

ภาคผนวก จ

ใบรับรองเอกสารการสอบเทียบเครื่องมือตรวจวิเคราะห์



รายการเครื่องมือที่ใช้ในการวิเคราะห์ / ทดสอบ

Sample Name	Parameter	Equipment Name	ID No.	Calibrated Date	Next Cal.	Freq. Calibrate (Months)
Amesent	Particulate Matter (PM10)	high volume	BA1-12083			On-site Calibration
Amesent	Particulate Matter (PM10)	high volume	BA1-15281			On-site Calibration
Amesent	Particulate Matter (PM10)	high volume	BA1-15015			On-site Calibration
Amesent	Particulate Matter (PM10)	high volume	BA1-15015			On-site Calibration
Amesent	Particulate Matter (PM10)	Partic Balance	BA1-15063	8-Jun-23	8-Jun-24	12
Amesent	Total Suspended Particulate	High Volume	BA1-15507			On-site Calibration
Amesent	Total Suspended Particulate	High Volume	BA1-15506			On-site Calibration
Amesent	Total Suspended Particulate	High Volume	BA1-15504			On-site Calibration
Amesent	Total Suspended Particulate	High Volume	BA1-15503			On-site Calibration
Amesent	Total Suspended Particulate	High Volume	BA1-15502			On-site Calibration
Amesent	Hydrogen Sulfide	NY Analyzer	BA1-15170	3-Jan-24	3-Jan-25	6
Amesent	Hydrogen Sulfide	NY Analyzer	BA1-15080	3-Jan-24	3-Jan-25	6
Amesent	Hydrogen Sulfide	NY Analyzer	BA1-15108	3-Jan-24	3-Jan-25	6
Amesent	Hydrogen Sulfide	NY Analyzer	BA1-15078	3-Jan-24	3-Jan-25	6
Amesent	Sulfur Dioxide	NY Analyzer	BA1-15169	3-Jan-24	3-Jan-25	6
Amesent	Sulfur Dioxide	NY Analyzer	BA1-15062	3-Jan-24	3-Jan-25	6
Amesent	Sulfur Dioxide	NY Analyzer	BA1-15157	3-Jan-24	3-Jan-25	6
Amesent	Sulfur Dioxide	NY Analyzer	BA1-15119	3-Jan-24	3-Jan-25	6
Amesent	Wind Speed / Wind Direction	Wind Speed - Sock Device	BA1-15112	19-Mar-23	19-Mar-24	18
Amesent	Wind Speed / Wind Direction	Wind Speed - Sock Device	BA1-15111	19-Mar-23	19-Mar-24	18
Amesent	Wind Speed / Wind Direction	Wind Speed - Sock Device	BA1-15110	19-Mar-23	19-Mar-24	18
Amesent	Wind Speed / Wind Direction	Wind Speed - Sock Device	BA1-15112	19-Mar-23	19-Mar-24	18
Amesent	Temperature	Temperature Sensor	BA1-15112	19-Mar-23	19-Mar-24	18
Amesent	Temperature	Temperature Sensor	BA1-15111	19-Mar-23	19-Mar-24	18
Amesent	Temperature	Temperature Sensor	BA1-15110	19-Mar-23	19-Mar-24	18
Amesent	Temperature	Temperature Sensor	BA1-15112	19-Mar-23	19-Mar-24	18
Track-CDDM	Carbon Monoxide	Analyzer - Direct oxidation, Standard gas	BA1-15045	1-Jan-24	1-Jan-25	12
Track-CDDM	Ozone	Analyzer - Direct oxidation, Standard gas	BA1-15046	1-Jan-24	1-Jan-25	12
Track-CDDM	Carbon Dioxide	Analyzer - Direct oxidation, Standard gas	BA1-15047	1-Jan-24	1-Jan-25	12
Track-CDDM	Breath	Analyzer - Direct oxidation, Standard gas	BA1-15048	1-Jan-24	1-Jan-25	12
Track-CDDM	Respirable	Analyzer - Direct oxidation, Standard gas	BA1-15049	1-Jan-24	1-Jan-25	12
Track	Total Suspended Particulate	Comau Corning grav	BA1-15527	8-Jun-23	8-Jun-24	6
Track	Total Suspended Particulate	Comau Corning grav	BA1-15545	8-Jun-23	8-Jun-24	6
Track	Total Suspended Particulate	Comau Corning grav	BA1-15545	8-Jun-23	8-Jun-24	6
Track	Total Suspended Particulate	Filter Tare	BA1-15581	8-Jun-23	8-Jun-24	6
Track	Total Suspended Particulate	Filter Tare	BA1-15611	8-Jun-23	8-Jun-24	6
Track	Total Suspended Particulate	Filter Tare	BA1-15540	8-Jun-23	8-Jun-24	6
Track	Total Suspended Particulate	Filter Tare	BA1-15546	8-Jun-23	8-Jun-24	6
Track	Total Suspended Particulate	Filter Tare	BA1-15552	8-Jun-23	8-Jun-24	6
Track	Total Suspended Particulate	Filter Tare Analysis	BA1-15119	8-Jun-23	8-Jun-24	12
Track	Total Suspended Particulate	Filter Balance	BA1-15069	8-Jun-23	8-Jun-24	12
Track	PM2.5	Track Smart Meter	BA1-15048	15-Jun-23	15-Jun-24	12
Track	PM2.5	Track Smart Meter	BA1-15049	15-Jun-23	15-Jun-24	12
Track	PM2.5	Track Smart Meter	BA1-15048	15-Jun-23	15-Jun-24	12
Track	PM2.5	Track Smart Meter	BA1-15049	15-Jun-23	15-Jun-24	12
Track	PM2.5	Track Smart Meter	BA1-15048	15-Jun-23	15-Jun-24	12
Track	PM2.5	Track Smart Meter	BA1-15049	15-Jun-23	15-Jun-24	12
Track	PM2.5	Track Smart Meter	BA1-15048	15-Jun-23	15-Jun-24	12
Track	PM2.5	Track Smart Meter	BA1-15049	15-Jun-23	15-Jun-24	12
Track	PM2.5	Track Smart Meter	BA1-15048	15-Jun-23	15-Jun-24	12
Track	PM2.5	Track Smart Meter	BA1-15049	15-Jun-23	15-Jun-24	12
Track	PM2.5	Track Smart Meter	BA1-15048	15-Jun-23	15-Jun-24	12
Track	PM2.5	Track Smart Meter	BA1-15049	15-Jun-23	15-Jun-24	12
Track	PM2.5	Track Smart Meter	BA1-15048	15-Jun-23	15-Jun-24	12
Track	PM2.5	Track Smart Meter	BA1-15049	15-Jun-23	15-Jun-24	12
Track	PM2.5	Track Smart Meter	BA1-15048	15-Jun-23	15-Jun-24	12
Track	PM2.5	Track Smart Meter	BA1-15049	15-Jun-23	15-Jun-24	12
Track	PM2.5	Track Smart Meter	BA1-15048	15-Jun-23	15-Jun-24	12
Track	PM2.5	Track Smart Meter	BA1-15049	15-Jun-23	15-Jun-24	12
Track	PM2.5	Track Smart Meter	BA1-15048	15-Jun-23	15-Jun-24	12
Track	PM2.5	Track Smart Meter	BA1-15049	15-Jun-23	15-Jun-24	12
Track	PM2.5	Track Smart Meter	BA1-15048	15-Jun-23	15-Jun-24	12
Track	PM2.5	Track Smart Meter	BA1-15049	15-Jun-23	15-Jun-24	12
Track	PM2.5	Track Smart Meter	BA1-15048	15-Jun-23	15-Jun-24	12
Track	PM2.5	Track Smart Meter	BA1-15049	15-Jun-23	15-Jun-24	12
Track	PM2.5	Track Smart Meter	BA1-15048	15-Jun-23	15-Jun-24	12
Track	PM2.5	Track Smart Meter	BA1-15049	15-Jun-23	15-Jun-24	12
Track	PM2.5	Track Smart Meter	BA1-15048	15-Jun-23	15-Jun-24	12
Track	PM2.5	Track Smart Meter	BA1-15049	15-Jun-23	15-Jun-24	12
Track	PM2.5	Track Smart Meter	BA1-15048	15-Jun-23	15-Jun-24	12
Track	PM2.5	Track Smart Meter	BA1-15049	15-Jun-23	15-Jun-24	12
Track	PM2.5	Track Smart Meter	BA1-15048	15-Jun-23	15-Jun-24	12
Track	PM2.5	Track Smart Meter	BA1-15049	15-Jun-23	15-Jun-24	12
Track	PM2.5	Track Smart Meter	BA1-15048	15-Jun-23	15-Jun-24	12
Track	PM2.5	Track Smart Meter	BA1-15049	15-Jun-23	15-Jun-24	12
Track	PM2.5	Track Smart Meter	BA1-15048	15-Jun-23	15-Jun-24	12
Track	PM2.5	Track Smart Meter	BA1-15049	15-Jun-23	15-Jun-24	12
Track	PM2.5	Track Smart Meter	BA1-15048	15-Jun-23	15-Jun-24	12
Track	PM2.5	Track Smart Meter	BA1-15049	15-Jun-23	15-Jun-24	12
Track	PM2.5	Track Smart Meter	BA1-15048	15-Jun-23	15-Jun-24	12
Track	PM2.5	Track Smart Meter	BA1-15049	15-Jun-23	15-Jun-24	12
Track	PM2.5	Track Smart Meter	BA1-15048	15-Jun-23	15-Jun-24	12
Track	PM2.5	Track Smart Meter	BA1-15049	15-Jun-23	15-Jun-24	12
Track	PM2.5	Track Smart Meter	BA1-15048	15-Jun-23	15-Jun-24	12
Track	PM2.5	Track Smart Meter	BA1-15049	15-Jun-23	15-Jun-24	12
Track	PM2.5	Track Smart Meter	BA1-15048	15-Jun-23	15-Jun-24	12
Track	PM2.5	Track Smart Meter	BA1-15049	15-Jun-23	15-Jun-24	12
Track	PM2.5	Track Smart Meter	BA1-15048	15-Jun-23	15-Jun-24	12
Track	PM2.5	Track Smart Meter	BA1-15049	15-Jun-23	15-Jun-24	12
Track	PM2.5	Track Smart Meter	BA1-15048	15-Jun-23	15-Jun-24	12
Track	PM2.5	Track Smart Meter	BA1-15049	15-Jun-23	15-Jun-24	12
Track	PM2.5	Track Smart Meter	BA1-15048	15-Jun-23	15-Jun-24	12
Track	PM2.5	Track Smart Meter	BA1-15049	15-Jun-23	15-Jun-24	12
Track	PM2.5	Track Smart Meter	BA1-15048	15-Jun-23	15-Jun-24	12
Track	PM2.5	Track Smart Meter	BA1-15049	15-Jun-23	15-Jun-24	12
Track	PM2.5	Track Smart Meter	BA1-15048	15-Jun-23	15-Jun-24	12
Track	PM2.5	Track Smart Meter	BA1-15049	15-Jun-23	15-Jun-24	12
Track	PM2.5	Track Smart Meter	BA1-15048	15-Jun-23	15-Jun-24	12
Track	PM2.5	Track Smart Meter	BA1-15049	15-Jun-23	15-Jun-24	12
Track	PM2.5	Track Smart Meter	BA1-15048	15-Jun-23	15-Jun-24	12
Track	PM2.5	Track Smart Meter	BA1-15049	15-Jun-23	15-Jun-24	12
Track	PM2.5	Track Smart Meter	BA1-15048	15-Jun-23	15-Jun-24	12
Track	PM2.5	Track Smart Meter	BA1-15049	15-Jun-23	15-Jun-24	12
Track	PM2.5	Track Smart Meter	BA1-15048	15-Jun-23	15-Jun-24	12
Track	PM2.5	Track Smart Meter	BA1-15049	15-Jun-23	15-Jun-24	12
Track	PM2.5	Track Smart Meter	BA1-15048	15-Jun-23	15-Jun-24	12
Track	PM2.5	Track Smart Meter	BA1-15049	15-Jun-23	15-Jun-24	12
Track	PM2.5	Track Smart Meter	BA1-15048	15-Jun-23	15-Jun-24	12
Track	PM2.5	Track Smart Meter	BA1-15049	15-Jun-23	15-Jun-24	12
Track	PM2.5	Track Smart Meter	BA1-15048	15-Jun-23	15-Jun-24	12
Track	PM2.5	Track Smart Meter	BA1-15049	15-Jun-23	15-Jun-24	12
Track	PM2.5	Track Smart Meter	BA1-15048	15-Jun-23	15-Jun-24	12
Track	PM2.5	Track Smart Meter	BA1-15049	15-Jun-23	15-Jun-24	12
Track	PM2.5	Track Smart Meter	BA1-15048	15-Jun-23	15-Jun-24	12
Track	PM2.5	Track Smart Meter	BA1-15049	15-Jun-23	15-Jun-24	12
Track	PM2.5	Track Smart Meter	BA1-15048	15-Jun-23	15-Jun-24	12
Track	PM2.5	Track Smart Meter	BA1-15049	15-Jun-23	15-Jun-24	12
Track	PM2.5	Track Smart Meter	BA1-15048	15-Jun-23	15-Jun-24	12
Track	PM2.5	Track Smart Meter	BA1-15049	15-Jun-23	15-Jun-24	12
Track	PM2.5	Track Smart Meter	BA1-15048	15-Jun-23	15-Jun-24	12
Track	PM2.5	Track Smart Meter	BA1-15049	15-Jun-23	15-Jun-24	12
Track	PM2.5	Track Smart Meter	BA1-15048	15-Jun-23	15-Jun-24	12
Track	PM2.5	Track Smart Meter	BA1-15049	15-Jun-23	15-Jun-24	12
Track	PM2.5	Track Smart Meter	BA1-15048	15-Jun-23	15-Jun-24	12
Track	PM2.5	Track Smart Meter	BA1-15049	15-Jun-23	15-Jun-24	12
Track	PM2.5	Track Smart Meter	BA1-15048	15-Jun-23	15-Jun-24	12
Track	PM2.5	Track Smart Meter	BA1-15049	15-Jun-23	15-Jun-24	12
Track	PM2.5	Track Smart Meter	BA1-15048	15-Jun-23	15-Jun-24	12
Track	PM2.5	Track Smart Meter	BA1-15049	15-Jun-23	15-Jun-24	12
Track	PM2.5	Track Smart Meter	BA1-15048	15-Jun-23	15-Jun-24	12
Track	PM2.5	Track Smart Meter	BA1-15049	15-Jun-23	15-Jun-24	12
Track	PM2.5	Track Smart Meter	BA1-15048	15-Jun-23	15-Jun-24	12
Track	PM2.5	Track Smart Meter	BA1-15049	15-Jun-23	15-Jun-24	12
Track	PM2.5	Track Smart Meter	BA1-15048	15-Jun-23	15-Jun-24	12
Track	PM2.5	Track Smart Meter	BA1-15049	15-Jun-23	15-Jun-24	12
Track	PM2.5	Track Smart Meter	BA1-15048	15-Jun-23	15-Jun-24	12
Track	PM2.5	Track Smart Meter	BA1-15049	15-Jun-23	15-Jun-24	12
Track	PM2.5	Track Smart Meter	BA1-15048	15-Jun-23	15-Jun-24	12
Track	PM2.5	Track Smart Meter	BA1-15049	15-Jun-23	15-Jun-24	12
Track	PM2.5	Track Smart Meter	BA1-15048	15-Jun-23	15-Jun-24	12
Track	PM2.5	Track Smart Meter	BA1-15049	15-Jun-23	15-Jun-24	12
Track	PM2.5	Track Smart Meter	BA1-15048	15-Jun-23	15-Jun-24	12
Track	PM2.5	Track Smart Meter	BA1-15049	15-Jun-23	15-Jun-24	12
Track	PM2.5	Track Smart Meter	BA1-15048	15-Jun-23	15-Jun-24	12
Track	PM2.5	Track Smart Meter	BA1-15049	15-Jun-23	15-Jun-24	12
Track	PM2.5	Track Smart Meter	BA1-15048	15-Jun-23	15-Jun-24	12
Track	PM2.5	Track Smart Meter	BA1-15049	15-Jun-23	15-Jun-24	12
Track	PM2.5	Track Smart Meter	BA1-15048	15-Jun-23	15-Jun-24	12
Track	PM2.5	Track Smart Meter	BA1-15049	15-Jun-23	15-Jun-24	12
Track	PM2.5	Track Smart Meter	BA1-15048	15-Jun-23	15-Jun-24	12
Track	PM2.5	Track Smart Meter	BA1-15049	15-Jun-23	15-Jun-24	12
Track	PM2.5	Track Smart Meter	BA1-15048	15-Jun-23	15-Jun-24	12
Track	PM2.5	Track Smart Meter	BA1-15049	15-Jun-23	15-Jun-24	12
Track	PM2.5	Track Smart Meter	BA1-15048	15-Jun-23	15-Jun-24	12
Track	PM2.5	Track Smart Meter	BA1-15049	15-Jun-23	15-Jun-24	12
Track	PM2.5	Track Smart Meter	BA1-15048	15-Jun-23	15-Jun-24	12
Track	PM2.5	Track Smart Meter	BA1-15049	15-Jun-23	15-Jun-24	12
Track	PM2.5	Track Smart Meter	BA1-15048	15-Jun-23	15-Jun-24	12
Track	PM2.5	Track Smart Meter	BA1-15049	15-Jun-23	15-Jun-24	12
Track	PM2.5	Track Smart Meter	BA1-15048	15-Jun-23	15-Jun-24	12
Track	PM2.5	Track Smart Meter	BA1-15049	15-Jun-23	15-Jun-24	12
Track	PM2.5	Track Smart Meter	BA1-15048	15-Jun-23	15-Jun-24	12
Track	PM2.5	Track Smart Meter	BA1-15049	15-Jun-23	15-Jun-24	12
Track	PM2.5	Track Smart Meter	BA1-15048	15-Jun-23	15-Jun-24	12
Track	PM2.5	Track Smart Meter	BA1-15049	15-Jun-23	15-Jun-24	12
Track	PM2.5	Track Smart Meter	BA1-15048	15-Jun-23	15-Jun-24	12
Track	PM2.5	Track Smart Meter	BA1-15049	15-Jun-23	15-Jun-24	12
Track	PM2.5	Track Smart Meter	BA1-15048	15-Jun-23	15-Jun-24	12
Track	PM2.5	Track Smart Meter	BA1-15049	15-Jun-23	15-Jun-24	12
Track	PM2.5	Track Smart Meter	BA1-15048	15-Jun-23	15-Jun-24	12
Track	PM2.5	Track Smart Meter	BA1-15049	15-Jun-23	15-Jun-24	12
Track	PM2.5	Track Smart Meter	BA1-15048	15-Jun-23	15-Jun-24	12
Track	PM2.5	Track Smart Meter	BA1-15049	15-Jun-23	15-Jun-24	12
Track	PM2.5	Track Smart Meter	BA1-15048	15-Jun-23	15-Jun-24	12
Track	PM2.5	Track Smart Meter	BA1-15049	15-Jun-23	15-Jun-24	12
Track	PM2.5	Track Smart Meter	BA1-15048	15-Jun-23	15-Jun-24	12
Track	PM2.5	Track Smart Meter	BA1-15049	15-Jun-23	15-Jun-24	12
Track	PM2.5	Track Smart Meter	BA1-15048	15-Jun-23	15-Jun-24	12
Track	PM2.5	Track Smart Meter	BA1-15049	15-Jun-23	15-Jun-24	12
Track	PM2.5	Track Smart Meter	BA1-15048	15-Jun-2		



รายการเครื่องมือที่ใช้ในการวิจัย / ทดสอบ

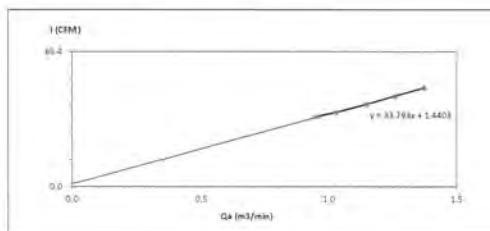
Sample Name	Parameter	Equipment Name	ID No.	Calibrated Date	Next Cal	Freq. Calibrat (Months)
Water Lab	pH at 15°C	HI 9142	HW_102842	27-Oct-23	27-Oct-24	12
Water Lab	Dissolved Diss. Chlorine	Drübe-Meter	HW_102826	22-Oct-24	22-Oct-25	12
Water Lab	DO Sat. %	DO Meter - Transducing Systems	HW_102825	19-Oct-23	19-Oct-24	12
Water Lab	Oil & Grease	Oil Tester	HW_102819	11-Jul-23	11-Jul-24	12
Water Lab	Total Dissolved Solids (TDS)	Electrode Top-Loading Balance	HW_102803	9-Aug-23	9-Aug-24	12
Water Lab	Total Dissolved Solids (TDS)	Electrode	HW_102815	8-Jul-23	8-Jul-24	12
Water Lab	Water Temperature (TDS)	Ice Machine	HW_102804	26-Sep-23	26-Sep-24	12
Water Lab	Chlorine	CHL-ME	HW_102801	6-Apr-23	6-Apr-24	12
Water Lab	Residual	HW_102828	HW_102828	22-Sep-23	22-May-24	12
Water Lab	Water Quality	Water Quality	HW_102827	25-Sep-23	25-Sep-24	12
Water Lab	Chlorine	CHL-ME	HW_102801	6-Apr-23	6-Apr-24	12
Water Lab	Free	HW_102824	HW_102824	22-Sep-23	22-May-24	12



High Volume Air Sampler Calibration Worksheet

Project Site :	Gold/HF UT Co., Ltd.	Barometric Pressure (mm Hg) :	756.0
Calibrate Location :	Tenue25th	Temperature (°C) :	33.4
Calibrate Date :	28-Feb-24	High Volume ID :	BKK PS0383
Calibration Sheet No. :	C-280224-BKK PS0383	High Volume Volume :	TE-5009Y
Calibrator ID :	BKK PS0625	High Volume S/N :	4787
Calibrator Model :	TE-5028A	Calibrator Stop :	1.04104
Calibrator S/N :	2585	Calibrator Intercept :	-0.00779

Test No.	Delta H ₂ O (inlb)	Q _a (m ³ /min)	1: Chart (CFM)	Linear Regression	
3	2.8	0.954	34	Slope :	33.7927
2	2.8	1.029	36	Intercept :	1.4403
3	3.5	1.150	40	Correlation Coefficient r :	0.9989
4	4.2	1.259	44		
5	5.0	1.373	48		



Calibrated by _____
(Mr. Ritthichai Phrasitbueng
Technician)

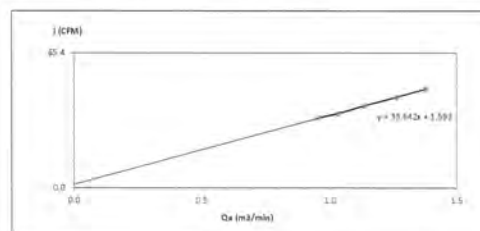
Approved by: _____
[Mr. Noppong Juntarupan]
Environ Field Coordinator Scientist (3)



High Volume Air Sampler Calibration Worksheet

Project Site :	CallTP UT Co. Ltd.	Barometric Pressure [mm Hg] :	759.6
Calibrate Location :	Ystradgynaf	Temperature ("C) :	35.5
Calibrate Date :	26-Feb-24	High Volume ID :	BKK-F503H1
CalibrationSheet No:	C-280224-BKK-F503H1	High Volume Model :	TE-F5000
Calibrator ID :	BKK-F50625	High Volume S/N :	4161
Calibrator Model :	TE-5628A	Calibrator Slope :	1.04104
Calibrator S/N :	2585	Calibrator Intercept :	-0.00779

Test No.	Delta H ₂ O (inch)	Qs (m ³ /min)	f: Chart (CFM)	Linear Regression	
1	2.4	0.957	34	Slope: 83.6422 Intercept: 1.5930 Correlation Coefficient: 0.9990	
2	2.8	1.093	36		
3	3.4	1.137	40		
4	4.2	1.263	44		
5	5.6	1.370	48		



Calibrated by _____
(Mr. Rittichai Phraibuang
Technician)

Approved by: _____
(Mr. Noppong Jantarapan)
Eastern Field Coordinator, Scientist (C)

REV.02 15/09/65



PLAY SOLUTION TECHNOLOGY COMPANY LIMITED
179/75 Navong Pradha Pattana Road, Sikin, Donmuang, Bangkok 10210
Tel: +66 2 011 0505, Fax: +66 2 010 7700
www.playstec.com



CERTIFICATE OF CALIBRATION

Result of Calibration

Certificate no. PST-0120-23

Page no. 3 of 3

3. Eccentricity

Test load at least 1/3 of the maximum capacity, typically placed between 1/2 and 1/3 of the distance from the centre of the load receptor to the edge



Weighting Range 1

Test Load: 100 (g)

Position	Indication (g)
1	99.99998
2	100.00000
3	99.99998
4	99.99997
5	99.99998
Max Deviation	0.00002

Weighting Range 2

Test Load: (g)

Position	Indication (g)
1	
2	
3	
4	
5	
Max Deviation	

Standard Method

The calibration was performed by using calibration laboratory's In-House calibration method: CP-MS-001 based of "UKAS LMS 14: Calibration of weighing machines" edition 6 | October 2019

Reference standards instrument

Instrument	QIML Class	S/N	Certificate No.	Due Date
Standard Weight Set	E2	A000021392	22-378725	November 30, 2024
Standard Weight Set				
Standard Weight Set				
Standard Weight Set				

Measurement Uncertainty

The given measurement uncertainty is the standard of the measurement multiplied by an extension factor k which corresponds to a confidence level of about 95% for a normal distribution. The standard uncertainty was calculated according to M3003

Traceability

This measurement is traceable to national standard, which realize the physical unit of measurement (SI)
Through the reference calibration laboratory of Axi Medical and Agricultural Laboratory and Research Center Co., Ltd

END OF REPORT

F-039

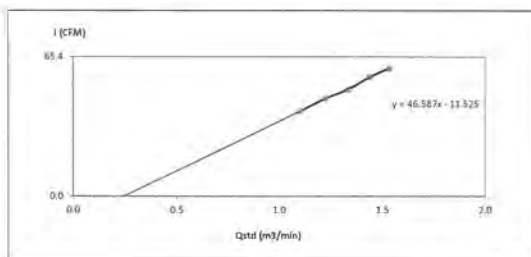
REV.02 15/08/65



High Volume Air Sampler Calibration Worksheet

Project Site:	Gulf IP UT Co., Ltd.	Barometric Pressure (mm Hg):	758.6
Calibrate Location:	โรงงานอุตสาหกรรม	Temperature (°C):	33.4
Calibrate Date:	28-Feb-24	High Volume ID:	BKK_FS0367
Calibration Sheet No.:	C-280224-BKK_FS0367	High Volume Model:	TE-5009X
Calibrator ID:	BKK_FS0625	High Volume S/N:	4162
Calibrator Model:	TE-5028A	Calibrator Slope:	1.66209
Calibrator S/N:	2585	Calibrator Intercept:	-0.01241

Test No.	Delta H ₂ O (inch)	Q _{ref} (m ³ /min)	I: Chart (CFM)	Linear Regression
1	3.4	1.1055	40	Slope: 46.5873
2	4.2	1.2273	46	Intercept: -11.5246
3	5.0	1.3379	50	Correlation Coefficient: 0.9991
4	5.8	1.4401	56	
5	6.6	1.5353	60	



Calibrated by:

(Mr. Rittichai Phraibureng)
Technician

Approved by:

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

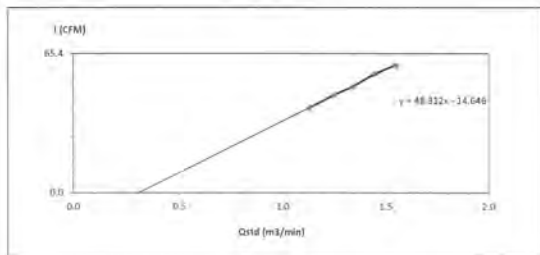
FORM NO. F-06-073 REVISION NO.2 ISSUE DATE: 20/11/23



High Volume Air Sampler Calibration Worksheet

Project Site:	Gulf IP UT Co., Ltd.	Barometric Pressure (mm Hg):	758.6
Calibrate Location:	โรงงานอุตสาหกรรม	Temperature (°C):	35.5
Calibrate Date:	28-Feb-24	High Volume ID:	BKK_FS0366
Calibration Sheet No.:	C-280224-BKK_FS0366	High Volume Model:	TE-5009X
Calibrator ID:	BKK_FS0625	High Volume S/N:	4156
Calibrator Model:	TE-5028A	Calibrator Slope:	1.66209
Calibrator S/N:	2585	Calibrator Intercept:	-0.01241

Test No.	Delta H ₂ O (inch)	Q _{ref} (m ³ /min)	I: Chart (CFM)	Linear Regression
1	3.6	1.1339	40	Slope: 48.3119
2	4.4	1.2516	46	Intercept: -14.6461
3	5.1	1.3466	50	Correlation Coefficient: 0.9993
4	5.8	1.4479	56	
5	6.6	1.5330	60	



Calibrated by:

(Mr. Rittichai Phraibureng)
Technician

Approved by:

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

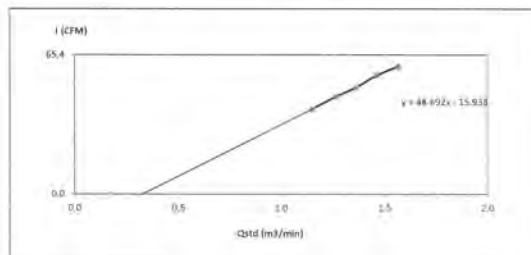
FORM NO. F-06-073 REVISION NO.2 ISSUE DATE: 20/11/23



High Volume Air Sampler Calibration Worksheet

Project Site:	Gulf IP UT Co., Ltd.	Barometric Pressure (mm Hg):	758.6
Calibrate Location:	โรงงานอุตสาหกรรม	Temperature (°C):	34.2
Calibrate Date:	28-Feb-24	High Volume ID:	BKK_FS0359
Calibration Sheet No.:	C-280224-BKK_FS0359	High Volume Model:	TE-5009X
Calibrator ID:	BKK_FS0625	High Volume S/N:	5104
Calibrator Model:	TE-5028A	Calibrator Slope:	1.66209
Calibrator S/N:	2585	Calibrator Intercept:	-0.01241

Test No.	Delta H ₂ O (inch)	Q _{ref} (m ³ /min)	I: Chart (CFM)	Linear Regression
1	3.7	1.1512	40	Slope: 48.6920
2	4.5	1.2682	46	Intercept: -15.9381
3	5.2	1.3424	50	Correlation Coefficient: 0.9982
4	6.0	1.4626	56	
5	6.6	1.5675	60	



Calibrated by:

(Mr. Rittichai Phraibureng)
Technician

Approved by:

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

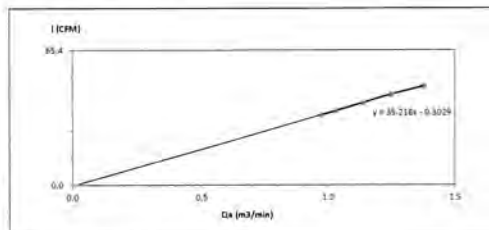
FORM NO. F-06-073 REVISION NO.2 ISSUE DATE: 20/11/23



High Volume Air Sampler Calibration Worksheet

Project Site : GuRIP UT Co., Ltd. Barometric Pressure (mm Hg) : 758.6
 Calibrate Location : ASUWATWATWATWATWATWAT 1-4 Temperature (°C) : 36.2
 Calibrate Date : 28-Feb-24 High Volume ID : BKK_F50374
 Calibration Sheet No. : C-280224-BKK_F50374 High Volume Model : TE-5009X
 Calibrator ID : BKK_F50625 High Volume S/N : 5195
 Calibrator Model : TE-5028A Calibrator Slope : 1.04104
 Calibrator S/N : 2585 Calibrator Intercept : -0.00779

Test No.	Delta H ₂ O (inch)	Q _a (m ³ /min)	I: Chart (CFM)	Linear Regression
1	2.5	0.977	34	Slope: 0.52104 Intercept: -0.3029 Correlation Coefficient: 0.999
2	2.8	1.034	36	
3	3.4	1.139	40	
4	4.1	1.250	44	
5	5.0	1.379	48	



Calibrated by

(Mr. Sittichai Phraithuang)
Technician

Approved by

(Mr. Wipong Jantarapan)
Environ Field Coordinator Scientist (3)

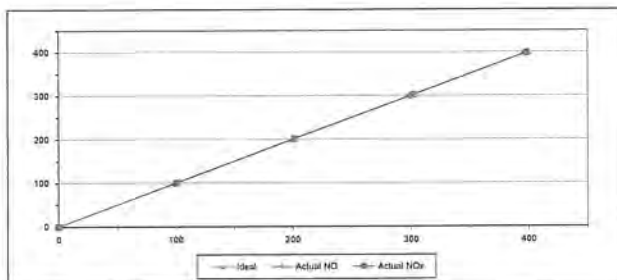
FORM NO. F 06-054 REVISION NO. 2 DATE: 28/11/23



MULTIPOINT CALIBRATION REPORT

Calibration Date : 3-Jan-24 Equipment Name : NOx Analyzer
 Manufacturer : HORIBA Model : APNA-370
 Serial No. : PPGM9HKH Equipment ID : BKK_F81070
 Calibrator Manufacturer : Teledyne API Model : 700
 Serial No. : 947
 Std. Gas Concentration (PPM) : 55.88 Cylinder No. : GN0027222
 Cylinder Pressure (psi) : 1800 Certified By : Airgas Inc.
 Certified Date : 9-Feb-22 Expired Date : 9-Feb-30

Point	CALIBRATION RESULTS						
	Ideal	Actual NO	Error NO	%Error NO	Actual NOx	Error NOx	%Error NOx
ZERO	0.00	0.10	0.10	0.10	0.10	0.10	0.10
1	100.00	98.80	-1.20	-1.20	100.50	0.50	0.50
2	200.00	201.30	1.30	0.65	201.50	1.50	0.75
3	300.00	298.30	-1.70	-0.57	302.40	2.40	0.80
4	400.00	398.80	-3.20	-0.80	398.60	-1.40	-0.35
AVERAGE (%)				-0.38			0.38



Calibrated By

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

Approved By

(Mr. Sarayuth Jitranont)
Assistant General Manager

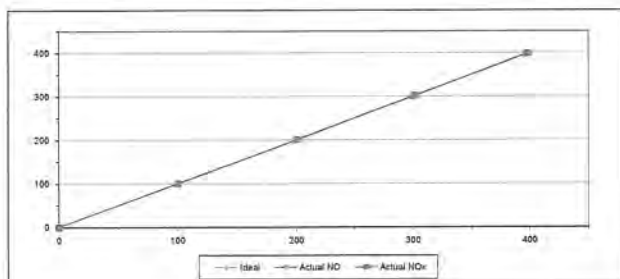
ALS Laboratory Group
FORM NO. F 06-056 REVISION NO. 1 ISSUE DATE: 02/04/12



MULTIPOINT CALIBRATION REPORT

Calibration Date : 3-Jan-24 Equipment Name : NOx Analyzer
 Manufacturer : HORIBA Model : APNA-370
 Serial No. : X9RAXH0D Equipment ID : BKK_F80803
 Calibrator Manufacturer : Teledyne API Model : 700
 Serial No. : 947
 Std. Gas Concentration (PPM) : 55.88 Cylinder No. : GN0027222
 Cylinder Pressure (psi) : 1800 Certified By : Airgas Inc.
 Certified Date : 9-Feb-22 Expired Date : 9-Feb-30

Point	CALIBRATION RESULTS						
	Ideal	Actual NO	Error NO	%Error NO	Actual NOx	Error NOx	%Error NOx
ZERO	0.00	0.10	0.10	0.10	0.10	0.10	0.10
1	100.00	98.80	-1.20	-1.20	100.50	0.50	0.50
2	200.00	201.50	1.50	0.75	201.20	1.20	0.60
3	300.00	298.40	-1.60	-0.53	302.20	2.20	0.73
4	400.00	398.50	-3.50	-0.88	398.50	-1.50	-0.38
AVERAGE (%)				-0.35			0.31



Calibrated By

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

Approved By

(Mr. Sarayuth Jitranont)
Assistant General Manager

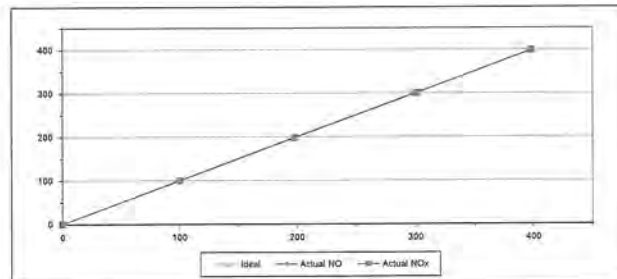
ALS Laboratory Group
FORM NO. F 06-056 REVISION NO. 1 ISSUE DATE: 02/04/12



MULTIPOINT CALIBRATION REPORT

Calibration Date : 3-Jan-24 Equipment Name : NOx Analyzer
 Manufacturer : HORIBA Model : APNA-370
 Serial No. : PX13CWAG Equipment ID : BKK_F81088
 Calibrator Manufacturer : Teledyne API Model : 700
 Serial No. : 947
 Std. Gas Concentration (PPM) : 55.88 Cylinder No. : GN0027222
 Cylinder Pressure (psi) : 1800 Certified By : Airgas Inc.
 Certified Date : 9-Feb-22 Expired Date : 9-Feb-30

Point	CALIBRATION RESULTS						
	Ideal	Actual NO	Error NO	%Error NO	Actual NOx	Error NOx	%Error NOx
ZERO	0.00	0.10	0.10	0.10	0.10	0.10	0.10
1	100.00	99.10	-0.90	-0.90	100.30	0.30	0.30
2	200.00	198.30	-1.70	-0.85	198.10	-1.90	-0.95
3	300.00	298.40	-1.60	-0.53	301.20	1.20	0.40
4	400.00	398.80	-3.20	-0.80	398.70	-1.30	-0.33
AVERAGE (%)				-0.80			-0.10



Calibrated By

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

Approved By

(Mr. Sarayuth Jitranont)
Assistant General Manager

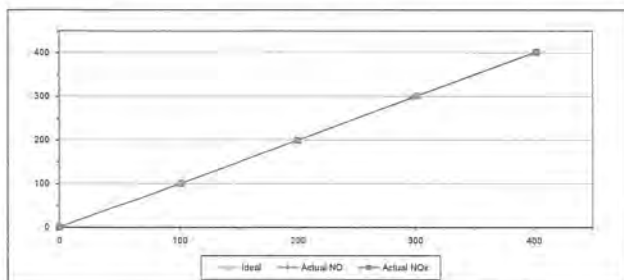
ALS Laboratory Group
FORM NO. F 06-056 REVISION NO. 1 ISSUE DATE: 02/04/12



MULTIPOINT CALIBRATION REPORT

Calibration Date 3-Jan-24 Equipment Name NOx Analyzer
 Manufacturer Teledyne API Model 200E
 Serial No. 4379 Equipment ID BKK_FS0776
 Calibrator Manufacturer Teledyne API Model 700
 Serial No. 947
 Std. Gas Concentration (PPM) 55.88 Cylinder No. GN0027222
 Cylinder Pressure (psi) 1800 Certified By Airgas Inc.
 Certified Date 9-Feb-22 Expired Date 9-Feb-30

Point	CALIBRATION RESULTS						
	Ideal	Actual NO	Error NO	%Error NO	Actual NOx	Error NOx	%Error NOx
ZERO	0.00	0.10	0.10	0.10	0.10	0.10	0.10
1	100.00	99.20	-0.80	-0.80	101.20	1.20	1.20
2	200.00	199.30	-0.70	-0.35	199.50	-0.50	-0.25
3	300.00	297.30	-2.70	-0.90	301.30	1.30	0.43
4	400.00	401.50	1.50	0.38	402.10	2.10	0.53
AVERAGE (%)				-0.31			0.40



Calibrated By

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

Approved By

(Mr.Sarayuth Jitnanont)
Assistant General Manager

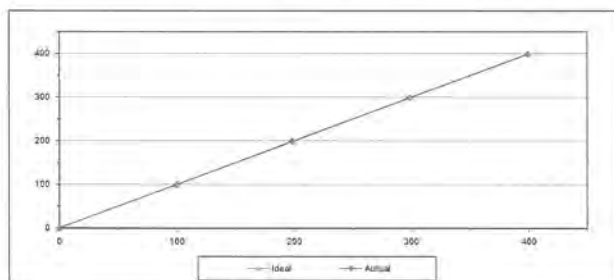
ALS Laboratory Group
FORM NO : F-06-055 REVISION NO : - ISSUE DATE 02/04/12



MULTIPOINT CALIBRATION REPORT

Calibration Date 3-Jan-24 Equipment Name SO2 Analyzer
 Manufacturer HORIBA Model APSA-370
 Serial No. 70Y1R8R0 Equipment ID BKK_FS1089
 Calibrator Manufacturer Teledyne API Model 700
 Serial No. 947
 Std. Gas Concentration (PPM) 56.3 Cylinder No. GN0027222
 Cylinder Pressure (psi) 1800 Certified By Airgas Inc.
 Certified Date 9-Feb-22 Expired Date 9-Feb-30

Point	CALIBRATION RESULTS			
	Ideal	Actual	Error	%Error
ZERO	0.00	0.10	0.10	0.10
1	100.00	99.30	-0.70	-0.70
2	200.00	198.20	-1.80	-0.90
3	300.00	298.70	-1.30	-0.43
4	400.00	398.70	-1.30	-0.33
AVERAGE (%)				-0.45



Calibrated By

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

Approved By

(Mr.Sarayuth Jitnanont)
Assistant General Manager

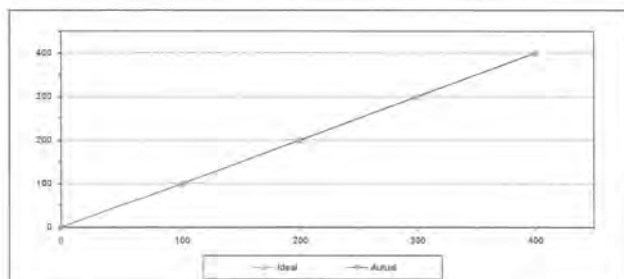
ALS Laboratory Group
FORM NO : F-06-055 REVISION NO : - ISSUE DATE 02/04/12



MULTIPOINT CALIBRATION REPORT

Calibration Date 3-Jan-24 Equipment Name SO2 Analyzer
 Manufacturer HORIBA Model APSA-370
 Serial No. 25SLA8G0 Equipment ID BKK_FS0802
 Calibrator Manufacturer Teledyne API Model 700
 Serial No. 947
 Std. Gas Concentration (PPM) 56.3 Cylinder No. GN0027222
 Cylinder Pressure (psi) 1800 Certified By Airgas Inc.
 Certified Date 9-Feb-22 Expired Date 9-Feb-30

Point	CALIBRATION RESULTS			
	Ideal	Actual	Error	%Error
ZERO	0.00	0.10	0.10	0.10
1	100.00	101.00	1.00	1.00
2	200.00	199.50	-0.50	-0.25
3	300.00	298.30	-1.70	-0.57
4	400.00	399.20	-0.80	-0.20
AVERAGE (%)				0.02



Calibrated By

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

Approved By

(Mr.Sarayuth Jitnanont)
Assistant General Manager

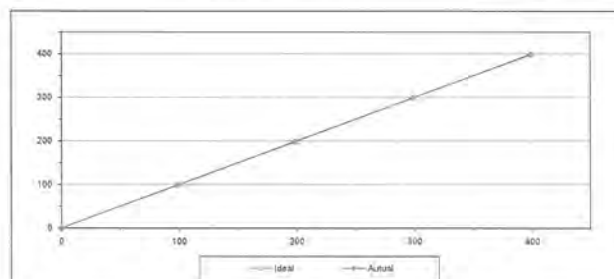
ALS Laboratory Group
FORM NO : F-06-055 REVISION NO : - ISSUE DATE 02/04/12



MULTIPOINT CALIBRATION REPORT

Calibration Date 3-Jan-24 Equipment Name SO2 Analyzer
 Manufacturer HORIBA Model APSA-370
 Serial No. XHV1S59F Equipment ID BKK_FS1087
 Calibrator Manufacturer Teledyne API Model 700
 Serial No. 947
 Std. Gas Concentration (PPM) 56.3 Cylinder No. GN0027222
 Cylinder Pressure (psi) 1800 Certified By Airgas Inc.
 Certified Date 9-Feb-22 Expired Date 9-Feb-30

Point	CALIBRATION RESULTS			
	Ideal	Actual	Error	%Error
ZERO	0.00	0.10	0.10	0.10
1	100.00	99.10	-0.90	-0.90
2	200.00	198.80	-1.20	-0.60
3	300.00	298.70	-1.30	-0.43
4	400.00	398.30	-1.70	-0.42
AVERAGE (%)				-0.45



Calibrated By

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

Approved By

(Mr.Sarayuth Jitnanont)
Assistant General Manager

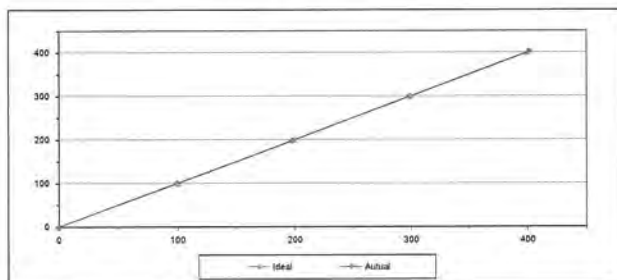
ALS Laboratory Group
FORM NO : F-06-055 REVISION NO : - ISSUE DATE 02/04/12



MULTIPOINT CALIBRATION REPORT

Calibration Date	3-Jan-24	Equipment Name	SO2 Analyzer
Manufacturer	Teledyne API	Model	100E
Serial No.	3469	Equipment ID	BKK_F80775
Calibrator Manufacturer	Teledyne API	Model	700
Serial No.	947		
Std. Gas Concentration (PPM)	56.3	Cylinder No.	GN0027222
Cylinder Pressure (psi)	1800	Certified By	Airgas Inc.
Certified Date	9-Feb-22	Expired Date	9-Feb-30

Point	CALIBRATION RESULTS			
	Ideal	Actual	Error	%Error
ZERO	0.00	0.10	0.10	0.10
1	100.00	99.00	-1.00	-1.00
2	200.00	198.10	-1.90	-0.95
3	300.00	298.30	-1.70	-0.57
4	400.00	401.30	1.30	0.33
AVERAGE (%)				-0.42



Calibrated By

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

Approved By

(Mr. Sarayuth Jitranont)
Assistant General Manager

ALS Laboratory Group
FORM NO. F-06-058 REVISION NO. : ISSUE DATE 02/04/12



IRANATEE ASSOCIATES CO., LTD.

