

ภาคผนวก ง

ใบรับรองเอกสารการสอบเทียบเครื่องมือตรวจวิเคราะห์



รายการเครื่องมือที่ใช้ในการวิเคราะห์ / ทดสอบ

Sample Name	Parameter	Equipment Name	ID No.	Calibrated Date	Next Cal	Freq. Calibrate (Months)
Ambient	Total Suspended Particulate	High Volume	RYG_FS0393	-	-	On site Calibration
Ambient	Total Suspended Particulate	High Volume	RYG_FS0179	-	-	On site Calibration
Ambient	Total Suspended Particulate	High Volume	RYG_FS0178	-	-	On site Calibration
Ambient	Total Suspended Particulate	High Volume	RYG_FS0291	-	-	On site Calibration
Ambient	Total Suspended Particulate	Digital Balance	RYG_EN0001	23-Mar-22	23-Mar-23	12
Ambient	Particulate Matter (PM-10)	High Volume	RYG_FS0191	-	-	On site Calibration
Ambient	Particulate Matter (PM-10)	High Volume	RYG_FS0399	-	-	On site Calibration
Ambient	Particulate Matter (PM-10)	High Volume	RYG_FS0398	-	-	On site Calibration
Ambient	Particulate Matter (PM-10)	High Volume	RYG_FS0188	-	-	On site Calibration
Ambient	Particulate Matter (PM-10)	Digital Balance	RYG_EN0001	23-Mar-22	23-Mar-23	12
Ambient	Nitrogen Dioxide	NO ₂ Analyzer	RYG_FS0455	4-Jan-22	4-Jul-22	6
Ambient	Nitrogen Dioxide	NO ₂ Analyzer	RYG_FS0461	4-Jan-22	4-Jul-22	6
Ambient	Nitrogen Dioxide	NO ₂ Analyzer	RYG_FS0463	4-Jan-22	4-Jul-22	6
Ambient	Nitrogen Dioxide	NO ₂ Analyzer	BKK_FS1064	4-Jan-22	4-Jul-22	6
Ambient	Sulfur Dioxide	SO ₂ Analyzer	RYG_FS0454	4-Jan-22	4-Jul-22	6
Ambient	Sulfur Dioxide	SO ₂ Analyzer	RYG_FS0460	4-Jan-22	4-Jul-22	6
Ambient	Sulfur Dioxide	SO ₂ Analyzer	RYG_FS0482	4-Jan-22	4-Jul-22	6
Ambient	Sulfur Dioxide	SO ₂ Analyzer	RYG_FS0266	4-Jan-22	4-Jul-22	6
Ambient	Wind Speed / Wind Direction	Wind Speed / Wind Direction	BKK_FS0141	7-Jun-21	6-Dec-22	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_FS0468	12-Jan-22	12-Jul-22	6
Stack	Total Suspended Particulate	Digital Balance	RYG_EN0003	23-Mar-22	23-Mar-23	12
Workplace	Sodium hydroxide	Field Rotameter	BKK_FS1040	4-Jan-22	4-Apr-22	3
Workplace	Chlorine	Field Rotameter	BKK_FS1040	4-Jan-22	4-Apr-22	3
Workplace	Chlorine	Ion Selective Electrode	BKK_EN0102	11-Mar-21	9-Sep-22	18
Workplace	Hydrogen Chloride	Field Rotameter	BKK_FS1005	4-Jan-22	4-Apr-22	3
Workplace	Hydrogen Chloride	Ion Chromatography	BKK_EN0069	12-Jan-22	12-Jan-23	12
Noise	Leq 24 hrs	Sound Calibrator	RYG_FS0496	10-Jan-22	10-Jan-23	12
Noise	Leq 24 hrs	Sound Level Meter	RYG_FS0022	21-Jan-22	21-Jan-23	12
Noise	Leq 8 hrs	Sound Calibrator	RYG_FS0496	10-Jan-22	10-Jan-23	12
Noise	Leq 8 hrs	Sound Level Meter	RYG_FS0015	21-Apr-21	21-Apr-22	12
Noise	Leq 8 hrs	Sound Level Meter	RYG_FS0016	28-Jun-21	28-Jun-22	12
Noise	Leq 8 hrs	Sound Level Meter	RYG_FS0017	4-Oct-21	4-Oct-22	12
Noise	Leq 8 hrs	Sound Level Meter	RYG_FS0018	4-Oct-21	4-Oct-22	12
Noise	Leq 8 hrs	Sound Level Meter	RYG_FS0019	10-Jan-22	10-Jan-23	12
Noise	Leq 8 hrs	Sound Level Meter	RYG_FS0021	21-Jan-22	21-Jan-23	12
Noise	Leq 8 hrs	Sound Level Meter	RYG_FS0022	21-Jan-22	21-Jan-23	12
Noise	Leq 8 hrs	Sound Calibrator	RYG_FS0213	26-Apr-22	26-Apr-23	12
Noise	Leq 8 hrs	Sound Level Meter	RYG_FS0012	4-Oct-21	4-Oct-22	12
Noise	Leq 8 hrs	Sound Level Meter	RYG_FS0017	4-Oct-21	4-Oct-22	12
Noise	Leq 8 hrs	Sound Level Meter	RYG_FS0022	21-Jan-22	21-Jan-23	12
Noise	Leq 8 hrs	Sound Level Meter	RYG_FS0301	13-Sep-21	13-Sep-22	12
Noise	Leq 8 hrs	Sound Level Meter	RYG_FS0381	7-Jul-21	7-Jul-22	12
Noise	Leq 8 hrs	Sound Level Meter	RYG_FS0388	13-Sep-21	13-Sep-22	12
Heat	Heat Stress	Heat Stress Monitor	RYG_FS0228	9-Jul-21	9-Jul-22	12
Heat	Heat Stress	Heat Stress Monitor	RYG_FS0230	12-Jul-21	12-Jul-22	12
Heat	Heat Stress	Heat Stress Monitor	RYG_FS0236	30-Sep-21	30-Sep-22	12
Heat	Heat Stress	Heat Stress Monitor	RYG_FS0237	10-May-21	10-May-22	12
Rayong Lab	pH at 25 °C	pH meter	RYG_EN0183	17-Mar-22	17-Mar-23	12
Rayong Lab	BOD (5 days at 20°C)	DO meter with Sensor	RYG_EN0032	14-Feb-22	15-Aug-23	18
Rayong Lab	BOD (5 days at 20°C)	Incubator	RYG_EN0154	22-Apr-22	21-Oct-23	18
Rayong Lab	Total Dissolved Solids 180°C	Electronic Balance	RYG_EN0002	23-Mar-22	23-Mar-23	12
Rayong Lab	Total Dissolved Solids 180°C	Chamber Oven	RYG_EN0010	5-May-21	3-Nov-22	18
Rayong Lab	Oil & Grease	Electronic Balance	RYG_EN0002	23-Mar-22	23-Mar-23	12
Rayong Lab	Oil & Grease	Chamber Oven	RYG_EN0006	5-May-21	3-Nov-22	18
Rayong Lab	Oil & Grease	Water Bath	RYG_EN0061	5-May-21	3-Nov-22	18
Rayong Lab	Temperature	Digital Thermometer	RYG_FS0467	7-Jul-21	7-Jul-22	18
Rayong Lab	Cyanide	SPECTROPHOTOMETER	RYG_EN0037	1-Apr-21	1-Oct-22	18
Rayong Lab	Formaldehyde	SPECTROPHOTOMETER	RYG_EN0037	1-Apr-21	1-Oct-22	18
Rayong Lab	Phenol	SPECTROPHOTOMETER	RYG_EN0037	1-Apr-21	1-Oct-22	18
Rayong Lab	Fluoride	pH ISE Meter	RYG_EN0152	23-Dec-21	23-Dec-22	12
Rayong Lab	Ammonia Nitrogen	SPECTROPHOTOMETER	RYG_EN0037	1-Apr-21	1-Oct-22	18
Rayong Lab	Color (at Original pH)	SPECTROPHOTOMETER	RYG_EN0037	1-Apr-21	1-Oct-22	18
Rayong Lab	Color (at pH 7.0)	SPECTROPHOTOMETER	RYG_EN0037	1-Apr-21	1-Oct-22	18
Rayong Lab	Sulfide	Chamber (Cold Room)	RYG_EN0184	22-Feb-22	22-Feb-23	12
Rayong Lab	COD	SPECTROPHOTOMETER	RYG_EN0037	1-Apr-21	1-Oct-22	18



รายการเครื่องมือที่ใช้ในการวิเคราะห์ / ทดสอบ

Sample Name	Parameter	Equipment Name	ID No.	Calibrated Date	Next Cal	Freq. Calibrate (Months)
Rayong Lab	Total Suspended Solids	Electronic Balance	RYG_EN0002	23-Mar-22	23-Mar-23	12
Rayong Lab	Total Suspended Solids	Chamber Oven	RYG_EN0010	5-May-21	3-Nov-22	18
Rayong Lab	Total Kjeldahl Nitrogen	Block Digestion Unit	RYG_EN0188	17-Mar-22	17-Mar-23	12
Rayong Lab	Total Kjeldahl Nitrogen	pH Meter	RYG_EN0152	23-Dec-21	23-Dec-22	12
Water Lab	Anionic Surfactant	Spectrophotometer	BKK_EN0018	15-Oct-21	15-Oct-22	12
Water Lab	Anionic Surfactant	Chamber (Cold Room)	BKK_EN0167	18-May-21	16-Nov-22	18
Water Lab	Organochlorine Pesticide	GC MSMS	BKK_EN0284	23-Nov-21	22-May-23	18
Water Lab	Pyrethroid Group Pesticides	GC MSMS	BKK_EN0284	23-Nov-21	22-May-23	18
Water Lab	Organo Phosphate Pesticide	GC MSMS	BKK_EN0284	23-Nov-21	22-May-23	18
Water Lab	Carbamate Pesticide	LC-MS/MS	BKK_FL0089	27-Jan-22	25-Jul-22	6
Water Lab	Hexavalent Chromium	Spectrophotometer	BKK_EN0018	15-Oct-21	15-Oct-22	12
Water Lab	Silver	ICP-MS	BKK_EL0043	30-Sep-21	29-Mar-23	12
Water Lab	Silver	Hot Block	BKK_EL0054	7-Apr-22	7-Oct-23	18
Water Lab	Silver	Chamber (Cold Room)	BKK_EN0167	18-May-21	16-Nov-22	18
Water Lab	Barium	ICP-MS	BKK_EL0043	30-Sep-21	29-Mar-23	12
Water Lab	Barium	Hot Block	BKK_EL0054	7-Apr-22	7-Oct-23	18
Water Lab	Barium	Chamber (Cold Room)	BKK_EN0167	18-May-21	16-Nov-22	18
Water Lab	Lead	ICP-MS	BKK_EL0043	30-Sep-21	29-Mar-23	12
Water Lab	Lead	Hot Block	BKK_EL0054	7-Apr-22	7-Oct-23	18
Water Lab	Lead	Chamber (Cold Room)	BKK_EN0167	18-May-21	16-Nov-22	18
Water Lab	Iron	ICP-MS	BKK_EL0043	30-Sep-21	29-Mar-23	12
Water Lab	Iron	Hot Block	BKK_EL0054	7-Apr-22	7-Oct-23	18
Water Lab	Iron	Chamber (Cold Room)	BKK_EN0167	18-May-21	16-Nov-22	18
Water Lab	Manganese	ICP-MS	BKK_EL0043	30-Sep-21	29-Mar-23	12
Water Lab	Manganese	Hot Block	BKK_EL0054	7-Apr-22	7-Oct-23	18
Water Lab	Manganese	Chamber (Cold Room)	BKK_EN0167	18-May-21	16-Nov-22	18
Water Lab	Copper	ICP-MS	BKK_EL0043	30-Sep-21	29-Mar-23	12
Water Lab	Copper	Hot Block	BKK_EL0054	7-Apr-22	7-Oct-23	18
Water Lab	Copper	Chamber (Cold Room)	BKK_EN0167	18-May-21	16-Nov-22	18
Water Lab	Nickel	ICP-MS	BKK_EL0043	30-Sep-21	29-Mar-23	12
Water Lab	Nickel	Hot Block	BKK_EL0054	7-Apr-22	7-Oct-23	18
Water Lab	Nickel	Chamber (Cold Room)	BKK_EN0167	18-May-21	16-Nov-22	18
Water Lab	Arsenic	ICP-MS	BKK_EL0043	30-Sep-21	29-Mar-23	12
Water Lab	Arsenic	Hot Block	BKK_EL0054	7-Apr-22	7-Oct-23	18
Water Lab	Arsenic	Chamber (Cold Room)	BKK_EN0167	18-May-21	16-Nov-22	18
Water Lab	Selenium	ICP-MS	BKK_EL0043	30-Sep-21	29-Mar-23	12
Water Lab	Selenium	Hot Block	BKK_EL0054	7-Apr-22	7-Oct-23	18
Water Lab	Selenium	Chamber (Cold Room)	BKK_EN0167	18-May-21	16-Nov-22	18
Water Lab	Cadmium	ICP-MS	BKK_EL0043	30-Sep-21	29-Mar-23	12
Water Lab	Cadmium	Hot Block	BKK_EL0054	7-Apr-22	7-Oct-23	18
Water Lab	Cadmium	Chamber (Cold Room)	BKK_EN0167	18-May-21	16-Nov-22	18
Water Lab	Zinc	ICP-MS	BKK_EL0043	30-Sep-21	29-Mar-23	12
Water Lab	Zinc	Hot Block	BKK_EL0054	7-Apr-22	7-Oct-23	18
Water Lab	Zinc	Chamber (Cold Room)	BKK_EN0167	18-May-21	16-Nov-22	18
Water Lab	Trivalent Chromium	ICP-MS	BKK_EL0043	30-Sep-21	29-Mar-23	12
Water Lab	Trivalent Chromium	Hot Block	BKK_EL0054	7-Apr-22	7-Oct-23	18
Water Lab	Trivalent Chromium	Chamber (Cold Room)	BKK_EN0167	18-May-21	16-Nov-22	18
Water Lab	Mercury	DUO-CVAFS / CVAAS	BKK_EL0023	6-Jun-22	5-Jun-23	12

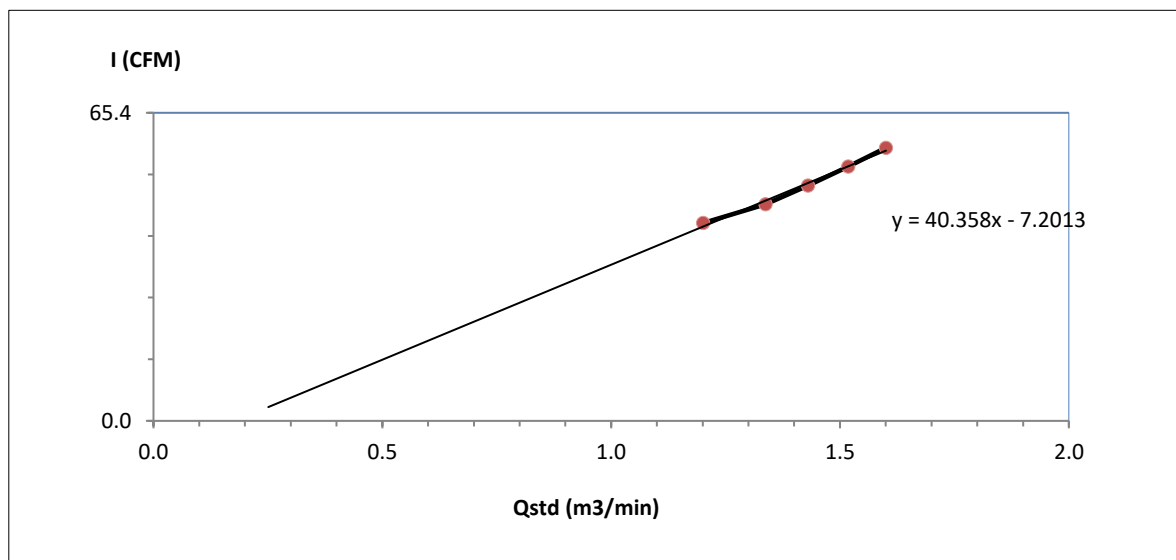


High Volume Air Sampler Calibration Worksheet

Project Site : Global Power Synergy Public Company Limited
Calibrate Location : วัดหนองแฟบ
Calibrate Date : 28-Mar-22
CalibrationSheet No.: C-280322-RYG_FS0393
Calibrator ID: RYG_FS0205
Calibrator Model : TE-5028A
Calibrator S/N : 1166

Barometric Pressure (mm Hg) : 758
Temperature (°C) : 32
High Volume ID : RYG_FS0393
High Volume Model : TE-5170D
High Volume S/N : 5682
Calibrator Slope : 1.53016
Calibrator Intercept : -0.0468

Test No.	Delta H ₂ O (inch)	Q _{std} (m ³ /min)	I : Chart (CFM)	Linear Regression
1	3.2	1.2008	42	Slope : 40.3580 Intercept : -7.2013 Correlation Coefficient : 0.9944
2	4.0	1.3371	46	
3	4.6	1.4304	50	
4	5.2	1.5179	54	
5	5.8	1.6005	58	



Calibrated by

Satcha P.

(Mr.Satcha Phetsawaeng)
Field Scientist (2)

Approved by :

Mr. Noppong Juntarupan

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

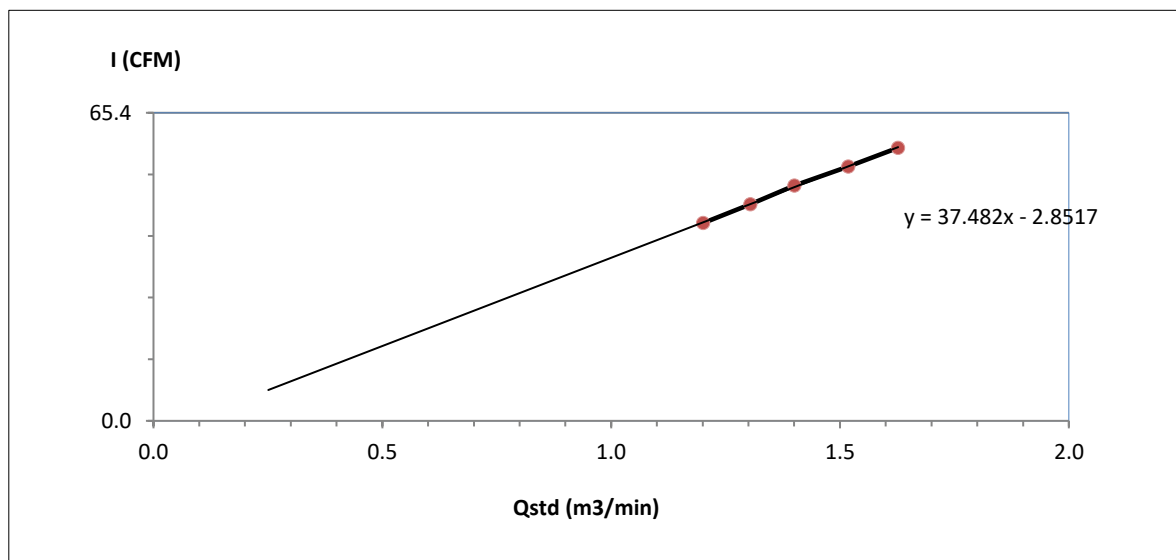


High Volume Air Sampler Calibration Worksheet

Project Site : Global Power Synergy Public Company Limited
Calibrate Location : วัดมาบชลด
Calibrate Date : 28-Mar-22
CalibrationSheet No.: C-280322-RYG_FS0179
Calibrator ID: RYG_FS0205
Calibrator Model : TE-5028A
Calibrator S/N : 1166

Barometric Pressure (mm Hg) : 758
Temperature (°C) : 32
High Volume ID : RYG_FS0179
High Volume Model : TE-5170D
High Volume S/N : 4805
Calibrator Slope : 1.53016
Calibrator Intercept : -0.0468

Test No.	Delta H ₂ O (inch)	Q _{std} (m ³ /min)	I : Chart (CFM)	Linear Regression
1	3.2	1.2008	42	Slope : 37.4823 Intercept : -2.8517 Correlation Coefficient : 0.9994
2	3.8	1.3044	46	
3	4.4	1.4000	50	
4	5.2	1.5179	54	
5	6.0	1.6270	58	



Calibrated by

Satcha P.

(Mr.Satcha Phetsawaeng)
Field Scientist (2)

Approved by :

Mr. Noppong Juntarupan

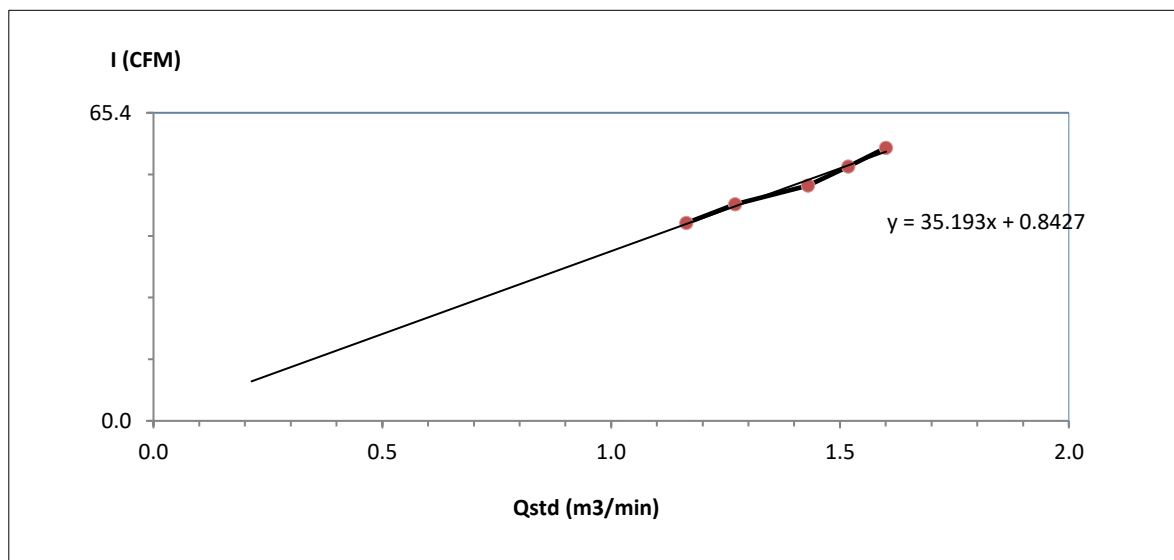
(Mr. Noppong Juntarupan)
Enviro Field Coordinator Scientist (3)



High Volume Air Sampler Calibration Worksheet

Project Site :	Global Power Synergy Public Company Limited	Barometric Pressure (mm Hg) :	758
Calibrate Location :	วัดชากลูกหญ้า	Temperature (°C) :	32
Calibrate Date :	28-Mar-22	High Volume ID :	RYG_FS0178
CalibrationSheet No.:	C-280322-RYG_FS0178	High Volume Model :	TE-5170D
Calibrator ID:	RYG_FS0205	High Volume S/N :	4804
Calibrator Model :	TE-5028A	Calibrator Slope :	1.53016
Calibrator S/N :	1166	Calibrator Intercept :	-0.0468

Test No.	Delta H ₂ O (inch)	Q _{std} (m ³ /min)	I : Chart (CFM)	Linear Regression
1	3.0	1.1642	42	Slope : 35.1934 Intercept : 0.8427 Correlation Coefficient : 0.9925
2	3.6	1.2708	46	
3	4.6	1.4304	50	
4	5.2	1.5179	54	
5	5.8	1.6005	58	



Calibrated by

Satcha P.

(Mr.Satcha Phetsawaeng)
Field Scientist (2)

Approved by :

(Signature)

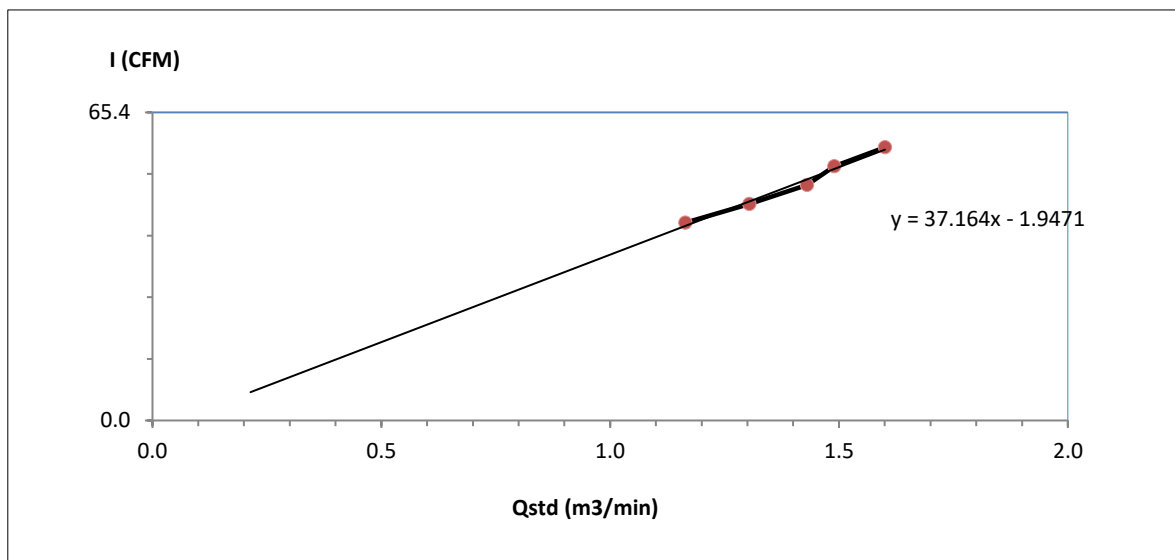
(Mr. Noppong Juntarupan)
Enviro Field Coordinator Scientist (3)



High Volume Air Sampler Calibration Worksheet

Project Site :	Global Power Synergy Public Company L	Barometric Pressure (mm Hg) :	758
Calibrate Location :	วัดโสมกวนาราม	Temperature (°C) :	32
Calibrate Date :	28-Mar-22	High Volume ID :	RYG_FS0291
CalibrationSheet No.:	C-280322-RYG_FS0291	High Volume Model :	TE-5170D
Calibrator ID:	RYG_FS0205	High Volume S/N :	5333
Calibrator Model :	TE-5028A	Calibrator Slope :	1.53016
Calibrator S/N :	1166	Calibrator Intercept :	-0.0468

Test No.	Delta H ₂ O (inch)	Q _{std} (m ³ /min)	I : Chart (CFM)	Linear Regression
1	3.0	1.1642	42	Slope : 37.1642 Intercept : -1.9471 Correlation Coefficient : 0.9912
2	3.8	1.3044	46	
3	4.6	1.4304	50	
4	5.0	1.4894	54	
5	5.8	1.6005	58	



Calibrated by

Satcha P.

(Mr.Satcha Phetsawaeng)
Field Scientist (2)

Approved by :

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



PENTA
CALIBRATION

PENTA CALIBRATION CO., LTD.

66/124 The Connect 33 Village Kanchanaphisek Road
Dokmai Prawet Bangkok 10250
Tel: +66 (0) 2069-9773
www.pentacal.com

Certificate of Calibration

Represent to Certificate of Calibration ,PTC/07/22102

Certificate No.:	PTC/07/22102	Page:	1 of 2
Equipment:	Digital Balance	Condition:	Normal
Manufacturer:	Sartorius	Serial No:	25409664
Model:	LA130S-F	ID No:	RYG_EN0001
Type of Balance:	Single interval		



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



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

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

The Method used: In house method, PTC-WI-07, base on Euramet cg. 18

Traceability: This certificate is traceable to the SI Units through Thai Calibration Service Co.,Ltd.
, NSC-ONSC Accreditation No.: Calibration 0189

Date Received: March 23, 2022

Calibration Date: March 23, 2022

Issued Date: March 25, 2022

Calibration By: Mr. Rungroje Metakul



PENTA CALIBRATION CO.,LTD

[Signature]

(Mr.Kriangsak Kalasri)

Reviewed by

Approved By :

[Signature]

(Mr. Keattisak Kerdto)

Laboratory Manager

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

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

This calibration certificate shall not be reproduced except in full only, without written approval from penta calibration co., ltd



Represent to Certificate of Calibration ,PTC/07/22102

Certificate No.: PTC/07/22102

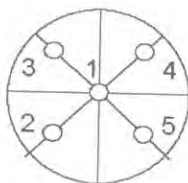
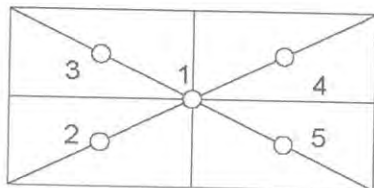
Page: 2 of 2

Measurement Results:

Without Adjustment :

Function Calibration: Non Adjustment

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



Eccentricity test 50 (g)

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

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

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

Nominal test value (g)	Standard Deviation
100	0.00009

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

Nominal Value (g)	Conventional Mass (g)	Indication (g)	Correction of Balance (g)	Uncertainty (g)	k
0	0.00000	0.0000	0.0000	0.00026	2.87
0.01	0.01000	0.0100	0.0000	0.00026	2.65
0.05	0.05000	0.0500	0.0000	0.00026	2.65
0.1	0.10000	0.1000	0.0000	0.00026	2.65
0.5	0.50000	0.4999	0.0001	0.00026	2.65
1	1.00000	0.9999	0.0001	0.00026	2.65
2	2.00000	1.9999	0.0001	0.00026	2.65
5	5.00001	5.0000	0.0000	0.00026	2.65
10	10.00000	10.0001	-0.0001	0.00026	2.65
20	20.00003	20.0001	-0.0001	0.00026	2.52
100	100.00004	100.0001	-0.0001	0.00027	2.18

Note: Weight of adjust - (g)

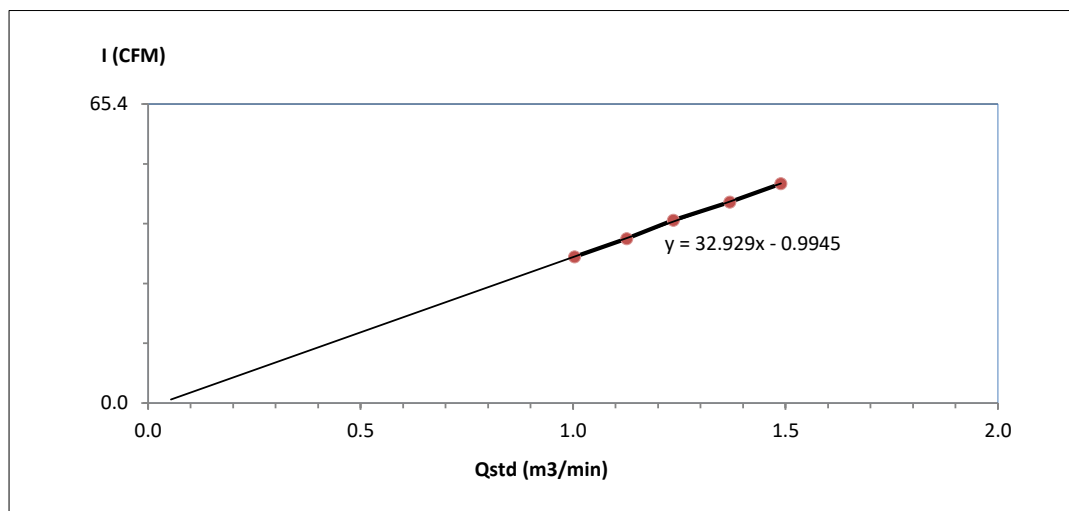
The End of Certificate



High Volume Air Sampler Calibration Worksheet

Project Site :	Global Power Synergy Public Company Limited	Barometric Pressure (mm Hg) :	758
Calibrate Location :	วัดหนองแฟบ	Temperature (°C) :	32
Calibrate Date :	28-Mar-22	High Volume ID :	RYG_FS0191
CalibrationSheet No.:	C-280322-RYG_FS0191	High Volume Model :	TE-5009X
Calibrator ID:	RYG_FS0205	High Volume S/N :	5330
Calibrator Model :	TE-5028A	Calibrator Slope :	1.53016
Calibrator S/N :	1166	Calibrator Intercept :	-0.0468

Test No.	Delta H ₂ O (inch)	Q _{std} (m ³ /min)	I : Chart (CFM)	Linear Regression
1	2.2	1.0037	32	Slope : 32.9294 Intercept : -0.9945 Correlation Coefficient : 0.9997
2	2.8	1.1263	36	
3	3.4	1.2364	40	
4	4.2	1.3689	44	
5	5.0	1.4894	48	



Calibrated by Satcha P.

(Mr.Satcha Phetsawaeng)
Field Scientist (2)

Approved by : Mr. Noppong Juntarupan

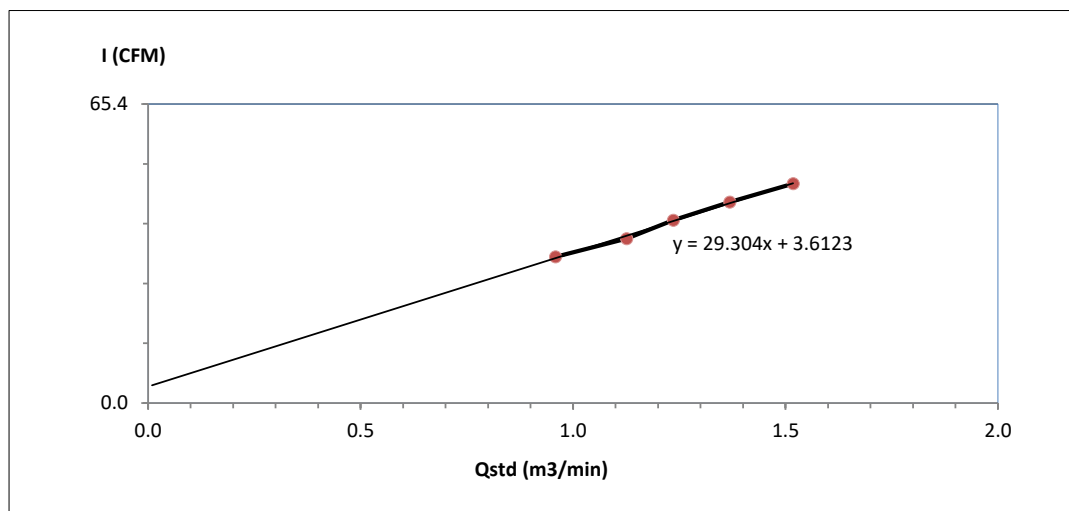
(Mr. Noppong Juntarupan)
Enviro Field Coordinator Scientist (3)



High Volume Air Sampler Calibration Worksheet

Project Site :	Global Power Synergy Public Company Limited	Barometric Pressure (mm Hg) :	758
Calibrate Location :	วัดมาบขลุ่ด	Temperature (°C) :	32
Calibrate Date :	28-Mar-22	High Volume ID :	RYG_FS0399
CalibrationSheet No.:	C-280322-RYG_FS0399	High Volume Model :	TE-5009X
Calibrator ID:	RYG_FS0205	High Volume S/N :	5683
Calibrator Model :	TE-5028A	Calibrator Slope :	1.53016
Calibrator S/N :	1166	Calibrator Intercept :	-0.0468

Test No.	Delta H ₂ O (inch)	Q _{std} (m ³ /min)	I : Chart (CFM)	Linear Regression
1	2.0	0.9591	32	Slope : 29.3040 Intercept : 3.6123 Correlation Coefficient : 0.9982
2	2.8	1.1263	36	
3	3.4	1.2364	40	
4	4.2	1.3689	44	
5	5.2	1.5179	48	



Calibrated by Satcha P.

(Mr.Satcha Phetsawaeng)
Field Scientist (2)

Approved by : [Signature]

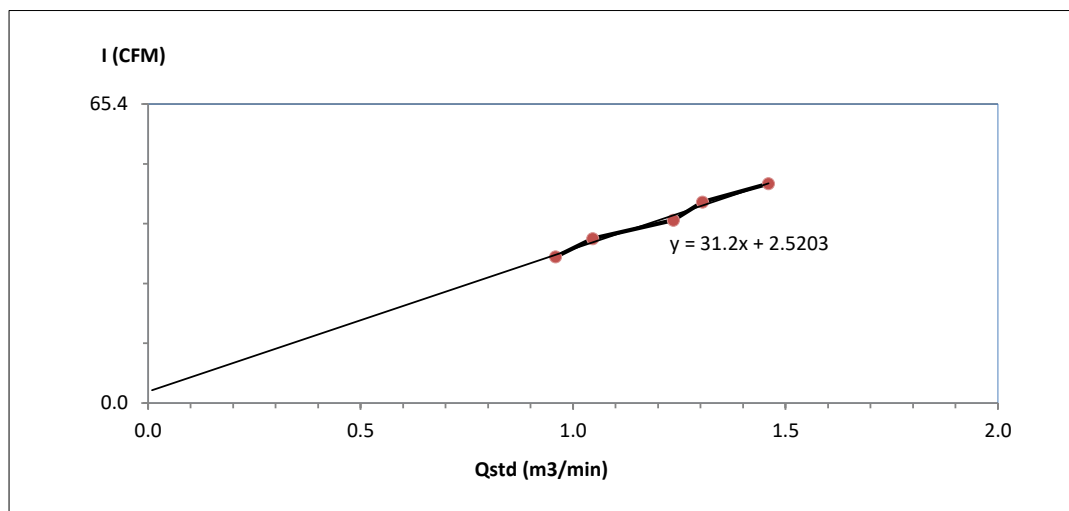
(Mr. Noppong Juntarupan)
Enviro Field Coordinator Scientist (3)



High Volume Air Sampler Calibration Worksheet

Project Site :	Global Power Synergy Public Company Limited	Barometric Pressure (mm Hg) :	758
Calibrate Location :	วัดซากลูกหญ้า	Temperature (°C) :	32
Calibrate Date :	28-Mar-22	High Volume ID :	RYG_FS0398
CalibrationSheet No.:	C-280322-RYG_FS0398	High Volume Model :	TE-5009X
Calibrator ID:	RYG_FS0205	High Volume S/N :	5684
Calibrator Model :	TE-5028A	Calibrator Slope :	1.53016
Calibrator S/N :	1166	Calibrator Intercept :	-0.0468

Test No.	Delta H ₂ O (inch)	Q _{std} (m ³ /min)	I : Chart (CFM)	Linear Regression
1	2.0	0.9591	32	Slope : 31.2002 Intercept : 2.5203 Correlation Coefficient : 0.9915
2	2.4	1.0462	36	
3	3.4	1.2364	40	
4	3.8	1.3044	44	
5	4.8	1.4602	48	



Calibrated by Satcha P.

(Mr.Satcha Phetsawaeng)
Field Scientist (2)

Approved by : [Signature]

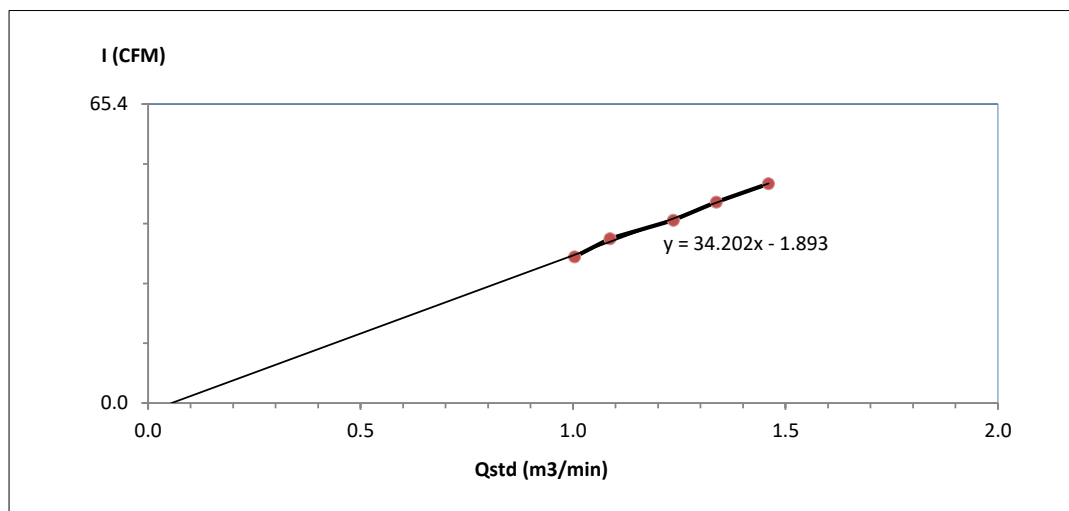
(Mr. Noppong Juntarupan)
Enviro Field Coordinator Scientist (3)



High Volume Air Sampler Calibration Worksheet

Project Site :	Global Power Synergy Public Company Limited	Barometric Pressure (mm Hg) :	758
Calibrate Location :	วัดโสมกวนาราม	Temperature (°C) :	32
Calibrate Date :	28-Mar-22	High Volume ID :	RYG_FS0188
CalibrationSheet No.:	C-280322-RYG_FS0188	High Volume Model :	TE-5009X
Calibrator ID:	RYG_FS0205	High Volume S/N :	4796
Calibrator Model :	TE-5028A	Calibrator Slope :	1.53016
Calibrator S/N :	1166	Calibrator Intercept :	-0.0468

Test No.	Delta H ₂ O (inch)	Q _{std} (m ³ /min)	I : Chart (CFM)	Linear Regression
1	2.2	1.0037	32	Slope : 34.2021 Intercept : -1.8930 Correlation Coefficient : 0.9972
2	2.6	1.0870	36	
3	3.4	1.2364	40	
4	4.0	1.3371	44	
5	4.8	1.4602	48	



Calibrated by Satcha P.

