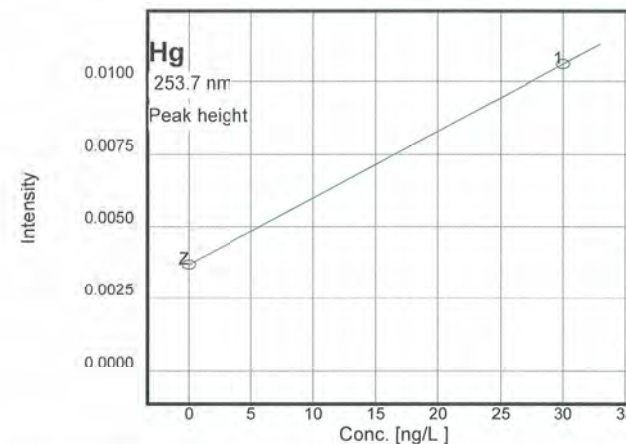
5/24/2023 14:00 Calibration (Peak height)

Ints=k1+k2*conc

k1=0.003700 k2=0.000230

Recal. factor: ---

Slope	0.00023 Ints/(ng/L)	R2-adjusted	1.0000
sc0	1.00000 ng/L		
Lower limit	0 ng/L	Upper limit	33.0 ng/L
Detection limit	---	Deter. limit	---



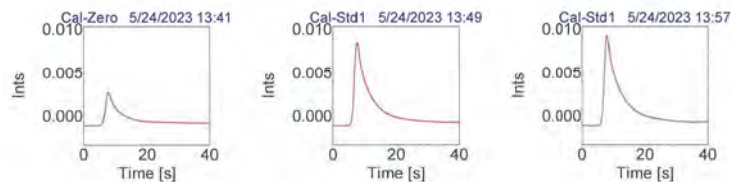
Measurements and events (sorted by time)

Hg	Enrichment / FER 30ng/L PM_24052023				5/24/2023	13:37
ID	Conc.	Ints	BG	SD	RSD/%	Int. type
Cal-Zero		0.003792				PkH
		0.003666				
		0.003640				
	0ng/L	0.003700		0.000081090	2.192	
Cal-Std1		0.009498				PkH
		0.008333				
		0.008961				
	30.00ng/L	0.008931		0.0005830	6.528	
Cal-Std1		0.01031				PkH
		0.01074				
		0.01076				
	30.00ng/L	0.01060		0.0002530	2.386	
Calibration	Calibration function: 01					14:00

Mercur

Peak plots

Hg



Mercur

Report file: C:\WinAAS\TMP\2023\May\Pro_034
 Program version: 4.7.10.0 Printed on: 5/24/2023 14:33
 Recording started on 5/24/2023 14:19 GMT+7.0
 Operator: PSU.OTA
 Laboratory: ALS-BKK
 Code: IL_Hg095_2023

Remarks:
 Food,water

Method parameters

Hg

Method Without enrichment / Abs / FBR 100ng/L_PM 24052023
 Created on 5/24/2023 Time 14:18
 Program ---

Parameters Mercur Technique: Hg absorption

Line	253.7 nm		
Lamp type	Hg-LP		
Integr. mode	Peak height	Integr. time	55 s
PMT	225 V		
AZ time	5 s	Peak smoothing	2/5
Delay	8 s		

Working mode	w/o enrich.	System cleaning	Acid
FBR technique	on	Wash time acid	15 s
Pump speed	4	Soaking time	20 s
Sample load time	8 s	Gas load time	5 NL/h
Reaction time	12 s		
Waiting time AZ	15 s		
Delay	10 s		
Purge time1	50 s		
Purge time2	10 s	Gas wash time2	10 NL/h

QC parameters

QC type	Conc. check		
QC check samp. 1	---	QC check samp. 2	---
Conc.	---	Conc.	---
Error limit	---	Error limit	---
Rep. measurement	off	Reaction	flag + continue
QC std.1 no.	1(100.00 ng/L)	QC std.2 no.	1(100.00 ng/L)
QC std.1 limit	± 50.00%	QC std.2 limit	± 0.00%
QC std. act.	flag + continue		
Expect. blank abs.	0.0100± 0.0100	Reaction	flag + continue
QC precision	off		
		Reaction	off
		QC Recal.factor	Off

Calibration settings

Calib. meth	Standard calib.	Calibr. unit	ng/L
No. standards	1	Conversion fac.	1000000
Type of standards	---	Standard prep.	Premixed
		Blank correct.	---
		Recalib. std. no.	---
Output unit	µg/L	Conversion fac.	1000
Calib. stat.	Mean	Meas. cycles	3
		Blind cycles	1
Stock sol. 1	---	Stock sol. 2	---
Stock sol. 3	---	Stock sol. 4	---
Type of cal. curve	linear	Intercept	calculated
Weighted cal.	off	Grubbs stat.	off
Check of cal. curve	no outlier test		

Sample statistics

Stat. mode	Mean	Meas. cycles	2
Confid. level	95.4 %	Blind cycles	1
Grubbs stat.	---		

Calibration standards

Hg

No	Name	State	Pos	Conc./ ng/L	Abs	SD	RSD/%
1	Cal-Zero	(--)	##	0.00	H: 0.000932 A: 0.035926	0.000138 0.006208	14.88 17.28
2	Cal-Std1	(--)	##	100.00	H: 0.004494 A: 0.061286	0.000116 0.001275	2.586 2.082

Mercur

Calibration function 1

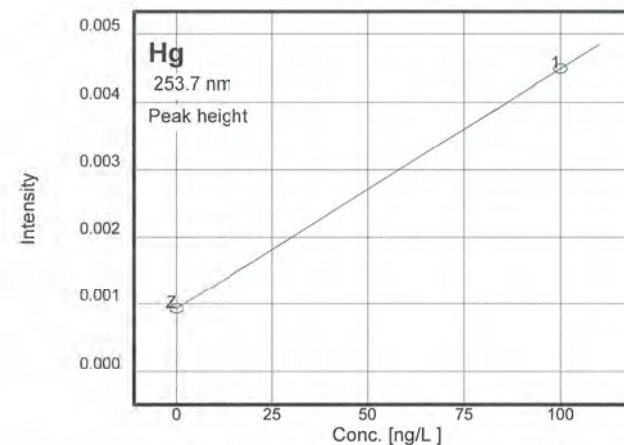
5/24/2023 14:33 Calibration (Peak height)

Abs=k1+k2*conc

k1=0.000932 k2=0.000036

Recal. factor: ---

Slope	0.00004 Abs/(ng/L)	R2-adjusted	1.0000
sc0	1.00000 ng/L	Charact. conc.	122.411 (ng/L)/1%
Lower limit	0 ng/L	Upper limit	110. ng/L
Detection limit	---	Deter. limit	---



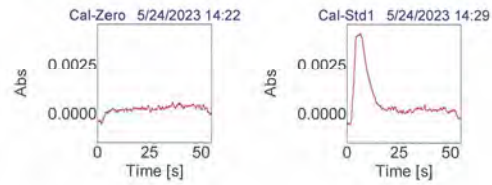
Measurements and events (sorted by time)

Hg	Without enrichment / Abs / FBR 100ng/L_ PM 24052023					5/24/2023	14:19
ID	Conc.	Abs	BG	SD	RSD/%	Int. type	Time
Cal-Zero		0.001039				PkH	14:22
		0.000775					14:23
		0.000981					14:25
	0ng/L	0.000932		0.00013672	14.88		14:25
Cal-Std1		0.004528				PkH	14:29
		0.004364					14:31
		0.004589					14:33
	100.ng/L	0.004494		0.00011623	2.586		14:33
Calibration	Calibration function: 01						14:33

Mercur

Peak plots

Hg



REVIEW BY *[Signature]*

APPROVED BY *[Signature]*

NEXT CAL. DATE 22/01/24



QTRAP 5500 System

Planned Maintenance Procedure



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(GEN-IDV-09-10816-D)

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AB Sciex Pte. Ltd.
Blk33, #04-06 Marsiling Industrial Estate Road 3
Woodlands Central Industrial Estate, Singapore 739256

Contents

1 Introduction	4
2 Planned Maintenance Tasks	5
Pre-Planned Maintenance	5
Pre-PM Tasks	5
PC Health Check	6
Vacuum System Tests	6
Pre-PM Pressure Test	7
Inspect for Contamination	7
Record the Probe Position	7
Pre-PM System Tests	8
Planned Maintenance	12
Mass Spectrometer Maintenance	12
Turbo V Ion Source Maintenance	14
Software Maintenance	15
Post-Planned Maintenance	16
Voltage Tests	16
Post-PM Pressure Test	16
Inspect for Contamination	17
Post-PM System Tests	17
Post-PM Tasks	35
Wrap-up	37
3 Service Request Number	38
Comments and Exceptions	39
A Inspect for Contamination	40
Guidelines for Cleaning the Front End	40

Introduction

1

Note: For regulatory and safety information for the mass spectrometer, refer to the document: *System User Guide*.

The planned maintenance (PM) procedure is designed to help maintain overall system performance.

Planned maintenance is not intended to take the place of an operational qualification (OQ) nor is it intended to verify the instrument specifications. Separate installation qualification (IQ) and OQ services are available. Contact a SCIEX representative.

The procedure must be performed by a trained SCIEX Field Service Employee (FSE).

The procedure has been developed for the QTRAP 5500 system with the Turbo V ion source. It does not apply to any other products or processes.

The procedure does not address any customer-specific analytical protocol (performance qualification) or method validation.

In this guide, the software that controls the mass spectrometer is referred to as the control software. The control software varies depending on the mass spectrometer used.

Note: If an issue is identified and the system requires repair, then the customer is responsible for the cost of the repair, except to the extent that the system and required repairs are covered by a SCIEX warranty or service contract. Customers must open a separate service call for the repair.

QTRAP 5500 System
4/40

Planned Maintenance Procedure
RUO-IDV-08-6743-H

Planned Maintenance Tasks

2

Note: Perform all procedures using the Turbo V ion source, unless otherwise specified.

Pre-Planned Maintenance

Note: Guideline values are for reference only. The pre-PM test results are not required to meet or exceed these values.

Pre-PM Tasks

Task	Complete	N/A
Ask the customer about system performance since the last visit and record comments. For fore PM the instrument Working Normal	<input checked="" type="checkbox"/>	—
If the customer maintains a log for the system, then review it.	<input checked="" type="checkbox"/>	<input type="radio"/>
Review the work to be performed with the customer.	<input checked="" type="checkbox"/>	—
Make sure that all of the ion source tubing is connected correctly.	<input checked="" type="checkbox"/>	—

Planned Maintenance Procedure
RUO-IDV-08-6743-H

QTRAP 5500 System
5/40

Planned Maintenance Tasks

PC Health Check

Task	Complete	N/A
Inspect the status of the RAID 1 hard drives.	<input checked="" type="checkbox"/>	—

Vacuum System Tests

Task	Complete																	
Record the turbo pump operational values.	<input checked="" type="checkbox"/>																	
<table><thead><tr><th>Parameter</th><th>Results</th></tr></thead><tbody><tr><td>Temperature (°C)</td><td>38</td></tr><tr><td>Current (A)</td><td>0.78</td></tr><tr><td>Voltage (V)</td><td>97</td></tr><tr><td>Power (W)</td><td>77</td></tr><tr><td>Driving frequency (Hz)</td><td>1010</td></tr></tbody></table>	Parameter	Results	Temperature (°C)	38	Current (A)	0.78	Voltage (V)	97	Power (W)	77	Driving frequency (Hz)	1010	<table><tbody><tr><td>1</td><td><input checked="" type="radio"/></td></tr><tr><td>2</td><td><input type="radio"/></td></tr></tbody></table>		1	<input checked="" type="radio"/>	2	<input type="radio"/>
Parameter	Results																	
Temperature (°C)	38																	
Current (A)	0.78																	
Voltage (V)	97																	
Power (W)	77																	
Driving frequency (Hz)	1010																	
1	<input checked="" type="radio"/>																	
2	<input type="radio"/>																	
Make sure that the vacuum gauge filament is functioning properly using the appropriate service tool (the Analyst Service Diagnostics (ASD) software for the Analyst software or the Tuning Tools software for SCIEX OS) and identify the filament position. If the mass spectrometer is using filament 2, then order a replacement vacuum gauge as a separate service call.																		

Planned Maintenance Tasks

Pre-PM Pressure Test

Pre-PM Pressure Test is Complete			<input checked="" type="checkbox"/>
Test	Guideline	Result	
Vacuum chamber pressure with CAD gas off	$0.4 \times 10^{-5} \text{ torr} \leq P_{\text{CAD off}} \leq 1.1 \times 10^{-5} \text{ torr}$	$0.7 \times 10^{-5} \text{ Torr}$	
Vacuum chamber pressure with CAD gas set to Full	$2.4 \times 10^{-5} \text{ torr} \leq P_{\text{CAD Full}} \leq 4.5 \times 10^{-5} \text{ torr}$	$3.2 \times 10^{-5} \text{ Torr}$	

Inspect for Contamination

Task	Complete	N/A
Inspect for front-end contamination. Refer to the section: Inspect for Contamination .	<input checked="" type="checkbox"/>	—

Record the Probe Position

Task	Result
Record the vertical and horizontal probe positions.	5

Planned Maintenance Tasks

Pre-PM System Tests
MS Tests

Q1 Positive MS Test is Complete				<input checked="" type="checkbox"/>
<ul style="list-style-type: none">• Test solution: POS PPG, 2e-7 M• Flow rate: 5 µL/min• Scan rate: 10 Da/s• Cycles: 10• MCA (Analyst software): On				
Note: SCIEX OS uses Sum Of cycles instead of MCA .				
<ul style="list-style-type: none">• Data required: Spectra for masses 59.050, 175.133, 500.380, 616.464, 906.673, with peak intensities, peak width, and mass shift results, complete with method file information. Printouts can be provided if required.				
Note: After calibration, the mass shift result must be within 0.1 Da for all assigned masses.				
Mass (Da)	Intensity (cps)		Peak Width (Da)	
	Guideline	Result	Guideline	Result
175.133	≥ 1.2 × 10 ⁶	7.6865e6	0.6 to 0.8	0.6554
906.673	≥ 1.4 × 10 ⁷	1.5392e7	0.6 to 0.8	0.6522

QTRAP 5500 System
8/40

Planned Maintenance Procedure
RUO-IDV-08-6743-H

Planned Maintenance Tasks

Q3 Positive MS Test is Complete				<input checked="" type="checkbox"/>
<ul style="list-style-type: none">• Test solution: POS PPG, 2e-7 M• Flow rate: 5 µL/min• Scan rate: 10 Da/s• Cycles: 10• MCA (Analyst software): On				
Note: SCIEX OS uses Sum Of cycles instead of MCA .				
<ul style="list-style-type: none">• Data required: Spectra for masses 59.050, 175.133, 500.380, 616.464, 906.673, with peak intensities, peak width, and mass shift results, complete with method file information. Printouts can be provided if required.				
Note: After calibration, the mass shift result must be within 0.1 Da for all assigned masses.				
Mass (Da)	Intensity (cps)		Peak Width (Da)	
	Guideline	Result	Guideline	Result
175.133	≥ 1.2 × 10 ⁶	8.9594e6	0.6 to 0.8	0.6881
906.673	≥ 1.4 × 10 ⁷	3.2894e7	0.6 to 0.8	0.7302

Planned Maintenance Procedure
RUO-IDV-08-6743-H

QTRAP 5500 System
9/40

Planned Maintenance Tasks

Q1 Negative MS Test is Complete				<input checked="" type="checkbox"/>
<ul style="list-style-type: none">• Test solution: NEG PPG, 3e-5 M• Flow rate: 10 µL/min• Scan rate: 10 Da/s• Cycles: 10• MCA (Analyst software): On <p>Note: SCIEX OS uses Sum Of cycles instead of MCA.</p> <ul style="list-style-type: none">• Data required: Spectra for masses 44,998, 411,259, 585,385, 933,636, with peak intensities, peak width, and mass shift results, complete with method file information. Printouts can be provided if required. <p>Note: After calibration, the mass shift result must be within 0.1 Da for all assigned masses.</p>				
Mass (Da)	Intensity (cps)		Peak Width (Da)	
	Guideline	Result	Guideline	Result
933.636	≥ 1.0 × 10 ⁷	1.1316e7	0.6 to 0.8	0.8424

Planned Maintenance Tasks

Q3 Negative MS Test is Complete				<input checked="" type="checkbox"/>
<ul style="list-style-type: none">• Test solution: NEG PPG, 3e-5 M• Flow rate: 10 µL/min• Scan rate: 10 Da/s• Cycles: 10• MCA (Analyst software): On <p>Note: SCIEX OS uses Sum Of cycles instead of MCA.</p> <ul style="list-style-type: none">• Data required: Spectra for masses 44,998, 411,259, 585,385, 933,636, with peak intensities, peak width, and mass shift results, complete with method file information. Printouts can be provided if required. <p>Note: After calibration, the mass shift result must be within 0.1 Da for all assigned masses.</p>				
Mass (Da)	Intensity (cps)		Peak Width (Da)	
	Guideline	Result	Guideline	Result
933.636	≥ 8.0 × 10 ⁶	1.1621e7	0.6 to 0.8	0.7749

Planned Maintenance Tasks

Planned Maintenance Mass Spectrometer Maintenance

Task	Complete	N/A
Shut down the system and then disconnect the mains supply power cable.	<input checked="" type="checkbox"/>	—
(If required) Replace the roughing pump oil. The recommended interval is every 24 months.	<input checked="" type="checkbox"/>	—
Note: If an oil change is not required, then inspect the oil level and top up the oil, if required.		
CAUTION: Potential System Damage. Do not mix different types of oil. Mixing mineral oil with synthetic oil can cause pump failure.		
(If required) Replace the oil exhaust filter on the roughing pump. The recommended interval is every 24 months.	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Make sure that there is no excessive oil leakage. Clean up any oil.	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Make sure that the roughing pump exhaust is properly routed to the ventilation system.	<input checked="" type="checkbox"/>	—

QTRAP 5500 System
12/40

Planned Maintenance Procedure
RUO-IDV-08-6743-H

Planned Maintenance Tasks

Task	Complete	N/A
Inspect the exhaust system: <ul style="list-style-type: none">• Make sure that all of the gas fittings at the rear bulkhead are tight.• Make sure that all of the exhaust hoses are free of kinks.• Make sure that all of the hoses at the waste bottle are secure, and that there are no signs of leaks.• Make sure that the waste bottle is upright.• Make sure that the exhaust hose is securely connected to the lab ventilation system.• Make sure that no liquid is trapped in the exhaust lines.	<input checked="" type="checkbox"/>	—
Clean or replace the four air filters in the base of the mass spectrometer chassis.	<input checked="" type="checkbox"/>	—
(If applicable) Clean the turbo pump filter screen.	<input checked="" type="checkbox"/>	<input type="checkbox"/>
(If applicable) Make sure that the SCIEX-supplied bench cooling fans are operating properly.	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Clean the curtain plate.	<input checked="" type="checkbox"/>	—
Clean the orifice plate.	<input checked="" type="checkbox"/>	—
Clean the QJet ion guide and IQ0 lens.	<input checked="" type="checkbox"/>	—
(If contamination is detected) Clean the Q0 region and the IQ1 lens.	<input checked="" type="checkbox"/>	<input type="checkbox"/>

Planned Maintenance Procedure
RUO-IDV-08-6743-H

QTRAP 5500 System
13/40

Planned Maintenance Tasks

Task	Complete	N/A
Inspect the cable connections: <ul style="list-style-type: none"> Make sure that the power cables for the mass spectrometer, LC system, roughing pump, syringe pump, gas generator, and UPS are securely connected. Make sure that the communications cables for the Ethernet ports, LC connections, and roughing pump are securely connected. 	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Verify system support functions — gas: <ul style="list-style-type: none"> Make sure that the input gas pressures at the regulators are within specifications. Make sure that there is no liquid present in the gas lines. 	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Make sure that the expiry date on the battery system for the UPS (sold by SCIEX) has not passed. Recommend replacement of the battery tray, if required. (If applicable) Perform the planned maintenance on SCIEX non-compressor-based gas generators. Replace the Breathing Air filter, if required.	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Note: For other gas generators (sold by SCIEX), follow the service process.		
Start up the system.		
	<input checked="" type="checkbox"/>	<input type="checkbox"/>

Turbo V Ion Source Maintenance

Task	Complete	N/A
(If required) Replace the electrode in the TurbolonSpray and APCI probes.	<input type="checkbox"/>	<input checked="" type="checkbox"/>

QTRAP 5500 System
14/40

Planned Maintenance Procedure
RUO-IDV-08-6743-H

Planned Maintenance Tasks

Task	Complete	N/A
With the TurbolonSpray probe installed, make sure that the temperature reaches the recommended set point of 500 °C.	<input checked="" type="checkbox"/>	<input type="checkbox"/>
(If applicable) With the APCI probe installed, make sure that the temperature reaches the recommended set point of 400 °C.	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Make sure that no visible signs of contamination are present on the ion source. If they are, then clean the inner surfaces using lint-free wipes and a 50:50 methanol:water solution.	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Note: Remove the corona discharge needle before cleaning.		