17/14 15, 47/15 36
Pochrasan 7/17, Rd Wathana, Bangkok,
Bangkok 10250 (Thailand)
Tel: +662888212
Mobile: +6623399413
E-mail: jnac-calibration@iranateec.com
Web site: www.iranateec.com

Accredited calibration laboratory:
ISO/IEC 17025:2017
NSC-TS1-TS 17025
CALIBRATION 0367

Air speed measurement laboratory:
Calibration services department



Certificate Number

CC-030-66

CERTIFICATE OF CALIBRATION

Page 1 of 2 Pages

MEASUREMENT ITEM : Cup anemometer
MANUFACTURER : Nowelma
MODEL/TYPE : Sensor: WS-02FA
Data logger: 130-WS-250X-D
SERIAL NUMBER : Sensor: WSD-AS969
Data logger: AS969
ID NUMBER : BKK_F51372
CONDITION AS-RECEIVED : New Item
CUSTOMER : ALS Laboratory group (Thailand) Co., Ltd.
104 Phatthanakan 40, Phatthanakan Rd, Khwaeng Suan Luang,
Khet Suan Luang, Bangkok 10250 Thailand.

RECEIVED DATE : 16 Jun 2023
MEASUREMENT DATE : 15 Jun 2023
ISSUE DATE : 15 Jun 2023

ENVIRONMENTAL CONDITIONS:

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

PLACE OF CALIBRATION : Effel-type wind tunnel of Iranateec Associates Co., Ltd.

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

Preconditioning : 24 hours at ambient conditions.
Measurement Condition : The average values during measurement are (34.1) °C, (44.5) %RH and (1008.0) hPa

TABULATION OF RESULTS:

The table on next page give the measured values.

Calibrated by:
☒ Mr. Sarawut Thichakul
☐ Miss Jitraporn Jitthomchul



Approved signature:

Mr. Panyee Booncharoen
Calibration Department Manager

Remark:
¹ Measuring cross-section area of the wind tunnel
² Projected cross-section area of the tested object include mounting pipe
³ Diameter of mounting pipe
⁴ Ratio $\frac{A}{A_0}$

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

Certificate Number

CC-010-66

Page 2 of 2 Pages

MEASUREMENT RESULTS⁵

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

V_{ref} (m/s)	Temp. wind tunnel (°C)	Temp. room (°C)	V_{meas} (m/s)	Error (m/s)	U (m/s)
1.024	24.04	24.10	0.8	-0.1	0.31
2.027	24.10	24.10	1.8	-0.1	0.31
3.017	23.96	24.10	2.8	-0.1	0.31
4.117	24.04	24.10	4.0	-0.1	0.31
5.01	23.90	24.10	4.8	-0.1	0.31
5.96	24.00	24.10	6.0	0.0	0.31
7.05	23.90	24.10	7.0	-0.1	0.31
8.16	24.06	24.10	8.0	-0.1	0.31
9.05	23.94	24.10	9.0	-0.1	0.31
10.06	24.10	24.10	10.0	0.0	0.31
11.15	24.00	24.10	11.0	-0.1	0.31
12.12	24.10	24.10	12.0	-0.1	0.31
13.18	23.98	24.10	13.0	-0.1	0.31
14.23	24.04	24.10	14.0	-0.1	0.31
15.22	24.00	24.10	15.0	-0.1	0.31
16.27	23.92	24.10	16.1	-0.1	0.31

Remark:

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

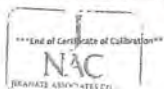
¹ Velocity of standard

² Velocity of Unit Under Calibration

PHOTO OF CALIBRATION SET-UP



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



Iranateec Associates Co., Ltd.
17/14 15, 47/15 36
Pochrasan 7/17, Rd Wathana, Bangkok,
Bangkok 10250 (Thailand)
Tel: +662888212
Mobile: +6623399413
E-mail: jnac-calibration@iranateec.com
Web site: www.iranateec.com

Accredited calibration laboratory:
ISO/IEC 17025:2017
NSC-TS1-TS 17025
CALIBRATION 0367

Air speed measurement laboratory:
Calibration services department

Certificate Number

CC-010-66

CERTIFICATE OF CALIBRATION

Page 2 of 2 Pages

MEASUREMENT ITEM : Wind Direction Sensor
MANUFACTURER : Nowelma
MODEL/TYPE : Sensor: WS-02FA
Data logger: 130-WS-250X-D
SERIAL NUMBER : Sensor: WSD-AS969
Data logger: AS969
ID NUMBER : BKK_F51372
CONDITION AS-RECEIVED : New Item
CUSTOMER : ALS Laboratory group (Thailand) Co., Ltd.
104 Phatthanakan 40, Phatthanakan Rd, Khwaeng Suan Luang,
Khet Suan Luang, Bangkok 10250 Thailand.

RECEIVED DATE : 16 Jun 2023
MEASUREMENT DATE : 19 Jun 2023
ISSUE DATE : 19 Jun 2023

ENVIRONMENTAL CONDITIONS:

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

PLACE OF CALIBRATION : Effel-type wind tunnel of Iranateec Associates Co., Ltd.

CALIBRATION CONDITION : Wind tunnel cross-section area¹ : 900 cm²
Win direction frontal area² : 129 cm²
Diameter of mounting pipe³ : mm
Blockage ratio of test object⁴ : 0.143 [-]

Preconditioning : 24 hours at ambient conditions.
Measurement Condition : The average values during measurement are (24.3) °C, (44.7) %RH and (1010.1) hPa.

TABULATION OF RESULTS:

The table on next page give the measured values.

Calibrated by:
☒ Mr. Sarawut Thichakul
☐ Miss Jitraporn Jitthomchul



Approved signature:

Mr. Panyee Booncharoen
Calibration Department Manager

Remark:
¹ Measuring cross-section area of the wind tunnel
² Projected cross-section area of the tested object include mounting pipe
³ Diameter of mounting pipe
⁴ Ratio $\frac{A}{A_0}$

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

MEASUREMENT RESULTS¹

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

Air speed m/s	D ¹ _{meas} Degree (°)	D ¹ _{ref} Degree (°)	Error Degree (°)	U (k=2) Degree (°)
0.000	0	0	0	1.0
45.000	42	42	-3	1.0
90.000	87	87	-3	1.0
135.000	133	133	-2	1.0
180.000	181	181	1	1.0
225.000	228	228	3	1.0
270.000	273	273	3	1.0
315.000	318	318	3	1.0

Remark:

¹ Calibration results only valid for the tested circumstances and environmental conditions during which calibration took place.

² Direction of standard

³ Direction of Unit Under Calibration

End of Certificate of Calibration



CERTIFICATE OF CALIBRATION

Certificate No.: CT-020-66
Page 1 of 2

Equipment Name: Data Logger with Temperature sensor
Manufacturer: Novolyta
Model: 110-WS-25DL-D
Serial No.: A5969
ID No: BKK_FS1372

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

Received date: 16 Jun 2023
Calibration date: 19 Jun 2023
Issue date: 22 Jun 2023

Reference Used During Calibration
1. Standard Temperature Probe Model: STS-100 A500,
Serial No.: 667682-09, Due date: 28 Mar 2024
2. Digital Temperature Indicator Model: DTI-1000-A-MH
II, Serial No.: 671407-00591 Due date: 22 July 2023

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

Calibration Procedure

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

Traceability

The measurement results are traceable to the international system of units (SI) through National Institute of Metrology Thailand (NIMT) Certificate number: TT-0038-23. Certificate number: ER-0092-22

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

Calibrated by
☐ Mr. Sorawit Thachalad
☒ Miss Jittrapon Lertsomphol
☐ Miss Ruangrumpai Phoommit



Approved Signatory:
Mr. Parinya Booncharoen
Calibration Department Manager

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

Certificate No.: CT-020-66
Page 2 of 2

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

Function:

This equipment was connected with temperature sensor Model: HMP60 5/te V1920208.

Dimension : Diameter 12 mm, Length 80 mm.

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
70	20.057	20.0	-0.1	0.096
70	25.053	24.9	-0.2	0.096
70	30.045	29.9	-0.1	0.096
70	35.039	34.8	-0.2	0.099
70	40.034	39.7	-0.3	0.099

UUC*: Unit Under Calibration

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

★ End of Certificate ★



CERTIFICATE OF CALIBRATION

Calibration No.: RH-03062023
Page 1 of 1 Pages

Measurement Item: Relative humidity with data logger
Manufacturer: Novolyta
Model/Type: 110-WS-25DL-D
Serial Number: A5969
ID No: BKK_FS1372
Customer: ALS laboratory group (Thailand) Co., Ltd.
104 Phatthanakan 40, Phatthanakan Rd., Khwaeng Suan Luang, Khet Suan Luang, Bangkok
10250 Thailand.

Environmental Condition:

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

Measurement Method:

Unit Under Calibration (UUC) was calibrated by comparison method with standard chilled mirror hygrometer model: V860-3 in the humidity generator chamber to determine the errors.

Traceability:

This instrument was calibrated using standard equipment whose accuracy is traceability through National Institute of Standards and Technology to the international system of units (SI) via MCS Calibration, Inc. Certificate number: 20929-001. Due date: Sep 26, 2024.

Measurement Date: Jun 19, 2023
Issue Date: Jun 22, 2023

Measurement Results:

This equipment was connected with indoor air quality probe and Displayed (RH) on display. Model: HM700. Serial number: V1920208.

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

The results of calibration are reported in table below.

Determined (%RH)	Standard (%RH)	UUC (%RH)	Error (%RH)	Uncertainty (%RH)
20	20.05	19.4	-0.7	0.52
50	50.28	49.8	-0.5	0.52
80	80.34	80.4	0.1	0.52

Performed by
☐ Mr. Sorawit Thachalad
☒ Miss Jittrapon Lertsomphol
☐ Miss Ruangrumpai Phoommit



Approved Signatory:
Mr. Parinya Booncharoen
Calibration Department Manager

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

CERTIFICATE OF CALIBRATION

Certificate No. : CP-004-66

Page 1 of 2 Pages

MEASUREMENT ITEM
MANUFACTURER
MODEL/TYPE
SERIAL NUMBER
ID NUMBER
CONDITION AS-RECEIVED
CUSTOMER
RECEIVED DATE
MEASUREMENT DATE
ISSUE DATE

Digital barometer
Navalyn
Sensor: 110-WS-250P
Data logger: 110-WS-250L-D
Sensor: BP-AS966
Data logger: AS966
BKK_F31371
New Item
ALS laboratory group (Thailand) Co., Ltd.
104 Phatthanakan 40, Phatthanakan Rd.
Khwang Suan Luang, Khet Suan Luang,
Bangkok 10250 Thailand.

Calibration procedure:

The pressure calibration was done by in-house calibration method as WJ-CL-003 according to comparison method with Digital pressure calibrator based on DPO-A-6-1

Traceability:

The measurement results are traceable to the international system of units (SI) through the NIMT (National Metrology Institute of Thailand) via Certificate number: MP-0205-22

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

CONDITION OF THIS RESULT OF CALIBRATION:

1. Reference Standard Instrument:

Instrument	Model	Serial No.	Certificate No.	Due Date
Absolute Pressure Transducer	CP02500	41001260	AMP-0205-22	02 Dec 2023

1. Calibration effort for calibration sequence C
2. The UUC* was installed in vertical orientation above reference standard instrument and center of UUC* was used as the reference level.

3. Calibration conditions:

4. Condition
Pressure transmitting medium
 p_a (20°C, 1 bar)
 T_{amb}
 T_{sens}
 P_{max}

☒ Normal
☐ Abnormal
Air
1.18 kg/m³
(55.615) %
(23.31) °C
(1010.10) mbar

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

Calibrated by:
Mr. Sorarin Thachulak
Mr. Nitipaporn Lertsomphol



Approved signature:
Mr. Parinya Booncharoen
Calibration Department Manager

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

CERTIFICATE OF CALIBRATION

Certificate No. : CP-004-66

Page 1 of 2 Pages

MEASUREMENT RESULTS ☒ Without adjustment ☐ With adjustment
CALIBRATION IN THE RANGE OF : 950 mbar to 1050 mbar

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

STD (mbar)	UUC* (mbar)	Error (mbar)	Uncertainty (k=2) (mbar)
950.09	950.3	0.4	0.59
970.06	970.3	0.2	0.45
990.05	990.2	0.1	0.41
1010.07	1010.0	-0.1	0.38
1030.05	1029.8	-0.2	0.48
1050.05	1049.6	-0.4	0.64

Note: UUC* Unit Under Calibration

*To convert the result in report unit to Pa should be multiply by 100

End of certificate



CERTIFICATE OF CALIBRATION

Page 1 of 2 Pages

MEASUREMENT ITEM
MANUFACTURER
MODEL/TYPE
SERIAL NUMBER
ID NUMBER
CONDITION AS-RECEIVED
CUSTOMER

Wind Direction Sensor
Navalyn
Sensor: WS-02FA
Data logger: 110-WS-250L-D
Sensor: WS0-AS966
Data logger: AS966
BKK_F31371
New Item
ALS laboratory group (Thailand) Co., Ltd.
104 Phatthanakan 40, Phatthanakan Rd, Khwang Suan Luang,
Khet Suan Luang, Bangkok 10250 Thailand.

Calibration procedure:
The wind direction sensor was calibrated against Standard Rotary Freeder model: AX40975-DMD4-P3-1-00 in an open test section of 200 mm type wind tunnel with 300 cm² cross test section area. The WS-CL-003 based on ISO 63400-21-1, Wind energy generation systems - Part 22: 1 Power performance measurement of electricity producing wind turbines, March 2017 was used as a calibration guideline.

Traceability:
The certificate provides a traceability of the measurement to recognized the national standards, and to realization of the international system of units (SI) through the NIMT (National Metrology Institute of Thailand) via Certificate Number: DA-0043-22

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

RECEIVED DATE
MEASUREMENT DATE
ISSUE DATE

16 Jun 2023
19 Jun 2023
19 Jun 2023

ENVIRONMENTAL CONDITIONS:

Ambient condition in the laboratory are as follows:
Temperature
Relative Humidity
Atmospheric Pressure

23.0 ± 3.0 °C
55.0 ± 15.0 %RH
1010.10 hPa

PLACE OF CALIBRATION

Effel-type wind tunnel of Jiranatee Associates Co., Ltd.

CALIBRATION CONDITION

Wind tunnel cross-section area¹
Wind direction frontal area²
Diameter of measuring pipe³
Blockage ratio of test object⁴

900 cm²
125 cm²
- mm
0.143 (-)

Preconditioning
Measurement Condition

24 hours at ambient conditions.
The average values during measurement are (24.3) °C, (45.3) %RH and (1010.1) hPa

TABULATION OF RESULTS:
The table on next page give the measured values.

Calibrated by:
Mr. Sorarin Thachulak
Mr. Nitipaporn Lertsomphol



Approved signature:
Mr. Parinya Booncharoen
Calibration Department Manager

Notes:
1. Actual cross-section area of the wind tunnel
2. Projected cross-section area of the tested object include mounting plate
3. Diameter of measuring pipe
4. Ratio $\frac{A_2}{A_1}$

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



CERTIFICATE OF CALIBRATION

Page 1 of 2 Pages

MEASUREMENT ITEM
MANUFACTURER
MODEL/TYPE
SERIAL NUMBER
ID NUMBER
CONDITION AS-RECEIVED
CUSTOMER

Cup anemometer
Navalyn
Sensor: WS-02FA
Data logger: 110-WS-250L-D
Sensor: WS0-AS966
Data logger: AS966
BKK_F31371
New Item
ALS laboratory group (Thailand) Co., Ltd.
104 Phatthanakan 40, Phatthanakan Rd, Khwang Suan Luang,
Khet Suan Luang, Bangkok 10250 Thailand.

Calibration procedure:

The cup anemometer was calibrated against Standard air velocity transducer model: 4455-22 and pitot tube with precision differential pressure meter model: DPM2500 in an open test section of Effel-type wind tunnel with 900 cm² cross test section area. The WS-CL-003 based on ISO 63400-21-1, Wind energy generation systems - Part 22: 1 Power performance measurement of electricity producing wind turbines, March 2017 was used as a calibration guideline.

Traceability:
The certificate provides a traceability of the measurement to recognized the national standards, and to realization of the international system of units (SI) through the NIMT (National Metrology Institute of Thailand) via Certificate Number: MW-0052-21 and MW-0066-22

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

ENVIRONMENTAL CONDITIONS:

Ambient condition in the laboratory are as follows:
Temperature
Relative Humidity
Atmospheric Pressure

23.0 ± 3.0 °C
55.0 ± 15.0 %RH
1010.10 hPa

PLACE OF CALIBRATION

Effel-type wind tunnel of Jiranatee Associates Co., Ltd.

CALIBRATION CONDITIONS

Wind tunnel cross-section area¹
Wind direction frontal area²
Diameter of measuring pipe³
Blockage ratio of test object⁴

900 cm²
100 cm²
- mm
0.111 (-)

Preconditioning
Measurement Condition

24 hours at ambient conditions.
The average values during measurement are (23.9) °C, (45.3) %RH and (1010.1) hPa

TABULATION OF RESULTS:
The table on next page give the measured values.

Calibrated by:
Mr. Sorarin Thachulak
Mr. Nitipaporn Lertsomphol



Approved signature:
Mr. Parinya Booncharoen
Calibration Department Manager

Notes:
1. Actual cross-section area of the wind tunnel
2. Projected cross-section area of the tested object include mounting plate
3. Diameter of measuring pipe
4. Ratio $\frac{A_2}{A_1}$

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

Certificate Number

CD-009-66

Page 2 of 2 Pages

MEASUREMENT RESULTS¹

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

Air speed m/s	D ¹ _{me} Degree (°)	D ¹ _{ref} Degree (°)	Error Degree (°)	U (%) ² Degree (°)
	0.000	0	0	1.0
	45.000	45	-2	1.0
	90.000	87	-3	1.0
	135.000	132	-3	1.0
	180.000	182	2	1.0
	225.000	228	3	1.0
	270.000	273	3	1.0
	315.000	318	3	1.0

Remarks:

¹ Calibration results only valid for the stated circumstances and environmental conditions during which calibration took place.

² Direction of standard

Direction of Unit Under Calibration

End of Certificate of Calibration



63/14-15,67/35-36, Soi Petchkasem 7/1, Petchkasem Rd.
Wathapra, Bangkokyai, Bangkok 10600 Thailand.
Tel: (66) 02-8680812#13 Fax: (66) 02-8680860 www.jiranatee.com



CERTIFICATE OF CALIBRATION

Certificate No.: CT-019-66
Page 1 of 2

Equipment Name: Data Logger with Temperature sensor
Manufacturer: Novatym
Model: 110-WS-25DL-D
Serial No.: A5966
ID No.: BKH_FS1371

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

Received date: 16 Jun 2023
Calibration date: 19 Jun 2023
Issue date: 22 Jun 2023

Reference Used During Calibration
1. Standard Temperature Probe Model: STS-100 A500,
Serial No.: 667682-09, Due date: 28 Mar 2024
2. Digital Temperature Indicator Model: DTI-1000-A MK
II, Serial No.: 671407-00591 Due date: 22 July 2023

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

Calibration Procedure

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

Traceability

The measurement results are traceable to the international system of units (SI) through National Institute of Metrology Thailand (NIMT) Certificate number: TT-0038-23, Certificate number: ER-0052-22

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

Calibrated by
☐ Mr. Sorawit Thachalad
☒ Miss Jitraporn Lertsomphol
☐ Miss Ruangruepai Phoommit



Approved Signatory:
Mr. Pannya Booncharoen
Calibration Department Manager

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



63/14-15,67/35-36, Soi Petchkasem 7/1, Petchkasem Rd.
Wathapra, Bangkokyai, Bangkok 10600 Thailand.
Tel: (66) 02-8680812#13 Fax: (66) 02-8680860 www.jiranatee.com



Certificate No.: CT-019-66
Page 2 of 2

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

Function:

This equipment was connected with temperature sensor Model: HMP60 S/K: V1920207.

Dimension : Diameter 12 mm, Length 60 mm.

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
70	20.056	20.0	-0.1	0.099
70	25.051	24.9	-0.2	0.099
70	30.044	29.9	-0.1	0.099
70	35.040	34.9	-0.1	0.099
70	40.034	39.8	-0.2	0.099

UUC¹ : Unit Under Calibration

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

★ End of Certificate ★



63/14-15,67/35-36, Soi Petchkasem 7/1, Petchkasem Rd.
Wathapra, Bangkokyai, Bangkok 10600 Thailand.
Tel: (66) 02-8680812#13 Fax: (66) 02-8680860 www.jiranatee.com

CERTIFICATE OF CALIBRATION

Calibration No.: RH-02062023
Page 1 of 1 Pages

Measurement Item: Relative humidity with data logger
Manufacturer: Novatym
Model/Type: 110-WS-25DL-D
Serial Number: A5966
ID No: BKH_FS1371
Customer: ALS laboratory group (Thailand) Co., Ltd.
104 Phatthanakan 40, Phatthanakan Rd., Khwaeng Suan Luang, Khet Suan Luang, Bangkok
10250 Thailand.

Environmental Condition:

The measurement was carried out in an ambient temperature of (25±3)°C and relative humidity of (60±15)%.

Measurement Method:

Unit Under Calibration (UUC) was calibrated by comparison method with standard chilled mirror hygrometer model: 1860-3 in the humidity generator chamber to determine the errors.

Traceability:

This instrument was calibrated using standard equipment whose accuracy is traceability through National Institute of Standards and Technology to the international system of units (SI) via NIST Calibration, Inc. Certificate number: 20926-001. Due date: Sep 20, 2024.

Measurement Date: Jun 19, 2023
Issued Date: Jun 22, 2023

Measurement Results:

This equipment was connected with indoor air quality probe and Display (LPI) on display Model: HMP60, Serial number: V1920207.

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

The results of calibration are reported in table below.

Determined (%RH)	Standard (%RH)	UUC (%RH)	Error (%RH)	Uncertainty (%RH)
20	20.06	19.5	-0.6	0.53
50	50.22	50.4	0.2	0.53
80	80.21	81.5	1.3	0.53

Performed by
☐ Mr. Sorawit Thachalad
☒ Miss Jitraporn Lertsomphol
☐ Miss Ruangruepai Phoommit



Approved Signatory:
Mr. Pannya Booncharoen
Calibration Department Manager

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

CERTIFICATE OF CALIBRATION

Certificate No. : CP-003-66

Page 1 of 2 Pages

MEASUREMENT ITEM : Digital Barometer
MANUFACTURER : Navalyne
MODEL/TYPE : Sensor: 110-W5-25BP
Data logger: 110-W5-25DL-D
SERIAL NUMBER : Sensor: BP-A5966
Data logger: A5966
ID NUMBER : BK01_F51371
CONDITION AS-RECEIVED : New item
CUSTOMER : ALS laboratory group (Thailand) Co., Ltd.
104 Phatthanakan Rd, Phatthanakan Rd,
Khwaeng Suan Luang, Khwaeng Suan Luang,
Bangkok 10250 Thailand.

RECEIVED DATE : 16 Jun 2023
MEASUREMENT DATE : 15 Jun 2023
ISSUE DATE : 15 Jun 2023

CONDITION OF THIS RESULT OF CALIBRATION:

1. Reference Standard Instrument:

Instrument	Model	Serial No.	Certificate No.	Due Date
Absolute Pressure Transducer	CP02500	41001268	MP-0205-22	02 Dec 2023

- Calibration effort for calibration sequence C
- The UUC* was installed in vertical orientation above reference standard instrument and center of UUC* was used as the reference level
- Calibration conditions:
- Condition
 - ☒ Normal ☐ Abnormal
 - Pressure transmitting medium : Air
 - p_0 (20°C, 3 bar) : 1.19 kg/m³
 - p_{rel} : (55135) %
 - T_{amb} : (23.31) °C
 - p_{rel} : (1010210) mbar
- The certificate is valid only to the item calibrated on date and place of calibration

Calibrated by:
☒ Mr. Sorawit Thairakul
☐ Miss Jitraporn Lertsomphol



Approved signature: Mr. Parinya Booncharoen
Calibration Department Manager

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

CERTIFICATE OF CALIBRATION

Certificate No. : CP-003-66

Page 2 of 2 Pages

MEASUREMENT RESULTS : ☒ Without adjustment ☐ With adjustment

CALIBRATION IN THE RANGE OF : 950 mbar to 1050 mbar

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

STD (mbar)	UUC* (mbar)	Error (mbar)	Uncertainty (k=2) (mbar)
950.03	950.6	0.6	0.77
970.14	970.4	0.3	0.51
990.04	990.1	0.1	0.39
1010.12	1010.1	-0.1	0.38
1030.09	1029.8	-0.3	0.50
1050.07	1049.6	-0.5	0.70

Note: UUC* Unit Under Calibration

To convert the result in report unit to Pa should be multiply by 100

*End of certificate



CERTIFICATE OF CALIBRATION

Page 1 of 2 Pages

MEASUREMENT ITEM : Cup anemometer
MANUFACTURER : Navalyne
MODEL/TYPE : Sensor: W5-02F
Data logger: 110-W5-25DL-D
SERIAL NUMBER : Sensor: W50-A5965
Data logger: A5965
ID NUMBER : BK01_F51370
CONDITION AS-RECEIVED : New item
CUSTOMER : ALS laboratory group (Thailand) Co., Ltd.
104 Phatthanakan Rd, Phatthanakan Rd,
Khwaeng Suan Luang, Khwaeng Suan Luang,
Bangkok 10250 Thailand.

RECEIVED DATE : 19 May 2023
MEASUREMENT DATE : 30 May 2023
ISSUE DATE : 31 May 2023

ENVIRONMENTAL CONDITIONS:

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

PLACE OF CALIBRATION

: Effel type wind tunnel of Jiranatee Associates Co., Ltd.

CALIBRATION CONDITIONS

Wind tunnel cross section area : 900 cm²
Win direction frontal area : 100 cm²
Diameter of mounting pipe : 10 mm
Blockage ratio of test object : 0.111 (%)

Preconditioning : 24 hours at ambient conditions.
Measurement Condition : The average values during measurement are (25.0) °C, (46.9) %RH and (1005.9) hPa.

TABULATION OF RESULTS:

The table on next page give the measured values

Calibrated by:
☒ Mr. Sorawit Thairakul
☐ Miss Jitraporn Lertsomphol



Approved signature: Mr. Parinya Booncharoen
Calibration Department Manager

REMARKS:
* Validity cross-section area of the wind tunnel
* Requested cross-section area of the tested object include mounting pipe
* Diameter of mounting pipe
* Ratio = $\frac{A_{obj}}{A_{tunnel}}$

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

Certificate Number
CC-005-66

Page 2 of 2 Pages

MEASUREMENT RESULTS¹

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

V_{std} (m/s)	Temp. wind tunnel (°C)	Temp. room (°C)	V_{UUC} (m/s)	Error (m/s)	U (k=2) (m/s)
1.046	25.06	25.00	0.9	-0.1	0.31
2.049	24.90	25.00	1.9	-0.1	0.31
3.028	25.14	25.00	2.9	-0.1	0.31
4.175	25.00	25.00	3.9	-0.3	0.31
5.00	25.00	25.00	4.9	-0.1	0.31
5.99	24.80	25.00	5.9	-0.1	0.31
7.05	24.96	25.00	6.9	-0.2	0.31
8.18	24.70	25.00	8.0	-0.2	0.31
9.08	25.06	25.00	8.9	-0.1	0.31
10.08	24.70	25.00	10.0	-0.1	0.31
11.15	25.10	25.00	11.0	-0.2	0.31
12.12	24.72	25.00	12.0	-0.1	0.31
13.18	25.08	25.00	13.1	-0.1	0.31
14.22	24.80	25.00	14.2	-0.1	0.31
15.21	25.00	25.00	15.1	-0.1	0.31
16.26	24.80	25.00	16.1	-0.2	0.31

Remark:

- Calibration results only shown for the tested circumstances and environmental conditions during which calibration took place
- Velocity of standard
- Velocity of Unit Under Calibration

PHOTO OF CALIBRATION SET-UP



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





JIRANATEE ASSOCIATES CO., LTD.
 Jirantee Associates Co., Ltd.
 43/14-15, 43/15-16
 Petchakum 7/71, Rd. Wattana, Bangkok,
 Bangkok 10000 (Thailand)
 Tel: +662 6080112
 Mobile: +662 6080113
 E-mail: jnc-calibration@jiranatee.com
 Web site: www.jiranatee.com

Accredited calibration laboratory
 ISO/IEC 17025:2017
 NSC-TIS-715 17025
 CALIBRATION 0367

Air speed measurement laboratory
 Calibration services department

Certificate Number

CD-005-66

CERTIFICATE OF CALIBRATION

Page 1 of 2 Pages

MEASUREMENT ITEM

Wind Direction Sensor

MANUFACTURER

Novallix

MODEL/TYPE

Sensor: WS-021

SERIAL NUMBER

Data logger: 110-WS-25DK-D

ID NUMBER

Sensor: WSD-ASNE

CONDITION AS-RECEIVED

Data logger: ASNE5

CUSTOMER

Box: FS1370

New item

Calibration procedure:

The wind direction sensor was calibrated against Standard Rotary Encoder, model: A1009730-0100A-P5.5-0.0 in an angle of 10 degrees. The wind tunnel with 300 cm² test section area. The WS-021-008 based on IEC 61400-12-1, Wind energy generation systems - Part 12-1, Power performance measurement of electricity producing wind turbines, March 2017 was used as a reference standard.

Traceability:

This certificate provides a traceability of the measurement to the national standard, and to the realization of the international system of units (SI) through the NMf (National Metrology Institute of Thailand) via Certificate number: DA-0043-22

Uncertainty of Measurement:

The reported uncertainty of measurement is based on the standard uncertainty multiplied by a coverage factor k=2, which for a normal distribution corresponds to a coverage probability of approximately 95%. The standard uncertainty has been determined in accordance with the Guide to the Expression of Uncertainty in Measurement.

RECEIVED DATE

19 May 2023

MEASUREMENT DATE

30 May 2023

ISSUE DATE

31 May 2023

ENVIRONMENTAL CONDITIONS:

Ambient condition in the laboratory are as follows:

Temperature

23.0 ± 0.5 °C

Relative Humidity

55.0 ± 15.0 %RH

Atmospheric Pressure

1010 ± 10 hPa

PLACE OF CALIBRATION

Diff-type wind tunnel of Jiranatee Associates Co., Ltd.

CALIBRATION CONDITION

Wind tunnel cross section area¹ 900 cm²

Win direction integral area² 128 cm²

Diameter of mounting pipe³ - mm

Blockage ratio of test object⁴ 0.143 [-]

Preconditioning

24 hours at ambient conditions.

Measurement Condition

The average values during measurements are (24.5) °C, (45.8) %RH and (1005.8) hPa.

TABULATION OF RESULTS:

The table on next page give the measured values.

Calibrated by:

☒ Mr. Sorawat Thachalad

☐ Miss Jiraporn Lertsomphol



Approved signature:

Mr. Parinya Booncharoen
 Calibration Department Manager

Remarks:

¹ Valid cross section area of the wind tunnel

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

³ Diameter of mounting pipe

⁴ Area² / A²

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

Certificate Number

CD-005-66

Page 2 of 2 Pages

MEASUREMENT RESULTS⁵

The wind direction sensor was calibrated against standard rotary encoder by comparison method. During calibration, the measurement was carried out at 45° intervals in clockwise and counter-clockwise directions after offset adjustment has been made. The flow speed of wind tunnel (usually 8 m/s) is kept constant while the sensor is rotated around its vertical axis. The results of calibration and associated measurement uncertainties are reported in the table below.

Air speed	D ₁₀₀	D ₁₀₀	Error	D ₁₀₀
m/s	Degree (°)	Degree (°)	Degree (°)	Degree (°)
0.000	0	0	0	1.0
45.000	43	-2	-2	1.0
90.000	89	-1	-1	1.0
135.000	135	0	0	1.0
180.000	182	2	2	1.0
225.000	228	3	3	1.0
270.000	273	3	3	1.0
315.000	317	2	2	1.0

Remarks:

¹ Calibration results only found for the tested circumstances and environmental conditions during which calibration was performed.

² Direction of standard

³ Direction of Unit Under Calibration



Accredited calibration laboratory
 ISO/IEC 17025:2017
 NSC-TIS-715 17025
 CALIBRATION 0367

Pressure measurement laboratory
 Calibration services department



NSC - TIS - TIS 17025
 CALIBRATION 0367

CERTIFICATE OF CALIBRATION

Certificate No. CP-002-66

Page 1 of 2 Pages

MEASUREMENT ITEM

Digital barometer

MANUFACTURER

Novallix

MODEL/TYPE

110-WS-25BP

SERIAL NUMBER

BP-ASNE5

ID NUMBER

Box: FS1370

CONDITION AS-RECEIVED

New item

CUSTOMER

ALS laboratory group (Thailand) Co., Ltd.
 104 Phatthanaikan 40, Phatthanaikan Rd.
 Khwaeng Suan Luang, Khet Suan Luang,
 Bangkok 10250 Thailand

RECEIVED DATE

19 May 2023

MEASUREMENT DATE

31 May 2023

ISSUE DATE

31 May 2023

Calibration procedure:

The pressure calibration was done by in-house calibration method in WJ-CL-001 according to comparison method with Digital pressure calibrator based on DAD-R 6-1

Traceability:

The measurement results are traceable to the international system of units (SI) through the NMf (National Metrology Institute of Thailand) which complies with the requirements of ISO/IEC 17025:2017, ANSI/NCSL Z540-1 via Certificate number: MP-0205-22

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

CONDITION OF THIS RESULT OF CALIBRATION:

1. Reference Standard instrument:

Instrument

Model

Serial No.

Certificate No.

Due Date

Absolute Pressure Transducer

CPG2500

#1001369

MP-0205-22

02 Dec 2023

1. Calibration effort for calibration sequence A

2. The UUC¹ was installed in vertical orientation above reference standard instrument and center of UUC¹ was used as the reference level.

3. Calibration conditions:

4. Condition

☒ Normal

☐ Abnormal

Pressure transmitting medium:

Air

Pressure (transmitting medium):

3.15 kg/m²

Pressure (transmitting medium):

(55.13) %

Pressure (transmitting medium):

(13.18) °C

Pressure (transmitting medium):

(1010.03) mbar

5. The certificate is valid only for the item calibrated on date and place of calibration.

Calibrated by:

☒ Mr. Sorawat Thachalad

☐ Miss Jiraporn Lertsomphol



Approved signature:

Mr. Parinya Booncharoen
 Calibration Department Manager

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



Accredited calibration laboratory
 ISO/IEC 17025:2017
 NSC-TIS-715 17025
 CALIBRATION 0367

Pressure measurement laboratory
 Calibration services department



NSC - TIS - TIS 17025
 CALIBRATION 0367

CERTIFICATE OF CALIBRATION

Certificate No. CP-002-66

Page 2 of 2 Pages

MEASUREMENT RESULTS

☒ Without adjustment ☐ With adjustment

CALIBRATION IN THE RANGE OF

1950 - 1050 mbar

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

STD	UUC ¹	Error	Uncertainty (k=2)
(mbar)	(mbar)	(mbar)	(mbar)
950.05	955.0	0.8	1.1
970.05	975.7	0.7	0.85
990.02	990.5	0.5	0.71
1010.04	1010.3	0.3	0.46
1030.01	1030.0	0.0	0.38
1050.03	1049.8	-0.2	0.44

Note: UUC¹: Unit Under Calibration

To convert the result in report unit to Pa should be multiply by 100





63/14-15,67/35-36, Soi Petchhasem 7/1, Petchhasem Rd,
Wathphra, Bangkok, Bangkok 10600 Thailand.
Tel: (66) 02-8680812#13 Fax: (66) 02-8680860 www.jiranate.com



CERTIFICATE OF CALIBRATION

Certificate No.: CT-006-06
Page 1 of 2

Equipment Name: Data Logger with Temperature
Sensor

Manufacturer: Novalyne
Model: 110-WS-25DL-D
Serial No.: A5965
ID No.: BKH_FS1370

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: 19 May 2023
Calibration date: 31 May 2023
Issue date: 31 May 2023

Reference Used During Calibration
1. Standard Temperature Probe Model: STS-100 A500,
Serial No.: 067682-09, Due date: 25 Mar 2024
2. Digital Temperature Indicator Model: DTI-1000-A MK
II, Serial No.: 671407-00591 Due date: 22 July 2023

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

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

Traceability
The measurement results are traceable to the
international system of units (SI) through National
Institute of Metrology Thailand (NIMT) Certificate
number: TT-0038-23, Certificate number: ER-0002-
22

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

Calibrated by
Mr. Sorawit Thachasid
Miss Jiraporn Lertsomphol



Approved Signature: Mr. Pailiny Booncharoen
Calibration Department Manager

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



63/14-15,67/35-36, Soi Petchhasem 7/1, Petchhasem Rd,
Wathphra, Bangkok, Bangkok 10600 Thailand.
Tel: (66) 02-8680812#13 Fax: (66) 02-8680860 www.jiranate.com



Certificate No.: CT-006-06
Page 2 of 2

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

Function:

This equipment was connected with temperature sensor Model: HMP60 S/NE U3641226.

Dimension : Diameter 12 mm. Length 80 mm.

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
60	20.001	20.0	0.0	0.099
60	25.004	24.9	-0.1	0.099
60	30.005	29.8	-0.2	0.099
60	35.002	34.8	-0.2	0.099
60	40.001	39.7	-0.3	0.099

UUC: Unit Under Calibration

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

★ End of Certificate ★



63/14-15,67/35-36, Soi Petchhasem 7/1, Petchhasem Rd,
Wathphra, Bangkok, Bangkok 10600 Thailand.
Tel: (66) 02-8680812#13 Fax: (66) 02-8680860 www.jiranate.com

CERTIFICATE OF CALIBRATION

Calibration No.: RH-03052023
Page 1 of 1 Pages

Measurement Item : Relative humidity with data logger
Manufacturer : Novalyne
Model/Type : 110-WS-25DL-D
Serial Number : A5965
ID No. : BKH_FS1370
Customer : ALS laboratory group (Thailand) Co., Ltd.
104 Phatthanakan 40, Phatthanakan Rd., Khwaeng Suan Luang, Khet Suan Luang, Bangkok
10250 Thailand

Environmental Condition:

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

Measurement Method:

Unit Under Calibration (UUC) was calibrated by comparison method with standard chilled mirror hygrometer model: 1860-3 in the humidity generator chamber to determine the errors.

Traceability:

This instrument was calibrated using standard equipment whose accuracy is traceability through National Institute of Standards and Technology to the international system of units (SI) via MCS Calibration, Inc. Certificate number: 20926-601. Due date: Sep 26, 2024.

Measurement Date : May 31, 2023
Issued Date : May 31, 2023

Measurement Results:

This equipment was connected with indoor air quality probe and Display (JIR) on display. Model: HMP60, Serial number: U3641226.

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

The results of calibration are reported in table below.