(Mr.Satcha Phetsawaeng)
Field Scientist (2)

Approved by : [Signature]

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

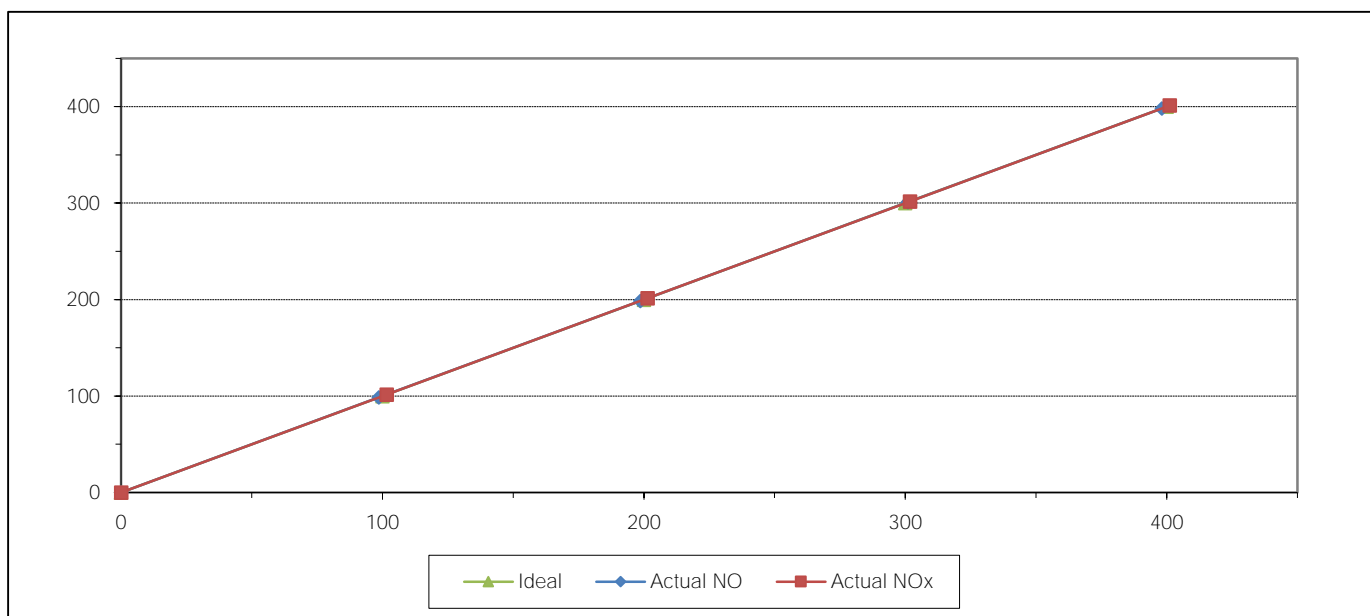


MULTIPOINT CALIBRATION REPORT

Calibration Date 4-Jan-22
Manufacturer HORIBA
Serial No. ALP0V0WY
Calibrator Manufacturer Teledyne API
Serial No. 947
Std. Gas Concentration (PPM) 51.33
Cylinder Pressure (psi) 1200
Certified Date 18-Mar-14

Equipment Name NOx Analyzer
Model APNA-370
Equipment ID RYG_FS0455
Model 700
Cylinder No. LL36633
Certified By Airgas Inc.
Expired Date 18-Mar-22

Point	CALIBRATION RESULTS						
	Ideal	Actual NO	Error NO	%Error NO	Actual NOx	Error NOx	%Error NOx
ZERO	0.00	0.10	0.10	0.10	0.10	0.10	0.10
1	100.00	98.60	-1.40	-1.40	101.60	1.60	1.60
2	200.00	198.70	-1.30	-0.65	201.40	1.40	0.70
3	300.00	301.00	1.00	0.33	301.80	1.80	0.60
4	400.00	398.20	-1.80	-0.45	401.20	1.20	0.30
AVERAGE (%)				-0.41			0.66



Calibrated By

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

Approved By

(Mr.Sarayuth Jittranont)
Assistant General Manager

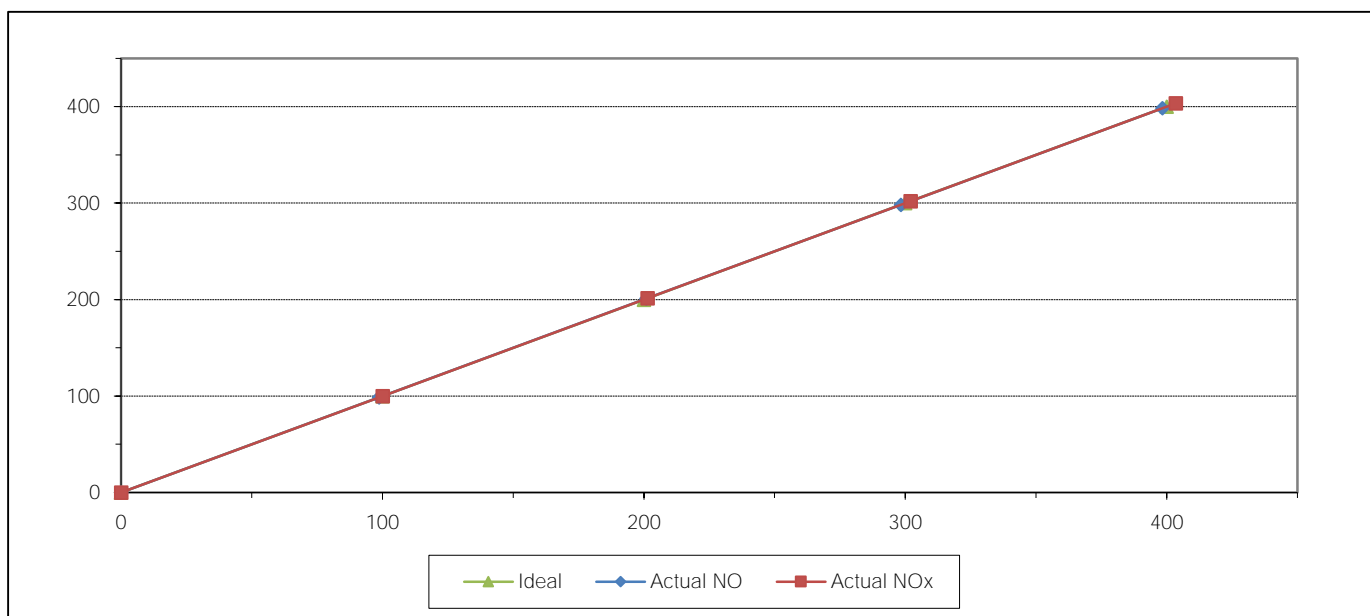


MULTIPOINT CALIBRATION REPORT

Calibration Date 4-Jan-22
Manufacturer HORIBA
Serial No. T95HWM41
Calibrator Manufacturer Teledyne API
Serial No. 947
Std. Gas Concentration (PPM) 51.33
Cylinder Pressure (psi) 1200
Certified Date 18-Mar-14

Equipment Name NOx Analyzer
Model APNA-370
Equipment ID RYG_FS0461
Model 700
Cylinder No. LL36633
Certified By Airgas Inc.
Expired Date 18-Mar-22

Point	CALIBRATION RESULTS						
	Ideal	Actual NO	Error NO	%Error NO	Actual NOx	Error NOx	%Error NOx
ZERO	0.00	0.10	0.10	0.10	0.10	0.10	0.10
1	100.00	98.70	-1.30	-1.30	100.10	0.10	0.10
2	200.00	201.00	1.00	0.50	201.40	1.40	0.70
3	300.00	298.30	-1.70	-0.57	302.10	2.10	0.70
4	400.00	398.40	-1.60	-0.40	403.50	3.50	0.88
AVERAGE (%)				-0.33			0.50



Calibrated By

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

Approved By

(Mr.Sarayuth Jittranont)
Assistant General Manager

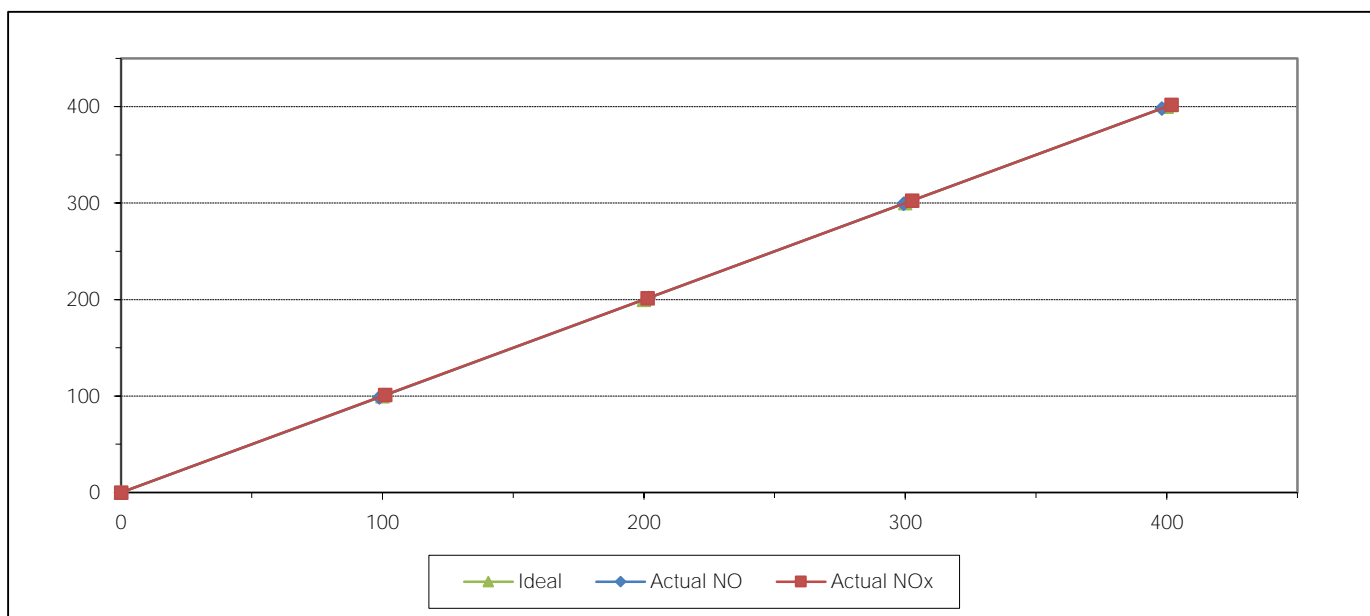


MULTIPOINT CALIBRATION REPORT

Calibration Date 4-Jan-22
Manufacturer HORIBA
Serial No. R06K0177
Calibrator Manufacturer Teledyne API
Serial No. 947
Std. Gas Concentration (PPM) 51.33
Cylinder Pressure (psi) 1200
Certified Date 18-Mar-14

Equipment Name NOx Analyzer
Model APNA-370
Equipment ID RYG_FS0463
Model 700
Cylinder No. LL36633
Certified By Airgas Inc.
Expired Date 18-Mar-22

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 Sakarn)
Field Environmental Scientist (3)

Approved By

(Mr.Sarayuth Jittranont)
Assistant General Manager

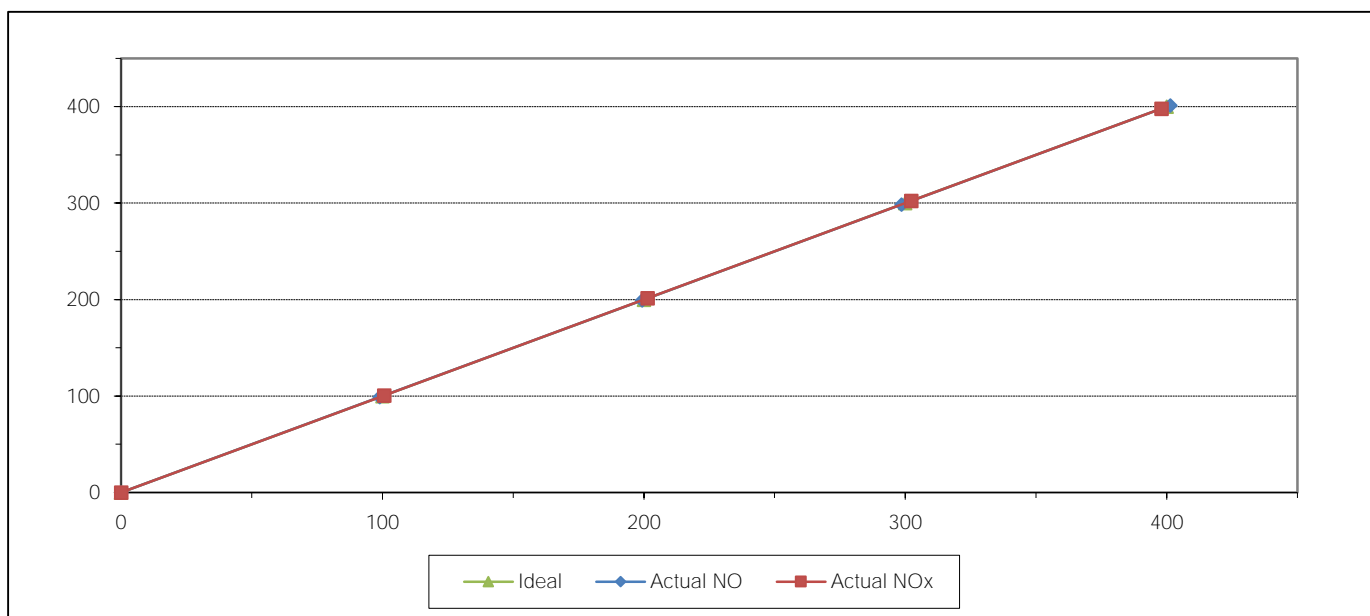


MULTIPOINT CALIBRATION REPORT

Calibration Date 4-Jan-22
Manufacturer HORIBA
Serial No. 148EH0E0
Calibrator Manufacturer Teledyne API
Serial No. 947
Std. Gas Concentration (PPM) 51.33
Cylinder Pressure (psi) 1200
Certified Date 18-Mar-14

Equipment Name NOx Analyzer
Model APNA-370
Equipment ID BKK_FS1064
Model 700
Cylinder No. LL36633
Certified By Airgas Inc.
Expired Date 18-Mar-22

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	99.00	-1.00	-1.00	100.70	0.70	0.70
2	200.00	199.40	-0.60	-0.30	201.50	1.50	0.75
3	300.00	298.60	-1.40	-0.47	302.30	2.30	0.77
4	400.00	401.40	1.40	0.35	398.00	-2.00	-0.50
AVERAGE (%)				-0.26			0.36



Calibrated By

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

Approved By

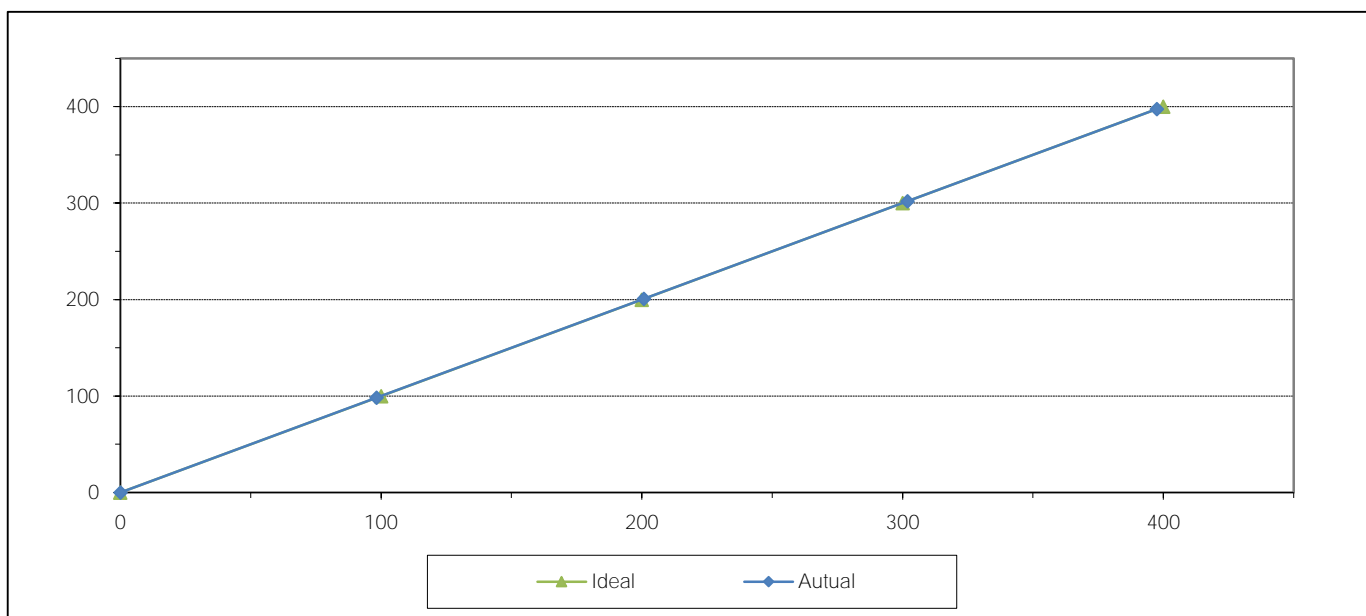
(Mr.Sarayuth Jittranont)
Assistant General Manager



MULTIPOINT CALIBRATION REPORT

Calibration Date	4-Jan-22	Equipment Name	SO2 Analyzer
Manufacturer	HORIBA	Model	APSA-370
Serial No.	H0S3D9FA	Equipment ID	RYG_FS0454
Calibrator Manufacturer	Teledyne API	Model	700
Serial No.	947		
Std. Gas Concentration (PPM)	50.87	Cylinder No.	LL36633
Cylinder Pressure (psi)	1200	Certified By	Airgas Inc.
Certified Date	18-Mar-14	Expired Date	18-Mar-22

Point	CALIBRATION RESULTS			
	Ideal	Autual	Error	%Error
ZERO	0.00	0.10	0.10	0.10
1	100.00	98.30	-1.70	-1.70
2	200.00	200.80	0.80	0.40
3	300.00	301.90	1.90	0.63
4	400.00	397.50	-2.50	-0.63
AVERAGE (%)				-0.24



Calibrated By

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

Approved By

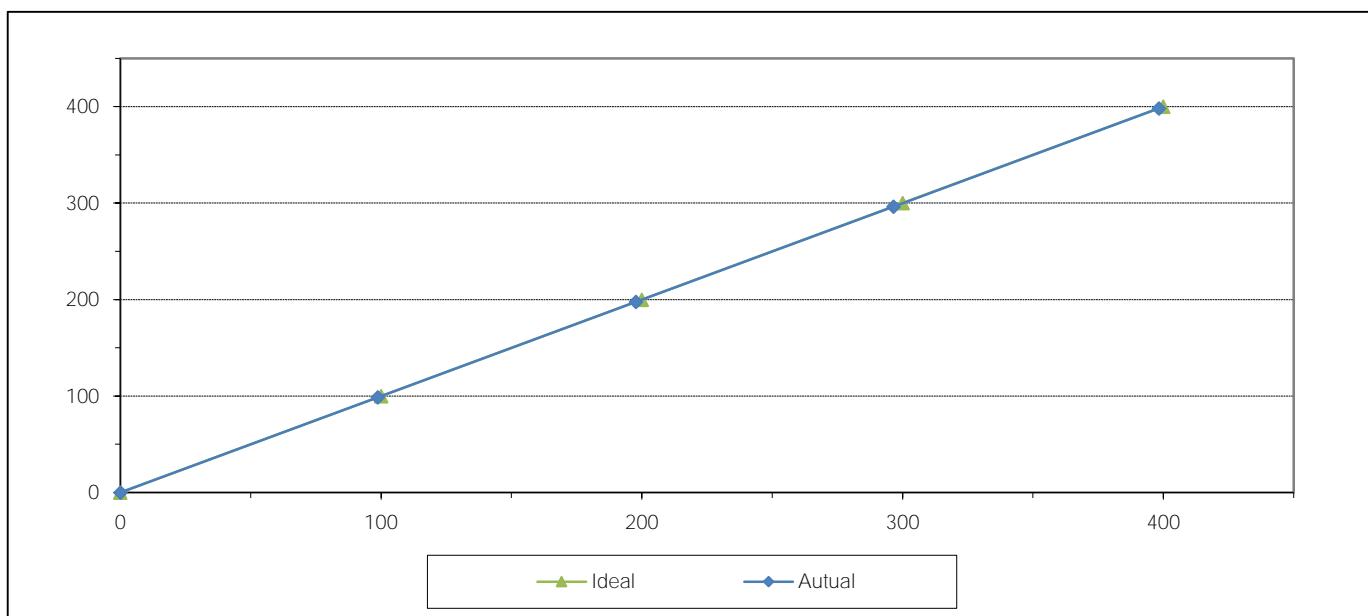
(Mr.Sarayuth Jittranont)
Assistant General Manager



MULTIPOINT CALIBRATION REPORT

Calibration Date	4-Jan-22	Equipment Name	SO2 Analyzer
Manufacturer	HORIBA	Model	APSA-370
Serial No.	VABF9LSH	Equipment ID	RYG_FS0460
Calibrator Manufacturer	Teledyne API	Model	700
Serial No.	947		
Std. Gas Concentration (PPM)	50.87	Cylinder No.	LL36633
Cylinder Pressure (psi)	1200	Certified By	Airgas Inc.
Certified Date	18-Mar-14	Expired Date	18-Mar-22

Point	CALIBRATION RESULTS			
	Ideal	Autual	Error	%Error
ZERO	0.00	0.10	0.10	0.10
1	100.00	98.70	-1.30	-1.30
2	200.00	197.80	-2.20	-1.10
3	300.00	296.50	-3.50	-1.17
4	400.00	398.30	-1.70	-0.42
AVERAGE (%)				-0.78



Calibrated By

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

Approved By

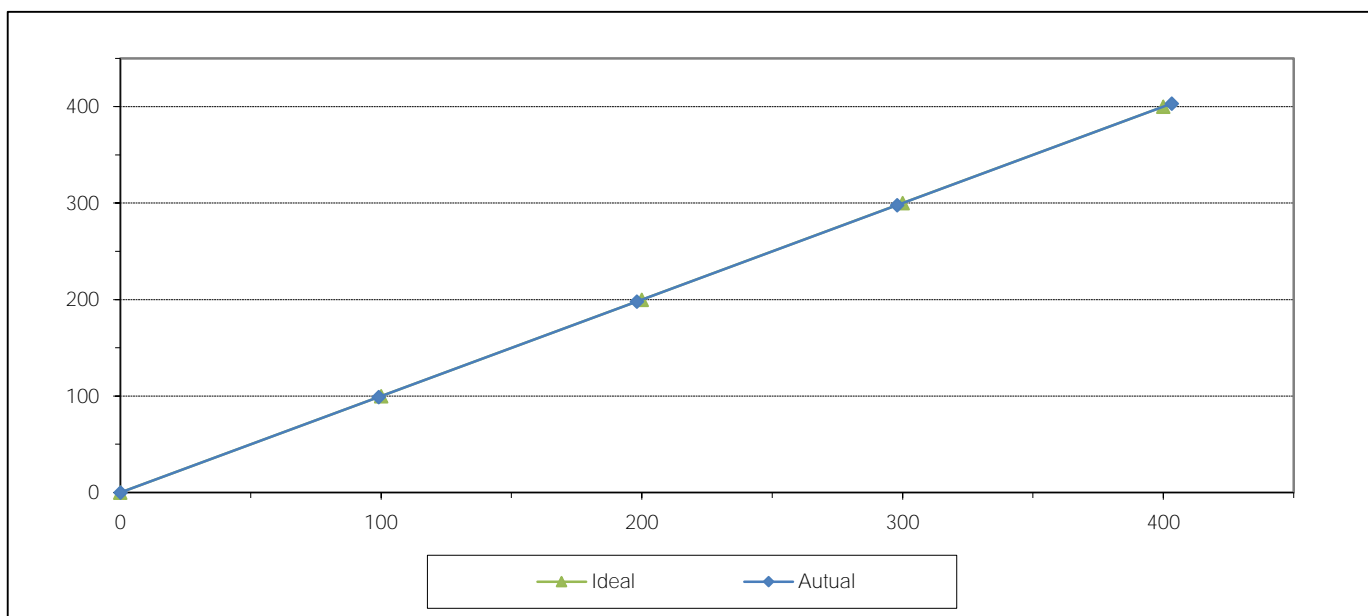
(Mr.Sarayuth Jittranont)
Assistant General Manager



MULTIPOINT CALIBRATION REPORT

Calibration Date	4-Jan-22	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)	50.87	Cylinder No.	LL36633
Cylinder Pressure (psi)	1200	Certified By	Airgas Inc.
Certified Date	18-Mar-14	Expired Date	18-Mar-22

Point	CALIBRATION RESULTS			
	Ideal	Autual	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

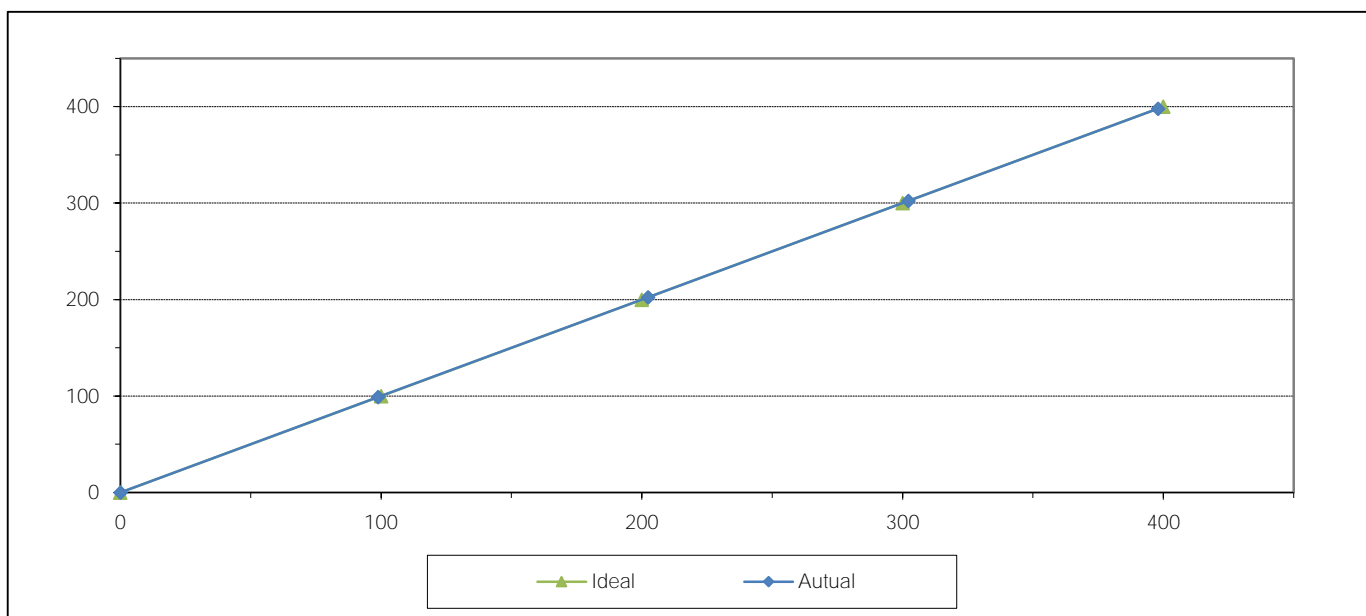
(Mr.Sarayuth Jittranont)
Assistant General Manager



MULTIPOINT CALIBRATION REPORT

Calibration Date	4-Jan-22	Equipment Name	SO2 Analyzer
Manufacturer	HORIBA	Model	APSA-370
Serial No.	NM3M2D5M	Equipment ID	RYG_FS0266
Calibrator Manufacturer	Teledyne API	Model	700
Serial No.	947		
Std. Gas Concentration (PPM)	50.87	Cylinder No.	LL36633
Cylinder Pressure (psi)	1200	Certified By	Airgas Inc.
Certified Date	18-Mar-14	Expired Date	18-Mar-22

Point	CALIBRATION RESULTS			
	Ideal	Autual	Error	%Error
ZERO	0.00	0.10	0.10	0.10
1	100.00	98.90	-1.10	-1.10
2	200.00	202.40	2.40	1.20
3	300.00	302.30	2.30	0.77
4	400.00	398.00	-2.00	-0.50
AVERAGE (%)				0.09



Calibrated By

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

Approved By

(Mr.Sarayuth Jittranont)
Assistant General Manager

CERTIFICATE OF CALIBRATION

Certificate No: WS-01062021

Page 1 of 2 pages

Measurement Item : Cup anemometer with data logger.

Manufacturer : Data logger: Novalynx.
: Cup anemometer: Novalynx.

Model/Type : Data logger: WS-25DL.
: Cup anemometer: WS-02F.

Serial Number : Data logger: A4481.
: Cup anemometer: -

ID No : Data logger: BKK_FSD141.
: Cup anemometer: -

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

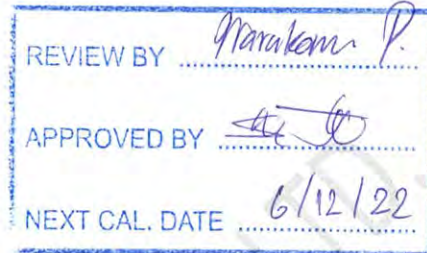
Test Conditions : Wind tunnel cross test section area 900 cm²
: Anemometer frontal area 100 cm²
: Diameter of mounting pipe - mm
: Blockage ratio of test object 0.111 [-]

Test Conditions : Air temperature 23.7 ±0.8 °C
: Air pressure 1010.3 ±0.4 hPa
: Relative air humidity 53.7 ±3.5 %RH

Calibration Procedure Calibration was carried out base on;
IEC 61400-12-1 ED.1: 2005-Power Performance Measurements of Electricity Producing Wind Turbines;
MEASNET Anemometer Calibration Procedure – Version 2: 2009;

Traceability This calibration documents the traceable to national standard, Which realize the unit of measurements according to the international system of units (SI) through National Institute of Metrology Thailand (NIMT).

Measurement Date : Jun 07, 2021.
Issued Date : Jun 07, 2021.



Calibrated by

- ☒ Mr. Sorawit Thachalad
☐ Miss Orathai Wiwatwittaya



Approved Signatory: _____



Mr. Parinya Booncharoen
Technical Support
and Calibration Manager

Continuation of Certificate of Calibration Number

Certificate No: WS-01062021

Page 2 of 2 Pages

Result of calibration: ☒ Without adjustment ☐ With adjustment

Calibration in the range of 1 – 16 m/s at a calibration interval of 1 m/s.

The results of calibration and associated measurement uncertainties are reported in the table below.

V _{STD} Reading m/s	V _{UUC} Reading m/s	Error (m/s)	Uncertainty (%)
2.065	2.0	-0.1	2.6
4.124	4.0	-0.1	1.2
5.99	6.0	0.0	1.01
8.00	8.0	0.0	0.74
9.99	10.1	0.1	0.60
11.96	12.2	0.2	0.67
14.02	14.4	0.4	0.45
16.03	16.6	0.6	0.36
15.01	15.3	0.3	2.8
12.99	13.3	0.3	0.41
10.99	11.2	0.2	0.53
9.01	9.3	0.3	1.2
7.05	7.0	0.0	0.77
5.121	5.0	-0.1	0.88
3.048	3.0	0.0	1.8
1.088	1.0	-0.1	5.3

UUC*: Unit Under Calibration

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

Appendix 1: Instrumentations

NO	Sensor	Manufacturer	Model/Type	Calibration Date	Certificate Report Number	Range
1	Pitot static	TESTO INC.	06352145	July 16, 2020	MW-0035-20	5 – 30 m/s
2	Precision Differential Pressure Meter	Zoglab	DPM2500	July 16, 2020	MW-0035-20	5 – 30 m/s
3	Air velocity transducer (hot wire)	TSI INC.	8455-12	July 20, 2020	MW-0036AA-20	0 - 5 m/s
4	Temperature	Zoglab	DSR-THP	March 30, 2021	CL-027-64	-30 - 70°C
5	Relative humidity	Zoglab	DSR-THP	March 30, 2021	RH-03032021	0 – 100 %RH
6	Atmospheric pressure	Zoglab	DSR-THP	March 30, 2021	BP-01032021	500 – 1100 hPa
7	Wind tunnel	ESSOM	MP330D	-	-	0 – 50 Hz

End of certificate of calibration



CERTIFICATE OF CALIBRATION

Certificate No.: WD-01062021

Page 1 of 2 pages

Measurement Item : Wind direction sensor with data logger.

Manufacturer : Data logger: Novalynx.
: Wind direction sensor: Novalynx.

Model/Type : Data logger: WS-25DL.
: Wind direction sensor: WS-02F.

Serial Number : Data logger: A4481.
: Wind direction sensor: -

ID No : Data logger: BKK_FS0141.
: Cup anemometer: -

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 $(23 \pm 3)^{\circ}\text{C}$, and relative humidity of $(40 \pm 10)\%$.

Measurement Method:

The wind direction sensor calibration according to comparison method with reference angle measurement electronic theodolite and line laser is used for axis control. The measurement were taken at 45° intervals in clockwise and counterclockwise directions.

Note: The UUC was warmed up for 1 hour prior to the calibration being performed

Traceability:

The measurement results are traceable to the international system of units (SI) through Certificate No.: CC563-07-0045, Certificate No.: KWS63/0044.

Measurement Date : Jun 07, 2021.

Issued Date : Jun 07, 2021.

Performed by

- ☒ Mr. Sorawit Thachalad
☐ Miss Orathai Wiwatwittaya



Approved Signatory:.....

Mr. Parinya Booncharoen.
Technical Support
and Calibration Manager

Continuation of Certificate of Calibration Number

Certificate No: WD-01062021

Pages 2 of 2 pages

Result of calibration: ☐ Without adjustment ☒ With adjustment.

Calibration in the range of 0 – 360 ° at a calibration interval of 45°.

The results of calibration and associated measurement uncertainties are reported in table below.

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

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

End of Certificate of Calibration





Lot No. 2223138-1

ANALYZER CALIBRATION DATA

Client : Global Power Synergy PCL. Location : Auxiliary Boiler 70Ton #1
Date : 29 Mar 22 Test Operator : Saksit P.

O₂ ANALYZER

Model : TELEDYNE API 200EH Serial No. : 774
Span (%) : 25

	Cylinder Value (%)	Initial Analyzers Calibration Response (%)	Final Analyzers Calibration Response (%)	Difference (Percent of Span)
Zero Gas	0.00	0.03	0.00	0.12
Low-Level Gas	8.05	8.08	8.05	0.12
Span Gas	16.06	16.09	16.06	0.12

NO_x ANALYZER

Model : TELEDYNE API 200EH Serial No. : 774
Span (ppm) : 100

	Cylinder Value (ppm)	Initial Analyzers Calibration Response (ppm)	Final Analyzers Calibration Response (ppm)	Difference (Percent of Span)
Zero Gas	0.00	0.04	0.00	0.04
Low-Level Gas	50.32	50.36	50.32	0.04
Span Gas	158.20	158.24	158.20	0.04

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	0.00	0.01
Low-Level Gas	50.27	50.28	50.27	0.01
Span Gas	161.60	161.61	161.60	0.01

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	-0.01	0.00	0.01
Low-Level Gas	49.99	49.98	49.99	0.01
Span Gas	157.50	157.49	157.50	0.01

Calibrated by

(Mr. Saksit Phalsanphisut)

Environmental Field Scientist (4)



Lot No. 2223138-1

SYSTEM CALIBRATION BIAS AND DRIFT DATA

Client : Global Power Synergy PCL. Location : Auxillary Boiler 70Ton #1
Date : 29 Mar 22 Test Operator : Saksit P.

O₂ ANALYZER

Cylinder Conc. (%) : 16.06 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	0.03	0.03	0.00	0.00	0.12	0.12
Upscale Gas	16.09	16.09	0.00	16.06	0.12	0.12

NO_x ANALYZER

Cylinder Conc. (ppm) : 158.20 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	0.04	0.04	0.00	0.00	0.04	0.04
Upscale Gas	158.24	158.24	0.00	158.20	0.04	0.04

SO₂ ANALYZER

Cylinder Conc. (ppm) : 161.60 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	0.00	0.01	0.01
Upscale Gas	161.61	161.61	0.00	161.60	0.01	0.01

CO ANALYZER

Cylinder Conc. (ppm) : 157.50 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	-0.01	-0.01	0.00	0.00	0.01	0.01
Upscale Gas	157.49	157.49	0.00	157.50	0.01	0.01

Calibrated by

(Mr. Saksit Phalsanphisut)

Environmental Field Scientist (4)

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

ALS Laboratory Group



EMISSION TEST RESULT

Run # 1

Location Auxiliary Boiler 70Ton #1

Test Operator Saksit P.

Finish Time 11:00

Serial No. 410

Serial No. 774

Serial No. 425

Client Global Power Synergy PCL.

Date 29 Mar 22

Start Time 10:40

SO₂ Analyzer Model TELEDYNE API 100EH

NO_x/O₂ Analyzer Model TELEDYNE API 200EH

CO/CO₂ Analyzer Model TELEDYNE API 300EM

Time (min)	O ₂ (%)	CO ₂ (%)	NO _x (ppm)	SO ₂ (ppm)	CO (ppm)	Remark
10:40	3.59	10.48	30.25	0.30	2.41	
10:41	3.59	10.50	30.25	0.29	2.41	
10:42	3.58	10.56	30.26	0.27	2.48	
10:43	3.63	10.55	30.37	0.29	2.16	
10:44	3.66	10.48	30.53	0.30	2.33	
10:45	3.65	10.56	30.63	0.31	2.40	
10:46	3.67	10.55	30.65	0.26	2.24	
10:47	3.68	10.53	30.67	0.27	2.01	
10:48	3.68	10.53	30.61	0.28	2.01	
10:49	3.68	10.51	30.56	0.30	2.01	
10:50	3.69	10.49	30.59	0.28	1.93	
10:51	3.71	10.47	30.72	0.28	2.17	
10:52	3.72	10.46	30.79	0.26	2.01	
10:53	3.73	10.52	30.87	0.27	2.01	
10:54	3.70	10.48	30.95	0.27	1.93	
10:55	3.70	10.60	30.89	0.28	2.08	
10:56	3.70	10.49	30.72	0.28	2.17	
10:57	3.72	10.56	30.76	0.26	2.08	
10:58	3.70	10.53	30.89	0.27	2.09	
10:59	3.67	10.54	30.85	0.27	2.24	
11:00	3.65	10.56	30.72	0.28	2.32	
Average	3.67	10.52	30.64	0.27	2.17	

(Mr. Saksit Phalsanphisut)

Environmental Field Scientist (4)



EMISSION TEST RESULT

Run # 2

Location Auxiliary Boiler 70Ton #1

Test Operator Saksit P.

Finish Time 11:21

Serial No. 410

Serial No. 774

Serial No. 425

Client Global Power Synergy PCL.