Software Maintenance

Task	Complete	N/A
(Obtain customer approval first) Install any applicable HotFixes for the control software. Note: Make sure that the compatible instrument firmware is installed.	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Analyst software: (Obtain customer approval first) Install the Analyst Diagnostic Tool if it is not already installed.		
Analyst software: Make sure that the MS Service Log is enabled, and that it is configured as follows:	<input checked="" type="checkbox"/>	<input type="checkbox"/>
<ul style="list-style-type: none"> Log Interval (min) = 15 Log File Size (MB) = 10 File Path = C:\ProgramData\AB SCIEX\Analyst\MSServiceLog\MSScr.csv 	<input type="checkbox"/>	<input checked="" type="checkbox"/>

Planned Maintenance Procedure
RUO-IDV-08-6743-H

QTRAP 5500 System
15/40

Post-Planned Maintenance Voltage Tests

Task	Complete
Inspect the RF tuning voltages at the QPS amplifier module and then, if required, tune the coil boxes.	<input checked="" type="checkbox"/>
Inspect the detector voltage. Optimize, if required.	<input checked="" type="checkbox"/>
Detector voltage	2900

Post-PM Pressure Test

Post-PM Pressure Test is Complete			<input checked="" type="checkbox"/>
Test	Specification	Result	
Vacuum chamber pressure with CAD gas off	$0.4 \times 10^{-5} \text{ torr} \leq P_{\text{CAD off}} \leq 1.1 \times 10^{-5} \text{ torr}$	$0.8 \times 10^{-5} \text{ Torr}$	
Vacuum chamber pressure with CAD gas set to Full	$2.4 \times 10^{-5} \text{ torr} \leq P_{\text{CAD FULL}} \leq 4.5 \times 10^{-5} \text{ torr}$	$3.2 \times 10^{-5} \text{ Torr}$	

Planned Maintenance Tasks

Inspect for Contamination

Task	Complete	N/A
Inspect for front-end contamination. Refer to the section: Inspect for Contamination .	<input checked="" type="checkbox"/>	—

Post-PM System Tests

Note: SCIEX OS does not support linear ion trap (LIT) scans. Therefore, the LIT performance tests cannot be done for systems that use SCIEX OS as the control software.

Planned Maintenance Tasks

MS Tests

Q1 Positive MS Test: Intensity and Peak Width is Complete				<input checked="" type="checkbox"/>
<ul style="list-style-type: none"> Test solution: POS PPG, 2e-7 M Flow rate: 5 µL/min Scan rate: 10 Da/s Cycles: 10 MCA (Analyst software): On 				
Note: SCIEX OS uses Sum Of cycles instead of MCA.				
<ul style="list-style-type: none"> Data required: Spectra for masses 59,050, 175,133, 500,380, 616,464, 906,673, with peak intensities, peak width, and mass shift results, complete with method file information. Printouts can be provided if required. 				
Note: After calibration, the mass shift result must be within 0.1 Da for all assigned masses.				
Mass (Da)	Intensity (cps)		Peak Width (Da)	
	Specification	Result	Specification	Result
175.133	$\geq 1.2 \times 10^6$	1.0417e7	0.6 to 0.8	0.6632
906.673	$\geq 1.4 \times 10^7$	1.4566e7	0.6 to 0.8	0.7698

Planned Maintenance Tasks

Q1 Positive MS Test: Peak Width for Identified Masses is Complete				<input checked="" type="checkbox"/>
<ul style="list-style-type: none"> Test solution: POS PPG, 2e-7 M Flow rate: 5 µL/min MCA (Analyst software): On 				
Note: SCIEX OS uses Sum Of cycles instead of MCA.				
<ul style="list-style-type: none"> Data required: Spectra for masses 59,050, 175,133, 500,380, 616,464, 906,673, with peak intensities, peak width, and mass shift results, complete with method file information. Printouts can be provided if required. 				
Note: After calibration, the mass shift result must be within 0.1 Da for all assigned masses.				
Mass (Da)	Scan Rate (Da/s)	Cycles	Specification (Da)	Result (Passed)
	10	10	0.6 to 0.8	<input checked="" type="checkbox"/>
	200	50	0.6 to 0.8	
	1,000	50	0.6 to 0.8	
	2,000	100	0.6 to 0.8	

Planned Maintenance Tasks

Q3 Positive MS Test: Intensity and Peak Width is Complete				<input checked="" type="checkbox"/>
<ul style="list-style-type: none"> Test solution: POS PPG, 2e-7 M Flow rate: 5 µL/min Scan rate: 10 Da/s Cycles: 10 MCA (Analyst software): On 				
Note: SCIEX OS uses Sum Of cycles instead of MCA .				
<ul style="list-style-type: none"> Data required: Spectra for masses 59,050, 175,133, 500,380, 616,464, 906,673, with peak intensities, peak width, and mass shift results, complete with method file information. Printouts can be provided if required. 				
Note: After calibration, the mass shift result must be within 0.1 Da for all assigned masses.				
Mass (Da)	Intensity (cps)		Peak Width (Da)	
	Specification	Result	Specification	Result
175.133	$\geq 1.2 \times 10^6$	1.2897e7	0.6 to 0.8	0.7448
906.673	$\geq 1.4 \times 10^7$	1.44172e7	0.6 to 0.8	0.7549

QTRAP 5500 System
20/40

Planned Maintenance Procedure
RUO-IDV-08-6743-H

Planned Maintenance Tasks

Q3 Positive MS Test: Peak Width for Identified Masses is Complete				<input checked="" type="checkbox"/>
<ul style="list-style-type: none"> Test solution: POS PPG, 2e-7 M Flow rate: 5 µL/min MCA (Analyst software): On 				
Note: SCIEX OS uses Sum Of cycles instead of MCA .				
<ul style="list-style-type: none"> Data required: Spectra for masses 59,050, 175,133, 500,380, 616,464, 906,673, with peak intensities, peak width, and mass shift results, complete with method file information. Printouts can be provided if required. 				
Note: After calibration, the mass shift result must be within 0.1 Da for all assigned masses.				
Mass (Da)	Scan Rate (Da/s)	Cycles	Specification (Da)	Result (Passed)
	10	10	0.6 to 0.8	<input checked="" type="checkbox"/>
	200	50	0.6 to 0.8	
	1,000	50	0.6 to 0.8	
	2,000	100	0.6 to 0.8	

Planned Maintenance Procedure
RUO-IDV-08-6743-H

QTRAP 5500 System
21/40

Planned Maintenance Tasks

Q1 Negative MS Test: Intensity and Peak Width is Complete				<input checked="" type="checkbox"/>
<ul style="list-style-type: none">• Test solution: NEG PPG, 3e-5 M• Flow rate: 10 µL/min• Scan rate: 10 Da/s• Cycles: 10• MCA (Analyst software): On <p>Note: SCIEX OS uses Sum Of cycles instead of MCA.</p> <ul style="list-style-type: none">• Data required: Spectra for masses 44,998, 411,259, 585,385, 933,636, with peak intensities, peak width, and mass shift results, complete with method file information. Printouts can be provided if required. <p>Note: After calibration, the mass shift result must be within 0.1 Da for all assigned masses.</p>				
Mass (Da)	Intensity (cps)		Peak Width (Da)	
	Specification	Result	Specification	Result
933.636	≥ 1.0 × 10 ⁷	1.2535e7	0.6 to 0.8	0.7192

Planned Maintenance Tasks

Q1 Negative MS Test: Peak Width for Identified Masses is Complete					<input checked="" type="checkbox"/>
<ul style="list-style-type: none">• Test solution: NEG PPG, 3e-5 M• Flow rate: 10 µL/min• MCA (Analyst software): On <p>Note: SCIEX OS uses Sum Of cycles instead of MCA.</p> <ul style="list-style-type: none">• Data required: Spectra for masses 44,998, 411,259, 585,385, 933,636, with peak intensities, peak width, and mass shift results, complete with method file information. Printouts can be provided if required. <p>Note: After calibration, the mass shift result must be within 0.1 Da for all assigned masses.</p>					
Mass (Da)	Scan Rate (Da/s)	Cycles	Specification (Da)	Result (Passed)	
	10	10	0.6 to 0.8	<input checked="" type="checkbox"/>	
	200	50	0.6 to 0.8		
	1,000	50	0.6 to 0.8		
	2,000	100	0.6 to 0.8		

Planned Maintenance Tasks

Q3 Negative MS Test: Intensity and Peak Width is Complete				<input checked="" type="checkbox"/>
<ul style="list-style-type: none"> Test solution: NEG PPG, 3e-5 M Flow rate: 10 µL/min Scan rate: 10 Da/s Cycles: 10 MCA (Analyst software): On 				
Note: SCIEX OS uses Sum Of cycles instead of MCA.				
<ul style="list-style-type: none"> Data required: Spectra for masses 44,998, 411,259, 585,385, 933,636, with peak intensities, peak width, and mass shift results, complete with method file information. Printouts can be provided if required. 				
Note: After calibration, the mass shift result must be within 0.1 Da for all assigned masses.				
Mass (Da)	Intensity (cps)		Peak Width (Da)	
	Specification	Result	Specification	Result
933.636	≥ 8.0 × 10 ⁶	1.1111e7	0.6 to 0.8	0.7997

Planned Maintenance Tasks

Q3 Negative MS Test: Peak Width for Identified Masses is Complete					<input checked="" type="checkbox"/>
<ul style="list-style-type: none"> Test solution: NEG PPG, 3e-5 M Flow rate: 10 µL/min MCA (Analyst software): On 					
Note: SCIEX OS uses Sum Of cycles instead of MCA.					
<ul style="list-style-type: none"> Data required: Spectra for masses 44,998, 411,259, 585,385, 933,636, with peak intensities, peak width, and mass shift results, complete with method file information. Printouts can be provided if required. 					
Note: After calibration, the mass shift result must be within 0.1 Da for all assigned masses.					
Mass (Da)	Scan Rate (Da/s)	Cycles	Specification (Da)	Result (Passed)	
44,998, 411,259, 585,385, 933,636	10	10	0.6 to 0.8	<input checked="" type="checkbox"/>	
	200	50	0.6 to 0.8		
	1,000	50	0.6 to 0.8		
	2,000	100	0.6 to 0.8		

Planned Maintenance Tasks

Reserpine MS/MS Transmission Test is Complete		<input checked="" type="checkbox"/>
<ul style="list-style-type: none"> Test solution: Reserpine solution 0.167 pmol/μL Flow rate: 5 μL/min Scan rate: 10 Da/s (both MS and MS/MS) Scan mode: Product Ion (MS2) Product Of: 609.3 (or as calibrated) Product Ion: 195.1 Cycles: 10 MCA (Analyst software): On 		
Note: SCIEX OS uses Sum Of cycles instead of MCA .		
<ul style="list-style-type: none"> Data required: Spectra for masses 609.3 and 195.1, with peak intensities, peak width, and mass shift results, complete with method file information. Printouts can be provided if required. 		
Specification	Result	
Transmission efficiency	$\frac{\text{Intensity for ion at } m/z \text{ 195.1}}{\text{Intensity for ion at } m/z \text{ 609.3 (or as calibrated)}} \times 100 \geq 10\%$	21.5%

QTRAP 5500 System
26/40

Planned Maintenance Procedure
RUO-IDV-08-8743-H



Planned Maintenance Tasks

LIT Tests

Positive Enhanced Resolution (ER) Mode Test: Intensity and Peak Width is Complete				Complete	N/A ¹
Note: If N/A is selected, then this section can be left blank.					
<ul style="list-style-type: none"> Test solution: ES Tuning Solution (1:100 dilution) Flow rate: 5 μL/min Cycles: 50 Fill time: 0.05 ms MCA: On Data required: Spectra for masses 118.087, 322.049, 622.029, 922.010, with peak intensities, peak width, and mass shift results, complete with method file information. Printouts can be provided if required. 					
Scan Rate (Da/s)	Mass	Intensity (cps)		Peak Width (Da)	
		Specification	Result	Specification	Result
1,000	118.087	$\geq 7.2 \times 10^6$	1.0480e7	< 0.35	0.1566
	922.010	$\geq 2.8 \times 10^7$	3.1680e7	< 0.35	0.2208
10,000	118.087	$\geq 2.4 \times 10^7$	4.4687e7	< 0.65	0.3330
	922.010	$\geq 6.8 \times 10^7$	7.1500e7	< 0.65	0.4882
20,000	118.087	$\geq 1.6 \times 10^7$	5.8667e7	< 0.75	0.4183

¹ Select this option if SCIEX OS is being used as the control software.



Planned Maintenance Tasks

Positive Enhanced Resolution (ER) Mode Test: Intensity and Peak Width is Complete						Complete	N/A
Scan Rate (Da/s)	Mass	Intensity (cps)		Peak Width (Da)			
		Specification	Result	Specification	Result		
	922.010	$\geq 5.6 \times 10^7$	6.8333e7	< 0.75	0.5779		

QTRAP 5500 System
28/40

Planned Maintenance Procedure
RUO-IDV-08-6743-H

Planned Maintenance Tasks

Positive Enhanced Resolution (ER) Mode Test: Peak Width for Identified Masses is Complete						Complete	N/A
Note: If N/A is selected, then this section can be left blank.							
<ul style="list-style-type: none">• Test solution: ES Tuning Solution (1:100 dilution)• Flow rate: 5 $\mu\text{L}/\text{min}$• Cycles: 50• MCA: On• Data required: Spectra for masses 118.087, 322.049, 622.029, 922.010, with peak intensities, peak width, and mass shift results, complete with method file information. Printouts can be provided if required.							
Scan Rate	Fill Time	Mass	Peak Width (Da)	Result			
50	2.0	118.087	< 0.20	0.0738			
		922.010	< 0.11	0.0560			
250	0.2	118.087	< 0.20	0.1272			
		922.010	< 0.20	0.1051			

Planned Maintenance Procedure
RUO-IDV-08-6743-H

QTRAP 5500 System
29/40

Planned Maintenance Tasks

Negative Enhanced Resolution (ER) Mode Test: Intensity and Peak Width is Complete			
Complete			N/A ¹
<input type="radio"/>			<input type="radio"/>

Note: If N/A is selected, then this section can be left blank.

- **Test solution:** ES Tuning Solution (1:100 dilution)
- **Flow rate:** 5 $\mu\text{L}/\text{min}$
- **Cycles:** 50
- **Fill time:** 0.05 ms
- **MCA:** On
- **Data required:** Spectra for masses 112.985, 431.982, 601.978, with peak intensities, peak width, and mass shift results, complete with method file information. Printouts can be provided if required.

Scan Rate (Da/s)	Mass	Intensity (cps)		Peak Width (Da)	
		Specification	Result	Specification	Result
1,000	431.982	$\geq 4.4 \times 10^7$	1.0220e8	< 0.35	0.2059
	601.978	$\geq 5.6 \times 10^7$	8.3040e7	< 0.35	0.1946
10,000	431.982	$\geq 1.2 \times 10^8$	1.6250e8	< 0.65	0.3339
	601.978	$\geq 1.6 \times 10^8$	1.4900e8	< 0.65	0.3100
20,000	431.982	$\geq 1.0 \times 10^8$	1.6083e8	< 0.75	0.4115

QTRAP 5500 System
30/40

Planned Maintenance Procedure
RUO-IDV-08-6743-H

Planned Maintenance Tasks

Negative Enhanced Resolution (ER) Mode Test: Intensity and Peak Width is Complete			
Complete			N/A ¹
<input checked="" type="radio"/>			<input type="radio"/>

Scan Rate (Da/s)	Mass	Intensity (cps)		Peak Width (Da)	
		Specification	Result	Specification	Result
	601.978	$\geq 1.2 \times 10^8$	1.2050e8	< 0.75	0.4336

Planned Maintenance Procedure
RUO-IDV-08-6743-H

QTRAP 5500 System
31/40

Planned Maintenance Tasks

Negative Enhanced Resolution (ER) Mode Test: Peak Width for Identified Masses is Complete					Complete	N/A ¹
Note: If N/A is selected, then this section can be left blank.						
<ul style="list-style-type: none"> Test solution: ES Tuning Solution (1:100 dilution) Flow rate: 5 $\mu\text{L}/\text{min}$ Cycles: 50 MCA: On Data required: Spectra for masses 112.985, 431.982, 601.978, with peak intensities, peak width, and mass shift results, complete with method file information. Printouts can be provided if required. 						
Mass (Da)	Scan Rate (Dals)	Fill Time (ms)	Peak Width (Da)	Result (Passed)		
431.982	50	2.0	< 0.11	<input checked="" type="checkbox"/>		
	250	0.05	< 0.20			
601.978	50	2.0	< 0.11			
	250	0.05	< 0.20			

Planned Maintenance Tasks

Enhanced Product Ion (EPI) Mode Test is Complete			Complete	N/A ¹
Note: If N/A is selected, then this section can be left blank.				
<ul style="list-style-type: none"> Test solution: Reserpine solution 0.167 $\text{pmol}/\mu\text{L}$ Flow rate: 5 $\mu\text{L}/\text{min}$ Scan mode: EPI Scan rate: 10,000 Da/s Cycles: 20 MCA: On Data required: Spectra for mass 397.2 Da, with peak intensities, peak width, and mass shift results for Q0 trapping ON and Q0 trapping OFF; complete with method file information, Printouts can be provided if required. 				
Intensity of 397.2				
Q0 Trapping Off		Q0 Trapping On		
Specification	Result	Specification	Result	
$\geq 2.0 \times 10^6$	6.5833e6	$\geq 6.4 \times 10^6$	2.3333e7	

Planned Maintenance Tasks

MS/MS/MS Mode Test is Complete		Complete	N/A									
<p>Note: If N/A is selected, then this section can be left blank.</p> <ul style="list-style-type: none"> • Test solution: Reserpine solution 0.167 pmol/μL • Flow rate: 5 μL/min • Scan mode: MS3 • Scan rate: 1,000 Da/s • Cycles: 20 • MCA: On • Data required: The full scan for Fragmentation Off and Fragmentation On, spectra for masses 236 and 365, with peak intensities, peak width, and mass shift results, complete with method file information. Printouts can be provided if required. 												
<p>Table 2-1 Verification for the MS/MS/MS Mode Test</p> <table border="1"> <thead> <tr> <th>Fragmentation</th> <th>Specification</th> <th>Result</th> </tr> </thead> <tbody> <tr> <td>OFF</td> <td>Spectrum contains mass 397.2 Da only.</td> <td><input checked="" type="radio"/></td> </tr> <tr> <td>ON</td> <td>Intensity of mass 236 Da or 365 Da $\geq 1.6 \times 10^6$.</td> <td>9.2400e6</td> </tr> </tbody> </table>				Fragmentation	Specification	Result	OFF	Spectrum contains mass 397.2 Da only.	<input checked="" type="radio"/>	ON	Intensity of mass 236 Da or 365 Da $\geq 1.6 \times 10^6$.	9.2400e6
Fragmentation	Specification	Result										
OFF	Spectrum contains mass 397.2 Da only.	<input checked="" type="radio"/>										
ON	Intensity of mass 236 Da or 365 Da $\geq 1.6 \times 10^6$.	9.2400e6										

Planned Maintenance Tasks

Post-PM Tasks

Task	Complete	N/A
Delete any unnecessary files.	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Back up the instrument settings folder for the control software. <ul style="list-style-type: none"> • Analyst software: API Instrument • SCIEX OS: InstrumentData 	<input checked="" type="checkbox"/>	<input type="checkbox"/>
(If applicable) Defragment the hard drive. Note: If the computer has solid state drives (SSDs), do not defragment.	<input type="checkbox"/>	<input checked="" type="radio"/>
If the customer has a Software Support Plan, then perform the Software Health Check: <ul style="list-style-type: none"> • (Obtain customer approval first) Install any compatible HotFixes and updates for SCIEX add-on software. 	<input type="checkbox"/>	<input checked="" type="radio"/>