Determined (%RH)	Standard (%RH)	UUC (%RH)	Error (%RH)	Uncertainty (%RH)
20	20.05	19.3	-0.8	0.52
50	50.29	49.4	-0.9	0.53
80	80.27	79.8	-0.5	0.52

Performed by
Mr. Sorawit Thachasid
Miss Jiraporn Lertsomphol



Approved Signature: Mr. Pailiny Booncharoen
Calibration Department Manager

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



Transfer of Calibration Certificate
63/14-15,67/35-36, Soi Petchhasem 7/1, Petchhasem Rd,
Wathphra, Bangkok, Bangkok 10600 Thailand.
Tel: (66) 02-8680812#13 Fax: (66) 02-8680860
www.jiranate.com

Accredited calibration laboratory
ISO/IEC 17025:2017
MSC-170175-1/2025
CALIBRATION 0367

An special measurement laboratory
Calibration services department

CERTIFICATE OF CALIBRATION

Page 1 of 1 Pages

MEASUREMENT ITEM:

MANUFACTURER

MODEL/TYPE

SERIAL NUMBER

ID NUMBER

CONDITION AS RECEIVED

CUSTOMER

Wind Direction Sensor

Novalyne

Sensor: WS-D21

Data logger: 110-WS-25DL-D

Sensor: WS-D21

Data logger: A5967

BKH_FS12137

Nov Item

ALS laboratory group (Thailand) Co., Ltd

104 Phatthanakan 40, Phatthanakan Rd., Khwaeng Suan Luang,

Khet Suan Luang, Bangkok 10250 Thailand

RECEIVED DATE

MEASUREMENT DATE

ISSUE DATE

09 Nov 2023

18 Nov 2023

23 Nov 2023

ENVIRONMENTAL CONDITIONS:

Ambient condition in the laboratory are as follow:

Temperature : (23.5) ± 0.0 °C

Relative Humidity : (55.0 ± 15.0) %RH

Atmospheric Pressure : (1010) ± 10 hPa

PLACE OF CALIBRATION

(This type wind tunnel) of Jiranate Associates Co., Ltd.

CALIBRATION CONDITION

Wind tunnel cross section area¹ 900 cm²

Wind direction frontal area² 120 cm²

Diameter of mounting pipe³ 12 mm

Blockage ratio of test object⁴ 0.143 [1]

Pre-conditioning

Measurement Condition

24 hours at ambient conditions

The average values during measurement are (23.4) °C, (47.7) %RH and (1012.3) hPa

TABULATION OF RESULTS:

The table on next page give the measured values.

Calibrated by

Mr. Sorawit Thachasid

Miss Jiraporn Lertsomphol



Remarks:

¹ Inside cross-section area of the wind tunnel

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

³ Diameter of mounting pipe

⁴ Ratio "a"/"b"

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

Certificate Number

CL-005-85

Page 2 of 2 Pages

MEASUREMENT RESULTS¹

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

Air speed m/s	D ₁₀₀ Degree (°)	D ₁₀₀ Degree (°)	Error Degree (°)	U (k=2) Degree (°)
	0.001	0	0	0.58
	45.001	42	-3	0.58
	90.000	90	0	0.68
	135.000	135	0	0.58
	180.000	181	1	0.68
	225.000	226	1	0.68
	270.001	270	0	0.68
	315.000	315	0	0.68

Remarks:

Calibration results only valid for the tested circumstances and environmental conditions during which calibration was performed.

Direction of standard

Direction of Unit Under Calibration

End of Certificate of Calibration



Accredited calibration laboratory
ISO/IEC 17025:2017
NAC 101-101-1001
CALIBRATION 0367

Air speed measurement laboratory
Calibration services department

Head Office: 63/14, 15, 67/35-36,
Soi Petchburi 7, 7/1, Petchburi Rd.,
Bangkok 10600 (Thailand)
Tel: (66) 02 8680813
Mobile: (66) 02 8680813
E-mail: jirana@jirana.co.th
www.jirana.co.th

Certificate Number

CL-005-65

CERTIFICATE OF CALIBRATION

Page 1 of 2 Pages

MEASUREMENT ITEM

Cup anemometer
Novelty
Sensor: WS-02F
Data logger: 310-WS-250L-D
Sensor: WS-01S
Data logger: AS002
ID NUMBER
BXK-YS1212
CONDITION AS RECEIVED
New item
CUSTOMER
ACS Laboratory group (Thailand) Co., Ltd.
104 Phatthanasarn 40, Phatthanasarn Rd., Khlong San, Bangkok 10250 Thailand

RECEIVED DATE

09 Nov 2022

MEASUREMENT DATE

18 Nov 2022

ISSUE DATE

23 Nov 2022

ENVIRONMENTAL CONDITIONS:

Ambient condition in the laboratory are as follows:

Temperature: 23.0 ± 3.0 °C
Relative Humidity: 55.0 ± 15.0 %RH
Atmospheric Pressure: 1019.0 ± 10 hPa

PLACE OF CALIBRATION

Effect-type wind tunnel of Jirana Associates Co., Ltd

CALIBRATION CONDITIONS

Wind tunnel cross-section area¹ 900 m²
Win direction frontal area² 100 cm²
Diameter of mounting pipe³ 10 mm
Blockage ratio of test object⁴ 0.11 %

Preconditioning

Measurement Condition

24 hours at ambient conditions
The average values during measurement are (23.9) °C, (48.6) %RH and (1010.7) hPa

TABULATION OF RESULTS:

The table on next page give the measured values.

Calibrated by:

1) Mr. Somchai Thachakul
2) Mr. Aniraporn Panchanong



Approved signatory:

Mr. Panyam Boonkarn
Calibration Department Manager

Remarks:

¹ Inside cross-section area of the wind tunnel
² Projected cross-section area of the tested object include mounting pipe
³ Diameter of mounting pipe
⁴ Ratio %

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

Certificate Number

CL-005-45

Page 2 of 2 Pages

MEASUREMENT RESULTS¹

The cup anemometer, type (cup) calibration (CUC) was carried out at 10 m/s for 5 minutes prior to calibration being performed. The standard air velocity 0.5 m/s to 5 m/s was calibrated by a standard air velocity transducer and alarm 5 m/s. The 10 m/s was calibrated by a pitot tube with pressure differential pressure meter which was installed at 100 mm and 300 mm upstream away from wind tunnel mouth. CUC was carried out at center of the test section. The calibration was carried out under both, strong and falling air velocity in the range of 1 m/s to 16 m/s at calibration interval of 1 m/s. The results of calibration and associated measurement uncertainties are reported in the table below.

Real (m/s)	Temp. wind tunnel (°C)	Temp. room (°C)	V _{ref} (m/s)	Error (m/s)	U (k=2) (m/s)
0.509	24.00	23.85	0.5	-0.2	0.20
0.835	23.76	23.85	1.0	-0.2	0.17
1.061	23.92	23.85	1.5	-0.2	0.15
1.124	23.90	23.85	2.0	-0.2	0.20
5.08	23.82	23.85	5.0	-0.1	0.17
6.01	23.98	23.85	5.5	-0.1	0.20
7.07	23.80	23.85	6.0	-0.2	0.22
8.18	23.98	23.85	6.0	-0.2	0.24
9.10	23.80	23.85	8.0	-0.2	0.20
10.11	23.84	23.85	8.0	-0.2	0.20
11.16	23.60	23.85	11.0	0.1	0.20
12.14	23.50	23.85	12.0	0.2	0.22
13.22	23.62	23.85	13.0	0.2	0.26
14.26	23.80	23.85	14.1	-0.2	0.25
15.25	23.70	23.85	15.1	-0.2	0.25
16.31	23.78	23.85	16.1	-0.2	0.26

Remarks:

Calibration results only valid for the tested circumstances and environmental conditions during which calibration was performed.

Velocity of standard

Velocity of Unit Under Calibration

PHOTO OF CALIBRATION SET-UP:



Calibration (CUC) of the cup anemometer in the wind tunnel of Jirana Associates Co., Ltd. The cup anemometer shown here after from the calibration. Remarks: The photograph of the set-up is not used to judge the testing accuracy.

End of Certificate of Calibration



63/14-15, 67/35-36, Soi Petchburi 7, 7/1, Petchburi Rd.,
Wallapra, Bangkok 10600 (Thailand)
Tel: (66) 02 8680813 Fax: (66) 02 8680800 www.jirana.co.th

CERTIFICATE OF CALIBRATION

Calibration No. JIR-1112022

Page 1 of 1 Pages

Measurement Item

Novelty
Manufacturer
Model/Type
310 WS 250L-D
Serial Number
AS002
ID No
BXK-YS1212
Customer
ACS Laboratory group (Thailand) Co., Ltd.
104 Phatthanasarn 40, Phatthanasarn Rd., Khlong San, Bangkok 10250 Thailand

Environmental Conditions:

The measurement was carried out in an ambient temperature of (23.9) °C, and relative humidity of (48.6) %RH

Measurement Method:

Cup Under Calibration (CUC) was performed by comparison method with standard (Novelty) equipment in the facility. General comments in support the results.

Traceability:

The calibration was calibrated using standard reference value acquired by traceability through National Institute of Standards and Technology by the international system of units (SI) via NIST Certificate No. 20334101. Issue date: May 14, 2021

Measurement Date

Nov 18, 2022

Issued Date

Nov 23, 2022

Measurement Results:

This equipment was connected with indoor air quality probe and employed (310-WS-250L-D) Model (WS-02) Sensor module U3047204

Calibration was performed in the range of 20000 to 80000

The result of calibration was reported as table below.

Determined (%RH)	Standard (%RH)	UUC (%RH)	Error (%RH)	Uncertainty (%RH)
70	70.04	18.3	1.2	0.52
50	50.28	18.3	2.0	0.58
80	80.27	18.3	1.4	0.52



Approved Signatory:

Mr. Panyam Boonkarn
Calibration Department Manager

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



63/14 15.67/35 36, Soi Petchkasem 7/71, Petchkasem Rd.,
Wattana, Bangkok, Bangkok 10600 Thailand
Tel: (66) 02-8680812#13 Fax: (66) 02-8680860 www.janato.com



CERTIFICATE OF CALIBRATION

Certificate No. CL-100-05
Page 1 of 2

Equipment Name: Auto Temperature
Model: 110V/250V

Manufacturer: Janato
Serial No.: A18017
ID No.: 151242

Customer Name: ALS Laboratory (Thailand) Co., Ltd.
Address: 104 Petchkasem Rd., Wattana
Bangkok 10600 Thailand
Tel: 02-8680812 Fax: 02-8680860

Received date: 09 Nov 2022
Calibration date: 18 Nov 2022
Issue date: 21 Nov 2022

Reference Used During Calibration:
1. Standard Temperature Probe Model: 110V/250V
Serial No.: 667632 09, Issue Date: 23 Mar 2022
2. Digital Temperature Indicator Model: HR 1000 A MK
Serial No.: 671407 00091, Issue Date: 22 Feb 2022

Calibration Condition:
Temperature: 23.33 °C
Relative Humidity: 65.15 %

Calibration Procedure

The temperature calibration was done by using the calibration method as per CL-001, and using the comparison method with standard digital temperature indicator and standard temperature probe. The temperature probe was used as reference.

Traceability

The measurement results are traceable to the international system of units (SI) through National Institute of Metrology Thailand (NIMT). Certificate number: IT 0054 22, Certificate number: IT 0052 22.

Calibrated by
Mr. Sarat Thachulad
Mrs. Annapa Pongsomjai



Approved Signature:

Mr. Pongthorn Pongthorn
Calibration Department Manager



63/14 15.67/35 36, Soi Petchkasem 7/71, Petchkasem Rd.,
Wattana, Bangkok, Bangkok 10600 Thailand
Tel: (66) 02-8680812#13 Fax: (66) 02-8680860 www.janato.com



Certificate No. CL-100-05
Page 2 of 2

Result of Calibration: 1- Without Adjustment 2- With Adjustment

Calibration Range: 0.0 - 10.0

Function:

This equipment was connected with temperature sensor Model HR1000 5716 1364 1224.

Dimensions: Diameter 1.2 mm, Length 100 mm.

Indication Depth (mm)	Standard Reading (°C)	UIG Reading (°C)	Error (°C)	Uncertainty (°C)
0.0	23.00	23.0	0.0	0.30
0.1	23.01	23.0	0.0	0.30
0.2	23.02	23.0	0.0	0.30
0.3	23.03	23.0	0.0	0.30
0.4	23.04	23.0	0.0	0.30
0.5	23.05	23.0	0.0	0.30

UIG* Limit 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 *



Lot No. 2418560-1

ANALYZER CALIBRATION DATA

Client: Gulf JP UT Co., Ltd. Location: HRSG 11
Date: 28 Feb 24 Test Operator: Worawich T.

O₂ ANALYZER Model: TELEDYNE API T200H Serial No.: 822
Span (%): 25

	Cylinder Value (%)	Initial Analyzers Calibration Response (%)	Final Analyzers Calibration Response (%)	Difference (Percent of Span)
Zero Gas	0.00	0.00	0.00	0.00
Low-Level Gas	7.58	7.59	8.02	0.12
Span Gas	16.04	16.04	16.03	0.04

NO_x ANALYZER Model: TELEDYNE API T200H Serial No.: 822
Span (ppm): 100

	Cylinder Value (ppm)	Initial Analyzers Calibration Response (ppm)	Final Analyzers Calibration Response (ppm)	Difference (Percent of Span)
Zero Gas	0.00	0.00	0.02	0.02
Low-Level Gas	55.58	55.55	55.83	0.03
Span Gas	80.49	80.47	80.41	0.06

SO₂ ANALYZER Model: TELEDYNE API T100H Serial No.: 834
Span (ppm): 100

	Cylinder Value (ppm)	Initial Analyzers Calibration Response (ppm)	Final Analyzers Calibration Response (ppm)	Difference (Percent of Span)
Zero Gas	0.00	0.00	0.00	0.00
Low-Level Gas	56.30	56.27	56.17	0.10
Span Gas	79.51	79.50	79.46	0.04

CO ANALYZER Model: TELEDYNE API T300H Serial No.: 844
Span (ppm): 100

	Cylinder Value (ppm)	Initial Analyzers Calibration Response (ppm)	Final Analyzers Calibration Response (ppm)	Difference (Percent of Span)
Zero Gas	0.00	0.00	0.04	0.04
Low-Level Gas	55.22	55.25	55.10	0.15
Span Gas	79.95	79.94	79.90	0.04

Calibrated by

Worawich T.

(Mr. Worawich Tongpoom)
Environmental Field Scientist (2)

FORM NO. P-06-02 REVISION NO. 4 ISSUE DATE: 18/01/24
ALS Laboratory Group



Lot No. 2418560-1

SYSTEM CALIBRATION BIAS AND DRIFT DATA

Client: Gulf JP UT Co., Ltd. Location: HRSG 11
Date: 28 Feb 24 Test Operator: Worawich T.

O₂ ANALYZER Cylinder Conc. (%): 16.04 Span (%): 25

	O ₂ Analyzer Calibration Response	Initial Values System Calibration Response	System Cal Bias (% of Span)	Final Values System Calibration Response	System Cal Bias (% of Span)	Drift (% of Span)
Zero Gas	0.00	0.01	0.04	0.00	0.00	0.04
Upscale Gas	16.04	16.01	0.12	16.05	0.04	0.16

NO_x ANALYZER Cylinder Conc. (ppm): 80.49 Span (ppm): 100

	NO _x Analyzer Calibration Response	Initial Values System Calibration Response	System Cal Bias (% of Span)	Final Values System Calibration Response	System Cal Bias (% of Span)	Drift (% of Span)
Zero Gas	0.00	0.03	0.03	0.01	0.01	0.02
Upscale Gas	80.47	79.78	0.69	79.72	0.75	0.06

SO₂ ANALYZER Cylinder Conc. (ppm): 79.51 Span (ppm): 100

	SO ₂ Analyzer Calibration Response	Initial Values System Calibration Response	System Cal Bias (% of Span)	Final Values System Calibration Response	System Cal Bias (% of Span)	Drift (% of Span)
Zero Gas	0.00	0.00	0.00	0.00	0.00	0.00
Upscale Gas	79.50	79.10	0.40	79.79	0.71	0.31

CO ANALYZER Cylinder Conc. (ppm): 79.95 Span (ppm): 100

	CO Analyzer Calibration Response	Initial Values System Calibration Response	System Cal Bias (% of Span)	Final Values System Calibration Response	System Cal Bias (% of Span)	Drift (% of Span)
Zero Gas	0.00	0.02	0.02	0.01	0.01	0.01
Upscale Gas	79.94	79.88	0.06	79.79	0.15	0.09

Calibrated by

Worawich T.

(Mr. Worawich Tongpoom)
Environmental Field Scientist (2)

FORM NO. P-06-02 REVISION NO. 4 ISSUE DATE: 18/01/24
ALS Laboratory Group



EMISSION TEST RESULT

Client: Gulf JP UT Co., Ltd.
Data: 28 Feb 24
Start Time: 10:40
SO₂ Analyzer Model: TELEDYNE API T100H
NO_x/O₂ Analyzer Model: TELEDYNE API T200H
CO/CO₂ Analyzer Model: TELEDYNE API T300M

Run # 1
Location: HRSG 11
Test Operator: Worawich T.
Finish Time: 11:00
Serial No.: 634
Serial No.: 922
Serial No.: 844

Time (min)	O ₂ (%)	CO ₂ (%)	NO _x (ppm)	SO ₂ (ppm)	CO (ppm)	Remark
10:40	13.41	4.23	23.56	0.23	0.87	
10:41	13.41	4.23	24.19	0.22	0.78	
10:42	13.38	4.25	24.28	0.24	0.65	
10:43	13.38	4.24	24.23	0.19	0.64	
10:44	13.37	4.25	24.18	0.20	0.64	
10:45	13.37	4.25	24.07	0.21	0.71	
10:46	13.37	4.25	23.83	0.21	0.70	
10:47	13.40	4.24	23.58	0.19	0.74	
10:48	13.38	4.23	23.45	0.30	0.67	
10:49	13.40	4.23	23.37	0.16	0.60	
10:50	13.40	4.24	23.32	0.20	0.57	
10:51	13.30	4.23	23.34	0.16	0.66	
10:52	13.39	4.23	23.43	0.20	0.68	
10:53	13.37	4.23	23.51	0.19	0.62	
10:54	13.39	4.24	23.63	0.22	0.60	
10:55	13.38	4.25	23.61	0.22	0.67	
10:56	13.39	4.25	23.69	0.18	0.60	
10:57	13.37	4.24	23.77	0.23	0.60	
10:58	13.36	4.24	23.99	0.22	0.60	
10:59	13.35	4.25	24.49	0.20	0.59	
11:00	13.39	4.25	23.39	0.23	0.58	
Average	13.38	4.24	23.72	0.21	0.66	

Norawich T.

(Mr. Worawich Tongpoom)

Environmental Field Scientist (2)

FORM NO. F-38-002 REVISION NO. 1 ISSUE DATE: 18/1/24

ALS Laboratory (Public)

Page 3 of 5



EMISSION TEST RESULT

Client: Gulf JP UT Co., Ltd.
Data: 28 Feb 24
Start Time: 11:01
SO₂ Analyzer Model: TELEDYNE API T100H
NO_x/O₂ Analyzer Model: TELEDYNE API T200H
CO/CO₂ Analyzer Model: TELEDYNE API T300M

Run # 2
Location: HRSG 11
Test Operator: Worawich T.
Finish Time: 11:21
Serial No.: 634
Serial No.: 922
Serial No.: 844

Time (min)	O ₂ (%)	CO ₂ (%)	NO _x (ppm)	SO ₂ (ppm)	CO (ppm)	Remark
11:01	13.38	4.23	23.32	0.14	0.61	
11:02	13.37	4.27	23.56	0.16	0.61	
11:03	13.38	4.28	23.67	0.20	0.62	
11:04	13.38	4.15	23.45	0.25	0.64	
11:05	13.37	4.24	23.28	0.20	0.53	
11:06	13.36	4.25	23.29	0.19	0.59	
11:07	13.37	4.25	23.31	0.18	0.67	
11:08	13.33	4.27	23.60	0.17	0.60	
11:09	13.39	4.27	23.75	0.21	0.60	
11:10	13.36	4.26	23.78	0.24	0.63	
11:11	13.38	4.26	23.80	0.26	0.66	
11:12	13.33	4.28	23.59	0.28	0.62	
11:13	13.35	4.27	23.54	0.18	0.59	
11:14	13.35	4.27	23.72	0.16	0.59	
11:15	13.34	4.27	23.64	0.20	0.57	
11:16	13.36	4.26	23.75	0.20	0.61	
11:17	13.33	4.26	23.68	0.21	0.64	
11:18	13.33	4.27	23.79	0.18	0.56	
11:19	13.34	4.27	23.80	0.16	0.57	
11:20	13.32	4.27	23.75	0.15	0.57	
11:21	13.36	4.25	23.75	0.22	0.60	
Average	13.36	4.28	23.61	0.20	0.60	

Norawich T.

(Mr. Worawich Tongpoom)

Environmental Field Scientist (2)

FORM NO. F-38-002 REVISION NO. 1 ISSUE DATE: 18/1/24

ALS Laboratory (Public)

Page 4 of 5



EMISSION TEST RESULT

Client: Gulf JP UT Co., Ltd.
Data: 28 Feb 24
Start Time: 11:22
SO₂ Analyzer Model: TELEDYNE API T100H
NO_x/O₂ Analyzer Model: TELEDYNE API T200H
CO/CO₂ Analyzer Model: TELEDYNE API T300M

Run # 3
Location: HRSG 11
Test Operator: Worawich T.
Finish Time: 11:42
Serial No.: 634
Serial No.: 922
Serial No.: 844

Time (min)	O ₂ (%)	CO ₂ (%)	NO _x (ppm)	SO ₂ (ppm)	CO (ppm)	Remark
11:22	13.37	4.26	23.68	0.27	0.78	
11:23	13.39	4.26	23.48	0.28	0.66	
11:24	13.34	4.25	23.31	0.19	0.58	
11:25	13.37	4.25	23.36	0.17	0.63	
11:26	13.36	4.26	23.58	0.22	0.58	
11:27	13.38	4.24	23.68	0.23	0.64	
11:28	13.36	4.25	23.78	0.23	0.61	
11:29	13.34	4.27	23.89	0.20	0.59	
11:30	13.36	4.27	23.95	0.27	0.63	
11:31	13.38	4.26	23.82	0.29	0.63	
11:32	13.36	4.26	23.84	0.28	0.63	
11:33	13.37	4.28	23.63	0.27	0.61	
11:34	13.35	4.24	23.75	0.23	0.68	
11:35	13.38	4.24	23.69	0.21	0.65	
11:36	13.35	4.23	23.67	0.23	0.68	
11:37	13.34	4.27	23.97	0.20	0.64	
11:38	13.36	4.27	24.18	0.25	0.58	
11:39	13.34	4.26	24.11	0.27	0.62	
11:40	13.34	4.28	24.10	0.23	0.62	
11:41	13.36	4.27	23.98	0.23	0.65	
11:42	13.34	4.26	23.76	0.20	0.58	
Average	13.36	4.28	23.79	0.23	0.63	

Norawich T.

(Mr. Worawich Tongpoom)

Environmental Field Scientist (2)

FORM NO. F-38-002 REVISION NO. 1 ISSUE DATE: 18/1/24

ALS Laboratory (Public)

Page 5 of 5



ANALYZER CALIBRATION DATA

Ltd No.: 2418551-1

Client: Gulf JP UT Co., Ltd.
Data: 08 Mar 24
SO₂ ANALYZER Model: TELEDYNE API T200H
Span (%): 25
Location: HRSG 12
Test Operator: Worawich T.
Serial No.: 922

	Cylinder Value (%)	Initial Analyzers Calibration Response (%)	Final Analyzers Calibration Response (%)	Difference (Percent of Span)
Zero Gas	0.00	0.00	0.01	0.04
Low-Level Gas	7.98	8.00	8.02	0.08
Span Gas	15.04	16.03	16.05	0.08

NO_x ANALYZER Model: TELEDYNE API T200H
Span (ppm): 100
Serial No.: 922

	Cylinder Value (ppm)	Initial Analyzers Calibration Response (ppm)	Final Analyzers Calibration Response (ppm)	Difference (Percent of Span)
Zero Gas	0.00	0.01	0.05	0.05
Low-Level Gas	55.88	55.83	55.79	0.04
Span Gas	80.49	80.50	80.38	0.14

SO₂ ANALYZER Model: TELEDYNE API T100H
Span (ppm): 100
Serial No.: 634

	Cylinder Value (ppm)	Initial Analyzers Calibration Response (ppm)	Final Analyzers Calibration Response (ppm)	Difference (Percent of Span)
Zero Gas	0.00	0.00	0.01	0.01
Low-Level Gas	56.30	56.24	56.21	0.03
Span Gas	79.51	79.53	79.47	0.06

CO ANALYZER Model: TELEDYNE API T300M
Span (ppm): 100
Serial No.: 844

	Cylinder Value (ppm)	Initial Analyzers Calibration Response (ppm)	Final Analyzers Calibration Response (ppm)	Difference (Percent of Span)
Zero Gas	0.00	0.02	0.01	0.01
Low-Level Gas	55.22	55.16	55.09	0.07
Span Gas	79.95	79.98	80.10	0.12

Calibrated by

Norawich T.

(Mr. Worawich Tongpoom)

Environmental Field Scientist (2)

FORM NO. F-38-002 REVISION NO. 4 ISSUE DATE: 18/1/24

ALS Laboratory (Public)

Page 1 of 5



Lot No. 2418561-1

SYSTEM CALIBRATION BIAS AND DRIFT DATA

Client: Gulf JP UT Co., Ltd. Location: HRSG 12
Date: 08 Mar 24 Test Operator: Worawich T.O₂ ANALYZER
Cylinder Conc. (%) : 18.04 Span (%) : 25

	O ₂ Analyzer Calibration Response	Initial Values System Calibration Response	System Cal Bias (% of Span)	Final Values System Calibration Response	System Cal Bias (% of Span)	Drift (% of Span)
Zero Gas	0.85	0.01	0.04	0.02	0.04	0.04
Upscale Gas	16.03	16.07	0.16	16.05	0.08	0.08

NO_x ANALYZER
Cylinder Conc. (ppm) : 80.49 Span (ppm) : 100

	NO _x Analyzer Calibration Response	Initial Values System Calibration Response	System Cal Bias (% of Span)	Final Values System Calibration Response	System Cal Bias (% of Span)	Drift (% of Span)
Zero Gas	0.01	0.04	0.03	0.07	0.06	0.03
Upscale Gas	80.50	79.79	0.71	79.61	0.89	0.18

SO₂ ANALYZER
Cylinder Conc. (ppm) : 79.51 Span (ppm) : 100

	SO ₂ Analyzer Calibration Response	Initial Values System Calibration Response	System Cal Bias (% of Span)	Final Values System Calibration Response	System Cal Bias (% of Span)	Drift (% of Span)
Zero Gas	0.00	0.01	0.01	0.01	0.01	0.00
Upscale Gas	79.53	79.36	0.17	79.42	0.11	0.06

CO ANALYZER
Cylinder Conc. (ppm) : 78.86 Span (ppm) : 100

	CO Analyzer Calibration Response	Initial Values System Calibration Response	System Cal Bias (% of Span)	Final Values System Calibration Response	System Cal Bias (% of Span)	Drift (% of Span)
Zero Gas	0.02	0.11	0.09	0.09	0.07	0.02
Upscale Gas	79.98	80.23	0.25	80.09	0.11	0.14

Calibrated by

Norawich T.

(Mr. Worawich Tongpoom)

Environmental Field Scientist (2)

FORM NO. E-06-002 REVISION NO. 3 ISSUE DATE 18/10/24

ALS Laboratory Group

Page 2 of 5



EMISSION TEST RESULT

Client: Gulf JP UT Co., Ltd. Run # 1
Date: 08 Mar 24 Location: HRSG 12
Start Time: 11:28 Test Operator: Worawich T.
Finish Time: 14:58
SO₂ Analyzer Model: TELEDYNE API T100H Serial No. 534
NO_x/O₂ Analyzer Model: TELEDYNE API T200H Serial No. 922
CO/CO₂ Analyzer Model: TELEDYNE API T300M Serial No. 844

Time (min)	O ₂ (%)	CO ₂ (%)	NO _x (ppm)	SO ₂ (ppm)	CO (ppm)	Remark
11:28	13.27	4.33	19.21	0.20	0.31	
11:28	13.27	4.31	19.16	0.13	0.25	
11:37	13.26	4.30	19.16	0.06	0.21	
11:48	13.30	4.32	19.19	0.14	0.26	
11:59	13.29	4.30	19.13	0.12	0.24	
12:10	13.30	4.28	19.03	0.16	0.28	
12:21	13.30	4.30	18.99	0.19	0.31	
12:32	13.30	4.30	19.00	0.17	0.29	
12:43	13.30	4.31	19.08	0.19	0.30	
12:54	13.27	4.31	19.17	0.16	0.27	
13:05	13.26	4.31	19.19	0.12	0.24	
13:16	13.29	4.30	19.16	0.08	0.20	
13:27	13.27	4.30	19.18	0.13	0.25	
13:38	13.30	4.31	19.16	0.17	0.28	
13:49	13.31	4.28	19.07	0.17	0.29	
14:00	13.28	4.29	19.01	0.13	0.25	
14:11	13.28	4.31	19.06	0.12	0.24	
14:22	13.29	4.30	19.07	0.14	0.26	
14:33	13.30	4.31	19.10	0.11	0.23	
14:44	13.26	4.30	19.11	0.15	0.25	
14:55	13.28	4.30	19.28	0.14	0.25	
Average	13.28	4.30	19.12	0.14	0.25	

Norawich T.

(Mr. Worawich Tongpoom)

Environmental Field Scientist (2)

FORM NO. E-06-002 REVISION NO. 3 ISSUE DATE 18/10/24

ALS Laboratory Group

Page 3 of 5



EMISSION TEST RESULT

Client: Gulf JP UT Co., Ltd. Run # 2
Date: 08 Mar 24 Location: HRSG 12
Start Time: 16:08 Test Operator: Worawich T.
Finish Time: 18:48
SO₂ Analyzer Model: TELEDYNE API T100H Serial No. 534
NO_x/O₂ Analyzer Model: TELEDYNE API T200H Serial No. 922
CO/CO₂ Analyzer Model: TELEDYNE API T300M Serial No. 844

Time (min)	O ₂ (%)	CO ₂ (%)	NO _x (ppm)	SO ₂ (ppm)	CO (ppm)	Remark
15:06	13.30	4.30	19.36	0.07	0.19	
15:17	13.29	4.30	19.35	0.12	0.24	
15:28	13.31	4.30	19.24	0.20	0.40	
15:39	13.30	4.30	19.18	0.23	0.34	
15:50	13.29	4.31	19.23	0.13	0.24	
16:01	13.28	4.31	19.26	0.11	0.23	
16:12	13.28	4.32	19.45	0.07	0.19	
16:23	13.30	4.33	19.47	0.10	0.22	
16:34	13.33	4.30	19.35	0.08	0.21	
16:45	13.31	4.30	19.23	0.08	0.20	
16:56	13.30	4.30	19.14	0.07	0.19	
17:07	13.30	4.29	18.65	0.09	0.21	
17:18	13.29	4.29	18.76	0.10	0.22	
17:29	13.29	4.30	18.77	0.12	0.24	
17:40	13.26	4.32	18.84	0.08	0.20	
17:51	13.28	4.33	18.94	0.12	0.24	
18:02	13.27	4.31	19.07	0.17	0.29	
18:13	13.29	4.31	19.08	0.11	0.23	
18:24	13.28	4.32	19.18	0.18	0.36	
18:35	13.28	4.32	19.32	0.12	0.24	
18:46	13.31	4.32	19.28	0.20	0.32	
Average	13.29	4.31	19.17	0.13	0.24	

Norawich T.

(Mr. Worawich Tongpoom)

Environmental Field Scientist (2)

FORM NO. E-06-002 REVISION NO. 3 ISSUE DATE 18/10/24

ALS Laboratory Group

Page 4 of 5



EMISSION TEST RESULT

Client: Gulf JP UT Co., Ltd. Run # 3
Date: 08 Mar 24 Location: HRSG 12
Start Time: 18:57 Test Operator: Worawich T.
Finish Time: 22:37
SO₂ Analyzer Model: TELEDYNE API T100H Serial No. 534
NO_x/O₂ Analyzer Model: TELEDYNE API T200H Serial No. 922
CO/CO₂ Analyzer Model: TELEDYNE API T300M Serial No. 844

Time (min)	O ₂ (%)	CO ₂ (%)	NO _x (ppm)	SO ₂ (ppm)	CO (ppm)	Remark
18:57	13.30	4.31	19.23	0.20	0.31	
19:08	13.31	4.31	19.16	0.22	0.34	
19:19	13.33	4.29	19.11	0.14	0.26	
19:30	13.30	4.29	19.07	0.20	0.31	
19:41	13.32	4.31	19.02	0.11	0.23	
19:52	13.31	4.29	19.02	0.17	0.29	
20:03	13.28	4.31	19.10	0.16	0.27	
20:14	13.31	4.31	19.12	0.20	0.32	
20:25	13.29	4.32	19.06	0.22	0.34	
20:36	13.28	4.32	19.14	0.19	0.29	
20:47	13.28	4.32	19.18	0.16	0.27	
20:58	13.28	4.32	19.24	0.15	0.27	
21:09	13.29	4.31	19.23	0.18	0.30	
21:20	13.29	4.31	19.16	0.19	0.31	
21:31	13.27	4.31	19.25	0.40	0.53	
21:42	13.30	4.32	19.36	0.35	0.46	
21:53	13.33	4.31	19.40	0.26	0.37	
22:04	13.30	4.30	19.33	0.17	0.29	
22:15	13.30	4.30	19.48	0.18	0.27	
22:26	13.28	4.31	19.63	0.15	0.27	
22:37	13.33	4.31	19.80	0.18	0.28	
Average	13.30	4.31	19.24	0.20	0.31	

Norawich T.

(Mr. Worawich Tongpoom)

Environmental Field Scientist (2)

FORM NO. E-06-002 REVISION NO. 3 ISSUE DATE 18/10/24

ALS Laboratory Group

Page 5 of 5



Lot No. 2418582-1

ANALYZER CALIBRATION DATA

Client : Gulf JP UT Co., Ltd. Location : HRSQ 21
Date : 18 Feb 24 Test Operator : Anuvut M.
O₂ ANALYZER :
Model : TELEDYNE API T200H Serial No. : 822
Span (%) : 25

	Cylinder Value (%)	Initial Analyzers Calibration Response (%)	Final Analyzers Calibration Response (%)	Difference (Percent of Span)
Zero Gas	0.00	0.11	0.14	0.12
Low-Level Gas	7.88	7.88	7.78	0.40
Span Gas	15.04	15.78	15.89	0.44

NO_x ANALYZER :
Model : TELEDYNE API T200H Serial No. : 822
Span (ppm) : 100

	Cylinder Value (ppm)	Initial Analyzers Calibration Response (ppm)	Final Analyzers Calibration Response (ppm)	Difference (Percent of Span)
Zero Gas	0.00	0.11	0.12	0.01
Low-Level Gas	55.88	56.77	56.34	0.43
Span Gas	80.49	81.23	81.11	0.12

SO₂ ANALYZER :
Model : TELEDYNE API T100H Serial No. : 834
Span (ppm) : 100

	Cylinder Value (ppm)	Initial Analyzers Calibration Response (ppm)	Final Analyzers Calibration Response (ppm)	Difference (Percent of Span)
Zero Gas	0.00	0.00	0.00	0.00
Low-Level Gas	56.30	55.89	56.00	0.11
Span Gas	79.51	78.86	79.00	0.12

CO ANALYZER :
Model : TELEDYNE API T300M Serial No. : 844
Span (ppm) : 100

	Cylinder Value (ppm)	Initial Analyzers Calibration Response (ppm)	Final Analyzers Calibration Response (ppm)	Difference (Percent of Span)
Zero Gas	0.00	0.00	0.00	0.00
Low-Level Gas	55.22	55.10	55.00	0.10
Span Gas	79.95	80.22	80.12	0.10

Calibrated by

Anuvut M

(Mr. Anuvut Moungeat)
Environmental Field Scientist (2)

FORM NO. 1-06-02 REVISION NO. 3 ISSUE DATE 20-11-23

ALS Laboratory Group

Page 1 of 5



Lot No. 2418582-1

SYSTEM CALIBRATION BIAS AND DRIFT DATA

Client : Gulf JP UT Co., Ltd. Location : HRSQ 21
Date : 18 Feb 24 Test Operator : Anuvut M.

O₂ ANALYZER :
Cylinder Conc. (%) : 18.04 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	0.11	0.11	0.00	0.13	0.08	0.08
Upscale Gas	15.78	15.99	0.84	15.88	0.40	0.44

NO_x ANALYZER :
Cylinder Conc. (ppm) : 80.49 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	0.11	0.00	0.11	0.00	0.11	0.00
Upscale Gas	81.23	81.00	0.23	81.08	0.15	0.08

SO₂ ANALYZER :
Cylinder Conc. (ppm) : 79.51 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	0.00	0.00	0.00	0.00	0.00	0.00
Upscale Gas	78.88	79.00	0.12	79.11	0.23	0.11

CO ANALYZER :
Cylinder Conc. (ppm) : 79.95 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	0.00	0.00	0.00	0.00	0.00	0.00
Upscale Gas	80.22	79.88	0.34	79.65	0.57	0.23

Calibrated by

Anuvut M

(Mr. Anuvut Moungeat)

Environmental Field Scientist (2)

FORM NO. 1-06-03 REVISION NO. 3 ISSUE DATE 20-11-23

ALS Laboratory Group

Page 2 of 5



EMISSION TEST RESULT

Client : Gulf JP UT Co., Ltd. Run # : 1
Date : 18 Feb 24 Location : HRSQ 21
Start Time : 10:40 Test Operator : Anuvut M.
Finish Time : 11:00
SO₂ Analyzer Model : TELEDYNE API T100H Serial No. : 834
NO_x/CO₂ Analyzer Model : TELEDYNE API T200H Serial No. : 822
CO/CO₂ Analyzer Model : TELEDYNE API T300M Serial No. : 844

Time (min)	O ₂ (%)	CO ₂ (%)	NO _x (ppm)	SO ₂ (ppm)	CO (ppm)	Remark
10:40	13.35	4.28	22.81	0.18	0.07	
10:41	13.37	4.28	22.91	0.16	0.03	
10:42	13.35	4.28	22.90	0.10	0.04	
10:43	13.36	4.30	22.71	0.12	0.11	
10:44	13.30	4.30	22.73	0.13	0.06	
10:45	13.33	4.30	23.00	0.14	0.07	
10:46	13.35	4.30	23.06	0.14	0.08	
10:47	13.36	4.29	22.78	0.17	0.11	
10:48	13.34	4.29	22.73	0.18	0.05	
10:49	13.37	4.29	22.82	0.19	0.03	
10:50	13.36	4.28	22.56	0.18	0.11	
10:51	13.38	4.29	22.60	0.19	0.11	
10:52	13.30	4.29	23.02	0.22	0.11	
10:53	13.33	4.30	23.26	0.24	0.08	
10:54	13.32	4.29	23.34	0.24	0.10	
10:55	13.33	4.31	23.13	0.26	0.07	
10:56	13.37	4.30	23.86	0.27	0.09	
10:57	13.35	4.27	22.71	0.29	0.11	
10:58	13.36	4.27	22.76	0.20	0.11	
10:59	13.36	4.27	22.81	0.34	0.01	
11:00	13.32	4.28	22.82	0.30	0.06	
Average	13.36	4.28	22.88	0.21	0.07	

Anuvut M

(Mr. Anuvut Moungeat)
Environmental Field Scientist (2)

FORM NO. 1-06-10 REVISION NO. 3 ISSUE DATE 20-11-23

ALS Laboratory Group

Page 1 of 5



EMISSION TEST RESULT

Client : Gulf JP UT Co., Ltd. Run # : 2
Date : 18 Feb 24 Location : HRSQ 21
Start Time : 11:01 Test Operator : Anuvut M.
Finish Time : 11:21
SO₂ Analyzer Model : TELEDYNE API T100H Serial No. : 834
NO_x/CO₂ Analyzer Model : TELEDYNE API T200H Serial No. : 822
CO/CO₂ Analyzer Model : TELEDYNE API T300M Serial No. : 844

Time (min)	O ₂ (%)	CO ₂ (%)	NO _x (ppm)	SO ₂ (ppm)	CO (ppm)	Remark
11:01	13.32	4.29	23.17	0.37	0.03	
11:02	13.34	4.31	23.37	0.36	0.08	
11:03	13.33	4.31	23.41	0.38	0.06	
11:04	13.33	4.29	23.38	0.41	0.06	
11:05	13.35	4.30	23.23	0.43	0.03	
11:06	13.37	4.30	23.10	0.44	0.01	
11:07	13.38	4.28	22.79	0.34	0.08	
11:08	13.35	4.28	22.92	0.09	0.11	
11:09	13.35	4.28	23.15	0.08	0.11	
11:10	13.34	4.29	23.32	0.10	0.11	
11:11	13.36	4.29	23.10	0.07	0.07	
11:12	13.39	4.28	22.92	0.08	0.08	
11:13	13.40	4.27	22.68	0.05	0.07	
11:14	13.41	4.25	22.51	0.01	0.08	
11:15	13.41	4.25	22.58	0.02	0.05	
11:16	13.38	4.24	22.47	0.02	0.13	
11:17	13.42	4.23	22.40	0.04	0.22	
11:18	13.44	4.25	22.29	0.05	0.18	
11:19	13.40	4.24	22.30	0.07	0.25	
11:20	13.34	4.27	22.77	0.41	0.08	
11:21	13.36	4.28	23.19	0.41	0.02	
Average	13.37	4.28	22.80	0.27	0.08	

Anuvut M

(Mr. Anuvut Moungeat)
Environmental Field Scientist (2)

FORM NO. 1-06-10 REVISION NO. 3 ISSUE DATE 20-11-23

ALS Laboratory Group

Page 2 of 5



EMISSION TEST RESULT

Client	Gulf JP UT Co., Ltd.	Run #	3
Date	18 Feb 24	Location	HRBG 21
Start Time	11:22	Test Operator	Anurat M.
SO ₂ Analyzer Model	TELEDYNE API T100H	Finish Time	11:42
NO _x /O ₂ Analyzer Model	TELEDYNE API T200H	Serial No.	834
CO/CO ₂ Analyzer Model	TELEDYNE API T300M	Serial No.	822
		Serial No.	844

Time (min)	O ₂ (%)	CO ₂ (%)	NO _x (ppm)	SO ₂ (ppm)	CO (ppm)	Remark
11:22	13.41	4.28	23.08	0.45	0.06	
11:23	13.41	4.26	22.69	0.46	0.09	
11:24	13.37	4.25	22.60	0.46	0.14	
11:25	13.28	4.27	22.83	0.51	0.11	
11:26	13.37	4.27	22.93	0.51	0.10	
11:27	13.35	4.28	22.66	0.50	0.10	
11:28	13.42	4.24	22.57	0.55	0.14	
11:29	13.51	4.22	22.29	0.57	0.25	
11:30	13.46	4.30	21.87	0.58	0.34	
11:31	13.43	4.23	22.45	0.62	0.22	
11:32	13.46	4.21	22.71	0.69	0.44	
11:33	13.57	4.18	21.67	0.69	0.66	
11:34	13.59	4.15	21.37	0.67	0.90	
11:35	13.67	4.11	20.97	0.70	1.29	
11:36	13.71	4.09	20.49	0.71	1.51	
11:37	13.73	4.07	20.02	0.80	1.77	
11:38	13.84	4.03	19.37	0.95	3.34	
11:39	13.90	4.00	18.50	0.98	4.88	
11:40	13.66	3.96	17.51	0.95	7.35	
11:41	13.56	3.93	17.33	0.11	8.51	
11:42	14.05	3.93	17.50	0.15	7.50	
Average	13.60	4.18	21.12	0.48	1.68	

Anurat M

(Mr. Anurat Moungpa)

Environmental Field Scientist (2)



Lot No. 2418563-1

ANALYZER CALIBRATION DATA

Client	Gulf JP UT Co., Ltd.	Location	HRBG 22
Date	18 Feb 24	Test Operator	Anurat M.
O ₂ ANALYZER Model	TELEDYNE API T200H	Serial No.	823
Span (%)	25		

Cylinder Value (%)	Initial Analyzers Calibration Response (%)	Final Analyzers Calibration Response (%)	Difference (Percent of Span)
Zero Gas	0.00	0.00	0.44
Low-Level Gas	7.98	8.06	0.12
Span Gas	16.04	16.04	0.32

NO _x ANALYZER Model	TELEDYNE API T200H	Serial No.	823
Span (ppm)	100		

Cylinder Value (ppm)	Initial Analyzers Calibration Response (ppm)	Final Analyzers Calibration Response (ppm)	Difference (Percent of Span)
Zero Gas	0.00	0.00	0.08
Low-Level Gas	55.68	55.57	0.31
Span Gas	80.49	80.79	0.09

SO ₂ ANALYZER Model	TELEDYNE API T100H	Serial No.	838
Span (ppm)	100		

Cylinder Value (ppm)	Initial Analyzers Calibration Response (ppm)	Final Analyzers Calibration Response (ppm)	Difference (Percent of Span)
Zero Gas	0.00	0.00	0.00
Low-Level Gas	56.30	56.00	0.11
Span Gas	79.51	79.00	0.24

CO ANALYZER Model	TELEDYNE API T300M	Serial No.	845
Span (ppm)	100		

Cylinder Value (ppm)	Initial Analyzers Calibration Response (ppm)	Final Analyzers Calibration Response (ppm)	Difference (Percent of Span)
Zero Gas	0.00	0.00	0.00
Low-Level Gas	56.22	54.89	0.10
Span Gas	79.55	80.00	0.02

Calibrated by

Anurat M

(Mr. Anurat Moungpa)

Environmental Field Scientist (2)



Lot No. 2418563-1

SYSTEM CALIBRATION BIAS AND DRIFT DATA

Client	Gulf JP UT Co., Ltd.	Location	HRBG 22
Date	18 Feb 24	Test Operator	Anurat M.