Date 29 Mar 22

Start Time 11:01

SO₂ Analyzer Model TELEDYNE API 100EH

NO_x/O₂ Analyzer Model TELEDYNE API 200EH

CO/CO₂ Analyzer Model TELEDYNE API 300EM

Time (min)	O ₂ (%)	CO ₂ (%)	NO _x (ppm)	SO ₂ (ppm)	CO (ppm)	Remark
11:01	3.64	10.55	30.51	0.28	2.32	
11:02	3.64	10.46	30.51	0.29	2.33	
11:03	3.65	10.54	30.61	0.28	2.32	
11:04	3.63	10.57	30.70	0.28	2.40	
11:05	3.64	10.57	30.74	0.30	2.32	
11:06	3.67	10.52	30.71	0.28	2.33	
11:07	3.68	10.51	30.56	0.28	2.33	
11:08	3.71	10.53	30.54	0.28	2.09	
11:09	3.71	10.48	30.60	0.26	2.09	
11:10	3.71	10.47	30.61	0.26	2.09	
11:11	3.68	10.56	30.57	0.29	2.16	
11:12	3.68	10.46	30.61	0.29	2.17	
11:13	3.71	10.40	30.73	0.29	2.01	
11:14	3.71	10.62	30.91	0.27	2.16	
11:15	3.69	10.46	30.81	0.28	2.25	
11:16	3.65	10.48	30.61	0.28	2.17	
11:17	3.63	10.53	30.39	0.25	2.25	
11:18	3.63	10.53	30.38	0.27	2.09	
11:19	3.67	10.51	30.47	0.26	1.93	
11:20	3.70	10.47	30.55	0.25	2.01	
11:21	3.70	10.54	30.59	0.25	2.00	
Average	3.67	10.51	30.60	0.27	2.18	

(Mr. Saksit Phalsanphisut)

Environmental Field Scientist (4)



EMISSION TEST RESULT

Client	Global Power Synergy PCL.	Run #	3
Date	29 Mar 22	Location	Auxiliary Boiler 70Ton #1
Start Time	11:22	Test Operator	Saksit P.
SO ₂ Analyzer Model	TELEDYNE API 100EH	Finish Time	11:42
NO _x /O ₂ Analyzer Model	TELEDYNE API 200EH	Serial No.	410
CO/CO ₂ Analyzer Model	TELEDYNE API 300EM	Serial No.	774
		Serial No.	425

Time (min)	O ₂ (%)	CO ₂ (%)	NO _x (ppm)	SO ₂ (ppm)	CO (ppm)	Remark
11:22	3.71	10.48	30.52	0.24	2.09	
11:23	3.70	10.58	30.43	0.25	2.08	
11:24	3.69	10.52	30.47	0.25	2.09	
11:25	3.70	10.51	30.57	0.26	2.01	
11:26	3.72	10.49	30.60	0.24	1.93	
11:27	3.74	10.44	30.73	0.26	1.93	
11:28	3.73	10.56	30.83	0.24	2.08	
11:29	3.74	10.50	30.94	0.25	1.77	
11:30	3.75	10.53	30.98	0.25	2.09	
11:31	3.98	10.32	30.93	0.23	1.85	
11:32	4.38	10.09	30.92	0.25	1.46	
11:33	4.66	9.81	31.11	0.23	1.14	
11:34	4.88	9.81	31.24	0.24	0.98	
11:35	4.98	9.74	31.30	0.25	0.98	
11:36	4.99	9.79	31.38	0.23	0.90	
11:37	5.02	9.81	31.36	0.25	0.98	
11:38	5.04	9.75	31.23	0.24	0.98	
11:39	5.03	9.71	31.21	0.22	0.98	
11:40	5.02	9.67	31.27	0.24	0.90	
11:41	5.01	9.71	31.39	0.25	0.98	
11:42	5.02	9.70	31.44	0.25	0.98	
Average	4.36	10.12	30.99	0.24	1.48	

(Mr. Saksit Phaisanphisut)

Environmental Field Scientist (4)



Lot No. 2223139-1

ANALYZER CALIBRATION DATA

Client : Global Power Synergy PCL. Location : Auxiliary Boiler 70Ton #2
Date : 30 Mar 22 Test Operator : Saksit P.

O₂ ANALYZER

Model : TELEDYNE API 200EH Serial No. : 774
Span (%) : 25

	Cylinder Value (%)	Initial Analyzers Calibration Response (%)	Final Analyzers Calibration Response (%)	Difference (Percent of Span)
Zero Gas	0.00	0.03	0.00	0.12
Low-Level Gas	8.05	8.08	8.05	0.12
Span Gas	16.06	16.09	16.06	0.12

NO_x ANALYZER

Model : TELEDYNE API 200EH Serial No. : 774
Span (ppm) : 100

	Cylinder Value (ppm)	Initial Analyzers Calibration Response (ppm)	Final Analyzers Calibration Response (ppm)	Difference (Percent of Span)
Zero Gas	0.00	0.04	0.00	0.04
Low-Level Gas	50.32	50.36	50.32	0.04
Span Gas	158.20	158.24	158.20	0.04

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	0.00	0.01
Low-Level Gas	50.27	50.28	50.27	0.01
Span Gas	161.60	161.61	161.60	0.01

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	-0.01	0.00	0.01
Low-Level Gas	49.99	49.98	49.99	0.01
Span Gas	157.50	157.49	157.50	0.01

Calibrated by

(Mr. Saksit Phalsanphisut)

Environmental Field Scientist (4)



Lot No. 2223139-1

SYSTEM CALIBRATION BIAS AND DRIFT DATA

Client : Global Power Synergy PCL. Location : Auxillary Boiler 70Ton #2
Date : 30 Mar 22 Test Operator : Saksit P.

O₂ ANALYZER

Cylinder Conc. (%) : 16.06 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	0.03	0.03	0.00	0.00	0.12	0.12
Upscale Gas	16.09	16.09	0.00	16.06	0.12	0.12

NO_x ANALYZER

Cylinder Conc. (ppm) : 158.20 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	0.04	0.04	0.00	0.00	0.04	0.04
Upscale Gas	158.24	158.24	0.00	158.20	0.04	0.04

SO₂ ANALYZER

Cylinder Conc. (ppm) : 161.60 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	0.00	0.01	0.01
Upscale Gas	161.61	161.61	0.00	161.60	0.01	0.01

CO ANALYZER

Cylinder Conc. (ppm) : 157.50 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	-0.01	-0.01	0.00	0.00	0.01	0.01
Upscale Gas	157.49	157.49	0.00	157.50	0.01	0.01

Calibrated by

(Mr. Saksit Phalsanphisut)

Environmental Field Scientist (4)

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

ALS Laboratory Group



EMISSION TEST RESULT

Run # 1

Location Auxiliary Boiler 70Ton #2

Test Operator Saksit P.

Finish Time 10:30

Serial No. 410

Serial No. 774

Serial No. 425

Client Global Power Synergy PCL.

Date 30 Mar 22

Start Time 10:10

SO₂ Analyzer Model TELEDYNE API 100EH

NO_x/O₂ Analyzer Model TELEDYNE API 200EH

CO/CO₂ Analyzer Model TELEDYNE API 300EM

Time (min)	O ₂ (%)	CO ₂ (%)	NO _x (ppm)	SO ₂ (ppm)	CO (ppm)	Remark
10:10	2.97	10.97	33.02	0.25	0.40	
10:11	2.95	10.94	33.00	0.25	0.48	
10:12	2.92	10.99	33.00	0.27	0.40	
10:13	2.93	10.95	32.98	0.23	0.40	
10:14	2.93	10.91	32.93	0.22	0.40	
10:15	2.96	10.99	32.90	0.26	0.40	
10:16	2.93	11.03	32.84	0.23	0.32	
10:17	2.92	10.97	32.81	0.23	0.40	
10:18	2.92	11.02	32.91	0.23	0.40	
10:19	2.92	10.97	32.96	0.23	0.40	
10:20	2.90	11.00	32.95	0.24	0.40	
10:21	2.88	10.93	32.88	0.22	0.40	
10:22	2.88	10.98	32.79	0.21	0.48	
10:23	2.88	11.04	32.77	0.23	0.40	
10:24	2.89	11.00	32.79	0.23	0.40	
10:25	2.90	11.02	32.83	0.23	0.40	
10:26	2.88	11.06	32.76	0.23	0.40	
10:27	2.87	11.09	32.58	0.20	0.48	
10:28	2.85	11.07	32.33	0.23	0.48	
10:29	2.86	11.08	32.15	0.21	0.64	
10:30	2.87	11.01	32.06	0.20	0.40	
Average	2.90	11.00	32.77	0.23	0.42	

(Mr. Saksit Phalsanphisut)

Environmental Field Scientist (4)



EMISSION TEST RESULT

Run # 2

Location Auxiliary Boiler 70Ton #2

Test Operator Saksit P.

Finish Time 10:51

Serial No. 410

Serial No. 774

Serial No. 425

Client Global Power Synergy PCL.

Date 30 Mar 22

Start Time 10:31

SO₂ Analyzer Model TELEDYNE API 100EH

NO_x/O₂ Analyzer Model TELEDYNE API 200EH

CO/CO₂ Analyzer Model TELEDYNE API 300EM

Time (min)	O ₂ (%)	CO ₂ (%)	NO _x (ppm)	SO ₂ (ppm)	CO (ppm)	Remark
10:31	2.87	10.89	32.01	0.19	0.40	
10:32	2.87	10.95	31.93	0.21	0.40	
10:33	2.84	11.09	31.88	0.18	0.40	
10:34	2.84	11.11	31.87	0.20	0.32	
10:35	2.88	10.97	31.93	0.21	0.32	
10:36	2.89	10.93	32.04	0.21	0.32	
10:37	2.88	10.98	32.09	0.22	0.40	
10:38	2.87	11.02	32.19	0.21	0.40	
10:39	2.85	10.99	32.30	0.21	0.32	
10:40	2.85	11.01	32.29	0.21	0.32	
10:41	2.88	10.92	32.20	0.22	0.32	
10:42	2.88	10.98	32.19	0.22	0.32	
10:43	2.87	11.02	32.27	0.21	0.32	
10:44	2.87	11.01	32.25	0.23	0.40	
10:45	2.89	10.97	32.27	0.21	0.40	
10:46	2.89	11.01	32.29	0.20	0.40	
10:47	2.90	11.04	32.37	0.22	0.32	
10:48	2.89	11.01	32.50	0.22	0.40	
10:49	2.89	11.06	32.56	0.21	0.48	
10:50	2.88	11.03	32.53	0.21	0.40	
10:51	2.86	10.98	32.43	0.21	0.40	
Average	2.87	11.00	32.21	0.21	0.37	

(Mr. Saksit Phalsanphisut)

Environmental Field Scientist (4)



EMISSION TEST RESULT

Client	Global Power Synergy PCL.	Run #	3
Date	30 Mar 22	Location	Auxiliary Boiler 70Ton #2
Start Time	10:52	Test Operator	Saksit P.
SO ₂ Analyzer Model	TELEDYNE API 100EH	Finish Time	11:12
NO _x /O ₂ Analyzer Model	TELEDYNE API 200EH	Serial No.	410
CO/CO ₂ Analyzer Model	TELEDYNE API 300EM	Serial No.	774
		Serial No.	425

Time (min)	O ₂ (%)	CO ₂ (%)	NO _x (ppm)	SO ₂ (ppm)	CO (ppm)	Remark
10:52	2.88	11.00	32.40	0.21	0.48	
10:53	2.85	11.05	32.49	0.23	0.40	
10:54	2.83	11.02	32.65	0.22	0.48	
10:55	2.84	11.05	32.74	0.20	0.40	
10:56	2.85	10.95	32.85	0.21	0.40	
10:57	2.86	11.01	32.82	0.23	0.40	
10:58	2.87	11.01	32.79	0.24	0.40	
10:59	2.85	11.03	32.79	0.21	0.40	
11:00	2.86	10.97	32.85	0.21	0.40	
11:01	2.88	11.03	32.91	0.24	0.40	
11:02	2.87	10.97	32.92	0.22	0.40	
11:03	2.87	11.06	32.89	0.20	0.40	
11:04	2.85	11.09	32.83	0.23	1.35	
11:05	2.88	11.01	32.77	0.21	1.51	
11:06	2.87	10.97	32.89	0.20	0.72	
11:07	2.84	11.01	33.01	0.21	0.48	
11:08	2.83	10.96	33.00	0.20	0.40	
11:09	2.84	11.04	33.01	0.20	0.40	
11:10	2.82	11.05	33.15	0.22	0.32	
11:11	2.81	11.02	33.33	0.20	0.32	
11:12	2.81	11.00	33.45	0.19	0.40	
Average	2.85	11.01	32.88	0.21	0.52	

(Mr. Saksit Phaisanphisut)

Environmental Field Scientist (4)



Lot No. 2223137-1

ANALYZER CALIBRATION DATA

Client : Global Power Synergy PCL. Location : Auxiliary Boiler 140Ton
Date : 31 Mar 22 Test Operator : Saksit P.

O₂ ANALYZER

Model : TELEDYNE API 200EH Serial No. : 774
Span (%) : 25

	Cylinder Value (%)	Initial Analyzers Calibration Response (%)	Final Analyzers Calibration Response (%)	Difference (Percent of Span)
Zero Gas	0.00	0.03	0.00	0.12
Low-Level Gas	8.05	8.08	8.05	0.12
Span Gas	16.06	16.09	16.06	0.12

NO_x ANALYZER

Model : TELEDYNE API 200EH Serial No. : 774
Span (ppm) : 100

	Cylinder Value (ppm)	Initial Analyzers Calibration Response (ppm)	Final Analyzers Calibration Response (ppm)	Difference (Percent of Span)
Zero Gas	0.00	0.04	0.00	0.04
Low-Level Gas	50.32	50.36	50.32	0.04
Span Gas	158.20	158.24	158.20	0.04

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	0.00	0.01
Low-Level Gas	50.27	50.28	50.27	0.01
Span Gas	161.60	161.61	161.60	0.01

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	-0.01	0.00	0.01
Low-Level Gas	49.99	49.98	49.99	0.01
Span Gas	157.50	157.49	157.50	0.01

Calibrated by

(Mr.Saksit Phalsanphisut)

Environmental Field Scientist (4)



Lot No. 2223137-1

SYSTEM CALIBRATION BIAS AND DRIFT DATA

Client : Global Power Synergy PCL. Location : Auxilliary Boiler 140Ton
Date : 31 Mar 22 Test Operator : Saksit P.

O₂ ANALYZER

Cylinder Conc. (%) : 16.06 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	0.03	0.03	0.00	0.00	0.12	0.12
Upscale Gas	16.09	16.09	0.00	16.06	0.12	0.12

NO_x ANALYZER

Cylinder Conc. (ppm) : 158.20 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	0.04	0.04	0.00	0.00	0.04	0.04
Upscale Gas	158.24	158.24	0.00	158.20	0.04	0.04

SO₂ ANALYZER

Cylinder Conc. (ppm) : 161.60 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	0.00	0.01	0.01
Upscale Gas	161.61	161.61	0.00	161.60	0.01	0.01

CO ANALYZER

Cylinder Conc. (ppm) : 157.50 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	-0.01	-0.01	0.00	0.00	0.01	0.01
Upscale Gas	157.49	157.49	0.00	157.50	0.01	0.01

Calibrated by

(Mr.Saksit Phalsanphitsut)

Environmental Field Scientist (4)

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

ALS Laboratory Group



EMISSION TEST RESULT

Run # 1

Client	Global Power Synergy PCL.
Date	31 Mar 22
Start Time	11:00
SO ₂ Analyzer Model	TELEDYNE API 100EH
NO _x /O ₂ Analyzer Model	TELEDYNE API 200EH
CO/CO ₂ Analyzer Model	TELEDYNE API 300EM

Location	Auxiliary Boiler 140Ton
Test Operator	Saksit P.
Finish Time	11:20
Serial No.	410
Serial No.	774
Serial No.	425

Time (min)	O ₂ (%)	CO ₂ (%)	NO _x (ppm)	SO ₂ (ppm)	CO (ppm)	Remark
11:00	9.45	7.19	30.27	0.22	0.52	
11:01	8.79	7.43	31.05	0.23	0.35	
11:02	8.55	7.49	32.06	0.24	0.35	
11:03	8.65	7.44	32.39	0.21	0.35	
11:04	8.85	7.35	32.40	0.21	0.35	
11:05	8.88	7.35	32.32	0.22	0.35	
11:06	8.91	7.34	32.21	0.21	0.43	
11:07	8.93	7.26	32.23	0.22	0.43	
11:08	8.96	7.32	32.09	0.22	0.43	
11:09	8.97	7.25	31.90	0.19	0.43	
11:10	8.95	7.28	31.76	0.20	0.35	
11:11	8.96	7.28	31.60	0.21	0.43	
11:12	8.92	7.23	31.59	0.21	0.43	
11:13	8.96	7.26	31.52	0.22	0.43	
11:14	8.96	7.24	31.47	0.19	0.35	
11:15	8.97	7.21	31.27	0.22	0.43	
11:16	8.96	7.28	31.25	0.21	0.43	
11:17	8.44	7.67	31.65	0.21	0.35	
11:18	8.41	7.49	32.09	0.19	0.35	
11:19	8.96	7.21	31.99	0.19	0.43	
11:20	8.93	7.42	31.29	0.19	0.60	
Average	8.87	7.33	31.73	0.21	0.41	

(Mr.Saksit Phalsanphisut)

Environmental Field Scientist (4)



EMISSION TEST RESULT

Run # 2

Client	Global Power Synergy PCL.
Date	31 Mar 22
Start Time	11:21
SO ₂ Analyzer Model	TELEDYNE API 100EH
NO _x /O ₂ Analyzer Model	TELEDYNE API 200EH
CO/CO ₂ Analyzer Model	TELEDYNE API 300EM

Location	Auxiliary Boiler 140Ton
Test Operator	Saksit P.
Finish Time	11:41
Serial No.	410
Serial No.	774
Serial No.	425

Time (min)	O ₂ (%)	CO ₂ (%)	NO _x (ppm)	SO ₂ (ppm)	CO (ppm)	Remark
11:21	7.97	7.79	31.10	0.21	0.43	
11:22	8.73	7.32	30.90	0.20	1.12	
11:23	8.68	7.50	30.70	0.19	1.20	
11:24	9.05	7.20	30.29	0.17	0.69	
11:25	9.13	7.25	30.20	0.22	0.61	
11:26	8.79	7.36	30.20	0.19	0.69	
11:27	8.71	7.35	30.51	0.17	0.61	
11:28	8.78	7.38	30.57	0.22	0.52	
11:29	8.84	7.31	30.60	0.20	0.52	
11:30	8.94	7.27	30.51	0.20	0.52	
11:31	8.97	7.31	30.35	0.21	0.52	
11:32	9.00	7.25	30.25	0.20	0.52	
11:33	8.94	7.27	30.28	0.18	0.61	
11:34	8.44	7.60	30.56	0.19	0.52	
11:35	8.60	7.40	30.71	0.19	0.52	
11:36	8.79	7.38	30.67	0.21	0.52	
11:37	8.90	7.30	30.48	0.19	0.52	
11:38	8.91	7.24	30.44	0.19	0.52	
11:39	8.95	7.26	30.47	0.20	0.52	
11:40	8.95	7.28	30.64	0.18	0.52	
11:41	8.96	7.29	30.79	0.18	0.61	
Average	8.81	7.35	30.53	0.19	0.61	

(Mr.Saksit Phalsanphisut)

Environmental Field Scientist (4)



EMISSION TEST RESULT

Client	Global Power Synergy PCL.	Run #	3
Date	31 Mar 22	Location	Auxiliary Boiler 140Ton
Start Time	11:42	Test Operator	Saksit P.
SO ₂ Analyzer Model	TELEDYNE API 100EH	Finish Time	12:02
NO _x /O ₂ Analyzer Model	TELEDYNE API 200EH	Serial No.	410
CO/CO ₂ Analyzer Model	TELEDYNE API 300EM	Serial No.	774
		Serial No.	425

Time (min)	O ₂ (%)	CO ₂ (%)	NO _x (ppm)	SO ₂ (ppm)	CO (ppm)	Remark
11:42	8.97	7.24	30.92	0.19	0.52	
11:43	8.92	7.30	30.98	0.16	0.52	
11:44	8.94	7.29	30.95	0.17	0.52	
11:45	8.82	7.36	31.03	0.18	0.52	
11:46	8.73	7.39	31.24	0.17	0.43	
11:47	8.72	7.47	31.67	0.17	0.43	
11:48	8.69	7.41	31.92	0.20	0.43	
11:49	8.65	7.45	32.04	0.16	0.35	
11:50	8.64	7.43	32.19	0.17	0.35	
11:51	8.68	7.36	32.22	0.17	0.35	
11:52	8.80	7.41	32.06	0.19	0.43	
11:53	8.87	7.32	31.83	0.17	0.43	
11:54	8.88	7.33	31.81	0.16	0.43	
11:55	8.87	7.40	31.92	0.19	0.43	
11:56	8.91	7.32	31.93	0.18	0.43	
11:57	8.90	7.33	31.96	0.19	0.35	
11:58	8.89	7.30	31.93	0.17	0.43	
11:59	8.91	7.29	31.83	0.16	0.43	
12:00	8.92	7.33	31.86	0.18	0.43	
12:01	9.12	7.21	31.75	0.18	0.43	
12:02	9.24	7.13	31.61	0.19	0.44	
Average	8.86	7.34	31.70	0.17	0.43	

(Mr.Saksit Phaisanphisut)

Environmental Field Scientist (4)

Lot No. 2223245-1

ANALYZER CALIBRATION DATA

Client : Global Power Synergy PCL. Location : Auxiliary Boiler 140Ton
Date : 31 Mar 22 Test Operator : Saksit P.

O₂ ANALYZER

Model : TELEDYNE API 200EH Serial No. : 774
Span (%) : 25

	Cylinder Value (%)	Initial Analyzers Calibration Response (%)	Final Analyzers Calibration Response (%)	Difference (Percent of Span)
Zero Gas	0.00	0.03	0.00	0.12
Low-Level Gas	8.05	8.08	8.05	0.12
Span Gas	16.06	16.09	16.06	0.12

NO_x ANALYZER

Model : TELEDYNE API 200EH Serial No. : 774
Span (ppm) : 100

	Cylinder Value (ppm)	Initial Analyzers Calibration Response (ppm)	Final Analyzers Calibration Response (ppm)	Difference (Percent of Span)
Zero Gas	0.00	0.04	0.00	0.04
Low-Level Gas	50.32	50.36	50.32	0.04
Span Gas	158.20	158.24	158.20	0.04

Calibrated by

(Mr. Saksit Phaisanphisut)

Environmental Field Scientist (4)

FORM NO.: F 06-104 REVISION NO.: - ISSUE DATE: 3/06/19

ALS Laboratory Group



Lot No. 2223245-1

SYSTEM CALIBRATION BIAS AND DRIFT DATA

Client : Global Power Synergy PCL. Location : Auxiliary Boiler 140Ton
Date : 31 Mar 22 Test Operator : Saksit P.

O₂ ANALYZER

Cylinder Conc. (%) : 16.06 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	0.03	0.03	0.00	0.00	0.12	0.12
Upscale Gas	16.09	16.09	0.00	16.06	0.12	0.12

NO_x ANALYZER

Cylinder Conc. (ppm) : 158.20 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	0.04	0.04	0.00	0.00	0.04	0.04
Upscale Gas	158.24	158.24	0.00	158.20	0.04	0.04

Calibrated by

(Mr. Saksit Phalsanphisut)

Environmental Field Scientist (4)

FORM NO.: F 06-104 REVISION NO.: - ISSUE DATE: 3/06/19

ALS Laboratory Group



CEMs Data

Client Name Global Power Synergy PCL
Plant Name CUP3

Date 31 Mar 22
Location Auxiliary Boiler 140Ton

Run No: 1

Time Base : 21 min

Run No: 2

Time Base : 21 min

Date	Time	SO2 ppm	NOx ppm	CO ppm	O2 Vol%	CO2 Vol%
31 Mar 22	11:05	-	30.70	-	8.90	-
31 Mar 22	11:06	-	30.60	-	8.98	-
31 Mar 22	11:07	-	30.90	-	8.93	-
31 Mar 22	11:08	-	30.70	-	9.05	-
31 Mar 22	11:09	-	30.70	-	8.99	-
31 Mar 22	11:10	-	29.90	-	8.98	-
31 Mar 22	11:11	-	29.40	-	8.99	-
31 Mar 22	11:12	-	29.30	-	8.93	-
31 Mar 22	11:13	-	29.20	-	9.03	-
31 Mar 22	11:14	-	29.90	-	8.95	-
31 Mar 22	11:15	-	29.70	-	9.03	-
31 Mar 22	11:16	-	30.20	-	8.97	-
31 Mar 22	11:17	-	30.20	-	8.48	-
31 Mar 22	11:18	-	30.60	-	8.29	-
31 Mar 22	11:19	-	32.10	-	9.13	-
31 Mar 22	11:20	-	30.70	-	9.39	-
31 Mar 22	11:21	-	29.30	-	7.21	-
31 Mar 22	11:22	-	28.70	-	8.95	-
31 Mar 22	11:23	-	29.50	-	8.76	-
31 Mar 22	11:24	-	28.60	-	9.28	-
31 Mar 22	11:25	-	29.30	-	9.38	-
Max		-	32.10	-	9.39	-
Avg		-	30.01	-	8.89	-

Date	Time	SO2 ppm	NOx ppm	CO ppm	O2 Vol%	CO2 Vol%
31 Mar 22	11:26	-	28.90	-	8.65	-
31 Mar 22	11:27	-	29.50	-	8.61	-
31 Mar 22	11:28	-	30.20	-	8.85	-
31 Mar 22	11:29	-	30.10	-	8.91	-
31 Mar 22	11:30	-	29.70	-	8.97	-
31 Mar 22	11:31	-	29.00	-	9.02	-
31 Mar 22	11:32	-	28.50	-	9.05	-
31 Mar 22	11:33	-	28.40	-	8.98	-
31 Mar 22	11:34	-	28.70	-	8.33	-
31 Mar 22	11:35	-	29.20	-	8.68	-
31 Mar 22	11:36	-	30.60	-	8.89	-
31 Mar 22	11:37	-	29.90	-	8.94	-
31 Mar 22	11:38	-	30.00	-	8.96	-
31 Mar 22	11:39	-	29.90	-	9.00	-
31 Mar 22	11:40	-	29.90	-	8.94	-
31 Mar 22	11:41	-	29.50	-	9.02	-
31 Mar 22	11:42	-	29.50	-	9.00	-
31 Mar 22	11:43	-	29.30	-	8.94	-
31 Mar 22	11:44	-	29.40	-	9.01	-
31 Mar 22	11:45	-	29.70	-	8.78	-
31 Mar 22	11:46	-	29.70	-	8.77	-
Max		-	30.60	-	9.05	-
Avg		-	29.50	-	8.87	-

Run No: 3

Time Base : 21 min

Run No: 4

Time Base : 21 min

Date	Time	SO2 ppm	NOx ppm	CO ppm	O2 Vol%	CO2 Vol%
31 Mar 22	11:47	-	30.60	-	8.77	-
31 Mar 22	11:48	-	31.00	-	8.67	-
31 Mar 22	11:49	-	30.90	-	8.72	-
31 Mar 22	11:50	-	30.70	-	8.75	-
31 Mar 22	11:51	-	30.20	-	8.66	-
31 Mar 22	11:52	-	30.50	-	8.89	-
31 Mar 22	11:53	-	30.60	-	8.93	-
31 Mar 22	11:54	-	30.50	-	8.87	-
31 Mar 22	11:55	-	30.70	-	8.92	-
31 Mar 22	11:56	-	31.40	-	8.97	-
31 Mar 22	11:57	-	31.60	-	8.88	-
31 Mar 22	11:58	-	31.50	-	8.96	-
31 Mar 22	11:59	-	31.70	-	8.95	-
31 Mar 22	12:00	-	31.20	-	8.92	-
31 Mar 22	12:01	-	30.60	-	9.22	-
31 Mar 22	12:02	-	30.70	-	9.26	-
31 Mar 22	12:03	-	30.00	-	9.25	-
31 Mar 22	12:04	-	30.00	-	8.32	-
31 Mar 22	12:05	-	30.00	-	8.66	-
31 Mar 22	12:06	-	31.80	-	8.84	-
31 Mar 22	12:07	-	31.20	-	8.89	-
Max		-	31.80	-	9.26	-
Avg		-	30.83	-	8.87	-

Date	Time	SO2 ppm	NOx ppm	CO ppm	O2 Vol%	CO2 Vol%
31 Mar 22	12:08	-	30.90	-	8.83	-
31 Mar 22	12:09	-	30.30	-	8.83	-
31 Mar 22	12:10	-	30.10	-	8.95	-
31 Mar 22	12:11	-	30.60	-	9.28	-
31 Mar 22	12:12	-	30.40	-	9.29	-
31 Mar 22	12:13	-	30.00	-	8.44	-
31 Mar 22	12:14	-	30.70	-	9.03	-
31 Mar 22	12:15	-	31.80	-	9.04	-
31 Mar 22	12:16	-	31.50	-	9.22	-
31 Mar 22	12:17	-	31.70	-	8.81	-
31 Mar 22	12:18	-	31.00	-	9.35	-
31 Mar 22	12:19	-	30.80	-	9.38	-
31 Mar 22	12:20	-	29.50	-	8.93	-
31 Mar 22	12:21	-	29.10	-	8.39	-
31 Mar 22	12:22	-	29.70	-	8.35	-
31 Mar 22	12:23	-	28.40	-	8.24	-
31 Mar 22	12:24	-	28.60	-	7.96	-
31 Mar 22	12:25	-	28.90	-	8.03	-
31 Mar 22	12:26	-	29.40	-	8.39	-
31 Mar 22	12:27	-	28.90	-	8.44	-
31 Mar 22	12:28	-	28.30	-	8.45	-
Max		-	31.80	-	9.38	-
Avg		-	30.03	-	8.74	-

Run No: 5

Time Base : 21 min

Run No: 6

Time Base : 21 min

Date	Time	SO2 ppm	NOx ppm	CO ppm	O2 Vol%	CO2 Vol%
31 Mar 22	12:29	-	27.90	-	8.42	-
31 Mar 22	12:30	-	27.60	-	8.43	-
31 Mar 22	12:31	-	27.90	-	8.41	-
31 Mar 22	12:32	-	28.10	-	8.82	-
31 Mar 22	12:33	-	28.40	-	8.71	-
31 Mar 22	12:34	-	28.50	-	8.78	-
31 Mar 22	12:35	-	28.80	-	8.05	-
31 Mar 22	12:36	-	29.10	-	8.66	-
31 Mar 22	12:37	-	30.20	-	8.89	-
31 Mar 22	12:38	-	28.90	-	8.07	-
31 Mar 22	12:39	-	28.10	-	8.33	-
31 Mar 22	12:40	-	28.90	-	8.65	-
31 Mar 22	12:41	-	28.10	-	8.68	-
31 Mar 22	12:42	-	27.90	-	8.70	-
31 Mar 22	12:43	-	28.10	-	8.69	-
31 Mar 22	12:44	-	28.60	-	8.65	-
31 Mar 22	12:45	-	28.80	-	8.74	-
31 Mar 22	12:46	-	29.20	-	8.56	-
31 Mar 22	12:47	-	29.30	-	7.77	-
31 Mar 22	12:48	-	29.80	-	8.76	-
31 Mar 22	12:49	-	30.70	-	8.83	-
Max		-	30.70	-	8.89	-
Avg		-	28.71	-	8.55	-

Date	Time	SO2 ppm	NOx ppm	CO ppm	O2 Vol%	CO2 Vol%
31 Mar 22	12:50	-	29.50	-	8.83	-
31 Mar 22	12:51	-	29.10	-	7.77	-
31 Mar 22	12:52	-	28.80	-	8.11	-
31 Mar 22	12:53	-	29.90	-	8.84	-
31 Mar 22	12:54	-	29.60	-	8.46	-
31 Mar 22	12:55	-	28.90	-	8.73	-
31 Mar 22	12:56	-	29.40	-	8.75	-
31 Mar 22	12:57	-	29.40	-	8.69	-
31 Mar 22	12:58	-	29.20	-	8.63	-
31 Mar 22	12:59	-	28.60	-	8.50	-
31 Mar 22	13:00	-	28.20	-	8.45	-
31 Mar 22	13:01	-	28.30	-	8.51	-
31 Mar 22	13:02	-	28.50	-	8.46	-
31 Mar 22	13:03	-	28.70	-	8.50	-
31 Mar 22	13:04	-	29.00	-	8.74	-
31 Mar 22	13:05	-	29.30	-	8.80	-
31 Mar 22	13:06	-	29.30	-	8.70	-
31 Mar 22	13:07	-	29.50	-	8.83	-
31 Mar 22	13:08	-	29.80	-	8.42	-
31 Mar 22	13:09	-	29.70	-	8.34	-
31 Mar 22	13:10	-	29.80	-	8.69	-
Max		-	29.90	-	8.84	-
Avg		-	29.17	-	8.56	-



CEMs Data

Client Name Global Power Synergy PCL
Plant Name CUP3

Date 31 Mar 22
Location Auxiliary Boiler 140Ton

Run No: 7

Time Base : 21 min

Run No: 8

Time Base : 21 min

Date	Time	SO2 ppm	NOx ppm	CO ppm	O2 Vol%	CO2 Vol%
31 Mar 22	13:11	-	29.50	-	8.76	-
31 Mar 22	13:12	-	28.80	-	8.62	-
31 Mar 22	13:13	-	28.70	-	8.77	-
31 Mar 22	13:14	-	28.90	-	8.71	-
31 Mar 22	13:15	-	29.10	-	8.79	-
31 Mar 22	13:16	-	29.30	-	8.78	-
31 Mar 22	13:17	-	29.10	-	8.72	-
31 Mar 22	13:18	-	29.10	-	8.78	-
31 Mar 22	13:19	-	28.90	-	8.67	-
31 Mar 22	13:20	-	28.80	-	8.60	-
31 Mar 22	13:21	-	29.10	-	8.53	-
31 Mar 22	13:22	-	29.50	-	8.46	-
31 Mar 22	13:23	-	30.10	-	8.52	-
31 Mar 22	13:24	-	30.30	-	8.63	-
31 Mar 22	13:25	-	30.10	-	8.68	-
31 Mar 22	13:26	-	30.00	-	8.76	-
31 Mar 22	13:27	-	30.20	-	8.71	-
31 Mar 22	13:28	-	30.10	-	8.73	-
31 Mar 22	13:29	-	30.00	-	8.75	-
31 Mar 22	13:30	-	29.80	-	8.71	-
31 Mar 22	13:31	-	29.50	-	8.80	-
Max		-	30.30	-	8.80	-
Avg		-	29.47	-	8.69	-

Date	Time	SO2 ppm	NOx ppm	CO ppm	O2 Vol%	CO2 Vol%
31 Mar 22	13:32	-	29.20	-	8.72	-
31 Mar 22	13:33	-	29.10	-	8.69	-
31 Mar 22	13:34	-	29.40	-	8.77	-
31 Mar 22	13:35	-	29.80	-	8.68	-
31 Mar 22	13:36	-	29.90	-	8.76	-
31 Mar 22	13:37	-	29.70	-	8.76	-
31 Mar 22	13:38	-	29.10	-	8.71	-
31 Mar 22	13:39	-	28.60	-	8.74	-
31 Mar 22	13:40	-	28.60	-	8.70	-
31 Mar 22	13:41	-	28.70	-	8.72	-
31 Mar 22	13:42	-	28.60	-	8.60	-
31 Mar 22	13:43	-	29.20	-	8.48	-
31 Mar 22	13:44	-	29.30	-	8.54	-
31 Mar 22	13:45	-	29.80	-	8.57	-
31 Mar 22	13:46	-	30.00	-	8.68	-
31 Mar 22	13:47	-	29.60	-	8.80	-
31 Mar 22	13:48	-	29.80	-	8.72	-
31 Mar 22	13:49	-	29.80	-	8.88	-
31 Mar 22	13:50	-	29.60	-	9.09	-
31 Mar 22	13:51	-	28.80	-	9.15	-
31 Mar 22	13:52	-	28.20	-	8.32	-
Max		-	30.00	-	9.15	-
Avg		-	29.28	-	8.72	-

Run No: 9

Time Base : 21 min

Run No: 10

Time Base : 21 min

Date	Time	SO2 ppm	NOx ppm	CO ppm	O2 Vol%	CO2 Vol%
31 Mar 22	13:53	-	28.60	-	8.66	-
31 Mar 22	13:54	-	30.00	-	9.02	-
31 Mar 22	13:55	-	31.90	-	9.34	-
31 Mar 22	13:56	-	31.90	-	9.01	-
31 Mar 22	13:57	-	31.30	-	8.84	-
31 Mar 22	13:58	-	31.60	-	8.67	-
31 Mar 22	13:59	-	31.40	-	8.53	-
31 Mar 22	14:00	-	31.70	-	8.71	-
31 Mar 22	14:01	-	32.30	-	9.02	-
31 Mar 22	14:02	-	32.40	-	8.99	-
31 Mar 22	14:03	-	32.00	-	9.12	-
31 Mar 22	14:04	-	32.30	-	8.98	-
31 Mar 22	14:05	-	32.30	-	8.98	-
31 Mar 22	14:06	-	32.60	-	8.87	-
31 Mar 22	14:07	-	33.00	-	8.69	-
31 Mar 22	14:08	-	32.80	-	8.96	-
31 Mar 22	14:09	-	32.70	-	8.32	-
31 Mar 22	14:10	-	32.20	-	9.06	-
31 Mar 22	14:11	-	32.30	-	9.18	-
31 Mar 22	14:12	-	31.30	-	8.85	-
31 Mar 22	14:13	-	31.50	-	9.05	-
Max		-	33.00	-	9.34	-
Avg		-	31.81	-	8.90	-

Date	Time	SO2 ppm	NOx ppm	CO ppm	O2 Vol%	CO2 Vol%
31 Mar 22	14:14	-	32.30	-	9.07	-
31 Mar 22	14:15	-	32.40	-	9.01	-
31 Mar 22	14:16	-	32.20	-	8.73	-
31 Mar 22	14:17	-	31.90	-	8.77	-
31 Mar 22	14:18	-	31.70	-	8.77	-
31 Mar 22	14:19	-	31.70	-	8.71	-
31 Mar 22	14:20	-	31.80	-	8.76	-
31 Mar 22	14:21	-	32.20	-	8.77	-
31 Mar 22	14:22	-	32.20	-	8.67	-
31 Mar 22	14:23	-	32.40	-	8.77	-
31 Mar 22	14:24	-	32.70	-	8.70	-
31 Mar 22	14:25	-	32.60	-	8.67	-
31 Mar 22	14:26	-	32.60	-	8.76	-
31 Mar 22	14:27	-	32.60	-	8.79	-
31 Mar 22	14:28	-	31.90	-	9.02	-
31 Mar 22	14:29	-	30.90	-	9.10	-
31 Mar 22	14:30	-	30.60	-	9.07	-
31 Mar 22	14:31	-	30.80	-	8.09	-
31 Mar 22	14:32	-	31.10	-	8.88	-
31 Mar 22	14:33	-	32.80	-	8.92	-
31 Mar 22	14:34	-	32.00	-	8.89	-
Max		-	32.80	-	9.10	-
Avg		-	31.97	-	8.81	-

Run No: 11

Time Base : 21 min

Run No: 12

Time Base : 21 min

Date	Time	SO2 ppm	NOx ppm	CO ppm	O2 Vol%	CO2 Vol%
31 Mar 22	14:35	-	31.90	-	9.00	-
31 Mar 22	14:36	-	32.00	-	8.87	-
31 Mar 22	14:37	-	31.50	-	8.67	-
31 Mar 22	14:38	-	31.30	-	8.68	-
31 Mar 22	14:39	-	31.10	-	8.60	-
31 Mar 22	14:40	-	30.80	-	8.59	-
31 Mar 22	14:41	-	31.30	-	8.64	-
31 Mar 22	14:42	-	31.60	-	8.53	-
31 Mar 22	14:43	-	31.80	-	8.64	-
31 Mar 22	14:44	-	32.20	-	8.70	-
31 Mar 22	14:45	-	32.40	-	8.78	-
31 Mar 22	14:46	-	32.50	-	8.88	-
31 Mar 22	14:47	-	32.40	-	8.88	-
31 Mar 22	14:48	-	31.90	-	8.80	-
31 Mar 22	14:49	-	31.40	-	8.84	-
31 Mar 22	14:50	-	31.00	-	8.89	-
31 Mar 22	14:51	-	30.80	-	8.78	-
31 Mar 22	14:52	-	30.70	-	8.93	-
31 Mar 22	14:53	-	31.30	-	8.82	-
31 Mar 22	14:54	-	31.40	-	8.85	-
31 Mar 22	14:55	-	31.90	-	8.86	-
Max		-	32.50	-	9.00	-
Avg		-	31.58	-	8.77	-

Date	Time	SO2 ppm	NOx ppm	CO ppm	O2 Vol%	CO2 Vol%
31 Mar 22	14:56	-	31.90	-	8.82	-
31 Mar 22	14:57	-	31.90	-	8.91	-
31 Mar 22	14:58	-	31.90	-	8.81	-
31 Mar 22	14:59	-	31.40	-	8.85	-
31 Mar 22	15:00	-	31.10	-	8.71	-
31 Mar 22	15:01	-	30.30	-	8.57	-
31 Mar 22	15:02	-	30.60	-	8.41	-
31 Mar 22	15:03	-	31.40	-	8.39	-
31 Mar 22	15:04	-	31.90	-	8.65	-
31 Mar 22	15:05	-	32.20	-	8.81	-
31 Mar 22	15:06	-	31.60	-	8.79	-
31 Mar 22	15:07	-	31.60	-	8.89	-
31 Mar 22	15:08	-	31.70	-	8.82	-
31 Mar 22	15:09	-	31.40	-	8.90	-
31 Mar 22	15:10	-	31.00	-	8.84	-
31 Mar 22	15:11	-	30.40	-	8.83	-
31 Mar 22	15:12	-	30.10	-	8.80	-
31 Mar 22	15:13	-	30.40	-	8.86	-
31 Mar 22	15:14	-	30.70	-	8.83	-
31 Mar 22	15:15	-	30.90	-	8.77	-
31 Mar 22	15:16	-	31.30	-	8.88	-
Max		-	32.20	-	8.91	-
Avg		-	31.22	-	8.77	-