Restore the Probe Position

Task	Complete	N/A
Restore the vertical and horizontal probe positions to those recorded in the section: Record the Probe Position .	<input checked="" type="checkbox"/>	<input type="checkbox"/>

Planned Maintenance Tasks

StatusScope Remote Monitoring Service Tasks

Task	Complete	N/A
<p>Note: Installation of the StatusScope remote monitoring service is available only to warranty and eligible contract customers. Go to scieix.com/instrument-service-and-support/statusscope-remote-monitoring for a list of eligible contracts.</p> <p>If the StatusScope remote monitoring service is not installed, then perform these tasks:</p> <ul style="list-style-type: none"> If the customer does not want the StatusScope remote monitoring service installed, then skip the remaining steps in this section. If the customer wants the StatusScope remote monitoring service installed, then complete the steps in this section. <p>Verify the connection to the server for the StatusScope remote monitoring service.</p> <p>Note: Use the <code>StatusScopePortCheck.exe</code>. The utility is included with the installer for the StatusScope remote monitoring service.</p> <p>Install the agent for the StatusScope remote monitoring service.</p> <p>Ask the customer to log on to SCIEIX Now to verify that the instrument is connected to the server for the StatusScope remote monitoring service.</p> <p>Note: The instrument is shown under the account of the Primary Contact.</p>	<input type="checkbox"/>	—
	<input type="radio"/>	<input checked="" type="radio"/>
	<input type="radio"/>	<input checked="" type="radio"/>
	<input type="radio"/>	<input checked="" type="radio"/>

QTRAP 5500 System
36/40

Planned Maintenance Procedure
RUO-IDW-08-8743-H

Planned Maintenance Tasks

Wrap-up

Task	Complete	N/A
Review the work performed with the customer.	<input checked="" type="checkbox"/>	—
Record the test results in this document and then attach all of the test data.	<input checked="" type="checkbox"/>	—
Review the routine maintenance schedule and the procedures with the customer.	<input checked="" type="checkbox"/>	—
<p>Complete this document:</p> <ul style="list-style-type: none"> Review the test results with the customer. SCIEX OS: In SCIEX OS, create the folder <code>D:\SCIEX_OS_Data\PM (data)</code>. Save reports and data in this folder. Provide the customer with the completed document. If an electronic copy of the document is supplied to the customer, then save a copy on the Service drive. 	<input checked="" type="checkbox"/>	—

Planned Maintenance Procedure
RUO-IDW-08-8743-H

QTRAP 5500 System
37/40

Service Request Number

3

Service request number		02435836
Organization		ALS Laboratory Group (Thailand) Co., Ltd
Mass spectrometer serial number		AU25591101
FSE name	Nitinal Phachai	Date (yyyy-mm-dd) 2023-07-20

QTRAP 5500 System
38/40

Planned Maintenance Procedure
RUO-IDV-08-6743-H

Service Request Number

Comments and Exceptions

After PM the instrument Working Normal

Planned Maintenance Procedure
RUO-IDV-08-6743-H

QTRAP 5500 System
39/40

Inspect for Contamination

A

Perform a Q1 and Q3 charging test to determine whether front end contamination is present.

1. Run the **Pos PPG** method for 10 minutes, monitoring the total ion count (TIC) for degradation of the signal or a decrease in sensitivity.
2. Change the polarity to Negative, and then scan for one minute.
3. Change the polarity to Positive, and then make sure that the **IS** parameter returns to the original value.
4. Run the method.
If the signal sensitivity is restored temporarily but the TIC again degrades by more than 5% over a 10 minute run, then a possible front-end contamination is indicated.
5. Repeat the test in Negative polarity using the Q1 Neg PPG method.

Guidelines for Cleaning the Front End

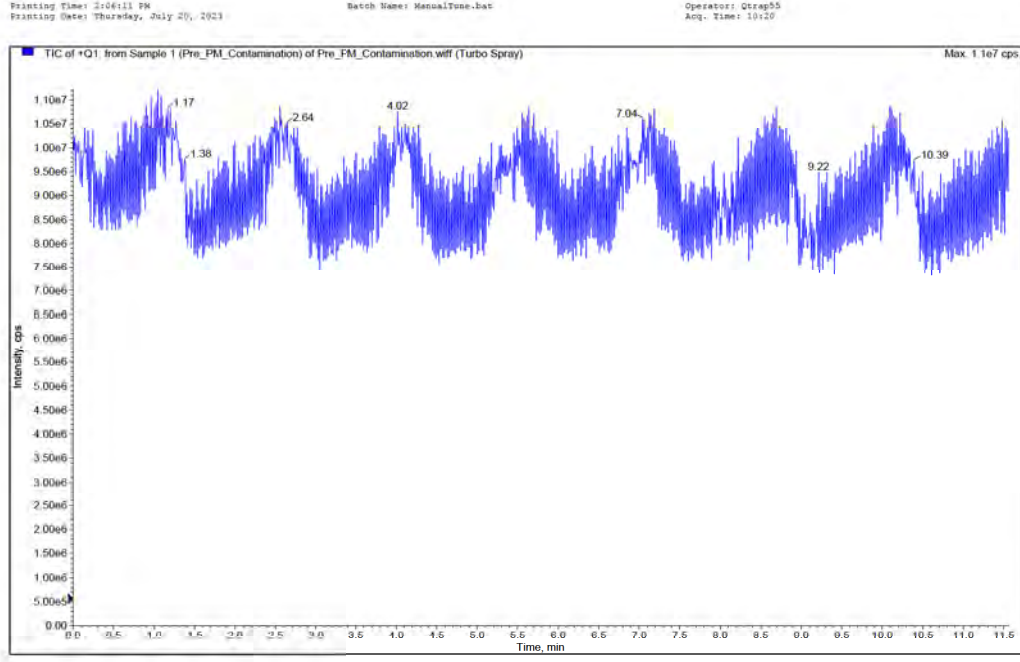
If charging tests indicate that cleaning is necessary, then clean the front-end components, including the QJet ion guide, IQ0 lens, Q0 quadrupole, and IQ1 lens.

Removing the ion optics is considered a repair activity. FSEs must open a separate service repair call.

Note: This procedure does not provide troubleshooting for all technical root causes of signal degradation or charging effect. Signal degradation might also result from a contaminated TurbolonSpray probe or electrode, method parameters that are not optimized, or other factors.

QTRAP 5500 Sy#1171
40/40

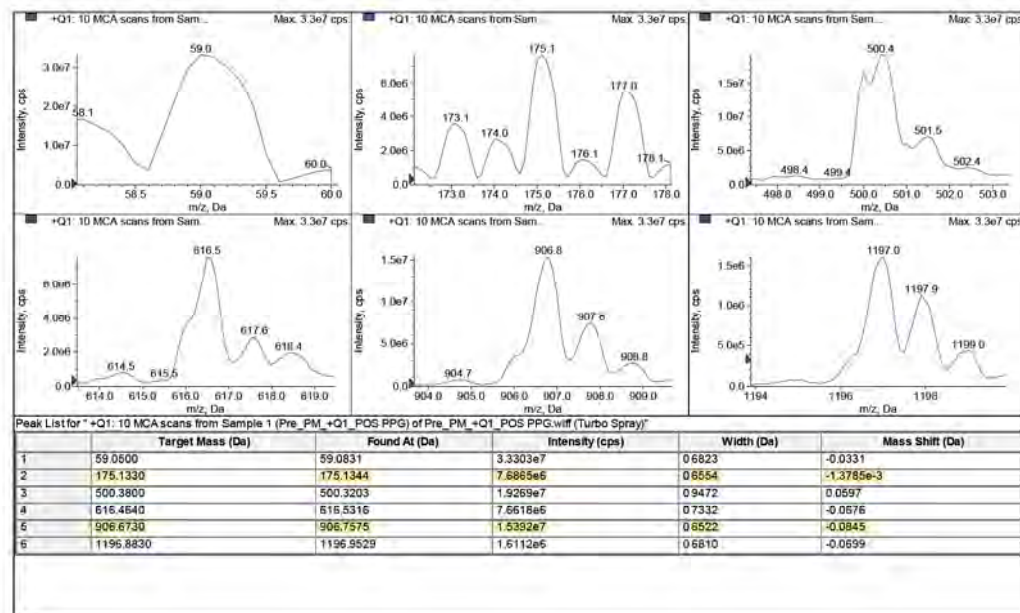
Planned Maintenance Procedure
RUO-IDV-08-6743-H



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Printing Date: Thursday, July 20, 2023

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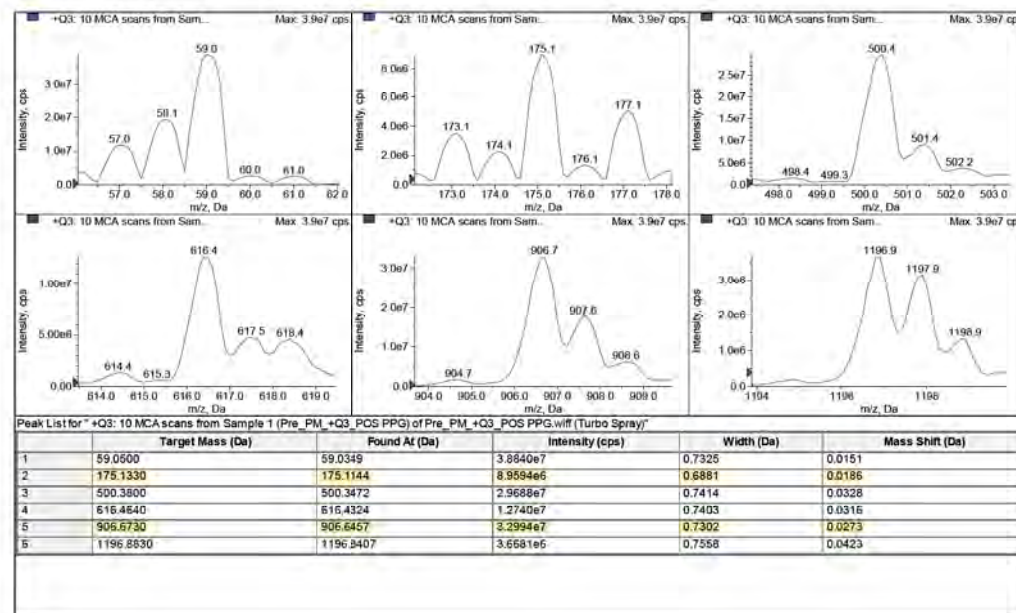
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Acq. Time: 10:14

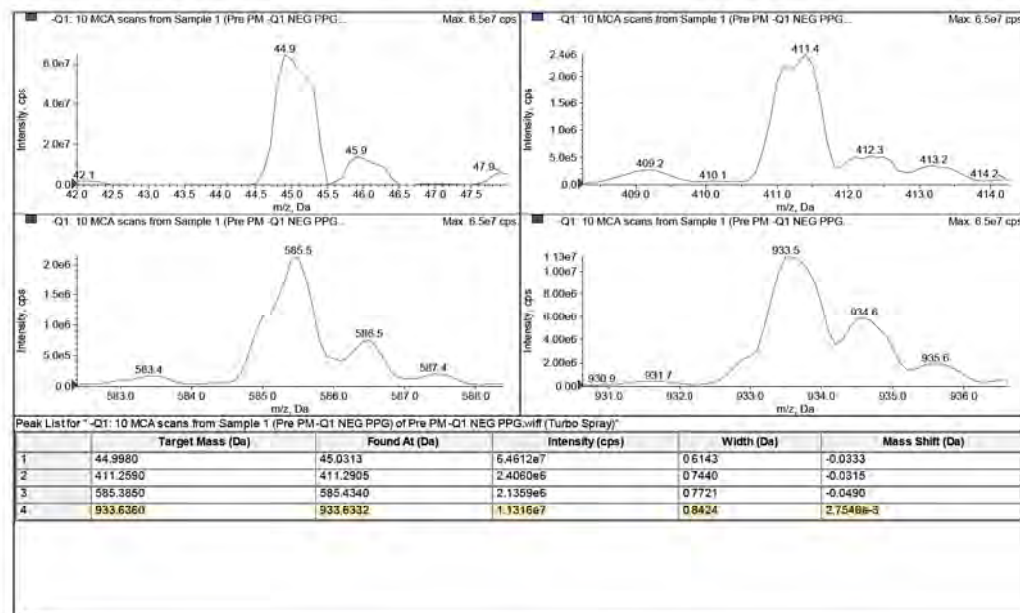


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Exp. Time: 12:10

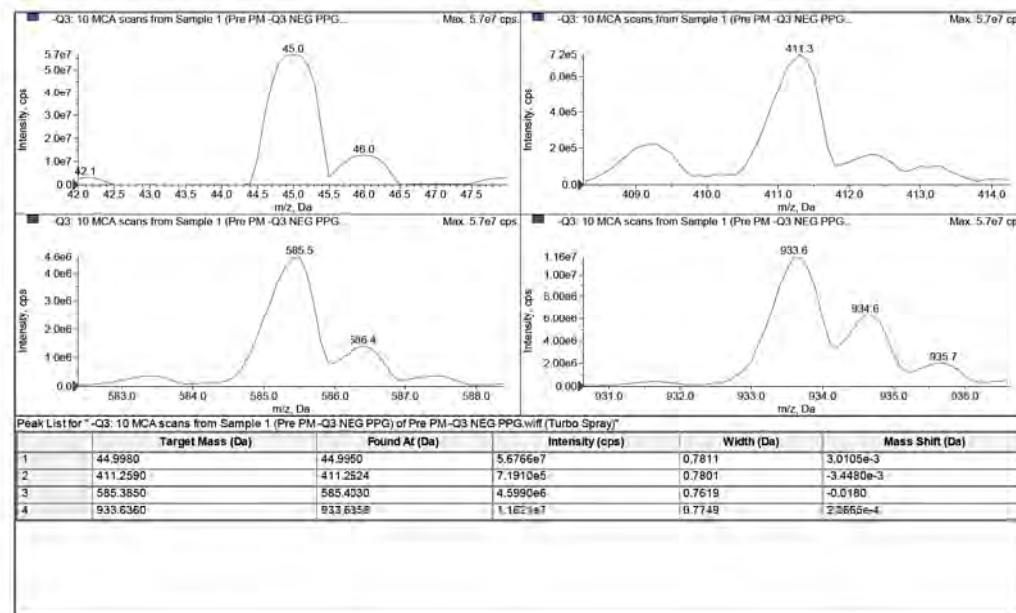


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Printing Date: Thursday, July 20, 2023