O ₂ ANALYZER Cylinder Conc. (%)	18.04	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	0.00	0.00	0.00	0.00	0.00	
Upscale Gas	16.04	15.99	0.20	16.00	0.16	

NO _x ANALYZER Cylinder Conc. (ppm)	80.49	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	0.00	0.00	0.00	0.00	0.00	
Upscale Gas	80.79	80.97	0.18	80.88	0.09	

SO ₂ ANALYZER Cylinder Conc. (ppm)	79.51	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	0.00	0.04	0.04	0.04	0.04	0.00
Upscale Gas	79.00	78.87	0.13	79.00	0.00	0.13

CO ANALYZER Cylinder Conc. (ppm)	79.86	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	0.00	0.00	0.00	0.00	0.00	
Uppscale Gas	80.00	80.12	0.12	80.18	0.18	

Calibrated by

Anurat M

(Mr. Anurat Moungpa)

Environmental Field Scientist (2)



EMISSION TEST RESULT

Client	Gulf JP UT Co., Ltd.	Run #	1
Date	18 Feb 24	Location	HRBG 22
Start Time	10:30	Test Operator	Anurat M.
SO ₂ Analyzer Model	TELEDYNE API T100H	Finish Time	10:40
NO _x /O ₂ Analyzer Model	TELEDYNE API T200H	Serial No.	838
CO/CO ₂ Analyzer Model	TELEDYNE API T300M	Serial No.	823
		Serial No.	846

Time (min)	O ₂ (%)	CO ₂ (%)	NO _x (ppm)	SO ₂ (ppm)	CO (ppm)	Remark
10:30	13.21	4.31	20.38	0.15	0.15	
10:31	13.20	4.31	20.40	0.18	0.18	
10:32	13.20	4.31	20.49	0.15	0.14	
10:33	13.17	4.25	20.65	0.17	0.12	
10:34	13.21	4.29	20.69	0.17	0.10	
10:35	13.22	4.24	20.57	0.17	0.10	
10:36	13.18	4.28	20.48	0.14	0.10	
10:37	13.17	4.23	20.48	0.13	0.10	
10:38	13.18	4.23	20.41	0.13	0.10	
10:39	13.19	4.21	20.35	0.06	0.10	
10:40	13.19	4.21	20.37	0.15	0.15	
10:41	13.19	4.21	20.43	0.16	0.14	
10:42	13.20	4.23	20.45	0.18	0.12	
10:43	13.20	4.23	20.76	0.17	0.10	
10:44	13.21	4.24	22.90	0.17	0.10	
10:45	13.20	4.23	22.77	0.17	0.04	
10:46	13.19	4.23	22.71	0.15	0.10	
10:47	13.22	4.23	22.83	0.16	0.10	
10:48	13.25	4.21	22.45	0.16	0.18	
10:49	13.24	4.21	22.54	0.17	0.14	
10:40	13.24	4.25	22.80	0.17	0.12	
Average	13.21	4.22	21.32	0.16	0.12	

Anurat M

(Mr. Anurat Moungpa)

Environmental Field Scientist (2)



EMISSION TEST RESULT

Client	Gulf JP UT Co., Ltd.	Run #	2
Date	19 Feb 24	Location	HRBQ 22
Start Time	10:41	Test Operator	Anuvit M.
End Time		Finish Time	11:01
SO ₂ Analyzer Model	TELEDYNE API T100H	Serial No.	838
NO _x Analyzer Model	TELEDYNE API T200H	Serial No.	823
CO/CO ₂ Analyzer Model	TELEDYNE API T300M	Serial No.	846

Time (min)	O ₂ (%)	CO ₂ (%)	NO _x (ppm)	SO ₂ (ppm)	CO (ppm)	Remark
10:41	13.18	4.23	23.97	0.17	0.10	
10:42	13.20	4.24	23.91	0.16	0.10	
10:43	13.23	4.23	23.96	0.16	0.10	
10:44	13.21	4.23	23.86	0.16	0.10	
10:45	13.18	4.23	23.95	0.17	0.10	
10:46	13.23	4.23	23.90	0.17	0.10	
10:47	13.21	4.23	23.75	0.17	0.09	
10:48	13.19	4.23	22.87	0.15	0.03	
10:49	13.20	4.24	22.55	0.21	0.05	
10:50	13.23	4.25	22.92	0.18	0.11	
10:51	13.22	4.25	22.89	0.17	0.08	
10:52	13.21	4.20	22.85	0.16	0.10	
10:53	13.17	4.24	23.03	0.16	0.10	
10:54	13.21	4.23	22.94	0.16	0.10	
10:55	13.18	4.23	22.93	0.17	0.10	
10:56	13.21	4.24	22.80	0.17	0.10	
10:57	13.24	4.22	22.73	0.17	0.14	
10:58	13.19	4.20	22.78	0.17	0.06	
10:59	13.23	4.20	22.88	0.17	0.06	
11:00	13.23	4.20	22.90	0.18	0.13	
11:01	13.19	4.23	23.16	0.15	0.10	
Average	13.21	4.23	22.64	0.17	0.08	

Anuvit M.

(Mr. Anuvit Mungpak)

Environmental Field Scientist (2)

FORM NO. 1-08-002 REVISION NO. 4 ISSUE DATE: 18/01/24

ALS Laboratory Group

Page 4 of 5



EMISSION TEST RESULT

Client	Gulf JP UT Co., Ltd.	Run #	3
Date	19 Feb 24	Location	HRBQ 22
Start Time	11:02	Test Operator	Anuvit M.
End Time		Finish Time	11:22
SO ₂ Analyzer Model	TELEDYNE API T100H	Serial No.	838
NO _x Analyzer Model	TELEDYNE API T200H	Serial No.	823
CO/CO ₂ Analyzer Model	TELEDYNE API T300M	Serial No.	846

Time (min)	O ₂ (%)	CO ₂ (%)	NO _x (ppm)	SO ₂ (ppm)	CO (ppm)	Remark
11:02	13.20	4.23	23.37	0.16	0.10	
11:03	13.18	4.23	23.17	0.14	0.05	
11:04	13.21	4.23	23.13	0.14	0.11	
11:05	13.17	4.22	23.12	0.14	0.13	
11:06	13.20	4.23	22.99	0.15	0.09	
11:07	13.26	4.20	22.89	0.23	0.10	
11:08	13.24	4.20	22.97	0.20	0.14	
11:09	13.21	4.22	23.33	0.22	0.08	
11:10	13.19	4.23	23.55	0.23	0.08	
11:11	13.20	4.23	23.82	0.23	0.13	
11:12	13.24	4.22	23.27	0.24	0.10	
11:13	13.28	4.20	23.11	0.23	0.10	
11:14	13.28	4.18	23.09	0.22	0.10	
11:15	13.31	4.18	23.13	0.23	0.10	
11:16	13.33	4.17	23.19	0.22	0.10	
11:17	13.33	4.17	23.24	0.25	0.10	
11:18	13.32	4.17	23.19	0.26	0.10	
11:19	13.33	4.17	23.30	0.25	0.10	
11:20	13.20	4.15	23.50	0.25	0.27	
11:21	13.21	4.21	23.89	0.26	0.10	
11:22	13.25	4.20	24.14	0.26	0.10	
Average	13.25	4.20	23.51	0.22	0.11	

Anuvit M.

(Mr. Anuvit Mungpak)

Environmental Field Scientist (2)

Page 5 of 5

FORM NO. 1-08-016 REVISION NO. 5 ISSUE DATE: 20/11/23

ALS Laboratory Group



Lot No. 2418546-1

ANALYZER CALIBRATION DATA

Client	Gulf JP UT Co., Ltd.	Location	HRBQ 11
Date	28 Feb 24	Test Operator	Worawich T.
SO ₂ ANALYZER Model	TELEDYNE API T200H	Serial No.	822
Span (%)	25		

	Cylinder Value (%)	Initial Analyzers Calibration Response (%)	Final Analyzers Calibration Response (%)	Difference (Percent of Span)
Zero Gas	0.00	0.00	0.00	0.00
Low-Level Gas	7.98	7.99	8.02	0.12
Span Gas	16.04	16.04	16.03	0.04

NO _x ANALYZER Model	TELEDYNE API T200H	Serial No.	822
Span (ppm)	100		

	Cylinder Value (ppm)	Initial Analyzers Calibration Response (ppm)	Final Analyzers Calibration Response (ppm)	Difference (Percent of Span)
Zero Gas	0.00	0.00	0.02	0.02
Low-Level Gas	55.83	55.85	55.83	0.03
Span Gas	80.48	80.47	80.41	0.06

SO ₂ ANALYZER Model	TELEDYNE API T100H	Serial No.	834
Span (ppm)	100		

	Cylinder Value (ppm)	Initial Analyzers Calibration Response (ppm)	Final Analyzers Calibration Response (ppm)	Difference (Percent of Span)
Zero Gas	0.00	0.00	0.00	0.00
Low-Level Gas	56.30	56.37	56.17	0.10
Span Gas	79.51	79.50	79.48	0.04

CO ANALYZER Model	TELEDYNE API T300M	Serial No.	844
Span (ppm)	100		

	Cylinder Value (ppm)	Initial Analyzers Calibration Response (ppm)	Final Analyzers Calibration Response (ppm)	Difference (Percent of Span)
Zero Gas	0.00	0.00	0.04	0.04
Low-Level Gas	55.22	55.25	55.10	0.15
Span Gas	79.55	79.54	79.50	0.04

Calibrated by

Worawich T.

(Mr. Worawich Tongpoom)

Environmental Field Scientist (2)

FORM NO. 1-08-002 REVISION NO. 4 ISSUE DATE: 18/01/24

ALS Laboratory Group



Lot No. 2418546-1

SYSTEM CALIBRATION BIAS AND DRIFT DATA

Client	Gulf JP UT Co., Ltd.	Location	HRBQ 11
Date	28 Feb 24	Test Operator	Worawich T.

SO ₂ ANALYZER Cylinder Conc. (ppm)	18.04	Span (%)	25
---	-------	----------	----

	SO ₂ Analyzer Calibration Response	System Calibration Response	System Cal Bias (% of Span)	System Calibration Response	System Cal Bias (% of Span)	Drift (% of Span)
Zero Gas	0.00	0.01	0.04	0.00	0.00	0.04
Upstream Gas	18.04	18.01	0.12	18.05	0.04	0.16

NO _x ANALYZER Cylinder Conc. (ppm)	80.48	Span (ppm)	100
---	-------	------------	-----

	NO _x Analyzer Calibration Response	System Calibration Response	System Cal Bias (% of Span)	System Calibration Response	System Cal Bias (% of Span)	Drift (% of Span)
Zero Gas	0.00	0.03	0.03	0.01	0.01	0.02
Upstream Gas	80.47	79.78	0.69	79.72	0.75	0.06

SO ₂ ANALYZER Cylinder Conc. (ppm)	79.51	Span (ppm)	100
---	-------	------------	-----

	SO ₂ Analyzer Calibration Response	System Calibration Response	System Cal Bias (% of Span)	System Calibration Response	System Cal Bias (% of Span)	Drift (% of Span)
Zero Gas	0.00	0.00	0.00	0.00	0.00	0.00
Upstream Gas	79.50	79.10	0.40	78.73	0.71	0.31

CO ANALYZER Cylinder Conc. (ppm)	79.55	Span (ppm)	100
----------------------------------	-------	------------	-----

	CO Analyzer Calibration Response	System Calibration Response	System Cal Bias (% of Span)	System Calibration Response	System Cal Bias (% of Span)	Drift (% of Span)
Zero Gas	0.00	0.02	0.02	0.01	0.01	0.01
Upstream Gas	79.54	79.38	0.06	79.79	0.15	0.09

Calibrated by

Worawich T.

(Mr. Worawich Tongpoom)

Environmental Field Scientist (2)

FORM NO. 1-08-002 REVISION NO. 4 ISSUE DATE: 18/01/24

ALS Laboratory Group

CEMs Data

2) min	Run

21 men	Flu

CEM_B 0

Page 21/28

0.0	1.0	2.0
-----	-----	-----

Reference Methods

28 mm	28 mm

21-0001	02
---------	----

Reference Material

Base	27 min
Run	10 min

Run	Time
1	2.1 min



ANALYZER CALIBRATION DATA

Client	Gulf JP UT Co., Ltd.	Location	HRSG 12
Date	08 Mar 24	Test Operator	Worawich T.
O ₂ ANALYZER			
Model	TELEDYNE API T200H	Serial No.	822
Span (%)	25		

NO_x ANALYZER
Model : TELEDYNE API T200H Serial No. : 922
Span (ppm) : 100

802 ANALYZER
Model : TELEDYNE API T100H Serial No. : 534
Scan (ppm) : 100

CO ANALYZER
Model : TELEDYNE API T300M Serial No. : 844
Span (ppm) : 100

	Cylinder Value (ppm)	Initial Analyzers Calibration Response (ppm)	Final Analyzers Calibration Response (ppm)	Difference (Percent of Span)
Zero Gas	0.00	0.02	0.01	0.01
Low-Level Gas	55.22	55.16	55.09	0.07
Span Gas	79.92	79.98	80.10	0.12

Calibrated by

Nbranich T.

(Mr. Worzwich: Tonaboom)

FORM NO. 9-88-02 REVISION NO. 4 ISSUE DATE 10/01/04

ALP Laboratory Group



SYSTEM CALIBRATION BIAS AND DRIFT DATA

Client :	Gulf JF UT Co., Ltd.	Location :	HRSG 12
Date :	08 Mar 24	Test Operator :	Wormwich T.

O₂ ANALYZER
Cylinder Conc. (%) : 16.04 Span (%) : 25

NO_x ANALYZER
Cylinder Conc. (ppm) : 80.48 Span (ppm) : 100

SO₂ ANALYZER
Cylinder Conc. (ppm) : 79.51 Span (ppm) : 100

CO ANALYZER
Cylinder Conc. (ppm) : 79.85 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)	
Zerol Gas	0.02	0.11	0.06	10.09	0.07	0.02
Ultralox Gas	79.08	80.73	0.26	80.09	0.37	0.34

Collected by

Norovich T.

(Mr.Worawich Tonsoom)

Environmental Field Scientist (2)



CEM₃ Data

Client Name	Gulf IP UT Co. Ltd.	Date	08 Mar 24
Plant Name	Gulf	Location	HR3212

Ship Name		Drive Base = 21 miles					Ship Name					Rowe Base = 21 miles				
Date	Time	012	015	018	021	024	Date	Time	012	015	018	021	024			
09 Nov 24	10:00	0.70	0.80	0.90	1.00	1.10	09 Nov 24	10:30	0.80	0.90	1.00	1.10	1.20			
09 Nov 24	10:30	0.80	0.90	1.00	1.10	1.20	09 Nov 24	10:45	0.90	1.00	1.10	1.20	1.30			
09 Nov 24	11:00	0.90	1.00	1.10	1.20	1.30	09 Nov 24	11:00	1.00	1.10	1.20	1.30	1.40			
09 Nov 24	11:30	1.00	1.10	1.20	1.30	1.40	09 Nov 24	11:15	1.10	1.20	1.30	1.40	1.50			
09 Nov 24	12:00	1.10	1.20	1.30	1.40	1.50	09 Nov 24	11:30	1.20	1.30	1.40	1.50	1.60			
09 Nov 24	12:30	1.20	1.30	1.40	1.50	1.60	09 Nov 24	11:45	1.30	1.40	1.50	1.60	1.70			
09 Nov 24	13:00	1.30	1.40	1.50	1.60	1.70	09 Nov 24	12:00	1.40	1.50	1.60	1.70	1.80			
09 Nov 24	13:30	1.40	1.50	1.60	1.70	1.80	09 Nov 24	12:15	1.50	1.60	1.70	1.80	1.90			
09 Nov 24	14:00	1.50	1.60	1.70	1.80	1.90	09 Nov 24	12:30	1.60	1.70	1.80	1.90	2.00			
09 Nov 24	14:30	1.60	1.70	1.80	1.90	2.00	09 Nov 24	12:45	1.70	1.80	1.90	2.00	2.10			
09 Nov 24	15:00	1.70	1.80	1.90	2.00	2.10	09 Nov 24	13:00	1.80	1.90	2.00	2.10	2.20			
09 Nov 24	15:30	1.80	1.90	2.00	2.10	2.20	09 Nov 24	13:15	1.90	2.00	2.10	2.20	2.30			
09 Nov 24	16:00	1.90	2.00	2.10	2.20	2.30	09 Nov 24	13:30	2.00	2.10	2.20	2.30	2.40			
09 Nov 24	16:30	2.00	2.10	2.20	2.30	2.40	09 Nov 24	13:45	2.10	2.20	2.30	2.40	2.50			
09 Nov 24	17:00	2.10	2.20	2.30	2.40	2.50	09 Nov 24	14:00	2.20	2.30	2.40	2.50	2.60			
09 Nov 24	17:30	2.20	2.30	2.40	2.50	2.60	09 Nov 24	14:15	2.30	2.40	2.50	2.60	2.70			
09 Nov 24	18:00	2.30	2.40	2.50	2.60	2.70	09 Nov 24	14:30	2.40	2.50	2.60	2.70	2.80			
09 Nov 24	18:30	2.40	2.50	2.60	2.70	2.80	09 Nov 24	14:45	2.50	2.60	2.70	2.80	2.90			
09 Nov 24	19:00	2.50	2.60	2.70	2.80	2.90	09 Nov 24	15:00	2.60	2.70	2.80	2.90	3.00			
09 Nov 24	19:30	2.60	2.70	2.80	2.90	3.00	09 Nov 24	15:15	2.70	2.80	2.90	3.00	3.10			
09 Nov 24	20:00	2.70	2.80	2.90	3.00	3.10	09 Nov 24	15:30	2.80	2.90	3.00	3.10	3.20			
09 Nov 24	20:30	2.80	2.90	3.00	3.10	3.20	09 Nov 24	15:45	2.90	3.00	3.10	3.20	3.30			
09 Nov 24	21:00	2.90	3.00	3.10	3.20	3.30	09 Nov 24	16:00	3.00	3.10	3.20	3.30	3.40			
09 Nov 24	21:30	3.00	3.10	3.20	3.30	3.40	09 Nov 24	16:15	3.10	3.20	3.30	3.40	3.50			
09 Nov 24	22:00	3.10	3.20	3.30	3.40	3.50	09 Nov 24	16:30	3.20	3.30	3.40	3.50	3.60			
09 Nov 24	22:30	3.20	3.30	3.40	3.50	3.										

Run No.		Time Base: 21 min					Run No. 4		Time Base: 21 min				
		Sec.	NO2	NO	O3	SO2			Sec.	NO2	NO	O3	SO2
Run No. 3	11:17	0:05	28.20	0.00	0.54	181.00	Run No. 4	11:20	0:05	03.80	0.00	0.94	182.00
Run No. 3	11:18	0:10	28.20	0.00	0.54	181.00	Run No. 4	11:21	0:10	03.80	0.00	0.94	182.00
Run No. 3	11:19	0:15	28.20	0.00	0.54	181.00	Run No. 4	11:22	0:15	03.80	0.00	0.94	182.00
Run No. 3	11:20	0:20	28.20	0.00	0.54	181.00	Run No. 4	11:23	0:20	03.80	0.00	0.94	182.00
Run No. 3	11:21	0:25	28.20	0.00	0.54	181.00	Run No. 4	11:24	0:25	03.80	0.00	0.94	182.00
Run No. 3	11:22	0:30	28.20	0.00	0.54	181.00	Run No. 4	11:25	0:30	03.80	0.00	0.94	182.00
Run No. 3	11:23	0:35	28.20	0.00	0.54	181.00	Run No. 4	11:26	0:35	03.80	0.00	0.94	182.00
Run No. 3	11:24	0:40	28.20	0.00	0.54	181.00	Run No. 4	11:27	0:40	03.80	0.00	0.94	182.00
Run No. 3	11:25	0:45	28.20	0.00	0.54	181.00	Run No. 4	11:28	0:45	03.80	0.00	0.94	182.00
Run No. 3	11:26	0:50	28.20	0.00	0.54	181.00	Run No. 4	11:29	0:50	03.80	0.00	0.94	182.00
Run No. 3	11:27	0:55	28.20	0.00	0.54	181.00	Run No. 4	11:30	0:55	03.80	0.00	0.94	182.00
Run No. 3	11:28	1:00	28.20	0.00	0.54	181.00	Run No. 4	11:31	1:00	03.80	0.00	0.94	182.00
Run No. 3	11:29	1:05	28.20	0.00	0.54	181.00	Run No. 4	11:32	1:05	03.80	0.00	0.94	182.00
Run No. 3	11:30	1:10	28.20	0.00	0.54	181.00	Run No. 4	11:33	1:10	03.80	0.00	0.94	182.00
Run No. 3	11:31	1:15	28.20	0.00	0.54	181.00	Run No. 4	11:34	1:15	03.80	0.00	0.94	182.00
Run No. 3	11:32	1:20	28.20	0.00	0.54	181.00	Run No. 4	11:35	1:20	03.80	0.00	0.94	182.00
Run No. 3	11:33	1:25	28.20	0.00	0.54	181.00	Run No. 4	11:36	1:25	03.80	0.00	0.94	182.00
Run No. 3	11:34	1:30	28.20	0.00	0.54	181.00	Run No. 4	11:37	1:30	03.80	0.00	0.94	182.00
Run No. 3	11:35	1:35	28.20	0.00	0.54	181.00	Run No. 4	11:38	1:35	03.80	0.00	0.94	182.00
Run No. 3	11:36	1:40	28.20	0.00	0.54	181.00	Run No. 4	11:39	1:40	03.80	0.00	0.94	182.00
Run No. 3	11:37	1:45	28.20	0.00	0.54	181.00	Run No. 4	11:40	1:45	03.80	0.00	0.94	182.00
Run No. 3	11:38	1:50	28.20	0.00	0.54	181.00	Run No. 4	11:41	1:50	03.80	0.00	0.94	182.00
Run No. 3	11:39	1:55	28.20	0.00	0.54	181.00	Run No. 4	11:42	1:55	03.80	0.00	0.94	182.00
Run No. 3	11:40	2:00	28.20	0.00	0.54	181.00	Run No. 4	11:43	2:00	03.80	0.00	0.94	182.00
Run No. 3	11:41	2:05	28.20	0.00	0.54	181.00	Run No. 4	11:44	2:05	03.80	0.00	0.94	182.00
Run No. 3	11:42	2:10	28.20	0.00	0.54	181.00	Run No. 4	11:45	2:10	03.80	0.00	0.94	182.00
Run No. 3	11:43	2:15	28.20	0.00	0.54	181.00	Run No. 4	11:46	2:15	03.80			

Run No. 3		Time Range: 21 min						Run No. 8						Time Range: 21 min					
Time	Time	PS2	PS1	PS0	PS3	PS4	PS5	Time	Time	PS2	PS1	PS0	PS3	PS4	PS5				
01 Mar 24	11:00	9.50	20.50	21.50	15.00	20.50	20.50	01 Mar 24	12:30	9.50	20.50	21.50	15.00	20.50	20.50				
01 Mar 24	11:05	9.50	20.50	21.50	15.00	20.50	20.50	01 Mar 24	12:35	9.50	20.50	21.50	15.00	20.50	20.50				
01 Mar 24	11:10	9.50	20.50	21.50	15.00	20.50	20.50	01 Mar 24	12:40	9.50	20.50	21.50	15.00	20.50	20.50				
01 Mar 24	11:15	9.50	20.50	21.50	15.00	20.50	20.50	01 Mar 24	12:45	9.50	20.50	21.50	15.00	20.50	20.50				
01 Mar 24	11:20	9.50	20.50	21.50	15.00	20.50	20.50	01 Mar 24	12:50	9.50	20.50	21.50	15.00	20.50	20.50				
01 Mar 24	11:25	9.50	20.50	21.50	15.00	20.50	20.50	01 Mar 24	12:55	9.50	20.50	21.50	15.00	20.50	20.50				
01 Mar 24	11:30	9.50	20.50	21.50	15.00	20.50	20.50	01 Mar 24	13:00	9.50	20.50	21.50	15.00	20.50	20.50				
01 Mar 24	11:35	9.50	20.50	21.50	15.00	20.50	20.50	01 Mar 24	13:05	9.50	20.50	21.50	15.00	20.50	20.50				
01 Mar 24	11:40	9.50	20.50	21.50	15.00	20.50	20.50	01 Mar 24	13:10	9.50	20.50	21.50	15.00	20.50	20.50				
01 Mar 24	11:45	9.50	20.50	21.50	15.00	20.50	20.50	01 Mar 24	13:15	9.50	20.50	21.50	15.00	20.50	20.50				
01 Mar 24	11:50	9.50	20.50	21.50	15.00	20.50	20.50	01 Mar 24	13:20	9.50	20.50	21.50	15.00	20.50	20.50				
01 Mar 24	11:55	9.50	20.50	21.50	15.00	20.50	20.50	01 Mar 24	13:25	9.50	20.50	21.50	15.00	20.50	20.50				
01 Mar 24	12:00	9.50	20.50	21.50	15.00	20.50	20.50	01 Mar 24	13:30	9.50	20.50	21.50	15.00	20.50	20.50				
01 Mar 24	12:05	9.50	20.50	21.50	15.00	20.50	20.50	01 Mar 24	13:35	9.50	20.50	21.50	15.00	20.50	20.50				
01 Mar 24	12:10	9.50	20.50	21.50	15.00	20.50	20.50	01 Mar 24	13:40	9.50	20.50	21.50	15.00	20.50	20.50				
01 Mar 24	12:15	9.50	20.50	21.50	15.00	20.50	20.50	01 Mar 24	13:45	9.50	20.50	21.50	15.00	20.50	20.50				
01 Mar 24	12:20	9.50	20.50	21.50	15.00	20.50	20.50	01 Mar 24	13:50	9.50	20.50	21.50	15.00	20.50	20.50				
01 Mar 24	12:25	9.50	20.50	21.50	15.00	20.50	20.50	01 Mar 24	13:55	9.50	20.50	21.50	15.00	20.50	20.50				
01 Mar 24	12:30	9.50	20.50	21.50	15.00	20.50	20.50	01 Mar 24	14:00	9.50	20.50	21.50	15.00	20.50	20.50				
01 Mar 24	12:35	9.50	20.50	21.50	15.00	20.50	20.50	01 Mar 24	14:05	9.50	20.50	21.50	15.00	20.50	20.50				
01 Mar 24	12:40	9.50	20.50	21.50	15.00	20.50	20.50	01 Mar 24	14:10	9.50	20.50	21.50	15.00	20.50	20.50				
01 Mar 24	12:45	9.50	2																



CEMs Data

Client Name	Gulf #FUT Co. Ltd.	Date	28 Mar 04
Blind Name	Gulf	Location	Offshore

Avg. Time		Time Stamp: 21:00					Avg. Time		Time Stamp: 21:00				
Case	Time	RRS	RRS	DB	DB	LR44	Case	Time	RRS	RRS	DB	DB	LR44
1st Nov 24	12:41	9:01	57:15	2:02	18.84	204.27	1st Nov 24	13:02	8:01	51:32	2:02	18.81	211.71
2nd Nov 24	12:42	9:01	57:20	2:02	18.86	211.33	2nd Nov 24	13:03	8:01	51:35	2:02	18.78	210.85
3rd Nov 24	12:43	9:01	57:25	2:02	18.88	211.33	3rd Nov 24	13:04	8:01	51:38	2:02	18.78	210.85
4th Nov 24	12:44	9:01	57:30	2:02	18.90	214.38	4th Nov 24	13:05	8:01	51:40	2:02	18.78	210.85
5th Nov 24	12:45	9:01	57:35	2:02	18.92	214.38	5th Nov 24	13:06	8:01	51:42	2:02	18.80	210.85
6th Nov 24	12:46	9:01	57:40	2:02	18.94	214.38	6th Nov 24	13:07	8:01	51:45	2:02	18.80	210.85
7th Nov 24	12:47	9:01	57:46	2:02	18.96	214.38	7th Nov 24	13:08	8:01	51:48	2:02	18.80	210.85
8th Nov 24	12:48	9:01	57:54	2:02	18.98	214.38	8th Nov 24	13:09	8:01	51:50	2:02	18.80	210.85
9th Nov 24	12:49	9:01	58:00	2:02	19.00	214.38	9th Nov 24	13:10	8:01	51:52	2:02	18.80	210.85
10th Nov 24	12:50	9:01	58:04	2:02	19.02	214.38	10th Nov 24	13:11	8:01	51:55	2:02	18.80	210.85
11th Nov 24	12:51	9:01	58:10	2:02	19.04	214.38	11th Nov 24	13:12	8:01	51:57	2:02	18.80	210.85
12th Nov 24	12:52	9:01	58:15	2:02	19.06	214.38	12th Nov 24	13:13	8:01	51:58	2:02	18.80	210.85
13th Nov 24	12:53	9:01	58:16	2:02	19.08	214.38	13th Nov 24	13:14	8:01	51:59	2:02	18.80	210.85
14th Nov 24	12:54	9:01	58:21	2:02	19.10	214.38	14th Nov 24	13:15	8:01	52:00	2:02	18.80	210.85
15th Nov 24	12:55	9:01	58:22	2:02	19.12	214.38	15th Nov 24	13:16	8:01	52:02	2:02	18.80	210.85
16th Nov 24	12:56	9:01	58:27	2:02	19.14	214.38	16th Nov 24	13:17	8:01	52:03	2:02	18.80	210.85
17th Nov 24	12:57	9:01	58:30	2:02	19.16	214.38	17th Nov 24	13:18	8:01	52:05	2:02	18.80	210.85
18th Nov 24	12:58	9:01	58:34	2:02	19.18	214.38	18th Nov 24	13:19	8:01	52:06	2:02	18.80	210.85
19th Nov 24	12:59	9:01	58:38	2:02	19.20	214.38	19th Nov 24	13:20	8:01	52:08	2:02	18.80	210.85
20th Nov 24	13:00	9:01	58:40	2:02	19.22	214.38	20th Nov 24	13:21	8:01	52:10	2:02	18.80	210.85
21st Nov 24	13:01	9:01	58:42	2:02	19.24	214.38	21st Nov 24	13:22	8:01	52:11	2:02	18.80	210.85
22nd Nov 24	13:02	9:01	58:44	2:02	19.26	214.38	22nd Nov 24	13:23	8:01	52:12	2:02	18.80	210.85
23rd Nov 24	13:03	9:01	58:46	2:02	19.28	214.38	23rd Nov 24	13:24	8:01	52:14	2:02	18.80	210.85
24th Nov 24	13:04	9:01	58:48	2:02	19.30	214.38	24th Nov 24	13:25	8:01	52:16	2:02	18.80	210.85

Run Step 9							Run Step 10						
Step	Time	Size	Nodes	DOF	DOF	Local	Step	Time	Size	Nodes	DOF	DOF	Local
						MB							MB
9999 Step 9	19:29	3393	2282	433	1341	254.78	9999 Step 10	19:40	3393	2176	433	1331	219.1
9998 Step 9	19:29	3333	2176	433	1341	254.78	9998 Step 10	19:40	3333	2176	433	1331	219.1
9997 Step 9	19:29	3273	2070	433	1341	254.78	9997 Step 10	19:40	3273	2070	433	1331	219.1
9996 Step 9	19:29	3213	1964	433	1341	254.78	9996 Step 10	19:40	3213	1964	433	1331	219.1
9995 Step 9	19:29	3153	1858	433	1341	254.78	9995 Step 10	19:40	3153	1858	433	1331	219.1
9994 Step 9	19:29	3093	1752	433	1341	254.78	9994 Step 10	19:40	3093	1752	433	1331	219.1
9993 Step 9	19:29	3033	1646	433	1341	254.78	9993 Step 10	19:40	3033	1646	433	1331	219.1
9992 Step 9	19:29	2973	1540	433	1341	254.78	9992 Step 10	19:40	2973	1540	433	1331	219.1
9991 Step 9	19:29	2913	1434	433	1341	254.78	9991 Step 10	19:40	2913	1434	433	1331	219.1
9990 Step 9	19:29	2853	1328	433	1341	254.78	9990 Step 10	19:40	2853	1328	433	1331	219.1
9989 Step 9	19:29	2793	1222	433	1341	254.78	9989 Step 10	19:40	2793	1222	433	1331	219.1
9988 Step 9	19:29	2733	1116	433	1341	254.78	9988 Step 10	19:40	2733	1116	433	1331	219.1
9987 Step 9	19:29	2673	1010	433	1341	254.78	9987 Step 10	19:40	2673	1010	433	1331	219.1
9986 Step 9	19:29	2613	904	433	1341	254.78	9986 Step 10	19:40	2613	904	433	1331	219.1
9985 Step 9	19:29	2553	798	433	1341	254.78	9985 Step 10	19:40	2553	798	433	1331	219.1
9984 Step 9	19:29	2493	692	433	1341	254.78	9984 Step 10	19:40	2493	692	433	1331	219.1
9983 Step 9	19:29	2433	586	433	1341	254.78	9983 Step 10	19:40	2433	586	433	1331	219.1
9982 Step 9	19:29	2373	480	433	1341	254.78	9982 Step 10	19:40	2373	480	433	1331	219.1
9981 Step 9	19:29	2313	374	433	1341	254.78	9981 Step 10	19:40	2313	374	433	1331	219.1
9980 Step 9	19:29	2253	268	433	1341	254.78	9980 Step 10	19:40	2253	268	433	1331	219.1
9979 Step 9	19:29	2193	162	433	1341	254.78	9979 Step 10	19:40	2193	162	433	1331	219.1
9978 Step 9	19:29	2133	56	433	1341	254.78	9978 Step 10	19:40	2133	56	433	1331	219.1
9977 Step 9	19:29	2073	0	433	1341	254.78	9977 Step 10	19:40	2073	0	433	1331	219.1
9976 Step 9	19:29	2013	0	433	1341	254.78	9976 Step 10	19:40	2013	0	433	1331	219.1
9975 Step 9	19:29	1953	0	433	1341	254.78	9975 Step 10	19:40	1953	0	4		

Run Map 11										Run Map 12										
Time Base 11 min										Time Base 12 min										
Run	Time	SEC	SEC	SEC	SEC	SEC	SEC	SEC	SEC	Run	Time	SEC	SEC	SEC	SEC	SEC	SEC	SEC	SEC	
11	2	3	4	5	6	7	8	9	10	11	2	3	4	5	6	7	8	9	10	
11	10:00	0:00	0:00	0:00	0:00	0:00	0:00	0:00	0:00	11	10:00	0:00	0:00	0:00	0:00	0:00	0:00	0:00	0:00	0:00
11	10:01	0:01	0:01	0:01	0:01	0:01	0:01	0:01	0:01	11	10:01	0:01	0:01	0:01	0:01	0:01	0:01	0:01	0:01	0:01
11	10:02	0:02	0:02	0:02	0:02	0:02	0:02	0:02	0:02	11	10:02	0:02	0:02	0:02	0:02	0:02	0:02	0:02	0:02	0:02
11	10:03	0:03	0:03	0:03	0:03	0:03	0:03	0:03	0:03	11	10:03	0:03	0:03	0:03	0:03	0:03	0:03	0:03	0:03	0:03
11	10:04	0:04	0:04	0:04	0:04	0:04	0:04	0:04	0:04	11	10:04	0:04	0:04	0:04	0:04	0:04	0:04	0:04	0:04	0:04
11	10:05	0:05	0:05	0:05	0:05	0:05	0:05	0:05	0:05	11	10:05	0:05	0:05	0:05	0:05	0:05	0:05	0:05	0:05	0:05
11	10:06	0:06	0:06	0:06	0:06	0:06	0:06	0:06	0:06	11	10:06	0:06	0:06	0:06	0:06	0:06	0:06	0:06	0:06	0:06
11	10:07	0:07	0:07	0:07	0:07	0:07	0:07	0:07	0:07	11	10:07	0:07	0:07	0:07	0:07	0:07	0:07	0:07	0:07	0:07
11	10:08	0:08	0:08	0:08	0:08	0:08	0:08	0:08	0:08	11	10:08	0:08	0:08	0:08	0:08	0:08	0:08	0:08	0:08	0:08
11	10:09	0:09	0:09	0:09	0:09	0:09	0:09	0:09	0:09	11	10:09	0:09	0:09	0:09	0:09	0:09	0:09	0:09	0:09	0:09
11	10:10	0:10	0:10	0:10	0:10	0:10	0:10	0:10	0:10	11	10:10	0:10	0:10	0:10	0:10	0:10	0:10	0:10	0:10	0:10
11	10:11	0:11	0:11	0:11	0:11	0:11	0:11	0:11	0:11	11	10:11	0:11	0:11	0:11	0:11	0:11	0:11	0:11	0:11	0:11
11	10:12	0:12	0:12	0:12	0:12	0:12	0:12	0:12	0:12	11	10:12	0:12	0:12	0:12	0:12	0:12	0:12	0:12	0:12	0:12
11	10:13	0:13	0:13	0:13	0:13	0:13	0:13	0:13	0:13	11	10:13	0:13	0:13	0:13	0:13	0:13	0:13	0:13	0:13	0:13
11	10:14	0:14	0:14	0:14	0:14	0:14	0:14	0:14	0:14	11	10:14	0:14	0:14	0:14	0:14	0:14	0:14	0:14	0:14	0:14
11	10:15	0:15	0:15	0:15	0:15	0:15	0:15	0:15	0:15	11	10:15	0:15	0:15	0:15	0:15	0:15	0:15	0:15	0:15	0:15
11	10:16	0:16	0:16	0:16	0:16	0:16	0:16	0:16	0:16	11	10:16	0:16	0:16	0:16	0:16	0:16	0:16	0:16	0:16	0:16
11	10:17	0:17	0:17	0:17																

Reference Method Data

Plant Name	Comp ID	LT	LM	Date	DE Mar 12								
Plant Name	Comp ID	LT	LM	Date	DE Mar 12								
Time Base: 31 min			Run Date										
Time	Flow	RO2	NO	CO	CO2	Time	Flow	RO2	NO	CO	CO2		
15:38	5.18	11.97	0.87	0.23	0.36	4:17	15:38	10.62	8.74	19.28	0.28	15.76	4.26
15:39	5.28	11.97	0.87	0.23	0.36	4:17	15:39	10.62	8.74	19.28	0.28	15.76	4.26
15:40	5.38	11.97	0.87	0.23	0.36	4:17	15:40	10.62	8.74	19.28	0.28	15.76	4.26
15:41	5.48	11.97	0.87	0.23	0.36	4:17	15:41	10.62	8.74	19.28	0.28	15.76	4.26
15:42	5.58	11.97	0.87	0.23	0.36	4:17	15:42	10.62	8.74	19.28	0.28	15.76	4.26
15:43	5.68	11.97	0.87	0.23	0.36	4:17	15:43	10.62	8.74	19.28	0.28	15.76	4.26
15:44	5.78	11.97	0.87	0.23	0.36	4:17	15:44	10.62	8.74	19.28	0.28	15.76	4.26
15:45	5.88	11.97	0.87	0.23	0.36	4:17	15:45	10.62	8.74	19.28	0.28	15.76	4.26
15:46	5.98	11.97	0.87	0.23	0.36	4:17	15:46	10.62	8.74	19.28	0.28	15.76	4.26
15:47	6.08	11.97	0.87	0.23	0.36	4:17	15:47	10.62	8.74	19.28	0.28	15.76	4.26
15:48	6.18	11.97	0.87	0.23	0.36	4:17	15:48	10.62	8.74	19.28	0.28	15.76	4.26
15:49	6.28	11.97	0.87	0.23	0.36	4:17	15:49	10.62	8.74	19.28	0.28	15.76	4.26
15:50	6.38	11.97	0.87	0.23	0.36	4:17	15:50	10.62	8.74	19.28	0.28	15.76	4.26
15:51	6.48	11.97	0.87	0.23	0.36	4:17	15:51	10.62	8.74	19.28	0.28	15.76	4.26
15:52	6.58	11.97	0.87	0.23	0.36	4:17	15:52	10.62	8.74	19.28	0.28	15.76	4.26
15:53	6.68	11.97	0.87	0.23	0.36	4:17	15:53	10.62	8.74	19.28	0.28	15.76	4.26
15:54	6.78	11.97	0.87	0.23	0.36	4:17	15:54	10.62	8.74	19.28	0.28	15.76	4.26
15:55	6.88	11.97	0.87	0.23	0.36	4:17	15:55	10.62	8.74	19.28	0.28	15.76	4.26
15:56	6.98	11.97	0.87	0.23	0.36	4:17	15:56	10.62	8.74	19.28	0.28	15.76	4.26
15:57	7.08	11.97	0.87	0.23	0.36	4:17	15:57	10.62	8.74	19.28	0.28	15.76	4.26
15:58	7.18	11.97	0.87	0.23	0.36	4:17	15:58	10.62	8.74	19.28	0.28	15.76	4.26
15:59	7.28	11.97	0.87	0.23	0.36	4:17	15:59	10.62	8.74	19.28	0.28	15.76	4.26
16:00	7.38	11.97	0.87	0.23	0.36	4:17	16:00	10.62	8.74	19.28	0.28	15.76	4.26
16:01	7.48	11.97	0.87	0.23	0.36	4:17	16:01	10.62	8.74	19.28	0.28	15.76	4.26
16:02	7.58	11.97	0.87	0.23	0.36	4:17	16:02	10.62	8.74	19.28	0.28	15.76	4.26
16:03	7.68	11.97	0.87	0.23	0.36	4:17	16:03	10.62	8.74	19.28	0.28	15.76	4.26
16:04	7.78	11.97	0.87	0.23	0.36	4:17	16:04	10.62	8.74	19.28	0.28	15.76	4.26
16:05	7.88	11.97	0.87	0.23	0.36	4:17	16:05	10.62	8.74	19.28	0.28	15.76	4.26
1							1						