Reference Method Data

Client Name Global Power Synergy PCL
Plant Name CUP3

Date 31 Mar 22
Location Auxiliary Boiler 140Ton

Run No: 1

Time Base : 21 min

Run No: 2

Time Base : 21 min

Date	Time	SO2 ppm	NOx ppm	CO ppm	O2 Vol%	CO2 Vol%
31 Mar 22	11:05	-	32.32	-	8.88	-
31 Mar 22	11:06	-	32.21	-	8.91	-
31 Mar 22	11:07	-	32.23	-	8.93	-
31 Mar 22	11:08	-	32.09	-	8.96	-
31 Mar 22	11:09	-	31.90	-	8.97	-
31 Mar 22	11:10	-	31.76	-	8.95	-
31 Mar 22	11:11	-	31.60	-	8.96	-
31 Mar 22	11:12	-	31.59	-	8.92	-
31 Mar 22	11:13	-	31.52	-	8.96	-
31 Mar 22	11:14	-	31.47	-	8.96	-
31 Mar 22	11:15	-	31.27	-	8.97	-
31 Mar 22	11:16	-	31.25	-	8.96	-
31 Mar 22	11:17	-	31.65	-	8.44	-
31 Mar 22	11:18	-	32.09	-	8.41	-
31 Mar 22	11:19	-	31.99	-	8.96	-
31 Mar 22	11:20	-	31.29	-	8.93	-
31 Mar 22	11:21	-	31.10	-	7.97	-
31 Mar 22	11:22	-	30.90	-	8.73	-
31 Mar 22	11:23	-	30.70	-	8.68	-
31 Mar 22	11:24	-	30.29	-	9.05	-
31 Mar 22	11:25	-	30.20	-	9.13	-
Max		-	32.32	-	9.13	-
Avg		-	31.50	-	8.84	-

Date	Time	SO2 ppm	NOx ppm	CO ppm	O2 Vol%	CO2 Vol%
31 Mar 22	11:26	-	30.20	-	8.79	-
31 Mar 22	11:27	-	30.51	-	8.71	-
31 Mar 22	11:28	-	30.57	-	8.78	-
31 Mar 22	11:29	-	30.60	-	8.84	-
31 Mar 22	11:30	-	30.51	-	8.94	-
31 Mar 22	11:31	-	30.35	-	8.97	-
31 Mar 22	11:32	-	30.25	-	9.00	-
31 Mar 22	11:33	-	30.28	-	8.94	-
31 Mar 22	11:34	-	30.56	-	8.44	-
31 Mar 22	11:35	-	30.71	-	8.60	-
31 Mar 22	11:36	-	30.67	-	8.79	-
31 Mar 22	11:37	-	30.48	-	8.90	-
31 Mar 22	11:38	-	30.44	-	8.91	-
31 Mar 22	11:39	-	30.47	-	8.95	-
31 Mar 22	11:40	-	30.64	-	8.95	-
31 Mar 22	11:41	-	30.79	-	8.96	-
31 Mar 22	11:42	-	30.92	-	8.97	-
31 Mar 22	11:43	-	30.98	-	8.92	-
31 Mar 22	11:44	-	30.95	-	8.94	-
31 Mar 22	11:45	-	31.03	-	8.82	-
31 Mar 22	11:46	-	31.24	-	8.73	-
Max		-	31.24	-	9.00	-
Avg		-	30.63	-	8.85	-

Run No: 3

Time Base : 21 min

Run No: 4

Time Base : 21 min

Date	Time	SO2 ppm	NOx ppm	CO ppm	O2 Vol%	CO2 Vol%
31 Mar 22	11:47	-	31.67	-	8.72	-
31 Mar 22	11:48	-	31.92	-	8.69	-
31 Mar 22	11:49	-	32.04	-	8.65	-
31 Mar 22	11:50	-	32.19	-	8.64	-
31 Mar 22	11:51	-	32.22	-	8.68	-
31 Mar 22	11:52	-	32.06	-	8.80	-
31 Mar 22	11:53	-	31.83	-	8.87	-
31 Mar 22	11:54	-	31.81	-	8.88	-
31 Mar 22	11:55	-	31.92	-	8.87	-
31 Mar 22	11:56	-	31.93	-	8.91	-
31 Mar 22	11:57	-	31.96	-	8.90	-
31 Mar 22	11:58	-	31.93	-	8.89	-
31 Mar 22	11:59	-	31.83	-	8.91	-
31 Mar 22	12:00	-	31.86	-	8.92	-
31 Mar 22	12:01	-	31.75	-	9.12	-
31 Mar 22	12:02	-	31.61	-	9.24	-
31 Mar 22	12:03	-	31.28	-	9.12	-
31 Mar 22	12:04	-	31.43	-	8.51	-
31 Mar 22	12:05	-	31.76	-	8.62	-
31 Mar 22	12:06	-	31.97	-	8.74	-
31 Mar 22	12:07	-	31.96	-	8.81	-
Max		-	32.22	-	9.24	-
Avg		-	31.85	-	8.83	-

Date	Time	SO2 ppm	NOx ppm	CO ppm	O2 Vol%	CO2 Vol%
31 Mar 22	12:08	-	31.99	-	8.82	-
31 Mar 22	12:09	-	32.06	-	8.81	-
31 Mar 22	12:10	-	32.03	-	8.93	-
31 Mar 22	12:11	-	31.73	-	9.21	-
31 Mar 22	12:12	-	31.55	-	9.04	-
31 Mar 22	12:13	-	31.71	-	8.70	-
31 Mar 22	12:14	-	31.95	-	8.93	-
31 Mar 22	12:15	-	32.06	-	9.02	-
31 Mar 22	12:16	-	31.88	-	9.12	-
31 Mar 22	12:17	-	31.70	-	8.92	-
31 Mar 22	12:18	-	31.43	-	9.17	-
31 Mar 22	12:19	-	31.18	-	9.30	-
31 Mar 22	12:20	-	31.08	-	8.93	-
31 Mar 22	12:21	-	30.87	-	8.46	-
31 Mar 22	12:22	-	30.20	-	8.33	-
31 Mar 22	12:23	-	29.89	-	8.24	-
31 Mar 22	12:24	-	29.84	-	7.92	-
31 Mar 22	12:25	-	29.90	-	8.06	-
31 Mar 22	12:26	-	29.95	-	8.31	-
31 Mar 22	12:27	-	29.78	-	8.37	-
31 Mar 22	12:28	-	29.70	-	8.42	-
Max		-	32.06	-	9.30	-
Avg		-	31.07	-	8.71	-

Run No: 5

Time Base : 21 min

Run No: 6

Time Base : 21 min

Date	Time	SO2 ppm	NOx ppm	CO ppm	O2 Vol%	CO2 Vol%
31 Mar 22	12:29	-	29.62	-	8.39	-
31 Mar 22	12:30	-	29.56	-	8.39	-
31 Mar 22	12:31	-	29.56	-	8.43	-
31 Mar 22	12:32	-	29.47	-	8.67	-
31 Mar 22	12:33	-	29.45	-	8.71	-
31 Mar 22	12:34	-	29.51	-	8.70	-
31 Mar 22	12:35	-	29.73	-	8.20	-
31 Mar 22	12:36	-	29.77	-	8.54	-
31 Mar 22	12:37	-	29.56	-	8.73	-
31 Mar 22	12:38	-	29.43	-	8.21	-
31 Mar 22	12:39	-	29.64	-	8.31	-
31 Mar 22	12:40	-	29.68	-	8.53	-
31 Mar 22	12:41	-	29.56	-	8.64	-
31 Mar 22	12:42	-	29.54	-	8.65	-
31 Mar 22	12:43	-	29.55	-	8.67	-
31 Mar 22	12:44	-	29.62	-	8.64	-
31 Mar 22	12:45	-	29.72	-	8.65	-
31 Mar 22	12:46	-	29.82	-	8.47	-
31 Mar 22	12:47	-	30.19	-	8.04	-
31 Mar 22	12:48	-	30.31	-	8.54	-
31 Mar 22	12:49	-	30.16	-	8.73	-
Max		-	30.31	-	8.73	-
Avg		-	29.69	-	8.52	-

Date	Time	SO2 ppm	NOx ppm	CO ppm	O2 Vol%	CO2 Vol%
31 Mar 22	12:50	-	30.02	-	8.64	-
31 Mar 22	12:51	-	30.33	-	8.00	-
31 Mar 22	12:52	-	30.66	-	8.10	-
31 Mar 22	12:53	-	30.62	-	8.57	-
31 Mar 22	12:54	-	30.33	-	8.58	-
31 Mar 22	12:55	-	30.15	-	8.65	-
31 Mar 22	12:56	-	30.16	-	8.68	-
31 Mar 22	12:57	-	30.26	-	8.68	-
31 Mar 22	12:58	-	30.26	-	8.58	-
31 Mar 22	12:59	-	30.20	-	8.49	-
31 Mar 22	13:00	-	30.13	-	8.46	-
31 Mar 22	13:01	-	30.12	-	8.45	-
31 Mar 22	13:02	-	30.13	-	8.44	-
31 Mar 22	13:03	-	30.16	-	8.49	-
31 Mar 22	13:04	-	30.06	-	8.63	-
31 Mar 22	13:05	-	30.02	-	8.73	-
31 Mar 22	13:06	-	30.05	-	8.72	-
31 Mar 22	13:07	-	30.06	-	8.75	-
31 Mar 22	13:08	-	30.25	-	8.44	-
31 Mar 22	13:09	-	30.38	-	8.39	-
31 Mar 22	13:10	-	30.49	-	8.58	-
Max		-	30.66	-	8.75	-
Avg		-	30.23	-	8.53	-



Reference Method Data

Client Name Global Power Synergy PCL
Plant Name CUP3

Date 31 Mar 22
Location Auxiliary Boiler 140Ton

Run No: 7

Time Base : 21 min

Run No: 8

Time Base : 21 min

Date	Time	SO2 ppm	NOx ppm	CO ppm	O2 Vol%	CO2 Vol%
31 Mar 22	13:11	-	30.32	-	8.67	-
31 Mar 22	13:12	-	30.14	-	8.63	-
31 Mar 22	13:13	-	30.07	-	8.70	-
31 Mar 22	13:14	-	30.10	-	8.70	-
31 Mar 22	13:15	-	30.11	-	8.72	-
31 Mar 22	13:16	-	30.27	-	8.74	-
31 Mar 22	13:17	-	30.59	-	8.72	-
31 Mar 22	13:18	-	30.77	-	8.71	-
31 Mar 22	13:19	-	30.82	-	8.67	-
31 Mar 22	13:20	-	30.89	-	8.56	-
31 Mar 22	13:21	-	30.93	-	8.50	-
31 Mar 22	13:22	-	31.10	-	8.47	-
31 Mar 22	13:23	-	31.07	-	8.47	-
31 Mar 22	13:24	-	30.87	-	8.59	-
31 Mar 22	13:25	-	30.66	-	8.65	-
31 Mar 22	13:26	-	30.53	-	8.68	-
31 Mar 22	13:27	-	30.48	-	8.70	-
31 Mar 22	13:28	-	30.57	-	8.66	-
31 Mar 22	13:29	-	30.72	-	8.70	-
31 Mar 22	13:30	-	30.76	-	8.69	-
31 Mar 22	13:31	-	30.66	-	8.72	-
Max		-	31.10	-	8.74	-
Avg		-	30.59	-	8.65	-

Date	Time	SO2 ppm	NOx ppm	CO ppm	O2 Vol%	CO2 Vol%
31 Mar 22	13:32	-	30.57	-	8.71	-
31 Mar 22	13:33	-	30.54	-	8.69	-
31 Mar 22	13:34	-	30.54	-	8.70	-
31 Mar 22	13:35	-	30.55	-	8.69	-
31 Mar 22	13:36	-	30.52	-	8.70	-
31 Mar 22	13:37	-	30.45	-	8.71	-
31 Mar 22	13:38	-	30.53	-	8.70	-
31 Mar 22	13:39	-	30.60	-	8.69	-
31 Mar 22	13:40	-	30.48	-	8.69	-
31 Mar 22	13:41	-	30.41	-	8.66	-
31 Mar 22	13:42	-	30.38	-	8.57	-
31 Mar 22	13:43	-	30.43	-	8.50	-
31 Mar 22	13:44	-	30.50	-	8.49	-
31 Mar 22	13:45	-	30.39	-	8.56	-
31 Mar 22	13:46	-	30.32	-	8.65	-
31 Mar 22	13:47	-	30.19	-	8.71	-
31 Mar 22	13:48	-	30.20	-	8.78	-
31 Mar 22	13:49	-	30.09	-	8.86	-
31 Mar 22	13:50	-	29.86	-	9.01	-
31 Mar 22	13:51	-	29.77	-	9.02	-
31 Mar 22	13:52	-	30.14	-	8.52	-
Max		-	30.60	-	9.02	-
Avg		-	30.36	-	8.70	-

Run No: 9

Time Base : 21 min

Run No: 10

Time Base : 21 min

Date	Time	SO2 ppm	NOx ppm	CO ppm	O2 Vol%	CO2 Vol%
31 Mar 22	13:53	-	30.90	-	8.58	-
31 Mar 22	13:54	-	32.15	-	8.92	-
31 Mar 22	13:55	-	32.56	-	9.15	-
31 Mar 22	13:56	-	32.72	-	9.02	-
31 Mar 22	13:57	-	33.04	-	8.84	-
31 Mar 22	13:58	-	33.29	-	8.67	-
31 Mar 22	13:59	-	33.48	-	8.56	-
31 Mar 22	14:00	-	33.55	-	8.67	-
31 Mar 22	14:01	-	33.43	-	8.93	-
31 Mar 22	14:02	-	33.22	-	8.97	-
31 Mar 22	14:03	-	33.01	-	9.01	-
31 Mar 22	14:04	-	32.98	-	9.00	-
31 Mar 22	14:05	-	33.06	-	8.92	-
31 Mar 22	14:06	-	33.16	-	8.83	-
31 Mar 22	14:07	-	33.32	-	8.75	-
31 Mar 22	14:08	-	33.33	-	8.70	-
31 Mar 22	14:09	-	33.43	-	8.55	-
31 Mar 22	14:10	-	33.30	-	8.95	-
31 Mar 22	14:11	-	32.96	-	9.02	-
31 Mar 22	14:12	-	32.92	-	8.93	-
31 Mar 22	14:13	-	33.10	-	9.03	-
Max		-	33.55	-	9.15	-
Avg		-	32.99	-	8.86	-

Date	Time	SO2 ppm	NOx ppm	CO ppm	O2 Vol%	CO2 Vol%
31 Mar 22	14:14	-	33.12	-	9.03	-
31 Mar 22	14:15	-	33.09	-	8.95	-
31 Mar 22	14:16	-	33.19	-	8.78	-
31 Mar 22	14:17	-	33.48	-	8.73	-
31 Mar 22	14:18	-	33.53	-	8.72	-
31 Mar 22	14:19	-	33.50	-	8.69	-
31 Mar 22	14:20	-	33.46	-	8.68	-
31 Mar 22	14:21	-	33.40	-	8.72	-
31 Mar 22	14:22	-	33.40	-	8.68	-
31 Mar 22	14:23	-	33.29	-	8.69	-
31 Mar 22	14:24	-	33.13	-	8.68	-
31 Mar 22	14:25	-	33.05	-	8.67	-
31 Mar 22	14:26	-	33.08	-	8.69	-
31 Mar 22	14:27	-	33.04	-	8.78	-
31 Mar 22	14:28	-	32.72	-	8.97	-
31 Mar 22	14:29	-	32.43	-	9.01	-
31 Mar 22	14:30	-	32.30	-	8.93	-
31 Mar 22	14:31	-	32.61	-	8.37	-
31 Mar 22	14:32	-	32.85	-	8.68	-
31 Mar 22	14:33	-	32.85	-	8.86	-
31 Mar 22	14:34	-	32.64	-	8.88	-
Max		-	33.53	-	9.03	-
Avg		-	33.06	-	8.77	-

Run No: 11

Time Base : 21 min

Run No: 12

Time Base : 21 min

Date	Time	SO2 ppm	NOx ppm	CO ppm	O2 Vol%	CO2 Vol%
31 Mar 22	14:35	-	32.42	-	8.90	-
31 Mar 22	14:36	-	32.34	-	8.83	-
31 Mar 22	14:37	-	32.43	-	8.68	-
31 Mar 22	14:38	-	32.53	-	8.64	-
31 Mar 22	14:39	-	32.71	-	8.61	-
31 Mar 22	14:40	-	32.89	-	8.57	-
31 Mar 22	14:41	-	32.90	-	8.58	-
31 Mar 22	14:42	-	32.93	-	8.56	-
31 Mar 22	14:43	-	32.89	-	8.58	-
31 Mar 22	14:44	-	32.87	-	8.68	-
31 Mar 22	14:45	-	32.86	-	8.76	-
31 Mar 22	14:46	-	32.70	-	8.81	-
31 Mar 22	14:47	-	32.56	-	8.84	-
31 Mar 22	14:48	-	32.48	-	8.82	-
31 Mar 22	14:49	-	32.54	-	8.81	-
31 Mar 22	14:50	-	32.51	-	8.84	-
31 Mar 22	14:51	-	32.59	-	8.80	-
31 Mar 22	14:52	-	32.56	-	8.86	-
31 Mar 22	14:53	-	32.62	-	8.84	-
31 Mar 22	14:54	-	32.59	-	8.81	-
31 Mar 22	14:55	-	32.54	-	8.84	-
Max		-	32.93	-	8.90	-
Avg		-	32.64	-	8.75	-

Date	Time	SO2 ppm	NOx ppm	CO ppm	O2 Vol%	CO2 Vol%
31 Mar 22	14:56	-	32.42	-	8.82	-
31 Mar 22	14:57	-	32.29	-	8.86	-
31 Mar 22	14:58	-	32.21	-	8.82	-
31 Mar 22	14:59	-	32.11	-	8.79	-
31 Mar 22	15:00	-	32.16	-	8.70	-
31 Mar 22	15:01	-	32.41	-	8.53	-
31 Mar 22	15:02	-	32.65	-	8.44	-
31 Mar 22	15:03	-	32.91	-	8.39	-
31 Mar 22	15:04	-	32.78	-	8.59	-
31 Mar 22	15:05	-	32.47	-	8.77	-
31 Mar 22	15:06	-	32.15	-	8.79	-
31 Mar 22	15:07	-	32.08	-	8.82	-
31 Mar 22	15:08	-	32.15	-	8.83	-
31 Mar 22	15:09	-	32.17	-	8.84	-
31 Mar 22	15:10	-	32.13	-	8.84	-
31 Mar 22	15:11	-	32.14	-	8.80	-
31 Mar 22	15:12	-	32.03	-	8.80	-
31 Mar 22	15:13	-	32.00	-	8.81	-
31 Mar 22	15:14	-	31.99	-	8.82	-
31 Mar 22	15:15	-	32.05	-	8.78	-
31 Mar 22	15:16	-	32.05	-	8.79	-
Max		-	32.91	-	8.86	-
Avg		-	32.25	-	8.74	-

Lot No. 2223246-1

ANALYZER CALIBRATION DATA

Client : Global Power Synergy PCL. Location : Auxiliary Boiler 70Ton #1
Date : 29 Mar 22 Test Operator : Saksit P.

O₂ ANALYZER

Model : TELEDYNE API 200EH Serial No. : 774
Span (%) : 25

	Cylinder Value (%)	Initial Analyzers Calibration Response (%)	Final Analyzers Calibration Response (%)	Difference (Percent of Span)
Zero Gas	0.00	0.03	0.00	0.12
Low-Level Gas	8.05	8.08	8.05	0.12
Span Gas	16.06	16.09	16.06	0.12

NO_x ANALYZER

Model : TELEDYNE API 200EH Serial No. : 774
Span (ppm) : 100

	Cylinder Value (ppm)	Initial Analyzers Calibration Response (ppm)	Final Analyzers Calibration Response (ppm)	Difference (Percent of Span)
Zero Gas	0.00	0.04	0.00	0.04
Low-Level Gas	50.32	50.36	50.32	0.04
Span Gas	158.20	158.24	158.20	0.04

Calibrated by

(Mr. Saksit Phaisanphisut)

Environmental Field Scientist (4)

FORM NO.: F 06-104 REVISION NO.: - ISSUE DATE: 3/06/19

ALS Laboratory Group



Lot No. 2223246-1

SYSTEM CALIBRATION BIAS AND DRIFT DATA

Client : Global Power Synergy PCL. Location : Auxillary Boiler 70Ton #1
Date : 29 Mar 22 Test Operator : Saksit P.

O₂ ANALYZER

Cylinder Conc. (%) : 16.06 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	0.03	0.03	0.00	0.00	0.12	0.12
Upscale Gas	16.09	16.09	0.00	16.06	0.12	0.12

NO_x ANALYZER

Cylinder Conc. (ppm) : 158.20 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	0.04	0.04	0.00	0.00	0.04	0.04
Upscale Gas	158.24	158.24	0.00	158.20	0.04	0.04

Calibrated by

(Mr. Saksit Phalsanphisut)

Environmental Field Scientist (4)

FORM NO.: F 06-104 REVISION NO.: - ISSUE DATE: 3/06/19

ALS Laboratory Group



CEMs Data

Client Name Global Power Synergy PCL
Plant Name CUP3

Date 29 Mar 22
Location Auxiliary Boiler 70Ton #1

Run No: 1

Time Base : 21 min

Run No: 2

Time Base : 21 min

Date	Time	SO2 ppm	NOx ppm	CO ppm	O2 Vol%	CO2 Vol%
29 Mar 22	10:40	-	29.70	-	3.51	-
29 Mar 22	10:41	-	29.70	-	3.60	-
29 Mar 22	10:42	-	27.70	-	3.61	-
29 Mar 22	10:43	-	27.60	-	3.57	-
29 Mar 22	10:44	-	28.50	-	3.60	-
29 Mar 22	10:45	-	28.60	-	3.61	-
29 Mar 22	10:46	-	28.90	-	3.61	-
29 Mar 22	10:47	-	28.80	-	3.62	-
29 Mar 22	10:48	-	28.50	-	3.62	-
29 Mar 22	10:49	-	29.30	-	3.64	-
29 Mar 22	10:50	-	28.10	-	3.66	-
29 Mar 22	10:51	-	29.30	-	3.67	-
29 Mar 22	10:52	-	28.40	-	3.62	-
29 Mar 22	10:53	-	28.30	-	3.63	-
29 Mar 22	10:54	-	28.60	-	3.64	-
29 Mar 22	10:55	-	28.10	-	3.66	-
29 Mar 22	10:56	-	29.40	-	3.63	-
29 Mar 22	10:57	-	29.30	-	3.63	-
29 Mar 22	10:58	-	27.50	-	3.59	-
29 Mar 22	10:59	-	27.80	-	3.56	-
29 Mar 22	11:00	-	28.10	-	3.58	-
Max		-	29.70	-	3.67	-
Avg		-	28.58	-	3.61	-

Date	Time	SO2 ppm	NOx ppm	CO ppm	O2 Vol%	CO2 Vol%
29 Mar 22	11:01	-	28.00	-	3.59	-
29 Mar 22	11:02	-	27.90	-	3.55	-
29 Mar 22	11:03	-	27.10	-	3.58	-
29 Mar 22	11:04	-	27.40	-	3.61	-
29 Mar 22	11:05	-	28.10	-	3.60	-
29 Mar 22	11:06	-	27.60	-	3.65	-
29 Mar 22	11:07	-	27.80	-	3.64	-
29 Mar 22	11:08	-	27.70	-	3.64	-
29 Mar 22	11:09	-	27.80	-	3.59	-
29 Mar 22	11:10	-	27.70	-	3.62	-
29 Mar 22	11:11	-	28.10	-	3.65	-
29 Mar 22	11:12	-	27.90	-	3.65	-
29 Mar 22	11:13	-	27.90	-	3.64	-
29 Mar 22	11:14	-	27.70	-	3.57	-
29 Mar 22	11:15	-	26.70	-	3.55	-
29 Mar 22	11:16	-	25.50	-	3.53	-
29 Mar 22	11:17	-	26.30	-	3.61	-
29 Mar 22	11:18	-	26.80	-	3.64	-
29 Mar 22	11:19	-	26.20	-	3.63	-
29 Mar 22	11:20	-	25.90	-	3.64	-
29 Mar 22	11:21	-	26.00	-	3.63	-
Max		-	28.10	-	3.65	-
Avg		-	27.24	-	3.61	-

Run No: 3

Time Base : 21 min

Run No: 4

Time Base : 21 min

Date	Time	SO2 ppm	NOx ppm	CO ppm	O2 Vol%	CO2 Vol%
29 Mar 22	11:22	-	26.20	-	3.63	-
29 Mar 22	11:23	-	26.20	-	3.65	-
29 Mar 22	11:24	-	26.70	-	3.64	-
29 Mar 22	11:25	-	27.00	-	3.67	-
29 Mar 22	11:26	-	27.30	-	3.65	-
29 Mar 22	11:27	-	27.40	-	3.68	-
29 Mar 22	11:28	-	27.20	-	3.67	-
29 Mar 22	11:29	-	26.20	-	3.99	-
29 Mar 22	11:30	-	26.90	-	4.43	-
29 Mar 22	11:31	-	27.60	-	4.67	-
29 Mar 22	11:32	-	26.90	-	4.88	-
29 Mar 22	11:33	-	27.70	-	4.94	-
29 Mar 22	11:34	-	27.70	-	4.93	-
29 Mar 22	11:35	-	27.40	-	4.96	-
29 Mar 22	11:36	-	28.50	-	4.98	-
29 Mar 22	11:37	-	28.60	-	4.95	-
29 Mar 22	11:38	-	30.00	-	4.97	-
29 Mar 22	11:39	-	29.30	-	4.95	-
29 Mar 22	11:40	-	29.20	-	4.95	-
29 Mar 22	11:41	-	28.60	-	4.98	-
29 Mar 22	11:42	-	28.80	-	4.97	-
Max		-	30.00	-	4.98	-
Avg		-	27.69	-	4.44	-

Date	Time	SO2 ppm	NOx ppm	CO ppm	O2 Vol%	CO2 Vol%
29 Mar 22	11:43	-	27.40	-	4.94	-
29 Mar 22	11:44	-	29.20	-	4.96	-
29 Mar 22	11:45	-	28.80	-	4.98	-
29 Mar 22	11:46	-	28.50	-	4.94	-
29 Mar 22	11:47	-	28.10	-	4.95	-
29 Mar 22	11:48	-	29.80	-	4.96	-
29 Mar 22	11:49	-	28.50	-	4.98	-
29 Mar 22	11:50	-	28.10	-	4.97	-
29 Mar 22	11:51	-	29.00	-	4.95	-
29 Mar 22	11:52	-	28.80	-	4.91	-
29 Mar 22	11:53	-	28.10	-	4.92	-
29 Mar 22	11:54	-	28.30	-	4.92	-
29 Mar 22	11:55	-	28.40	-	4.95	-
29 Mar 22	11:56	-	27.20	-	4.94	-
29 Mar 22	11:57	-	26.70	-	4.92	-
29 Mar 22	11:58	-	26.60	-	4.91	-
29 Mar 22	11:59	-	27.10	-	4.92	-
29 Mar 22	12:00	-	27.90	-	4.88	-
29 Mar 22	12:01	-	29.00	-	4.92	-
29 Mar 22	12:02	-	28.60	-	4.91	-
29 Mar 22	12:03	-	27.60	-	4.90	-
Max		-	29.80	-	4.98	-
Avg		-	28.18	-	4.93	-

Run No: 5

Time Base : 21 min

Run No: 6

Time Base : 21 min

Date	Time	SO2 ppm	NOx ppm	CO ppm	O2 Vol%	CO2 Vol%
29 Mar 22	12:04	-	27.10	-	4.89	-
29 Mar 22	12:05	-	27.10	-	4.90	-
29 Mar 22	12:06	-	27.10	-	4.88	-
29 Mar 22	12:07	-	27.40	-	4.84	-
29 Mar 22	12:08	-	27.20	-	4.82	-
29 Mar 22	12:09	-	27.30	-	4.86	-
29 Mar 22	12:10	-	28.00	-	4.85	-
29 Mar 22	12:11	-	28.90	-	4.86	-
29 Mar 22	12:12	-	27.60	-	4.86	-
29 Mar 22	12:13	-	27.90	-	4.88	-
29 Mar 22	12:14	-	27.80	-	4.84	-
29 Mar 22	12:15	-	27.90	-	4.84	-
29 Mar 22	12:16	-	29.10	-	4.84	-
29 Mar 22	12:17	-	28.60	-	4.83	-
29 Mar 22	12:18	-	28.50	-	4.85	-
29 Mar 22	12:19	-	28.50	-	4.86	-
29 Mar 22	12:20	-	28.30	-	4.83	-
29 Mar 22	12:21	-	28.00	-	4.81	-
29 Mar 22	12:22	-	28.50	-	4.83	-
29 Mar 22	12:23	-	28.40	-	4.84	-
29 Mar 22	12:24	-	28.70	-	4.82	-
Max		-	29.10	-	4.90	-
Avg		-	28.00	-	4.85	-

Date	Time	SO2 ppm	NOx ppm	CO ppm	O2 Vol%	CO2 Vol%
29 Mar 22	12:25	-	27.90	-	4.82	-
29 Mar 22	12:26	-	28.30	-	4.84	-
29 Mar 22	12:27	-	27.90	-	4.83	-
29 Mar 22	12:28	-	28.20	-	4.85	-
29 Mar 22	12:29	-	28.70	-	4.84	-
29 Mar 22	12:30	-	27.90	-	4.80	-
29 Mar 22	12:31	-	29.00	-	4.81	-
29 Mar 22	12:32	-	29.30	-	4.84	-
29 Mar 22	12:33	-	29.00	-	4.83	-
29 Mar 22	12:34	-	28.20	-	4.88	-
29 Mar 22	12:35	-	28.80	-	4.88	-
29 Mar 22	12:36	-	29.20	-	4.88	-
29 Mar 22	12:37	-	29.00	-	4.86	-
29 Mar 22	12:38	-	28.70	-	4.86	-
29 Mar 22	12:39	-	29.10	-	4.84	-
29 Mar 22	12:40	-	29.00	-	4.84	-
29 Mar 22	12:41	-	29.40	-	4.82	-
29 Mar 22	12:42	-	28.70	-	4.87	-
29 Mar 22	12:43	-	29.00	-	4.89	-
29 Mar 22	12:44	-	28.80	-	4.85	-
29 Mar 22	12:45	-	29.90	-	4.84	-
Max		-	29.90	-	4.89	-
Avg		-	28.76	-	4.85	-



CEMs Data

Client Name Global Power Synergy PCL
Plant Name CUP3

Date 29 Mar 22
Location Auxiliary Boiler 70Ton #1

Run No: 7

Time Base : 21 min

Run No: 8

Time Base : 21 min

Date	Time	SO2 ppm	NOx ppm	CO ppm	O2 Vol%	CO2 Vol%
29 Mar 22	12:46	-	31.10	-	4.84	-
29 Mar 22	12:47	-	29.80	-	4.82	-
29 Mar 22	12:48	-	30.80	-	4.90	-
29 Mar 22	12:49	-	30.60	-	4.87	-
29 Mar 22	12:50	-	30.30	-	4.85	-
29 Mar 22	12:51	-	29.90	-	4.86	-
29 Mar 22	12:52	-	29.20	-	4.89	-
29 Mar 22	12:53	-	28.80	-	4.91	-
29 Mar 22	12:54	-	29.70	-	4.85	-
29 Mar 22	12:55	-	29.60	-	4.89	-
29 Mar 22	12:56	-	29.90	-	4.90	-
29 Mar 22	12:57	-	30.20	-	4.90	-
29 Mar 22	12:58	-	29.80	-	4.85	-
29 Mar 22	12:59	-	30.70	-	4.84	-
29 Mar 22	13:00	-	30.40	-	4.82	-
29 Mar 22	13:01	-	30.50	-	4.88	-
29 Mar 22	13:02	-	31.10	-	4.88	-
29 Mar 22	13:03	-	30.60	-	4.87	-
29 Mar 22	13:04	-	29.20	-	4.85	-
29 Mar 22	13:05	-	29.80	-	4.82	-
29 Mar 22	13:06	-	30.70	-	4.82	-
Max		-	31.10	-	4.91	-
Avg		-	30.13	-	4.86	-

Date	Time	SO2 ppm	NOx ppm	CO ppm	O2 Vol%	CO2 Vol%
29 Mar 22	13:07	-	30.90	-	4.82	-
29 Mar 22	13:08	-	31.30	-	4.84	-
29 Mar 22	13:09	-	30.70	-	4.83	-
29 Mar 22	13:10	-	30.60	-	4.68	-
29 Mar 22	13:11	-	30.50	-	4.14	-
29 Mar 22	13:12	-	31.20	-	3.93	-
29 Mar 22	13:13	-	30.00	-	3.93	-
29 Mar 22	13:14	-	29.90	-	3.92	-
29 Mar 22	13:15	-	29.90	-	3.92	-
29 Mar 22	13:16	-	30.40	-	3.94	-
29 Mar 22	13:17	-	30.50	-	3.94	-
29 Mar 22	13:18	-	31.10	-	3.97	-
29 Mar 22	13:19	-	31.10	-	4.00	-
29 Mar 22	13:20	-	30.90	-	3.96	-
29 Mar 22	13:21	-	31.20	-	3.96	-
29 Mar 22	13:22	-	30.60	-	4.02	-
29 Mar 22	13:23	-	30.30	-	4.01	-
29 Mar 22	13:24	-	31.00	-	4.02	-
29 Mar 22	13:25	-	31.10	-	3.99	-
29 Mar 22	13:26	-	31.70	-	4.00	-
29 Mar 22	13:27	-	31.80	-	3.98	-
Max		-	31.80	-	4.84	-
Avg		-	30.80	-	4.13	-

Run No: 9

Time Base : 21 min

Run No: 10

Time Base : 21 min

Date	Time	SO2 ppm	NOx ppm	CO ppm	O2 Vol%	CO2 Vol%
29 Mar 22	13:28	-	30.90	-	3.95	-
29 Mar 22	13:29	-	30.30	-	3.93	-
29 Mar 22	13:30	-	30.30	-	3.93	-
29 Mar 22	13:31	-	30.20	-	3.99	-
29 Mar 22	13:32	-	30.40	-	3.99	-
29 Mar 22	13:33	-	30.90	-	4.02	-
29 Mar 22	13:34	-	30.10	-	3.99	-
29 Mar 22	13:35	-	30.70	-	3.99	-
29 Mar 22	13:36	-	30.70	-	3.99	-
29 Mar 22	13:37	-	31.00	-	4.00	-
29 Mar 22	13:38	-	30.20	-	3.99	-
29 Mar 22	13:39	-	29.80	-	4.00	-
29 Mar 22	13:40	-	31.10	-	4.02	-
29 Mar 22	13:41	-	31.20	-	4.04	-
29 Mar 22	13:42	-	31.60	-	4.03	-
29 Mar 22	13:43	-	30.80	-	3.99	-
29 Mar 22	13:44	-	31.90	-	4.03	-
29 Mar 22	13:45	-	31.80	-	4.05	-
29 Mar 22	13:46	-	31.70	-	4.06	-
29 Mar 22	13:47	-	31.60	-	4.03	-
29 Mar 22	13:48	-	31.20	-	4.04	-
Max		-	31.90	-	4.06	-
Avg		-	30.88	-	4.00	-

Date	Time	SO2 ppm	NOx ppm	CO ppm	O2 Vol%	CO2 Vol%
29 Mar 22	13:49	-	31.50	-	4.03	-
29 Mar 22	13:50	-	31.20	-	3.97	-
29 Mar 22	13:51	-	31.20	-	3.96	-
29 Mar 22	13:52	-	31.90	-	3.98	-
29 Mar 22	13:53	-	31.00	-	4.01	-
29 Mar 22	13:54	-	31.40	-	4.03	-
29 Mar 22	13:55	-	31.80	-	4.04	-
29 Mar 22	13:56	-	31.60	-	4.04	-
29 Mar 22	13:57	-	31.50	-	4.00	-
29 Mar 22	13:58	-	30.80	-	3.97	-
29 Mar 22	13:59	-	31.80	-	4.00	-
29 Mar 22	14:00	-	31.70	-	4.05	-
29 Mar 22	14:01	-	30.70	-	4.04	-
29 Mar 22	14:02	-	31.30	-	3.98	-
29 Mar 22	14:03	-	32.90	-	3.72	-
29 Mar 22	14:04	-	33.10	-	3.53	-
29 Mar 22	14:05	-	31.90	-	3.44	-
29 Mar 22	14:06	-	32.10	-	3.40	-
29 Mar 22	14:07	-	32.50	-	3.42	-
29 Mar 22	14:08	-	33.00	-	3.42	-
29 Mar 22	14:09	-	33.80	-	3.36	-
Max		-	33.80	-	4.05	-
Avg		-	31.84	-	3.83	-

Run No: 11

Time Base : 21 min

Run No: 12

Time Base : 21 min

Date	Time	SO2 ppm	NOx ppm	CO ppm	O2 Vol%	CO2 Vol%
29 Mar 22	14:10	-	33.60	-	3.36	-
29 Mar 22	14:11	-	32.50	-	3.35	-
29 Mar 22	14:12	-	31.90	-	3.34	-
29 Mar 22	14:13	-	32.00	-	3.38	-
29 Mar 22	14:14	-	31.30	-	3.35	-
29 Mar 22	14:15	-	32.10	-	3.40	-
29 Mar 22	14:16	-	31.90	-	3.40	-
29 Mar 22	14:17	-	33.60	-	3.43	-
29 Mar 22	14:18	-	33.20	-	3.45	-
29 Mar 22	14:19	-	33.90	-	3.44	-
29 Mar 22	14:20	-	33.70	-	3.42	-
29 Mar 22	14:21	-	33.20	-	3.45	-
29 Mar 22	14:22	-	32.90	-	3.44	-
29 Mar 22	14:23	-	32.70	-	3.43	-
29 Mar 22	14:24	-	32.70	-	3.44	-
29 Mar 22	14:25	-	32.60	-	3.44	-
29 Mar 22	14:26	-	33.20	-	3.42	-
29 Mar 22	14:27	-	33.70	-	3.44	-
29 Mar 22	14:28	-	33.20	-	3.40	-
29 Mar 22	14:29	-	33.10	-	3.40	-
29 Mar 22	14:30	-	31.90	-	3.37	-
Max		-	33.90	-	3.45	-
Avg		-	32.80	-	3.41	-

Date	Time	SO2 ppm	NOx ppm	CO ppm	O2 Vol%	CO2 Vol%
29 Mar 22	14:31	-	33.10	-	3.38	-
29 Mar 22	14:32	-	32.90	-	3.37	-
29 Mar 22	14:33	-	33.10	-	3.38	-
29 Mar 22	14:34	-	33.80	-	3.35	-
29 Mar 22	14:35	-	34.00	-	3.35	-
29 Mar 22	14:36	-	34.70	-	3.37	-
29 Mar 22	14:37	-	34.10	-	3.37	-
29 Mar 22	14:38	-	33.60	-	3.38	-
29 Mar 22	14:39	-	33.90	-	3.36	-
29 Mar 22	14:40	-	34.20	-	3.37	-
29 Mar 22	14:41	-	33.60	-	3.36	-
29 Mar 22	14:42	-	33.10	-	3.37	-
29 Mar 22	14:43	-	33.00	-	3.36	-
29 Mar 22	14:44	-	32.80	-	3.38	-
29 Mar 22	14:45	-	34.30	-	3.35	-
29 Mar 22	14:46	-	32.90	-	3.34	-
29 Mar 22	14:47	-	32.40	-	3.36	-
29 Mar 22	14:48	-	32.20	-	3.35	-
29 Mar 22	14:49	-	32.30	-	3.33	-
29 Mar 22	14:50	-	32.80	-	3.33	-
29 Mar 22	14:51	-	33.40	-	3.34	-
Max		-	34.70	-	3.38	-
Avg		-	33.34	-	3.36	-