Batch Name: ManualTune.dat

Operator: Qtrap55

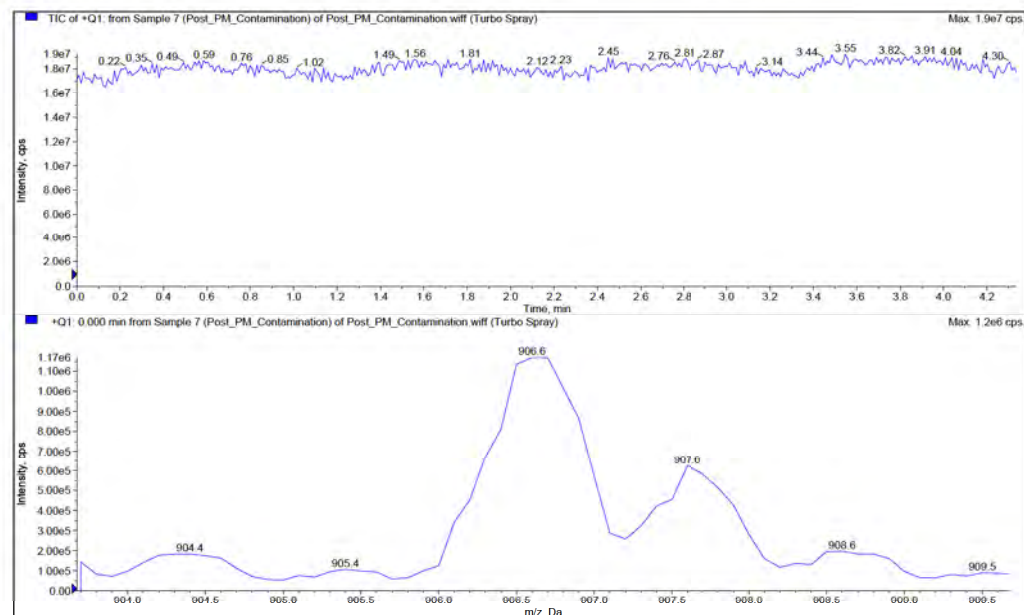
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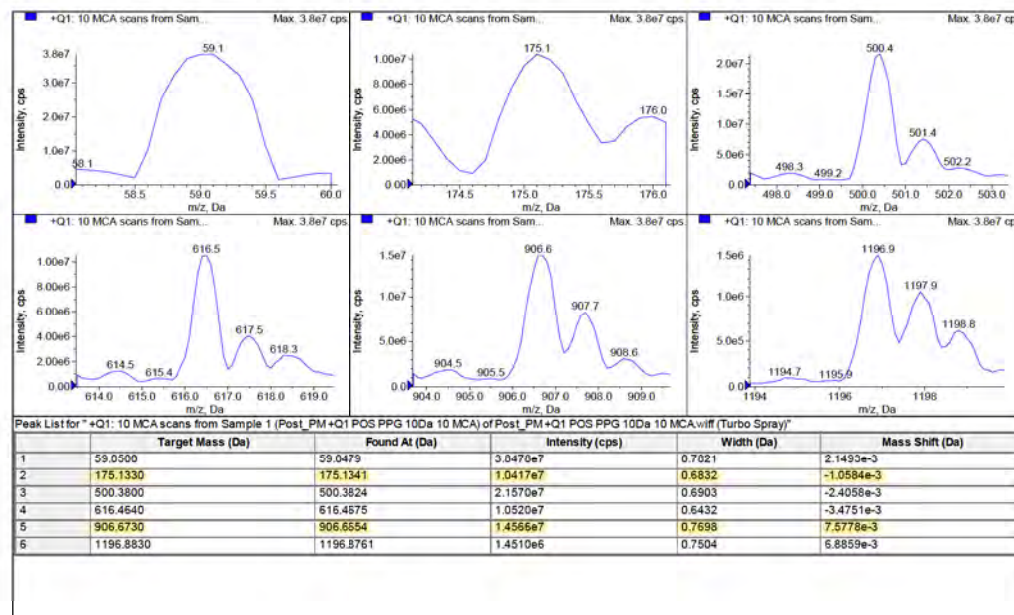
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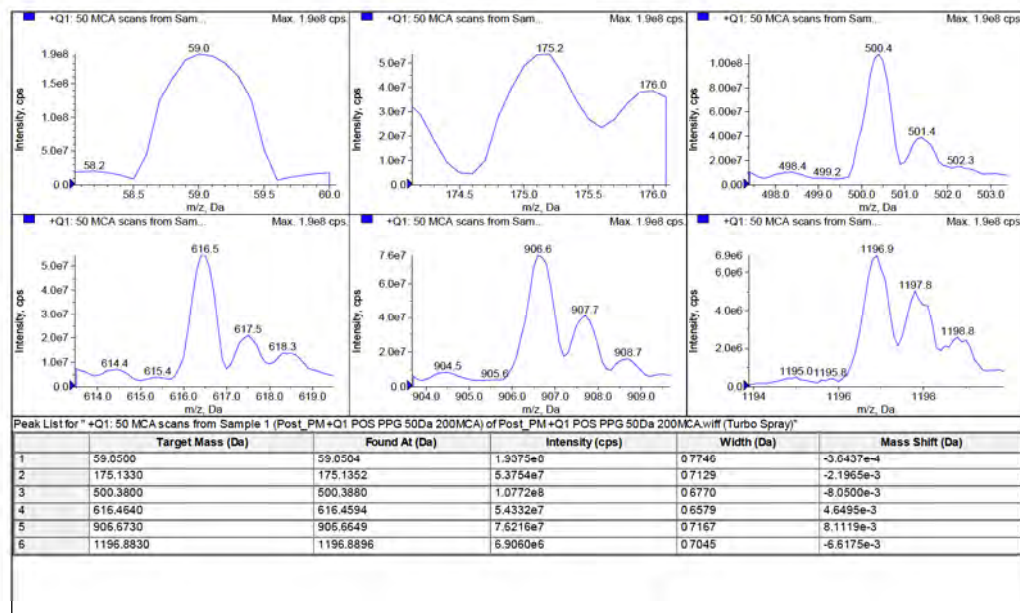
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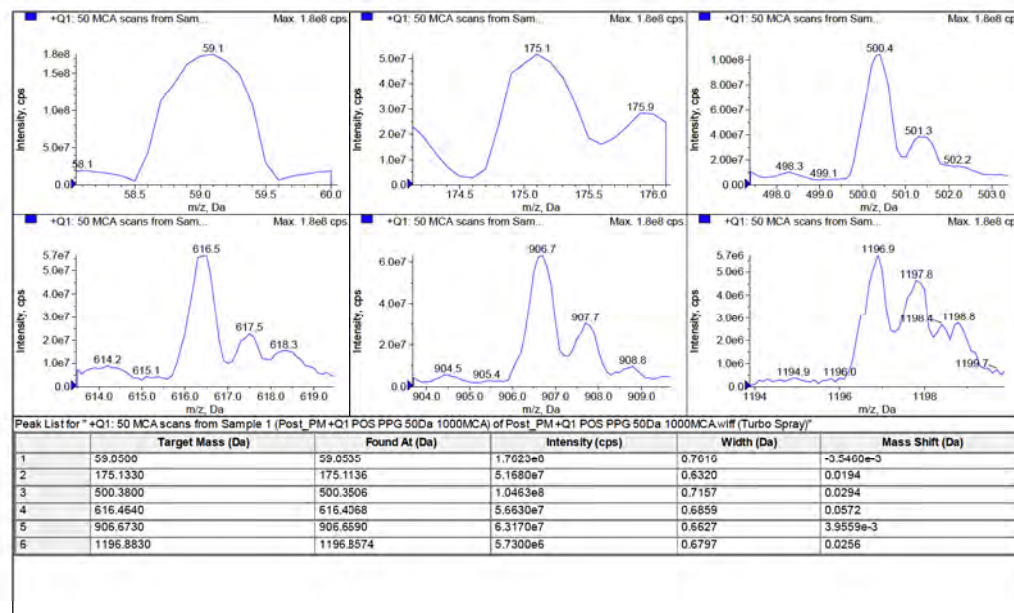
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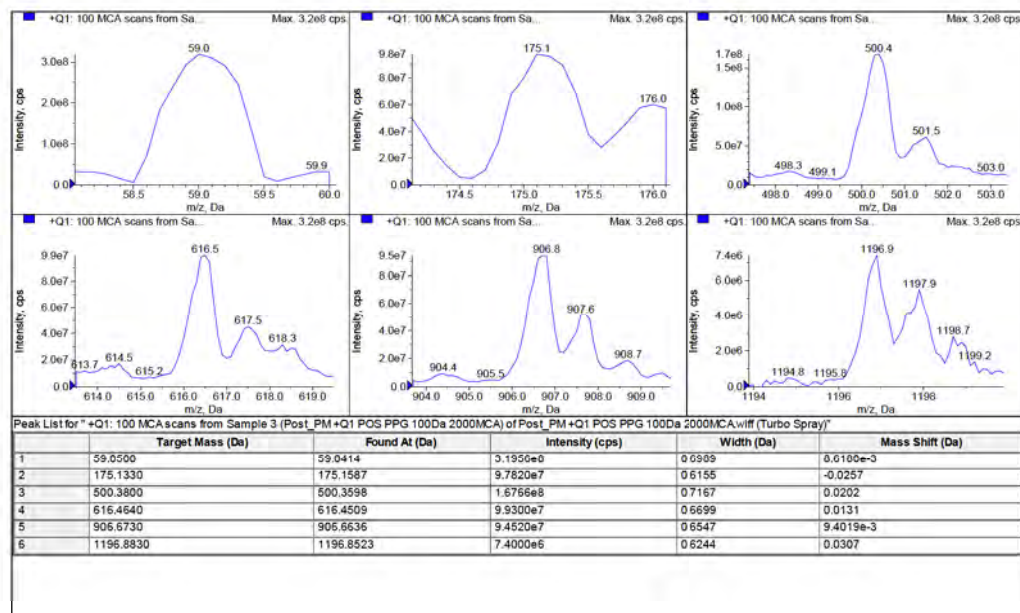
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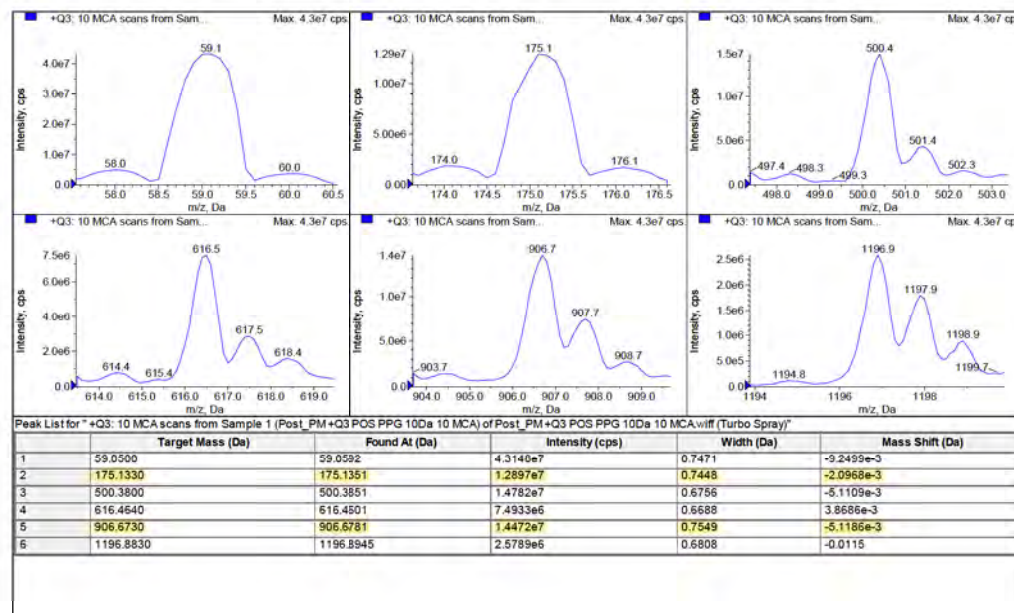
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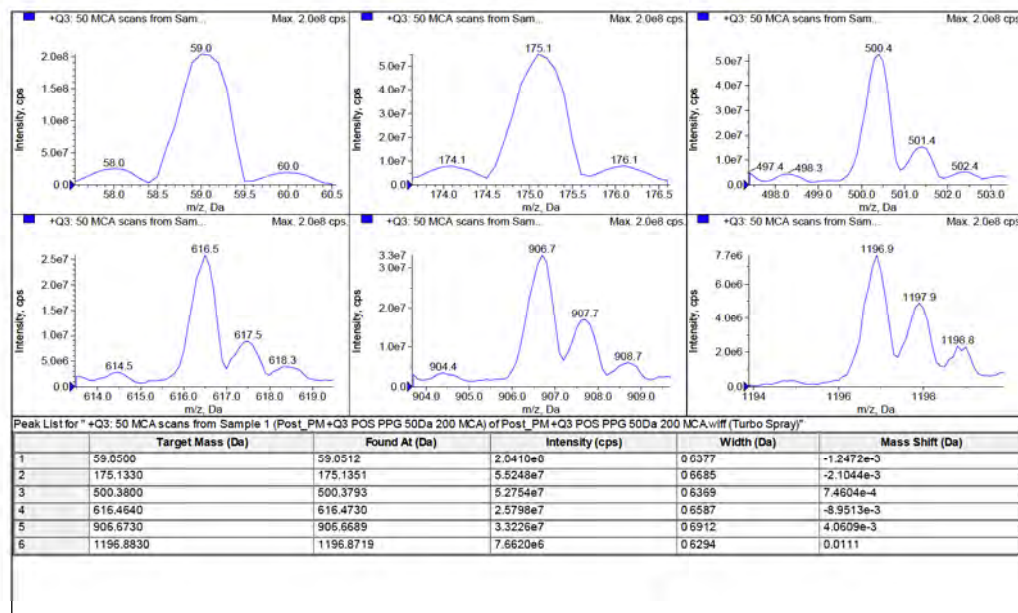
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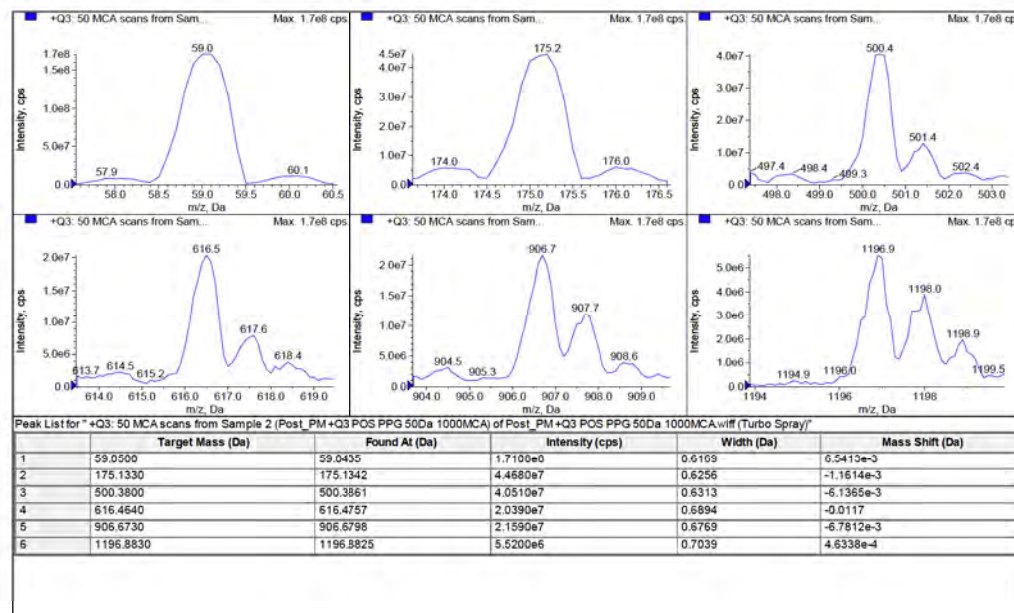
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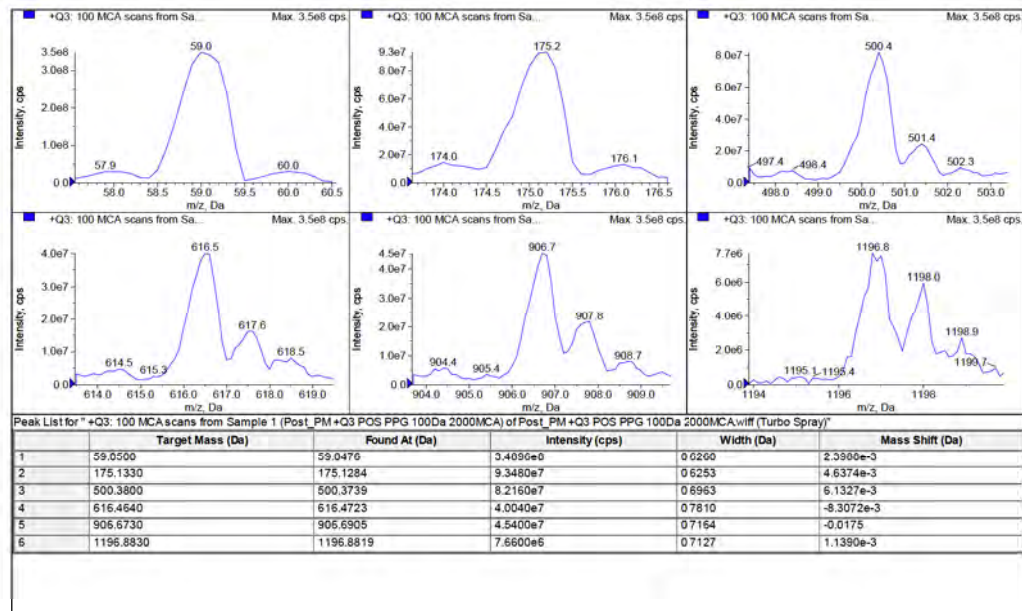
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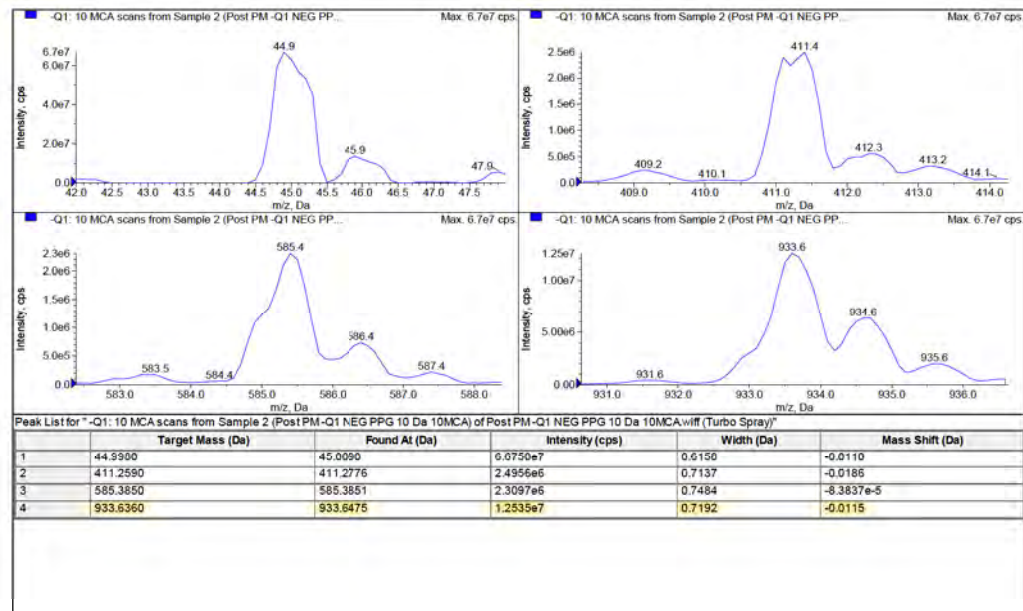
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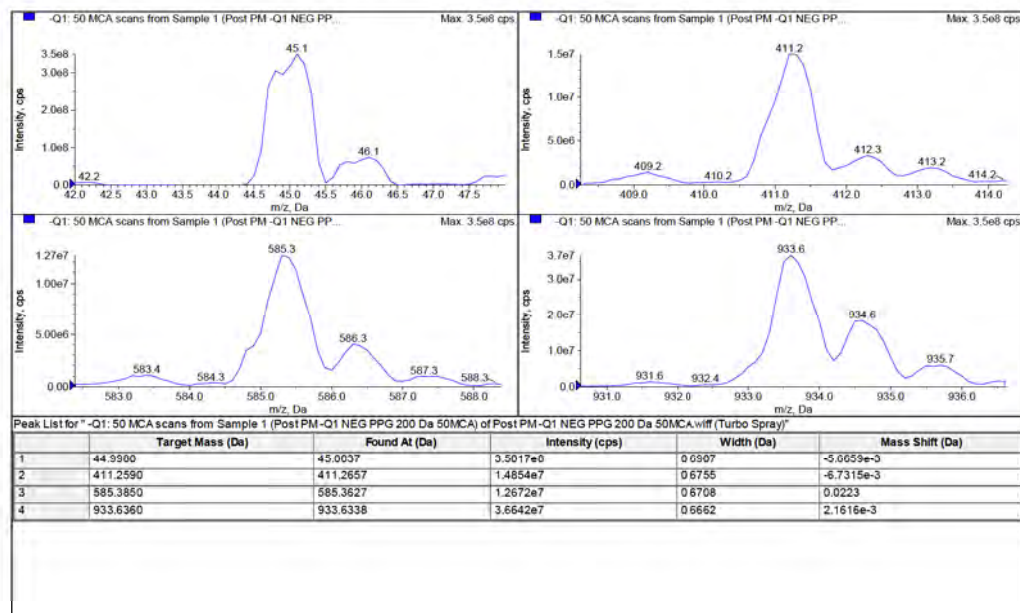
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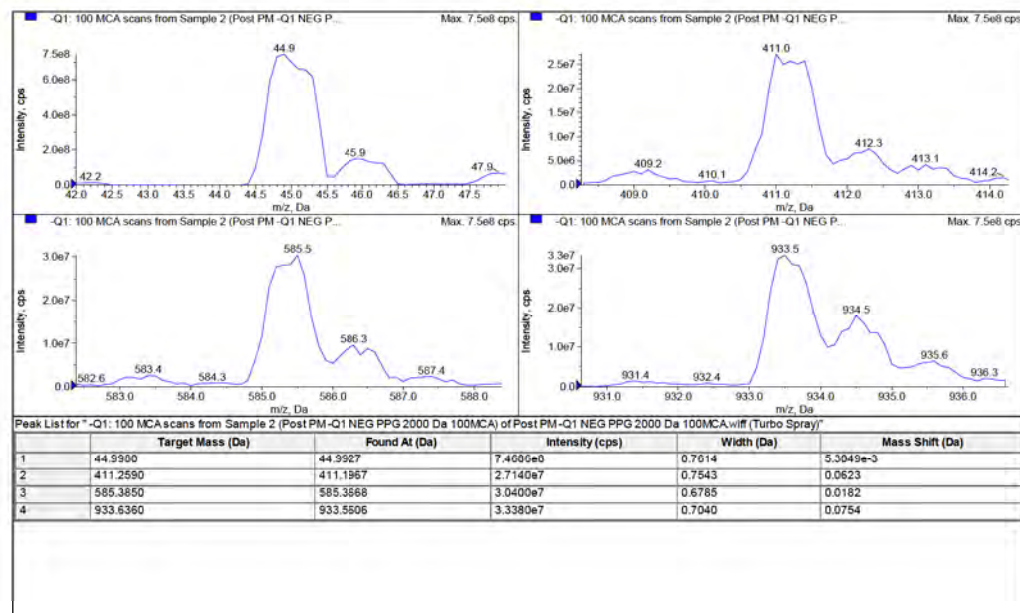
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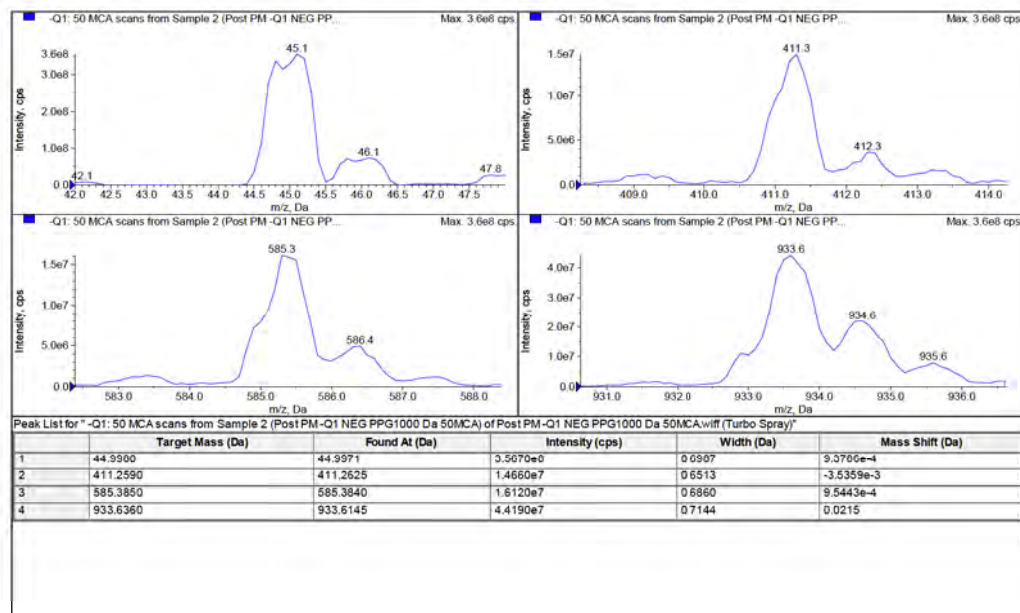