[illegible]

Run Set 1										Run Set 2									
Run		Run 1	Run 2	Run 3	Run 4	Run 5	Run 6	Run 7	Run 8	Run		Run 1	Run 2	Run 3	Run 4	Run 5	Run 6	Run 7	Run 8
Time		Time Base 21 min								Time		Time Base 21 min							
Day	Time	Run 1	Run 2	Run 3	Run 4	Run 5	Run 6	Run 7	Run 8	Day	Time	Run 1	Run 2	Run 3	Run 4	Run 5	Run 6	Run 7	Run 8
Mon	11:00	0:11	0:11	0:11	0:11	0:11	0:11	0:11	0:11	Mon	12:00	0:11	0:11	0:11	0:11	0:11	0:11	0:11	0:11
Tue	11:00	0:11	0:11	0:11	0:11	0:11	0:11	0:11	0:11	Tue	12:00	0:11	0:11	0:11	0:11	0:11	0:11	0:11	0:11
Wed	11:00	0:11	0:11	0:11	0:11	0:11	0:11	0:11	0:11	Wed	12:00	0:11	0:11	0:11	0:11	0:11	0:11	0:11	0:11
Thu	11:00	0:11	0:11	0:11	0:11	0:11	0:11	0:11	0:11	Thu	12:00	0:11	0:11	0:11	0:11	0:11	0:11	0:11	0:11
Fri	11:00	0:11	0:11	0:11	0:11	0:11	0:11	0:11	0:11	Fri	12:00	0:11	0:11	0:11	0:11	0:11	0:11	0:11	0:11
Sat	11:00	0:11	0:11	0:11	0:11	0:11	0:11	0:11	0:11	Sat	12:00	0:11	0:11	0:11	0:11	0:11	0:11	0:11	0:11
Sun	11:00	0:11	0:11	0:11	0:11	0:11	0:11	0:11	0:11	Sun	12:00	0:11	0:11	0:11	0:11	0:11	0:11	0:11	0:11
Mon	12:00	0:11	0:11	0:11	0:11	0:11	0:11	0:11	0:11	Mon	13:00	0:11	0:11	0:11	0:11	0:11	0:11	0:11	0:11
Tue	12:00	0:11	0:11	0:11	0:11	0:11	0:11	0:11	0:11	Tue	13:00	0:11	0:11	0:11	0:11	0:11	0:11	0:11	0:11
Wed	12:00	0:11	0:11	0:11	0:11	0:11	0:11	0:11	0:11	Wed	13:00	0:11	0:11	0:11	0:11	0:11	0:11	0:11	0:11
Thu	12:00	0:11	0:11	0:11	0:11	0:11	0:11	0:11	0:11	Thu	13:00	0:11	0:11	0:11	0:11	0:11	0:11	0:11	0:11
Fri	12:00	0:11	0:11	0:11	0:11	0:11	0:11	0:11	0:11	Fri	13:00	0:11	0:11	0:11	0:11	0:11	0:11	0:11	0:11
Sat	12:00	0:11	0:11	0:11	0:11	0:11	0:11	0:11	0:11	Sat	13:00	0:11	0:11	0:11	0:11	0:11	0:11	0:11	0:11
Sun	12:00	0:11	0:11	0:11	0:11	0:11	0:11	0:11	0:11	Sun	13:00	0:11	0:11	0:11	0:11	0:11	0:11	0:11	0:11
Mon	13:00	0:11	0:11	0:11	0:11	0:11	0:11	0:11	0:11	Mon	14:00	0:11	0:11	0:11	0:11	0:11	0:11	0:11	0:11
Tue	13:00	0:11	0:11	0:11	0:11	0:11	0:11	0:11	0:11	Tue	14:00	0:11	0:11	0:11	0:11	0:11	0:11	0:11	0:11
Wed	13:00	0:11	0:11	0:11	0:11	0:11	0:11	0:11	0:11	Wed	14:00	0:11	0:11	0:11	0:11	0:11	0:11	0:11	0:11
Thu	13:00	0:11	0:11	0:11	0:11	0:11	0:11	0:11	0:11	Thu	14:00	0:11	0:11	0:11	0:11	0:11	0:11	0:11	0:11
Fri	13:00	0:11	0:11	0:11	0:11	0:11	0:11	0:11	0:11	Fri	14:00	0:11	0:11	0:11	0:11	0:11	0:11	0:11	0:11
Sat	13:00	0:11	0:11	0:11	0:11	0:11	0:11	0:11	0:11	Sat	14:00	0:11	0:11	0:11	0:11	0:11	0:11	0:11	0:11
Sun	13:00	0:11	0:11	0:11	0:11	0:11	0:11	0:11	0:11	Sun	14:00	0:11	0:11	0:11	0:11	0:11	0:11	0:11	0:11
Mon	14:00	0:11	0:11	0:11	0:11	0:11	0:11	0:11	0:11	Mon	15:00	0:11	0:11	0:11	0:11	0:11	0:11	0:11	0:11
Tue	14:00	0:11	0:11	0:11	0:11	0:11	0:11	0:11	0:11	Tue	15:00	0:11	0:11	0:11	0:11	0:11	0:11	0:11	0:11
Wed	14:00	0:11	0:11	0:11	0:11	0:11	0:11	0:11	0:11	Wed	15:00	0:11	0:11	0:11	0:11	0:11	0:11	0:11	0:11
Thu	14:00	0:11	0:11	0:11	0:11	0:11	0:11	0:11	0:11	Thu	15:00	0:11	0:11	0:11	0:11	0:11	0:11	0:11	0:11
Fri	14:00	0:11	0:11	0:11	0:11	0:11	0:11	0:11	0:11	Fri	15:00	0:11	0:11	0:11	0:11	0:11	0:11	0:11	0:11
Sat	14:00	0:11	0:11	0:11	0:11	0:11	0:11	0:11	0:11	Sat	15:00	0:11	0:11	0:11	0:11	0:11	0:11	0:11	0:11
Sun	14:00	0:11	0:11	0:11	0:11	0:11	0:11	0:11	0:11	Sun	15:00	0:11	0:11	0:11	0:11	0:11	0:11	0:11	0:11
Mon	15:00	0:11	0:11	0:11	0:11	0:11	0:11	0:11	0:11	Mon	16:00	0:11	0:11	0:11	0:11	0:11	0:11	0:11	0:11
Tue	15:00	0:11	0:11	0:11	0:11	0:11	0:11	0:11	0:11	Tue	16:00	0:11	0:11	0:11	0:11	0:11	0:11	0:11	0:11
Wed	15:00	0:11	0:11	0:11	0:11	0:11	0:11	0:11	0:11	Wed	16:00	0:11	0:11	0:11	0:11	0:11	0:11	0:11	0:11
Thu	15:00	0:11	0:11	0:11	0:11	0:11	0:11	0:11	0:11	Thu	16:00	0:11	0:11	0:11	0:11	0:11	0:11	0:11	0:11
Fri	15:00	0:11	0:11	0:11	0:11	0:11	0:11	0:11	0:11	Fri	16:00	0:11	0:11	0:11	0:11	0:11	0:11	0:11	0:11
Sat	15:00	0:11	0:11	0:11	0:11	0:11	0:11	0:11	0:11	Sat	16:00	0:11	0:11	0:11	0:11	0:11	0:11	0:11	0:11
Sun	15:00	0:11	0:11	0:11	0:11	0:11	0:11	0:11	0:11	Sun	16:00	0:11	0:11	0:11	0:11	0:11	0:11	0:11	0:11
Mon	16:00	0:11	0:11	0:11	0:11	0:11	0:11	0:11	0:11	Mon	17:00	0:11	0:11	0:11	0:11	0:11	0:11	0:11	0:11
Tue	16:00	0:11	0:11	0:11	0:11	0:11	0:11	0:11	0:11	Tue	17:00	0:11	0:11	0:11	0:11	0:11	0:11	0:11	0:11
Wed	16:00	0:11	0:11	0:11	0:11	0:11	0:11	0:11	0:11	Wed	17:00	0:11	0:11	0:11	0:11	0:11	0:11	0:11	0:11
Thu	16:00	0:11	0:11	0:11	0:11	0:11	0:11	0:11	0:11	Thu	17:00	0:11	0:11	0:11	0:11	0:11	0:11	0:11	0:11
Fri	16:00	0:11	0:11	0:11	0:11	0:11	0:11	0:11	0:11	Fri	17:00	0:11	0:11	0:11	0:11	0:11	0:11	0:11	0:11
Sat	16:00	0:11	0:11	0:11	0:11	0:11	0:11	0:11	0:11	Sat	17:00	0:11	0:11	0:11	0:11	0:11	0:11	0:11	0:11
Sun	16:00	0:11	0:11	0:11	0:11	0:11	0:11	0:11	0:11	Sun	17:00	0:11	0:11	0:11	0:11	0:11	0:11	0:11	0:11
Mon	17:00	0:11	0:11	0:11	0:11	0:11	0:11	0:11	0:11	Mon	18:00	0:11	0:11	0:11	0:11	0:11	0:11	0:11	0:11
Tue	17:00	0:11	0:11	0:11	0:11	0:11	0:11	0:11	0:11	Tue	18:00	0:11	0:11	0:11	0:11	0:11	0:11	0:11	0:11
Wed	17:00	0:11	0:11	0:11	0:11	0:11	0:11	0:11	0:11	Wed	18:00	0:11	0:11	0:11	0:11	0:11	0:11	0:11	0:11
Thu	17:00	0:11	0:11	0:11	0:11	0:11	0:11	0:11	0:11	Thu	18:00	0:11	0:11	0:11	0:11	0:11	0:11	0:11	0:11
Fri	17:00	0:11	0:11	0:11	0:11	0:11	0:11	0:11	0:11	Fri	18:00	0:11	0:11	0:11	0:11	0:11	0:11	0:11	0:11
Sat	17:00	0:11	0:11	0:11	0:11	0:11	0:11	0:11	0:11	Sat	18:00	0:11	0:11	0:11	0:11	0:11	0:11	0:11	0:11
Sun	17:00	0:11	0:11	0:11	0:11	0:11	0:11	0:11	0:11	Sun	18:00	0:11	0:11	0:11	0:11	0:11	0:11	0:11	0:11
Mon	18:00	0:11	0:11	0:11	0:11	0:11	0:11	0:11	0:11	Mon	19:00	0:11	0:11	0:11	0:11	0:11	0:11	0:11	0:11
Tue	18:00	0:11	0:11	0:11	0:11	0:11	0:11	0:11	0:11	Tue	19:00	0:11	0:11	0:11	0:11	0:11	0:11	0:11	0:11
Wed	18:00	0:11	0:11	0:11	0:11	0:11	0:11	0:11	0:11	Wed	19:00	0:11	0:11	0:11	0:11	0:11	0:11	0:11	0:11
Thu	18:00	0:11	0:11	0:11	0:11	0:11	0:11	0:11	0:11	Thu	19:00	0:11	0:11	0:11	0:11	0:11	0:11	0:11	0:11
Fri	18:00	0:11	0:11	0:11	0:11	0:11	0:11	0:11	0:11	Fri	19:00	0:11	0:11	0:11	0:11	0:11	0:11	0:11	0:11
Sat	18:00	0:11	0:11	0:11	0:11	0:11	0:11	0:11	0:11	Sat	19:00	0:11	0:11	0:11	0:11	0:11	0:11	0:11	0:11
Sun	18:00	0:11	0:11	0:11	0:11	0:11	0:11	0:11	0:11	Sun	19:00	0:11	0:11	0:11	0:11	0:11	0:11	0:11	0:11
Mon	19:00	0:11	0:11	0:11	0:11	0:11	0:11	0:11	0:11	Mon	20:00	0:11	0:11	0:11	0:11	0:11	0:11	0:11	0:11
Tue	19:00	0:11	0:11	0:11	0:11	0:11	0:11	0:11	0:11	Tue	20:00	0:11	0:11	0:11	0:11	0:11	0:11	0:11	0:11
Wed	19:00	0:11	0:11	0:11	0:11	0:11	0:11	0:11	0:11	Wed	20:00	0:11	0:11	0:11	0:11	0:11	0:11	0:11	0:11
Thu	19:00	0:11	0:11	0:11	0:11	0:11	0:11	0:11	0:11	Thu	20:00	0:11	0:11	0:11	0:11	0:11	0:11	0:11	0:11
Fri	19:00	0:11	0:11	0:11	0:11	0:11	0:11	0:11	0:11	Fri	20:00	0:11	0:11	0:11	0:11	0:11	0:11	0:11	0:11
Sat	19:00	0:11	0:11	0:11	0:11	0:11	0:11	0:11	0:11	Sat	20:00	0:11	0:11	0:11	0:11	0:11	0:11	0:11	0:11
Sun	19:00	0:11	0:11	0:11	0:11	0:11	0:11	0:11	0:11	Sun	20:00	0:11	0:11	0:11	0:11	0:11	0:11	0:11	0:11
Mon	20:00	0:11	0:11	0:11	0:11	0:11	0:11	0:11	0:11	Mon	21:00	0:11	0:11	0:11	0:11	0:11	0:11	0:11	0:11
Tue	20:00	0:11	0:11	0:11	0:11	0:11	0:11	0:11	0:11	Tue	21:00	0:11	0:11	0:11	0:11	0:11	0:11	0:11	0:11
Wed	20:00	0:11	0:11	0:11	0:11	0:11	0:11	0:11	0:11	Wed	21:00	0:11	0:11	0:11	0:11	0:11	0:11	0:11	0:11
Thu	20:00	0:11	0:11	0:11	0:11	0:11	0:11	0:11	0:11	Thu	21:00	0:11							

Reference Method Data

[illegible]

Run No. 8		Time Base 21 min						Run No. 15							
Day	Time	RTZ	WDR	SDR	QD	QD		Day	Time	RTZ	WDR	SDR	QD	QD	
			WDR	SDR	QD	QD					WDR	SDR	QD	QD	
Wk 14	12:31	0.55	0.83	0.84	0.90	0.89		Wk 14	12:39	0.59	0.89	0.86	0.91	0.91	0.91
Wk 14	12:32	0.56	0.83	0.84	0.90	0.89		Wk 14	12:41	0.60	0.90	0.87	0.92	0.92	0.92
Wk 14	12:33	0.57	0.84	0.85	0.91	0.90		Wk 14	12:42	0.61	0.91	0.88	0.93	0.93	0.93
Wk 14	12:34	0.58	0.84	0.85	0.91	0.90		Wk 14	12:43	0.62	0.92	0.89	0.94	0.94	0.94
Wk 14	12:35	0.59	0.85	0.86	0.92	0.91		Wk 14	12:44	0.63	0.93	0.90	0.95	0.95	0.95
Wk 14	12:36	0.60	0.86	0.87	0.93	0.92		Wk 14	12:45	0.64	0.94	0.91	0.96	0.96	0.96
Wk 14	12:37	0.61	0.87	0.88	0.94	0.93		Wk 14	12:46	0.65	0.95	0.92	0.97	0.97	0.97
Wk 14	12:38	0.62	0.88	0.89	0.95	0.94		Wk 14	12:47	0.66	0.96	0.93	0.98	0.98	0.98
Wk 14	12:39	0.63	0.89	0.90	0.96	0.95		Wk 14	12:48	0.67	0.97	0.94	0.99	0.99	0.99
Wk 14	12:40	0.64	0.90	0.91	0.97	0.96		Wk 14	12:49	0.68	0.98	0.95	1.00	1.00	1.00
Wk 14	12:41	0.65	0.91	0.92	0.98	0.97		Wk 14	12:50	0.69	0.99	0.96	1.01	1.01	1.01
Wk 14	12:42	0.66	0.92	0.93	0.99	0.98		Wk 14	12:51	0.70	1.00	0.97	1.02	1.02	1.02
Wk 14	12:43	0.67	0.93	0.94	1.00	0.99		Wk 14	12:52	0.71	1.01	0.98	1.03	1.03	1.03
Wk 14	12:44	0.68	0.94	0.95	1.01	1.00		Wk 14	12:53	0.72	1.02	0.99	1.04	1.04	1.04
Wk 14	12:45	0.69	0.95	0.96	1.02	1.01		Wk 14	12:54	0.73	1.03	1.00	1.05	1.05	1.05
Wk 14	12:46	0.70	0.96	0.97	1.03	1.02		Wk 14	12:55	0.74	1.04	1.01	1.06	1.06	1.06
Wk 14	12:47	0.71	0.97	0.98	1.04	1.03		Wk 14	12:56	0.75	1.05	1.02	1.07	1.07	1.07
Wk 14	12:48	0.72	0.98	0.99	1.05	1.04		Wk 14	12:57	0.76	1.06	1.03	1.08	1.08	1.08
Wk 14	12:49	0.73	0.99	1.00	1.06	1.05		Wk 14	12:58	0.77	1.07	1.04	1.09	1.09	1.09
Wk 14	12:50	0.74	1.00	1.01	1.07	1.06		Wk 14	12:59	0.78	1.08	1.05	1.10	1.10	1.10
Wk 14	12:51	0.75	1.01	1.02	1.08	1.07		Wk 14	13:00	0.79	1.09	1.06	1.11	1.11	1.11
Wk 14	12:52	0.76	1.02	1.03	1.09	1.08		Wk 14	13:01	0.80	1.10	1.07	1.12	1.12	1.12
Wk 14	12:53	0.77	1.03	1.04	1.10	1.09		Wk 14	13:02	0.81	1.11	1.08	1.13	1.13	1.13
Wk 14	12:54	0.78	1.04	1.05	1.11	1.10		Wk 14	13:03	0.82	1.12	1.09	1.14	1.14	1.14
Wk 14	12:55	0.79	1.05	1.06	1.12	1.11		Wk 14	13:04	0.83	1.13	1.10	1.1		

[illegible]

Lot No. 2412548-1

ANALYZER CALIBRATION DATA

Client	Gulf JP UT Co., Ltd.	Location	HRSG 21
Date	19 Feb 24	Test Operator	Amroet M.
O ₂ ANALYZER			
Model	TELEDYNE API T200H	Serial No.	922
Span (%)	25		

	Cylinder Value (%)	Initial Analyzers Calibration Response (%)	Final Analyzers Calibration Response (%)	Difference (Percent of Span)
Zero Gas	0.00	0.11	0.14	0.12
Low-Level Gas	7.98	7.88	7.75	0.40
Span Gas	16.04	15.78	15.89	0.44

NO_x ANALYZER
Model : TELEDYNE API T200H Serial No. : 822
Span (ppm) : 100

	Cylinder Value (ppm)	Initial Analyzers Calibration Responses (ppm)	Final Analyzers Calibration Responses (ppm)	Difference (Percent of Span)
Zero Gas	0.00	0.11	0.12	0.01
Low-Level Gas	55.88	56.77	56.34	0.43
Span Gas	80.49	81.23	81.11	0.12

802 ANALYZER
Model : TELEDYNE API T100H Serial No. : 534
Span (ppm) : 100

	Cylinder Value (ppm)	Initial Analyzers Calibration Response (ppm)	Final Analyzers Calibration Response (ppm)	Difference (Percent of Span)
Zero Gas	0.00	0.00	0.00	0.00
Low-Level Gas	58.30	55.89	56.00	0.11
Span Gas	79.51	78.88	79.00	0.12

CO ANALYZER
Model : TELEDYNE API T300M Serial No. : 844
Span (ppm) : 100

	Cylinder Value (ppm)	Initial Analyzers Calibration Response (ppm)	Final Analyzers Calibration Response (ppm)	Difference (Percent of Span)
Zero Gas	0.00	0.00	0.00	0.00
Low-Level Gas	58.22	55.10	55.00	0.10
Span Gas	79.95	80.22	80.18	0.04

Calibrated by

Anuvrat 17

(Mr. Anuval Mounpaal)
Environmental Field Scientist (2)

FORM NO. FDL-104 REVISION NO. ISSUE DATE 3/06/16

4.5 Laboratory Design

Lot No. 2410548.

SYSTEM CALIBRATION BIAS AND DRIFT DATA

Client	:	Gulf JP UT Co., Ltd.	Location	:	HRSG 21
Date	:	19 Feb 24	Test Operator	:	Anwar M.

O₂ ANALYZER
Cylinder Conc. (%) : 18.04 Span (%) : 25

	O ₂ Analyzer Calibration Response	Initial Values		Final Values		Drift (% of Span)
		System Calibration Response	System Cell Bias (% of Span)	System Calibration Response	System Cell Bias (% of Span)	
Zero Gas:	0.11	0.11	0.00	0.13	0.08	0.08
Urethane/Gas:	15.78	15.99	0.84	15.88	0.40	0.44

NO_x ANALYZER
Cylinder Conc. (ppm) : 80.48 Span (ppm) : 100

	NO _x Analyzer Calibration Response	Initial Values		Final Values		Drift (% of Span)
		System Calibration Response	System Cell Bias (% of Span)	System Calibration Response	System Cell Bias (% of Span)	
Zero Gas	0.11	0.00	0.11	0.00	0.11	0.00
Uppercase Gas	81.23	81.00	0.23	81.08	0.15	0.08

SO₂ ANALYZER
Cylinder Conc. (ppm) : 79.51 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	0.00		0.00	0.00	0.00	
Urethane Gas	79.89	0.00	0.12	79.11	0.23	0.11

CO ANALYZER
Cylinder Conc. (ppm) : 78.85 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	0.00	0.00	0.00	0.00	0.00	
Ultimate Gas	80.22	79.63	0.34	79.65	0.57	
					0.23	

Calibrated by

Arnat M
(Mr Arnat Moumouny)

Environmental Field Scientist (2)

FORM NO. F-05-104 REVISION NO. - ISSUE DATE 3/04/11

All Laboratory Group



Lot No. 2418548-1

ANALYZER CALIBRATION DATA

Client : Gulf JP UT Co., Ltd. Location : HRSG 22
Date : 18 Feb 24 Test Operator : Anwar M.
O₂ ANALYZER
Model : TELEDYNE API 2100H Serial No. : 823
Span (%) : 25

Cylinder Value (%)	Initial Analyzers Calibration Response (%)	Final Analyzers Calibration Response (%)	Difference (Percent of Span)
Zero Gas	0.00	0.00	0.44
Low-Level Gas	7.98	8.08	0.12
Span Gas	16.04	16.04	0.32

NO_x ANALYZER
Model : TELEDYNE API 2100H Serial No. : 823
Span (ppm) : 100

Cylinder Value (ppm)	Initial Analyzers Calibration Response (ppm)	Final Analyzers Calibration Response (ppm)	Difference (Percent of Span)
Zero Gas	0.00	0.00	0.08
Low-Level Gas	55.86	55.67	0.11
Span Gas	80.49	80.79	0.09

SO₂ ANALYZER
Model : TELEDYNE API 2100H Serial No. : 836
Span (ppm) : 100

Cylinder Value (ppm)	Initial Analyzers Calibration Response (ppm)	Final Analyzers Calibration Response (ppm)	Difference (Percent of Span)
Zero Gas	0.00	0.00	0.09
Low-Level Gas	56.30	56.00	0.11
Span Gas	79.51	79.00	0.24

CO ANALYZER
Model : TELEDYNE API 2100H Serial No. : 845
Span (ppm) : 100

Cylinder Value (ppm)	Initial Analyzers Calibration Response (ppm)	Final Analyzers Calibration Response (ppm)	Difference (Percent of Span)
Zero Gas	0.00	0.00	0.11
Low-Level Gas	55.22	54.99	0.10
Span Gas	79.95	80.00	0.02

Calibrated by

Anwar M

(Mr. Anwar Moungeer)
Environmental Field Scientist (2)

FORM NO. F-06-104 REVISION NO. : ISSUE DATE 30/01/18

ALS Laboratory Group



Lot No. 2418549-1

SYSTEM CALIBRATION BIAS AND DRIFT DATA

Client : Gulf JP UT Co., Ltd. Location : HRSG 22
Date : 18 Feb 24 Test Operator : Anwar M.

O₂ ANALYZER
Cylinder Conc. (%) : 16.04 Span (%) : 25

	O ₂ Analyzer Calibration Response	System Calibration Response	System Cal Bias (% of Span)	System Calibration Response	System Cal Bias (% of Span)	Drift (% of Span)
Zero Gas	0.00	0.00	0.00	0.00	0.00	0.00
Upscale Gas	16.04	15.99	0.30	16.00	0.16	0.04

NO_x ANALYZER
Cylinder Conc. (ppm) : 80.49 Span (ppm) : 100

	NO _x Analyzer Calibration Response	System Calibration Response	System Cal Bias (% of Span)	System Calibration Response	System Cal Bias (% of Span)	Drift (% of Span)
Zero Gas	0.00	0.00	0.00	0.00	0.00	0.00
Upscale Gas	80.79	80.97	0.18	80.88	0.09	0.09

SO₂ ANALYZER
Cylinder Conc. (ppm) : 79.51 Span (ppm) : 100

	SO ₂ Analyzer Calibration Response	System Calibration Response	System Cal Bias (% of Span)	System Calibration Response	System Cal Bias (% of Span)	Drift (% of Span)
Zero Gas	0.00	0.04	0.04	0.04	0.04	0.00
Upscale Gas	79.00	78.87	0.13	79.00	0.00	0.13

CO ANALYZER
Cylinder Conc. (ppm) : 79.95 Span (ppm) : 100

	CO Analyzer Calibration Response	System Calibration Response	System Cal Bias (% of Span)	System Calibration Response	System Cal Bias (% of Span)	Drift (% of Span)
Zero Gas	0.00	0.00	0.11	0.11	0.11	0.11
Upscale Gas	80.00	80.12	0.12	80.18	0.18	0.08

Calibrated by

Anwar M

(Mr. Anwar Moungeer)

Environmental Field Scientist (2)

FORM NO. F-06-104 REVISION NO. : ISSUE DATE 30/01/18

ALS Laboratory Group



CEMs Data

Client Name : Gulf JP UT Co., Ltd.

Plant Name : GUT

Date : 18 Feb 24

Location : HRSG 22

Run No. 1	Time Base: 21 min						Run No. 2	Time Base: 21 min					
Time	SO ₂	NO _x	CO	PM ₁₀	PM _{2.5}	PM ₁₀	Time	SO ₂	NO _x	CO	PM ₁₀	PM _{2.5}	PM ₁₀
18 Feb 24 10:03	0.00	0.00	0.00	0.00	0.00	0.00	18 Feb 24 10:41	0.00	0.00	0.00	0.00	0.00	0.00
18 Feb 24 10:21	0.00	0.00	0.00	0.00	0.00	0.00	18 Feb 24 10:59	0.00	0.00	0.00	0.00	0.00	0.00
18 Feb 24 10:39	0.00	0.00	0.00	0.00	0.00	0.00	18 Feb 24 11:17	0.00	0.00	0.00	0.00	0.00	0.00
18 Feb 24 10:57	0.00	0.00	0.00	0.00	0.00	0.00	18 Feb 24 11:35	0.00	0.00	0.00	0.00	0.00	0.00
18 Feb 24 11:15	0.00	0.00	0.00	0.00	0.00	0.00	18 Feb 24 11:53	0.00	0.00	0.00	0.00	0.00	0.00
18 Feb 24 11:33	0.00	0.00	0.00	0.00	0.00	0.00	18 Feb 24 12:11	0.00	0.00	0.00	0.00	0.00	0.00
18 Feb 24 11:51	0.00	0.00	0.00	0.00	0.00	0.00	18 Feb 24 12:29	0.00	0.00	0.00	0.00	0.00	0.00
18 Feb 24 12:09	0.00	0.00	0.00	0.00	0.00	0.00	18 Feb 24 12:47	0.00	0.00	0.00	0.00	0.00	0.00
18 Feb 24 12:27	0.00	0.00	0.00	0.00	0.00	0.00	18 Feb 24 13:05	0.00	0.00	0.00	0.00	0.00	0.00
18 Feb 24 12:45	0.00	0.00	0.00	0.00	0.00	0.00	18 Feb 24 13:23	0.00	0.00	0.00	0.00	0.00	0.00
18 Feb 24 13:03	0.00	0.00	0.00	0.00	0.00	0.00	18 Feb 24 13:41	0.00	0.00	0.00	0.00	0.00	0.00
18 Feb 24 13:21	0.00	0.00	0.00	0.00	0.00	0.00	18 Feb 24 13:59	0.00	0.00	0.00	0.00	0.00	0.00
18 Feb 24 13:39	0.00	0.00	0.00	0.00	0.00	0.00	18 Feb 24 14:17	0.00	0.00	0.00	0.00	0.00	0.00
18 Feb 24 13:57	0.00	0.00	0.00	0.00	0.00	0.00	18 Feb 24 14:35	0.00	0.00	0.00	0.00	0.00	0.00
18 Feb 24 14:15	0.00	0.00	0.00	0.00	0.00	0.00	18 Feb 24 14:53	0.00	0.00	0.00	0.00	0.00	0.00
18 Feb 24 14:33	0.00	0.00	0.00	0.00	0.00	0.00	18 Feb 24 15:11	0.00	0.00	0.00	0.00	0.00	0.00
18 Feb 24 14:51	0.00	0.00	0.00	0.00	0.00	0.00	18 Feb 24 15:29	0.00	0.00	0.00	0.00	0.00	0.00
18 Feb 24 15:09	0.00	0.00	0.00	0.00	0.00	0.00	18 Feb 24 15:47	0.00	0.00	0.00	0.00	0.00	0.00
18 Feb 24 15:27	0.00	0.00	0.00	0.00	0.00	0.00	18 Feb 24 16:05	0.00	0.00	0.00	0.00	0.00	0.00
18 Feb 24 15:45	0.00	0.00	0.00	0.00	0.00	0.00	18 Feb 24 16:23	0.00	0.00	0.00	0.00	0.00	0.00
18 Feb 24 16:03	0.00	0.00	0.00	0.00	0.00	0.00	18 Feb 24 16:41	0.00	0.00	0.00	0.00	0.00	0.00
18 Feb 24 16:21	0.00	0.00	0.00	0.00	0.00	0.00	18 Feb 24 16:59	0.00	0.00	0.00	0.00	0.00	0.00
18 Feb 24 16:39	0.00	0.00	0.00	0.00	0.00	0.00	18 Feb 24 17:17	0.00	0.00	0.00	0.00	0.00	0.00
18 Feb 24 16:57	0.00	0.00	0.00	0.00	0.00	0.00	18 Feb 24 17:35	0.00	0.00	0.00	0.00	0.00	0.00
18 Feb 24 17:15	0.00	0.00	0.00	0.00	0.00	0.00	18 Feb 24 17:53	0.00	0.00	0.00	0.00	0.00	0.00
18 Feb 24 17:33	0.00	0.00	0.00	0.00	0.00	0.00	18 Feb 24 18:11	0.00	0.00	0.00	0.00	0.00	0.00
18 Feb 24 17:51	0.00	0.00	0.00	0.00	0.00	0.00	18 Feb 24 18:29	0.00	0.00	0.00	0.00	0.00	0.00
18 Feb 24 18:09	0.00	0.00	0.00	0.00	0.00	0.00	18 Feb 24 18:47	0.00	0.00	0.00	0.00	0.00	0.00
18 Feb 24 18:27	0.00	0.00	0.00	0.00	0.00	0.00	18 Feb 24 19:05	0.00	0.00	0.00	0.00	0.00	0.00
18 Feb 24 18:45	0.00	0.00	0.00	0.00	0.00	0.00	18 Feb 24 19:23	0.00	0.00	0.00	0.00	0.00	0.00
18 Feb 24 19:03	0.00	0.00	0.00	0.00	0.00	0.00	18 Feb 24 19:41	0.00	0.00	0.00	0.00	0.00	0.00
18 Feb 24 19:21	0.00	0.00	0.00	0.00	0.00	0.00	18 Feb 24 19:59	0.00	0.00	0.00	0.00	0.00	0.00
18 Feb 24 19:39	0.00	0.00	0.00	0.00	0.00	0.00	18 Feb 24 20:17	0.00	0.00	0.00	0.00	0.00	0.00
18 Feb 24 19:57	0.00	0.00	0.00	0.00	0.00	0.00	18 Feb 24 20:35	0.00	0.00	0.00	0.00	0.00	0.00
18 Feb 24 20:15	0.00	0.00	0.00	0.00	0.00	0.00	18 Feb 24 20:53	0.00	0.00	0.00	0.00	0.00	0.00
18 Feb 24 20:33	0.00	0.00	0.00	0.00	0.00	0.00	18 Feb 24 21:11	0.00	0.00	0.00	0.00	0.00	0.00
18 Feb 24 20:51	0.00	0.00	0.00	0.00	0.00	0.00	18 Feb 24 21:29	0.00	0.00	0.00	0.00	0.00	0.00
18 Feb 24 21:09	0.00	0.00	0.00	0.00	0.00	0.00	18 Feb 24 21:47	0.00	0.00	0.00	0.00	0.00	0.00
18 Feb 24 21:27	0.00	0.00	0.00	0.00	0.00	0.00	18 Feb 24 22:05	0.00	0.00	0.00	0.00	0.00	0.00
18 Feb 24 21:45	0.00	0.00	0.00	0.00	0.00	0.00	18 Feb 24 22:23	0.00	0.00	0.00	0.00	0.00	0.00
18 Feb 24 22:03	0.00	0.00	0.00	0.00	0.00	0.00	18 Feb 24 22:41	0.00	0.00	0.00	0.00	0.00	0.00
18 Feb 24 22:21	0.00	0.00	0.00	0.00	0.00	0.00	18 Feb 24 22:59	0.00	0.00	0.00	0.00	0.00	0.00
18 Feb 24 22:39	0.00	0.00	0.00	0.00	0.00	0.00	18 Feb 24 23:17	0.00	0.00	0.00	0.00	0.00	0.00
18 Feb 24 22:57	0.00	0.00	0.00	0.00	0.00	0.00	18 Feb 24 23:35	0.00	0.00	0.00	0.00	0.00	0.00
18 Feb 24 23:15	0.00	0.00	0.00	0.00	0.00	0.00	18 Feb 24 23:53	0.00	0.00	0.00	0.00	0.00	0.00
18 Feb 24 23:33	0.00	0.00	0.00	0.00	0.00	0.00	18 Feb 24 24:11	0.00	0.00	0.00	0.00	0.00	0.00
18 Feb 24 23:51	0.00	0.00	0.00	0.00	0.00	0.00	18 Feb 24 24:29	0.00	0.00	0.00	0.00	0.00	0.00
18 Feb 24 24:09	0.00	0.00	0.00	0.00	0.00	0.00	18 Feb 24 24:47	0.00	0.00	0.00	0.00	0.00	0.00
18 Feb 24 24:27	0.00	0.00	0.00	0.00	0.00	0.00	18 Feb 24 25:05	0.00	0.00	0.00	0.00	0.00	0.00
18 Feb 24 24:45	0.00	0.00	0.00	0.00	0.00	0.00	18 Feb 24 25:23	0.00	0.00	0.00	0.00	0.00	0.00
18 Feb 24 25:03	0.00	0.00	0.00	0.00	0.00	0.00	18 Feb 24 25:41	0.00	0.00	0.00	0.00	0.00	0.00
18 Feb 24 25:21	0.00	0.00	0.00	0.00	0.00	0.00	18 Feb 24 25:59	0.00	0.00	0.00	0.00	0.00	0.00
18 Feb 24 25:39	0.00	0.00	0.00	0.00	0.00	0.00	18 Feb 24 26:17	0.00	0.00	0.00	0.00	0.00	0.00
18 Feb 24 25:57	0.00	0.00	0.00	0.00	0.00	0.00	18 Feb 24 26:35	0.00	0.00	0.00	0.00	0.00	0.00
18 Feb 24 26:15	0.00	0.00	0.00	0.00	0.00	0.00	18 Feb 24 26:53	0.00	0.00	0.00	0.00	0.00	0.00
18 Feb 24 26:33	0.00	0.00	0.00	0.00	0.00	0.00	18 Feb 24 27:11	0.00	0.00	0.00	0.00	0.00	0.00
18 Feb 24 26:51	0.00	0.00	0.00	0.00	0.00	0.00	18 Feb 24 27:29	0.00	0.00	0.00	0.00	0.00	0.00
18 Feb 24 27:09	0.00	0.00	0.00	0.00	0.00	0.00	18 Feb 24 27:47	0.00	0.00	0.00	0.00	0.00	0.00
18 Feb 24 27:27	0.00	0.00	0.00	0.00	0.00	0.00	18 Feb 24 28:05	0.00	0.00	0.00	0.00	0.00	0.00
18 Feb 24 27:45	0.00	0.00	0.00	0.00	0.00	0.00	18 Feb 24 28:23	0.00	0.00	0.00	0.00	0.00	0.00
18 Feb 24 28:03	0.00	0.00	0.00	0.00	0.00	0.00	18 Feb 24 28:41	0.00	0.00	0.00	0.00	0.00	0.00
18 Feb 24 28:21	0.00	0.00	0.00	0.00	0.00	0.00	18 Feb 24 28:59	0.00	0.00	0.00	0.00	0.00	0.00
18 Feb 24 28:39	0.00	0.00	0.00	0.00	0.00	0.00	18 Feb 24 29:17	0.00	0.00	0.00	0.00	0.00	0.00
18 Feb 24 28:57	0.00	0.00	0.00	0.00	0.00	0.00	18 Feb 24 29:35	0.00	0.00	0.00	0.00	0.00	0.00
18 Feb 24 29:15	0.00	0.00	0.00	0.00	0.00	0.00	18 Feb 24 29:53	0.00	0.00	0.00	0.00	0.00	0.00
18 Feb 24 29:33	0.00	0.00	0.00	0.00	0.00	0.00	18 Feb 24 30:11	0.00	0.00	0.00	0.00	0.00	0.00
18 Feb 24 29:51	0.00	0.00	0.00	0.00	0.00	0.00	18 Feb 24 30:29	0.00	0.00	0.00	0.00	0.00	0.00
18 Feb 24 30:09	0.00	0.00	0.00	0.00	0.00	0.00	18 Feb 24 30:47	0.00	0.00	0.00	0.00	0.00	0.00
18 Feb 24 30:27	0.00	0.00	0.00	0.00	0.00	0.00	18 Feb 24 31:05	0.00	0.00	0.00	0.00	0.00	0.00
18 Feb 24 30:45	0.00	0.00	0.00	0.00	0.00	0.00	18 Feb 24 31:23	0.00	0.00	0.00	0.00	0.00	0.00
18 Feb 24 31:03	0.00	0.00	0.00	0.00	0.00	0.00	18 Feb 24 31:41	0.00	0.00	0.00	0.00	0.00	0.00
18 Feb 24 31:21	0.00	0.00	0.00	0.00	0.00	0.00	18 Feb 24 31:59	0.00	0.00	0.00	0.00	0.00	0.00
18 Feb 24 31:39	0.00	0.00	0.00	0.00	0.00	0.00	18 Feb 24 32:17	0.00	0.00	0.00	0.00	0.00	0.00
18 Feb 24 31:57	0.00	0.00	0.00	0.00	0.00	0.00	18 Feb 24 32:35	0.00	0.00	0.00	0.00	0.00	0.00
18 Feb 24 32:15	0.00	0.00	0.00	0.00	0.00	0.00	18 Feb 24 32:53	0.00	0.00	0.00	0.00	0.00	0.00
18 Feb 24 32:33	0.00	0.00	0.00	0.00	0.00	0.00	18 Feb 24 33:11	0.00	0.00	0.00	0.00	0.00	0.00
18 Feb 24 32:51	0.00	0.00	0.00	0.00	0.00	0.00	18 Feb 24 33:29	0.00	0.00	0.00	0.00	0.00	0.00
18 Feb 24 33:09	0.00	0.00	0.00	0.00	0.00	0.00	18 Feb 24 33:47	0.00	0.00	0.00	0.00	0.00	0.00
18 Feb 24 33:27	0.00	0.00	0.00	0.00	0.00	0.00	18 Feb 24 34:05	0.00	0.00	0.00	0.00	0.00	0.00
18 Feb 24 33:45	0.00	0.00	0.00	0.00	0.00	0.00	18 Feb 24 34:23	0.00	0.00	0.00	0.00	0.00	0.00
18 Feb 24 34:03	0.00	0.00	0.00	0.00	0.00	0.00	18 Feb 24 34:41	0.00	0.00	0.00	0.00	0.00	0.00
18 Feb 24 34:21	0.00	0.00	0.00	0.00	0.00	0.00	18 Feb 24 34:59	0.00	0.00	0.00	0.00	0.00	0.00
18 Feb 24 34:39	0.00	0.00	0.00	0.00	0.00	0.00	18 Feb 24 35:17	0.00	0.00	0.00	0.00	0.00	0.00
18 Feb 24 34:57	0.00	0.00	0.00	0.00									