Reference Method Data

Client Name Global Power Synergy PCL
Plant Name CUP3

Date 29 Mar 22
Location Auxiliary Boiler 70Ton #1

Run No: 1

Time Base : 21 min

Run No: 2

Time Base : 21 min

Date	Time	SO2 ppm	NOx ppm	CO ppm	O2 Vol%	CO2 Vol%
29 Mar 22	10:40	-	30.25	-	3.59	-
29 Mar 22	10:41	-	30.25	-	3.59	-
29 Mar 22	10:42	-	30.26	-	3.58	-
29 Mar 22	10:43	-	30.37	-	3.63	-
29 Mar 22	10:44	-	30.53	-	3.66	-
29 Mar 22	10:45	-	30.63	-	3.65	-
29 Mar 22	10:46	-	30.65	-	3.67	-
29 Mar 22	10:47	-	30.67	-	3.68	-
29 Mar 22	10:48	-	30.61	-	3.68	-
29 Mar 22	10:49	-	30.56	-	3.68	-
29 Mar 22	10:50	-	30.59	-	3.69	-
29 Mar 22	10:51	-	30.72	-	3.71	-
29 Mar 22	10:52	-	30.79	-	3.72	-
29 Mar 22	10:53	-	30.87	-	3.73	-
29 Mar 22	10:54	-	30.95	-	3.70	-
29 Mar 22	10:55	-	30.89	-	3.70	-
29 Mar 22	10:56	-	30.72	-	3.70	-
29 Mar 22	10:57	-	30.76	-	3.72	-
29 Mar 22	10:58	-	30.89	-	3.70	-
29 Mar 22	10:59	-	30.85	-	3.67	-
29 Mar 22	11:00	-	30.72	-	3.65	-
Max		-	30.95	-	3.73	-
Avg		-	30.64	-	3.67	-

Date	Time	SO2 ppm	NOx ppm	CO ppm	O2 Vol%	CO2 Vol%
29 Mar 22	11:01	-	30.51	-	3.64	-
29 Mar 22	11:02	-	30.51	-	3.64	-
29 Mar 22	11:03	-	30.61	-	3.65	-
29 Mar 22	11:04	-	30.70	-	3.63	-
29 Mar 22	11:05	-	30.74	-	3.64	-
29 Mar 22	11:06	-	30.71	-	3.67	-
29 Mar 22	11:07	-	30.56	-	3.68	-
29 Mar 22	11:08	-	30.54	-	3.71	-
29 Mar 22	11:09	-	30.60	-	3.71	-
29 Mar 22	11:10	-	30.61	-	3.71	-
29 Mar 22	11:11	-	30.57	-	3.68	-
29 Mar 22	11:12	-	30.61	-	3.68	-
29 Mar 22	11:13	-	30.73	-	3.71	-
29 Mar 22	11:14	-	30.91	-	3.71	-
29 Mar 22	11:15	-	30.81	-	3.69	-
29 Mar 22	11:16	-	30.61	-	3.65	-
29 Mar 22	11:17	-	30.39	-	3.63	-
29 Mar 22	11:18	-	30.38	-	3.63	-
29 Mar 22	11:19	-	30.47	-	3.67	-
29 Mar 22	11:20	-	30.55	-	3.70	-
29 Mar 22	11:21	-	30.59	-	3.70	-
Max		-	30.91	-	3.71	-
Avg		-	30.60	-	3.67	-

Run No: 3

Time Base : 21 min

Run No: 4

Time Base : 21 min

Date	Time	SO2 ppm	NOx ppm	CO ppm	O2 Vol%	CO2 Vol%
29 Mar 22	11:22	-	30.52	-	3.71	-
29 Mar 22	11:23	-	30.43	-	3.70	-
29 Mar 22	11:24	-	30.47	-	3.69	-
29 Mar 22	11:25	-	30.57	-	3.70	-
29 Mar 22	11:26	-	30.60	-	3.72	-
29 Mar 22	11:27	-	30.73	-	3.74	-
29 Mar 22	11:28	-	30.83	-	3.73	-
29 Mar 22	11:29	-	30.94	-	3.74	-
29 Mar 22	11:30	-	30.98	-	3.75	-
29 Mar 22	11:31	-	30.93	-	3.98	-
29 Mar 22	11:32	-	30.92	-	4.38	-
29 Mar 22	11:33	-	31.11	-	4.66	-
29 Mar 22	11:34	-	31.24	-	4.88	-
29 Mar 22	11:35	-	31.30	-	4.98	-
29 Mar 22	11:36	-	31.38	-	4.99	-
29 Mar 22	11:37	-	31.36	-	5.02	-
29 Mar 22	11:38	-	31.23	-	5.04	-
29 Mar 22	11:39	-	31.21	-	5.03	-
29 Mar 22	11:40	-	31.27	-	5.02	-
29 Mar 22	11:41	-	31.39	-	5.01	-
29 Mar 22	11:42	-	31.44	-	5.02	-
Max		-	31.44	-	5.04	-
Avg		-	30.99	-	4.36	-

Date	Time	SO2 ppm	NOx ppm	CO ppm	O2 Vol%	CO2 Vol%
29 Mar 22	11:43	-	31.44	-	5.03	-
29 Mar 22	11:44	-	31.38	-	5.03	-
29 Mar 22	11:45	-	31.38	-	5.01	-
29 Mar 22	11:46	-	31.39	-	5.02	-
29 Mar 22	11:47	-	31.38	-	5.03	-
29 Mar 22	11:48	-	31.29	-	5.02	-
29 Mar 22	11:49	-	31.29	-	5.01	-
29 Mar 22	11:50	-	31.29	-	5.01	-
29 Mar 22	11:51	-	31.30	-	5.03	-
29 Mar 22	11:52	-	31.32	-	5.03	-
29 Mar 22	11:53	-	31.51	-	5.01	-
29 Mar 22	11:54	-	31.64	-	4.98	-
29 Mar 22	11:55	-	31.53	-	4.98	-
29 Mar 22	11:56	-	31.38	-	4.95	-
29 Mar 22	11:57	-	31.37	-	4.98	-
29 Mar 22	11:58	-	31.41	-	5.00	-
29 Mar 22	11:59	-	31.44	-	4.99	-
29 Mar 22	12:00	-	31.44	-	4.98	-
29 Mar 22	12:01	-	31.49	-	4.98	-
29 Mar 22	12:02	-	31.53	-	4.96	-
29 Mar 22	12:03	-	31.49	-	4.98	-
Max		-	31.64	-	5.03	-
Avg		-	31.41	-	5.00	-

Run No: 5

Time Base : 21 min

Run No: 6

Time Base : 21 min

Date	Time	SO2 ppm	NOx ppm	CO ppm	O2 Vol%	CO2 Vol%
29 Mar 22	12:04	-	31.40	-	4.97	-
29 Mar 22	12:05	-	31.39	-	4.95	-
29 Mar 22	12:06	-	31.40	-	4.95	-
29 Mar 22	12:07	-	31.36	-	4.96	-
29 Mar 22	12:08	-	31.09	-	4.95	-
29 Mar 22	12:09	-	30.92	-	4.91	-
29 Mar 22	12:10	-	30.79	-	4.89	-
29 Mar 22	12:11	-	30.91	-	4.91	-
29 Mar 22	12:12	-	31.10	-	4.91	-
29 Mar 22	12:13	-	31.29	-	4.92	-
29 Mar 22	12:14	-	31.31	-	4.92	-
29 Mar 22	12:15	-	31.25	-	4.93	-
29 Mar 22	12:16	-	31.14	-	4.91	-
29 Mar 22	12:17	-	31.19	-	4.90	-
29 Mar 22	12:18	-	31.24	-	4.90	-
29 Mar 22	12:19	-	31.30	-	4.90	-
29 Mar 22	12:20	-	31.24	-	4.91	-
29 Mar 22	12:21	-	31.21	-	4.90	-
29 Mar 22	12:22	-	31.28	-	4.87	-
29 Mar 22	12:23	-	31.24	-	4.86	-
29 Mar 22	12:24	-	31.14	-	4.88	-
Max		-	31.40	-	4.97	-
Avg		-	31.20	-	4.91	-

Date	Time	SO2 ppm	NOx ppm	CO ppm	O2 Vol%	CO2 Vol%
29 Mar 22	12:25	-	31.18	-	4.90	-
29 Mar 22	12:26	-	31.24	-	4.88	-
29 Mar 22	12:27	-	31.18	-	4.88	-
29 Mar 22	12:28	-	31.11	-	4.89	-
29 Mar 22	12:29	-	31.11	-	4.89	-
29 Mar 22	12:30	-	31.11	-	4.91	-
29 Mar 22	12:31	-	31.27	-	4.88	-
29 Mar 22	12:32	-	31.40	-	4.87	-
29 Mar 22	12:33	-	31.45	-	4.87	-
29 Mar 22	12:34	-	31.35	-	4.89	-
29 Mar 22	12:35	-	31.32	-	4.90	-
29 Mar 22	12:36	-	31.33	-	4.93	-
29 Mar 22	12:37	-	31.45	-	4.94	-
29 Mar 22	12:38	-	31.45	-	4.94	-
29 Mar 22	12:39	-	31.39	-	4.93	-
29 Mar 22	12:40	-	31.28	-	4.92	-
29 Mar 22	12:41	-	31.26	-	4.91	-
29 Mar 22	12:42	-	31.28	-	4.90	-
29 Mar 22	12:43	-	31.27	-	4.89	-
29 Mar 22	12:44	-	31.23	-	4.92	-
29 Mar 22	12:45	-	31.22	-	4.94	-
Max		-	31.45	-	4.94	-
Avg		-	31.28	-	4.90	-



Reference Method Data

Client Name Global Power Synergy PCL
Plant Name CUP3

Date 29 Mar 22
Location Auxiliary Boiler 70Ton #1

Run No: 7

Time Base : 21 min

Run No: 8

Time Base : 21 min

Date	Time	SO2 ppm	NOx ppm	CO ppm	O2 Vol%	CO2 Vol%
29 Mar 22	12:46	-	31.29	-	4.91	-
29 Mar 22	12:47	-	31.34	-	4.88	-
29 Mar 22	12:48	-	31.40	-	4.87	-
29 Mar 22	12:49	-	31.31	-	4.89	-
29 Mar 22	12:50	-	31.26	-	4.94	-
29 Mar 22	12:51	-	31.32	-	4.93	-
29 Mar 22	12:52	-	31.31	-	4.91	-
29 Mar 22	12:53	-	31.27	-	4.92	-
29 Mar 22	12:54	-	31.24	-	4.95	-
29 Mar 22	12:55	-	31.21	-	4.96	-
29 Mar 22	12:56	-	31.30	-	4.92	-
29 Mar 22	12:57	-	31.47	-	4.93	-
29 Mar 22	12:58	-	31.52	-	4.95	-
29 Mar 22	12:59	-	31.73	-	4.95	-
29 Mar 22	13:00	-	31.78	-	4.92	-
29 Mar 22	13:01	-	31.69	-	4.90	-
29 Mar 22	13:02	-	31.51	-	4.90	-
29 Mar 22	13:03	-	31.52	-	4.92	-
29 Mar 22	13:04	-	31.57	-	4.93	-
29 Mar 22	13:05	-	31.57	-	4.93	-
29 Mar 22	13:06	-	31.47	-	4.92	-
Max		-	31.78	-	4.96	-
Avg		-	31.43	-	4.92	-

Date	Time	SO2 ppm	NOx ppm	CO ppm	O2 Vol%	CO2 Vol%
29 Mar 22	13:07	-	31.44	-	4.90	-
29 Mar 22	13:08	-	31.47	-	4.88	-
29 Mar 22	13:09	-	31.54	-	4.88	-
29 Mar 22	13:10	-	31.66	-	4.89	-
29 Mar 22	13:11	-	31.71	-	4.90	-
29 Mar 22	13:12	-	31.67	-	4.72	-
29 Mar 22	13:13	-	31.46	-	4.29	-
29 Mar 22	13:14	-	31.20	-	4.06	-
29 Mar 22	13:15	-	30.99	-	4.01	-
29 Mar 22	13:16	-	30.92	-	3.99	-
29 Mar 22	13:17	-	30.92	-	3.99	-
29 Mar 22	13:18	-	31.02	-	4.00	-
29 Mar 22	13:19	-	31.13	-	4.02	-
29 Mar 22	13:20	-	31.20	-	4.03	-
29 Mar 22	13:21	-	31.19	-	4.04	-
29 Mar 22	13:22	-	31.17	-	4.02	-
29 Mar 22	13:23	-	31.29	-	4.04	-
29 Mar 22	13:24	-	31.42	-	4.07	-
29 Mar 22	13:25	-	31.44	-	4.09	-
29 Mar 22	13:26	-	31.43	-	4.08	-
29 Mar 22	13:27	-	31.48	-	4.07	-
Max		-	31.71	-	4.90	-
Avg		-	31.32	-	4.28	-

Run No: 9

Time Base : 21 min

Run No: 10

Time Base : 21 min

Date	Time	SO2 ppm	NOx ppm	CO ppm	O2 Vol%	CO2 Vol%
29 Mar 22	13:28	-	31.52	-	4.07	-
29 Mar 22	13:29	-	31.43	-	4.05	-
29 Mar 22	13:30	-	31.32	-	4.03	-
29 Mar 22	13:31	-	31.13	-	4.02	-
29 Mar 22	13:32	-	31.10	-	4.01	-
29 Mar 22	13:33	-	31.15	-	4.05	-
29 Mar 22	13:34	-	31.32	-	4.06	-
29 Mar 22	13:35	-	31.48	-	4.08	-
29 Mar 22	13:36	-	31.47	-	4.08	-
29 Mar 22	13:37	-	31.47	-	4.06	-
29 Mar 22	13:38	-	31.44	-	4.05	-
29 Mar 22	13:39	-	31.45	-	4.07	-
29 Mar 22	13:40	-	31.30	-	4.07	-
29 Mar 22	13:41	-	31.25	-	4.08	-
29 Mar 22	13:42	-	31.28	-	4.09	-
29 Mar 22	13:43	-	31.40	-	4.10	-
29 Mar 22	13:44	-	31.47	-	4.10	-
29 Mar 22	13:45	-	31.50	-	4.08	-
29 Mar 22	13:46	-	31.60	-	4.10	-
29 Mar 22	13:47	-	31.58	-	4.12	-
29 Mar 22	13:48	-	31.58	-	4.13	-
Max		-	31.60	-	4.13	-
Avg		-	31.39	-	4.07	-

Date	Time	SO2 ppm	NOx ppm	CO ppm	O2 Vol%	CO2 Vol%
29 Mar 22	13:49	-	31.49	-	4.10	-
29 Mar 22	13:50	-	31.51	-	4.11	-
29 Mar 22	13:51	-	31.50	-	4.10	-
29 Mar 22	13:52	-	31.48	-	4.06	-
29 Mar 22	13:53	-	31.47	-	4.03	-
29 Mar 22	13:54	-	31.65	-	4.03	-
29 Mar 22	13:55	-	31.68	-	4.07	-
29 Mar 22	13:56	-	31.69	-	4.10	-
29 Mar 22	13:57	-	31.64	-	4.11	-
29 Mar 22	13:58	-	31.65	-	4.12	-
29 Mar 22	13:59	-	31.60	-	4.08	-
29 Mar 22	14:00	-	31.47	-	4.06	-
29 Mar 22	14:01	-	31.43	-	4.07	-
29 Mar 22	14:02	-	31.51	-	4.12	-
29 Mar 22	14:03	-	31.54	-	4.12	-
29 Mar 22	14:04	-	31.59	-	4.05	-
29 Mar 22	14:05	-	31.70	-	3.85	-
29 Mar 22	14:06	-	31.75	-	3.66	-
29 Mar 22	14:07	-	31.70	-	3.54	-
29 Mar 22	14:08	-	31.62	-	3.49	-
29 Mar 22	14:09	-	31.68	-	3.48	-
Max		-	31.75	-	4.12	-
Avg		-	31.59	-	3.97	-

Run No: 11

Time Base : 21 min

Run No: 12

Time Base : 21 min

Date	Time	SO2 ppm	NOx ppm	CO ppm	O2 Vol%	CO2 Vol%
29 Mar 22	14:10	-	31.78	-	3.47	-
29 Mar 22	14:11	-	31.83	-	3.44	-
29 Mar 22	14:12	-	31.85	-	3.44	-
29 Mar 22	14:13	-	31.87	-	3.43	-
29 Mar 22	14:14	-	31.88	-	3.42	-
29 Mar 22	14:15	-	31.83	-	3.44	-
29 Mar 22	14:16	-	31.90	-	3.44	-
29 Mar 22	14:17	-	32.23	-	3.46	-
29 Mar 22	14:18	-	32.43	-	3.48	-
29 Mar 22	14:19	-	32.62	-	3.49	-
29 Mar 22	14:20	-	32.68	-	3.50	-
29 Mar 22	14:21	-	32.62	-	3.52	-
29 Mar 22	14:22	-	32.62	-	3.50	-
29 Mar 22	14:23	-	32.59	-	3.52	-
29 Mar 22	14:24	-	32.49	-	3.51	-
29 Mar 22	14:25	-	32.45	-	3.51	-
29 Mar 22	14:26	-	32.55	-	3.52	-
29 Mar 22	14:27	-	32.58	-	3.52	-
29 Mar 22	14:28	-	32.65	-	3.51	-
29 Mar 22	14:29	-	32.67	-	3.50	-
29 Mar 22	14:30	-	32.64	-	3.48	-
Max		-	32.68	-	3.52	-
Avg		-	32.32	-	3.48	-

Date	Time	SO2 ppm	NOx ppm	CO ppm	O2 Vol%	CO2 Vol%
29 Mar 22	14:31	-	32.60	-	3.47	-
29 Mar 22	14:32	-	32.58	-	3.45	-
29 Mar 22	14:33	-	32.59	-	3.45	-
29 Mar 22	14:34	-	32.56	-	3.44	-
29 Mar 22	14:35	-	32.59	-	3.44	-
29 Mar 22	14:36	-	32.63	-	3.43	-
29 Mar 22	14:37	-	32.63	-	3.43	-
29 Mar 22	14:38	-	32.70	-	3.44	-
29 Mar 22	14:39	-	32.73	-	3.45	-
29 Mar 22	14:40	-	32.73	-	3.45	-
29 Mar 22	14:41	-	32.71	-	3.43	-
29 Mar 22	14:42	-	32.70	-	3.44	-
29 Mar 22	14:43	-	32.62	-	3.44	-
29 Mar 22	14:44	-	32.51	-	3.44	-
29 Mar 22	14:45	-	32.53	-	3.44	-
29 Mar 22	14:46	-	32.60	-	3.45	-
29 Mar 22	14:47	-	32.67	-	3.43	-
29 Mar 22	14:48	-	32.64	-	3.43	-
29 Mar 22	14:49	-	32.47	-	3.43	-
29 Mar 22	14:50	-	32.38	-	3.42	-
29 Mar 22	14:51	-	32.30	-	3.39	-
Max		-	32.73	-	3.47	-
Avg		-	32.59	-	3.44	-

Lot No. 2223247-1

ANALYZER CALIBRATION DATA

Client : Global Power Synergy PCL. Location : Auxiliary Boiler 70Ton #2
Date : 30 Mar 22 Test Operator : Saksit P.

O₂ ANALYZER

Model : TELEDYNE API 200EH Serial No. : 774
Span (%) : 25

	Cylinder Value (%)	Initial Analyzers Calibration Response (%)	Final Analyzers Calibration Response (%)	Difference (Percent of Span)
Zero Gas	0.00	0.03	0.00	0.12
Low-Level Gas	8.05	8.08	8.05	0.12
Span Gas	16.06	16.09	16.06	0.12

NO_x ANALYZER

Model : TELEDYNE API 200EH Serial No. : 774
Span (ppm) : 100

	Cylinder Value (ppm)	Initial Analyzers Calibration Response (ppm)	Final Analyzers Calibration Response (ppm)	Difference (Percent of Span)
Zero Gas	0.00	0.04	0.00	0.04
Low-Level Gas	50.32	50.36	50.32	0.04
Span Gas	158.20	158.24	158.20	0.04

Calibrated by

(Mr. Saksit Phaisanphisut)

Environmental Field Scientist (4)

FORM NO.: F 06-104 REVISION NO.: - ISSUE DATE: 3/06/19

ALS Laboratory Group

Lot No. 2223247-1

SYSTEM CALIBRATION BIAS AND DRIFT DATA

Client : Global Power Synergy PCL. Location : Auxiliary Boiler 70Ton #2
Date : 30 Mar 22 Test Operator : Saksit P.

O₂ ANALYZERCylinder Conc. (%) : 16.06 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	0.03	0.03	0.00	0.00	0.12	0.12
Upscale Gas	16.09	16.09	0.00	16.06	0.12	0.12

NO_x ANALYZERCylinder Conc. (ppm) : 158.20 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	0.04	0.04	0.00	0.00	0.04	0.04
Upscale Gas	158.24	158.24	0.00	158.20	0.04	0.04

Calibrated by

(Mr. Saksit Phalsanphisut)

Environmental Field Scientist (4)

FORM NO.: F 06-104 REVISION NO.: - ISSUE DATE: 3/06/19

ALS Laboratory Group



CEMs Data

Client Name Global Power Synergy PCL
Plant Name CUP3

Date 30 Mar 22
Location Auxiliary Boiler 70Ton #2

Run No: 1

Time Base : 21 min

Date	Time	SO2 ppm	NOx ppm	CO ppm	O2 Vol%	CO2 Vol%
30 Mar 22	10:10	-	33.60	-	2.93	-
30 Mar 22	10:11	-	33.00	-	2.94	-
30 Mar 22	10:12	-	32.50	-	2.93	-
30 Mar 22	10:13	-	31.90	-	2.94	-
30 Mar 22	10:14	-	32.90	-	2.95	-
30 Mar 22	10:15	-	33.90	-	2.93	-
30 Mar 22	10:16	-	32.70	-	2.92	-
30 Mar 22	10:17	-	32.80	-	2.90	-
30 Mar 22	10:18	-	32.70	-	2.93	-
30 Mar 22	10:19	-	32.90	-	2.87	-
30 Mar 22	10:20	-	34.30	-	2.91	-
30 Mar 22	10:21	-	34.50	-	2.89	-
30 Mar 22	10:22	-	33.00	-	2.88	-
30 Mar 22	10:23	-	34.00	-	2.90	-
30 Mar 22	10:24	-	32.50	-	2.89	-
30 Mar 22	10:25	-	32.60	-	2.87	-
30 Mar 22	10:26	-	32.30	-	2.86	-
30 Mar 22	10:27	-	32.90	-	2.84	-
30 Mar 22	10:28	-	32.70	-	2.88	-
30 Mar 22	10:29	-	32.40	-	2.87	-
30 Mar 22	10:30	-	32.40	-	2.89	-
Max		-	34.50	-	2.95	-
Avg		-	32.98	-	2.90	-

Run No: 2

Time Base : 21 min

Date	Time	SO2 ppm	NOx ppm	CO ppm	O2 Vol%	CO2 Vol%
30 Mar 22	10:31	-	32.40	-	2.83	-
30 Mar 22	10:32	-	32.20	-	2.84	-
30 Mar 22	10:33	-	31.80	-	2.88	-
30 Mar 22	10:34	-	33.20	-	2.90	-
30 Mar 22	10:35	-	33.20	-	2.88	-
30 Mar 22	10:36	-	32.70	-	2.89	-
30 Mar 22	10:37	-	33.10	-	2.88	-
30 Mar 22	10:38	-	32.80	-	2.84	-
30 Mar 22	10:39	-	32.40	-	2.88	-
30 Mar 22	10:40	-	33.50	-	2.89	-
30 Mar 22	10:41	-	31.80	-	2.88	-
30 Mar 22	10:42	-	33.90	-	2.86	-
30 Mar 22	10:43	-	32.80	-	2.89	-
30 Mar 22	10:44	-	32.20	-	2.89	-
30 Mar 22	10:45	-	32.60	-	2.91	-
30 Mar 22	10:46	-	33.60	-	2.89	-
30 Mar 22	10:47	-	33.20	-	2.89	-
30 Mar 22	10:48	-	33.00	-	2.89	-
30 Mar 22	10:49	-	32.80	-	2.84	-
30 Mar 22	10:50	-	33.60	-	2.89	-
30 Mar 22	10:51	-	33.40	-	2.85	-
Max		-	33.90	-	2.91	-
Avg		-	32.87	-	2.88	-

Run No: 3

Time Base : 21 min

Date	Time	SO2 ppm	NOx ppm	CO ppm	O2 Vol%	CO2 Vol%
30 Mar 22	10:52	-	33.10	-	2.88	-
30 Mar 22	10:53	-	33.00	-	2.85	-
30 Mar 22	10:54	-	34.20	-	2.85	-
30 Mar 22	10:55	-	34.20	-	2.87	-
30 Mar 22	10:56	-	34.00	-	2.88	-
30 Mar 22	10:57	-	32.70	-	2.86	-
30 Mar 22	10:58	-	35.00	-	2.86	-
30 Mar 22	10:59	-	33.70	-	2.89	-
30 Mar 22	11:00	-	33.30	-	2.88	-
30 Mar 22	11:01	-	33.20	-	2.88	-
30 Mar 22	11:02	-	32.30	-	2.89	-
30 Mar 22	11:03	-	32.40	-	2.85	-
30 Mar 22	11:04	-	33.30	-	2.89	-
30 Mar 22	11:05	-	33.20	-	2.83	-
30 Mar 22	11:06	-	33.20	-	2.83	-
30 Mar 22	11:07	-	32.30	-	2.86	-
30 Mar 22	11:08	-	32.80	-	2.87	-
30 Mar 22	11:09	-	34.30	-	2.82	-
30 Mar 22	11:10	-	35.20	-	2.82	-
30 Mar 22	11:11	-	35.60	-	2.85	-
30 Mar 22	11:12	-	34.80	-	2.84	-
Max		-	35.60	-	2.89	-
Avg		-	33.61	-	2.86	-

Run No: 4

Time Base : 21 min

Date	Time	SO2 ppm	NOx ppm	CO ppm	O2 Vol%	CO2 Vol%
30 Mar 22	11:13	-	34.00	-	2.86	-
30 Mar 22	11:14	-	33.30	-	2.83	-
30 Mar 22	11:15	-	33.00	-	2.82	-
30 Mar 22	11:16	-	32.30	-	2.84	-
30 Mar 22	11:17	-	33.20	-	2.87	-
30 Mar 22	11:18	-	33.00	-	2.79	-
30 Mar 22	11:19	-	34.20	-	2.86	-
30 Mar 22	11:20	-	33.60	-	2.85	-
30 Mar 22	11:21	-	34.40	-	2.81	-
30 Mar 22	11:22	-	34.30	-	2.85	-
30 Mar 22	11:23	-	35.40	-	2.86	-
30 Mar 22	11:24	-	32.70	-	2.79	-
30 Mar 22	11:25	-	34.10	-	2.87	-
30 Mar 22	11:26	-	34.50	-	2.82	-
30 Mar 22	11:27	-	33.80	-	2.82	-
30 Mar 22	11:28	-	33.50	-	2.86	-
30 Mar 22	11:29	-	33.30	-	2.83	-
30 Mar 22	11:30	-	32.50	-	2.86	-
30 Mar 22	11:31	-	34.00	-	2.87	-
30 Mar 22	11:32	-	33.20	-	2.86	-
30 Mar 22	11:33	-	33.20	-	2.84	-
Max		-	35.40	-	2.87	-
Avg		-	33.60	-	2.84	-

Run No: 5

Time Base : 21 min

Date	Time	SO2 ppm	NOx ppm	CO ppm	O2 Vol%	CO2 Vol%
30 Mar 22	11:34	-	34.50	-	2.85	-
30 Mar 22	11:35	-	34.20	-	2.83	-
30 Mar 22	11:36	-	33.90	-	2.81	-
30 Mar 22	11:37	-	32.60	-	2.87	-
30 Mar 22	11:38	-	33.30	-	2.83	-
30 Mar 22	11:39	-	35.20	-	2.86	-
30 Mar 22	11:40	-	34.60	-	2.84	-
30 Mar 22	11:41	-	34.00	-	2.85	-
30 Mar 22	11:42	-	33.80	-	2.80	-
30 Mar 22	11:43	-	36.20	-	2.81	-
30 Mar 22	11:44	-	33.90	-	2.75	-
30 Mar 22	11:45	-	34.30	-	2.75	-
30 Mar 22	11:46	-	35.00	-	2.77	-
30 Mar 22	11:47	-	34.60	-	2.80	-
30 Mar 22	11:48	-	34.80	-	2.76	-
30 Mar 22	11:49	-	35.30	-	2.81	-
30 Mar 22	11:50	-	34.00	-	2.83	-
30 Mar 22	11:51	-	33.20	-	2.80	-
30 Mar 22	11:52	-	34.20	-	2.79	-
30 Mar 22	11:53	-	34.70	-	2.76	-
30 Mar 22	11:54	-	34.40	-	2.80	-
Max		-	36.20	-	2.87	-
Avg		-	34.32	-	2.81	-

Run No: 6

Time Base : 21 min

Date	Time	SO2 ppm	NOx ppm	CO ppm	O2 Vol%	CO2 Vol%
30 Mar 22	11:55	-	35.00	-	2.83	-
30 Mar 22	11:56	-	33.80	-	2.78	-
30 Mar 22	11:57	-	34.60	-	2.76	-
30 Mar 22	11:58	-	32.70	-	2.77	-
30 Mar 22	11:59	-	34.50	-	2.78	-
30 Mar 22	12:00	-	34.40	-	2.73	-
30 Mar 22	12:01	-	35.20	-	2.81	-
30 Mar 22	12:02	-	34.90	-	2.83	-
30 Mar 22	12:03	-	34.00	-	2.84	-
30 Mar 22	12:04	-	35.40	-	2.86	-
30 Mar 22	12:05	-	34.50	-	2.85	-
30 Mar 22	12:06	-	34.60	-	2.83	-
30 Mar 22	12:07	-	33.90	-	2.87	-
30 Mar 22	12:08	-	34.70	-	2.90	-
30 Mar 22	12:09	-	33.90	-	2.84	-
30 Mar 22	12:10	-	34.30	-	2.86	-
30 Mar 22	12:11	-	33.50	-	2.87	-
30 Mar 22	12:12	-	33.60	-	2.83	-
30 Mar 22	12:13	-	33.40	-	2.83	-
30 Mar 22	12:14	-	32.50	-	2.83	-
30 Mar 22	12:15	-	32.80	-	2.81	-
Max		-	35.40	-	2.90	-
Avg		-	34.10	-	2.82	-



CEMs Data

Client Name Global Power Synergy PCL
Plant Name CUP3

Date 30 Mar 22
Location Auxiliary Boiler 70Ton #2

Run No: 7

Time Base : 21 min

Run No: 8

Time Base : 21 min

Date	Time	SO2 ppm	NOx ppm	CO ppm	O2 Vol%	CO2 Vol%
30 Mar 22	12:16	-	32.00	-	2.78	-
30 Mar 22	12:17	-	31.90	-	2.80	-
30 Mar 22	12:18	-	33.00	-	2.81	-
30 Mar 22	12:19	-	34.20	-	2.80	-
30 Mar 22	12:20	-	33.50	-	2.80	-
30 Mar 22	12:21	-	33.20	-	2.77	-
30 Mar 22	12:22	-	32.70	-	2.80	-
30 Mar 22	12:23	-	33.10	-	2.75	-
30 Mar 22	12:24	-	34.20	-	2.80	-
30 Mar 22	12:25	-	34.10	-	2.84	-
30 Mar 22	12:26	-	32.40	-	2.81	-
30 Mar 22	12:27	-	32.90	-	2.84	-
30 Mar 22	12:28	-	32.40	-	2.83	-
30 Mar 22	12:29	-	32.00	-	2.80	-
30 Mar 22	12:30	-	32.70	-	2.77	-
30 Mar 22	12:31	-	32.90	-	2.78	-
30 Mar 22	12:32	-	33.40	-	2.77	-
30 Mar 22	12:33	-	35.40	-	2.80	-
30 Mar 22	12:34	-	33.50	-	2.84	-
30 Mar 22	12:35	-	33.60	-	2.84	-
30 Mar 22	12:36	-	34.50	-	2.84	-
Max		-	35.40	-	2.84	-
Avg		-	33.22	-	2.80	-

Date	Time	SO2 ppm	NOx ppm	CO ppm	O2 Vol%	CO2 Vol%
30 Mar 22	12:37	-	34.20	-	2.83	-
30 Mar 22	12:38	-	35.30	-	2.81	-
30 Mar 22	12:39	-	33.30	-	2.87	-
30 Mar 22	12:40	-	33.40	-	2.88	-
30 Mar 22	12:41	-	34.20	-	2.85	-
30 Mar 22	12:42	-	34.20	-	2.85	-
30 Mar 22	12:43	-	34.00	-	2.84	-
30 Mar 22	12:44	-	33.40	-	2.82	-
30 Mar 22	12:45	-	35.10	-	2.78	-
30 Mar 22	12:46	-	33.60	-	2.77	-
30 Mar 22	12:47	-	33.90	-	2.83	-
30 Mar 22	12:48	-	33.50	-	2.85	-
30 Mar 22	12:49	-	34.70	-	2.78	-
30 Mar 22	12:50	-	34.00	-	2.78	-
30 Mar 22	12:51	-	33.30	-	2.80	-
30 Mar 22	12:52	-	32.70	-	2.78	-
30 Mar 22	12:53	-	33.20	-	2.81	-
30 Mar 22	12:54	-	33.70	-	2.81	-
30 Mar 22	12:55	-	33.50	-	2.76	-
30 Mar 22	12:56	-	33.80	-	2.80	-
30 Mar 22	12:57	-	32.50	-	2.75	-
Max		-	35.30	-	2.88	-
Avg		-	33.79	-	2.81	-

Run No: 9

Time Base : 21 min

Run No: 10

Time Base : 21 min

Date	Time	SO2 ppm	NOx ppm	CO ppm	O2 Vol%	CO2 Vol%
30 Mar 22	12:58	-	32.50	-	2.80	-
30 Mar 22	12:59	-	32.20	-	2.78	-
30 Mar 22	13:00	-	33.60	-	2.79	-
30 Mar 22	13:01	-	33.40	-	2.74	-
30 Mar 22	13:02	-	31.90	-	2.72	-
30 Mar 22	13:03	-	34.10	-	2.72	-
30 Mar 22	13:04	-	34.00	-	2.72	-
30 Mar 22	13:05	-	34.10	-	2.73	-
30 Mar 22	13:06	-	32.20	-	2.73	-
30 Mar 22	13:07	-	34.60	-	2.74	-
30 Mar 22	13:08	-	33.70	-	2.74	-
30 Mar 22	13:09	-	33.40	-	2.70	-
30 Mar 22	13:10	-	34.90	-	2.75	-
30 Mar 22	13:11	-	34.40	-	2.77	-
30 Mar 22	13:12	-	32.20	-	2.78	-
30 Mar 22	13:13	-	32.80	-	2.79	-
30 Mar 22	13:14	-	34.40	-	2.73	-
30 Mar 22	13:15	-	34.30	-	2.75	-
30 Mar 22	13:16	-	34.50	-	2.73	-
30 Mar 22	13:17	-	33.90	-	2.79	-
30 Mar 22	13:18	-	33.50	-	2.74	-
Max		-	34.90	-	2.80	-
Avg		-	33.55	-	2.75	-

Date	Time	SO2 ppm	NOx ppm	CO ppm	O2 Vol%	CO2 Vol%
30 Mar 22	13:19	-	33.70	-	2.72	-
30 Mar 22	13:20	-	33.50	-	2.74	-
30 Mar 22	13:21	-	33.10	-	2.75	-
30 Mar 22	13:22	-	32.90	-	2.76	-
30 Mar 22	13:23	-	32.30	-	2.75	-
30 Mar 22	13:24	-	33.90	-	2.75	-
30 Mar 22	13:25	-	33.80	-	2.78	-
30 Mar 22	13:26	-	34.40	-	2.79	-
30 Mar 22	13:27	-	34.90	-	2.80	-
30 Mar 22	13:28	-	34.30	-	2.77	-
30 Mar 22	13:29	-	33.00	-	2.82	-
30 Mar 22	13:30	-	35.00	-	2.88	-
30 Mar 22	13:31	-	35.50	-	2.89	-
30 Mar 22	13:32	-	34.10	-	2.90	-
30 Mar 22	13:33	-	35.30	-	2.93	-
30 Mar 22	13:34	-	34.70	-	2.90	-
30 Mar 22	13:35	-	35.50	-	2.87	-
30 Mar 22	13:36	-	36.00	-	2.92	-
30 Mar 22	13:37	-	35.00	-	2.94	-
30 Mar 22	13:38	-	34.70	-	2.95	-
30 Mar 22	13:39	-	36.40	-	2.97	-
Max		-	36.40	-	2.97	-
Avg		-	34.38	-	2.84	-

Run No: 11

Time Base : 21 min

Run No: 12

Time Base : 21 min

Date	Time	SO2 ppm	NOx ppm	CO ppm	O2 Vol%	CO2 Vol%
30 Mar 22	13:40	-	36.70	-	2.99	-
30 Mar 22	13:41	-	35.90	-	3.03	-
30 Mar 22	13:42	-	36.80	-	3.06	-
30 Mar 22	13:43	-	35.90	-	3.05	-
30 Mar 22	13:44	-	36.20	-	3.07	-
30 Mar 22	13:45	-	36.90	-	3.01	-
30 Mar 22	13:46	-	37.80	-	3.00	-
30 Mar 22	13:47	-	35.60	-	3.07	-
30 Mar 22	13:48	-	34.30	-	3.08	-
30 Mar 22	13:49	-	34.90	-	3.14	-
30 Mar 22	13:50	-	35.70	-	3.09	-
30 Mar 22	13:51	-	35.10	-	3.15	-
30 Mar 22	13:52	-	36.10	-	3.13	-
30 Mar 22	13:53	-	34.10	-	3.16	-
30 Mar 22	13:54	-	36.10	-	3.14	-
30 Mar 22	13:55	-	36.40	-	3.14	-
30 Mar 22	13:56	-	34.90	-	3.11	-
30 Mar 22	13:57	-	36.20	-	3.11	-
30 Mar 22	13:58	-	36.10	-	3.09	-
30 Mar 22	13:59	-	33.20	-	3.08	-
30 Mar 22	14:00	-	35.00	-	3.05	-
Max		-	37.80	-	3.16	-
Avg		-	35.71	-	3.08	-

Date	Time	SO2 ppm	NOx ppm	CO ppm	O2 Vol%	CO2 Vol%
30 Mar 22	14:01	-	34.60	-	3.08	-
30 Mar 22	14:02	-	35.30	-	3.06	-
30 Mar 22	14:03	-	34.20	-	3.06	-
30 Mar 22	14:04	-	35.20	-	3.06	-
30 Mar 22	14:05	-	35.50	-	3.04	-
30 Mar 22	14:06	-	34.70	-	3.02	-
30 Mar 22	14:07	-	33.30	-	3.00	-
30 Mar 22	14:08	-	33.80	-	2.99	-
30 Mar 22	14:09	-	31.30	-	3.00	-
30 Mar 22	14:10	-	33.40	-	2.95	-
30 Mar 22	14:11	-	33.40	-	2.99	-
30 Mar 22	14:12	-	32.70	-	2.97	-
30 Mar 22	14:13	-	33.60	-	3.00	-
30 Mar 22	14:14	-	32.60	-	2.97	-
30 Mar 22	14:15	-	35.10	-	3.07	-
30 Mar 22	14:16	-	33.50	-	2.99	-
30 Mar 22	14:17	-	32.80	-	2.98	-
30 Mar 22	14:18	-	32.70	-	3.01	-
30 Mar 22	14:19	-	34.40	-	3.01	-
30 Mar 22	14:20	-	34.40	-	2.95	-
30 Mar 22	14:21	-	34.30	-	2.96	-
Max		-	35.50	-	3.08	-
Avg		-	33.85	-	3.01	-



Reference Method Data

Client Name Global Power Synergy PCL
Plant Name CUP3

Date 30 Mar 22
Location Auxiliary Boiler 70Ton #2

Run No: 1

Time Base : 21 min

Run No: 2

Time Base : 21 min

Date	Time	SO2 ppm	NOx ppm	CO ppm	O2 Vol%	CO2 Vol%
30 Mar 22	10:10	-	33.02	-	2.97	-
30 Mar 22	10:11	-	33.00	-	2.95	-
30 Mar 22	10:12	-	33.00	-	2.92	-
30 Mar 22	10:13	-	32.98	-	2.93	-
30 Mar 22	10:14	-	32.93	-	2.93	-
30 Mar 22	10:15	-	32.90	-	2.96	-
30 Mar 22	10:16	-	32.84	-	2.93	-
30 Mar 22	10:17	-	32.81	-	2.92	-
30 Mar 22	10:18	-	32.91	-	2.92	-
30 Mar 22	10:19	-	32.96	-	2.92	-
30 Mar 22	10:20	-	32.95	-	2.90	-
30 Mar 22	10:21	-	32.88	-	2.88	-
30 Mar 22	10:22	-	32.79	-	2.88	-
30 Mar 22	10:23	-	32.77	-	2.88	-
30 Mar 22	10:24	-	32.79	-	2.89	-
30 Mar 22	10:25	-	32.83	-	2.90	-
30 Mar 22	10:26	-	32.76	-	2.88	-
30 Mar 22	10:27	-	32.58	-	2.87	-
30 Mar 22	10:28	-	32.33	-	2.85	-
30 Mar 22	10:29	-	32.15	-	2.86	-
30 Mar 22	10:30	-	32.06	-	2.87	-
Max		-	33.02	-	2.97	-
Avg		-	32.77	-	2.90	-