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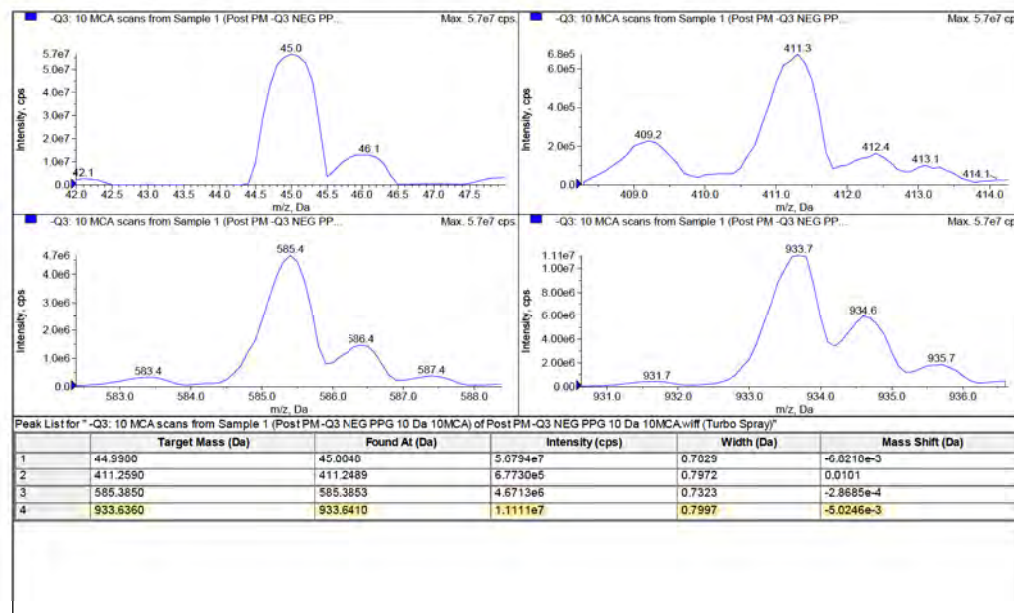
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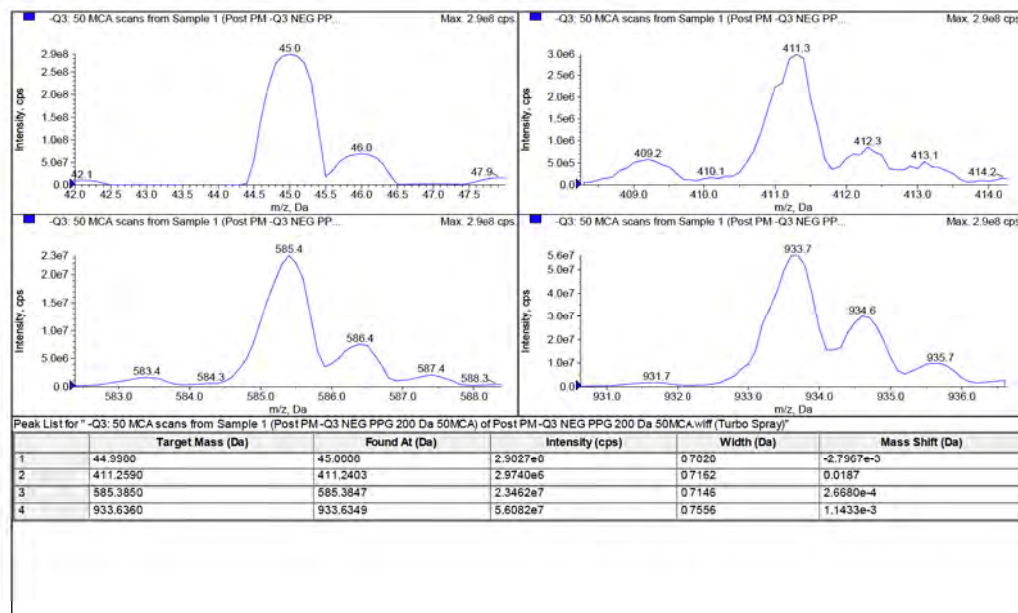
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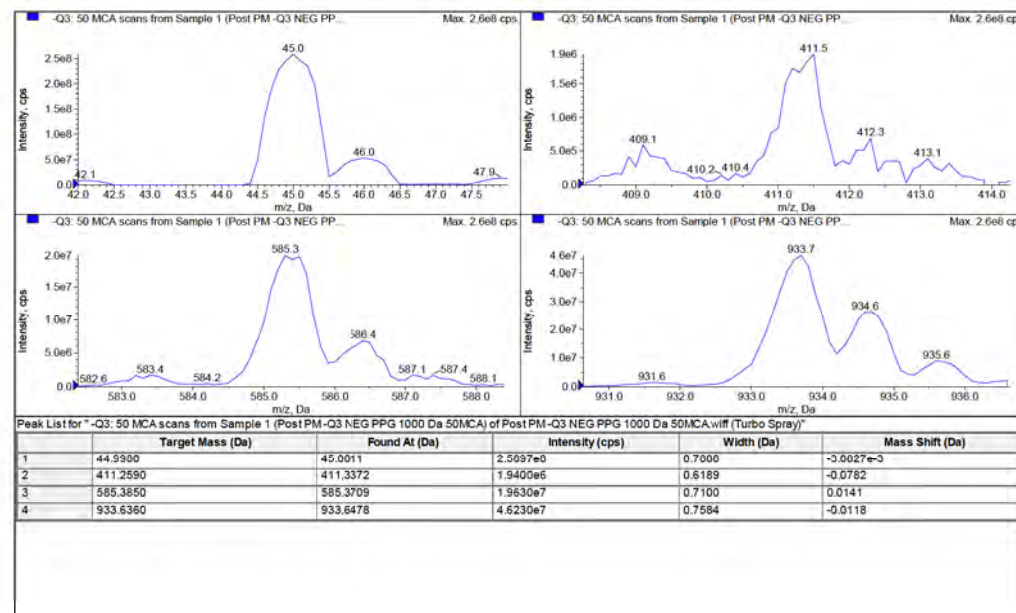
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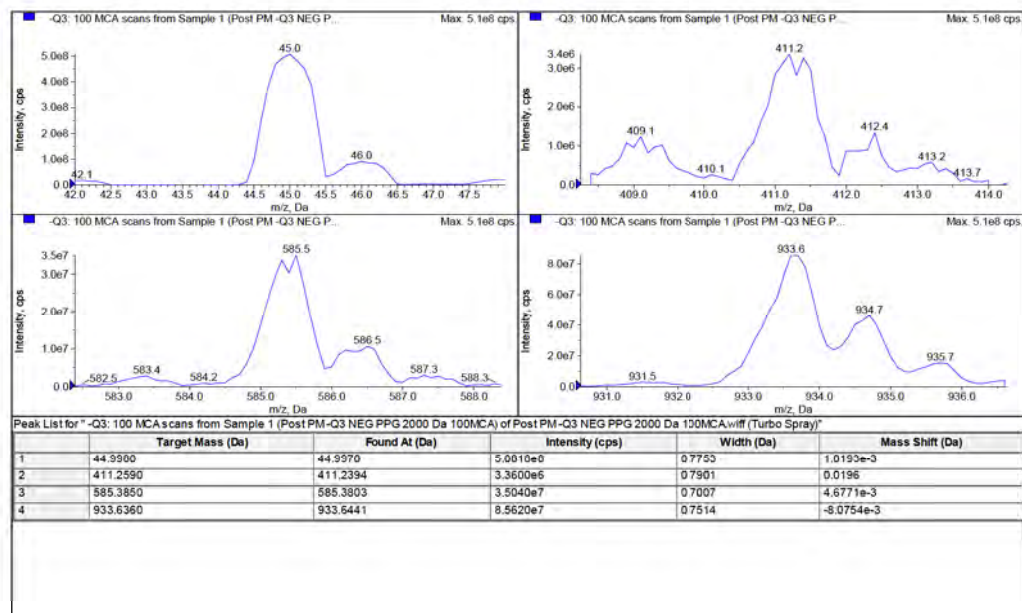
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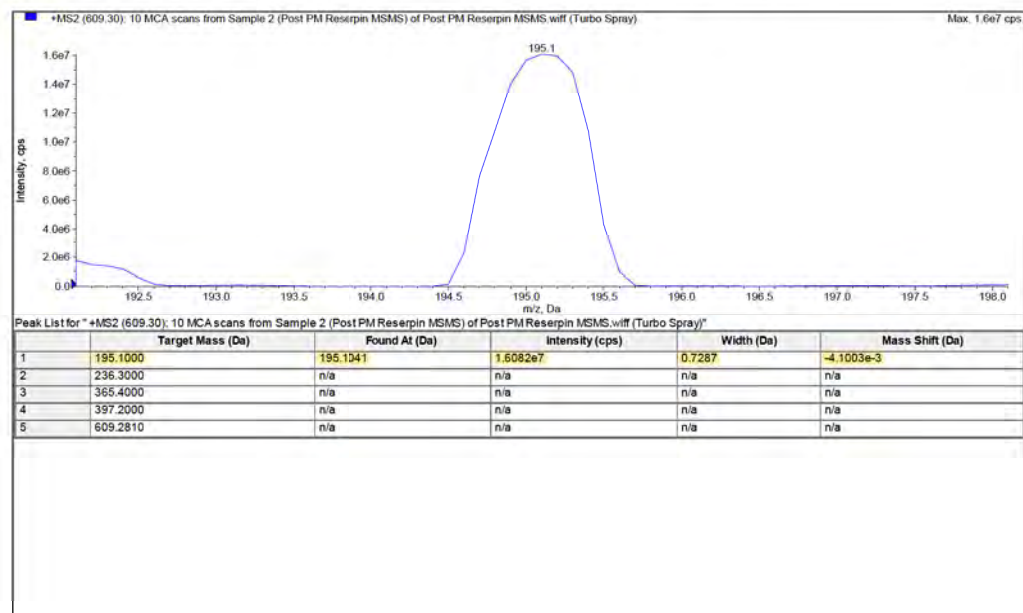
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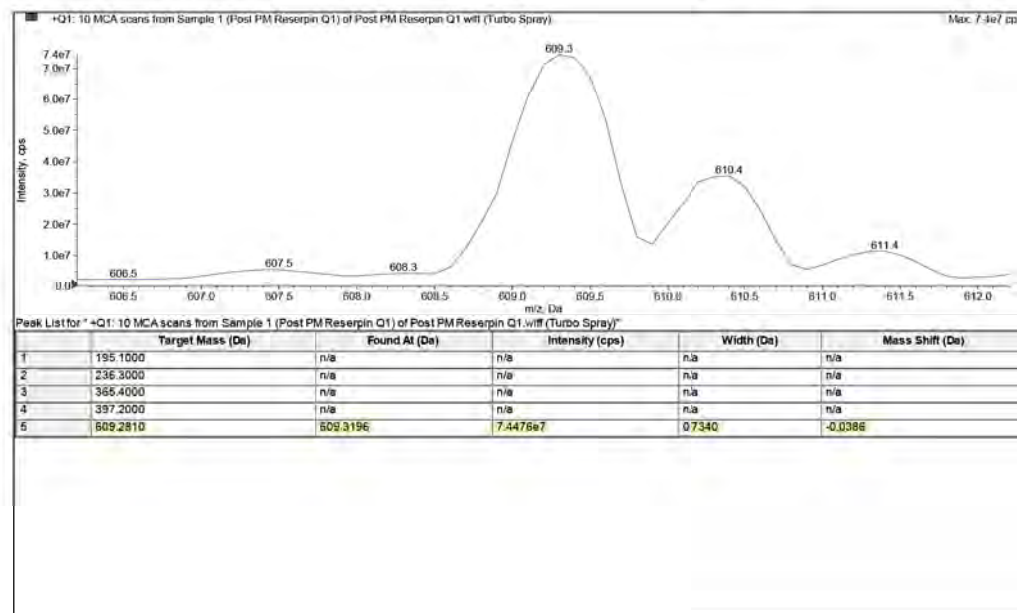
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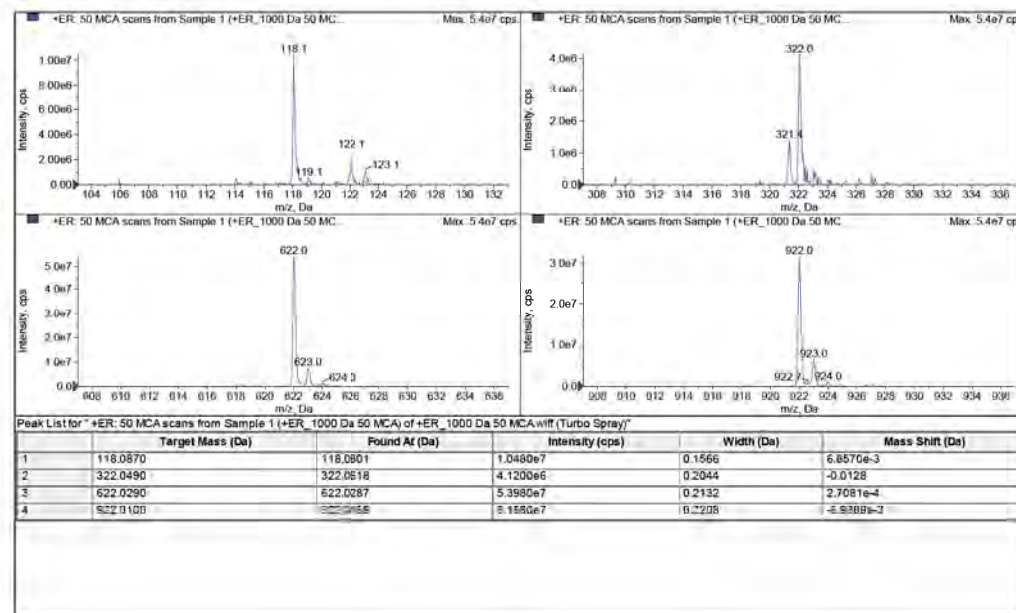
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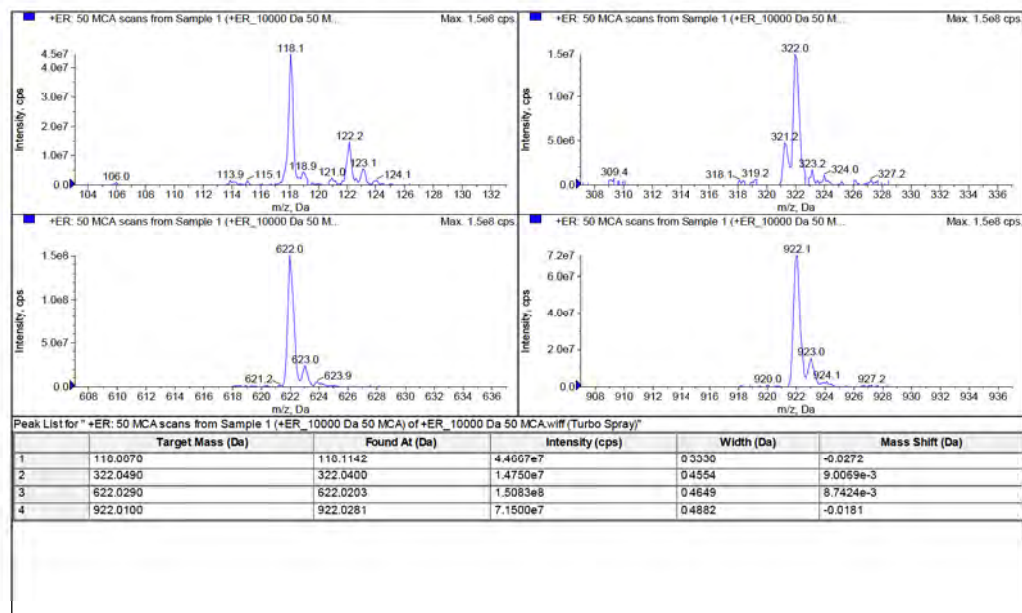
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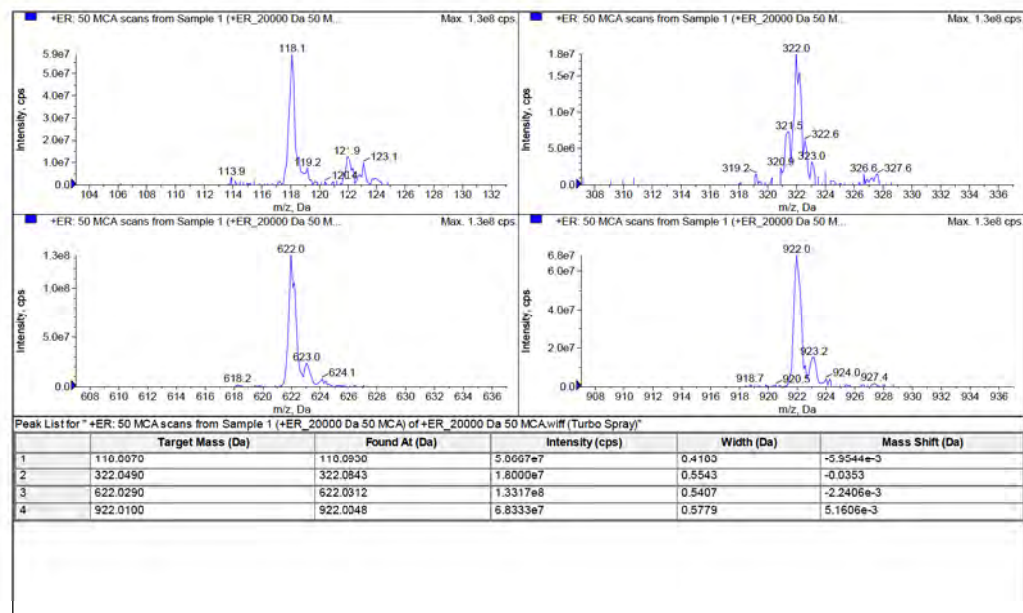
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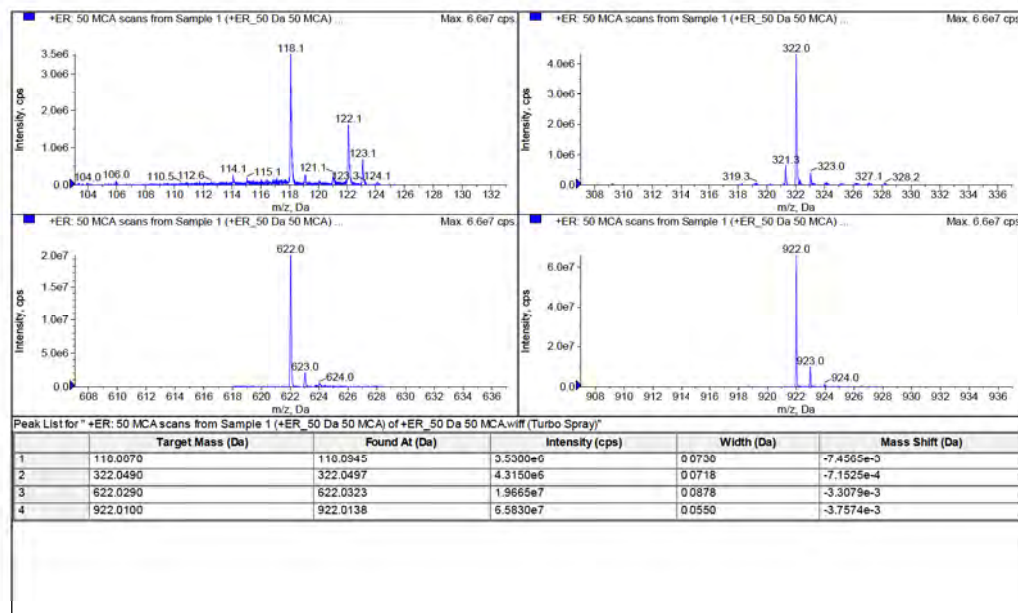
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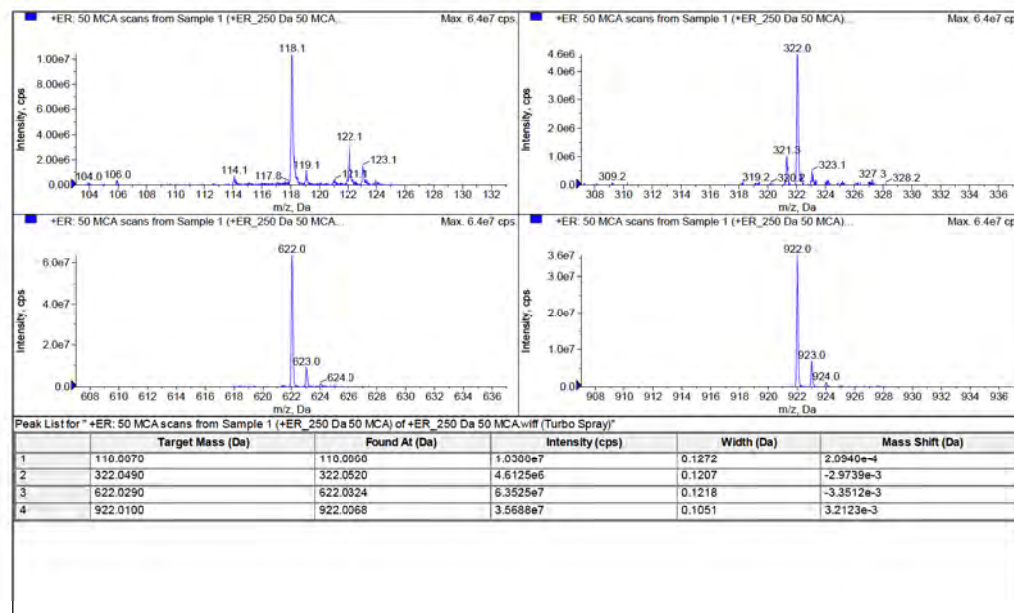
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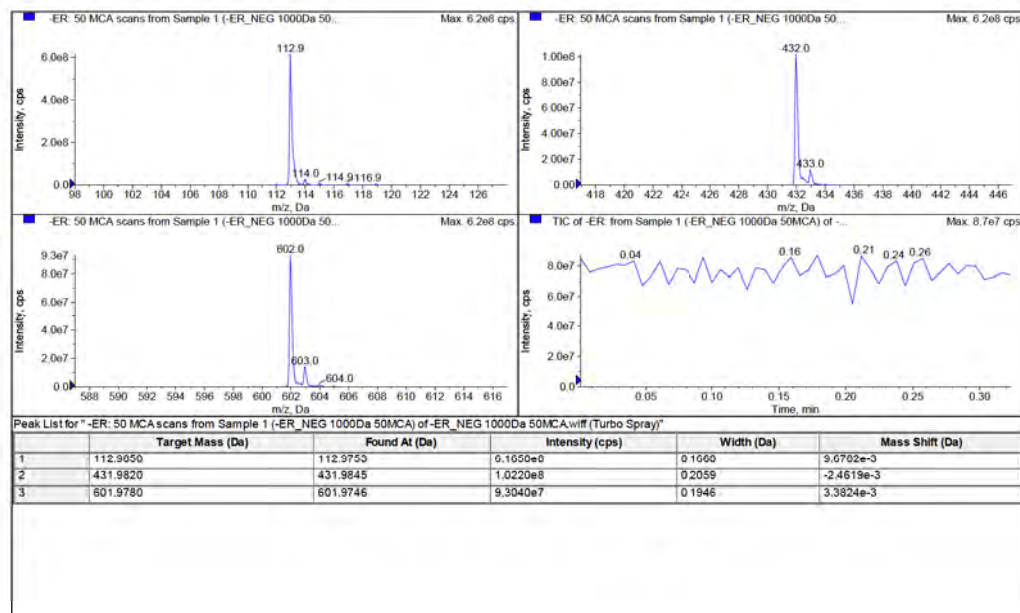
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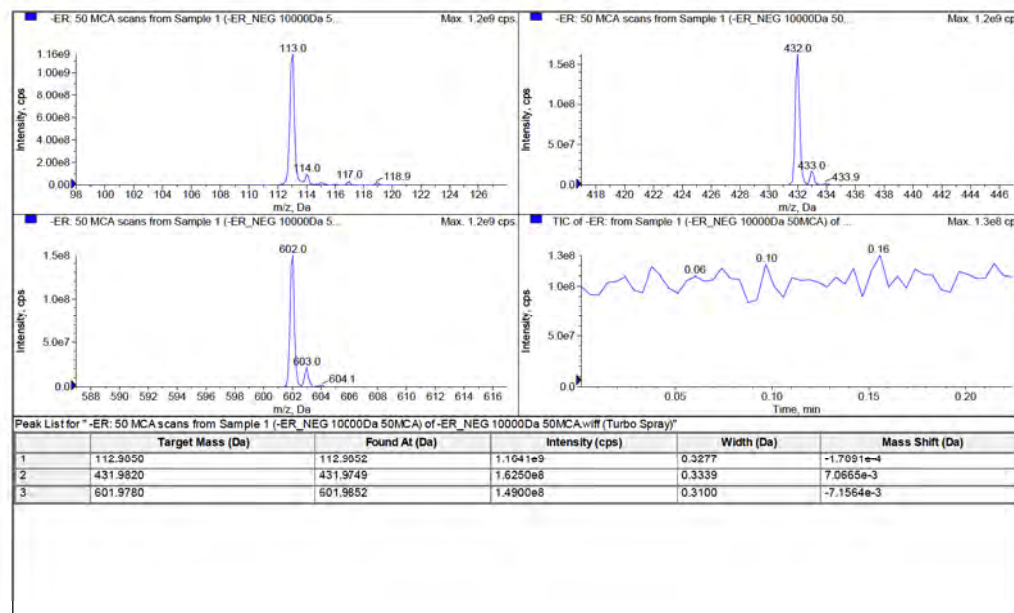
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 Acq. Time: 13:39