Run Day 1							Time Base = 21 min							Run Day 2							Time Base = 21 min						
Run	Time	002	100	010	010	010	Run	Time	002	100	010	010	010	Run	Time	002	100	010	010	010	Run	Time	002	100	010	010	
17 Feb 14	18:20	6.15	38.80	0.10	12.31	4.21	17 Feb 14	19:41	6.17	32.87	0.04	13.36	4.18	17 Feb 14	18:20	6.15	38.80	0.10	12.31	4.21	17 Feb 14	19:41	6.17	32.87	0.04	13.36	4.18
17 Feb 14	18:21	6.16	38.79	0.11	12.32	4.21	17 Feb 14	19:42	6.18	32.88	0.05	13.37	4.19	17 Feb 14	18:21	6.16	38.79	0.11	12.32	4.21	17 Feb 14	19:42	6.18	32.88	0.05	13.37	4.19
17 Feb 14	18:22	6.18	38.48	0.13	12.29	4.21	17 Feb 14	19:43	6.19	32.89	0.06	13.38	4.20	17 Feb 14	18:22	6.18	38.48	0.13	12.29	4.21	17 Feb 14	19:43	6.19	32.89	0.06	13.38	4.20
17 Feb 14	18:23	6.17	38.80	0.20	12.31	4.22	17 Feb 14	19:44	6.20	32.90	0.06	13.39	4.21	17 Feb 14	18:23	6.17	38.80	0.20	12.31	4.22	17 Feb 14	19:44	6.20	32.90	0.06	13.39	4.21
17 Feb 14	18:24	6.19	38.80	0.20	12.31	4.22	17 Feb 14	19:45	6.21	32.91	0.07	13.40	4.22	17 Feb 14	18:24	6.19	38.80	0.20	12.31	4.22	17 Feb 14	19:45	6.21	32.91	0.07	13.40	4.22
17 Feb 14	18:26	6.19	38.87	0.16	12.34	4.22	17 Feb 14	19:46	6.22	32.92	0.08	13.41	4.23	17 Feb 14	18:26	6.19	38.87	0.16	12.34	4.22	17 Feb 14	19:46	6.22	32.92	0.08	13.41	4.23
17 Feb 14	18:26	6.19	38.86	0.16	12.34	4.22	17 Feb 14	19:47	6.23	32.93	0.09	13.42	4.24	17 Feb 14	18:26	6.19	38.86	0.16	12.34	4.22	17 Feb 14	19:47	6.23	32.93	0.09	13.42	4.24
17 Feb 14	18:27	6.20	38.86	0.16	12.34	4.23	17 Feb 14	19:48	6.24	32.94	0.10	13.43	4.25	17 Feb 14	18:27	6.20	38.86	0.16	12.34	4.23	17 Feb 14	19:48	6.24	32.94	0.10	13.43	4.25
17 Feb 14	18:29	6.21	38.86	0.16	12.34	4.23	17 Feb 14	19:49	6.25	32.95	0.11	13.44	4.26	17 Feb 14	18:29	6.21	38.86	0.16	12.34	4.23	17 Feb 14	19:49	6.25	32.95	0.11	13.44	4.26
17 Feb 14	18:31	6.21	38.86	0.20	12.34	4.23	17 Feb 14	19:50	6.26	32.96	0.12	13.45	4.27	17 Feb 14	18:31	6.21	38.86	0.20	12.34	4.23	17 Feb 14	19:50	6.26	32.96	0.12	13.45	4.27
17 Feb 14	18:32	6.23	38.86	0.20	12.34	4.23	17 Feb 14	19:51	6.27	32.97	0.13	13.46	4.28	17 Feb 14	18:32	6.23	38.86	0.20	12.34	4.23	17 Feb 14	19:51	6.27	32.97	0.13	13.46	4.28
17 Feb 14	18:33	6.21	38.86	0.20	12.34	4.23	17 Feb 14	19:52	6.28	32.98	0.14	13.47	4.29	17 Feb 14	18:33	6.21	38.86	0.20	12.34	4.23	17 Feb 14	19:52	6.28	32.98	0.14	13.47	4.29
17 Feb 14	18:34	6.22	38.86	0.20	12.34	4.23	17 Feb 14	19:53	6.29	32.99	0.15	13.48	4.30	17 Feb 14	18:34	6.22	38.86	0.20	12.34	4.23	17 Feb 14	19:53	6.29	32.99	0.15	13.48	4.30
17 Feb 14	18:35	6.23	38.86	0.20	12.34	4.23	17 Feb 14	19:54	6.30	33.00	0.16	13.49	4.31	17 Feb 14	18:35	6.23	38.86	0.20	12.34	4.23	17 Feb 14	19:54	6.30	33.00	0.16	13.49	4.31
17 Feb 14	18:36	6.24	38.86	0.20	12.34	4.23	17 Feb 14	19:55	6.31	33.01	0.17	13.50	4.32	17 Feb 14	18:36	6.24	38.86	0.20	12.34	4.23	17 Feb 14	19:55	6.31	33.01	0.17	13.50	4.32
17 Feb 14	18:37	6.24	38.86	0.20	12.34	4.23	17 Feb 14	19:56	6.32	33.02	0.18	13.51	4.33	17 Feb 14	18:37	6.24	38.86	0.20	12.34	4.23	17 Feb 14	19:56	6.32	33.02	0.18	13.51	4.33
17 Feb 14	18:38	6.25	38.86	0.20	12.34	4.23	17 Feb 14	19:57	6.33	33.03	0.19	13.52	4.34	17 Feb 14	18:38	6.25	38.86	0.20	12.34	4.23	17 Feb 14	19:57	6.33	33.03	0.19	13.52	4.34
17 Feb 14	18:39	6.25	38.86	0.20	12.34	4.23	17 Feb 14	19:58	6.34	33.04	0.20	13.53	4.35	17 Feb 14	18:39	6.25	38.86	0.20	12.34	4.23	17 Feb 14	19:58	6.34	33.04	0.20	13.53	4.35
17 Feb 14	18:40	6.26	38.86	0.20	12.34	4.23	17 Feb 14	19:59	6.35	33.05	0.21	13.54	4.36	17 Feb 14	18:40	6.26	38.86	0.20	12.34	4.23	17 Feb 14	19:59	6.35	33.05	0.21	13.54	4.36
Aug	0.19	0.17	0.26	0.26	0.22	0.22	Aug	0.17	0.26	0.26	0.26	0.26	0.26	Aug	0.19	0.17	0.26	0.26	0.22	0.22	Aug	0.17	0.26	0.26	0.26	0.26	

Run No. 3										Run No. 4									
Time Base: 21 min										Time Base: 21 min									
Run	Year	AGE	Info	DOB	DOB	DOB	DOB	DOB	DOB	Run	Year	AGE	Info	DOB	DOB	DOB	DOB	DOB	DOB
1	1969	11-02	116	11-02	116	11-02	116	11-02	116	2	1969	11-03	116	11-03	116	11-03	116	11-03	116
2	1969	11-02	116	11-02	116	11-02	116	11-02	116	3	1969	11-03	116	11-03	116	11-03	116	11-03	116
3	1969	11-04	116	11-04	116	11-04	116	11-04	116	4	1969	11-03	116	11-03	116	11-03	116	11-03	116
4	1969	11-04	116	11-04	116	11-04	116	11-04	116	5	1969	11-03	116	11-03	116	11-03	116	11-03	116
5	1969	11-04	116	11-04	116	11-04	116	11-04	116	6	1969	11-03	116	11-03	116	11-03	116	11-03	116
6	1969	11-05	116	11-05	116	11-05	116	11-05	116	7	1969	11-03	116	11-03	116	11-03	116	11-03	116
7	1969	11-05	116	11-05	116	11-05	116	11-05	116	8	1969	11-03	116	11-03	116	11-03	116	11-03	116
8	1969	11-05	116	11-05	116	11-05	116	11-05	116	9	1969	11-03	116	11-03	116	11-03	116	11-03	116
9	1969	11-05	116	11-05	116	11-05	116	11-05	116	10	1969	11-03	116	11-03	116	11-03	116	11-03	116
10	1969	11-05	116	11-05	116	11-05	116	11-05	116	11	1969	11-03	116	11-03	116	11-03	116	11-03	116
11	1969	11-05	116	11-05	116	11-05	116	11-05	116	12	1969	11-03	116	11-03	116	11-03	116	11-03	116
12	1969	11-05	116	11-05	116	11-05	116	11-05	116	13	1969	11-03	116	11-03	116	11-03	116	11-03	116
13	1969	11-05	116	11-05	116	11-05	116	11-05	116	14	1969	11-03	116	11-03	116	11-03	116	11-03	116
14	1969	11-05	116	11-05	116	11-05	116	11-05	116	15	1969	11-03	116	11-03	116	11-03	116	11-03	116
15	1969	11-05	116	11-05	116	11-05	116	11-05	116	16	1969	11-03	116	11-03	116	11-03	116	11-03	116
16	1969	11-05	116	11-05	116	11-05	116	11-05	116	17	1969	11-03	116	11-03	116	11-03	116	11-03	116
17	1969	11-05	116	11-05	116	11-05	116	11-05	116	18	1969	11-03	116	11-03	116	11-03	116	11-03	116
18	1969	11-05	116	11-05	116	11-05	116	11-05	116	19	1969	11-03	116	11-03	116	11-03	116	11-03	116
19	1969	11-05	116	11-05	116	11-05	116	11-05	116	20	1969	11-03	116	11-03	116	11-03	116	11-03	116
20	1969	11-05	116	11-05	116	11-05	116	11-05	116	21	1969	11-03	116	11-03	116	11-03	116	11-03	116
21	1969	11-05	116	11-05	116	11-05	116	11-05	116	22	1969	11-03	116	11-03	116	11-03	116	11-03	116
22	1969	11-05	116	11-05	116	11-05	116	11-05	116	23	1969	11-03	116	11-03	116	11-03	116	11-03	116
23	1969	11-05	116	11-05	116	11-05	116	11-05	116	24	1969	11-03	116	11-03	116	11-03	116	11-03	116
24	1969	11-05	116	11-05	116	11-05	116	11-05	116	25	1969	11-03	116	11-03	116	11-03	116	11-03	116
25	1969	11-05	116	11-05	116	11-05	116	11-05	116	26	1969	11-03	116	11-03	116	11-03	116	11-03	116
26	1969	11-05	116	11-05	116	11-05	116	11-05	116	27	1969	11-03	116	11-03	116	11-03	116	11-03	116
27	1969	11-05	116	11-05	116	11-05	116	11-05	116	28	1969	11-03	116	11-03	116	11-03	116	11-03	116
28	1969	11-05	116	11-05	116	11-05	116	11-05	116	29	1969	11-03	116	11-03	116	11-03	116	11-03	116
29	1969	11-05	116	11-05	116	11-05	116	11-05	116	30	1969	11-03	116	11-03	116	11-03	116	11-03	116
30	1969	11-05	116	11-05	116	11-05	116	11-05	116	31	1969	11-03	116	11-03	116	11-03	116	11-03	116
31	1969	11-05	116	11-05	116	11-05	116	11-05	116	32	1969	11-03	116	11-03	116	11-03	116	11-03	116
32	1969	11-05	116	11-05	116	11-05	116	11-05	116	33	1969	11-03	116	11-03	116	11-03	116	11-03	116
33	1969	11-05	116	11-05	116	11-05	116	11-05	116	34	1969	11-03	116	11-03	116	11-03	116	11-03	116
34	1969	11-05	116	11-05	116	11-05	116	11-05	116	35	1969	11-03	116	11-03	116	11-03	116	11-03	116
35	1969	11-05	116	11-05	116	11-05	116	11-05	116	36	1969	11-03	116	11-03	116	11-03	116	11-03	116
36	1969	11-05	116	11-05	116	11-05	116	11-05	116	37	1969	11-03	116	11-03	116	11-03	116	11-03	116
37	1969	11-05	116	11-05	116	11-05	116	11-05	116	38	1969	11-03	116	11-03	116	11-03	116	11-03	116
38	1969	11-05	116	11-05	116	11-05	116	11-05	116	39	1969	11-03	116	11-03	116	11-03	116	11-03	116
39	1969	11-05	116	11-05	116	11-05	116	11-05	116	40	1969	11-03	116	11-03	116	11-03	116	11-03	116
40	1969	11-05	116	11-05	116	11-05	116	11-05	116	41	1969	11-03	116	11-03	116	11-03	116	11-03	116
41	1969	11-05	116	11-05	116	11-05	116	11-05	116	42	1969	11-03	116	11-03	116	11-03	116	11-03	116
42	1969	11-05	116	11-05	116	11-05	116	11-05	116	43	1969	11-03	116	11-03	116	11-03	116	11-03	116
43	1969	11-05	116	11-05	116	11-05	116	11-05	116	44	1969	11-03	116	11-03	116	11-03	116	11-03	116
44	1969	11-05	116	11-05	116	11-05	116	11-05	116	45	1969	11-03	116	11-03	116	11-03	116	11-03	116
45	1969	11-05	116	11-05	116	11-05	116	11-05	116	46	1969	11-03	116	11-03	116	11-03	116	11-03	116
46	1969	11-05	116	11-05	116	11-05	116	11-05	116	47	1969	11-03	116	11-03	116	11-03	116	11-03	116
47	1969	11-05	116	11-05	116	11-05	116	11-05	116	48	1969	11-03	116	11-03	116	11-03	116	11-03	116
48	1969	11-05	116	11-05	116	11-05	116	11-05	116	49	1969	11-03	116	11-03	116	11-03	116	11-03	116
49	1969	11-05	116	11-05	116	11-05	116	11-05	116	50	1969	11-03	116	11-03	116	11-03	116	11-03	116
50	1969	11-05	116	11-05	116	11-05	116	11-05	116	51	1969	11-03	116	11-03	116	11-03	116	11-03	116
51	1969	11-05	116	11-05	116	11-05	116	11-05	116	52	1969	11-03	116	11-03	116	11-03	116	11-03	116
52	1969	11-05	116	11-05	116	11-05	116	11-05	116	53	1969	11-03	116	11-03	116	11-03	116	11-03	116
53	1969	11-05	116	11-05	116	11-05	116	11-05	116	54	1969	11-03	116	11-03	116	11-03	116	11-03	116
54	1969	11-05	116	11-05	116	11-05	116	11-05	116	55	1969	11-03	116	11-03	116	11-03	116	11-03	116
55	1969	11-05	116	11-05	116	11-05	116	11-05	116	56	1969	11-03	116	11-03	116	11-03	116	11-03	116
56	1969	11-05	116	11-05	116	11-05	116	11-05	116	57	1969	11-03	116	11-03	116	11-03	116	11-03	116
57	1969	11-05	116	11-05	116	11-05	116	11-05	116	58	1969	11-03	116	11-03	116	11-03	116	11-03	116
58	1969	11-05	116	11-05	116	11-05	116	11-05	116	59	1969	11-03	116	11-03	116	11-03	116	11-03	116
59	1969	11-05	116	11-05	116	11-05	116	11-05	116	60	1969	11-03	116	11-03	116	11-03	116	11-03	116
60	1969	11-05	116	11-05	116	11-05	116	11-05	116	61	1969	11-03	116	11-03	116	11-03	116	11-03	116
61	1969	11-05	116	11-05	116	11-05	116	11-05	116	62	1969	11-03	116	11-03	116	11-03	116	11-03	116
62	1969	11-05	116	11-05	116	11-05	116	11-05	116	63	1969	11-03	116	11-03	116	11-03	116	11-03	116
63	1969	11-05	116	11-05	116	11-05	116	11-05	116	64	1969	11-03	116	11-03	116	11-03	116	11-03	116
64	1969	11-05	116	11-05	116	11-05	116	11-05	116	65	1969	11-03	116	11-03	116	11-03	116	11-03	116
65	1969	11-05	116	11-05	116	11-05	116	11-05	116	66	1969	11-03	116	11-03	116	11-03	116	11-03	116
66	1969	11-05	116	11-05	116	11-05	116	11-05	116	67	1969	11-03	116	11-03	116	11-03	116	11-03	116
67	1969	11-05	116	11-05	116	11-05	116	11-05	116	68	1969	11-03	116	11-03	116	11-03	116	11-03	116
68	1969	11-05	116	11-05	116	11-05													

Run No. 6							Time Base: 21 sec							Run No. 7							Time Base: 21 sec						
Run	Time	Alt	Wind	Dir	Spd	Dir	Run	Time	Alt	Wind	Dir	Spd	Dir	Run	Time	Alt	Wind	Dir	Spd	Dir	Run	Time	Alt	Wind	Dir	Spd	Dir
19 Feb 24	11:44	833	21.42	71.2	14.86	979	19 Feb 24	12:08	836	20.89	69.8	15.81	979	19 Feb 24	12:38	839	20.81	69.3	15.81	979	19 Feb 24	13:07	842	20.73	68.8	15.81	979
19 Feb 24	11:46	828	21.42	71.2	14.86	979	19 Feb 24	12:10	841	20.81	69.8	15.81	979	19 Feb 24	12:40	844	20.73	68.8	15.81	979	19 Feb 24	13:09	847	20.65	68.3	15.81	979
19 Feb 24	11:48	823	21.42	71.2	14.86	979	19 Feb 24	12:12	836	20.81	69.8	15.81	979	19 Feb 24	12:42	839	20.73	68.8	15.81	979	19 Feb 24	13:11	842	20.65	68.3	15.81	979
19 Feb 24	11:50	818	21.42	71.2	14.86	979	19 Feb 24	12:14	831	20.81	69.8	15.81	979	19 Feb 24	12:44	834	20.73	68.8	15.81	979	19 Feb 24	13:13	837	20.65	68.3	15.81	979
19 Feb 24	11:52	813	21.42	71.2	14.86	979	19 Feb 24	12:16	826	20.81	69.8	15.81	979	19 Feb 24	12:46	829	20.73	68.8	15.81	979	19 Feb 24	13:15	832	20.65	68.3	15.81	979
19 Feb 24	11:54	808	21.42	71.2	14.86	979	19 Feb 24	12:18	821	20.81	69.8	15.81	979	19 Feb 24	12:48	824	20.73	68.8	15.81	979	19 Feb 24	13:17	827	20.65	68.3	15.81	979
19 Feb 24	11:56	803	21.42	71.2	14.86	979	19 Feb 24	12:20	816	20.81	69.8	15.81	979	19 Feb 24	12:50	819	20.73	68.8	15.81	979	19 Feb 24	13:19	822	20.65	68.3	15.81	979
19 Feb 24	11:58	798	21.42	71.2	14.86	979	19 Feb 24	12:22	811	20.81	69.8	15.81	979	19 Feb 24	12:52	814	20.73	68.8	15.81	979	19 Feb 24	13:21	817	20.65	68.3	15.81	979
19 Feb 24	12:00	793	21.42	71.2	14.86	979	19 Feb 24	12:24	806	20.81	69.8	15.81	979	19 Feb 24	12:54	809	20.73	68.8	15.81	979	19 Feb 24	13:23	812	20.65	68.3	15.81	979
19 Feb 24	12:02	788	21.42	71.2	14.86	979	19 Feb 24	12:26	801	20.81	69.8	15.81	979	19 Feb 24	12:56	804	20.73	68.8	15.81	979	19 Feb 24	13:25	807	20.65	68.3	15.81	979
19 Feb 24	12:04	783	21.42	71.2	14.86	979	19 Feb 24	12:28	796	20.81	69.8	15.81	979	19 Feb 24	12:58	799	20.73	68.8	15.81	979	19 Feb 24	13:27	802	20.65	68.3	15.81	979
19 Feb 24	12:06	778	21.42	71.2	14.86	979	19 Feb 24	12:30	791	20.81	69.8	15.81	979	19 Feb 24	13:00	794	20.73	68.8	15.81	979	19 Feb 24	13:29	797	20.65	68.3	15.81	979
19 Feb 24	12:08	773	21.42	71.2	14.86	979	19 Feb 24	12:32	786	20.81	69.8	15.81	979	19 Feb 24	13:02	789	20.73	68.8	15.81	979	19 Feb 24	13:31	792	20.65	68.3	15.81	979
19 Feb 24	12:10	768	21.42	71.2	14.86	979	19 Feb 24	12:34	781	20.81	69.8	15.81	979	19 Feb 24	13:04	784	20.73	68.8	15.81	979	19 Feb 24	13:33	787	20.65	68.3	15.81	979
19 Feb 24	12:12	763	21.42	71.2	14.86	979	19 Feb 24	12:36	776	20.81	69.8	15.81	979	19 Feb 24	13:06	779	20.73	68.8	15.81	979	19 Feb 24	13:35	782	20.65	68.3	15.81	979
19 Feb 24	12:14	758	21.42	71.2	14.86	979	19 Feb 24	12:38	771	20.81	69.8	15.81	979	19 Feb 24	13:08	774	20.73	68.8	15.81	979	19 Feb 24	13:37	777	20.65	68.3	15.81	979
19 Feb 24	12:16	753	21.42	71.2	14.86	979	19 Feb 24	12:40	766	20.81	69.8	15.81	979	19 Feb 24	13:10	769	20.73	68.8	15.81	979	19 Feb 24	13:39	772	20.65	68.3	15.81	979
19 Feb 24	12:18	748	21.42	71.2	14.86	979	19 Feb 24	12:42	761	20.81	69.8	15.81	979	19 Feb 24	13:12	764	20.73	68.8	15.81	979	19 Feb 24	13:41	767	20.65	68.3	15.81	979
19 Feb 24	12:20	743	21.42	71.2	14.86	979	19 Feb 24	12:44	756	20.81	69.8	15.81	979	19 Feb 24	13:14	759	20.73	68.8	15.81	979	19 Feb 24	13:43	762	20.65	68.3	15.81	979
19 Feb 24	12:22	738	21.42	71.2	14.86	979	19 Feb 24	12:46	751	20.81	69.8	15.81	979	19 Feb 24	13:16	754	20.73	68.8	15.81	979	19 Feb 24	13:45	757	20.65	68.3	15.81	979
19 Feb 24	12:24	733	21.42	71.2	14.86	979	19 Feb 24	12:48	746	20.81	69.8	15.81	979	19 Feb 24	13:18	749	20.73	68.8	15.81	979	19 Feb 24	13:47	752	20.65	68.3	15.81	979
19 Feb 24	12:26	728	21.42	71.2	14.86	979	19 Feb 24	12:50	741	20.81	69.8	15.81	979	19 Feb 24	13:20	744	20.73	68.8	15.81	979	19 Feb 24	13:49	747	20.65	68.3	15.81	979
19 Feb 24	12:28	723	21.42	71.2	14.86	979	19 Feb 24	12:52	736	20.81	69.8	15.81	979	19 Feb 24	13:22	739	20.73	68.8	15.81	979	19 Feb 24	13:51	742	20.65	68.3	15.81	979
19 Feb 24	12:30	718	21.42	71.2	14.86	979	19 Feb 24	12:54	731	20.81	69.8	15.81	979	19 Feb 24	13:24	734	20.73	68.8	15.81	979	19 Feb 24	13:53	737	20.65	68.3	15.81	979
19 Feb 24	12:32	713	21.42	71.2	14.86	979	19 Feb 24	12:56	726	20.81	69.8	15.81	979	19 Feb 24	13:26	729	20.73	68.8	15.81	979	19 Feb 24	13:55	732	20.65	68.3	15.81	979
19 Feb 24	12:34	708	21.42	71.2	14.86	979	19 Feb 24	12:58	721	20.81	69.8	15.81	979	19 Feb 24	13:28	724	20.73	68.8	15.81	979	19 Feb 24	13:57	727	20.65	68.3	15.81	979
19 Feb 24	12:36	703	21.42	71.2	14.86	979	19 Feb 24	13:00	716	20.81	69.8	15.81	979	19 Feb 24	13:30	719	20.73	68.8	15.81	979	19 Feb 24	13:59	722	20.65	68.3	15.81	979
19 Feb 24	12:38	698	21.42	71.2	14.86	979	19 Feb 24	13:02	711	20.81	69.8	15.81	979	19 Feb 24	13:32	714	20.73	68.8	15.81	979	19 Feb 24	14:01	717	20.65	68.3	15.81	979
19 Feb 24	12:40	693	21.42	71.2	14.86	979	19 Feb 24	13:04	706	20.81	69.8	15.81	979	19 Feb 24	13:34	709	20.73	68.8	15.81	979	19 Feb 24	14:03	712	20.65	68.3	15.81	979
19 Feb 24	12:42	688	21.42	71.2	14.86	979	19 Feb 24	13:06	701	20.81	69.8	15.81	979	19 Feb 24	13:36	704	20.73	68.8	15.81	979	19 Feb 24	14:05	707	20.65	68.3	15.81	979
19 Feb 24	12:44	683	21.42	71.2	14.86	979	19 Feb 24	13:08	696	20.81	69.8	15.81	979	19 Feb 24	13:38	699	20.73	68.8	15.81	979	19 Feb 24	14:07	702	20.65	68.3	15.81	979
19 Feb 24	12:46	678	21.42	71.2	14.86	979	19 Feb 24	13:10	691	20.81	69.8	15.81	979	19 Feb 24	13:40	694	20.73	68.8	15.81	979	19 Feb 24	14:09	697	20.65	68.3	15.81	979
19 Feb 24	12:48	673	21.42	71.2	14.86	979	19 Feb 24	13:12	686	20.81	69.8	15.81	979	19 Feb 24	13:42	689	20.73	68.8	15.81	979	19 Feb 24	14:11	692	20.65	68.3	15.81	979
19 Feb 24	12:50	668	21.42	71.2	14.86	979	19 Feb 24	13:14	681	20.81	69.8	15.81	979	19 Feb 24	13:44	684	20.73	68.8	15.81	979	19 Feb 24	14:13	687	20.65	68.3	15.81	979
19 Feb 24	12:52	663	21.42	71.2	14.86	979	19 Feb 24	13:16	676	20.81	69.8	15.81	979	19 Feb 24	13:46	679	20.73	68.8	15.81	979	19 Feb 24	14:15	682	20.65	68.3	15.81	979
19 Feb 24	12:54	658	21.42	71.2	14.86	979	19 Feb 24	13:18	671	20.81	69.8	15.81	979	19 Feb 24	13:48	674	20.73	68.8	15.81	979	19 Feb 24	14:17	677	20.65	68.3	15.81	979
19 Feb 24	12:56	653	21.42	71.2	14.86	979	19 Feb 24	13:20	666	20.81	69.8	15.81	979	19 Feb 24	13:50	669	20.73	68.8	15.81	979	19 Feb 24	14:19	672	20.65	68.3	15.81	979
19 Feb 24	12:58	648	21.42	71.2	14.86	979	19 Feb 24	13:22	661	20.81	69.8	15.81	979	19 Feb 24	13:52	664	20.73	68.8	15.81	979	19 Feb 24	14:21	667	20.65	68.3	15.81	979
19 Feb 24	13:00	643	21.42	71.2	14.86	979	19 Feb 24	13:24	656	20.81	69.8	15.81	979	19 Feb 24	13:54	659	20.73	68.8	15.81	979	19 Feb 24	14:23	662	20.65	68.3	15.81	979
19 Feb 24	13:02	638	21.42	71.2	14.86	979	19 Feb 24	13:26	651	20.81	69.8	15.81	979	19 Feb 24	13:56	654	20.73	68.8	15.81	979	19 Feb 24	14:25	657	20.65	68.3	15.81	979
19 Feb 24	13:04	633	21.42	71.2	14.86	979	19 Feb 24	13:28	646	20.81	69.8	15.81	979	19 Feb 24	13:58	649	20.73	68.8	15.81	979	19 Feb 24	14:27	652	20.65	68.3	15.81	979
19 Feb 24	13:06	628	21.42	71.2	14.86	979	19 Feb 24	13:30	641	20.81	69.8	15.81	979	19 Feb 24	14:00	644	20.73	68.8	15.81	979	19 Feb 24	14:29	647	20.65	68.3	15.81	979
19 Feb 24	13:08	623	21.42	71.2	14.86	979	19 Feb 24	13:32	636	20.81	69.8	15.81	979	19 Feb 24	14:02	639	20.73	68.8	15.81	979	19 Feb 24	14:31	642	20.65	68.3	15.81	979
19 Feb 24	13:10	618	21.42	71.2	14.86	979	19 Feb 24	13:34	631	20.81	69.8	15.81	979	19 Feb 24	14:04	634	20.73	68.8	15.81	979	19 Feb 24	14:33	637	20.65	68.3	15.81	979
19 Feb 24	13:12	613	21.42	71.2	14.86	979	19 Feb 24	13:36	626	20.81	69.8	15.81	979	19 Feb 24	14:06	629	20.73	68.8	15.81	979	19 Feb 24	14:35	632	20.65	68.3	15.81	979
19 Feb 24	13:14	608	21.42	71.2	14.86	979	19 Feb 24	13:38																			

Reference Method Data

[illegible]

Date	Time Band 21 (min)					Time Band 21 (min)							
	Time	Time	SEI	WCI	SEI	Time	Time	SEI	WCI	SEI			
1979-10-18	11:00	1:23	28.24	4.24	19.84	1:00	1979-10-20	11:28	3.65	12.75	5.94	13.75	3.40
1979-10-20	11:00	1:23	28.24	4.24	19.84	1:00	1979-10-21	11:28	3.65	12.75	5.94	13.75	3.40
1979-10-21	11:00	1:23	28.24	4.24	19.84	1:00	1979-10-22	11:28	3.65	12.75	5.94	13.75	3.40
1979-10-22	11:00	1:23	28.24	4.24	19.84	1:00	1979-10-23	11:28	3.65	12.75	5.94	13.75	3.40
1979-10-23	11:00	1:23	28.24	4.24	19.84	1:00	1979-10-24	11:28	3.65	12.75	5.94	13.75	3.40
1979-10-24	11:00	1:23	28.24	4.24	19.84	1:00	1979-10-25	11:28	3.65	12.75	5.94	13.75	3.40
1979-10-25	11:00	1:23	28.24	4.24	19.84	1:00	1979-10-26	11:28	3.65	12.75	5.94	13.75	3.40
1979-10-26	11:00	1:23	28.24	4.24	19.84	1:00	1979-10-27	11:28	3.65	12.75	5.94	13.75	3.40
1979-10-27	11:00	1:23	28.24	4.24	19.84	1:00	1979-10-28	11:28	3.65	12.75	5.94	13.75	3.40
1979-10-28	11:00	1:23	28.24	4.24	19.84	1:00	1979-10-29	11:28	3.65	12.75	5.94	13.75	3.40
1979-10-29	11:00	1:23	28.24	4.24	19.84	1:00	1979-10-30	11:28	3.65	12.75	5.94	13.75	3.40
1979-10-30	11:00	1:23	28.24	4.24	19.84	1:00	1979-10-31	11:28	3.65	12.75	5.94	13.75	3.40
1979-10-31	11:00	1:23	28.24	4.24	19.84	1:00	1979-11-01	11:28	3.65	12.75	5.94	13.75	3.40
1979-11-01	11:00	1:23	28.24	4.24	19.84	1:00	1979-11-02	11:28	3.65	12.75	5.94	13.75	3.40
1979-11-02	11:00	1:23	28.24	4.24	19.84	1:00	1979-11-03	11:28	3.65	12.75	5.94	13.75	3.40
1979-11-03	11:00	1:23	28.24	4.24	19.84	1:00	1979-11-04	11:28	3.65	12.75	5.94	13.75	3.40
1979-11-04	11:00	1:23	28.24	4.24	19.84	1:00	1979-11-05	11:28	3.65	12.75	5.94	13.75	3.40
1979-11-05	11:00	1:23	28.24	4.24	19.84	1:00	1979-11-06	11:28	3.65	12.75	5.94	13.75	3.40
1979-11-06	11:00	1:23	28.24	4.24	19.84	1:00	1979-11-07	11:28	3.65	12.75	5.94	13.75	3.40
1979-11-07	11:00	1:23	28.24	4.24	19.84	1:00	1979-11-08	11:28	3.65	12.75	5.94	13.75	3.40
1979-11-08	11:00	1:23	28.24	4.24	19.84	1:00	1979-11-09	11:28	3.65	12.75	5.94	13.75	3.40
1979-11-09	11:00	1:23	28.24	4.24	19.84	1:00	1979-11-10	11:28	3.65	12.75	5.94	13.75	3.40
1979-11-10	11:00	1:23	28.24	4.24	19.84	1:00	1979-11-11	11:28	3.65	12.75	5.94	13.75	3.40
1979-11-11	11:00	1:23	28.24	4.24	19.84	1:00	1979-11-12	11:28	3.65	12.75	5.94	13.75	3.40
1979-11-12	11:00	1:23	28.24	4.24	19.84	1:00	1979-11-13	11:28	3.65	12.75	5.94	13.75	3.40
1979-11-13	11:00	1:23	28.24	4.24	19.84	1:00	1979-11-14	11:28	3.65	12.75	5.94	13.75	3.40
1979-11-14	11:00	1:23	28.24	4.24	19.84	1:00	1979-11-15	11:28	3.65	12.75	5.94	13.75	3.40
1979-11-15	11:00	1:23	28.24	4.24	19.84	1:00	1979-11-16	11:28	3.65	12.75	5.94	13.75	3.40
1979-11-16	11:00	1:23	28.24	4.24	19.84	1:00	1979-11-17	11:28	3.65	12.75	5.94	13.75	3.40
1979-11-17	11:00	1:23	28.24	4.24	19.84	1:00	1979-11-18	11:28	3.65	12.75	5.94	13.75	3.40
1979-11-18	11:00	1:23	28.24	4.24	19.84	1:00	1979-11-19	11:28	3.65	12.75	5.94	13.75	3.40
1979-11-19	11:00	1:23	28.24	4.24	19.84	1:00	1979-11-20	11:28	3.65	12.75	5.94	13.75	3.40
1979-11-20	11:00	1:23	28.24	4.24	19.84	1:00	1979-11-21	11:28	3.65	12.75	5.94	13.75	3.40
1979-11-21	11:00	1:23	28.24	4.24	19.84	1:00	1979-11-22	11:28	3.65	12.75	5.94	13.75	3.40
1979-11-22	11:00	1:23	28.24	4.24	19.84	1:00	1979-11-23	11:28	3.65	12.75	5.94	13.75	3.40
1979-11-23	11:00	1:23	28.24	4.24	19.84	1:00	1979-11-24	11:28	3.65	12.75	5.94	13.75	3.40
1979-11-24	11:00	1:23	28.24	4.24	19.84	1:00	1979-11-25	11:28	3.65	12.75	5.94	13.75	3.40
1979-11-25	11:00	1:23	28.24	4.24	19.84	1:00	1979-11-26	11:28	3.65	12.75	5.94	13.75	3.40
1979-11-26	11:00	1:23	28.24	4.24	19.84	1:00	1979-11-27	11:28	3.65	12.75	5.94	13.75	3.40
1979-11-27	11:00	1:23	28.24	4.24	19.84	1:00	1979-11-28	11:28	3.65	12.75	5.94	13.75	3.40
1979-11-28	11:00	1:23	28.24	4.24	19.84	1:00	1979-11-29	11:28	3.65	12.75	5.94	13.75	3.40
1979-11-29	11:00	1:23	28.24	4.24	19.84	1:00	1979-11-30	11:28	3.65	12.75	5.94	13.75	3.40
1979-11-30	11:00	1:23	28.24	4.24	19.84	1:00	1979-12-01	11:28	3.65	12.75	5.94	13.75	3.40
1979-12-01	11:00	1:23	28.24	4.24	19.84	1:00	1979-12-02	11:28	3.65	12.75	5.94	13.75	3.40
1979-12-02	11:00	1:23	28.24	4.24	19.84	1:00	1979-12-03	11:28	3.65	12.75	5.94	13.75	3.40
1979-12-03	11:00	1:23	28.24	4.24	19.84	1:00	1979-12-04	11:28	3.65	12.75	5.94	13.75	3.40
1979-12-04	11:00	1:23	28.24	4.24	19.84	1:00	1979-12-05	11:28	3.65	12.75	5.94	13.75	3.40
1979-12-05	11:00	1:23	28.24	4.24	19.84	1:00	1979-12-06	11:28	3.65	12.75	5.94	13.75	3.40
1979-12-06	11:00	1:23	28.24	4.24	19.84	1:00	1979-12-07	11:28	3.65	12.75	5.94	13.75	3.40
1979-12-07	11:00	1:23	28.24	4.24	19.84	1:00	1979-12-08	11:28	3.65	12.75	5.94	13.75	3.40
1979-12-08	11:00	1:23	28.24	4.24	19.84	1:00	1979-12-09	11:28	3.65	12.75	5.94	13.75	3.40
1979-12-09	11:00	1:23	28.24	4.24	19.84	1:00	1979-12-10	11:28	3.65	12.75	5.94	13.75	3.40
1979-12-10	11:00	1:23	28.24	4.24	19.84	1:00	1979-12-11	11:28	3.65	12.75	5.94	13.75	3.40
1979-12-11	11:00	1:23	28.24	4.24	19.84	1:00	1979-12-12	11:28	3.65	12.75	5.94	13.75	3.40
1979-12-12	11:00	1:23	28.24	4.24	19.84	1:00	1979-12-13	11:28	3.65	12.75	5.94	13.75	3.40
1979-12-13	11:00	1:23	28.24	4.24	19.84	1:00	1979-12-14	11:28	3.65	12.75	5.94	13.75	3.40
1979-12-14	11:00	1:23	28.24	4.24	19.84	1:00	1979-12-15	11:28	3.65	12.75	5.94	13.75	3.40
1979-12-15	11:00	1:23	28.24	4.24	19.84	1:00	1979-12-16	11:28	3.65	12.75	5.94	13.75	3.40
1979-12-16	11:00	1:23	28.24	4.24	19.84	1:00	1979-12-17	11:28	3.65	12.75	5.94	13.75	3.40
1979-12-17	11:00	1:23	28.24	4.24	19.84	1:00	1979-12-18	11:28	3.65	12.75	5.94	13.75	3.40
1979-12-18	11:00	1:23	28.24	4.24	19.84	1:00	1979-12-19	11:28	3.65	12.75	5.94	13.75	3.40
1979-12-19	11:00	1:23	28.24	4.24	19.84	1:00	1979-12-20	11:28	3.65	12.75	5.94	13.75	3.40
1979-12-20	11:00	1:23	28.24	4.24	19.84	1:00	1979-12-21	11:28	3.65	12.75	5.94	13.75	3.40
1979-12-21	11:00	1:23	28.24	4.24	19.84	1:00	1979-12-22	11:28	3.65	12.75	5.94	13.75	3.40
1979-12-22	11:00	1:23	28.24	4.24	19.84	1:00	1979-12-23	11:28	3.65	12.75	5.94	13.75	3.40
1979-12-23	11:00	1:23	28.24	4.24	19.84	1:00	1979-12-24	11:28	3.65	12.75	5.94	13.75	3.40
1979-12-24	11:00	1:23	28.24	4.24	19.84	1:00	1979-12-25	11:28	3.65	12.75	5.94	13.75	3.40
1979-12-25	11:00	1:23	28.24	4.24	19.84	1:00	1979-12-26	11:28	3.65	12.75	5.94	13.75	3.40
1979-12-26	11:00	1:23	28.24	4.24	19.84	1:00	1979-12-27	11:28	3.65	12.75	5.94	13.75	3.40
1979-12-27	11:00	1:23	28.24	4.24	19.84	1:00	1979-12-28	11:28	3.65	12.75	5.94	13.75	3.40
1979-12-28	11:00	1:23	28.24	4.24	19.84	1:00	1979-12-29	11:28	3.65	12.75	5.94	13.75	3.40
1979-12-29	11:00	1:23	28.24	4.24	19.84	1:00	1979-12-30	11:28	3.65	12.75	5.94	13.75	3.40
1979-12-30	11:00	1:23	28.24	4.24	19.84	1:00	1979-12-31	11:28	3.65	12.75	5.94	13.75	3.40
1979-12-31	11:00	1:23	28.24	4.24	19.84	1:00	1980-01-01	11:28	3.65	12.75	5.94	13.75	3.40
1980-01-01	11:00	1:23	28.24	4.24	19.84	1:00	1980-01-02	11:28	3.65	12.75	5.94	13.75	3.40
1980-01-02	11:00	1:23	28.24	4.24	19.84	1:00	1980-01-03	11:28	3.65	12.75	5.94	13.75	3.40
1980-01-03	11:00	1:23	28.24	4.24	19.84	1:00	1980-01-04	11:28	3.65	12.75	5.94	13.75	3.40
1980-01-04	11:00	1:23	28.24	4.24	19.84	1:00	1980-01-05	11:28	3.65	12.75	5.94	13.75	3.40
1980-01-05	11:00	1:23	28.24	4.24	19.84	1:00	1980-01-06	11:28	3.65	12.75	5.94	13.75	3.40
1980-01-06	11:00	1:23	28.24	4.24	19.84	1:00	1980-01-07	11:28	3.65	12.75	5.94	13.75	3.40
1980-01-07	11:00	1:23	28.24	4.24	19.84	1:00	1980-01-08	11:28	3.65	12.75	5.94	13.75	3.40
1980-01-08	11:00	1:23	28.24	4.24	19.84	1:00	1980-01-09	11:28	3.65	12.75	5.94	13.75	3.40
1980-01-09	11:00	1:23	28.24	4.24	19.84	1:00	1980-01-10	11:28	3.65	12.75	5.94	13.7	

[illegible]