Date	Time	SO2 ppm	NOx ppm	CO ppm	O2 Vol%	CO2 Vol%
30 Mar 22	10:31	-	32.01	-	2.87	-
30 Mar 22	10:32	-	31.93	-	2.87	-
30 Mar 22	10:33	-	31.88	-	2.84	-
30 Mar 22	10:34	-	31.87	-	2.84	-
30 Mar 22	10:35	-	31.93	-	2.88	-
30 Mar 22	10:36	-	32.04	-	2.89	-
30 Mar 22	10:37	-	32.09	-	2.88	-
30 Mar 22	10:38	-	32.19	-	2.87	-
30 Mar 22	10:39	-	32.30	-	2.85	-
30 Mar 22	10:40	-	32.29	-	2.85	-
30 Mar 22	10:41	-	32.20	-	2.88	-
30 Mar 22	10:42	-	32.19	-	2.88	-
30 Mar 22	10:43	-	32.27	-	2.87	-
30 Mar 22	10:44	-	32.25	-	2.87	-
30 Mar 22	10:45	-	32.27	-	2.89	-
30 Mar 22	10:46	-	32.29	-	2.89	-
30 Mar 22	10:47	-	32.37	-	2.90	-
30 Mar 22	10:48	-	32.50	-	2.89	-
30 Mar 22	10:49	-	32.56	-	2.89	-
30 Mar 22	10:50	-	32.53	-	2.88	-
30 Mar 22	10:51	-	32.43	-	2.86	-
Max		-	32.56	-	2.90	-
Avg		-	32.21	-	2.87	-

Run No: 3

Time Base : 21 min

Run No: 4

Time Base : 21 min

Date	Time	SO2 ppm	NOx ppm	CO ppm	O2 Vol%	CO2 Vol%
30 Mar 22	10:52	-	32.40	-	2.88	-
30 Mar 22	10:53	-	32.49	-	2.85	-
30 Mar 22	10:54	-	32.65	-	2.83	-
30 Mar 22	10:55	-	32.74	-	2.84	-
30 Mar 22	10:56	-	32.85	-	2.85	-
30 Mar 22	10:57	-	32.82	-	2.86	-
30 Mar 22	10:58	-	32.79	-	2.87	-
30 Mar 22	10:59	-	32.79	-	2.85	-
30 Mar 22	11:00	-	32.85	-	2.86	-
30 Mar 22	11:01	-	32.91	-	2.88	-
30 Mar 22	11:02	-	32.92	-	2.87	-
30 Mar 22	11:03	-	32.89	-	2.87	-
30 Mar 22	11:04	-	32.83	-	2.85	-
30 Mar 22	11:05	-	32.77	-	2.88	-
30 Mar 22	11:06	-	32.89	-	2.87	-
30 Mar 22	11:07	-	33.01	-	2.84	-
30 Mar 22	11:08	-	33.00	-	2.83	-
30 Mar 22	11:09	-	33.01	-	2.84	-
30 Mar 22	11:10	-	33.15	-	2.82	-
30 Mar 22	11:11	-	33.33	-	2.81	-
30 Mar 22	11:12	-	33.45	-	2.81	-
Max		-	33.45	-	2.88	-
Avg		-	32.88	-	2.85	-

Date	Time	SO2 ppm	NOx ppm	CO ppm	O2 Vol%	CO2 Vol%
30 Mar 22	11:13	-	33.54	-	2.83	-
30 Mar 22	11:14	-	33.45	-	2.84	-
30 Mar 22	11:15	-	33.32	-	2.84	-
30 Mar 22	11:16	-	33.21	-	2.82	-
30 Mar 22	11:17	-	33.10	-	2.82	-
30 Mar 22	11:18	-	32.99	-	2.84	-
30 Mar 22	11:19	-	33.04	-	2.83	-
30 Mar 22	11:20	-	33.15	-	2.79	-
30 Mar 22	11:21	-	33.19	-	2.84	-
30 Mar 22	11:22	-	33.19	-	2.83	-
30 Mar 22	11:23	-	33.15	-	2.82	-
30 Mar 22	11:24	-	33.06	-	2.84	-
30 Mar 22	11:25	-	32.99	-	2.83	-
30 Mar 22	11:26	-	32.96	-	2.81	-
30 Mar 22	11:27	-	32.99	-	2.84	-
30 Mar 22	11:28	-	32.99	-	2.81	-
30 Mar 22	11:29	-	33.01	-	2.82	-
30 Mar 22	11:30	-	33.05	-	2.84	-
30 Mar 22	11:31	-	33.02	-	2.84	-
30 Mar 22	11:32	-	33.01	-	2.84	-
30 Mar 22	11:33	-	33.01	-	2.86	-
Max		-	33.54	-	2.86	-
Avg		-	33.12	-	2.83	-

Run No: 5

Time Base : 21 min

Run No: 6

Time Base : 21 min

Date	Time	SO2 ppm	NOx ppm	CO ppm	O2 Vol%	CO2 Vol%
30 Mar 22	11:34	-	33.04	-	2.86	-
30 Mar 22	11:35	-	33.12	-	2.82	-
30 Mar 22	11:36	-	33.28	-	2.83	-
30 Mar 22	11:37	-	33.37	-	2.81	-
30 Mar 22	11:38	-	33.45	-	2.83	-
30 Mar 22	11:39	-	33.55	-	2.85	-
30 Mar 22	11:40	-	33.65	-	2.84	-
30 Mar 22	11:41	-	33.66	-	2.84	-
30 Mar 22	11:42	-	33.65	-	2.84	-
30 Mar 22	11:43	-	33.65	-	2.84	-
30 Mar 22	11:44	-	33.72	-	2.81	-
30 Mar 22	11:45	-	33.77	-	2.78	-
30 Mar 22	11:46	-	33.74	-	2.76	-
30 Mar 22	11:47	-	33.66	-	2.76	-
30 Mar 22	11:48	-	33.61	-	2.77	-
30 Mar 22	11:49	-	33.61	-	2.79	-
30 Mar 22	11:50	-	33.61	-	2.76	-
30 Mar 22	11:51	-	33.50	-	2.79	-
30 Mar 22	11:52	-	33.42	-	2.81	-
30 Mar 22	11:53	-	33.45	-	2.78	-
30 Mar 22	11:54	-	33.47	-	2.77	-
Max		-	33.77	-	2.86	-
Avg		-	33.52	-	2.81	-

Date	Time	SO2 ppm	NOx ppm	CO ppm	O2 Vol%	CO2 Vol%
30 Mar 22	11:55	-	33.44	-	2.76	-
30 Mar 22	11:56	-	33.38	-	2.79	-
30 Mar 22	11:57	-	33.29	-	2.82	-
30 Mar 22	11:58	-	33.29	-	2.77	-
30 Mar 22	11:59	-	33.33	-	2.77	-
30 Mar 22	12:00	-	33.46	-	2.75	-
30 Mar 22	12:01	-	33.56	-	2.76	-
30 Mar 22	12:02	-	33.58	-	2.74	-
30 Mar 22	12:03	-	33.57	-	2.81	-
30 Mar 22	12:04	-	33.56	-	2.82	-
30 Mar 22	12:05	-	33.50	-	2.82	-
30 Mar 22	12:06	-	33.35	-	2.86	-
30 Mar 22	12:07	-	33.32	-	2.83	-
30 Mar 22	12:08	-	33.40	-	2.83	-
30 Mar 22	12:09	-	33.39	-	2.87	-
30 Mar 22	12:10	-	33.35	-	2.88	-
30 Mar 22	12:11	-	33.35	-	2.84	-
30 Mar 22	12:12	-	33.36	-	2.86	-
30 Mar 22	12:13	-	33.29	-	2.85	-
30 Mar 22	12:14	-	33.30	-	2.83	-
30 Mar 22	12:15	-	33.30	-	2.83	-
Max		-	33.58	-	2.88	-
Avg		-	33.40	-	2.81	-



Reference Method Data

Client Name Global Power Synergy PCL
Plant Name CUP3

Date 30 Mar 22
Location Auxiliary Boiler 70Ton #2

Run No: 7

Time Base : 21 min

Run No: 8

Time Base : 21 min

Date	Time	SO2 ppm	NOx ppm	CO ppm	O2 Vol%	CO2 Vol%
30 Mar 22	12:16	-	33.19	-	2.82	-
30 Mar 22	12:17	-	33.00	-	2.78	-
30 Mar 22	12:18	-	32.90	-	2.77	-
30 Mar 22	12:19	-	32.89	-	2.79	-
30 Mar 22	12:20	-	32.99	-	2.79	-
30 Mar 22	12:21	-	33.05	-	2.80	-
30 Mar 22	12:22	-	33.08	-	2.78	-
30 Mar 22	12:23	-	33.08	-	2.77	-
30 Mar 22	12:24	-	33.05	-	2.78	-
30 Mar 22	12:25	-	33.03	-	2.76	-
30 Mar 22	12:26	-	33.02	-	2.78	-
30 Mar 22	12:27	-	32.97	-	2.81	-
30 Mar 22	12:28	-	32.96	-	2.80	-
30 Mar 22	12:29	-	33.01	-	2.84	-
30 Mar 22	12:30	-	32.98	-	2.82	-
30 Mar 22	12:31	-	32.90	-	2.79	-
30 Mar 22	12:32	-	32.86	-	2.77	-
30 Mar 22	12:33	-	32.81	-	2.77	-
30 Mar 22	12:34	-	32.76	-	2.78	-
30 Mar 22	12:35	-	32.73	-	2.80	-
30 Mar 22	12:36	-	32.70	-	2.83	-
Max		-	33.19	-	2.84	-
Avg		-	32.95	-	2.79	-

Date	Time	SO2 ppm	NOx ppm	CO ppm	O2 Vol%	CO2 Vol%
30 Mar 22	12:37	-	32.75	-	2.84	-
30 Mar 22	12:38	-	32.76	-	2.83	-
30 Mar 22	12:39	-	32.69	-	2.82	-
30 Mar 22	12:40	-	32.67	-	2.81	-
30 Mar 22	12:41	-	32.69	-	2.86	-
30 Mar 22	12:42	-	32.67	-	2.85	-
30 Mar 22	12:43	-	32.76	-	2.82	-
30 Mar 22	12:44	-	32.77	-	2.84	-
30 Mar 22	12:45	-	32.86	-	2.82	-
30 Mar 22	12:46	-	32.88	-	2.81	-
30 Mar 22	12:47	-	32.93	-	2.79	-
30 Mar 22	12:48	-	32.84	-	2.78	-
30 Mar 22	12:49	-	32.82	-	2.81	-
30 Mar 22	12:50	-	32.85	-	2.82	-
30 Mar 22	12:51	-	32.86	-	2.77	-
30 Mar 22	12:52	-	32.89	-	2.77	-
30 Mar 22	12:53	-	32.97	-	2.79	-
30 Mar 22	12:54	-	33.02	-	2.78	-
30 Mar 22	12:55	-	33.06	-	2.79	-
30 Mar 22	12:56	-	33.07	-	2.79	-
30 Mar 22	12:57	-	33.11	-	2.76	-
Max		-	33.11	-	2.86	-
Avg		-	32.85	-	2.81	-

Run No: 9

Time Base : 21 min

Run No: 10

Time Base : 21 min

Date	Time	SO2 ppm	NOx ppm	CO ppm	O2 Vol%	CO2 Vol%
30 Mar 22	12:58	-	33.06	-	2.77	-
30 Mar 22	12:59	-	32.91	-	2.77	-
30 Mar 22	13:00	-	32.89	-	2.79	-
30 Mar 22	13:01	-	32.87	-	2.78	-
30 Mar 22	13:02	-	32.91	-	2.76	-
30 Mar 22	13:03	-	32.89	-	2.75	-
30 Mar 22	13:04	-	32.88	-	2.72	-
30 Mar 22	13:05	-	32.84	-	2.71	-
30 Mar 22	13:06	-	32.88	-	2.72	-
30 Mar 22	13:07	-	32.93	-	2.71	-
30 Mar 22	13:08	-	33.04	-	2.70	-
30 Mar 22	13:09	-	33.01	-	2.74	-
30 Mar 22	13:10	-	33.01	-	2.73	-
30 Mar 22	13:11	-	32.98	-	2.71	-
30 Mar 22	13:12	-	33.06	-	2.73	-
30 Mar 22	13:13	-	33.08	-	2.76	-
30 Mar 22	13:14	-	33.03	-	2.79	-
30 Mar 22	13:15	-	33.00	-	2.76	-
30 Mar 22	13:16	-	33.02	-	2.73	-
30 Mar 22	13:17	-	33.07	-	2.73	-
30 Mar 22	13:18	-	33.01	-	2.74	-
Max		-	33.08	-	2.79	-
Avg		-	32.97	-	2.74	-

Date	Time	SO2 ppm	NOx ppm	CO ppm	O2 Vol%	CO2 Vol%
30 Mar 22	13:19	-	32.97	-	2.76	-
30 Mar 22	13:20	-	33.05	-	2.73	-
30 Mar 22	13:21	-	33.05	-	2.72	-
30 Mar 22	13:22	-	33.09	-	2.73	-
30 Mar 22	13:23	-	33.06	-	2.75	-
30 Mar 22	13:24	-	33.10	-	2.75	-
30 Mar 22	13:25	-	33.08	-	2.74	-
30 Mar 22	13:26	-	32.99	-	2.74	-
30 Mar 22	13:27	-	32.93	-	2.77	-
30 Mar 22	13:28	-	32.95	-	2.78	-
30 Mar 22	13:29	-	32.99	-	2.78	-
30 Mar 22	13:30	-	33.09	-	2.78	-
30 Mar 22	13:31	-	33.44	-	2.82	-
30 Mar 22	13:32	-	33.97	-	2.86	-
30 Mar 22	13:33	-	34.41	-	2.87	-
30 Mar 22	13:34	-	34.59	-	2.89	-
30 Mar 22	13:35	-	34.63	-	2.90	-
30 Mar 22	13:36	-	34.57	-	2.90	-
30 Mar 22	13:37	-	34.44	-	2.89	-
30 Mar 22	13:38	-	34.42	-	2.92	-
30 Mar 22	13:39	-	34.49	-	2.93	-
Max		-	34.63	-	2.93	-
Avg		-	33.59	-	2.81	-

Run No: 11

Time Base : 21 min

Run No: 12

Time Base : 21 min

Date	Time	SO2 ppm	NOx ppm	CO ppm	O2 Vol%	CO2 Vol%
30 Mar 22	13:40	-	34.66	-	2.95	-
30 Mar 22	13:41	-	34.74	-	2.96	-
30 Mar 22	13:42	-	34.94	-	2.99	-
30 Mar 22	13:43	-	35.20	-	3.03	-
30 Mar 22	13:44	-	35.40	-	3.04	-
30 Mar 22	13:45	-	35.55	-	3.05	-
30 Mar 22	13:46	-	35.51	-	3.05	-
30 Mar 22	13:47	-	35.38	-	2.98	-
30 Mar 22	13:48	-	35.21	-	3.03	-
30 Mar 22	13:49	-	35.05	-	3.04	-
30 Mar 22	13:50	-	35.03	-	3.07	-
30 Mar 22	13:51	-	34.99	-	3.11	-
30 Mar 22	13:52	-	34.88	-	3.11	-
30 Mar 22	13:53	-	34.74	-	3.13	-
30 Mar 22	13:54	-	34.59	-	3.13	-
30 Mar 22	13:55	-	34.51	-	3.15	-
30 Mar 22	13:56	-	34.55	-	3.15	-
30 Mar 22	13:57	-	34.66	-	3.11	-
30 Mar 22	13:58	-	34.73	-	3.11	-
30 Mar 22	13:59	-	34.79	-	3.09	-
30 Mar 22	14:00	-	34.80	-	3.09	-
Max		-	35.55	-	3.15	-
Avg		-	34.95	-	3.07	-

Date	Time	SO2 ppm	NOx ppm	CO ppm	O2 Vol%	CO2 Vol%
30 Mar 22	14:01	-	34.59	-	3.08	-
30 Mar 22	14:02	-	34.44	-	3.07	-
30 Mar 22	14:03	-	34.33	-	3.07	-
30 Mar 22	14:04	-	34.34	-	3.05	-
30 Mar 22	14:05	-	34.26	-	3.03	-
30 Mar 22	14:06	-	34.03	-	3.03	-
30 Mar 22	14:07	-	33.64	-	3.04	-
30 Mar 22	14:08	-	33.36	-	3.02	-
30 Mar 22	14:09	-	33.16	-	3.00	-
30 Mar 22	14:10	-	32.92	-	2.99	-
30 Mar 22	14:11	-	32.75	-	2.99	-
30 Mar 22	14:12	-	32.73	-	2.96	-
30 Mar 22	14:13	-	32.81	-	2.98	-
30 Mar 22	14:14	-	32.98	-	2.96	-
30 Mar 22	14:15	-	33.12	-	2.99	-
30 Mar 22	14:16	-	33.15	-	2.99	-
30 Mar 22	14:17	-	33.20	-	3.02	-
30 Mar 22	14:18	-	33.33	-	2.98	-
30 Mar 22	14:19	-	33.39	-	2.98	-
30 Mar 22	14:20	-	33.42	-	3.01	-
30 Mar 22	14:21	-	33.48	-	2.99	-
Max		-	34.59	-	3.08	-
Avg		-	33.50	-	3.01	-

CERTIFICATE OF ANALYSIS

Grade of Product: EPA Protocol

Part Number:	E04NI99E15A0617	Reference Number:	160-401977168-1
Cylinder Number:	EB0140265	Cylinder Volume:	144.4 CF
Laboratory:	124 - Plumsteadville - PA	Cylinder Pressure:	2015 PSIG
PGVP Number:	A12020	Valve Outlet:	660
Gas Code:	CO,NO,NOX,SO2,BALN	Certification Date:	Dec 22, 2020

Expiration Date: Dec 22, 2028

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	160.0 PPM	158.2 PPM	G1	+/- 0.7% NIST Traceable	12/14/2020, 12/22/2020
CARBON MONOXIDE	160.0 PPM	157.5 PPM	G1	+/- 0.5% NIST Traceable	12/14/2020
NITRIC OXIDE	160.0 PPM	158.1 PPM	G1	+/- 0.7% NIST Traceable	12/14/2020, 12/22/2020
SULFUR DIOXIDE	160.0 PPM	161.6 PPM	G1	+/- 1.0% NIST Traceable	12/14/2020, 12/22/2020
NITROGEN	Balance				

CALIBRATION STANDARDS					
Type	Lot ID	Cylinder No	Concentration	Uncertainty	Expiration Date
NTRM	13010210	KAL003128	246.9 PPM CARBON MONOXIDE/NITROGEN	+/- 0.2%	Oct 16, 2024
PRM	12386	D685025	9.91 PPM AIR/NITROGEN DIOXIDE	2.0%	Feb 20, 2020
NTRM	13010302	KAL003022	243.4 PPM NITRIC OXIDE/NITROGEN	+/- 0.5%	May 04, 2026
GMIS	124206889	CC323707	4.028 PPM NITROGEN DIOXIDE/NITROGEN	2.1%	Aug 15, 2021
NTRM	10010212	AAL072873	255.3 PPM SULFUR DIOXIDE/NITROGEN	+/-0.8%	Apr 25, 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 6700 APW1100391 CO	FTIR	Nov 30, 2020
Nicolet 6700 APW1100391 NO	FTIR	Dec 02, 2020
Nicolet 6700 APW1100391 NO2	FTIR	Dec 02, 2020
Nicolet 6700 APW1100391 SO2	FTIR	Dec 10, 2020

Triad Data Available Upon Request

NOTES:

Gross Weight: 27.7 Kg
Net Weight: 4.7 Kg



Michael A. Fisher
Approved for Release

CERTIFICATE OF ANALYSIS

Grade of Product: EPA Protocol

Part Number: E04NI99E3HA0023 Reference Number: 160-401754137-1
Cylinder Number: GN0024388 Cylinder Volume: 247.2 CF
Laboratory: 124 - Plumsteadville - PA Cylinder Pressure: 2215 PSIG
PGVP Number: A12020 Valve Outlet: 660
Gas Code: CO,NO,NOX,SO2,BALN Certification Date: Mar 26, 2020

Expiration Date: Mar 26, 2028

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	50.00 PPM	50.32 PPM	G1	+/- 0.8% NIST Traceable	03/19/2020, 03/26/2020
CARBON MONOXIDE	50.00 PPM	49.99 PPM	G1	+/- 0.5% NIST Traceable	03/19/2020
NITRIC OXIDE	50.00 PPM	50.32 PPM	G1	+/- 0.8% NIST Traceable	03/19/2020, 03/26/2020
SULFUR DIOXIDE	50.00 PPM	50.27 PPM	G1	+/- 0.8% NIST Traceable	03/19/2020, 03/26/2020
NITROGEN	Balance				

CALIBRATION STANDARDS

Type	Lot ID	Cylinder No	Concentration	Uncertainty	Expiration Date
NTRM	11010130	KAL004536	97.31 PPM CARBON MONOXIDE/NITROGEN	+/- 0.4%	Oct 04, 2022
NTRM	13010405	KAL003984	97.60 PPM NITRIC OXIDE/NITROGEN	+/- 0.8%	Jul 23, 2025
NTRM	13010405	KAL003984	97.60 PPM NOx/NITROGEN	+/- 0.8%	Jul 23, 2025
NTRM	16010235	KAL004419	97.69 PPM SULFUR DIOXIDE/NITROGEN	+/- 0.8%	Dec 23, 2021

ANALYTICAL EQUIPMENT

Instrument/Make/Model	Analytical Principle	Last Multipoint Calibration
MKS FTIR - CO - 000928781	FTIR	Mar 12, 2020
MKS FTIR - NO - 000928781	FTIR	Mar 05, 2020
MKS FTIR - NOx - 000928781	FTIR	Mar 05, 2020
MKS FTIR - SO2 - 000928781	FTIR	Mar 19, 2020



Triad Data Available Upon Request

NOTES: Gross Weight: 47.7 Kg, Net Weight: 7.5 Kg.



Michael A. Miller
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 Certification of Gaseous Calibration Standards using procedure G1. 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: 3983/17		Analyst:  ARISSARA THONGNURL	
Cylinder Number: 40233			
Nominal Cylinder Content: 6.520 M³		Approve:  SUKANYA KAMUTHARAT	
Nominal Pressure: 145.0 Bar			
Valve Outlet: CGA 590 BRASS		To Re-Order Please Quote: 478100-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

<u>Component</u>	<u>Request Concentration</u>	<u>Certified Concentration</u>	<u>Certified Uncertainty</u>	<u>Method</u>	<u>Assay Date</u>
Oxygen In Nitrogen	8.00 %	8.05 %	± 1% relative	(2) I-PB-354	04-Dec-2017

Reference Standard used in Assay

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

Analytical Instruments used in Assay

<u>Instrument/Make/Model</u>	<u>Analytical Principle</u>	<u>Last Multipoint Calibration</u>
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 40233
Production Order Number 90145553

Certification Date: 07-Dec-2017
Expiration Date: 07-Dec-2025

CERTIFICATE OF ANALYSIS

Grade of Product: EPA Protocol

Part Number:	E02NI84E15A07B7	Reference Number:	160-401948145-1
Cylinder Number:	CC740033	Cylinder Volume:	145.8 CF
Laboratory:	124 - Plumsteadville - PA	Cylinder Pressure:	2015 PSIG
PGVP Number:	A12020	Valve Outlet:	590
Gas Code:	O2,BALN	Certification Date:	Nov 11, 2020

Expiration Date: Nov 11, 2028

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
OXYGEN	16.00 %	16.06 %	G1	+/- 0.2% NIST Traceable	11/11/2020
NITROGEN	Balance				

CALIBRATION STANDARDS					
Type	Lot ID	Cylinder No	Concentration	Uncertainty	Expiration Date
NTRM	16060503	CC109542	23.204 % OXYGEN/NITROGEN	+/- 0.2%	Dec 24, 2021

ANALYTICAL EQUIPMENT		
Instrument/Make/Model	Analytical Principle	Last Multipoint Calibration
SIEMENS OXYMAT 6 - N1-W5-951 - O2	PARAMAGNETIC	Oct 26, 2020

Triad Data Available Upon Request

NOTES:

Gross Weight: 27.8 Kg
Net Weight: 4.7 Kg



Chen

Approved for Release



CONSOLE CONTROL UNIT CALIBRATION TEST REPORT

Calibration of Date : 12 Jan 22
Next Cal. Date : 12 Jul 22

Barometric Pressure (mm.Hg) : 760
Relative Humidity (%) : 55.0
Temperature (°C) : 28.0

Console Control Meter Data

Calibration No. : C-120122-BKK_FS0468
Dry Gas Meter No. : BKK_FS0468
Console Serial No. : 1302005
Console Model No. : XC-572-V

Reference Dry Gas Meter Data

Serial No. : 1607009
Model No. : SK25EXSR-QC6
Correction Factor (Yr) : 1.0060
Next Calibration Date : 8 Apr 22

ΔH (mm.H ₂ O)	Θ Minutes	Reference Dry Gas Meter Calibration				Console Control ; Drygas Meter						Dry Gas Meter Correction	Orifice Calibration
		Vr (Liters)			Tr (°C)	Vm (Liters)			Ti (°C)	To (°C)	Avg.Tm (°C)	Factor (Y)	Factor $\Delta H@$
		Final	Initial	Total		Final	Initial	Total					
15	12.38	150.00	0.00	150.00	30.0	2564504.0	2564355.0	149.00	29.0	29.0	29.0	1.0079	47.0425
25	9.33	150.00	0.00	150.00	31.0	2564661.0	2564510.0	151.00	30.0	30.0	30.0	0.9936	44.6773
50	6.57	150.00	0.00	150.00	31.0	2564821.0	2564670.0	151.00	31.0	31.0	31.0	0.9945	44.1625
80	5.14	150.00	0.00	150.00	31.0	2564983.0	2564830.0	153.00	32.0	32.0	32.0	0.9819	43.1065
120	4.18	150.00	0.00	150.00	32.0	2565149.0	2564995.0	154.00	32.0	32.0	32.0	0.9686	43.0440
											Avg.	0.9893	44.4066

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

$\Delta H@$: Orifice pressure differential that equates to 21.24 lm 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 Phaisanphisut

(Mr.Saksit Phaisanphisut)

Field Scientist (4)

Approved by:

Wichan Choonharat

(Mr.Wichan Choonharat)

Manager



DIGITAL TEMPERATURE CALIBRATION DATA SHEET

Calibration Date :	12-Jan-22	Ambient Temperature (°C) :	28
Calibration sheet No. :	C-120122-BKK_FS0469	Relative Humidity (%) :	55
Digital Temperature ID	BKK_FS0469	Reference Temperature ID	BKK_FS0609
Serial No. :	1302005	Serial No. :	7688004
Model :	XC-572-V	Model :	FLUKE 714
		Next Calibrate :	13 Jan 22

Location	Reference Temperature °C	Digital Temperature °C	Error °C	Remark
Stack	0	0	0	
	25	24	-1	
	50	49	-1	
	100	98	-2	
	150	148	-2	
	200	197	-3	
	250	247	-3	
	300	297	-3	
	500	497	-3	
	1000	997	-3	
	1200	1197	-3	
Probe	100	99	-1	
	125	124	-1	
	150	149	-1	
Oven	100	99	-1	
	125	124	-1	
	150	149	-1	
Filter	100	100	0	
	125	125	0	
	150	149	-1	
Exit	0	0	0	
	10	11	1	
	20	21	1	
Meter	0	0	0	
	25	25	0	
	50	50	0	
AUX	0	0	0	
	25	25	0	
	50	50	0	

Calibrated by

Saksit Phaisanphisut

(Mr.Saksit Phaisanphisut)

Field Scientist (4)

Approved by :

Wichan Choonharat

Mr.Wichan Choonharat

Manager



Pitot Tube Calibration Data

Pitot Tube Identification Number : BKK_FS0472 Calibration Date : 12 Jan 22
 Lab test duct Number : 258-1-13-01 Standard Pitot ID : BKK_FS0441
 Calibration Sheet No. : C-120122-BKK_FS0472 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	16.60	0.842	-
	B	12.00	16.60	-	0.842
Test 2	A	12.00	16.60	0.842	-
	B	12.00	16.60	-	0.842
Test 3	A	12.00	16.60	0.842	-
	B	12.00	16.60	-	0.842
			\bar{C}_p	0.842	0.842

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

$$\bar{C}_{p(A)} - \bar{C}_{p(B)} \Big] must BE \leq 0.01$$

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

Calibrated by

Saksit Phaisanphisut

(Mr.Saksit Phaisanphisut)

Field Scientist (4)

Approved by

Wichan Choonharat

Mr.Wichan Choonharat

Manager



Pitot Tube Calibration Data

Pitot Tube Identification Number : BKK_FS0473 Calibration Date : 12 Jan 22
 Lab test duct Number : 258-1-13-01 Standard Pitot ID : BKK_FS0441
 Calibration Sheet No. : C-120122-BKK_FS0473 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	16.60	0.842	-
	B	12.00	16.60	-	0.842
Test 2	A	12.00	16.60	0.842	-
	B	12.00	16.60	-	0.842
Test 3	A	12.00	16.60	0.842	-
	B	12.00	16.60	-	0.842
			\bar{C}_p	0.842	0.842

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

$$\bar{C}_{p(A)} - \bar{C}_{p(B)} \Big] must BE \leq 0.01$$

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

Calibrated by

Saksit Phaisanphisut

Approved by

Wichan Choonharat

(Mr.Saksit Phaisanphisut)

Mr.Wichan Choonharat

Field Scientist (4)

Manager



PROBE NOZZLE DIAMETER CALIBRATION DATA SHEET

Calibration Date	12 Jan 22	Nozzle Set ID. :	BKK_FS0474
Calibration Sheet No. :	C-120122-BKK_FS0474	Vernier Caliper ID. :	BKK_FS0626

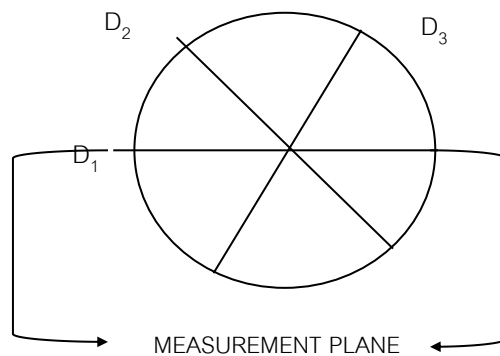
Nozzle ID #	Nozzle Diameter (cm.)			Hi - Lo ΔD	$(D_1 + D_2 + D_3) / 3$ D_{avg}
	D_1	D_2	D_3		
1	0.300	0.300	0.300	0.000	0.300
2	0.450	0.450	0.450	0.000	0.450
3	0.600	0.600	0.600	0.000	0.600
4	0.780	0.780	0.780	0.000	0.780
5	0.932	0.932	0.932	0.000	0.932
6	1.094	1.094	1.094	0.000	1.094
7	1.264	1.264	1.264	0.000	1.264

Where :

D_1, D_2, D_3 = Three different nozzle diameters at 60 degrees to each other, each measured the nearest 0.025 mm.

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

D_{avg} = $(D_1 + D_2 + D_3) / 3$



Calibrated by

Saksit Phaisanphisut

(Mr.Saksit Phaisanphisut)

Field Scientist (4)

Approved by

Wichan Choonharat

Mr.Wichan Choonharat

Manager



PENTA
CALIBRATION

PENTA CALIBRATION CO., LTD.

66/124 The Connect 33 Village Kanchanaphisek Road
Dokmai Prawet Bangkok 10250
Tel: +66 (0) 2069-9773
www.pentacal.com

Certificate of Calibration

Represent to Certificate of Calibration ,PTC/07/22099

Certificate No.:	PTC/07/22099	Page:	1 of 2
Equipment:	Digital Balance	Condition:	Normal
Manufacturer:	Sartorius	Serial No:	31709552
Model:	MSU224S-100-DU	ID No:	RYG_EN0003
Type of Balance:	Single interval		



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

REVIEW BY Thanitall.
APPROVED BY D. [Signature]
NEXT CAL. DATE 23/03/23

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

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

The Method used: In house method, PTC-WI-07, base on Euramet cg. 18

Traceability: This certificate is traceable to the SI Units through Thai Calibration Service Co.,Ltd.
, NSC-ONSC Accreditation No.: Calibration 0189

Date Received: March 23, 2022

Calibration Date: March 23, 2022

Issued Date: March 25, 2022

Calibration By: Mr. Rungroje Metakul



PENTA CALIBRATION CO.,LTD

[Signature]
(Mr.Kriangsak Kalasri)

Reviewed by

Approved By : [Signature]
(Mr. Keattisak Kerdto)

Laboratory Manager

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

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

This calibration certificate shall not be reproduced except in full only, without written approval from penta calibration co., ltd



Represent to Certificate of Calibration ,PTC/07/22099

Certificate No.: PTC/07/22099

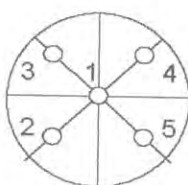
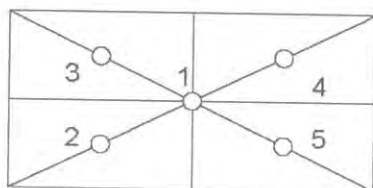
Page: 2 of 2

Measurement Results:

Without Adjustment :

Function Calibration: Non Adjustment

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



Eccentricity test 100 (g)

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

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

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

Nominal test value (g)	Standard Deviation
200	0.00007

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

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

Note: Weight of adjust - (g)

The End of Certificate



ROTA METER CALIBRATION RESULT JANUARY 2022

Rotameter ID.	Calibration Date	Regression Result	Coefficient (R ²)
BKK_FS0577	05 Jan 22	$Y = 0.9899x + 0.9112$	0.9999
BKK_FS0579	05 Jan 22	$Y = 1.007x - 0.0299$	1.0000
BKK_FS0583	05 Jan 22	$Y = 1.0513x + 1.869$	0.9967
BKK_FS0584	05 Jan 22	$Y = 1.0048x - 1.069$	1.0000
BKK_FS0585	05 Jan 22	$Y = 1.0076x - 1.1036$	0.9999
BKK_FS0586	05 Jan 22	$Y = 0.9933x + 3.2655$	1.0000
BKK_FS0587	05 Jan 22	$Y = 1.0401x - 17.457$	0.9996
BKK_FS0588	05 Jan 22	$Y = 1.0154x + 4.8357$	0.9999
BKK_FS0589	05 Jan 22	$Y = 0.9918x + 4.8069$	0.9999
BKK_FS0590	05 Jan 22	$Y = 0.9861x + 10.07$	0.9995
BKK_FS0591	05 Jan 22	$Y = 1.0117x - 92.415$	0.9995
BKK_FS0592	05 Jan 22	$Y = 1.0031x - 69.305$	0.9996
BKK_FS0593	05 Jan 22	$Y = 1.0131x - 98.198$	0.9996
BKK_FS0594	05 Jan 22	$Y = 1.0075x - 7.0829$	0.9999
BKK_FS0595	05 Jan 22	$Y = 1.0249x - 98.162$	0.9999
BKK_FS0596	05 Jan 22	$Y = 0.9843x - 26.806$	0.9991
BKK_FS0597	05 Jan 22	$Y = 1.0203x - 122.14$	0.9999
BKK_FS1004	04 Jan 22	$Y = 0.9651x + 19.648$	0.9989
BKK_FS1005	04 Jan 22	$Y = 1.0096x + 4.6643$	0.9997
BKK_FS1006	04 Jan 22	$Y = 1.2188x - 7.1214$	0.9994
BKK_FS1007	05 Jan 22	$Y = 1.0563x - 1.0912$	1.0000
BKK_FS1008	05 Jan 22	$Y = 0.9689x + 1.9061$	1.0000
BKK_FS1009	05 Jan 22	$Y = 1.0132x + 1.1633$	0.9960
BKK_FS1010	05 Jan 22	$Y = 1.0033x + 0.5758$	0.9999
BKK_FS1014	05 Jan 22	$Y = 1.0021x + 0.3148$	0.9998
BKK_FS1015	05 Jan 22	$Y = 0.9994x + 1.786$	1.0000
BKK_FS1016	05 Jan 22	$Y = 1.0105x - 80.256$	0.9998
BKK_FS1017	05 Jan 22	$Y = 0.9995x + 0.649$	1.0000
BKK_FS1018	05 Jan 22	$Y = 1.0011x + 1.1786$	1.0000
BKK_FS1019	05 Jan 22	$Y = 1.0023x - 68.424$	0.9996
BKK_FS1020	05 Jan 22	$Y = 0.9887x + 2.8844$	0.9999
BKK_FS1021	05 Jan 22	$Y = 0.9659x + 1.4905$	0.9978
BKK_FS1022	05 Jan 22	$Y = 1.022x - 17.957$	0.9997
BKK_FS1023	05 Jan 22	$Y = 1.0094x + 0.0717$	0.9999
BKK_FS1024	05 Jan 22	$Y = 1.0042x + 0.4086$	0.9997
BKK_FS1025	05 Jan 22	$Y = 1.0132x - 88.507$	0.9996
BKK_FS1026	05 Jan 22	$Y = 0.9902x + 0.9554$	1.0000
BKK_FS1027	05 Jan 22	$Y = 1.0086x - 2.279$	1.0000
BKK_FS1028	05 Jan 22	$Y = 1.0105x - 81.055$	0.9997



ROTA METER CALIBRATION RESULT JANUARY 2022

Rotameter ID.	Calibration Date	Regression Result	Coefficient (R ²)
BKK_FS1029	05 Jan 22	$Y = 0.9935x + 0.8234$	1.0000
BKK_FS1030	05 Jan 22	$Y = 1.0039x + 0.515$	0.9999
BKK_FS1031	05 Jan 22	$Y = 1.009x - 79.295$	0.9998
BKK_FS1039	04 Jan 22	$Y = 0.9916x + 6.1524$	0.9988
BKK_FS1040	04 Jan 22	$Y = 1.0133x - 10.177$	0.9985
BKK_FS1041	04 Jan 22	$Y = 1.0805x - 1.7381$	0.9998
BKK_FS1042	04 Jan 22	$Y = 1.0061x + 1.3405$	0.9994
BKK_FS1043	04 Jan 22	$Y = 1.0112x - 10.393$	0.9999
BKK_FS1044	04 Jan 22	$Y = 1.0495x - 1.0136$	0.9996
BKK_FS1161	05 Jan 22	$Y = 0.9812x + 15571$	1.0000
BKK_FS1162	05 Jan 22	$Y = 0.9932x + 5.0014$	0.9997
BKK_FS1163	05 Jan 22	$Y = 1.0082x - 82.062$	0.9998
BKK_FS1164	05 Jan 22	$Y = 0.9914x + 0.8427$	0.9997
BKK_FS1165	05 Jan 22	$Y = 0.9893x + 6.5919$	0.9998
BKK_FS1166	05 Jan 22	$Y = 1.0031x - 77.881$	0.9996
RYG_FS0197	04 Jan 22	$Y = 1.0068x + 1.7152$	0.9998
RYG_FS0198	04 Jan 22	$Y = 0.9986x + 18.196$	0.9995
RYG_FS0199	04 Jan 22	$Y = 1.1202x - 3.5782$	0.9999

Review By :

(Mr. Wichan Choonharat)

Enviro Field Services Manager

Approved By :

(Mr. Sarayuth Jittrantont)

Assistant General Manager



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. : 21E818

Page : 1 of 2

Equipment : pH Meter
Manufacturer: Thermo Orion
Model : EA940
Serial No.: 6983
ID No.: BKK_EN0102

Condition As-Received: Used Item

Received Date: 05 March 2021

Calibration Date: 11 March 2021

Reference: 2103-0265DSC

Ambient Temperature: (23 ± 2) °C

Relative Humidity: (50 ± 10) %

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

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

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

Condition of this result of calibration

1.Reference standards instruments :

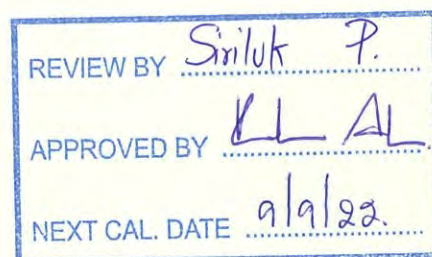
<u>Instrument</u>	<u>Model</u>	<u>Serial No.</u>	<u>Certificate No.</u>	<u>Due Date</u>
1) Multi-Product Calibrator	5500A	6440007	20E1574	07 May 2021

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 : Pongsagorn Boonyaporn
Issue Date : 12 March 2021

Approved Signatory :

- [] Phalinee Prabpaipal
[☒] Nuntawat Khamchai
[] Pornthippa Tameyakul



Cert. No.: 21E818

Page.: 2 of 2

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

Function: DC voltage measurement **Range:** Autorange

Channel : 1

<u>Standard Value</u>	<u>UUC* Reading</u>	<u>Error</u>	<u>Uncertainty</u>
(mV)	(mV)	(mV)	(\pm μ V)
-200.0000	-200.1	-0.1	72
-100.0000	-100.1	-0.1	65
0.0000	-0.1	-0.1	58
100.0000	99.9	-0.1	65
200.0000	199.9	-0.1	72

Function: DC voltage measurement **Range:** Autorange

Channel : 2

<u>Standard Value</u>	<u>UUC* Reading</u>	<u>Error</u>	<u>Uncertainty</u>
(mV)	(mV)	(mV)	(\pm μ V)
-200.0000	-200.2	-0.2	72
-100.0000	-100.2	-0.2	65
0.0000	-0.2	-0.2	58
100.0000	99.9	-0.1	65
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-



REVIEW BY	Autcharawan S.
APPROVED BY	Sarasat M.
NEXT CAL. DATE	12 / Jan / 23
	12 / Jan / 22
	ASL

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, 2022

(Mr.Thitipong Piromkripuk)

Applications Chemist

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

NSC-TISI-TIS 17025
CALIBRATION 0394

Cert. No. : ACC22001

Pages : 1 of 3

Calibration Certificate

Equipment : SOUND CALIBRATOR
Manufacturer : RION
Model : NC-75
Serial No.: 35002736
ID No.: - RYD0496

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 : 05 JANUARY 2022
Calibration Date : 10 JANUARY 2022
Date of Issue : 13 JANUARY 2022

REVIEW BY	Nathakorn P.
APPROVED BY	[Signature]
NEXT CAL. DATE	10/1/23

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.