Printing Time: 1:41:40 PM
 Printing Date: Thursday, July 20, 2023

Batch Name: ManualTune.bat

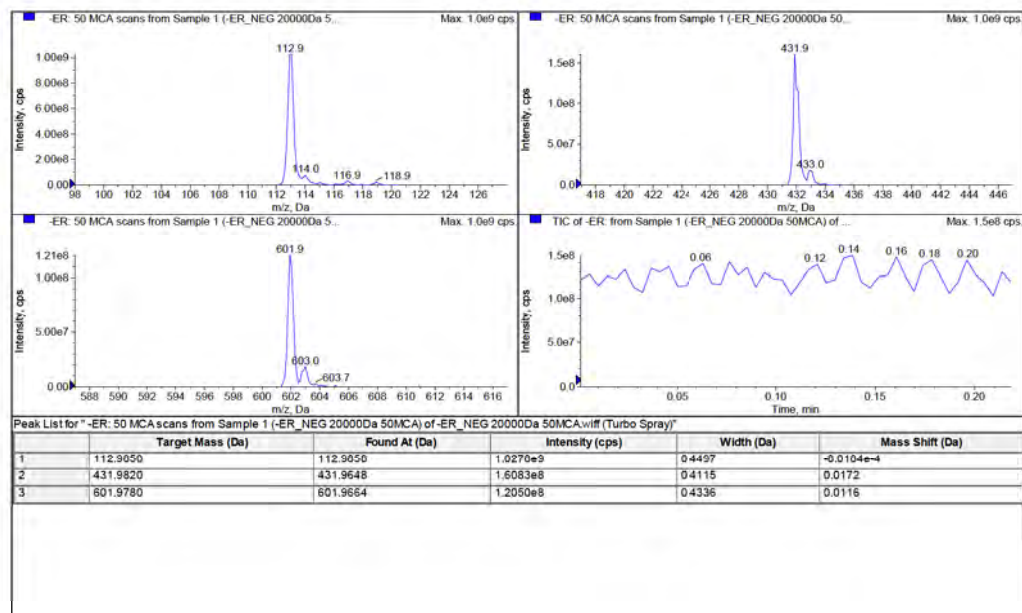
Operator: Gtrap55
 Acq. Time: 13:41



Printing Time: 1:42:58 PM
Printing Date: Thursday, July 20, 2023

Batch Name: ManualTune.bat

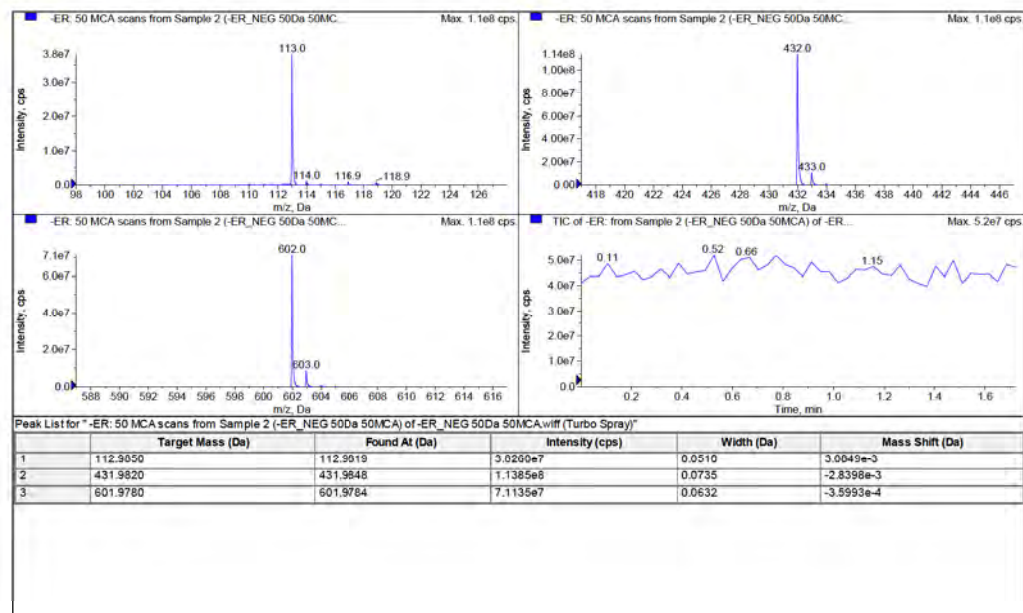
Operator: Gtrap55
Acq. Time: 13:45



Printing Time: 1:46:17 PM
Printing Date: Thursday, July 20, 2023

Batch Name: ManualTune.bat

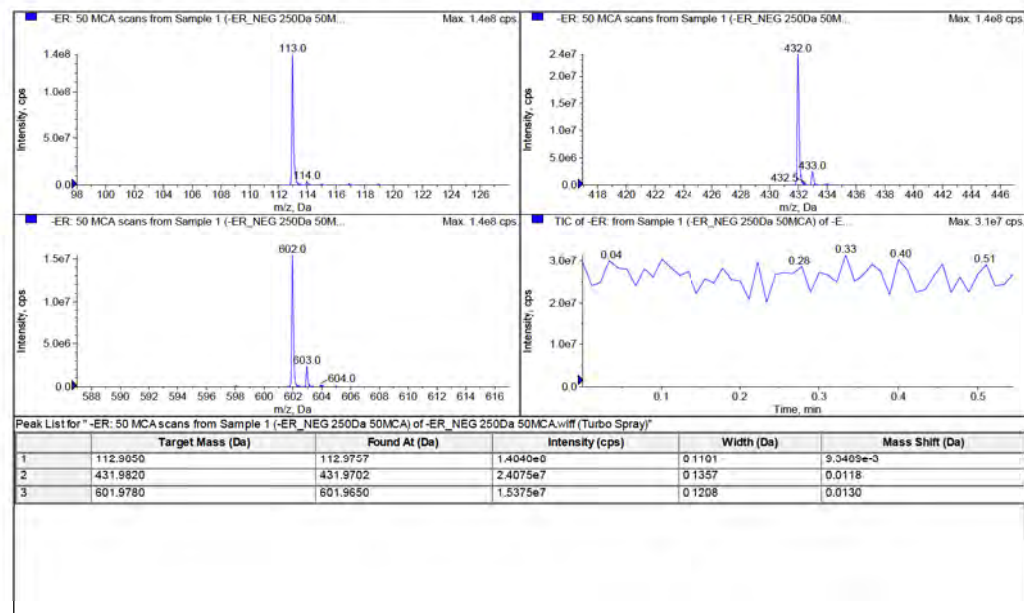
Operator: Gtrap55
Acq. Time: 13:44



Printing Time: 1:49:04 PM
Printing Date: Thursday, July 20, 2023

Batch Name: ManualTune.bat

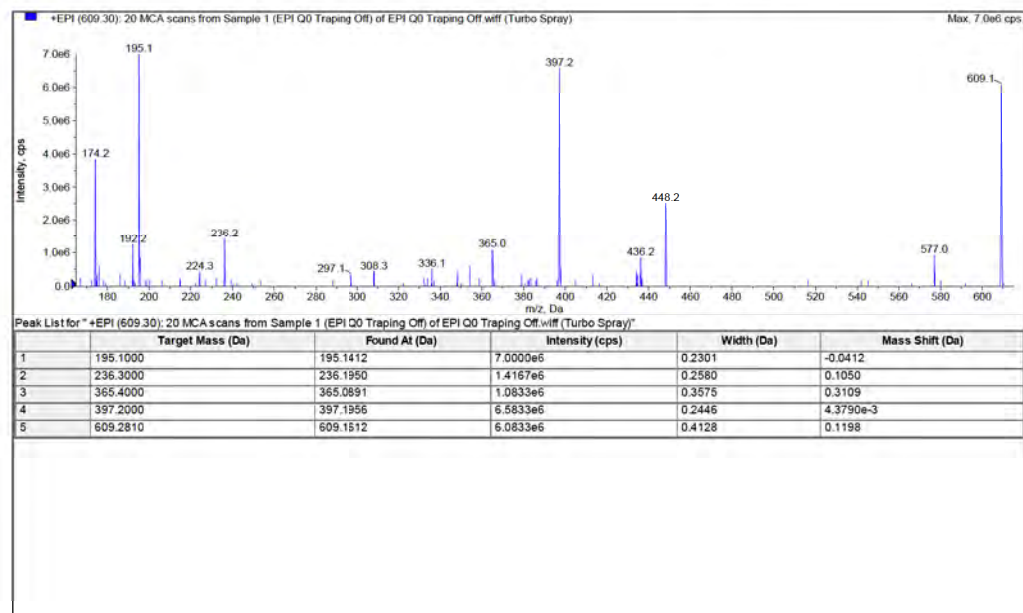
Operator: Gtrap55
Acq. Time: 13:48



Printing Time: 1:59:34 PM
Printing Date: Thursday, July 20, 2023

Batch Name: ManualTune.bat

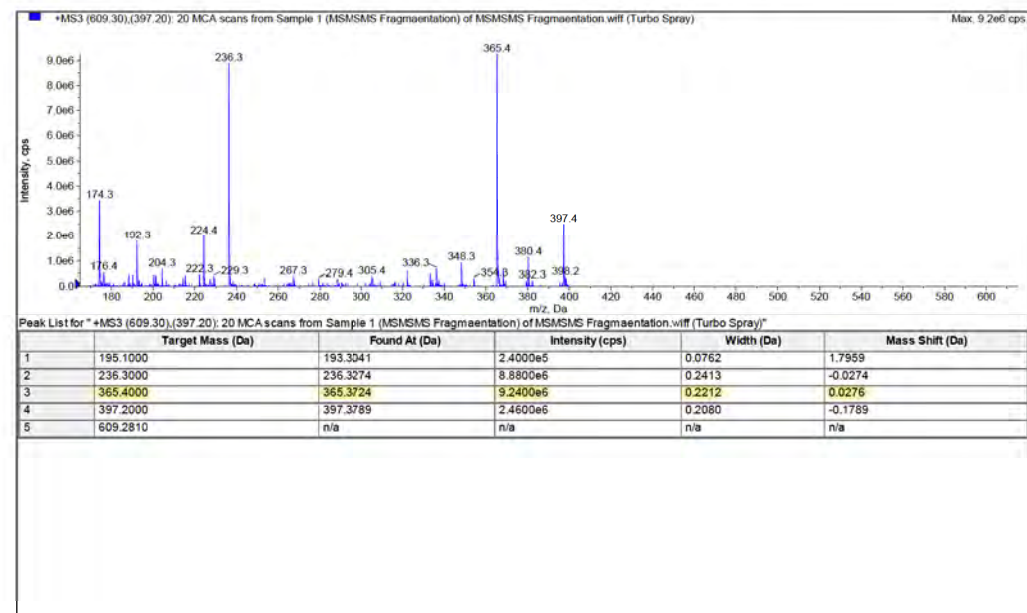
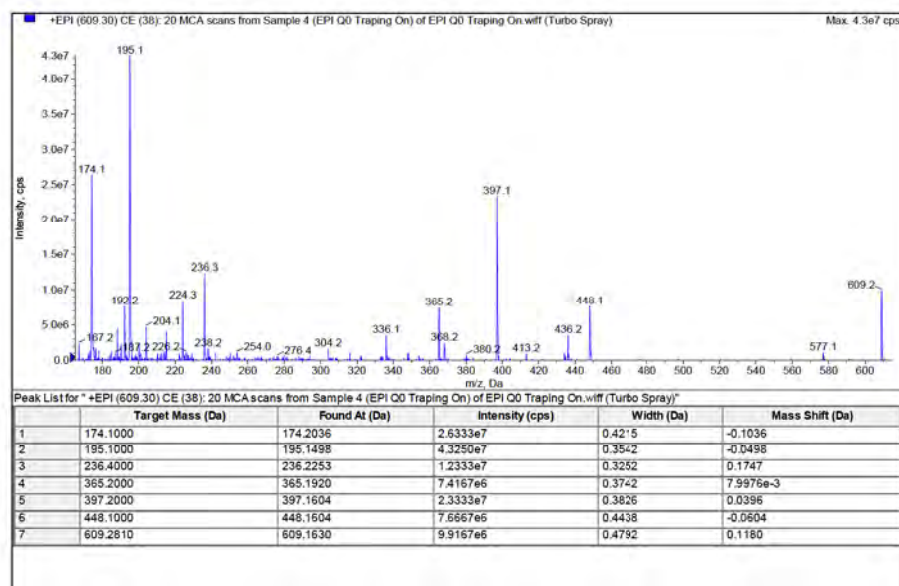
Operator: Gtrap55
Acq. Time: 13:39



Printing Time: 2:04:57 PM
Printing Date: Thursday, July 20, 2023

Batch Name: ManualTune.bat

Operator: Gttag55
Acq. Time: 18:04



Certificate of Analysis

Product Identification

Standards Chemical Kit with Low/High Concentration PPGs
Part number: 4406127

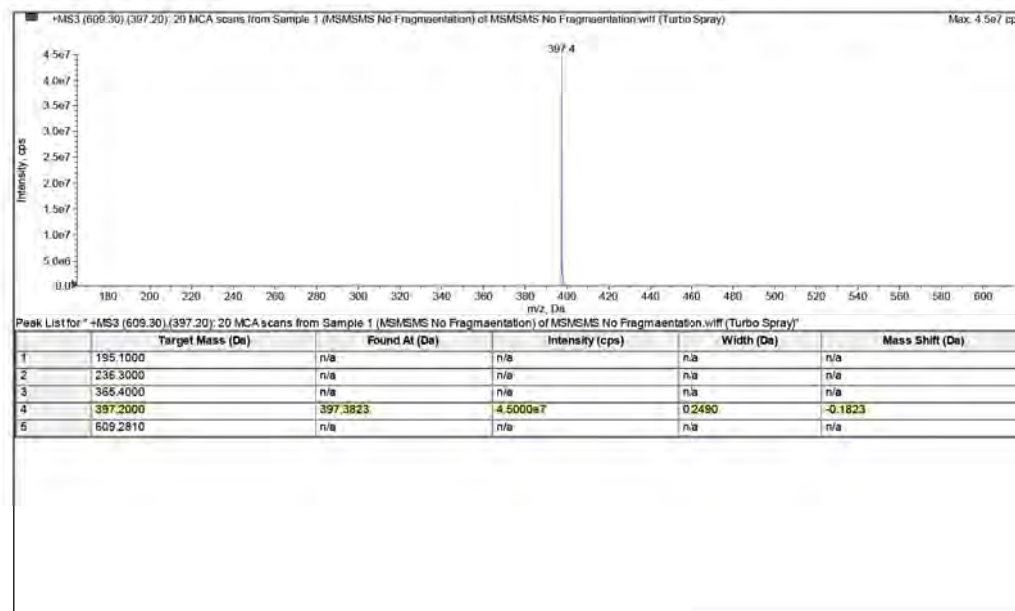
Lot Specific Information

Lot number: M303560
Manufacture date: 2023-04-20
Expiration date: 2024-02-09

Printing Time: 2:03:37 PM
Printing Date: Thursday, July 28, 2023

Sample Name: M303560-001

Operator: Qtrav55
Inq. Time: 18.03



Bottle Part Number	Lot Number	Component	Concentration (+/- <2%)
4405227	M302601	POS PPG 1E-4M	100 µM
4405229	M301763	POS PPG 1E-5M	10 µM
4405231	M302605	POS PPG 2E-6M	2 µM
4405233	M303693	POS PPG 2E-7M	0.2 µM
4405234	M302609	NEG PPG 3E-4M	300 µM
4405235	M303587	NEG PPG 3E-5M	30 µM
4405236	M302612	RESERPINE 1 µM	1 µM
4405237	M303662	RESERPINE 0.167 µM	0.167 µM
4405238	M303690	RESERPINE 0.0167 µM	0.0167 µM
4405247	M302618	RENIN - RESERPINE MIX (1 pmol/µL Renin + 400 fmol/µL Reserpine)	1 µM - 0.4 µM

Quality Assurance Statement:

These standards have been manufactured using ISO9001 procedures. Concentrations are calculated gravimetrically, and balances are calibrated to NIST traceable standards in accordance with our ISO procedures. Purity from interferences is verified through mass spectrometric analysis. Solvents are minimum HPLC grade.