CEMs Data

Client Name		Gulf of UT Co. (in)		Location		MHQ (1)	
Start Date		GUT					
Run 1a		Run 2		Run 3		Run 4	
Site	Time	Down	Temperature	Site	Time	Down	Temperature
		in/ft	°C			in/ft	°C
28-Jan-24	10:45	1799.12	10.8	28-Jan-24	11:25	1389.7	10.7
28-Jan-24	11:41	1717.6	10.7	28-Jan-24	11:56	1388.8	10.6
28-Jan-24	12:41	1742.1	10.7	28-Jan-24	12:16	1387.6	10.5
28-Jan-24	13:41	1714.6	10.6	28-Jan-24	13:16	1373.5	10.3
28-Jan-24	14:41	1740.9	10.6	28-Jan-24	14:16	1374.2	10.4
28-Jan-24	15:41	1740.9	10.6	28-Jan-24	15:16	1377.7	10.5
28-Jan-24	16:41	1695.7	10.5	28-Jan-24	16:16	1368.5	10.4
28-Jan-24	17:41	1720.9	10.5	28-Jan-24	17:16	1368.5	10.4
28-Jan-24	18:41	1800.9	10.7	28-Jan-24	18:16	1368.5	10.4
28-Jan-24	19:41	1800.5	10.7	28-Jan-24	19:16	1368.5	10.4
28-Jan-24	20:41	1800.5	10.7	28-Jan-24	20:16	1368.5	10.4
28-Jan-24	21:41	1800.5	10.7	28-Jan-24	21:16	1368.5	10.4
28-Jan-24	22:41	1800.5	10.7	28-Jan-24	22:16	1368.5	10.4
28-Jan-24	23:41	1800.5	10.7	28-Jan-24	23:16	1368.5	10.4
28-Jan-24	00:41	1800.5	10.7	28-Jan-24	00:16	1368.5	10.4
28-Jan-24	01:41	1800.5	10.7	28-Jan-24	01:16	1368.5	10.4
28-Jan-24	02:41	1800.5	10.7	28-Jan-24	02:16	1368.5	10.4
28-Jan-24	03:41	1800.5	10.7	28-Jan-24	03:16	1368.5	10.4
28-Jan-24	04:41	1800.5	10.7	28-Jan-24	04:16	1368.5	10.4
28-Jan-24	05:41	1800.5	10.7	28-Jan-24	05:16	1368.5	10.4
28-Jan-24	06:41	1800.5	10.7	28-Jan-24	06:16	1368.5	10.4
28-Jan-24	07:41	1800.5	10.7	28-Jan-24	07:16	1368.5	10.4
28-Jan-24	08:41	1800.5	10.7	28-Jan-24	08:16	1368.5	10.4
28-Jan-24	09:41	1800.5	10.7	28-Jan-24	09:16	1368.5	10.4
28-Jan-24	10:41	1800.5	10.7	28-Jan-24	10:16	1368.5	10.4
28-Jan-24	11:41	1800.5	10.7	28-Jan-24	11:16	1368.5	10.4
28-Jan-24	12:41	1800.5	10.7	28-Jan-24	12:16	1368.5	10.4
28-Jan-24	13:41	1800.5	10.7	28-Jan-24	13:16	1368.5	10.4
28-Jan-24	14:41	1800.5	10.7	28-Jan-24	14:16	1368.5	10.4
28-Jan-24	15:41	1800.5	10.7	28-Jan-24	15:16	1368.5	10.4
28-Jan-24	16:41	1800.5	10.7	28-Jan-24	16:16	1368.5	10.4
28-Jan-24	17:41	1800.5	10.7	28-Jan-24	17:16	1368.5	10.4
28-Jan-24	18:41	1800.5	10.7	28-Jan-24	18:16	1368.5	10.4
28-Jan-24	19:41	1800.5	10.7	28-Jan-24	19:16	1368.5	10.4
28-Jan-24	20:41	1800.5	10.7	28-Jan-24	20:16	1368.5	10.4
28-Jan-24	21:41	1800.5	10.7	28-Jan-24	21:16	1368.5	10.4
28-Jan-24	22:41	1800.5	10.7	28-Jan-24	22:16	1368.5	10.4
28-Jan-24	23:41	1800.5	10.7	28-Jan-24	23:16	1368.5	10.4
28-Jan-24	00:41	1800.5	10.7	28-Jan-24	00:16	1368.5	10.4
28-Jan-24	01:41	1800.5	10.7	28-Jan-24	01:16	1368.5	10.4
28-Jan-24	02:41	1800.5	10.7	28-Jan-24	02:16	1368.5	10.4
28-Jan-24	03:41	1800.5	10.7	28-Jan-24	03:16	1368.5	10.4
28-Jan-24	04:41	1800.5	10.7	28-Jan-24	04:16	1368.5	10.4
28-Jan-24	05:41	1800.5	10.7	28-Jan-24	05:16	1368.5	10.4
28-Jan-24	06:41	1800.5	10.7	28-Jan-24	06:16	1368.5	10.4
28-Jan-24	07:41	1800.5	10.7	28-Jan-24	07:16	1368.5	10.4
28-Jan-24	08:41	1800.5	10.7	28-Jan-24	08:16	1368.5	10.4
28-Jan-24	09:41	1800.5	10.7	28-Jan-24	09:16	1368.5	10.4
28-Jan-24	10:41	1800.5	10.7	28-Jan-24	10:16	1368.5	10.4
28-Jan-24	11:41	1800.5	10.7	28-Jan-24	11:16	1368.5	10.4
28-Jan-24	12:41	1800.5	10.7	28-Jan-24	12:16	1368.5	10.4
28-Jan-24	13:41	1800.5	10.7	28-Jan-24	13:16	1368.5	10.4
28-Jan-24	14:41	1800.5	10.7	28-Jan-24	14:16	1368.5	10.4
28-Jan-24	15:41	1800.5	10.7	28-Jan-24	15:16	1368.5	10.4
28-Jan-24	16:41	1800.5	10.7	28-Jan-24	16:16	1368.5	10.4
28-Jan-24	17:41	1800.5	10.7	28-Jan-24	17:16	1368.5	10.4
28-Jan-24	18:41	1800.5	10.7	28-Jan-24	18:16	1368.5	10.4
28-Jan-24	19:41	1800.5	10.7	28-Jan-24	19:16	1368.5	10.4
28-Jan-24	20:41	1800.5	10.7	28-Jan-24	20:16	1368.5	10.4
28-Jan-24	21:41	1800.5	10.7	28-Jan-24	21:16	1368.5	10.4
28-Jan-24	22:41	1800.5	10.7	28-Jan-24	22:16	1368.5	10.4
28-Jan-24	23:41	1800.5	10.7	28-Jan-24	23:16	1368.5	10.4
28-Jan-24	00:41	1800.5	10.7	28-Jan-24	00:16	1368.5	10.4
28-Jan-24	01:41	1800.5	10.7	28-Jan-24	01:16	1368.5	10.4
28-Jan-24	02:41	1800.5	10.7	28-Jan-24	02:16	1368.5	10.4
28-Jan-24	03:41	1800.5	10.7	28-Jan-24	03:16	1368.5	10.4
28-Jan-24	04:41	1800.5	10.7	28-Jan-24	04:16	1368.5	10.4
28-Jan-24	05:41	1800.5	10.7	28-Jan-24	05:16	1368.5	10.4
28-Jan-24	06:41	1800.5	10.7	28-Jan-24	06:16	1368.5	10.4
28-Jan-24	07:41	1800.5	10.7	28-Jan-24	07:16	1368.5	10.4
28-Jan-24	08:41	1800.5	10.7	28-Jan-24	08:16	1368.5	10.4
28-Jan-24	09:41	1800.5	10.7	28-Jan-24	09:16	1368.5	10.4
28-Jan-24	10:41	1800.5	10.7	28-Jan-24	10:16	1368.5	10.4
28-Jan-24	11:41	1800.5	10.7	28-Jan-24	11:16	1368.5	10.4
28-Jan-24	12:41	1800.5	10.7	28-Jan-24	12:16	1368.5	10.4
28-Jan-24	13:41	1800.5	10.7	28-Jan-24	13:16	1368.5	10.4
28-Jan-24	14:41	1800.5	10.7	28-Jan-24	14:16	1368.5	10.4
28-Jan-24	15:41	1800.5	10.7	28-Jan-24	15:16	1368.5	10.4
28-Jan-24	16:41	1800.5	10.7	28-Jan-24	16:16	1368.5	10.4
28-Jan-24	17:41	1800.5	10.7	28-Jan-24	17:16	1368.5	10.4
28-Jan-24	18:41	1800.5	10.7	28-Jan-24	18:16	1368.5	10.4
28-Jan-24	19:41	1800.5	10.7	28-Jan-24	19:16	1368.5	10.4
28-Jan-24	20:41	1800.5	10.7	28-Jan-24	20:16	1368.5	10.4
28-Jan-24	21:41	1800.5	10.7	28-Jan-24	21:16	1368.5	10.4
28-Jan-24	22:41	1800.5	10.7	28-Jan-24	22:16	1368.5	10.4
28-Jan-24	23:41	1800.5	10.7	28-Jan-24	23:16	1368.5	10.4
28-Jan-24	00:41	1800.5	10.7	28-Jan-24	00:16	1368.5	10.4
28-Jan-24	01:41	1800.5	10.7	28-Jan-24	01:16	1368.5	10.4
28-Jan-24	02:41	1800.5	10.7	28-Jan-24	02:16	1368.5	10.4
28-Jan-24	03:41	1800.5	10.7	28-Jan-24	03:16	1368.5	10.4
28-Jan-24	04:41	1800.5	10.7	28-Jan-24	04:16	1368.5	10.4
28-Jan-24	05:41	1800.5	10.7	28-Jan-24	05:16	1368.5	10.4
28-Jan-24	06:41	1800.5	10.7	28-Jan-24	06:16	1368.5	10.4
28-Jan-24	07:41	1800.5	10.7	28-Jan-24	07:16	1368.5	10.4
28-Jan-24	08:41	1800.5	10.7	28-Jan-24	08:16	1368.5	10.4
28-Jan-24	09:41	1800.5	10.7	28-Jan-24	09:16	1368.5	10.4
28-Jan-24	10:41	1800.5	10.7	28-Jan-24	10:16	1368.5	10.4
28-Jan-24	11:41	1800.5	10.7	28-Jan-24	11:16	1368.5	10.4
28-Jan-24	12:41	1800.5	10.7	28-Jan-24	12:16	1368.5	10.4
28-Jan-24	13:41	1800.5	10.7	28-Jan-24	13:16	1368.5	10.4
28-Jan-24	14:41	1800.5	10.7	28-Jan-24	14:16	1368.5	10.4
28-Jan-24	15:41	1800.5	10.7	28-Jan-24	15:16	1368.5	10.4
28-Jan-24	16:41	1800.5	10.7	28-Jan-24	16:16	1368.5	10.4
28-Jan-24	17:41	1800.5	10.7	28-Jan-24	17:16	1368.5	10.4
28-Jan-24	18:41	1800.5	10.7	28-Jan-24	18:16	1368.5	10.4
28-Jan-24	19:41	1800.5	10.7	28-Jan-24	19:16	1368.5	10.4
28-Jan-24	20:41	1800.5	10.7	28-Jan-24	20:16	1368.5	10.4
28-Jan-24	21:41	1800.5	10.7	28-Jan-24	21:16	1368.5	10.4
28-Jan-24	22:41	1800.5	10.7	28-Jan-24	22:16	1368.5	10.4
28-Jan-24	23:41	1800.5	10.7	28-Jan-24	23:16	1368.5	10.4
28-Jan-24	00:41	1800.5	10.7	28-Jan-24	00:16	1368.5	10.4
28-Jan-24	01:41	1800.5	10.7	28-Jan-24	01:16	1368.5	10.4
28-Jan-24	02:41	1800.5	10.7	28-Jan-24	02:16	1368.5	10.4
28-Jan-24	03:41	1800.5	10.7	28-Jan-24	03:16	1368.5	10.4
28-Jan-24	04:41	1800.5	10.7	28-Jan-24	04:16	1368.5	10.4
28-Jan-24	05:41	1800.5	10.7	28-Jan-24	05:16	1368.5	10.4
28-Jan-24	06:41	1800.5	10.7	28-Jan-24	06:16	1368.5	10.4
28-Jan-24	07:41	1800.5	10.7	28-Jan-24	07:16	1368.5	10.4
28-Jan-24	08:41	1800.5	10.7	28-Jan-24	08:16	1368.5	10.4
28-Jan-24	09:41	1800.5	10.7	28-Jan-24	09:16	1368.5	10.4
28-Jan-24	10:41	1800.5	10.7	28-Jan-24	10:16	1368.5	10.4
28-Jan-24	11:41	1800.5	10.7	28-Jan-24	11:16	1368.5	10.4
28-Jan-24	12:41	1800.5	10.7	28-Jan-24	12:16	1368.5	10.4
28-Jan-24	13:41	1800.5	10.7	28-Jan-24	13:16	1368.5	10.4
28-Jan-24	14:41	1800.5	10.7	28-Jan-24	14:16	1368.5	10.4
28-Jan-24	15:41	1800.5	10.7	28-Jan-24	15:16	1368.5	10.4
28-Jan-24	16:41	1800.5	10.7	28-Jan-24	16:16	1368.5	10.4
28-Jan-24	17:41	1800.5	10.7	28-Jan-24	17:16	1368.5	10.4
28-Jan-24	18:41	1800.5	10.7	28-Jan-24	18:16	1368.5	10.4
28-Jan-24	19:41	1800.5	10.7	28-Jan-24	19:16	1368.5	10.4
28-Jan-24	20:41	1800.5	10.7	28-Jan-24	20:16	1368.5	10.4
28-Jan-24	21:41	1800.5	10.7	28-Jan-24	21:16	1368.5	10.4
28-Jan-24	22:41	1800.5	10.7	28-Jan-24	22:16	1368.5	10.4
28-Jan-24	23:41	1800.5	10.7	28-Jan-24	23:16	1368.5	10.4
28-Jan-24	00:41	1800.5	10.7	28-Jan-24	00:16	1368.5	10.4
28-Jan-24	01:41	1800.5	10.7	28-Jan-24	01:16	1368.5	10.4
28-Jan-24	02:41	1800.5	10.7	28-Jan-24	02:16	1368.5	10.4
28-Jan-24	03:41	1800.5	10.7	28-Jan-24	03:16	1368.5	10.4
28-Jan-24	04:41	1800.5	10.7	28-Jan-24	04:16	1368.5	10.4
28-Jan-24	05:41	1800.5	10.7	28-Jan-24	05:16	1368.5	10.4
28-Jan-24	06:41	1800.5	10.7	28-Jan-24	06:16	1368.5	10.4
28-Jan-24							

CEMs Data

Client Name		Gulf Oil Co. Ltd.		1606098		WRS2 (1)									
Plant Name		GUT													
Run No. 5				Run No. 6				Run No. 7				Run No. 8			
Date	Time	Pressure bar/hr	Temperature	Date	Time	Pressure bar/hr	Temperature	Date	Time	Pressure bar/hr	Temperature	Date	Time	Pressure bar/hr	Temperature
23-Feb-16	12:30	1.7700 E	80.7	28-Feb-16	12:30	1.7500 E	80.5	28-Feb-16	12:30	1.7300 E	80.5	28-Feb-16	12:30	1.6800 E	80.5
23-Feb-16	12:35	1.7800 E	80.7	28-Feb-16	12:35	1.7600 E	80.5	28-Feb-16	12:35	1.7200 E	80.5	28-Feb-16	12:35	1.6900 E	80.5
23-Feb-16	12:40	1.7900 E	80.7	28-Feb-16	12:40	1.7700 E	80.5	28-Feb-16	12:40	1.7300 E	80.5	28-Feb-16	12:40	1.7000 E	80.5
23-Feb-16	12:45	1.7900 E	80.7	28-Feb-16	12:45	1.7700 E	80.5	28-Feb-16	12:45	1.7300 E	80.5	28-Feb-16	12:45	1.7000 E	80.5
23-Feb-16	12:50	1.7900 E	80.7	28-Feb-16	12:50	1.7700 E	80.5	28-Feb-16	12:50	1.7300 E	80.5	28-Feb-16	12:50	1.7000 E	80.5
23-Feb-16	12:55	1.7900 E	80.7	28-Feb-16	12:55	1.7700 E	80.5	28-Feb-16	12:55	1.7300 E	80.5	28-Feb-16	12:55	1.7000 E	80.5
23-Feb-16	13:00	1.7900 E	80.7	28-Feb-16	13:00	1.7700 E	80.5	28-Feb-16	13:00	1.7300 E	80.5	28-Feb-16	13:00	1.7000 E	80.5
23-Feb-16	13:05	1.7900 E	80.7	28-Feb-16	13:05	1.7700 E	80.5	28-Feb-16	13:05	1.7300 E	80.5	28-Feb-16	13:05	1.7000 E	80.5
23-Feb-16	13:10	1.7900 E	80.7	28-Feb-16	13:10	1.7700 E	80.5	28-Feb-16	13:10	1.7300 E	80.5	28-Feb-16	13:10	1.7000 E	80.5
23-Feb-16	13:15	1.7900 E	80.7	28-Feb-16	13:15	1.7700 E	80.5	28-Feb-16	13:15	1.7300 E	80.5	28-Feb-16	13:15	1.7000 E	80.5
23-Feb-16	13:20	1.7900 E	80.7	28-Feb-16	13:20	1.7700 E	80.5	28-Feb-16	13:20	1.7300 E	80.5	28-Feb-16	13:20	1.7000 E	80.5
23-Feb-16	13:25	1.7900 E	80.7	28-Feb-16	13:25	1.7700 E	80.5	28-Feb-16	13:25	1.7300 E	80.5	28-Feb-16	13:25	1.7000 E	80.5
23-Feb-16	13:30	1.7900 E	80.7	28-Feb-16	13:30	1.7700 E	80.5	28-Feb-16	13:30	1.7300 E	80.5	28-Feb-16	13:30	1.7000 E	80.5
23-Feb-16	13:35	1.7900 E	80.7	28-Feb-16	13:35	1.7700 E	80.5	28-Feb-16	13:35	1.7300 E	80.5	28-Feb-16	13:35	1.7000 E	80.5
23-Feb-16	13:40	1.7900 E	80.7	28-Feb-16	13:40	1.7700 E	80.5	28-Feb-16	13:40	1.7300 E	80.5	28-Feb-16	13:40	1.7000 E	80.5
23-Feb-16	13:45	1.7900 E	80.7	28-Feb-16	13:45	1.7700 E	80.5	28-Feb-16	13:45	1.7300 E	80.5	28-Feb-16	13:45	1.7000 E	80.5
23-Feb-16	13:50	1.7900 E	80.7	28-Feb-16	13:50	1.7700 E	80.5	28-Feb-16	13:50	1.7300 E	80.5	28-Feb-16	13:50	1.7000 E	80.5
23-Feb-16	13:55	1.7900 E	80.7	28-Feb-16	13:55	1.7700 E	80.5	28-Feb-16	13:55	1.7300 E	80.5	28-Feb-16	13:55	1.7000 E	80.5
23-Feb-16	14:00	1.7900 E	80.7	28-Feb-16	14:00	1.7700 E	80.5	28-Feb-16	14:00	1.7300 E	80.5	28-Feb-16	14:00	1.7000 E	80.5
23-Feb-16	14:05	1.7900 E	80.7	28-Feb-16	14:05	1.7700 E	80.5	28-Feb-16	14:05	1.7300 E	80.5	28-Feb-16	14:05	1.7000 E	80.5
23-Feb-16	14:10	1.7900 E	80.7	28-Feb-16	14:10	1.7700 E	80.5	28-Feb-16	14:10	1.7300 E	80.5	28-Feb-16	14:10	1.7000 E	80.5
23-Feb-16	14:15	1.7900 E	80.7	28-Feb-16	14:15	1.7700 E	80.5	28-Feb-16	14:15	1.7300 E	80.5	28-Feb-16	14:15	1.7000 E	80.5
23-Feb-16	14:20	1.7900 E	80.7	28-Feb-16	14:20	1.7700 E	80.5	28-Feb-16	14:20	1.7300 E	80.5	28-Feb-16	14:20	1.7000 E	80.5
23-Feb-16	14:25	1.7900 E	80.7	28-Feb-16	14:25	1.7700 E	80.5	28-Feb-16	14:25	1.7300 E	80.5	28-Feb-16	14:25	1.7000 E	80.5
23-Feb-16	14:30	1.7900 E	80.7	28-Feb-16	14:30	1.7700 E	80.5	28-Feb-16	14:30	1.7300 E	80.5	28-Feb-16	14:30	1.7000 E	80.5
23-Feb-16	14:35	1.7900 E	80.7	28-Feb-16	14:35	1.7700 E	80.5	28-Feb-16	14:35	1.7300 E	80.5	28-Feb-16	14:35	1.7000 E	80.5
23-Feb-16	14:40	1.7900 E	80.7	28-Feb-16	14:40	1.7700 E	80.5	28-Feb-16	14:40	1.7300 E	80.5	28-Feb-16	14:40	1.7000 E	80.5
23-Feb-16	14:45	1.7900 E	80.7	28-Feb-16	14:45	1.7700 E	80.5	28-Feb-16	14:45	1.7300 E	80.5	28-Feb-16	14:45	1.7000 E	80.5
23-Feb-16	14:50	1.7900 E	80.7	28-Feb-16	14:50	1.7700 E	80.5	28-Feb-16	14:50	1.7300 E	80.5	28-Feb-16	14:50	1.7000 E	80.5
23-Feb-16	14:55	1.7900 E	80.7	28-Feb-16	14:55	1.7700 E	80.5	28-Feb-16	14:55	1.7300 E	80.5	28-Feb-16	14:55	1.7000 E	80.5
23-Feb-16	15:00	1.7900 E	80.7	28-Feb-16	15:00	1.7700 E	80.5	28-Feb-16	15:00	1.7300 E	80.5	28-Feb-16	15:00	1.7000 E	80.5
23-Feb-16	15:05	1.7900 E	80.7	28-Feb-16	15:05	1.7700 E	80.5	28-Feb-16	15:05	1.7300 E	80.5	28-Feb-16	15:05	1.7000 E	80.5
23-Feb-16	15:10	1.7900 E	80.7	28-Feb-16	15:10	1.7700 E	80.5	28-Feb-16	15:10	1.7300 E	80.5	28-Feb-16	15:10	1.7000 E	80.5
23-Feb-16	15:15	1.7900 E	80.7	28-Feb-16	15:15	1.7700 E	80.5	28-Feb-16	15:15	1.7300 E	80.5	28-Feb-16	15:15	1.7000 E	80.5
23-Feb-16	15:20	1.7900 E	80.7	28-Feb-16	15:20	1.7700 E	80.5	28-Feb-16	15:20	1.7300 E	80.5	28-Feb-16	15:20	1.7000 E	80.5
23-Feb-16	15:25	1.7900 E	80.7	28-Feb-16	15:25	1.7700 E	80.5	28-Feb-16	15:25	1.7300 E	80.5	28-Feb-16	15:25	1.7000 E	80.5
23-Feb-16	15:30	1.7900 E	80.7	28-Feb-16	15:30	1.7700 E	80.5	28-Feb-16	15:30	1.7300 E	80.5	28-Feb-16	15:30	1.7000 E	80.5
23-Feb-16	15:35	1.7900 E	80.7	28-Feb-16	15:35	1.7700 E	80.5	28-Feb-16	15:35	1.7300 E	80.5	28-Feb-16	15:35	1.7000 E	80.5
23-Feb-16	15:40	1.7900 E	80.7	28-Feb-16	15:40	1.7700 E	80.5	28-Feb-16	15:40	1.7300 E	80.5	28-Feb-16	15:40	1.7000 E	80.5
23-Feb-16	15:45	1.7900 E	80.7	28-Feb-16	15:45	1.7700 E	80.5	28-Feb-16	15:45	1.7300 E	80.5	28-Feb-16	15:45	1.7000 E	80.5
23-Feb-16	15:50	1.7900 E	80.7	28-Feb-16	15:50	1.7700 E	80.5	28-Feb-16	15:50	1.7300 E	80.5	28-Feb-16	15:50	1.7000 E	80.5
23-Feb-16	15:55	1.7900 E	80.7	28-Feb-16	15:55	1.7700 E	80.5	28-Feb-16	15:55	1.7300 E	80.5	28-Feb-16	15:55	1.7000 E	80.5
23-Feb-16	16:00	1.7900 E	80.7	28-Feb-16	16:00	1.7700 E	80.5	28-Feb-16	16:00	1.7300 E	80.5	28-Feb-16	16:00	1.7000 E	80.5
23-Feb-16	16:05	1.7900 E	80.7	28-Feb-16	16:05	1.7700 E	80.5	28-Feb-16	16:05	1.7300 E	80.5	28-Feb-16	16:05	1.7000 E	80.5
23-Feb-16	16:10	1.7900 E	80.7	28-Feb-16	16:10	1.7700 E	80.5	28-Feb-16	16:10	1.7300 E	80.5	28-Feb-16	16:10	1.7000 E	80.5
23-Feb-16	16:15	1.7900 E	80.7	28-Feb-16	16:15	1.7700 E	80.5	28-Feb-16	16:15	1.7300 E	80.5	28-Feb-16	16:15	1.7000 E	80.5
23-Feb-16	16:20	1.7900 E	80.7	28-Feb-16	16:20	1.7700 E	80.5	28-Feb-16	16:20	1.7300 E	80.5	28-Feb-16	16:20	1.7000 E	80.5
23-Feb-16	16:25	1.7900 E	80.7	28-Feb-16	16:25	1.7700 E	80.5	28-Feb-16	16:25	1.7300 E	80.5	28-Feb-16	16:25	1.7000 E	80.5
23-Feb-16	16:30	1.7900 E	80.7	28-Feb-16	16:30	1.7700 E	80.5	28-Feb-16	16:30	1.7300 E	80.5	28-Feb-16	16:30	1.7000 E	80.5
23-Feb-16	16:35	1.7900 E	80.7	28-Feb-16	16:35	1.7700 E	80.5	28-Feb-16	16:35	1.7300 E	80.5	28-Feb-16	16:35	1.7000 E	80.5
23-Feb-16	16:40	1.7900 E	80.7	28-Feb-16	16:40	1.7700 E	80.5	28-Feb-16	16:40	1.7300 E	80.5	28-Feb-16	16:40	1.7000 E	80.5
23-Feb-16	16:45	1.7900 E	80.7	28-Feb-16	16:45	1.7700 E	80.5	28-Feb-16	16:45	1.7300 E	80.5	28-Feb-16	16:45	1.7000 E	80.5
23-Feb-16	16:50	1.7900 E	80.7	28-Feb-16	16:50	1.7700 E	80.5	28-Feb-16	16:50	1.7300 E	80.5	28-Feb-16	16:50	1.7000 E	80.5
23-Feb-16	16:55	1.7900 E	80.7	28-Feb-16	16:55	1.7700 E	80.5	28-Feb-16	16:55	1.7300 E	80.5	28-Feb-16	16:55	1.7000 E	80.5
23-Feb-16	17:00	1.7900 E	80.7	28-Feb-16	17:00	1.7700 E	80.5	28-Feb-16	17:00	1.7300 E	80.5	28-Feb-16	17:00	1.7000 E	80.5
23-Feb-16	17:05	1.7900 E	80.7	28-Feb-16	17:05	1.7700 E	80.5	28-Feb-16	17:05	1.7300 E	80.5	28-Feb-16	17:05	1.7000 E	80.5
23-Feb-16	17:10	1.7900 E	80.7	28-Feb-16	17:10	1.7700 E	80.5	28-Feb-16	17:10	1.7300 E	80.5	28-Feb-16	17:10	1.7000 E	80.5
23-Feb-16	17:15	1.7900 E	80.7	28-Feb-16	17:15	1.7700 E	80.5	28-Feb-16	17:15	1.7300 E	80.5	28-Feb-16	17:15	1.7000 E	80.5
23-Feb-16	17:20	1.7900 E	80.7	28-Feb-16	17:20	1.7700 E	80.5	28-Feb-16	17:20	1.7300 E	80.5	28-Feb-16	17:20	1.7000 E	80.5
23-Feb-16	17:25	1.7900 E	80.7	28-Feb-16	17:25	1.7700 E	80.5	28-Feb-16	17:25	1.7300 E	80.5	28-Feb-16	17:25	1.7000 E	80.5
23-Feb-16	17:30	1.7900 E	80.7	28-Feb-16	17:30	1.7700 E	80.5	28-Feb-16	17:30	1.7300 E	80.5	28-Feb-16	17:30	1.7000 E	80.5
23-Feb-16	17:35	1.7900 E	80.7	28-Feb-16	17:35	1.7700 E	80.5	28-Feb-16	17:35	1.7300 E	80.5	28-Feb-16	17:35	1.7000 E	80.5
23-Feb-16	17:40	1.7900 E	80.7	28-Feb-16	17:40	1.7700 E	80.5	28-Feb-16	17:40	1.7300 E	80.5	28-Feb-16	17:40	1.7000 E	80.5
23-Feb-16	17:45	1.7900 E	80.7	28-Feb-16	17:45	1.7700 E	80.5	28-Feb-16	17:45	1.7300 E	80.5	28-Feb-16	17:45	1.7000 E	80.5
23-Feb-16	17:50	1.7900 E	80.7	28-Feb-16	17:50	1.7700 E	80.5	28-Feb-16	17:50	1.7300 E	80.5	28-Feb-16	17:50	1.7000 E	80.5
23-Feb-16	17:55	1.7900 E	80.7	28-Feb-16	17:55	1.7700 E	80.5	28-Feb-16	17:55	1.7300 E	80.5	28-Feb-16	17:55	1.7000 E	80.5
23-Feb-16	18:00	1.7900 E	80.7	28-Feb-16	18:00	1.7700 E	80.5	28-Feb-16	18:00	1.7300 E	80.5	28-Feb-16	18:00	1.7000 E	80.5
23-Feb-16	18:05	1.7900 E	80.7	28-Feb-16	18:05	1.7700 E	80.5	28-Feb-16	18:05	1.7300 E	80.5	28-Feb-16	18:05	1.7000 E	80.5
23-Feb-16	18:10	1.7900 E	80.7	28-Feb-16	18:10	1.7700 E	80.5	28-Feb-16	18:10	1.7300 E	80.5	28-Feb-16	18:10	1.7000 E	80.5
23-Feb-16	18:15	1.7900 E	80.7	28-Feb-16	18:15	1.7700 E	80.5	28-Feb-16	18:15	1.7300 E	80.5	28-Feb-16	18:15	1.7000 E	80.5
23-Feb-16	18:20	1.7900 E	80.7	28-Feb-16	18:20	1.7700 E	8								



CEMs Data

Client Name: Gulf IP UT Co. Ltd.
Plant Name: GUT

Location: HRSG 11

Run No. 10				Run No. 11				Run No. 12			
Date	Time	Fluegas Flow No.	Temperature °C	Date	Time	Fluegas Flow No.	Temperature °C	Date	Time	Fluegas Flow No.	Temperature °C
28-Feb-24	13:20	1708.8	85.2	28-Feb-24	13:20	1724.2	85.9	28-Feb-24	13:20	1717.1	85.9
28-Feb-24	13:21	1717.7	85.2	28-Feb-24	13:21	1727.9	86.4	28-Feb-24	13:21	1695.0	85.8
28-Feb-24	13:22	1722.3	85.2	28-Feb-24	13:22	1734.8	86.5	28-Feb-24	13:22	1697.1	85.8
28-Feb-24	13:23	1731.2	85.3	28-Feb-24	13:23	1743.1	86.5	28-Feb-24	13:23	1699.2	85.8
28-Feb-24	13:24	1739.2	85.3	28-Feb-24	13:24	1751.5	86.5	28-Feb-24	13:24	1701.4	85.8
28-Feb-24	13:25	1749.1	85.3	28-Feb-24	13:25	1759.9	86.5	28-Feb-24	13:25	1703.9	85.8
28-Feb-24	13:26	1759.2	85.2	28-Feb-24	13:26	1767.4	86.5	28-Feb-24	13:26	1706.3	85.8
28-Feb-24	13:27	1768.9	85.2	28-Feb-24	13:27	1775.9	86.5	28-Feb-24	13:27	1708.9	85.8
28-Feb-24	13:28	1778.9	85.2	28-Feb-24	13:28	1783.8	86.5	28-Feb-24	13:28	1711.4	85.8
28-Feb-24	13:29	1788.9	85.2	28-Feb-24	13:29	1791.8	86.5	28-Feb-24	13:29	1713.9	85.8
28-Feb-24	13:30	1798.9	85.2	28-Feb-24	13:30	1799.8	86.5	28-Feb-24	13:30	1716.4	85.8
28-Feb-24	13:31	1808.9	85.2	28-Feb-24	13:31	1807.8	86.5	28-Feb-24	13:31	1718.9	85.8
28-Feb-24	13:32	1818.9	85.2	28-Feb-24	13:32	1815.8	86.5	28-Feb-24	13:32	1721.4	85.8
28-Feb-24	13:33	1828.9	85.2	28-Feb-24	13:33	1823.8	86.5	28-Feb-24	13:33	1723.9	85.8
28-Feb-24	13:34	1838.9	85.2	28-Feb-24	13:34	1831.8	86.5	28-Feb-24	13:34	1726.4	85.8
28-Feb-24	13:35	1848.9	85.2	28-Feb-24	13:35	1841.8	86.5	28-Feb-24	13:35	1728.9	85.8
28-Feb-24	13:36	1858.9	85.2	28-Feb-24	13:36	1851.8	86.5	28-Feb-24	13:36	1731.4	85.8
28-Feb-24	13:37	1868.9	85.2	28-Feb-24	13:37	1861.8	86.5	28-Feb-24	13:37	1733.9	85.8
28-Feb-24	13:38	1878.9	85.2	28-Feb-24	13:38	1871.8	86.5	28-Feb-24	13:38	1736.4	85.8
28-Feb-24	13:39	1888.9	85.2	28-Feb-24	13:39	1881.8	86.5	28-Feb-24	13:39	1738.9	85.8
28-Feb-24	13:40	1898.9	85.2	28-Feb-24	13:40	1891.8	86.5	28-Feb-24	13:40	1741.4	85.8
28-Feb-24	13:41	1908.9	85.2	28-Feb-24	13:41	1901.8	86.5	28-Feb-24	13:41	1743.9	85.8
28-Feb-24	13:42	1918.9	85.2	28-Feb-24	13:42	1911.8	86.5	28-Feb-24	13:42	1746.4	85.8
28-Feb-24	13:43	1928.9	85.2	28-Feb-24	13:43	1921.8	86.5	28-Feb-24	13:43	1748.9	85.8
28-Feb-24	13:44	1938.9	85.2	28-Feb-24	13:44	1931.8	86.5	28-Feb-24	13:44	1751.4	85.8
28-Feb-24	13:45	1948.9	85.2	28-Feb-24	13:45	1941.8	86.5	28-Feb-24	13:45	1753.9	85.8
28-Feb-24	13:46	1958.9	85.2	28-Feb-24	13:46	1951.8	86.5	28-Feb-24	13:46	1756.4	85.8
28-Feb-24	13:47	1968.9	85.2	28-Feb-24	13:47	1961.8	86.5	28-Feb-24	13:47	1758.9	85.8
28-Feb-24	13:48	1978.9	85.2	28-Feb-24	13:48	1971.8	86.5	28-Feb-24	13:48	1761.4	85.8
28-Feb-24	13:49	1988.9	85.2	28-Feb-24	13:49	1981.8	86.5	28-Feb-24	13:49	1763.9	85.8
28-Feb-24	13:50	1998.9	85.2	28-Feb-24	13:50	1991.8	86.5	28-Feb-24	13:50	1766.4	85.8
28-Feb-24	13:51	2008.9	85.2	28-Feb-24	13:51	2001.8	86.5	28-Feb-24	13:51	1768.9	85.8
28-Feb-24	13:52	2018.9	85.2	28-Feb-24	13:52	2011.8	86.5	28-Feb-24	13:52	1771.4	85.8
28-Feb-24	13:53	2028.9	85.2	28-Feb-24	13:53	2021.8	86.5	28-Feb-24	13:53	1773.9	85.8
28-Feb-24	13:54	2038.9	85.2	28-Feb-24	13:54	2031.8	86.5	28-Feb-24	13:54	1776.4	85.8
28-Feb-24	13:55	2048.9	85.2	28-Feb-24	13:55	2041.8	86.5	28-Feb-24	13:55	1778.9	85.8
28-Feb-24	13:56	2058.9	85.2	28-Feb-24	13:56	2051.8	86.5	28-Feb-24	13:56	1781.4	85.8
28-Feb-24	13:57	2068.9	85.2	28-Feb-24	13:57	2061.8	86.5	28-Feb-24	13:57	1783.9	85.8
28-Feb-24	13:58	2078.9	85.2	28-Feb-24	13:58	2071.8	86.5	28-Feb-24	13:58	1786.4	85.8
28-Feb-24	13:59	2088.9	85.2	28-Feb-24	13:59	2081.8	86.5	28-Feb-24	13:59	1788.9	85.8
28-Feb-24	14:00	2098.9	85.2	28-Feb-24	14:00	2091.8	86.5	28-Feb-24	14:00	1791.4	85.8
28-Feb-24	14:01	2108.9	85.2	28-Feb-24	14:01	2101.8	86.5	28-Feb-24	14:01	1793.9	85.8
28-Feb-24	14:02	2118.9	85.2	28-Feb-24	14:02	2111.8	86.5	28-Feb-24	14:02	1796.4	85.8
28-Feb-24	14:03	2128.9	85.2	28-Feb-24	14:03	2121.8	86.5	28-Feb-24	14:03	1798.9	85.8
28-Feb-24	14:04	2138.9	85.2	28-Feb-24	14:04	2131.8	86.5	28-Feb-24	14:04	1801.4	85.8
28-Feb-24	14:05	2148.9	85.2	28-Feb-24	14:05	2141.8	86.5	28-Feb-24	14:05	1803.9	85.8
28-Feb-24	14:06	2158.9	85.2	28-Feb-24	14:06	2151.8	86.5	28-Feb-24	14:06	1806.4	85.8
28-Feb-24	14:07	2168.9	85.2	28-Feb-24	14:07	2161.8	86.5	28-Feb-24	14:07	1808.9	85.8
28-Feb-24	14:08	2178.9	85.2	28-Feb-24	14:08	2171.8	86.5	28-Feb-24	14:08	1811.4	85.8
28-Feb-24	14:09	2188.9	85.2	28-Feb-24	14:09	2181.8	86.5	28-Feb-24	14:09	1813.9	85.8
28-Feb-24	14:10	2198.9	85.2	28-Feb-24	14:10	2191.8	86.5	28-Feb-24	14:10	1816.4	85.8
28-Feb-24	14:11	2208.9	85.2	28-Feb-24	14:11	2201.8	86.5	28-Feb-24	14:11	1818.9	85.8
28-Feb-24	14:12	2218.9	85.2	28-Feb-24	14:12	2211.8	86.5	28-Feb-24	14:12	1821.4	85.8
28-Feb-24	14:13	2228.9	85.2	28-Feb-24	14:13	2221.8	86.5	28-Feb-24	14:13	1823.9	85.8
28-Feb-24	14:14	2238.9	85.2	28-Feb-24	14:14	2231.8	86.5	28-Feb-24	14:14	1826.4	85.8
28-Feb-24	14:15	2248.9	85.2	28-Feb-24	14:15	2241.8	86.5	28-Feb-24	14:15	1828.9	85.8
28-Feb-24	14:16	2258.9	85.2	28-Feb-24	14:16	2251.8	86.5	28-Feb-24	14:16	1831.4	85.8
28-Feb-24	14:17	2268.9	85.2	28-Feb-24	14:17	2261.8	86.5	28-Feb-24	14:17	1833.9	85.8
28-Feb-24	14:18	2278.9	85.2	28-Feb-24	14:18	2271.8	86.5	28-Feb-24	14:18	1836.4	85.8
28-Feb-24	14:19	2288.9	85.2	28-Feb-24	14:19	2281.8	86.5	28-Feb-24	14:19	1838.9	85.8
28-Feb-24	14:20	2298.9	85.2	28-Feb-24	14:20	2291.8	86.5	28-Feb-24	14:20	1841.4	85.8
28-Feb-24	14:21	2308.9	85.2	28-Feb-24	14:21	2301.8	86.5	28-Feb-24	14:21	1843.9	85.8
28-Feb-24	14:22	2318.9	85.2	28-Feb-24	14:22	2311.8	86.5	28-Feb-24	14:22	1846.4	85.8
28-Feb-24	14:23	2328.9	85.2	28-Feb-24	14:23	2321.8	86.5	28-Feb-24	14:23	1848.9	85.8
28-Feb-24	14:24	2338.9	85.2	28-Feb-24	14:24	2331.8	86.5	28-Feb-24	14:24	1851.4	85.8
28-Feb-24	14:25	2348.9	85.2	28-Feb-24	14:25	2341.8	86.5	28-Feb-24	14:25	1853.9	85.8
28-Feb-24	14:26	2358.9	85.2	28-Feb-24	14:26	2351.8	86.5	28-Feb-24	14:26	1856.4	85.8
28-Feb-24	14:27	2368.9	85.2	28-Feb-24	14:27	2361.8	86.5	28-Feb-24	14:27	1858.9	85.8
28-Feb-24	14:28	2378.9	85.2	28-Feb-24	14:28	2371.8	86.5	28-Feb-24	14:28	1861.4	85.8
28-Feb-24	14:29	2388.9	85.2	28-Feb-24	14:29	2381.8	86.5	28-Feb-24	14:29	1863.9	85.8
28-Feb-24	14:30	2398.9	85.2	28-Feb-24	14:30	2391.8	86.5	28-Feb-24	14:30	1866.4	85.8
28-Feb-24	14:31	2408.9	85.2	28-Feb-24	14:31	2401.8	86.5	28-Feb-24	14:31	1868.9	85.8
28-Feb-24	14:32	2418.9	85.2	28-Feb-24	14:32	2411.8	86.5	28-Feb-24	14:32	1871.4	85.8
28-Feb-24	14:33	2428.9	85.2	28-Feb-24	14:33	2421.8	86.5	28-Feb-24	14:33	1873.9	85.8
28-Feb-24	14:34	2438.9	85.2	28-Feb-24	14:34	2431.8	86.5	28-Feb-24	14:34	1876.4	85.8
28-Feb-24	14:35	2448.9	85.2	28-Feb-24	14:35	2441.8	86.5	28-Feb-24	14:35	1878.9	85.8
28-Feb-24	14:36	2458.9	85.2	28-Feb-24	14:36	2451.8	86.5	28-Feb-24	14:36	1881.4	85.8
28-Feb-24	14:37	2468.9	85.2	28-Feb-24	14:37	2461.8	86.5	28-Feb-24	14:37	1883.9	85.8
28-Feb-24	14:38	2478.9	85.2	28-Feb-24	14:38	2471.8	86.5	28-Feb-24	14:38	1886.4	85.8
28-Feb-24	14:39	2488.9	85.2	28-Feb-24	14:39	2481.8	86.5	28-Feb-24	14:39	1888.9	85.8
28-Feb-24	14:40	2498.9	85.2	28-Feb-24	14:40	2491.8	86.5	28-Feb-24	14:40	1891.4	85.8
28-Feb-24	14:41	2508.9	85.2	28-Feb-24	14:41	2501.8	86.5	28-Feb-24	14:41	1893.9	85.8
28-Feb-24	14:42	2518.9	85.2	28-Feb-24	14:42	2511.8	86.5	28-Feb-24	14:42	1896.4	85.8
28-Feb-24	14:43	2528.9	85.2	28-Feb-24	14:43	2521.8	86.5	28-Feb-24	14:43	1898.9	85.8
28-Feb-24	14:44	2538.9	85.2	28-Feb-24	14:44	2531.8	86.5	28-Feb-24	14:44	1901.4	85.8
28-Feb-24	14:45	2548.9	85.2	28-Feb-24	14:45	2541.8	86.5	28-Feb-24	14:45	1903.9	85.8
28-Feb-24	14:46	2558.9	85.2	28-Feb-24	14:46	2551.8	86.5	28-Feb-24	14:46	1906.4	85.8
28-Feb-24	14:47	2568.9	85.2	28-Feb-24	14:47	2561.8	86.5	28-Feb-24	14:47	1908.9	85.8
28-Feb-24	14:48	2578.9	85.2	28-Feb-24	14:48	2571.8	86.5	28-Feb-24	14:48	1911.4	85.8
28-Feb-24	14:49	2588.9	85.2	28-Feb-24	14:49	2581.8	86.5	28-Feb-24	14:49	1913.9	85.8
28-Feb-24	14:50	2598.9	85.2	28-Feb-24	14:50	2591.8	86.5	28-Feb-24	14:50	1916.4	85.8
28-Feb-24	14:51	2608.9	85.2	28-Feb-24	14:51	2601.8	86.5	28-Feb-24	14:51	1918.9	85.8
28-Feb-24	14:52	2618.9	85.2	28-Feb-24	14:52	2611.8	86.5	28-Feb-24	14:52	1921.4	85.8
28-Feb-24	14:53	2628.9	85.2	28-Feb-24	14:53	2621.8	86.5	28-Feb-24	14:53	1923.9	85.8
28-Feb-24	14:54										

Run #1				Run #2				Run #3				Run #4			
Date	Time	Flowrate	Temperature	Date	Time	Flowrate	Temperature	Date	Time	Flowrate	Temperature	Date	Time	Flowrate	Temperature
10/26/20	10:10	1.118	80.0	10/26/20	10:10	1.131	80.0	10/26/20	11:41	1.067	80.0	10/26/20	12:01	1.077	80.0
10/26/20	10:11	1.100	80.0	10/26/20	10:12	1.057	80.0	10/26/20	11:42	1.091	80.0	10/26/20	12:02	1.034	80.0
10/26/20	10:12	1.118	80.0	10/26/20	10:13	1.051	80.0	10/26/20	11:43	1.090	80.0	10/26/20	12:03	1.064	80.0
10/26/20	10:13	1.100	80.0	10/26/20	10:14	1.056	80.0	10/26/20	11:44	1.093	80.0	10/26/20	12:04	1.096	80.0
10/26/20	10:14	1.100	80.0	10/26/20	10:15	1.053	80.0	10/26/20	11:45	1.094	80.0	10/26/20	12:05	1.074	80.0
10/26/20	10:15	1.100	80.0	10/26/20	10:16	1.053	80.0	10/26/20	11:46	1.094	80.0	10/26/20	12:06	1.074	80.0
10/26/20	10:16	1.100	80.0	10/26/20	10:17	1.053	80.0	10/26/20	11:47	1.094	80.0	10/26/20	12:07	1.096	80.0
10/26/20	10:17	1.100	80.0	10/26/20	10:18	1.053	80.0	10/26/20	11:48	1.094	80.0	10/26/20	12:08	1.096	80.0
10/26/20	10:18	1.100	80.0	10/26/20	10:19	1.053	80.0	10/26/20	11:49	1.094	80.0	10/26/20	12:09	1.096	80.0
10/26/20	10:19	1.100	80.0	10/26/20	10:20	1.053	80.0	10/26/20	11:50	1.094	80.0	10/26/20	12:10	1.096	80.0
10/26/20	10:20	1.100	80.0	10/26/20	10:21	1.053	80.0	10/26/20	11:51	1.094	80.0	10/26/20	12:11	1.096	80.0
10/26/20	10:21	1.100	80.0	10/26/20	10:22	1.053	80.0	10/26/20	11:52	1.094	80.0	10/26/20	12:12	1.096	80.0
10/26/20	10:22	1.100	80.0	10/26/20	10:23	1.053	80.0	10/26/20	11:53	1.094	80.0	10/26/20	12:13	1.096	80.0
10/26/20	10:23	1.100	80.0	10/26/20	10:24	1.053	80.0	10/26/20	11:54	1.094	80.0	10/26/20	12:14	1.096	80.0
10/26/20	10:24	1.100	80.0	10/26/20	10:25	1.053	80.0	10/26/20	11:55	1.094	80.0	10/26/20	12:15	1.096	80.0
10/26/20	10:25	1.100	80.0	10/26/20	10:26	1.053	80.0	10/26/20	11:56	1.094	80.0	10/26/20	12:16	1.096	80.0
10/26/20	10:26	1.100	80.0	10/26/20	10:27	1.053	80.0	10/26/20	11:57	1.094	80.0	10/26/20	12:17	1.096	80.0
10/26/20	10:27	1.100	80.0	10/26/20	10:28	1.053	80.0	10/26/20	11:58	1.094	80.0	10/26/20	12:18	1.096	80.0
10/26/20	10:28	1.100	80.0	10/26/20	10:29	1.053	80.0	10/26/20	11:59	1.094	80.0	10/26/20	12:19	1.096	80.0
10/26/20	10:29	1.100	80.0	10/26/20	10:30	1.053	80.0	10/26/20	12:00	1.094	80.0	10/26/20	12:20	1.096	80.0
10/26/20	10:30	1.100	80.0	10/26/20	10:31	1.053	80.0	10/26/20	12:01	1.094	80.0	10/26/20	12:21	1.096	80.0
10/26/20	10:31	1.100	80.0	10/26/20	10:32	1.053	80.0	10/26/20	12:02	1.094	80.0	10/26/20	12:22	1.	