Continuation of Calibration Certificate

Cert. No. : ACC22001

Job No. : VC65AC0040

Pages : 2 of 3

Calibration Procedure : CP-AC-03

Calibration Method :

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

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

Condition of this result of calibration :

1. Reference Standard Instruments :

<u>Instrument</u>	<u>Model</u>	<u>Serial No.</u>	<u>Cert. No.</u>	<u>Due Date</u>
Waveform Generator	33511B	MY52302742	EF-0011-21	10-Feb-22
Digital Multimeter	33461A	MY53220104	EEL.BP. 05/0264	10-Feb-22
Digital Multimeter	33461A	MY53220076	EEL.BP. 03/0264	08-Feb-22
Digital Multimeter	33461A	MY60024273	1-15180725251-1	15-Sep-22
Programmable Attenuator	MAT-1070	62100114	1500-07774E	08-Mar-22
Condenser Microphone	4180	2977900	AA-1008-21	05-Feb-22
Measuring Amplifier	NA-42KAI	34560495	AA-3003-21	16-Feb-22
Audio Analyzer	AVR-3360A	V744B6069	EF-0010-21	10-Feb-22

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

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

3.1 National Institute of Metrology (Thailand).

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

Continuation of Calibration Certificate

Cert. No. : ACC22001

Job No. : VC65AC0040

Pages : 3 of 3

Result of calibration :**1. Sound pressure level**

Specified sound pressure level (dB)	Measured value (dB)	Deviated value (dB)	Uncertainty (dB)	Tolerance limit (dB)
94	93.99	-0.01	0.14	0.40

2. Frequency

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

3. Total distortion

Measured value (%)	Uncertainty (%)	Tolerance limit (%)
0.28	0.10	3.0

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

End of Calibration Certificate

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. : ACL22062

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

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



Calibrated by : Nathakorn Pisutpaisan

Approved by :

()
(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

Cert. No. : ACL22062
Job No. : VC65AC0043
Pages : 2 of 8

Calibration Procedure : CP-AC-01

Calibration Method :

This equipment was calibrated by based on IEC-61672-3 (2013) Standard for sound level meter (SLM).

The SLM had tests to Acoustical and Electrical signal tests of frequency weighting with Anechoic chamber and Reference Standard Instruments.

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

Condition of this result of calibration :

1. Reference Standard Instruments :

<u>Instrument</u>	<u>Model</u>	<u>Serial No.</u>	<u>Cert. No.</u>	<u>Due Date</u>
Waveform Generator	33210A	MY48017076	EF-0012-21	10-Feb-22
Waveform Generator	33511B	MY52302742	EF-0011-21	10-Feb-22
Digital Multimeter	33461A	MY53220104	EEL.BP. 05/0264	10-Feb-22
Digital Multimeter	33461A	MY53220076	EEL.BP. 03/0264	08-Feb-22
Digital Multimeter	34461A	MY60024273	1-15180725251-1	15-Sep-22
Programmable Attenuator	MAT-1070	62100114	1500-07774E	08-Mar-22
Condenser Microphone	4180	2977900	AA-1008-21	05-Feb-22
Measuring Amplifier	NA-42KAI	34560495	AA-3003-21	16-Feb-22

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

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

3.1 National Institute of Metrology (Thailand).

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

Continuation of Calibration Certificate

Cert. No. : ACL22062
Job No. : VC65AC0043
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. : ACL22062

Job No. : VC65AC0043

Pages : 4 of 8

Result of calibration :**1. Absolute sensitivity**

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

2. Self-generated noise

2.1 Normal test

Measured Value (dB)
14.8

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

Frequency Weighting	Measured value (dB)
A - weight	12.0
C - weight	18.0
Flat	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)			
	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	-0.4	-0.3	-0.3	±5.0

Continuation of Calibration Certificate

Cert. No. : ACL22062

Job No. : VC65AC0043

Pages : 5 of 8

4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

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

5. Frequency and time weightings at 1 kHz
5.1 Frequency weightings at 1 kHz

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

5.2 Time weighting at 1 kHz

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

6. Long - term stability

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

Continuation of Calibration Certificate

Cert. No. : ACL22062

Job No. : VC65AC0043

Pages : 6 of 8

7. Level linearity on the reference level range

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

Continuation of Calibration Certificate

 Cert. No. : ACL22062
 Job No. : VC65AC0043
 Pages : 7 of 8

8. Level linearity including the level range control

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

9. Tone burst response

Time Weighting	Tone burst duration, 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. : ACL22062

Job No. : VC65AC0043

Pages : 8 of 8

11. Overload indication

Measured value (dB)		Deviated Value (dB)	Acceptance Limits (dB)
Positive one-half cycle	Negative one-half cycle		
89.6	89.6	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** —————

Certificate No.: 0167SV21
Operation No.: CP2021040003

Certificate of Calibration

Equipment: Sound Level Meter

Manufacturer: RION

Model/Type: NL-21 (Meter), UC-52 (Microphone), NH-21 (Preamplifier)

Serial No.: 00509355 (Meter), 143845 (Microphone), 32731 (Preamplifier)

ID No.: RYG_FS0015

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

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

Received Date: 7 April 2021

Calibrated Date: 21 - 27 April 2021

Issued Date: 28 April 2021

Calibrated by: Ms. Juntaporn Kunhakom

REVIEW BY	<i>Mara Korn P.</i>
APPROVED BY	<i>[Signature]</i>
NEXT CAL. DATE	21/4/22

Approved by: _____

(Mr. Sittichai Swaksuriyawong)

Group Manager

สถาบันไฟฟ้าและอิเล็กทรอนิกส์
ELECTRICAL AND ELECTRONICS INSTITUTE

The reported uncertainty of measurement was based on standard uncertainty multiplied by a coverage factor $k = 2.00$, providing a level of confidence of approximately 95%. This certificate may not be reproduced other than in full except with the prior written approval of the Electrical and Electronics Institute, Foundation for Industrial Development.

Certificate No.: 0167SV21

Calibration Report

Equipment: Sound Level Meter
Manufacturer: RION
Model/Type: NL-21 (Meter), UC-52 (Microphone), NH-21 (Preamplifier)
Serial No.: 00509355 (Meter), 143845 (Microphone), 32731 (Preamplifier)
ID No.: RYG_FS0015
Ambient Temperature: (23 ± 2) °C
Relative Humidity: (50 ± 15) %
Pressure: (101.3 ± 1.5) kPa

Method of Calibration :-

IEC61672-3:2013.

Condition of this result of calibration

1. Reference standards instrument :-

Instrument	Model	Serial No.	Cert. No.	Due Date
1) Standard microphone	4180	2661000	AA-1013-20	12 May 2021
2) Sine generator	1051	1501442	0151RF20	21 September 2021
3) Arbitrary Function Generator	AFG2021	C010063	0099RF20	17 June 2021
4) Programmable Attenuator	PA5	2755	EF-0034-20	10 November 2021
5) 6.5 Digit precision multimeter	8846A	9609027	0498EL20	10 August 2021
6) 6.5 Digit precision multimeter	8846A	9610014	0669EL20	27 October 2021
7) Pressure humidity and Temperature Transmitter	PTU301	F0640002	CL1-P200051 0305TE20	31 May 2021 28 June 2021
8) Pressure humidity and Temperature Transmitter	PTU301	F0640003	CL1-P200052 0306TE20	1 June 2021 28 June 2021

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

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

Reference standards instrument for Acoustic function

- National Institute of Metrology (Thailand)

Reference standards instrument for Electrical function

- National Institute of Metrology (Thailand)

- Electrical and Electronics Institute; ONSC Accredited Calibration No.0119

Result of Calibration:-

Function : 1. Indication at the calibration check frequency

Reference Acoustic Signal (dB)	Measured value (dB)	Deviation (dB)	Acceptance limits (dB)
94.0	94.0	0.0	±1.0

Note : Absolute sensitivity was established by the use of the Sound Calibrator RION Type NC-74 S/N : 34615278.

Certificate No.: 0167SV21

Calibration Report

Function : 2. Self-generated Noise

2.1 Microphone Installed

Measured value (dB)
16.4

2.2 Microphone replaced by the electrical input signal device

Frequency Weighting	Measured value (dB)
A-weighting	12.6
C-weighting	17.6
Z-weighting	23.2

Function : 3. Acoustical signal tests of frequency weightings (Without Windscreen)

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

Frequency (Hz)	Deviation from various Frequency Weighting Response Curve			
	C-Weighting (dB)	A-Weighting (dB)	Z-Weighting (dB)	Acceptance limits (dB)
125	0.6	0.8	0.6	±1.5
1000	-0.1	-0.1	0.0	±1.0
8000	-0.8	-0.8	-0.9	±5.0

Function : 4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

Frequency (Hz)	Deviation from various Frequency Weighting Response Curve			
	C-Weighting (dB)	A-Weighting (dB)	Z-Weighting (dB)	Acceptance limits (dB)
63	-0.1	0.0	-0.2	±2.0
125	0.0	-0.1	-0.1	±1.5
250	0.0	0.0	0.0	±1.5
500	0.0	-0.1	0.0	±1.5
1000	0.0	0.0	0.0	±1.0
2000	0.1	0.1	0.1	±2.0
4000	0.1	0.1	0.1	±3.0
8000	0.2	0.3	0.0	±5.0

Function : 5. Frequency and time weighting at 1 kHz

5.1 Frequency weighting at 1 kHz

Frequency Weighting	Measured value (dB)	Deviated value (dB)	Acceptance limits (dB)
C-weighting	94.0	0.0	±0.2
A-weighting	94.0	0.0	±0.2
Z-weighting	94.0	0.0	±0.2

Certificate No.: 0167SV21

Calibration Report

5.2 Time weighting at 1 kHz

Time Weighting	Measured value (dB)	Deviated value (dB)	Acceptance limits (dB)
Fast	94.0	0.0	±0.1
Slow	94.0	0.0	±0.1
LAeq	94.0	0.0	±0.1

Function : 6. Long-Term Stability

Long-term stability over 30 minutes, with steady 1 kHz signal at reference level.

Time Period to Apply Signal (min)	Reference SPL (dB)	Record SPL at Conclusion of Time Period (dB)	Deviated value (dB)	Acceptance limits (dB)
30	94.0	94.0	0.0	±0.3

Function : 7. Level Linearity on the reference level range

7.1 Level Linearity on the reference level range, Upper

Anticipated Value (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limits (dB)
94.0	94.0	0.0	±1.1
99.0	99.0	0.0	±1.1
104.0	104.0	0.0	±1.1
109.0	109.0	0.0	±1.1
114.0	114.0	0.0	±1.1
119.0	119.0	0.0	±1.1
120.0	120.0	0.0	±1.1
121.0	121.0	0.0	±1.1
122.0	122.0	0.0	±1.1
123.0	123.0	0.0	±1.1
124.0	124.0	0.0	±1.1
125.0	125.0	0.0	±1.1

7.2 Level Linearity on the reference level range, Lower

Anticipated Value (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limits (dB)
94.0	94.0	0.0	±1.1
89.0	89.0	0.0	±1.1
84.0	84.1	0.1	±1.1
79.0	79.0	0.0	±1.1
74.0	74.0	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

Certificate No.: 0167SV21

Calibration Report

7.2 Level Linearity on the reference level range, Lower (Cont.)

Anticipated Value (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limits (dB)
39.0	38.9	-0.1	±1.1
34.0	33.9	-0.1	±1.1
33.0	32.9	-0.1	±1.1
32.0	31.8	-0.2	±1.1
31.0	30.9	-0.1	±1.1
30.0	29.8	-0.2	±1.1
29.0	28.8	-0.2	±1.1
28.0	27.7	-0.3	±1.1

Function : 8. Level Linearity including level range control

8.1. Level Linearity Including the Level Range (Reference Signal)

Range	Anticipated Value (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limits (dB)
20-100	94.0	94.1	0.1	±1.1
20-110	94.0	94.0	0.0	±1.1
30-120	94.0	94.0	0.0	±1.1
40-130	94.0	94.0	0.0	±1.1

8.2. Level Linearity Including the Level range (5dB Above Under-range)

Range	Anticipated Value (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limits (dB)
20-80	25.0	25.3	0.3	±1.1
20-90	25.0	25.3	0.3	±1.1
20-100	25.0	25.3	0.3	±1.1
20-110	25.0	25.2	0.2	±1.1
30-120	35.0	35.0	0.0	±1.1
40-130	45.0	45.0	0.0	±1.1

Function : 9. Tone burst response

Time Weighting	Tone burst duration, Tb (ms)	Measured value (dB)	Deviated value (dB)	Acceptance limits (dB)
Fast	200	116.0	0.0	±1.0
	2	99.0	0.0	+1.0 ; -2.5
	0.25	89.9	-0.1	+1.5 ; -5.0
Slow	200	109.6	0.0	±1.0
	2	90.0	0.0	+1.0 ; -5.0
LAE	200	110.0	0.0	±1.0
	2	90.0	0.0	+1.0 ; -2.5
	0.25	80.9	-0.1	+1.5 ; -5.0

Certificate No.: 0167SV21

Calibration Report

Function : 10. Peak C sound level

Number of cycles in test signal	Anticipated Value (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limits (dB)
Complete cycle	125.4	124.9	-0.5	±3.0
Positive half cycle	124.4	124.1	-0.3	±2.0
Negative half cycle	124.4	124.1	-0.3	±2.0

Function : 11. Overload indication

Measured value (dB)		Deviated value (dB)	Acceptance limits (dB)
Positive one-half cycle	Negative one-half cycle		
139.4	139.3	-0.1	±1.5

Function : 12. High-Level Stability

High-level stability over 5 minutes, with steady 1 kHz signal, 1 dB below upper boundary.

Time Period to Apply Signal (min)	Reference SPL (dB)	Record SPL at Conclusion of Time Period (dB)	Deviated value (dB)	Acceptance limits (dB)
5	129.0	129.0	0.0	±0.3

Uncertainty of measurement

Function	Uncertainty (dB)	Maximum-permitted uncertainty of measurement (dB)
1) Indication at the calibration check frequency	0.30	Not applicable
2) Self-generated Noise	0.10	Not applicable
3) Acoustical signal tests of frequency weightings - Free-field sound pressure response level	0.30	0.60 (10Hz to 4kHz) 0.70 (>4kHz to 10kHz)
4) Electrical signal tests of frequency weightings	0.20	0.20
5) Frequency and time weighting at 1 kHz	0.20	0.20
6) Long-Term Stability	0.10	0.10
7) Level Linearity on the reference level range	0.30	0.30
8) Level Linearity including level range control	0.30	0.30
9) Tone burst response	0.20	0.30
10) Peak C sound level	0.20	0.35
11) Overload indication	0.20	0.25
12) High-Level Stability	0.10	0.10

Remarks: 1. The acceptance limit is for the deviated value.
2. Acceptance limits was IEC61672-3:2013 Class 2.

- - End of Report - -

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. : ACL21063

Pages : 1 of 8

Calibration Certificate

Equipment : SOUND LEVEL METER
Manufacturer : RION
Model : NL-42/ Microphone UC-52 / Preamplifier NH-24
Serial No.: 01122567 / 143473 / 22605
ID No.: RYG_FS0016

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 : 22 JUNE 2021
Calibration Date : 28-30 JUNE 2021
Date of Issue : 05 JULY 2021

REVIEW BY	<i>Nathakorn P.</i>
APPROVED BY	<i>[Signature]</i>
NEXT CAL. DATE	28/6/22

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.

Continuation of Calibration Certificate

Cert. No. : ACL21063

Job No. : VC64AC0048

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 :

<u>Instrument</u>	<u>Model</u>	<u>Serial No.</u>	<u>Cert. No.</u>	<u>Due Date</u>
Waveform Generator	33210A	MY48017076	EF-0012-21	10-Feb-22
Waveform Generator	33511B	MY52302742	EF-0011-21	10-Feb-22
Digital Multimeter	33461A	MY53220104	EEL.BP. 05/0264	10-Feb-22
Digital Multimeter	33461A	MY53220076	EEL.BP. 03/0264	08-Feb-22
Digital Multimeter	33461A	MY53220116	EEL.BP. 04/0264	10-Feb-22
Programmable Attenuator	MAT-1070	62100114	1500-07774E	08-Mar-22
Condenser Microphone	4180	2977900	AA-1008-21	05-Feb-22
Measuring Amplifier	NA-42KAI	34560495	AA-3003-21	16-Feb-22

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

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

3.1 National Institute of Metrology (Thailand).

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

Continuation of Calibration Certificate

Cert. No. : ACL21063

Job No. : VC64AC0048

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. : ACL21063

Job No. : VC64AC0048

Pages : 4 of 8

Result of calibration :

1. Absolute sensitivity

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

2. Self-generated noise

2.1 Normal test

Measured Value (dB)
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	0.4	0.5	0.5	± 1.5
1000	0.0	0.0	0.0	± 1.0
8000	-1.0	-0.9	-0.9	±5.0

Continuation of Calibration Certificate

Cert. No. : ACL21063
Job No. : VC64AC0048
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	0.0	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. : ACL21063
Job No. : VC64AC0048
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	26.9	-0.1	± 1.1
26.0	25.8	-0.2	± 1.1
25.0	24.9	-0.1	± 1.1

Continuation of Calibration Certificate

Cert. No. : ACL21063
Job No. : VC64AC0048
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, Lcpeak (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.0	0.0	-
One	136.4	136.2	-0.2	±3.0

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

Continuation of Calibration Certificate

Cert. No. : ACL21063

Job No. : VC64AC0048

Pages : 8 of 8

11. Overload indication

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

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. : ACL21118

Pages : 1 of 8

Calibration Certificate

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

Condition As Found : GOOD

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

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

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

REVIEW BY	<i>Thakorn P.</i>
APPROVED BY	<i>[Signature]</i>
NEXT CAL. DATE	4/10/22

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.

Continuation of Calibration Certificate

Cert. No. : ACL21118

Job No. : VC64AC0070

Pages : 2 of 8

Calibration Procedure : CP-AC-01

Calibration Method :

This equipment was calibrated by based on IEC-61672-3 (2013) Standard for sound level meter (SLM).

The SLM had tests to Acoustical and Electrical signal tests of frequency weighting with Anechoic chamber and Reference Standard Instruments.

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

Condition of this result of calibration :

1. Reference Standard Instruments :

<u>Instrument</u>	<u>Model</u>	<u>Serial No.</u>	<u>Cert. No.</u>	<u>Due Date</u>
Waveform Generator	33210A	MY48017076	EF-0012-21	10-Feb-22
Waveform Generator	33511B	MY52302742	EF-0011-21	10-Feb-22
Digital Multimeter	33461A	MY53220104	EEL.BP. 05/0264	10-Feb-22
Digital Multimeter	33461A	MY53220076	EEL.BP. 03/0264	08-Feb-22
Digital Multimeter	8846A	1997025	EEL.BP. 06/0264	05-Feb-22
Programmable Attenuator	MAT-1070	62100114	1500-07774E	08-Mar-22
Condenser Microphone	4180	2977900	AA-1008-21	05-Feb-22
Measuring Amplifier	NA-42KAI	34560495	AA-3003-21	16-Feb-22

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

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

3.1 National Institute of Metrology (Thailand).

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

Continuation of Calibration Certificate

Cert. No. : ACL21118
Job No. : VC64AC0070
Pages : 3 of 8

Summary of Measurement Result :

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

Continuation of Calibration Certificate

Cert. No. : ACL21118

Job No. : VC64AC0070

Pages : 4 of 8

Result of calibration :**1. Absolute sensitivity**

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

2. Self-generated noise

2.1 Normal test

Measured Value (dB)
17.9

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

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

3. Acoustical signal tests of frequency weightings

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

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

Continuation of Calibration Certificate

Cert. No. : ACL21118
Job No. : VC64AC0070
Pages : 5 of 8

4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

Frequency (Hz)	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. : ACL21118

Job No. : VC64AC0070

Pages : 6 of 8

7. Level linearity on the reference level range

Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
137.0	137.0	0.0	± 1.1
136.0	136.0	0.0	± 1.1
135.0	135.0	0.0	± 1.1
134.0	134.0	0.0	± 1.1
133.0	133.0	0.0	± 1.1
132.0	132.0	0.0	± 1.1
131.0	131.0	0.0	± 1.1
129.0	129.0	0.0	± 1.1
124.0	124.0	0.0	± 1.1
119.0	119.0	0.0	± 1.1
114.0	114.0	0.0	± 1.1
109.0	109.0	0.0	± 1.1
104.0	104.0	0.0	± 1.1
99.0	99.0	0.0	± 1.1
94.0	94.0	0.0	± 1.1
89.0	89.0	0.0	± 1.1
84.0	84.1	0.1	± 1.1
79.0	79.0	0.0	± 1.1
74.0	74.1	0.1	± 1.1
69.0	69.1	0.1	± 1.1
64.0	64.0	0.0	± 1.1
59.0	59.1	0.1	± 1.1
54.0	54.0	0.0	± 1.1
49.0	49.0	0.0	± 1.1
44.0	44.0	0.0	± 1.1
39.0	39.0	0.0	± 1.1
34.0	34.1	0.1	± 1.1
30.0	30.2	0.2	± 1.1
29.0	29.2	0.2	± 1.1
28.0	28.2	0.2	± 1.1
27.0	27.3	0.3	± 1.1
26.0	26.4	0.4	± 1.1
25.0	25.5	0.5	± 1.1

Continuation of Calibration Certificate

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

8. Level linearity including the level range control

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

9. Tone burst response

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

10. Peak C sound level

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

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

Continuation of Calibration Certificate

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

11. Overload indication

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

12. High level stability

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

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

_____ **End of Calibration Certificate** _____

SITHIPHORN ASSOCIATES CO.,LTD. CALIBRATION LABORATORY

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



Cert. No. : ACL21119

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

REVIEW BY	<i>Nathakorn P.</i>
APPROVED BY	<i>[Signature]</i>
NEXT CAL. DATE	4/10/22

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.

Continuation of Calibration Certificate

Cert. No. : ACL21119

Job No. : VC64AC0070

Pages : 2 of 8

Calibration Procedure : CP-AC-01

Calibration Method :

This equipment was calibrated by based on IEC-61672-3 (2013) Standard for sound level meter (SLM).

The SLM had tests to Acoustical and Electrical signal tests of frequency weighting with Anechoic chamber and Reference Standard Instruments.

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

Condition of this result of calibration :

1. Reference Standard Instruments :

<u>Instrument</u>	<u>Model</u>	<u>Serial No.</u>	<u>Cert. No.</u>	<u>Due Date</u>
Waveform Generator	33210A	MY48017076	EF-0012-21	10-Feb-22
Waveform Generator	33511B	MY52302742	EF-0011-21	10-Feb-22
Digital Multimeter	33461A	MY53220104	EEL.BP. 05/0264	10-Feb-22
Digital Multimeter	33461A	MY53220076	EEL.BP. 03/0264	08-Feb-22
Digital Multimeter	8846A	1997025	EEL.BP. 06/0264	05-Feb-22
Programmable Attenuator	MAT-1070	62100114	1500-07774E	08-Mar-22
Condenser Microphone	4180	2977900	AA-1008-21	05-Feb-22
Measuring Amplifier	NA-42KAI	34560495	AA-3003-21	16-Feb-22

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

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

3.1 National Institute of Metrology (Thailand).

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

Continuation of Calibration Certificate

Cert. No. : ACL21119
Job No. : VC64AC0070
Pages : 3 of 8

Summary of Measurement Result :

Parameter	Pass	Fail	Uncertainty (dB)	Maximum-permitted uncertainty of measurement (dB)
1. Absolute sensitivity	✓	-	0.2	N/A
2. Self-generated noise	✓	-	0.3	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. : ACL21119

Job No. : VC64AC0070

Pages : 4 of 8

Result of calibration :**1. Absolute sensitivity**

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

2. Self-generated noise

2.1 Normal test

Measured Value (dB)
14.8

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	19.5
Flat	26.2

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)			Acceptance Limits
	Flat	C-weight	A-weight	
125	0.2	0.3	0.2	± 1.5
1000	0.0	-0.1	0.0	± 1.0
8000	-1.0	-0.9	-0.9	±5.0

Continuation of Calibration Certificate

Cert. No. : ACL21119

Job No. : VC64AC0070

Pages : 5 of 8

4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

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

5. Frequency and time weightings at 1 kHz

5.1 Frequency weightings at 1 kHz

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

5.2 Time weighting at 1 kHz

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

6. Long - term stability

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

Continuation of Calibration Certificate

Cert. No. : ACL21119
Job No. : VC64AC0070
Pages : 6 of 8

7. Level linearity on the reference level range

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

Continuation of Calibration Certificate

Cert. No. : ACL21119
Job No. : VC64AC0070
Pages : 7 of 8

8. Level linearity including the level range control

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

9. Tone burst response

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

10. Peak C sound level

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

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

Continuation of Calibration Certificate

Cert. No. : ACL21119
Job No. : VC64AC0070
Pages : 8 of 8

11. Overload indication

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

SITHIPHORN ASSOCIATES CO.,LTD. CALIBRATION LABORATORY

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



NSC-TISI-TIS 17025
CALIBRATION 0394

Cert. No. : ACL22030

Pages : 1 of 8

Calibration Certificate

Equipment : SOUND LEVEL METER
Manufacturer : RION
Model : NL-42/ Microphone UC-52 / Preamplifier NH-24
Serial No.: 01122607 / 145554 / 34373
ID No.: RYG_FS0019

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 : 05 JANUARY 2022
Calibration Date : 10-12 JANUARY 2022
Date of Issue : 13 JANUARY 2022

REVIEW BY	<i>Nathakorn P.</i>
APPROVED BY	<i>[Signature]</i>
NEXT CAL. DATE	10/1/23

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.

Continuation of Calibration Certificate

Cert. No. : ACL22030

Job No. : VC65AC0040

Pages : 2 of 8

Calibration Procedure : CP-AC-01

Calibration Method :

This equipment was calibrated by based on IEC-61672-3 (2013) Standard for sound level meter (SLM).

The SLM had tests to Acoustical and Electrical signal tests of frequency weighting with Anechoic chamber and Reference Standard Instruments.

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

Condition of this result of calibration :

1. Reference Standard Instruments :

<u>Instrument</u>	<u>Model</u>	<u>Serial No.</u>	<u>Cert. No.</u>	<u>Due Date</u>
Waveform Generator	33210A	MY48017076	EF-0012-21	10-Feb-22
Waveform Generator	33511B	MY52302742	EF-0011-21	10-Feb-22
Digital Multimeter	33461A	MY53220104	EEL.BP. 05/0264	10-Feb-22
Digital Multimeter	33461A	MY53220076	EEL.BP. 03/0264	08-Feb-22
Digital Multimeter	34461A	MY60024273	1-15180725251-1	15-Sep-22
Programmable Attenuator	MAT-1070	62100114	1500-07774E	08-Mar-22
Condenser Microphone	4180	2977900	AA-1008-21	05-Feb-22
Measuring Amplifier	NA-42KAI	34560495	AA-3003-21	16-Feb-22

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

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

3.1 National Institute of Metrology (Thailand).

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

Continuation of Calibration Certificate

Cert. No. : ACL22030

Job No. : VC65AC0040

Pages : 3 of 8

Summary of Measurement Result :

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

Continuation of Calibration Certificate

Cert. No. : ACL22030

Job No. : VC65AC0040

Pages : 4 of 8

Result of calibration :

1. Absolute sensitivity

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

2. Self-generated noise

2.1 Normal test

Measured Value (dB)
16.5

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

Frequency Weighting	Measured value (dB)
A - weight	13.1
C - weight	19.4
Flat	24.8

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	0.6	± 1.5
1000	0.0	0.0	0.0	± 1.0
8000	-1.7	-1.7	-1.6	±5.0

Continuation of Calibration Certificate

Cert. No. : ACL22030

Job No. : VC65AC0040

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	0.0	±1.5
250	0.0	0.0	0.0	±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. : ACL22030

Job No. : VC65AC0040

Pages : 6 of 8

7. Level linearity on the reference level range

Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
137.0	137.0	0.0	± 1.1
136.0	136.0	0.0	± 1.1
135.0	135.0	0.0	± 1.1
134.0	134.0	0.0	± 1.1
133.0	133.0	0.0	± 1.1
132.0	132.0	0.0	± 1.1
131.0	131.0	0.0	± 1.1
129.0	129.0	0.0	± 1.1
124.0	124.0	0.0	± 1.1
119.0	119.0	0.0	± 1.1
114.0	114.0	0.0	± 1.1
109.0	109.0	0.0	± 1.1
104.0	104.0	0.0	± 1.1
99.0	99.0	0.0	± 1.1
94.0	94.0	0.0	± 1.1
89.0	89.0	0.0	± 1.1
84.0	84.1	0.1	± 1.1
79.0	79.0	0.0	± 1.1
74.0	74.1	0.1	± 1.1
69.0	69.1	0.1	± 1.1
64.0	64.0	0.0	± 1.1
59.0	59.1	0.1	± 1.1
54.0	54.0	0.0	± 1.1
49.0	49.0	0.0	± 1.1
44.0	44.0	0.0	± 1.1
39.0	39.0	0.0	± 1.1
34.0	34.0	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	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. : ACL22030
Job No. : VC65AC0040
Pages : 7 of 8

8. Level linearity including the level range control

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

9. Tone burst response

Time Weighting	Tone burst duration, Tb (ms)	Cycle	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Fast	0.25	1	108.0	107.9	-0.1	1.5 ; -5.0
	2	8	117.0	117.0	0.0	1.0 ; -2.5
	200	800	134.0	134.0	0.0	±1.0
Slow	2	8	108.0	108.0	0.0	1.5 ; -5.0
	200	800	127.6	127.6	0.0	±1.0
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	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. : ACL22030

Job No. : VC65AC0040

Pages : 8 of 8

11. Overload indication

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

SITHIPHORN ASSOCIATES CO.,LTD. CALIBRATION LABORATORY

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



Cert. No. : ACL22061

Pages : 1 of 8

Calibration Certificate

Equipment : SOUND LEVEL METER
Manufacturer : RION
Model : NL-42/ Microphone UC-52 / Preamplifier NH-24
Serial No.: 01222722 / 143840 / 22769
ID No.: RYG_FS0021

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

REVIEW BY	<i>Nathakorn P.</i>
APPROVED BY	<i>[Signature]</i>
NEXT CAL. DATE	21/1/23

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.

Continuation of Calibration Certificate

Cert. No. : ACL22061

Job No. : VC65AC0043

Pages : 2 of 8

Calibration Procedure : CP-AC-01

Calibration Method :

This equipment was calibrated by based on IEC-61672-3 (2013) Standard for sound level meter (SLM).

The SLM had tests to Acoustical and Electrical signal tests of frequency weighting with Anechoic chamber and Reference Standard Instruments.

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

Condition of this result of calibration :

1. Reference Standard Instruments :

<u>Instrument</u>	<u>Model</u>	<u>Serial No.</u>	<u>Cert. No.</u>	<u>Due Date</u>
Waveform Generator	33210A	MY48017076	EF-0012-21	10-Feb-22
Waveform Generator	33511B	MY52302742	EF-0011-21	10-Feb-22
Digital Multimeter	33461A	MY53220104	EEL.BP. 05/0264	10-Feb-22
Digital Multimeter	33461A	MY53220076	EEL.BP. 03/0264	08-Feb-22
Digital Multimeter	34461A	MY60024273	1-15180725251-1	15-Sep-22
Programmable Attenuator	MAT-1070	62100114	1500-07774E	08-Mar-22
Condenser Microphone	4180	2977900	AA-1008-21	05-Feb-22
Measuring Amplifier	NA-42KAI	34560495	AA-3003-21	16-Feb-22

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

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

3.1 National Institute of Metrology (Thailand).

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

Continuation of Calibration Certificate

Cert. No. : ACL22061
Job No. : VC65AC0043
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. : ACL22061

Job No. : VC65AC0043

Pages : 4 of 8

Result of calibration :**1. Absolute sensitivity**

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

2. Self-generated noise

2.1 Normal test

Measured Value (dB)
16.8

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

Frequency Weighting	Measured value (dB)
A - weight	11.9
C - weight	18.0
Flat	23.7

3. Acoustical signal tests of frequency weightings

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

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)			
	Flat	C-weight	A-weight	Acceptance Limits
125	0.0	0.1	0.1	± 1.5
1000	0.0	0.0	0.0	± 1.0
8000	-0.5	-0.4	-0.4	±5.0

Continuation of Calibration Certificate

Cert. No. : ACL22061

Job No. : VC65AC0043

Pages : 5 of 8

4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

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

5. Frequency and time weightings at 1 kHz
5.1 Frequency weightings at 1 kHz

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

5.2 Time weighting at 1 kHz

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

6. Long - term stability

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

Continuation of Calibration Certificate

Cert. No. : ACL22061

Job No. : VC65AC0043

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	89.1	0.1	± 1.1
84.0	84.1	0.1	± 1.1
79.0	79.1	0.1	± 1.1
74.0	74.1	0.1	± 1.1
69.0	69.1	0.1	± 1.1
64.0	64.0	0.0	± 1.1
59.0	59.1	0.1	± 1.1
54.0	54.0	0.0	± 1.1
49.0	49.0	0.0	± 1.1
44.0	44.0	0.0	± 1.1
39.0	39.0	0.0	± 1.1
34.0	34.0	0.0	± 1.1
30.0	30.0	0.0	± 1.1
29.0	29.1	0.1	± 1.1
28.0	28.0	0.0	± 1.1
27.0	27.1	0.1	± 1.1
26.0	26.1	0.1	± 1.1
25.0	25.1	0.1	± 1.1

Continuation of Calibration Certificate

Cert. No. : ACL22061
Job No. : VC65AC0043
Pages : 7 of 8

8. Level linearity including the level range control

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

9. Tone burst response

Time Weighting	Tone burst duration, 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	135.7	-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	-
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. : ACL22061

Job No. : VC65AC0043

Pages : 8 of 8

11. Overload indication

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

12. High level stability

Frequency 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

SITHIPHORN ASSOCIATES CO.,LTD.

CALIBRATION LABORATORY



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

NSC-TISI-TIS 17025
CALIBRATION 0394

Cert. No. : ACC22013

Pages : 1 of 3

Calibration Certificate

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

Condition As Found : GOOD

Customer : ALS LABORATORY GROUP (THAILAND) CO., LTD.
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 : 22 APRIL 2022
Calibration Date : 26 APRIL 2022
Date of Issue : 29 APRIL 2022

REVIEW BY	<i>Nathakorn P.</i>
APPROVED BY	<i>[Signature]</i>
NEXT CAL. DATE	26/4/23

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.

Continuation of Calibration Certificate

Cert. No. : ACC22013

Job No. : VC65AC0054

Pages : 2 of 3

Calibration Procedure : CP-AC-03

Calibration Method :

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

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

Condition of this result of calibration :

1. Reference Standard Instruments :

<u>Instrument</u>	<u>Model</u>	<u>Serial No.</u>	<u>Cert. No.</u>	<u>Due Date</u>
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. : ACC22013

Job No. : VC65AC0054

Pages : 3 of 3

Result of calibration :**1. Sound pressure level**

Specified sound pressure level (dB)	Measured value (dB)	Deviated value (dB)	Uncertainty (dB)	Tolerance limit (dB)
94	94.11	0.11	0.14	0.40

2. Frequency

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

3. Total distortion

Measured value (%)	Uncertainty (%)	Tolerance limit (%)
2.02	0.10	3.0

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

————— End of Calibration Certificate —————

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. : ACL21116

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

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

REVIEW BY	Narakorn P.
APPROVED BY	[Signature]
NEXT CAL. DATE	4/10/22

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.

Continuation of Calibration Certificate

Cert. No. : ACL21116

Job No. : VC64AC0070

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 :

<u>Instrument</u>	<u>Model</u>	<u>Serial No.</u>	<u>Cert. No.</u>	<u>Due Date</u>
Waveform Generator	33210A	MY48017076	EF-0012-21	10-Feb-22
Waveform Generator	33511B	MY52302742	EF-0011-21	10-Feb-22
Digital Multimeter	33461A	MY53220104	EEL.BP. 05/0264	10-Feb-22
Digital Multimeter	33461A	MY53220076	EEL.BP. 03/0264	08-Feb-22
Digital Multimeter	8846A	1997025	EEL.BP. 06/0264	05-Feb-22
Programmable Attenuator	MAT-1070	62100114	1500-07774E	08-Mar-22
Condenser Microphone	4180	2977900	AA-1008-21	05-Feb-22
Measuring Amplifier	NA-42KAI	34560495	AA-3003-21	16-Feb-22

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

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

3.1 National Institute of Metrology (Thailand).

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

Continuation of Calibration Certificate

Cert. No. : ACL21116

Job No. : VC64AC0070

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. : ACL21116

Job No. : VC64AC0070

Pages : 4 of 9

Result of calibration :**1. Absolute sensitivity**

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

2. Self-generated noise

2.1 Normal test

Measured Value (dB)
23.8

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

Frequency Weighting	Measured value (dB)
A - weight	22.0
C - weight	22.7
Flat	25.6

3. Acoustical signal tests of frequency weightings

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

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)			
	Flat	C-weight	A-weight	Acceptance Limits
125	0.4	0.4	0.4	± 1.5
1000	0.1	0.1	0.1	± 1.0
8000	0.1	0.2	0.2	±5.0

Continuation of Calibration Certificate

Cert. No. : ACL21116

Job No. : VC64AC0070

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	-0.2	0.0	0.0	±1.5
250	-0.1	0.0	-0.1	±1.5
500	-0.1	0.0	-0.1	±1.5
1000	0.0	0.0	0.0	±1.0
2000	0.0	0.1	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	94.0	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. : ACL21116

Job No. : VC64AC0070

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. : ACL21116
Job No. : VC64AC0070
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	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. : ACL21116
Job No. : VC64AC0070
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	133.00	0.0	-
One	136.4	136	-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. : ACL21116

Job No. : VC64AC0070

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

SITHIPHORN ASSOCIATES CO.,LTD. CALIBRATION LABORATORY

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



Cert. No. : ACL21098

Pages : 1 of 8

Calibration Certificate

Equipment : SOUND LEVEL METER
Manufacturer : RION
Model : NL-42/ Microphone UC-52 / Preamplifier NH-24
Serial No.: 00472126 / 180410 / 88180
ID No.: RYG_FS0301

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 : 01 SEPTEMBER 2021
Calibration Date : 13-15 SEPTEMBER 2021
Date of Issue : 16 SEPTEMBER 2021

REVIEW BY	<i>Nathakorn P.</i>
APPROVED BY	<i>[Signature]</i>
NEXT CAL. DATE	13/9/22

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.