The information on this certificate has been reviewed and accurately reflects manufacturing and analysis data for the product lot specified.

Quality Assurance Associate:

Date:

2023-04-20

Support

Technical Support call 1 800-952-4716 or 877-740-2129 or E-mail: Support@sciex.com

This certificate may be obtained at: <http://sciex.com/coa>

AB Sciex Plc. Ltd.
500 Old Connecticut Path
Framingham, MA 01701
U.S.A.

Confidential/Commercially Sensitive Document No.: RUO-IDV-09-2453-B
Part Number: 4412401 Rev. F
Page 1 of 1

Certificate of Conformance

Product Identification

Name: ES Tuning Mix

Part number: 4405243

Lot Specific Information

Lot number: M302555

Manufacture date: 2023-03-01

Description: Constituent Concentrations (weight to volume) and Purity/Grades

COMPONENT	% GRAVIMETRIC CONCENTRATION	% PURITY and/or GRADE
Betaine (CAS No.:107-43-7)	<0.01	99.9%
Trifluoroacetic Acid Ammonium Salt (CAS.:3336-58-1)	<0.01	99.7%
Hexamethoxyphosphazene (CAS No. 957-13-1)	<0.01	99.0%
Hexakis(2,2-Difluoroethoxy) Phosphazene (CAS No.: 186817-57-2)	<0.01	99.0%
Hexakis(1H, 1H, 3H-Tetrafluoropropoxy)Phosphazene (CAS No.: 58943-98-9)	<0.01	99.0%
Hexakis(1H, 1H, 5H-Octafluoropentoxy)Phosphazene (CAS No.: 16059-16-8)	<0.01	98.0%
Hexakis(1H, 1H, 7H-Dodecafluoroheptoxy)Phosphazene (CAS No.: 3830-74-84)	<0.01	97.0%
Hexakis(1H, 1H, 9H-Perfluorononyloxy)Phosphazene (CAS No.: 186043-87-4)	<0.01	98.0%
Tris (heptafluoropropyl)-S-Triazine (CAS No.:915-76-4)	<0.01	98.0%
Acetonitrile (CAS No.: 75-05-8)	95.0	HPLC Grade 99.9
DI Water (CAS No.:7732-18-5)	5.0	De-ionized

Traceability:

This standard has been produced gravimetrically using ISO9001 quality procedures. NIST traceable weights are used to verify balance calibration with the preparation of each lot. Concentration of analyte in solution is µg/ml +/- 0.5% uncertainty based upon balance and Class A volumetric glassware. High-performance liquid chromatography mass spectroscopy was used to evaluate system performance.

Quality Assurance Statement:

The information on this certificate has been reviewed and accurately reflects the manufacturing and analysis data for the product lot specified above.

X Migdalia Febus-Bozzay
Migdalia Febus-Bozzay
Senior Technician, Quality Control
Signed by Febus-Bozzay Migdalia

Quality Assurance Associate:

Date: 2023-03-03

Support

Technical Support call 1 800-952-4716 or 877-740-2129 or E-mail: Support@sciex.com

This certificate may be obtained at: <http://sciex.com/certificates-of-analysis>

AB Sciex Pte. Ltd.
500 Old Connecticut Path
Framingham, MA 01701
U.S.A.

Controlled Company Property 4426223 Rev C
RUO-IDV-09-3030A

Standards Chemical Kit

With Low/High Concentration PPGs (PN 4406127)

Printed in USA

For all chemicals, read the SDS and follow the handling instructions. Wear appropriate protective eyewear, clothing, and gloves.

List of kit components

Item (ingredients)	Volume (mL)	Quantity (each)	SCIEX part number
POS PPG, 1E-4 M (100 µM or stock solution) [Polypropylene glycol, average M_n ~425; polypropylene glycol, average M_n ~1000; polypropylene glycol, average M_n ~2000; ammonium acetate; formic acid; ACS reagent, 96%; acetonitrile, HPLC-grade; methanol; HPLC-grade; water]	20	1	4405227
POS PPG, 1E-5 M (10 µM or 10:1) [†]	20	1	4405229
POS PPG, 2E-6 M (2 µM or 50:1) [‡]	20	1	4405231
POS PPG, 2E-7 M (0.2 µM or 500:1) [‡]	20	1	4405233
NEG PPG, 3E-4 M (300 µM or stock solution) [Polypropylene glycol, average M_n ~425; polypropylene glycol, average M_n ~1000; polypropylene glycol, average M_n ~2000; polypropylene glycol, average M_n ~3000; ammonium acetate; formic acid; ACS reagent, 96%; acetonitrile; HPLC-grade; methanol; HPLC-grade; water]	20	1	4405234
NEG PPG, 3E-5 M (30 µM or 10:1) ^{††}	20	1	4405235
RESERPINE, 1 pmol/µL (1 µM) [Reserpine, acetonitrile, acetic acid, water]	5	1	4405236
RESERPINE, 0.167 pmol/µL (0.167 µM or 6:1) ^{‡‡}	5	2	4405237
RESERPINE, 0.0167 pmol/µL (0.0167 µM or 60:1) ^{‡‡}	5	2	4405238
ES TUNING MIX ^{§§} [Betaine; trifluoroacetic acid ammonium salt; hexamethoxyphosphazene; hexakis(2,2-difluoroethoxy)Phosphazene; hexakis(1H, 1H, 3H-tetrafluoropropoxy)phosphazene; hexakis(1H, 1H, 5H-octafluoropentoxy)phosphazene; hexakis(1H, 1H, 7H-dodecafluoroheptoxy)phosphazene; hexakis(1H, 1H, 9H-perfluorononyloxy)phosphazene; tris (heptafluoropropyl)-S-triazine; acetonitrile; distilled-deionized water]	4	1	4405243
AMMONIUM ACETATE [Ammonium acetate 7.5 M]	5	1	4465674
Renin-Reserpine Mix (1 pmol/µL Renin + 400 fmol/µL Reserpine) [Reserpine; Acetonitrile, HPLC-grade; renin substrate leucodecapeptide; porcine; acetic acid; water]	5	1	4405247
WASH SOLVENT [50/50 methanol/water]	30	1	4405249
REN/RES DILUTION SOLVENT [50/50 acetonitrile/water + 0.1% acetic acid]	20	1	4405255
ES TUNING DILUTION SOLVENT [95/5 acetonitrile/water]	20	1	4412397
BOTTLE, HDPE, CLEAR NM RND, 15 mL	—	1	T8183

[†] Poly(propylene glycol)

[‡] Narrow molecular-weight distribution

^{‡‡} Same ingredients as in POS PPG, 1E-4 M (100 µM)

- ^{††} Same ingredients as in NEG PPG, 3E-4 M (300 µM)
^{†‡} Same ingredients as in RESERPINE, 1 pmol/µL (1 µM)
^{‡‡} Prepare as described in "100:1 ES Tuning Mix".[†]

When stored at 2 to 8 °C, this kit maintains performance for one year. Before use, mix components well.

Prepare solutions

100:1 ES Tuning Mix

Mix in the provided empty bottle 9.9 mL of ES TUNING DILUTION SOLVENT and 100 µL ES TUNING MIX stock solution. The diluted solution can be used for up to one week after preparation if the diluted solution is stored at 2 to 8 °C.

Reconstituted stock solutions

If any stock solution requires reconstitution, it is recommended to use the reconstituted solution within one week after preparation while the solution is stored at 2 to 8 °C.

Solvents

Prepare additional solvents, if required:

Preparation of solvents [†]						
Component	POS PPG Dilution Solvent	NEG PPG Dilution Solvent	REN/RES DILUTION SOLVENT	WASH SOLVENT	ES TUNING DILUTION SOLVENT	Flow Injection Solvent 70/30 ACN/water [‡]
Methanol	50 mL	75 mL	—	50 mL	—	—
Formic acid	100 µL	100 µL	—	—	—	0.1 mL
Acetonitrile	100 µL	100 µL	50 mL	—	95 mL	700 mL
Acetic acid	—	—	0.1 mL	—	—	—
Ammonium acetate [†]	27 µL	676 µL	—	—	—	266 µL
Water	49.8 mL	24.1 mL	49.9 mL	50 mL	5 mL	299.6 mL

[†] All the chemicals for preparing dilution solvents should be HPLC-grade or higher.

[†] Required for selected instruments only.

[‡] for this solution 2mMole is 27µl per 100ml

Store the diluted solvent at 2 to 8 °C.

How to obtain support

For the latest services and support information for all locations, go to:

<http://sciex.com>, then click **Support**.

At the Support home page, you can:

- Access worldwide telephone and fax numbers to contact Technical Support and Sales facilities.
- Submit a question directly to Technical Support.
- Find user documents, SDSs, certificates of analysis, and other related documents.

NOTICE TO PURCHASER: LIMITED LICENSE

<http://sciex.com>

RUO-IDV-05-2621A

Part Number 4412466 Rev. H



Chemical Install Kits Customer Usage Table

Instrument	Quad. (Q1 & Q3) Calibration		Linear Ion Trap Calibration	
	Positive	Negative	Positive and Negative	MS/MS/MS
API 2000™ Instrument	POS PPG, 1E-4 M	NEG PPG, 3E-4 M	NEG PPG, 3E-4 M	N/A
QTRAP® Instrument	POS PPG, 1E-4 M	NEG PPG, 3E-4 M	NEG PPG, 3E-4 M	N/A
API 3000™ Instrument	POS PPG, 1E-5 M	NEG PPG, 3E-4 M	N/A	N/A
API 3200 Instrument	POS PPG, 1E-5 M	NEG PPG, 3E-4 M	N/A	N/A
3200 QTRAP® Instrument	POS PPG, 1E-5 M	NEG PPG, 3E-4 M	NEG PPG, 3E-4 M	1:100 ES TUNING MIX
API 4000™ Instrument	POS PPG, 2E-6 M	NEG PPG, 3E-4 M	N/A	N/A
4000 QTRAP® Instrument	POS PPG, 2E-6 M	NEG PPG, 3E-4 M	1:100 ES TUNING MIX	1:100 ES TUNING MIX
AB SCIEX Triple Quad™ 4500 LC/MS System	POS PPG, 2E-6 M	NEG PPG, 3E-4 M	N/A	N/A
API 5000™ Instrument	POS PPG, 2E-7 M	NEG PPG, 3E-5 M	N/A	N/A
AB SCIEX QTRAP® 5500 Instrument	POS PPG, 2E-7 M	NEG PPG, 3E-5 M	1:100 ES TUNING MIX	1:100 ES TUNING MIX
AB SCIEX Triple Quad™ 5500 LC/MS System	POS PPG, 2E-7 M	NEG PPG, 3E-5 M	N/A	N/A
SCIEX QTRAP® 6500 Instrument	POS PPG, 2E-7 M	NEG PPG, 3E-5 M	1:100 ES TUNING MIX	1:100 ES TUNING MIX
SCIEX Triple Quad™ 6500 LC/MS System	POS PPG, 2E-7 M	NEG PPG, 3E-5 M	N/A	N/A

4465988 Rev B

RUO-IDV-06-3051

12/2015

Record of Completion

Nitinai Phachai

4500/5500/6500 Series LC/MS Systems Training Program

4/25/2013 13:25:32 PM



AB SCIEX confirms that the above-named engineer has been trained and is eligible to receive continuing training on installation, repair, maintenance, qualification, and has the ability to train customers on operation of the instruments listed in this record. Through the course of employment with AB SCIEX or by an AB SCIEX Authorized Dealer, this engineer has access to the latest AB SCIEX product information, service tools, and spare parts.

This record is being issued on the date noted above, and remains valid provided that the above-named engineer remains employed by AB SCIEX or by one of AB SCIEX authorized dealers. Please feel free to contact CustomerCare@absciex.com to confirm the ongoing validity of this certificate at any time.

Joe Lepore

Head of Global Service Training

AB SCIEX

Certificate of System Qualification

GC-OQ + GCMS-OQ

System ID: GM-10
Organization Name: ALS Laboratory Group (Thailand) Co., Ltd.
Organization Location: 104 Patthanakarn 40, Patthanakarn Rd., Kwang Suan Luang, Khet Suan Luang, Bangkok 10250

Date: May 25, 2023 11:05:07 AM
EQP Name: AgilentRecommended , AgilentRecommended
EQP Revision: GC.02.52, GCMS.02.51
Overall Qualification Status: Pass

REVIEW BY *Suchada T.*
APPROVED BY *Nant Sord*
NEXT CAL DATE *25 Nov 24*

CDS Logon Verification - GC

Logon: SESSIONNAME

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: May 25, 2023 11:05:07 AM
System ID: GM-10

Overall Inlet Pressure Accuracy Test Status

Pass

GC Oven Temperature Accuracy

Name: 7890

Setpoint Status: Pass

Zone: Oven

Setpoint/Actual

Temperature: 230.0 230.0 °C

Accuracy: 0.0 °C

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

Setpoint Status: Pass

Zone: Oven

Setpoint/Actual

Temperature: 100.0 100.0 °C

Accuracy: 0.0 °C

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

Overall GC Oven Temperature Accuracy Test Status

Pass

GC Oven Temperature Stability

Name: 7890

Setpoint Status: Pass

Setpoint/Average

Temperature: 100.0 100.0333 °C

Stability: 0.1 °C

Agilent Recommended: ≤ 0.5

Overall GC Oven Temperature Stability Test Status

Pass

Date: May 25, 2023 11:05:07 AM

System ID: GM-10

Tune EI

Tested Combination1 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 Combination1 Front MMI / External TQ

Injection Tower

Name: 7693A

Source: EI - Extractor

Setpoint Status: Completed

Injection Volume on Column: 1.0 uL

Overall Scouting Run Status

Completed

Instrument Detection Limit

Tested Combination1 Front MMI / External TQ

Injection Tower

Name: 7693A

Source: EI - Extractor

Date: May 25, 2023 11:05:07 AM

System ID: GM-10

Setpoint Status:

Pass

Injection Volume on Column:

1.0 uL

Minimum RSD:

10.98 %

Agilent Recommended:

<= 12.00

Status:

Pass

Instrument Detection Limit:

3.69552 fg

Agilent Recommended:

<= 4.03800

Status:

Pass

Overall Instrument Detection Limit Test Status

Pass

Mass Ratio Precision

Tested Combination1

Front

MMI

/ External

TQ

Injection Tower

Name:

7693A

Source:

EI - Extractor

Setpoint Status:

Pass

Injection Volume on Column:

1.0 uL

Area Mass 1

Abundance*s

RSD:

3.22 %

Agilent Recommended:

<= 5.00

Pass

Mass Ratio

4.06 %

<= 5.00

Pass

Overall Mass Ratio Precision Test Status

Pass

Date: May 25, 2023 11:05:07 AM
System ID: GM-10

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	7693A
Model Number	G4513A
Serial Number	CN18180003
Firmware Revision	A.11.02
Usage	Sample Injection
Location	Front
Syringe Volume (µL)	10

Date: May 25, 2023 11:05:07 AM
System ID: GM-10

Sampler 2

Manufacturer	Agilent Technologies
Type	Tray
Name	7693A
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

Inlet 2

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

Detector 1

Manufacturer	Agilent Technologies
Name	Mass Spectrometer
Type	Mass Spectrometer
Location	External

Mass Spectrometer 1

Manufacturer	Agilent Technologies
Type	TQ
Name	7000D
Serial Number	US1826U108
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

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 logon 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: Nattapat Hengcharoen
Logged On User Name: nattapat.hengcharoen@agilent.com
Signature Creation Date: May 25, 2023
Reason for Signature: Executed protocol and published this original version of document

Regulatory Disclaimer

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User Name: nattapat.hengcharoen
Hostname: ASBKXWX265
System Id: GM-10
Print Date: May 25, 2023 11:05:08 AM

ALS_GM-10 Transaction log :

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
May 22, 2023 1:32:30 PM	Audit	SessionCreated	Session	None
May 22, 2023 1:32:30 PM	Start	Configuration	Session	None
May 22, 2023 1:32:30 PM	Audit	Entitlement	Licensing	User is FieldEngineer and does not require an unlock code
May 22, 2023 1:37:48 PM	Audit	EqpLoaded	Session	EQP details for primary technique [Gc] - File path: [ProtocolPacks/Gc/Configurations/02.52/Gc.02.52.eqp], EQP File Name: [Gc.02.52.eqp], EQP Name: [AgilentRecommended], Protocol Revision [Gc.02.52] EQP details for hyphenated technique [GcMs] - File path: [ProtocolPacks/GcMs/Configurations/02.51/GcMs.02.51.aqp], EQP File Name: [GcMs.02.51.eqp], EQP Name: [AgilentRecommended]
May 22, 2023 1:37:52 PM	End	Configuration	Session	None
May 22, 2023 1:37:55 PM	Start	Qualification	Session	OQ
May 22, 2023 1:37:55 PM	Start	Execution	CDS Logon Verification - GC : - Qualitative test	None
May 22, 2023 2:02:27 PM	Start	Execution	CDS Logon Verification - GC : - Qualitative test	None
May 22, 2023 2:02:33 PM	Start	Execution	Instrument Detection Limit - Injection Tower, Front MMI, TQ: - Source: - EI - Extractor - RSD L (Area): <= 12.00% - RSD L (Ret. Time): <= 1.00%	None

User Name: nattapat.hengcharoen
Hostname: ASBKWX265

System Id: GM-10
Print Date: May 25, 2023 11:05:08 AM

ALS_GM-10 Transaction log :

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
May 22, 2023 2:02:37 PM	Start	Execution	CDS Logon Verification - GC : - Qualitative test	None
May 22, 2023 2:03:33 PM	End	Execution	CDS Logon Verification - GC : - Qualitative test	Run Count : 1
May 22, 2023 2:34:48 PM	Start	Execution	System Inspection and Basic Safety and Operation - 7890: - Qualitative Test - No setpoints associated	None
May 22, 2023 2:35:02 PM	End	Execution	System Inspection and Basic Safety and Operation - 7890: - Qualitative Test - No setpoints associated	Run Count : 1
May 22, 2023 2:35:17 PM	Start	Execution	Inlet Pressure Accuracy - Front MMI: - Pressure Controlled Inlet - S: 25.0 psi - L: <= 1.2 psi	None
May 22, 2023 2:35:22 PM	End	Execution	Inlet Pressure Accuracy - Front MMI: - Pressure Controlled Inlet - S: 25.0 psi - L: <= 1.2 psi	Run Count : 1
May 22, 2023 2:35:24 PM	Start	Execution	GC Oven Temperature Accuracy - 7890: - Temperature : Oven - S: 230.0°C - L: >= -1.0 AND <= 1.0 % setpoint in K	None
May 22, 2023 2:35:48 PM	Audit	Data	GC Oven Temperature Accuracy - 7890: - Temperature : Oven - S: 230.0°C - L: >= -1.0 AND <= 1.0 % setpoint in K	Manual Data Entry
May 22, 2023 2:35:54 PM	End	Execution	GC Oven Temperature Accuracy - 7890: - Temperature : Oven - S: 230.0°C - L: >= -1.0 AND <= 1.0 % setpoint in K	Run Count : 1

Page 2 / 9

User Name: nattapat.hengcharoen
Hostname: ASBKWX265

System Id: GM-10
Print Date: May 25, 2023 11:05:08 AM

ALS_GM-10 Transaction log :

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
May 22, 2023 2:35:55 PM	Start	Execution	GC Oven Temperature Accuracy - 7890: - Temperature : Oven - S: 100.0°C - L: >= -1.0 AND <= 1.0 % setpoint in K	None
May 22, 2023 2:59:09 PM	Start	Execution	Instrument Detection Limit - Injection Tower, Front MMI, TQ: - Source: - EI - Extractor - RSD L (Area): <= 12.00% - RSD L (Ret. Time): <= 1.00%	None
May 22, 2023 3:08:09 PM	Start	Execution	Scouting Run - Injection Tower, Front MMI, TQ: - Source: - EI - Extractor- Part of GCMS System Preparation	None
May 22, 2023 3:10:34 PM	Start	Execution	Instrument Detection Limit - Injection Tower, Front MMI, TQ: - Source: - EI - Extractor - RSD L (Area): <= 12.00% - RSD L (Ret. Time): <= 1.00%	None
May 22, 2023 3:12:01 PM	Start	Execution	Mass Ratio Precision - Injection Tower, Front MMI, TQ: - Source: EI - Extractor - L (RSD): <= 5.00%	None
May 22, 2023 3:17:49 PM	Start	Execution	GC Oven Temperature Accuracy - 7890: - Temperature : Oven - S: 100.0°C - L: >= -1.0 AND <= 1.0 % setpoint in K	None
May 22, 2023 3:17:55 PM	Start	Execution	GC Oven Temperature Accuracy - 7890: - Temperature : Oven - S: 100.0°C - L: >= -1.0 AND <= 1.0 % setpoint in K	None
May 22, 2023 3:18:05 PM	Audit	Data	GC Oven Temperature Accuracy - 7890: - Temperature : Oven - S: 100.0°C - L: >= -1.0 AND <= 1.0 % setpoint in K	Manual Data Entry

Page 3 / 9

Date: May 25, 2023 11:05:07 AM
System ID: GM-10

Page 10 / 17

Date: May 25, 2023 11:05:07 AM
System ID: GM-10

Page 11 / 17

User Name: nattapat.hengcharoen
Hostname: ASBKWX265

System Id: GM-10
Print Date: May 25, 2023 11:05:08 AM

ALS_GM-10 Transaction log :

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
May 22, 2023 3:18:07 PM	End	Execution	GC Oven Temperature Accuracy - 7890: - Temperature : Oven - S: 100.0°C - L: >= -1.0 AND <= 1.0 % setpoint in K	Run Count : 1
May 22, 2023 3:39:07 PM	Start	Execution	Scouting Run - Injection Tower, Front MMI, TQ: - Source: - EI - Extractor- Part of GCMS System Preparation	None
May 22, 2023 3:39:10 PM	Start	Execution	Instrument Detection Limit - Injection Tower, Front MMI, TQ: - Source: - EI - Extractor - RSD L (Area): <= 12.00% - RSD L (Ret. Time): <= 1.00%	None
May 22, 2023 4:02:59 PM	Start	Execution	Instrument Detection Limit - Injection Tower, Front MMI, TQ: - Source: - EI - Extractor - RSD L (Area): <= 12.00% - RSD L (Ret. Time): <= 1.00%	None
May 22, 2023 4:03:06 PM	Start	Execution	GC Oven Temperature Stability - 7890: - Temperature : Oven - S: 100.0°C - L: <= 0.5°C	None
May 22, 2023 4:03:52 PM	Audit	Data	GC Oven Temperature Stability - 7890: - Temperature : Oven - S: 100.0°C - L: <= 0.5°C	Manual Data Entry
May 22, 2023 4:03:54 PM	End	Execution	GC Oven Temperature Stability - 7890: - Temperature : Oven - S: 100.0°C - L: <= 0.5°C	Run Count : 1
May 23, 2023 3:58:15 PM	Audit	AceClosed	Session	None
May 24, 2023 4:03:19 PM	Audit	AceRestarted	Session	None
May 24, 2023 4:14:45 PM	Audit	AceClosed	Session	None
May 25, 2023 10:13:57 AM	Audit	AceRestarted	Session	None
May 25, 2023 10:27:12 AM	Audit	SessionReloaded	Session	None

Page 4 / 9

Date: May 25, 2023 11:05:07 AM
System ID: GM-10

Page 12 / 17

Usor Name: nattapat.hengcharoen
Hostname: ASBKWX265

System Id: GM-10
Print Date: May 25, 2023 11:05:08 AM

ALS_GM-10 Transaction log :

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
May 25, 2023 10:27:13 AM	Start	Qualification	Session	OQ
May 25, 2023 10:27:16 AM	Start	Execution	Tune EI - 7000D TQ: - Source: - None EI - Extractor Filament 1 (Qualitative - No setpoints associated)	
May 25, 2023 10:27:42 AM	Start	Execution	Tune EI - 7000D TQ: - Source: - None EI - Extractor Filament 1 (Qualitative - No setpoints associated)	
May 25, 2023 10:27:56 AM	End	Execution	Tune EI - 7000D TQ: - Source: - EI - Extractor Filament 1 (Qualitative - No setpoints associated)	Run Count : 1
May 25, 2023 10:27:57 AM	Start	Execution	Tune EI - 7000D TQ: - Source: - None EI - Extractor Filament 2 (Qualitative - No setpoints associated)	
May 25, 2023 10:28:07 AM	End	Execution	Tune EI - 7000D TQ: - Source: - EI - Extractor Filament 2 (Qualitative - No setpoints associated)	Run Count : 1
May 25, 2023 10:28:08 AM	Start	Execution	Scouting Run - Injection Tower, Front MMI, TQ: - Source: - EI - Extractor- Part of GCMS System Preparation	None
May 25, 2023 10:28:17 AM	Start	Execution	Instrument Detection Limit - Injection Tower, Front MMI, TQ: - Source: - EI - Extractor - RSD L (Area): <= 12.00% - RSD L (Ret. Time): <= 1.00%	None
May 25, 2023 10:28:20 AM	Start	Execution	Scouting Run - Injection Tower, Front MMI, TQ: - Source: - EI - Extractor- Part of GCMS System Preparation	None

Page 5 / 9

Date: May 25, 2023 11:05:07 AM
System ID: GM-10

Page 13 / 17

User Name: nattapat.hongcharoen
Hostname: ASBKWX265

System Id: GM-10
Print Date: May 25, 2023 11:05:08 AM

ALS_GM-10 Transaction log :

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
May 25, 2023 10:28:58 AM	Audit	Data	Scouting Run - Injection Tower, Front MMI, TQ: - Source: - EI - Extractor- Part of GCMS System Preparation	Data files Path : D:\MassHunter\GCMS\1\data \Agilent\IQ_2023\ISQ_01.D
May 25, 2023 10:29:24 AM	End	Execution	Scouting Run - Injection Tower, Front MMI, TQ: - Source: - EI - Extractor- Part of GCMS System Preparation	Run Count : 1
May 25, 2023 10:29:25 AM	Start	Execution	Instrument Detection Limit - Injection Tower, Front MMI, TQ: - Source: - EI - Extractor - RSD L (Area): <= 12.00% - RSD L (Ret. Time): <= 1.00%	None
May 25, 2023 10:30:00 AM	Audit	Data	Instrument Detection Limit - Injection Tower, Front MMI, TQ: - Source: - EI - Extractor - RSD L (Area): <= 12.00% - RSD L (Ret. Time): <= 1.00%	Data files Path : D:\MassHunter\GCMS\1\data \Agilent\IQ_2023\IDL_001.D
May 25, 2023 10:30:00 AM	Audit	Data	Instrument Detection Limit - Injection Tower, Front MMI, TQ: - Source: - EI - Extractor - RSD L (Area): <= 12.00% - RSD L (Ret. Time): <= 1.00%	Data files Path : D:\MassHunter\GCMS\1\data \Agilent\IQ_2023\IDL_002.D
May 25, 2023 10:30:00 AM	Audit	Data	Instrument Detection Limit - Injection Tower, Front MMI, TQ: - Source: - EI - Extractor - RSD L (Area): <= 12.00% - RSD L (Ret. Time): <= 1.00%	Data files Path : D:\MassHunter\GCMS\1\data \Agilent\IQ_2023\IDL_003.D
May 25, 2023 10:30:00 AM	Audit	Data	Instrument Detection Limit - Injection Tower, Front MMI, TQ: - Source: - EI - Extractor - RSD L (Area): <= 12.00% - RSD L (Ret. Time): <= 1.00%	Data files Path : D:\MassHunter\GCMS\1\data \Agilent\IQ_2023\IDL_004.D

Page 6 / 9

Date: May 25, 2023 11:05:07 AM
System ID: GM-10

Page 14 / 17

User Name: nattapat.hongcharoen
Hostname: ASBKWX265

System Id: GM-10
Print Date: May 25, 2023 11:05:08 AM

ALS_GM-10 Transaction log :

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
May 25, 2023 10:30:00 AM	Audit	Data	Instrument Detection Limit - Injection Tower, Front MMI, TQ: - Source: - EI - Extractor - RSD L (Area): <= 12.00% - RSD L (Ret. Time): <= 1.00%	Data files Path : D:\MassHunter\GCMS\1\data \Agilent\IQ_2023\IDL_005.D
May 25, 2023 10:30:00 AM	Audit	Data	Instrument Detection Limit - Injection Tower, Front MMI, TQ: - Source: - EI - Extractor - RSD L (Area): <= 12.00% - RSD L (Ret. Time): <= 1.00%	Data files Path : D:\MassHunter\GCMS\1\data \Agilent\IQ_2023\IDL_006.D
May 25, 2023 10:30:00 AM	Audit	Data	Instrument Detection Limit - Injection Tower, Front MMI, TQ: - Source: - EI - Extractor - RSD L (Area): <= 12.00% - RSD L (Ret. Time): <= 1.00%	Data files Path : D:\MassHunter\GCMS\1\data \Agilent\IQ_2023\IDL_007.D
May 25, 2023 10:30:00 AM	Audit	Data	Instrument Detection Limit - Injection Tower, Front MMI, TQ: - Source: - EI - Extractor - RSD L (Area): <= 12.00% - RSD L (Ret. Time): <= 1.00%	Data files Path : D:\MassHunter\GCMS\1\data \Agilent\IQ_2023\IDL_008.D
May 25, 2023 10:30:00 AM	Audit	Data	Instrument Detection Limit - Injection Tower, Front MMI, TQ: - Source: - EI - Extractor - RSD L (Area): <= 12.00% - RSD L (Ret. Time): <= 1.00%	Data files Path : D:\MassHunter\GCMS\1\data \Agilent\IQ_2023\IDL_009.D
May 25, 2023 10:30:01 AM	Audit	Data	Instrument Detection Limit - Injection Tower, Front MMI, TQ: - Source: - EI - Extractor - RSD L (Area): <= 12.00% - RSD L (Ret. Time): <= 1.00%	Data files Path : D:\MassHunter\GCMS\1\data \Agilent\IQ_2023\IDL_010.D
May 25, 2023 10:30:19 AM	End	Execution	Instrument Detection Limit - Injection Tower, Front MMI, TQ: - Source: - EI - Extractor - RSD L (Area): <= 12.00% - RSD L (Ret. Time): <= 1.00%	Run Count : 1

Page 7 / 9

Date: May 25, 2023 11:05:07 AM
System ID: GM-10

Page 15 / 17

User Name: nattapat.hengcharoen
Hostname: ASBKWX265

System Id: GM-10
Print Date: May 25, 2023 11:05:08 AM

ALS_GM-10 Transaction log :

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
May 25, 2023 10:30:22 AM	Start	Execution	Mass Ratio Precision - Injection	None Tower, Front MMI, TQ: - Source: EI - Extractor - L (RSD): <= 5.00%
May 25, 2023 10:30:49 AM	Audit	Data	Mass Ratio Precision - Injection	Data files Path : Tower, Front MMI, TQ: - D:\MassHunter\GCMS\1\data Source: EI - Extractor - L (RSD): \Agilent\OQ_2023\MRP_01.D <= 5.00%
May 25, 2023 10:30:49 AM	Audit	Data	Mass Ratio Precision - Injection	Data files Path : Tower, Front MMI, TQ: - D:\MassHunter\GCMS\1\data Source: EI - Extractor - L (RSD): \Agilent\OQ_2023\MRP_02.D <= 5.00%
May 25, 2023 10:30:49 AM	Audit	Data	Mass Ratio Precision - Injection	Data files Path : Tower, Front MMI, TQ: - D:\MassHunter\GCMS\1\data Source: EI - Extractor - L (RSD): \Agilent\OQ_2023\MRP_03.D <= 5.00%
May 25, 2023 10:30:49 AM	Audit	Data	Mass Ratio Precision - Injection	Data files Path : Tower, Front MMI, TQ: - D:\MassHunter\GCMS\1\data Source: EI - Extractor - L (RSD): \Agilent\OQ_2023\MRP_04.D <= 5.00%
May 25, 2023 10:30:49 AM	Audit	Data	Mass Ratio Precision - Injection	Data files Path : Tower, Front MMI, TQ: - D:\MassHunter\GCMS\1\data Source: EI - Extractor - L (RSD): \Agilent\OQ_2023\MRP_05.D <= 5.00%
May 25, 2023 10:30:49 AM	Audit	Data	Mass Ratio Precision - Injection	Data files Path : Tower, Front MMI, TQ: - D:\MassHunter\GCMS\1\data Source: EI - Extractor - L (RSD): \Agilent\OQ_2023\MRP_06.D <= 5.00%
May 25, 2023 10:30:57 AM	End	Execution	Mass Ratio Precision - Injection	Run Count : 1 Tower, Front MMI, TQ: - Source: EI - Extractor - L (RSD): <= 5.00%
May 25, 2023 10:31:02 AM	End	Qualification	Session	OQ

Page 8 / 9

Date: May 25, 2023 11:05:07 AM
System ID: GM-10

Page 16 / 17

User Name: nattapat.hengcharoen
Hostname: ASBKWX265

System Id: GM-10
Print Date: May 25, 2023 11:05:08 AM

ALS_GM-10 Transaction log :

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
May 25, 2023 10:31:02 AM	Start	Reporting	Session	None
May 25, 2023 11:04:34 AM	Audit	Reporting	Session	Report Generated : Certificate

Page 9 / 9

Date: May 25, 2023 11:05:07 AM
System ID: GM-10

Page 17 / 17

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:cal-center@sithiporn.com http://www.sithiporn.com



Cert. No. : ACC23030
Pages : 1 of 3

Calibration Certificate

Equipment : SOUND CALIBRATOR
Manufacturer : RION
Model : NC-74
Serial No.: 34178124
ID No.: RYG_FS0216

REVIEW BY *Nathakorn P.*
APPROVED BY *[Signature]*
NEXT CAL. DATE *20/9/24*

Condition As Found : GOOD

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

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

Received Date : 07 SEPTEMBER 2023
Calibration Date : 20 SEPTEMBER 2023
Date of Issue : 20 SEPTEMBER 2023

Calibrated by : Nathakorn Pisutpaisan

Approved by :

[Signature]
(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.

SITHIPORN ASSOCIATES CO.,LTD. CALIBRATION LABORATORY

Continuation of Calibration Certificate

Cert. No. : ACC23030
Job No. : VC66AC0100
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-0010-23	07-FEB-24
Digital Multimeter	33461A	MY53220104	EEL.BP 30/0266	13-FEB-24
Digital Multimeter	33461A	MY53220076	EFI_BP 30/0267	13-FEB-24
Digital Multimeter	33461A	MY60024273	EEL.BP 31/0266	14-FEB-24
Programmable Attenuator	MAT-1070	62100114	EF-0011-23	08-FEB-24
Condenser Microphone	4180	2977900	AA-1001-23	14-FEB-24
Measuring Amplifier	NA-42KAI	34560495	AA-3002-23	14-FEB-24
Audio Analyzer	AVR-3360A	V744B6069	EF-0012-23	10-FEB-24

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).

[Signature]

Continuation of Calibration Certificate

Cert. No. : ACC23030
Job No. : VC66AC0100
Pages : 3 of 3

Result of calibration :

1. Sound pressure level

Specified sound pressure level (dB)	Measured value (dB)	Deviated value (dB)	Uncertainty (dB)	Acceptance limit (dB)
94	94.23	0.23	0.14	0.40

2. Frequency

Specified Frequency (Hz)	Measured value (Hz)	Deviated value (%)	Uncertainty (%)	Acceptance limit (%)
1000	1001.3	0.1	0.1	1.0

3. Total distortion

Measured value (%)	Uncertainty (%)	Acceptance limit (%)
1.96	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

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



Cert. No. : ACL23320
Pages : 1 of 8

Calibration Certificate

Equipment : SOUND LEVEL METER
Manufacturer : RION
Model : NL-42/ Microphone UC-52 / Preamplifier NH-24
Serial No.: 00597167 / 179118 / 87525
ID No.: RYG_FS0437

Condition As Found : GOOD

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

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

Received Date : 11 OCTOBER 2023
Calibration Date : 19-20 OCTOBER 2023
Date of Issue : 24 OCTOBER 2023

REVIEW BY	<i>Nathakorn P</i>
APPROVED BY	<i>[Signature]</i>
NEXT CAL. DATE	19/10/24

Calibrated by : Nathakorn Pisutpaisan

Approved by :

T. Petchur
(Thanakul Petchurai)

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

Continuation of Calibration Certificate

Calibration Procedure : CP-AC-01

Cert. No. : ACL23320
Job No. : VC67AC0011
Pages : 2 of 8

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 weightings 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-0009-23	07-FEB-24
Waveform Generator	33511B	MY52302742	EF-0010-23	07-FEB-24
Digital Multimeter	33461A	MY53220104	EEL.BP 30/0266	13-FEB-24
Digital Multimeter	33461A	MY53220076	EEL.BP 29/0266	13-FEB-24
Digital Multimeter	34461A	MY60024273	EEL.BP 31/0266	14-FEB-24
Programmable Attenuator	MAT-1070	62100114	EF-0011-23	08-FEB-24
Condenser Microphone	4180	2977900	AA-1001-23	14-FEB-24
Measuring Amplifier	NA-42KAI	34560495	AA-3002-23	14-FEB-24

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).

Continuation of Calibration Certificate

Cert. No. : ACL23320
Job No. : VC67AC0011
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

Note : Pass/Fail evaluation for each parameter,
will be considered together from the acceptance limit and the Maximum-permitted uncertainty of measurement.

Continuation of Calibration Certificate

Cert. No. : ACL23320

Job No. : VC67AC0011

Pages : 4 of 8

Result of calibration :

1. Absolute sensitivity

Reference Acoustic Signal (dB)	Measured Value (dB)	Deviation (dB)	Acceptance Limit (dB)
93.9 (93.98)	93.9	0.0	±0.3

2. Self-generated noise

2.1 Normal test

Measured Value (dB)
14.6

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

Frequency Weighting	Measured value (dB)
A - weight	11.2
C - weight	17.5
Flat	23.1

3. Acoustical signal tests of frequency weightings

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

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)			
	Flat	C-weight	A-weight	Acceptance Limits
125	0.2	0.2	0.2	± 1.5
1000	0.0	0.0	0.0	± 1.0
8000	1.3	1.4	1.4	±5.0

Continuation of Calibration Certificate

Cert. No. : ACL23320

Job No. : VC67AC0011

Pages : 5 of 8

4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)			
	Flat	C-weight	A-weight	Acceptance Limits
63	-0.1	-0.1	-0.1	±2.0
125	0.0	0.0	-0.1	±1.5
250	0.0	0.0	-0.1	±1.5
500	0.0	0.0	0.0	±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	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
A - weight	94.0	94.0	0.0	± 0.2
C - weight	94.0	94.0	0.0	± 0.2
Flat	94.0	94.0	0.0	± 0.2

5.2 Time weighting at 1 kHz

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

Continuation of Calibration Certificate

Cert. No. : ACL23320
Job No. : VC67AC0011
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	63.9	-0.1	± 1.1
59.0	59.0	0.0	± 1.1
54.0	53.9	-0.1	± 1.1
49.0	48.9	-0.1	± 1.1
44.0	43.9	-0.1	± 1.1
39.0	38.9	-0.1	± 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

Continuation of Calibration Certificate

Cert. No. : ACL23320
Job No. : VC67AC0011
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, Lcpeak (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.1	0.1	±3.0
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	133.1	0.1	±2.0
Positive half cycle	135.4	135.2	-0.2	±2.0
Negative half cycle	135.4	135.2	-0.2	±2.0

Continuation of Calibration Certificate

Cert. No. : ACL23320
 Job No. : VC67AC0011
 Pages : 8 of 8

11. Overload indication

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

12. High level stability

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

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

End of Calibration Certificate