Continuation of Calibration Certificate

Cert. No. : ACL21098

Job No. : VC64AC0066

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 :

<u>Instrument</u>	<u>Model</u>	<u>Serial No.</u>	<u>Cert. No.</u>	<u>Due Date</u>
Waveform Generator	33210A	MY48017076	EF-0012-21	10-Feb-22
Waveform Generator	33511B	MY52302742	EF-0011-21	10-Feb-22
Digital Multimeter	33461A	MY53220104	EEL.BP. 05/0264	10-Feb-22
Digital Multimeter	33461A	MY53220076	EEL.BP. 03/0264	08-Feb-22
Digital Multimeter	8846A	1997025	EEL.BP. 06/0264	05-Feb-22
Programmable Attenuator	MAT-1070	62100114	1500-07774E	08-Mar-22
Condenser Microphone	4180	2977900	AA-1008-21	05-Feb-22
Measuring Amplifier	NA-42KAI	34560495	AA-3003-21	16-Feb-22

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

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

3.1 National Institute of Metrology (Thailand).

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

Continuation of Calibration Certificate

Cert. No. : ACL21098
Job No. : VC64AC0066
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. : ACL21098
Job No. : VC64AC0066
Pages : 4 of 8

Result of calibration :

1. Absolute sensitivity

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

2. Self-generated noise

2.1 Normal test

Measured Value (dB)
26.1

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	18.4
Flat	23.9

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	-1.6	-1.6	-1.6	± 1.5
1000	0.0	0.0	0.0	± 1.0
8000	0.4	0.5	0.5	±5.0

Continuation of Calibration Certificate

Cert. No. : ACL21098
Job No. : VC64AC0066
Pages : 5 of 8

4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)			
	Flat	C-weight	A-weight	Acceptance Limits
63	-0.1	-0.2	-0.1	±2.0
125	0.0	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	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. : ACL21098

Job No. : VC64AC0066

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	89.1	0.1	± 1.1
84.0	84.1	0.1	± 1.1
79.0	79.1	0.1	± 1.1
74.0	74.1	0.1	± 1.1
69.0	69.1	0.1	± 1.1
64.0	64.1	0.1	± 1.1
59.0	59.1	0.1	± 1.1
54.0	54.0	0.0	± 1.1
49.0	49.1	0.1	± 1.1
44.0	44.0	0.0	± 1.1
39.0	39.1	0.1	± 1.1
34.0	34.0	0.0	± 1.1
30.0	30.1	0.1	± 1.1
29.0	29.1	0.1	± 1.1
28.0	28.1	0.1	± 1.1
27.0	27.2	0.2	± 1.1
26.0	26.2	0.2	± 1.1
25.0	25.2	0.2	± 1.1

Continuation of Calibration Certificate

Cert. No. : ACL21098

Job No. : VC64AC0066

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	135.8	-0.6	±3.0

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

Continuation of Calibration Certificate

Cert. No. : ACL21098

Job No. : VC64AC0066

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

SITHIPHORN ASSOCIATES CO.,LTD. CALIBRATION LABORATORY



NSC-TISI-TIS 17025
CALIBRATION 0394

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

Cert. No. : ACL21068

Pages : 1 of 8

Calibration Certificate

Equipment : SOUND LEVEL METER
Manufacturer : RION
Model : NL-42/ Microphone UC-52 / Preamplifier NH-24
Serial No.: 00873057 / 171591 / 73333
ID No.: RYG_FS0381

Condition As Found : GOOD

Customer : ALS LABORATORY GROUP (THAILAND) CO., LTD.
104 PHATTHANAKAN 40, PHATTHANAKAN ROAD,
KHWAEANG 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 JULY 2021
Calibration Date : 07-08 JULY 2021
Date of Issue : 13 JULY 2021

REVIEW BY	Narakorn P.
APPROVED BY	[Signature]
NEXT CAL. DATE	7/7/22

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.

Continuation of Calibration Certificate

Cert. No. : ACL21068

Job No. : VC64AC0052

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 :

<u>Instrument</u>	<u>Model</u>	<u>Serial No.</u>	<u>Cert. No.</u>	<u>Due Date</u>
Waveform Generator	33210A	MY48017076	EF-0012-21	10-Feb-22
Waveform Generator	33511B	MY52302742	EF-0011-21	10-Feb-22
Digital Multimeter	33461A	MY53220104	EEL.BP. 05/0264	10-Feb-22
Digital Multimeter	33461A	MY53220076	EEL.BP. 03/0264	08-Feb-22
Digital Multimeter	33461A	MY53220116	EEL.BP. 04/0264	10-Feb-22
Programmable Attenuator	MAT-1070	62100114	1500-07774E	08-Mar-22
Condenser Microphone	4180	2977900	AA-1008-21	05-Feb-22
Measuring Amplifier	NA-42KAI	34560495	AA-3003-21	16-Feb-22

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

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

3.1 National Institute of Metrology (Thailand).

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

Continuation of Calibration Certificate

Cert. No. : ACL21068

Job No. : VC64AC0052

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. : ACL21068

Job No. : VC64AC0052

Pages : 4 of 8

Result of calibration :**1. Absolute sensitivity**

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

2. Self-generated noise

2.1 Normal test

Measured Value (dB)
13.8

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

Frequency Weighting	Measured value (dB)
A - weight	9.9
C - weight	16.5
Flat	22.1

3. Acoustical signal tests of frequency weightings

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

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)			Acceptance Limits
	Flat	C-weight	A-weight	
125	0.4	0.4	0.4	± 1.5
1000	-0.1	-0.1	-0.1	± 1.0
8000	-0.9	-0.8	-0.8	±5.0

Continuation of Calibration Certificate

Cert. No. : ACL21068

Job No. : VC64AC0052

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	-0.1	±2.0
125	0.0	0.0	0.0	±1.5
250	0.0	0.0	0.0	±1.5
500	0.0	0.0	0.0	±1.5
1000	0.0	0.0	0.0	±1.0
2000	0.0	0.0	0.0	±2.0
4000	0.0	0.0	0.0	±3.0
8000	0.0	0.1	0.1	±5.0

5. Frequency and time weightings at 1 kHz

5.1 Frequency weightings at 1 kHz

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

5.2 Time weighting at 1 kHz

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

6. Long - term stability

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

Continuation of Calibration Certificate

Cert. No. : ACL21068
Job No. : VC64AC0052
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	25.8	-0.2	± 1.1
25.0	24.8	-0.2	± 1.1

Continuation of Calibration Certificate

Cert. No. : ACL21068

Job No. : VC64AC0052

Pages : 7 of 8

8. Level linearity including the level range control

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

9. Tone burst response

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

10. Peak C sound level

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

Number of cycle in test signal	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.0	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. : ACL21068

Job No. : VC64AC0052

Pages : 8 of 8

11. Overload indication

Measured value (dB)		Deviated Value (dB)	Acceptance Limits (dB)
Positive one-half cycle	Negative one-half cycle		
89.8	89.5	-0.3	±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

SITHIPHORN ASSOCIATES CO.,LTD. CALIBRATION LABORATORY

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



Cert. No. : ACL21100

Pages : 1 of 8

Calibration Certificate

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

Condition As Found : GOOD

Customer : 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 : 01 SEPTEMBER 2021
Calibration Date : 13-15 SEPTEMBER 2021
Date of Issue : 16 SEPTEMBER 2021

REVIEW BY	<i>Marakorn P.</i>
APPROVED BY	<i>[Signature]</i>
NEXT CAL. DATE	13/9/22

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.

Continuation of Calibration Certificate

Cert. No. : ACL21100

Job No. : VC64AC0066

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 :

<u>Instrument</u>	<u>Model</u>	<u>Serial No.</u>	<u>Cert. No.</u>	<u>Due Date</u>
Waveform Generator	33210A	MY48017076	EF-0012-21	10-Feb-22
Waveform Generator	33511B	MY52302742	EF-0011-21	10-Feb-22
Digital Multimeter	33461A	MY53220104	EEL.BP. 05/0264	10-Feb-22
Digital Multimeter	33461A	MY53220076	EEL.BP. 03/0264	08-Feb-22
Digital Multimeter	8846A	1997025	EEL.BP. 06/0264	05-Feb-22
Programmable Attenuator	MAT-1070	62100114	1500-07774E	08-Mar-22
Condenser Microphone	4180	2977900	AA-1008-21	05-Feb-22
Measuring Amplifier	NA-42KAI	34560495	AA-3003-21	16-Feb-22

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

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

3.1 National Institute of Metrology (Thailand).

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

Continuation of Calibration Certificate

Cert. No. : ACL21100
Job No. : VC64AC0066
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. : ACL21100

Job No. : VC64AC0066

Pages : 4 of 8

Result of calibration :**1. Absolute sensitivity**

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

2. Self-generated noise

2.1 Normal test

Measured Value (dB)
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	18.1
Flat	23.9

3. Acoustical signal tests of frequency weightings

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

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)			
	Flat	C-weight	A-weight	Acceptance Limits
125	0.4	0.4	0.4	± 1.5
1000	0.0	0.0	0.0	± 1.0
8000	-0.7	-0.6	-0.6	±5.0

Continuation of Calibration Certificate

Cert. No. : ACL21100

Job No. : VC64AC0066

Pages : 5 of 8

4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)			
	Flat	C-weight	A-weight	Acceptance Limits
63	0.0	-0.1	-0.1	±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	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. : ACL21100

Job No. : VC64AC0066

Pages : 6 of 8

7. Level linearity on the reference level range

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

Continuation of Calibration Certificate

Cert. No. : ACL21100
Job No. : VC64AC0066
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	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	135.2	-0.2	±2.0

Continuation of Calibration Certificate

Cert. No. : ACL21100

Job No. : VC64AC0066

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

CERTIFICATE OF CALIBRATION

Certificate No. : CL-045-64
Page 1 of 2

Equipment Name : Heat Stress Monitor with Sensor
Manufacturer. : DeltaOHM
Model: HD32.2
Serial No: 15020724
ID No: RYG_FS0228

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 : 05 JUL 2021
Calibration date : 09 JUL 2021
Issue date : 13 JUL 2021

Reference Used During Calibration

1.Standard Temperature Probe Model : STS-100 A500,
Serial No. : 667682-09, Due date : 25 Mar 2022
2.Digital Temperature Indicator Model : DTI-1000-A MK II,
Serial No.: 671407-00591 Due date : 04 June 2022

Calibration Condition

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

REVIEW BY	<i>Narakorn P.</i>
APPROVED BY	<i>[Signature]</i>
NEXT CAL. DATE	<i>9/7/25 22</i> <i>9/7/21</i> <i>OK</i>

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-0036-21, Certificate number : ER-0032-21

Calibrated by

- ☐ Mr. Sorawit Thachalad
☒ Miss Orathai Wiwatwittaya



Approved Signatory:

[Signature]
Mr. Parinya Booncharoen
Technical Support
And Calibration Manager

Result of Calibration :- ☒ Without Adjustment ☐ With Adjustment

Calibration Range: 20 °C – 40 °C

Function:

Table 1: This equipment was connected with wet bulb probe Model: HP3201.2 S/N: 15031956.
Dimension : Diameter 14 mm. Length 170 mm.

<u>Immersion</u> <u>Depth</u> (mm)	<u>Standard</u> <u>Reading</u> (°C)	<u>UUC</u> <u>Reading</u> (°C)	<u>Error</u> (°C)	<u>Uncertainty</u> (°C)
30	20.055	20.4	0.3	0.16
30	25.046	25.3	0.3	0.099
30	30.040	30.4	0.3	0.16
30	35.036	35.3	0.2	0.14
30	40.029	40.3	0.3	0.30

Table 2: This equipment was connected with temperature probe Model: TP3207.2 S/N: 15031951.
Dimension : Diameter 14 mm. Length 150 mm.

<u>Immersion</u> <u>Depth</u> (mm)	<u>Standard</u> <u>Reading</u> (°C)	<u>UUC</u> <u>Reading</u> (°C)	<u>Error</u> (°C)	<u>Uncertainty</u> (°C)
70	20.054	20.3	0.2	0.099
70	24.878	25.0	0.1	0.099
70	29.825	29.9	0.1	0.099
70	34.778	34.8	0.0	0.099
70	39.731	39.7	0.0	0.099

Table 3: This equipment was connected with Globe thermometer probe Model: TP3276.2 S/N: 15028490.
Dimension : Diameter 8 mm. Length 170 mm.

<u>Immersion</u> <u>Depth</u> (mm)	<u>Standard</u> <u>Reading</u> (°C)	<u>UUC</u> <u>Reading</u> (°C)	<u>Error</u> (°C)	<u>Uncertainty</u> (°C)
110	20.055	20.1	0.0	0.099
110	25.046	25.1	0.1	0.099
110	30.040	30.1	0.1	0.099
110	35.035	35.1	0.1	0.099
110	40.029	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-047-64
Page 1 of 2

Equipment Name : Heat Stress Monitor with Sensor
Manufacturer. : DeltaOHM
Model: HD32.2
Serial No: 15020734
ID No: RYG_FS0230

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 : 05 JUL 2021
Calibration date : 12 JUL 2021
Issue date : 13 JUL 2021

Reference Used During Calibration

1. Standard Temperature Probe Model : STS-100 A500, Serial No. : 667682-09, Due date : 25 Mar 2022
2. Digital Temperature Indicator Model : DTI-1000-A MK II, Serial No.: 671407-00591 Due date : 04 June 2022

Calibration Condition

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

REVIEW BY

APPROVED BY

NEXT CAL. DATE

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-0036-21, Certificate number : ER-0032-21

Calibrated by

- ☐ Mr. Sorawit Thachalad
☒ Miss Orathai Wiwatwittaya



Approved Signatory:

Mr. Parinya Booncharoen
Technical Support
And Calibration Manager

Result of Calibration :- ☒ Without Adjustment ☐ With Adjustment

Calibration Range: 20 °C – 40 °C

Function:

Table 1: This equipment was connected with wet bulb probe Model: HP3201.2 S/N: 15028544.
Dimension : Diameter 14 mm. Length 170 mm.

<u>Immersion</u> <u>Depth</u> (mm)	<u>Standard</u> <u>Reading</u> (°C)	<u>UUC</u> <u>Reading</u> (°C)	<u>Error</u> (°C)	<u>Uncertainty</u> (°C)
30	20.042	20.0	0.0	0.099
30	25.046	24.9	-0.1	0.099
30	30.040	29.9	-0.1	0.099
30	35.032	34.9	-0.1	0.099
30	40.026	39.9	-0.1	0.099

Table 2: This equipment was connected with temperature probe Model: TP3207.2 S/N: 15033222.
Dimension : Diameter 14 mm. Length 150 mm.

<u>Immersion</u> <u>Depth</u> (mm)	<u>Standard</u> <u>Reading</u> (°C)	<u>UUC</u> <u>Reading</u> (°C)	<u>Error</u> (°C)	<u>Uncertainty</u> (°C)
70	20.040	20.1	0.1	0.099
70	24.921	24.9	0.0	0.099
70	29.830	29.7	-0.1	0.099
70	34.783	34.6	-0.2	0.099
70	39.739	39.5	-0.2	0.099

Table 3: This equipment was connected with Globe thermometer probe Model: TP3276.2 S/N: 15028482.
Dimension : Diameter 8 mm. Length 170 mm.

<u>Immersion</u> <u>Depth</u> (mm)	<u>Standard</u> <u>Reading</u> (°C)	<u>UUC</u> <u>Reading</u> (°C)	<u>Error</u> (°C)	<u>Uncertainty</u> (°C)
110	20.041	20.1	0.1	0.099
110	25.046	25.1	0.1	0.099
110	30.040	30.1	0.1	0.099
110	35.033	35.1	0.1	0.099
110	40.026	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-073-64
Page 1 of 2

Equipment Name : Heat Stress Monitor with Sensor
Manufacturer. : DeltaOHM
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 : 8 SEP 2021

Calibration date : 30 SEP 2021

Issue date : 4 OCT 2021

Reference Used During Calibration

1.Standard Temperature Probe Model: STS-100 A500,
Serial No.: 667682-09, Due date: 25 Mar 2022
2.Digital Temperature Indicator Model: DTI-1000-A MK
II, Serial No.: 671407-00591 Due date: 04 June 2022

Calibration Condition

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

Calibration Procedure

The temperature calibration was done by In-House
calibration method as 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-0036-21, Certificate number: ER-0032-
21

REVIEW BY	<i>Mankorn P.</i>
APPROVED BY	<i>[Signature]</i>
NEXT CAL. DATE	30/9/22

Calibrated by

- ☐ Mr. Sorawit Thachalad
☒ Miss Orathai Wiwatwittaya



Approved Signatory: *[Signature]*

Mr. Parinya Booncharoen
Technical Support
and Calibration Manager

Result of Calibration :- ☒ Without Adjustment ☐ With Adjustment

Calibration Range: 20 °C – 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.

<u>Immersion</u> <u>Depth</u> (mm)	<u>Standard</u> <u>Reading</u> (°C)	<u>UUC</u> <u>Reading</u> (°C)	<u>Error</u> (°C)	<u>Uncertainty</u> (°C)
30	20.051	20.1	0.0	0.099
30	25.047	25.1	0.1	0.099
30	30.041	30.1	0.1	0.099
30	35.028	35.1	0.1	0.099
30	40.017	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.

<u>Immersion</u> <u>Depth</u> (mm)	<u>Standard</u> <u>Reading</u> (°C)	<u>UUC</u> <u>Reading</u> (°C)	<u>Error</u> (°C)	<u>Uncertainty</u> (°C)
70	20.053	20.2	0.0	0.099
70	24.872	24.8	-0.1	0.10
70	29.826	29.6	-0.2	0.099
70	34.797	34.5	-0.3	0.099
70	39.707	39.3	-0.4	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.

<u>Immersion</u> <u>Depth</u> (mm)	<u>Standard</u> <u>Reading</u> (°C)	<u>UUC</u> <u>Reading</u> (°C)	<u>Error</u> (°C)	<u>Uncertainty</u> (°C)
110	20.051	20.0	-0.1	0.099
110	25.047	25.0	0.0	0.099
110	30.041	30.0	0.0	0.099
110	35.028	35.0	0.0	0.099
110	40.017	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%.

✱ 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. 0-2717-3000-24 FAX. 0-2719-9484



Certificate of Calibration

Certificate No. : 21H1023

Page : 1 of 2

Equipment : Heat Stress Monitor

Manufacturer: Delta OHM

Model : HD32.2

Serial No.: 15030245

ID No.: RYG_FS0237

Condition As-Received: Used Item

Received Date: 06 May 2021

Calibration Date: 10 May 2021
to 12 May 2021

Reference: 2105-0119WSC

Ambient Temperature: (25 ± 3) °C

Relative Humidity: (50 ± 20) %

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

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

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

Procedure used: Calibration were conducted using in-house calibration procedure CP-H03 according to comparison with
standard temperature probe for temperature measurement function into humidity / temperature chamber.

Condition of this result of calibration

1. Reference standards instruments :

Instrument

Model

Serial No.

Certificate No.

Due Date

1) Handheld Thermometer With Sensor

1521

A5A339

201968

10 Aug 2021

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

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

-National Institute of Metrology Thailand (NIMT)

REVIEW BY	<i>Narakorn P.</i>
APPROVED BY	<i>[Signature]</i>
NEXT CAL. DATE	10/5/22

Calibrated by : Kraipop Onrat
Issue Date : 17 May 2021

Approved Signatory :

☒ Chakrit Waewanjua

☐ Pornthippa Tameyakul

☐ Pitak Srimongkol

B 0260154



Cert. No.: 21H1023

Page.: 2 of 2

Result of Calibration:-

Without Adjustment

Function: Temperature measurement.

This instrument was connected with temperature probe.

Measurement Function	Model of Sensor	Serial of Sensor	Standard Temperature (°C)	UUC* Reading (°C)	Error (°C)	Uncertainty of Measurement (±°C)
Tn	HP3201.2	13035026	25.020	25.1	0.080	0.42
			35.024	35.1	0.076	0.42
			*45.023	45.1	0.077	0.42
Tg	TP 3276.2	20008279	25.020	25.1	0.080	0.42
			35.024	35.2	0.176	0.42
			*45.023	45.2	0.177	0.42
T	TP 3207.2	15031949	25.020	25.2	0.180	0.42
			35.024	35.2	0.176	0.42
			*45.023	45.2	0.177	0.42

* Not NSC-ONSC Accredited

UUC* : Unit Under Calibration

The reported uncertainty of measurement was base on standard uncertainty multiplied by coverage factor $k = 2.00$, providing confidence level approximately 95%.

-o0o-

a 1054462



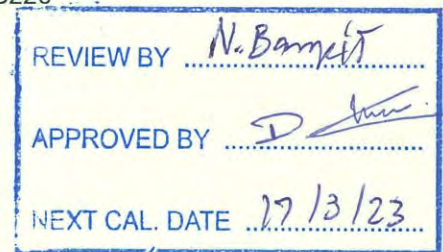
TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES
534/4 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG BANGKOK 10250
TEL. 0-2717-3000-27 FAX. 0-2719-9484



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

Certificate of Calibration

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

Approved by :

Malee

Approved Signatory

- (☒) Malee Butkruea
() Saithip Meangmai
() Warakorn Lernagtrakul

Issue Date : 22 March 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 0037307



Cert.No.: 22CH405

Page.: 2 of 3

Condition of this calibration result

1. Reference Standard Instrument : -

<u>Instrument</u>	<u>Serial No.</u>	<u>ID No.</u>	<u>Cert. No.</u>	<u>Due Date</u>
1) Document Process Calibrator	54030049	130RC116	21E2682	25 Aug 2022
2) Ref. Standard Thermometer	4982054	110RC044	21I1201	26 Oct 2022

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

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

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

<u>Buffer Solution</u>	<u>Manufacturer</u>	<u>Lot No.</u>	<u>Exp. date</u>
pH 4.008	CPA chem	788995	01 Jan 2024
pH 6.982	CPA chem	761017	02 Aug 2022
pH 10.015	CPA chem	766824	04 Sep 2022

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

Calibration Results

Function : mV Measurement

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

Unit Under Calibration	Nominal Value	Standard Voltage Input	Actual Reading		Uncertainty of Measurement (±mV)	Coverage factor <i>k</i>
	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

Malu.



Cert.No.: 22CH405

Page.: 3 of 3

Calibration Results**Function : pH Measurement**

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

Unit Under Calibration	Standard pH Buffer Solution	Actual pH Reading	Actual mV Reading (mV)	Uncertainty of pH measurement (\pm)	Coverage factor k
pH Electrode S/N.: 1453404	4.008	4.010	177.7	0.0046	2.00
	6.982	6.988	3.6	0.0084	2.00
	10.015	10.010	-172.9	0.0073	2.05

Function : Temperature Measurement**(*) Without adjustment**

This equipment was connected with Temperature Probe;

- Model : InLab Expert Pro-ISM

- Serial No. : 1453404

Dimension of probe;

- Length : 120 mm.

- Diameter : 12 mm.

- Immersion Depth : 100 mm.

Calibration Point ($^{\circ}\text{C}$)	Standard Temperature ($^{\circ}\text{C}$)	UUC* Reading ($^{\circ}\text{C}$)	Error ($^{\circ}\text{C}$)	Uncertainty of measurement (\pm $^{\circ}\text{C}$)	Coverage factor k
25.0	25.002	24.9	-0.102	0.13	2.00

Remark : - UUC* = Unit Under Calibration

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

-o0o-

Maku.



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. : 22E986

Page : 1 of 2

Equipment : pH Meter
Manufacturer: Mettler Toledo
Model : SevenCompact S220
Serial No.: C104059460
ID No.: RYG_EN0183

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.

Condition As-Received: Used Item
Received Date: 16 March 2022
Calibration Date: 21 March 2022

Reference: 2203-0611DSC
Ambient Temperature: (23 ± 2) °C
Relative Humidity: (50 ± 10) %

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

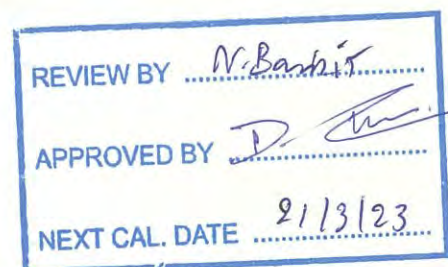
<u>Instrument</u>	<u>Model</u>	<u>Serial No.</u>	<u>Certificate No.</u>	<u>Due Date</u>
1) Multi-Product Calibrator	5500A	6440007	21E1444	07 May 2022

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

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

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

-National Institute of Metrology Thailand (NIMT)



Calibrated by : Pongsagorn Boonyaporn
Issue Date : 22 March 2022

Approved Signatory :

☒ Phalinee Prabpaipal
☐ Nuntawat Khamchai
☐ Pornthippa Tameyakul

B 0284414



Cert. No.: 22E986

Page.: 2 of 2

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

Function:	DC voltage measurement		Range:	2000	mV
	<u>Standard Value</u>	<u>UUC* Reading</u>	<u>Error</u>	<u>Uncertainty</u>	
	(mV)	(mV)	(mV)	($\pm \mu V$)	
	-200.0000	-200.0	0.0	72	
	-150.0000	-150.0	0.0	69	
	-100.0000	-100.0	0.0	65	
	-50.0000	-50.0	0.0	62	
	0.0000	0.0	0.0	58	
	50.0000	50.0	0.0	62	
	100.0000	100.0	0.0	65	
	150.0000	150.0	0.0	69	
	200.0000	200.0	0.0	72	

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

*UUC= Unit Under Calibration.

-o0o-

a 1101070



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.: 22TW34

Page.: 1 of 2

Certificate of Testing

Equipment :	DO Meter
Manufacturer :	YSI
Model :	5000-115V
Serial No. :	15E102796
ID No. :	RYG_EN0032
Received Date :	11 February 2022
Test Date :	14 February 2022
Reference :	2202-0404DSC-4
Submitted by :	ALS Laboratory Group (Thailand) Co.,Ltd. (Rayong Branch) 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	
(<input checked="" type="checkbox"/>) Saithip Meangmai	
() Warakorn Lerngagtrakul	
Issue Date :	18 February 2022

REVIEW BY	<u>N. Bannit</u>
APPROVED BY	<u>D. [Signature]</u>
NEXT CAL. DATE	<u>15/8/23</u>



Cert.No.: 22TW34

Page.: 2 of 2

Result : Dissolved Oxygen Meter Adjustment With Air 100 %

Dissolved Oxygen Probe No.: 15E100464

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

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

-o0o-

Saithip



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.: 22LM12

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 : 11 February 2022

Calibrated Date : 21 February 2022

Ambient Temperature : (26 ± 10) °C

Relative Humidity : (50 ± 30) %

AC Line Voltage : (220 ± 22) V

Calibrated by : Kunchit Promprat

Approved by : Malee Butkruea
Approved Signatory

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

Issue Date : 21 February 2022

The Uncertainties are for a confidence probability of approximately 95%

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

A 0038008



Equipment : DO Meter with Sensor

Condition As-Received : Used Item

Reference : 2202-0404DSC-5

Cert. No.: 22LM12

Page.: 2 of 2

Procedure Used :-

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

The temperature scale used was based on ITS-90.

Condition of this result of calibration

1. Reference standard instrument:-

<u>Instrument</u>	<u>Model</u>	<u>Serial No.</u>	<u>Cert. No.</u>	<u>Due Date</u>
1) Digital Thermometer	1523	2188080	2111273	22 Nov 2022

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

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

Result of Calibration :- (*) Without Adjustment

Function : Temperature measurement.

This instrument was connected with temperature sensor, S/N.: 15E100464

<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	45	20.001	19.88	-0.121	0.15	2.00

UUC* : Unit Under Calibration

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

-o0o-

Mahu



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.: 22TM317

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 : 22 April 2022

Calibration Date : 22 April 2022

Ambient Temperature : (26 ± 10) °C

Relative Humidity : (50 ± 30) %

Calibrated by : Man Pattanapongpaiboon

REVIEW BY	<i>N. Banvit</i>
APPROVED BY	<i>D. [Signature]</i>
NEXT CAL. DATE	21/10/23

Approved by :

Manu

Approved Signatory

- () Pornthippa Tameyakul
(/) Malee Butkruea
() Suwit Imjai

Issue Date :

3 May 2022

The Uncertainties are for a confidence probability of approximately 95%

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

A 0040735



Equipment : Low Temp. Incubator

Condition As-Received : Used Item

Reference : 2204-0146OC-1

Cert. No.: 22TM317

Page.: 2 of 3

Procedure Used :-

Calibration were conducted using calibration procedure CP-OT02 according to direct measurement

The temperature scale used was based on ITS-90.

Condition of this result of calibration

1. Reference standard instrument:-

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

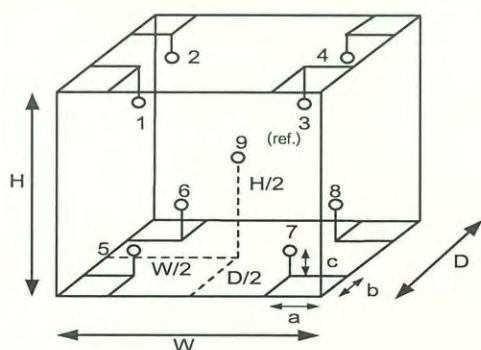
2. This certificate is valid only to the item calibrated on date and place of calibration.

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	58
AC Supply (Volt)	221	223

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	9RTD-2/1
2	9RTD-2/2
3	9RTD-2/3
4	9RTD-2/4
5	9RTD-2/5
6	9RTD-2/6
7	9RTD-2/7
8	9RTD-2/8
9 (ref.)	9RTD-2/9

Malu



Equipment : Low Temp. Incubator
Condition As-Received : Used Item
Reference : 2204-0146OC-1
Result of Calibration :- (*) Without Adjustment

Cert. No.: 22TM317

Page.: 3 of 3

Function of UUC* : Temperature Source

Fresh air setting : Close

Calibration Point (°C)	UUC* Setting (°C)	UUC* Reading (°C)	Temperature stability (± °C)	Temperature uniformity (°C)	Overall Variation (°C)	Uncertainty (± °C)	Coverage Factor <i>k</i>
20.0	20.0	20.0	0.022	0.20	0.22	0.30	2

Calibration Point (°C)	Measured Temperature (°C)								
	Position								
	1	2	3	4	5	6	7	8	9 (ref.)
20.0	20.209	20.174	20.199	20.110	20.075	20.062	20.027	20.069	20.030

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

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

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

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

UUC* : Unit Under Calibration

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

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

-o0o-

Malu



PENTA
CALIBRATION

PENTA CALIBRATION CO., LTD.

66/124 The Connect 33 Village Kanchanaphisek Road
Dokmai Prawet Bangkok 10250
Tel: +66 (0) 2069-9773
www.pentacal.com

Certificate of Calibration

Represent to Certificate of Calibration ,PTC/07/22103

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



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



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

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

The Method used: In house method, PTC-WI-07, base on Euramet cg. 18

Traceability: This certificate is traceable to the SI Units through Thai Calibration Service Co.,Ltd.
, NSC-ONSC Accreditation No.: Calibration 0189

Date Received: March 23, 2022

Calibration Date: March 23, 2022

Issued Date: March 25, 2022

Calibration By: Mr. Rungroje Metakul



PENTA CALIBRATION CO.,LTD.

Mr. Kriangsak Kalasri

(Mr.Kriangsak Kalasri)

Reviewed by

Approved By :

Mr. Keattisak Kerdto

(Mr. Keattisak Kerdto)

Laboratory Manager

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

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

This calibration certificate shall not be reproduced except in full only, without written approval from penta calibration co., Ltd



Represent to Certificate of Calibration ,PTC/07/22103

Certificate No.: PTC/07/22103

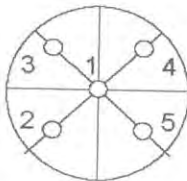
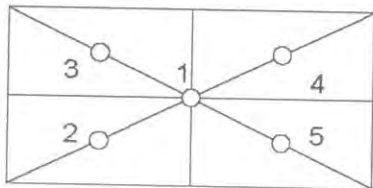
Page: 2 of 2

Measurement Results:

Without Adjustment :

Function Calibration: Non Adjustment

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



Eccentricity test 100 (g)

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

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

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

Nominal test value (g)	Standard Deviation
200	0.00003

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

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

Note: Weight of adjust - (g)

The End of Certificate



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.: 21TM827

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 : 5 May 2021

Calibration Date : 5 May 2021

Ambient Temperature : (26 ± 10) °C

Relative Humidity : (50 ± 30) %

Calibrated by : Khit Ruttanaprapachai

Approved by :

Malee

Approved Signatory

() Pornthippa Tameyakul

(✓) Malee Butkruea

() Suwit Imjai

Issue Date : 14 May 2021

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 : Hot Air Oven
 Condition As-Received : Used Item
 Reference : 2105-0005OC-4
 Procedure Used :-

Cert. No.: 21TM827
 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	MY57013823	21LM3	26 Feb 2022

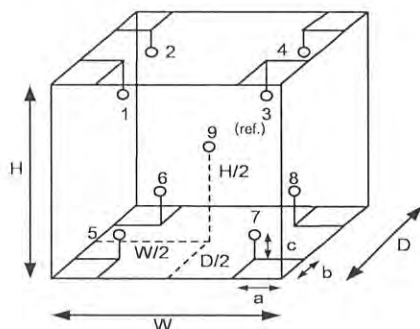
2. This certificate is valid only to the item calibrated on date and place of calibration.

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. (%)	59	56
AC Supply (Volt)	220	221

Probe Installation Details :			Dimension of Chamber :		
a =	5.0	cm	D =	0.40	m
b =	5.0	cm	W =	0.56	m
c =	5.0	cm	H =	0.48	m
Capacity =			0.11 m ³		

Ref. Std. ID No.: @ Calibration Point		
Position :	(104) °C	(180) °C
1	21-17RTD-01	19-17TC-01
2	21-17RTD-02	19-17TC-02
3	17RTD-03	19-17TC-03
4	17RTD-04	19-17TC-04
5	17RTD-05	19-17TC-05
6	17RTD-06	19-17TC-06
7	17RTD-07	19-17TC-07
8	17RTD-08	19-17TC-08
9 (ref.)	17RTD-09	19-17TC-09

Mahu .



Equipment : Hot Air Oven
Condition As-Received : Used Item
Reference : 2105-0005OC-4
Result of Calibration :- (*) Without Adjustment
Function of UUC* : Temperature Source

Cert. No.: 21TM827

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 <i>k</i>
104.0	104.0	104.0	0.063	0.54	0.70	0.42	2
180.0	180.0	180.0	0.15	0.89	1.3	1.1	2

Calibration Point (°C)	Measured Temperature (°C)								
	Position								
	1	2	3	4	5	6	7	8	9 (ref.)
104.0	104.243	103.732	103.760	103.742	103.863	103.743	104.311	103.689	103.815
180.0	180.101	180.481	179.401	179.692	179.980	179.943	180.127	179.915	179.709

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 1054286



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.: 21TM829

Page.: 1 of 3

Certificate of Calibration

Equipment :	Hot Air Oven	 REVIEW BY <u>Thamitall.</u> APPROVED BY <u>D. [Signature]</u> NEXT CAL. DATE <u>3/11/22.</u>
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 :	5 May 2021	
Calibration Date :	5 - 6 May 2021	
Ambient Temperature :	(26 ± 10) °C	
Relative Humidity :	(50 ± 30) %	
Calibrated by :	Khit Ruttanaprapachai	

Approved by :

Approved Signatory

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

Issue Date :

14 May 2021

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 : Hot Air Oven
 Condition As-Received : Used Item
 Reference : 2105-0005OC-1
 Procedure Used :-

Cert. No.: 21TM829
 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:-

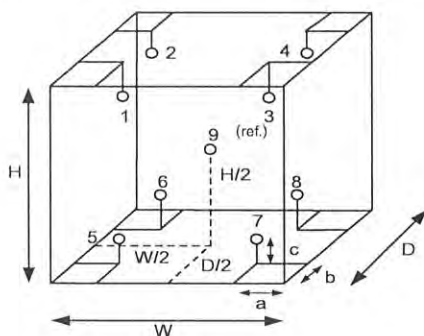
Instrument	Model	Serial No.	Cert. No.	Due Date
1) Data Acquisition	34972A	MY57013823	21LM3	26 Feb 2022

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)	29	30
REL.Humid. (%)	56	58
AC Supply (Volt)	221	222

Position :	Ref. Std. ID No.:
1	21-17RTD-01
2	21-17RTD-02
3	17RTD-03
4	17RTD-04
5	17RTD-05
6	17RTD-06
7	17RTD-07
8	17RTD-08
9 (ref.)	17RTD-09

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

Malu



Equipment : Hot Air Oven
Condition As-Received : Used Item
Reference : 2105-0005OC-1
Result of Calibration :- (*) Without Adjustment
Function of UUC* : Temperature Source

Cert. No.: 21TM829

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 <i>k</i>
70.0	70.0	70.0	0.21	1.8	2.0	0.55	2

Calibration Point (°C)	Measured Temperature (°C)								
	Position								
	1	2	3	4	5	6	7	8	9 (ref.)
70.0	70.404	70.277	70.607	70.307	68.789	69.257	68.846	69.331	70.495

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-

Make



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.: 21TM673

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 : 5 May 2021

Calibration Date : 5 May 2021

Ambient Temperature : (26 ± 10) °C

Relative Humidity : (50 ± 30) %

Calibrated by : Tawatchai Pama

Approved by :

Malee

Approved Signatory

() Pornthippa Tameyakul

(☒) Malee Butkruea

() Suwit Imjai

Issue Date : 14 May 2021

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 : Water Bath
Condition As-Received : Used Item
Reference : 2105-0005OC-3
Procedure Used :-

Cert. No.: 21TM673
Page.: 2 of 3

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

The temperature scale used was based on ITS-90.

Condition of this result of calibration

1. Reference standard instrument:-

<u>Instrument</u>	<u>Model</u>	<u>Serial No.</u>	<u>Cert. No.</u>	<u>Due Date</u>
1) Data Acquisition	34970A	MY44060450	21LM4	06 Mar 2022

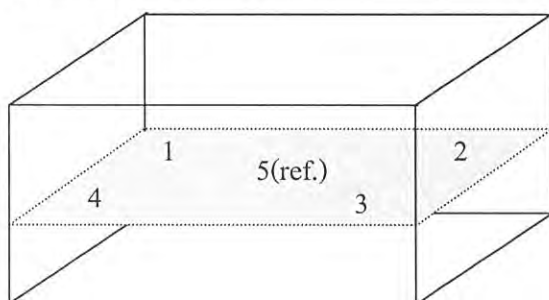
2. This certificate is valid only to the item calibrated on date and place of calibration.

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

Result of Calibration :- (*) Without Adjustment

Function of UUC* : Temperature Source

	Environmental		AC Voltage Supply
	(°C)	(%R.H.)	(Volt)
Beginning of Calibration	22	68	230
Finished of Calibration	20	64	231



Front

Position :	Ref. Std. S/N.:
1	4803988-001
2	4803988-002
3	4803988-003
4	4803988-004
5(ref.)	4803988-005

Malek .



Equipment : Water Bath
Condition As-Received : Used Item
Reference : 2105-0005OC-3
Result of Calibration :- (*) Without Adjustment
Function of UUC* : Temperature Source

Cert. No.: 21TM673
Page.: 3 of 3

Calibration point (°C)	UUC* Setting (°C)	UUC* Reading (°C)	Average* Standard Reading (°C)				
			Position				
			1	2	3	4	5 (ref.)
85.0	85.0	85.0	84.891	84.893	84.880	84.892	84.917

Calibration point (°C)	Uniformity (°C)	Stability (± °C)	Uncertainty (± °C)	Coverage Factor <i>k</i>
85.0	0.089	0.052	0.22	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



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. : 21T1200

Page : 1 of 2

Equipment : Digital Thermometer With Sensor

Manufacturer: Testo

Model : 106

Serial No.: 31281494/504

ID No.: RYG_FS0467

Condition As-Received: Used Item

Received Date: 02 July 2021

Calibration Date: 07 July 2021
to 08 July 2021

Reference: 2107-0069DSC

Ambient Temperature: (25 ± 3) °C

Relative Humidity: (50 ± 20) %

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

Submitted by: ALS Laboratory Group (Thailand) Co.,Ltd. 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-T01 according to comparison with
Platinum Resistance Thermometer (PRT) into liquid bath temperature controller.
The temperature scale used was based on ITS-90.

Condition of this result of calibration

1.Reference standards instruments :

<u>Instrument</u>	<u>Model</u>	<u>Serial No.</u>	<u>Certificate No.</u>	<u>Due Date</u>
1) Digital Thermometer	1529-R	B19520	211680	26 Jun 2022
2) Platinum Resistance Thermometer	935-14-95	261589/1	211680	26 Jun 2022

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

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

-National Institute of Metrology Thailand (NIMT)

REVIEW BY	Tanasit.
APPROVED BY	Supt S
NEXT CAL. DATE	7/7/22

Calibrated by : Yossapon Poljorn

Issue Date : 09 July 2021

Approved Signatory :

☐ Phalinee Prabpaipal

☐ Chatchawan Khunpiluek

☒ Wanlop Larpkurn

B 0265214