CEMs Data

Chart Name	Gut JP UT Co. Ltd
Plant Name	GUT

Location 44852.73

1000

1998, 1999, 2000, 2001, 2002, 2003, 2004, 2005, 2006, 2007, 2008, 2009, 2010, 2011, 2012, 2013, 2014, 2015, 2016, 2017, 2018, 2019, 2020, 2021, 2022, 2023, 2024, 2025, 2026, 2027, 2028, 2029, 2030, 2031, 2032, 2033, 2034, 2035, 2036, 2037, 2038, 2039, 2040, 2041, 2042, 2043, 2044, 2045, 2046, 2047, 2048, 2049, 2050, 2051, 2052, 2053, 2054, 2055, 2056, 2057, 2058, 2059, 2060, 2061, 2062, 2063, 2064, 2065, 2066, 2067, 2068, 2069, 2070, 2071, 2072, 2073, 2074, 2075, 2076, 2077, 2078, 2079, 2080, 2081, 2082, 2083, 2084, 2085, 2086, 2087, 2088, 2089, 2090, 2091, 2092, 2093, 2094, 2095, 2096, 2097, 2098, 2099, 2100, 2101, 2102, 2103, 2104, 2105, 2106, 2107, 2108, 2109, 2110, 2111, 2112, 2113, 2114, 2115, 2116, 2117, 2118, 2119, 2120, 2121, 2122, 2123, 2124, 2125, 2126, 2127, 2128, 2129, 2130, 2131, 2132, 2133, 2134, 2135, 2136, 2137, 2138, 2139, 2140, 2141, 2142, 2143, 2144, 2145, 2146, 2147, 2148, 2149, 2150, 2151, 2152, 2153, 2154, 2155, 2156, 2157, 2158, 2159, 2160, 2161, 2162, 2163, 2164, 2165, 2166, 2167, 2168, 2169, 2170, 2171, 2172, 2173, 2174, 2175, 2176, 2177, 2178, 2179, 2180, 2181, 2182, 2183, 2184, 2185, 2186, 2187, 2188, 2189, 2190, 2191, 2192, 2193, 2194, 2195, 2196, 2197, 2198, 2199, 2200, 2201, 2202, 2203, 2204, 2205, 2206, 2207, 2208, 2209, 2210, 2211, 2212, 2213, 2214, 2215, 2216, 2217, 2218, 2219, 2220, 2221, 2222, 2223, 2224, 2225, 2226, 2227, 2228, 2229, 2230, 2231, 2232, 2233, 2234, 2235, 2236, 2237, 2238, 2239, 2240, 2241, 2242, 2243, 2244, 2245, 2246, 2247, 2248, 2249, 2250, 2251, 2252, 2253, 2254, 2255, 2256, 2257, 2258, 2259, 2260, 2261, 2262, 2263, 2264, 2265, 2266, 2267, 2268, 2269, 2270, 2271, 2272, 2273, 2274, 2275, 2276, 2277, 2278, 2279, 2280, 2281, 2282, 2283, 2284, 2285, 2286, 2287, 2288, 2289, 2290, 2291, 2292, 2293, 2294, 2295, 2296, 2297, 2298, 2299, 2300, 2301, 2302, 2303, 2304, 2305, 2306, 2307, 2308, 2309, 2310, 2311, 2312, 2313, 2314, 2315, 2316, 2317, 2318, 2319, 2320, 2321, 2322, 2323, 2324, 2325, 2326, 2327, 2328, 2329, 2330, 2331, 2332, 2333, 2334, 2335, 2336, 2337, 2338, 2339, 2340, 2341, 2342, 2343, 2344, 2345, 2346, 2347, 2348, 2349, 2350, 2351, 2352, 2353, 2354, 2355, 2356, 2357, 2358, 2359, 2360, 2361, 2362, 2363, 2364, 2365, 2366, 2367, 2368, 2369, 2370, 2371, 2372, 2373, 2374, 2375, 2376, 2377, 2378, 2379, 2380, 2381, 2382, 2383, 2384, 2385, 2386, 2387, 2388, 2389, 2390, 2391, 2392, 2393, 2394, 2395, 2396, 2397, 2398, 2399, 2400, 2401, 2402, 2403, 2404, 2405, 2406, 2407, 2408, 2409, 2410, 2411, 2412, 2413, 2414, 2415, 2416, 2417, 2418, 2419, 2420, 2421, 2422, 2423, 2424, 2425, 2426, 2427, 2428, 2429, 2430, 2431, 2432, 2433, 2434, 2435, 2436, 2437, 2438, 2439, 2440, 2441, 2442, 2443, 2444, 2445, 2446, 2447, 2448, 2449, 2450, 2451, 2452, 2453, 2454, 2455, 2456, 2457, 2458, 2459, 2460, 2461, 2462, 2463, 2464, 2465, 2466, 2467, 2468, 2469, 2470, 2471, 2472, 2473, 2474, 2475, 2476, 2477, 2478, 2479, 2480, 2481, 2482, 2483, 2484, 2485, 2486, 2487, 2488, 2489, 2490, 2491, 2492, 2493, 2494, 2495, 2496, 2497, 2498, 2499, 2500, 2501, 2502, 2503, 2504, 2505, 2506, 2507, 2508, 2509, 2510, 2511, 2512, 2513, 2514, 2515, 2516, 2517, 2518, 2519, 2520, 2521, 2522, 2523, 2524, 2525, 2526, 2527, 2528, 2529, 2530, 2531, 2532, 2533, 2534, 2535, 2536, 2537, 2538, 2539, 2540, 2541, 2542, 2543, 2544, 2545, 2546, 2547, 2548, 2549, 2550, 2551, 2552, 2553, 2554, 2555, 2556, 2557, 2558, 2559, 2560, 2561, 2562, 2563, 2564, 2565, 2566, 2567, 2568, 2569, 2570, 2571, 2572, 2573, 2574, 2575, 2576, 2577, 2578, 2579, 2580, 2581, 2582, 2583, 2584, 2585, 2586, 2587, 2588, 2589, 2590, 2591, 2592, 2593, 2594, 2595, 2596, 2597, 2598, 2599, 2600, 2601, 2602, 2603, 2604, 2605, 2606, 2607, 2608, 2609, 2610, 2611, 2612, 2613, 2614, 2615, 2616, 2617, 2618, 2619, 2620, 2621, 2622, 2623, 2624, 2625, 2626, 2627, 2628, 2629, 2630, 2631, 2632, 2633, 2634, 2635, 2636, 2637, 2638, 2639, 2640, 2641, 2642, 2643, 2644, 2645, 2646, 2647, 2648, 2649, 2650, 2651, 2652, 2653, 2654, 2655, 2656, 2657, 2658, 2659, 2660, 2661, 2662, 2663, 2664, 2665, 2666, 2667, 2668, 2669, 2670, 2671, 2672, 2673, 2674, 2675, 2676, 2677, 2678, 2679, 26

1998, 1999, 2000, 2001, 2002, 2003, 2004, 2005, 2006, 2007, 2008, 2009, 2010, 2011, 2012, 2013, 2014, 2015, 2016, 2017, 2018, 2019, 2020, 2021, 2022, 2023, 2024, 2025, 2026, 2027, 2028, 2029, 2030, 2031, 2032, 2033, 2034, 2035, 2036, 2037, 2038, 2039, 2040, 2041, 2042, 2043, 2044, 2045, 2046, 2047, 2048, 2049, 2050, 2051, 2052, 2053, 2054, 2055, 2056, 2057, 2058, 2059, 2060, 2061, 2062, 2063, 2064, 2065, 2066, 2067, 2068, 2069, 2070, 2071, 2072, 2073, 2074, 2075, 2076, 2077, 2078, 2079, 2080, 2081, 2082, 2083, 2084, 2085, 2086, 2087, 2088, 2089, 2090, 2091, 2092, 2093, 2094, 2095, 2096, 2097, 2098, 2099, 2100, 2101, 2102, 2103, 2104, 2105, 2106, 2107, 2108, 2109, 2110, 2111, 2112, 2113, 2114, 2115, 2116, 2117, 2118, 2119, 2120, 2121, 2122, 2123, 2124, 2125, 2126, 2127, 2128, 2129, 2130, 2131, 2132, 2133, 2134, 2135, 2136, 2137, 2138, 2139, 2140, 2141, 2142, 2143, 2144, 2145, 2146, 2147, 2148, 2149, 2150, 2151, 2152, 2153, 2154, 2155, 2156, 2157, 2158, 2159, 2160, 2161, 2162, 2163, 2164, 2165, 2166, 2167, 2168, 2169, 2170, 2171, 2172, 2173, 2174, 2175, 2176, 2177, 2178, 2179, 2180, 2181, 2182, 2183, 2184, 2185, 2186, 2187, 2188, 2189, 2190, 2191, 2192, 2193, 2194, 2195, 2196, 2197, 2198, 2199, 2200, 2201, 2202, 2203, 2204, 2205, 2206, 2207, 2208, 2209, 2210, 2211, 2212, 2213, 2214, 2215, 2216, 2217, 2218, 2219, 2220, 2221, 2222, 2223, 2224, 2225, 2226, 2227, 2228, 2229, 2230, 2231, 2232, 2233, 2234, 2235, 2236, 2237, 2238, 2239, 2240, 2241, 2242, 2243, 2244, 2245, 2246, 2247, 2248, 2249, 2250, 2251, 2252, 2253, 2254, 2255, 2256, 2257, 2258, 2259, 2260, 2261, 2262, 2263, 2264, 2265, 2266, 2267, 2268, 2269, 2270, 2271, 2272, 2273, 2274, 2275, 2276, 2277, 2278, 2279, 2280, 2281, 2282, 2283, 2284, 2285, 2286, 2287, 2288, 2289, 2290, 2291, 2292, 2293, 2294, 2295, 2296, 2297, 2298, 2299, 2300, 2301, 2302, 2303, 2304, 2305, 2306, 2307, 2308, 2309, 2310, 2311, 2312, 2313, 2314, 2315, 2316, 2317, 2318, 2319, 2320, 2321, 2322, 2323, 2324, 2325, 2326, 2327, 2328, 2329, 2330, 2331, 2332, 2333, 2334, 2335, 2336, 2337, 2338, 2339, 2340, 2341, 2342, 2343, 2344, 2345, 2346, 2347, 2348, 2349, 2350, 2351, 2352, 2353, 2354, 2355, 2356, 2357, 2358, 2359, 2360, 2361, 2362, 2363, 2364, 2365, 2366, 2367, 2368, 2369, 2370, 2371, 2372, 2373, 2374, 2375, 2376, 2377, 2378, 2379, 2380, 2381, 2382, 2383, 2384, 2385, 2386, 2387, 2388, 2389, 2390, 2391, 2392, 2393, 2394, 2395, 2396, 2397, 2398, 2399, 2400, 2401, 2402, 2403, 2404, 2405, 2406, 2407, 2408, 2409, 2410, 2411, 2412, 2413, 2414, 2415, 2416, 2417, 2418, 2419, 2420, 2421, 2422, 2423, 2424, 2425, 2426, 2427, 2428, 2429, 2430, 2431, 2432, 2433, 2434, 2435, 2436, 2437, 2438, 2439, 2440, 2441, 2442, 2443, 2444, 2445, 2446, 2447, 2448, 2449, 2450, 2451, 2452, 2453, 2454, 2455, 2456, 2457, 2458, 2459, 2460, 2461, 2462, 2463, 2464, 2465, 2466, 2467, 2468, 2469, 2470, 2471, 2472, 2473, 2474, 2475, 2476, 2477, 2478, 2479, 2480, 2481, 2482, 2483, 2484, 2485, 2486, 2487, 2488, 2489, 2490, 2491, 2492, 2493, 2494, 2495, 2496, 2497, 2498, 2499, 2500, 2501, 2502, 2503, 2504, 2505, 2506, 2507, 2508, 2509, 2510, 2511, 2512, 2513, 2514, 2515, 2516, 2517, 2518, 2519, 2520, 2521, 2522, 2523, 2524, 2525, 2526, 2527, 2528, 2529, 2530, 2531, 2532, 2533, 2534, 2535, 2536, 2537, 2538, 2539, 2540, 2541, 2542, 2543, 2544, 2545, 2546, 2547, 2548, 2549, 2550, 2551, 2552, 2553, 2554, 2555, 2556, 2557, 2558, 2559, 2560, 2561, 2562, 2563, 2564, 2565, 2566, 2567, 2568, 2569, 2570, 2571, 2572, 2573, 2574, 2575, 2576, 2577, 2578, 2579, 2580, 2581, 2582, 2583, 2584, 2585, 2586, 2587, 2588, 2589, 2590, 2591, 2592, 2593, 2594, 2595, 2596, 2597, 2598, 2599, 2600, 2601, 2602, 2603, 2604, 2605, 2606, 2607, 2608, 2609, 2610, 2611, 2612, 2613, 2614, 2615, 2616, 2617, 2618, 2619, 2620, 2621, 2622, 2623, 2624, 2625, 2626, 2627, 2628, 2629, 2630, 2631, 2632, 2633, 2634, 2635, 2636, 2637, 2638, 2639, 2640, 2641, 2642, 2643, 2644, 2645, 2646, 2647, 2648, 2649, 2650, 2651, 2652, 2653, 2654, 2655, 2656, 2657, 2658, 2659, 2660, 2661, 2662, 2663, 2664, 2665, 2666, 2667, 2668, 2669, 2670, 2671, 2672, 2673, 2674, 2675, 2676, 2677, 2678, 2679, 26

0000-0001-9151-1000

Run Time 1				Run Time 2				Run Time 3				Run Time 4			
Date	Time	Fluents	Temperature	Date	Time	Fluents	Temperature	Date	Time	Fluents	Temperature	Date	Time	Fluents	Temperature
16/04/20	10:15	1.253	81.5	16/04/20	12:15	1.017	80.9	16/04/20	14:15	1.029	80.9	16/04/20	16:15	1.258	81.4
16/04/20	11:15	1.001	80.9	16/04/20	13:15	1.017	80.9	16/04/20	15:15	1.047	80.9	16/04/20	17:15	1.072	80.9
16/04/20	12:15	1.070	80.8	16/04/20	14:15	1.223	81.9	16/04/20	16:15	1.079	80.9	16/04/20	18:15	1.073	81.5
16/04/20	13:15	1.070	80.8	16/04/20	15:15	1.070	80.9	16/04/20	17:15	1.079	80.9	16/04/20	19:15	1.073	81.5
16/04/20	14:15	0.92	80.8	16/04/20	16:15	1.038	80.9	16/04/20	18:15	1.079	80.9	16/04/20	20:15	1.064	80.8
16/04/20	15:15	1.042	81.2	16/04/20	17:15	1.070	80.9	16/04/20	19:15	1.201	81.0	16/04/20	21:15	1.064	80.8
16/04/20	16:15	1.018	80.7	16/04/20	18:15	1.070	80.9	16/04/20	20:15	1.079	80.9	16/04/20	22:15	1.064	80.8
16/04/20	17:15	1.038	80.8	16/04/20	19:15	1.038	80.9	16/04/20	21:15	1.067	80.9	16/04/20	23:15	1.069	81.2
16/04/20	18:15	1.038	81.1	16/04/20	20:15	1.012	80.9	16/04/20	22:15	1.054	80.9	16/04/20	24:15	1.038	80.8
16/04/20	19:15	1.039	80.9	16/04/20	21:15	1.088	80.9	16/04/20	23:15	1.054	80.9	16/04/20	01:15	1.038	80.8
16/04/20	20:15	1.039	80.9	16/04/20	22:15	1.039	80.9	16/04/20	00:15	1.039	80.9	16/04/20	02:15	1.037	80.8
16/04/20	21:15	1.039	80.9	16/04/20	23:15	1.088	80.9	16/04/20	01:15	1.037	80.9	16/04/20	03:15	1.038	80.8
16/04/20	22:15	1.042	80.8	16/04/20	00:15	1.037	81.2	16/04/20	02:15	1.039	80.9	16/04/20	04:15	1.038	80.8
16/04/20	23:15	1.039	80.9	16/04/20	01:15	1.039	80.9	16/04/20	03:15	1.039	80.9	16/04/20	05:15	1.038	80.8
16/04/20	24:15	1.039	80.9	16/04/20	02:15	1.041	80.9	16/04/20	04:15	1.039	80.9	16/04/20	06:15	1.038	80.8
16/04/20	01:15	1.039	80.9	16/04/20	03:15	1.041	80.9	16/04/20	05:15	1.039	80.9	16/04/20	07:15	1.038	80.8
16/04/20	02:15	1.039	80.9	16/04/20	04:15	1.041	80.9	16/04/20	06:15	1.039	80.9	16/04/20	08:15	1.038	80.8
16/04/20	03:15	1.039	80.9	16/04/20	05:15	1.041	80.9	16/04/20	07:15	1.039	80.9	16/04/20	09:15	1.038	80.8
16/04/20	04:15	1.039	80.9	16/04/20	06:15	1.041	80.9	16/04/20	08:15	1.039	80.9	16/04/20	10:15	1.038	80.8
16/04/20	05:15	1.039	80.9	16/04/20	07:15	1.041	80.9	16/04/20	09:15	1.039	80.9	16/04/20	11:15	1.038	80.8
16/04/20	06:15	1.039	80.9	16/04/20	08:15	1.0									



CEMs Data

Client Name: Gulf IP UT Co., Ltd.
Plant Name: GUT

LOCATION: HRSO 2

Figure 10-10 9

Buyers' tips

Figure 10.10-1

San Francisco 12

Year	Time	Fluents (g/s)	Temperature (°C)	Date	Time	Fluents (g/s)	Temperature (°C)	Date	Time	Fluents (g/s)	Temperature (°C)	Date	Time	Fluents (g/s)	Temperature (°C)
1976-78	1513	1.948	82.2	1976-78	1513	1.854	81.1	1976-78	1513	1.729	82.4	1976-78	1513	1.518	82.2
1976-78	1517	1.776	83.3	1976-78	1517	1.943	83.9	1976-78	1517	2.074	83.8	1976-78	1517	1.724	84.0
1976-78	1521	1.943	84.4	1976-78	1521	1.776	84.4	1976-78	1521	1.518	84.4	1976-78	1521	1.724	84.4
1976-78	1525	1.776	85.5	1976-78	1525	1.943	85.7	1976-78	1525	1.729	85.7	1976-78	1525	1.724	85.7
1976-78	1529	1.518	86.6	1976-78	1529	1.518	86.6	1976-78	1529	1.518	86.6	1976-78	1529	1.518	86.6
1976-78	1533	1.518	87.7	1976-78	1533	1.518	87.7	1976-78	1533	1.518	87.7	1976-78	1533	1.518	87.7
1976-78	1537	1.518	88.8	1976-78	1537	1.518	88.8	1976-78	1537	1.518	88.8	1976-78	1537	1.518	88.8
1976-78	1541	1.518	89.9	1976-78	1541	1.518	89.9	1976-78	1541	1.518	89.9	1976-78	1541	1.518	89.9
1976-78	1545	1.518	91.0	1976-78	1545	1.518	91.0	1976-78	1545	1.518	91.0	1976-78	1545	1.518	91.0
1976-78	1549	1.518	92.1	1976-78	1549	1.518	92.1	1976-78	1549	1.518	92.1	1976-78	1549	1.518	92.1
1976-78	1553	1.518	93.2	1976-78	1553	1.518	93.2	1976-78	1553	1.518	93.2	1976-78	1553	1.518	93.2
1976-78	1557	1.518	94.3	1976-78	1557	1.518	94.3	1976-78	1557	1.518	94.3	1976-78	1557	1.518	94.3
1976-78	1561	1.518	95.4	1976-78	1561	1.518	95.4	1976-78	1561	1.518	95.4	1976-78	1561	1.518	95.4
1976-78	1565	1.518	96.5	1976-78	1565	1.518	96.5	1976-78	1565	1.518	96.5	1976-78	1565	1.518	96.5
1976-78	1569	1.518	97.6	1976-78	1569	1.518	97.6	1976-78	1569	1.518	97.6	1976-78	1569	1.518	97.6
1976-78	1573	1.518	98.7	1976-78	1573	1.518	98.7	1976-78	1573	1.518	98.7	1976-78	1573	1.518	98.7
1976-78	1577	1.518	99.8	1976-78	1577	1.518	99.8	1976-78	1577	1.518	99.8	1976-78	1577	1.518	99.8
1976-78	1581	1.518	100.9	1976-78	1581	1.518	100.9	1976-78	1581	1.518	100.9	1976-78	1581	1.518	100.9
1976-78	1585	1.518	102.0	1976-78	1585	1.518	102.0	1976-78	1585	1.518	102.0	1976-78	1585	1.518	102.0
1976-78	1589	1.518	103.1	1976-78	1589	1.518	103.1	1976-78	1589	1.518	103.1	1976-78	1589	1.518	103.1
1976-78	1593	1.518	104.2	1976-78	1593	1.518	104.2	1976-78	1593	1.518	104.2	1976-78	1593	1.518	104.2
1976-78	1597	1.518	105.3	1976-78	1597	1.518	105.3	1976-78	1597	1.518	105.3	1976-78	1597	1.518	105.3
1976-78	1601	1.518	106.4	1976-78	1601	1.518	106.4	1976-78	1601	1.518	106.4	1976-78	1601	1.518	106.4
1976-78	1605	1.518	107.5	1976-78	1605	1.518	107.5	1976							



Airgas Specialty Gases
Airgas USA LLC
6141 Easton Road
Plumsteadville, PA 17044
Airgas.com

CERTIFICATE OF ANALYSIS
Grade of Product: EPA PROTOCOL STANDARD

Customer: AIR LIQUIDE
(THAILAND) LTD
Part Number: E04N199E3HA0066
Cylinder Number: GN0027222
Laboratory: 124 - Plumsteadville - PA
PGVP Number: A12022
Gas Code: CO,NO,NOX,SO2,BALN

Reference Number: 150-402340012-1
Cylinder Volume: 247.2 CF
Cylinder Pressure: 2215 PSIG
Valve Outlet: 660
Certification Date: Feb 09, 2022

Expiration Date: Feb 09, 2030

Confidence performed in accordance with EPA Traceability Protocol for Assay and Calibration of Gaseous Calibration Standards (May 2012) documents EPA 800R-12311 using the assay procedure listed. Analytical methodology does not require correction for analytical interference. This method has a limit analytical uncertainty as stated below with a confidence level of 95%. There are no significant interferences which affect the data calibration results. All concentrations are on a moisture basis unless otherwise noted.

On Gas Use This Calibration covers 100 ppm (i.e. 0.7 megagrams)

ANALYTICAL RESULTS					
Component	Requested Concentration	Actual Concentration	Protocol Method	Total Relative Uncertainty	Assay Dates
NOX	55.00 PPM	55.86 PPM	G1	+/- 1.0% NIST Traceable	02/02/2022, 02/09/2022
CARBONYL MONOXIDE	35.00 PPM	55.22 PPM	G1	+/- 0.8% NIST Traceable	02/02/2022
NITRIC OXIDE	55.00 PPM	55.86 PPM	G1	+/- 1.0% NIST Traceable	02/02/2022, 02/09/2022
SULFUR DIOXIDE	35.00 PPM	55.30 PPM	G1	+/- 0.4% NIST Traceable	02/02/2022, 02/09/2022
NONPAP					

CALIBRATION STANDARDS						
Type	Lot ID	Cylinder No	Concentration	Uncertainty	Expiration Date	
NTRM	09010212	KAL04777	88.48 PPM CARBON MONOXIDE/NITROGEN	+/- 0.5%	Oct 18, 2024	
NTRM	20061015	CC731206	98.81 PPM CARBON MONOXIDE/NITROGEN	+/- 0.5%	Oct 08, 2026	
GMIE	121020889139	CC332370	4.097 PPM NITROGEN DIOXIDE/NITROGEN	+/- 2.0%	Oct 08, 2024	
NTRM	11010413	KAL04813	9.85 PPM SULFUR DIOXIDE/NITROGEN	+/- 0.5%	Oct 08, 2024	

ANALYTICAL EQUIPMENT		
Instrument/Make/Model	Analytical Principle	Last Multipoint Calibration
Nicolet iS50 FTIR ALP2010248 CO	FTIR	Jan 06, 2022
Nicolet iS10 FTIR ALP2010245 HO	FTIR	Jan 17, 2022
Nicolet iS10 FTIR ALP2010245 H2O	FTIR	Jan 17, 2022
Nicolet iS50 FTIR ALP2010246 N02	FTIR	Jan 27, 2022

Trials Data Available Upon Request
NOTES: Gross Weight: 49.4 Kg
Net Weight: 8.4 Kg



Approved for Release



Airgas Specialty Gases
Airgas USA LLC
614: Easton Road
Plumsteadville, PA 18949
Airgas.com

CERTIFICATE OF ANALYSIS
Grade of Product: EPA PROTOCOL STANDARD

Customer: AIR LIQUIDE
(THAILAND) LTD
Part Number: E04N199E3HA0002
Cylinder Number: GN0027214
Laboratory: 124 - Plumsteadville - PA
PGVP Number: A12022
Gas Code: CO, NO, NOX, SO2, BALN

Reference Number: 160-402340013-1
Cylinder Volume: 247.2 CF
Cylinder Pressure: 2215 PSIG
Valve Outlet: 560
Certification Date: Feb 11, 2022

Expiration Date: Feb 11, 2030

Certification performed in accordance with EPA Transparency Protocol for Assay and Certification of Geoprobe Calibration Standards (May 2012) according to EPA 8200-11-02511, using the assay procedures listed. Analytical Methodology does not require correction for analytical interferences. 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 dry weight basis unless otherwise noted.

ANALYTICAL RESULTS					
Component	Requested Concentration	Actual Concentration	Protocol Method	Total Relative Uncertainty	Assay Dates
NOX	80.00 PPM	80.48 PPM	G1	<= 1.6% NIST Traceable	02/04/2022, 02/11/2022
CARBON MONOXIDE	30.00 PPM	76.95 PPM	G1	<= 6.0% NIST Traceable	02/04/2022
NITRIC OXIDE	80.00 PPM	80.47 PPM	G1	<= 1.6% NIST Traceable	02/04/2022, 02/11/2022
SULFUR DIOXIDE	80.00 PPM	78.81 PPM	G1	<= 0.8% NIST Traceable	02/04/2022, 02/11/2022

CALIBRATION STANDARDS						
Type	Lot ID	Cylinder No	Concentration	Uncertainty	Expiration Date	
NITRM	06012912	KAL004777	96.48 PPB CARBON MONOXIDE/NITROGEN	+/- 0.5%	Oct 16, 2024	
NITRM	20061015	CY332106	98.61 PPB NITRIC OXIDE/NITROGEN	- 0.5%	Oct 06, 2025	
NITRM	20061010	CT070804	98.61 PPB NITRIC OXIDE/NITROGEN	+/- 0.5%	Oct 06, 2026	
GAIS	1242060810	CC323107	4.997 PPB NITROGEN DIOXIDE/NITROGEN	+/- 2.6%	Sep 03, 2024	

NTM	11010415	KAL004813	99.6 PPM SULFUR DIOXIDE/NITROGEN	< 0.0%	Jul 28, 2023
ANALYTICAL EQUIPMENT					
Instrument/Make/Model		Analytical Principle		Last Multipoint Calibration	
Accum 1550 FTIR AUP/2010245 CD		FTIR		Feb-03-2022	
Nuclei 1550 FTIR AUP/2010245 HG		FTIR		Feb-10-2022	
Nuclei 1550 FTIR AUP/2010245 NGC		FTIR		Jan-27-2022	

Triad Data Available Upon Request
 NOTES: Gross Weight: 48.5 Kg
 Net Weight: 8.1 Kg



Approved for Release

CERTIFICATE OF ANALYSIS

Grade of Product: EPA PROTOCOL STANDARD

Customer: AIR LIQUIDE
(THAILAND) LTD.
Part Number: E02N192E3HA0000
Cylinder Number: GN0027033
Laboratory: 124 - Plumsteadville - PA
PGVP Number: A12022
Gas Code: O2,BALN

Reference Number: 160-402340009-1
Cylinder Volume: 248.4 CF
Cylinder Pressure: 2214 PSIG
Valve Outlet: 590
Certification Date: Feb 10, 2022
Expiration Date: Feb 10, 2030

Certification performed in accordance with EPA Traceability Protocol for Assay and Certification of Gaseous Calibration Standards (May 2012) document EPA 8200P-12051, 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	8.000 %	7.975 %	G1	±0.34% NIST Traceable	12/10/2022
NITROGEN	Balance				

CALIBRATION STANDARDS					
Type	Lot ID	Cylinder No	Concentration	Uncertainty	Expiration Date
NTRM	10010635	K022176	8.987 % OXYGEN/NITROGEN	±0.33%	Apr 19, 2022

ANALYTICAL EQUIPMENT		
Instrument/Make/Model	Analytical Principle	Last Multipoint Calibration
SIEMENS OXYMAT 6 - N1-W5-951 - 02	PARAMAGNETIC	Jan 27, 2022

Triad Data Available Upon Request

NOTES: Gross Weight: 48.3 Kg
Net Weight: 8.1 Kg



Approved for Release

Page 1 of 160-402340009-1

CERTIFICATE OF ANALYSIS

Grade of Product: EPA PROTOCOL STANDARD

Customer: AIR LIQUIDE
(THAILAND) LTD.
Part Number: E02N184E3HA0001
Cylinder Number: GN0027201
Laboratory: 124 - Plumsteadville - PA
PGVP Number: A12022
Gas Code: O2,BALN

Reference Number: 160-402340010-1
Cylinder Volume: 249.6 CF
Cylinder Pressure: 2214 PSIG
Valve Outlet: 590
Certification Date: Feb 02, 2022
Expiration Date: Feb 02, 2030

Certification performed in accordance with EPA Traceability Protocol for Assay and Certification of Gaseous Calibration Standards (May 2012) document EPA 8200P-12051, 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 %	16.04 %	G1	±0.44% NIST Traceable	02/02/2022
NITROGEN	Balance				

CALIBRATION STANDARDS					
Type	Lot ID	Cylinder No	Concentration	Uncertainty	Expiration Date
NTRM	08010230	K005228	23.20 % OXYGEN/NITROGEN	±0.44%	Jun 01, 2022

ANALYTICAL EQUIPMENT		
Instrument/Make/Model	Analytical Principle	Last Multipoint Calibration
SIEMENS OXYMAT 6 - N1-W5-951 - 02	PARAMAGNETIC	Jan 27, 2022

Triad Data Available Upon Request

NOTES: Gross Weight: 48.8 Kg
Net Weight: 8.2 Kg



Approved for Release

Page 1 of 160-402340010-1

CONSOLE CONTROL UNIT: CALIBRATION TEST REPORT

Calibration of Date		1 Jan 24	Next Cal. Date		4 Jan 24
Barometric Pressure (mmHg)		760	Temperature (°C)		31.0
Relative Humidity (%)		87.0	Reference Stopwatch Data		
Stopwatch ID No.		RYG_FS0540	Dry Gas Meter No.		6KCF50507
Model		F306	Model		KC-572-V
Serial No.		E18061	Serial No.		1153017
Calibration Date		9 Dec 22	Certificate No.		E-2009018

Calibration of Date						Next Cal. Date					
Barometric Pressure (mmHg)						Temperature (°C)					
Relative Humidity (%)						Reference Stopwatch Data					
Stopwatch ID No.						Dry Gas Meter No.					
Model						Model					
Serial No.						Serial No.					
Calibration Date						Certificate No.					

Alt (meters)	E (mmHg)	Reference Stopwatch Data						Dry Gas Meter Data					
		In (L/min)			Out (L/min)			In (L/min)			Out (L/min)		
		Flow	Rate	Time	Flow	Rate	Time	Flow	Rate	Time	Flow	Rate	Time
14	752	2070	100	10.70	2100	100	10.50	2070	100	10.70	2100	100	10.50
15	807	2070	100	10.70	2100	100	10.50	2070	100	10.70	2100	100	10.50
16	862	2070	100	10.70	2100	100	10.50	2070	100	10.70	2100	100	10.50
17	917	2070	100	10.70	2100	100	10.50	2070	100	10.70	2100	100	10.50
18	972	2070	100	10.70	2100	100	10.50	2070	100	10.70	2100	100	10.50

Run No.		Time Actual (m:ss.ms)	Time Reading (m:ss)	Diff. (ms)	Diff. (min)
1		5:00:10	5:00	10	0.00017
2		5:00:11	5:00	11	0.00018
3		5:00:11	5:00	11	0.00018
4		5:00:07	5:00	7	0.00012
5		5:00:07	5:00	7	0.00012
6		5:00:09	5:00	9	0.00015
7		5:00:11	5:00	11	0.00018
8		5:00:09	5:00	9	0.00015
9		5:00:10	5:00	10	0.00017
10		5:00:09	5:00	9	0.00015
Average				10	0.00016
SD					0.00003



Stopwatch Calibration Test Report

Calibration Date: 4 Jan 24
Barometric Pressure (mmHg): 760
Relative Humidity (%): 87.0

Reference Stopwatch Data
Stopwatch ID No.: RYG_FS0540
Model: F306
Serial No.: E18061
Calibration Date: 9 Dec 22
Certificate No.: E-2009018

Run No.		Time Actual (m:ss.ms)	Time Reading (m:ss)	Diff. (ms)	Diff. (min)
1		5:00:10	5:00	10	0.00017
2		5:00:11	5:00	11	0.00018
3		5:00:11	5:00	11	0.00018
4		5:00:07	5:00	7	0.00012
5		5:00:07	5:00	7	0.00012
6		5:00:09	5:00	9	0.00015
7		5:00:11	5:00	11	0.00018
8		5:00:09	5:00	9	0.00015
9		5:00:10	5:00	10	0.00017
10		5:00:09	5:00	9	0.00015
Average				10	0.00016
SD					0.00003

Calibrated by

M. Navachul Siranya

Field Specialist (C)

Approved by

M. Simari Boonchan

Specialist (I)



DIGITAL TEMPERATURE CALIBRATION DATA SHEET

Calibration Date :	4 Jan 24	Ambient Temperature (°C)	31		
Calibration sheet No. :	C-040124-BKK_FS0508	Relative Humidity (%) :	87		
Digital Temperature ID :	BKK_FS0508	Reference Temperature ID :	BKK_FS1144		
Serial No. :	1503017	Serial No. :	201000008013		
Model :	XC-572-V	Model :	Digicon-CC-VT-MS		
		Next Calibrate :	14 Aug 24		
Location	Reference Temperature °C	Digital Temperature °C	Error °C	MPE	Pass / Fail
Stack	0	0	0	±3	Pass
	25	25	0	±3	Pass
	50	50	0	±3	Pass
	100	100	0	±3	Pass
	150	150	0	±3	Pass
Probe	200	200	0	±3	Pass
	250	249	-1	±3	Pass
	300	299	-1	±3	Pass
	500	498	-2	±3	Pass
	100	100	0	±3	Pass
Oven	120	120	0	±3	Pass
	140	140	0	±3	Pass
	100	100	0	±3	Pass
	120	120	0	±3	Pass
	140	140	0	±3	Pass
Fiber	100	100	0	±3	Pass
	120	120	0	±3	Pass
	140	140	0	±3	Pass
	0	0	0	±3	Pass
	10	10	0	±3	Pass
Exit	20	20	0	±3	Pass
	0	0	0	±3	Pass
	25	25	0	±3	Pass
	50	50	0	±3	Pass
	0	0	0	±3	Pass
AUX	25	25	0	±3	Pass
	50	50	0	±3	Pass

MPE : (Maximum permissible error of measurement) ค่าความคลาดเคลื่อนการวัดสูงสุด

Calibrated by :

Navaphut S
(Mr.Navaphut Snirinya)
Field Scientist (2)

Approved by :

S.P.
(Mr.Samart Roong-ngan)
Specialist (1)

FORM NO. T-06-027 REVISION NO. 7 ISSUE DATE 9 Feb 23



PROBE NOZZLE DIAMETER CALIBRATION DATA SHEET

Calibration Date : 4 Jan 24		Nozzle Set ID : BKK_FS0513			
Calibration Sheet No. : C-040124-BKK_FS0513		Vernier Caliper ID : RYG_FS0539			
Nozzle ID #	Nozzle Diameter (cm.)			Hi - Lo	$(D_1 + D_2 + D_3) / 3$
	D ₁	D ₂	D ₃	ΔD	D _{avg}
1	0.315	0.315	0.315	0.000	0.315
2	0.475	0.475	0.475	0.000	0.475
3	0.530	0.530	0.530	0.000	0.530
4	0.635	0.635	0.635	0.000	0.635
5	0.790	0.790	0.790	0.000	0.790
6	0.950	0.950	0.950	0.000	0.950
7	1.110	1.110	1.110	0.000	1.110
8	1.270	1.270	1.270	0.000	1.270
9	1.600	1.600	1.600	0.000	1.600

Where :

D₁, D₂, D₃

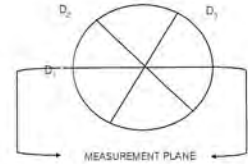
= Three different nozzle diameters at 60 degrees to each other, each measured the nearest 0.025 mm

ΔD

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

D_{avg}

= (D₁ + D₂ + D₃) / 3



Calibrated by

Navaphut S
(Mr.Navaphut Snirinya)
Field Scientist (2)

Approved by

S.P.
(Mr.Samart Roong-ngan)
Field Specialist (1)

FORM NO. T-06-027 REVISION NO. 7 ISSUE DATE 9 Feb 23



Stopwatch Calibration Test Report

Calibration Date : 3 Jan 24
Barometric Pressure (mmHg) : 760
Relative Humidity (%) : 58.0

Next Cal. Date : 3 Jul 24
Temperature (°C) : 31.0

Reference Stopwatch Data

Stopwatch ID No. : E18091
Model : F808
Serial No. :
Calibration Date : 8 Sep 20
Certificate No. : E-2009018

Console Control Meter Data

Dry Gas Meter No. : BKK_FS0427
Model : C-5000 Source Sample
Serial No. : 1612

Run No.	Time Actual (m:ss.ms)	Time Reading (m:ss)	Diff. (ms)	Diff. (min)
1	5:00:03	5:00	3	0.00005
2	5:00:09	5:00	9	0.00013
3	5:00:09	5:00	9	0.00015
4	5:00:11	5:00	11	0.00016
5	5:00:05	5:00	5	0.00008
6	5:00:06	5:00	6	0.00010
7	5:00:06	5:00	6	0.00010
8	5:00:08	5:00	8	0.00013
9	5:00:08	5:00	8	0.00015
10	5:00:07	5:00	7	0.00012
Average			7	0.00012
SD				0.00004

Calibrate by :

Prasert S
Mr. Prasert Surakhian
Field Scientist (3)

Approved by :

S.P.
Mr. Samart Roong-ngan
Specialist (1)

CONSOLE CONTROL UNIT CALIBRATION TEST REPORT

Calibration Date : 3 Jan 24
Next Cal. Date : 3 Jul 24

Barometric Pressure (mmHg) : 760
Relative Humidity (%) : 58.0

Console Control Meter Data

Calibration Date : 8 Sep 20
Certificate No. : E-2009018

Calibration Date : 8 Sep 20
Certificate No. : E-2009018

JH	EV	Reference Value (mmHg)				Console Control Meter Data			
		Temp	Pressure	Temp	Pressure	Temp	Pressure	Temp	Pressure
1	11.1	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0
2	11.1	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0
3	11.1	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0
4	11.1	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0
5	11.1	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0
6	11.1	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0
7	11.1	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0
8	11.1	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0
9	11.1	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0
10	11.1	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0

1. All console control meters are calibrated to the nearest 0.01 mmHg.
2. All console control meters are calibrated to the nearest 0.01 mmHg.
3. All console control meters are calibrated to the nearest 0.01 mmHg.
4. All console control meters are calibrated to the nearest 0.01 mmHg.
5. All console control meters are calibrated to the nearest 0.01 mmHg.
6. All console control meters are calibrated to the nearest 0.01 mmHg.
7. All console control meters are calibrated to the nearest 0.01 mmHg.
8. All console control meters are calibrated to the nearest 0.01 mmHg.
9. All console control meters are calibrated to the nearest 0.01 mmHg.
10. All console control meters are calibrated to the nearest 0.01 mmHg.



DIGITAL TEMPERATURE CALIBRATION DATA SHEET

Calibration Date : 4 Jan 24		Ambient Temperature (°C) 29			
Calibration sheet No. : C-040124-BKK_FS0486		Relative Humidity (%) 48			
Digital Temperature ID : BKK_FS0486		Reference Temperature ID BKK_FS1144			
Serial No. : 1310055		Serial No. : 201000000013			
Model : XC-572-V		Model : Digicon-CC-VT-MS			
Next Calibrate : 14 Aug 24					
Location	Reference Temperature °C	Digital Temperature °C	Error °C	MPE	Pass / Fail
Stack	0	0	0	±3	Pass
	25	25	0	±3	Pass
	50	50	0	±3	Pass
	100	99	-1	±3	Pass
	150	149	-1	±3	Pass
	200	199	-1	±3	Pass
	250	248	-2	±3	Pass
	300	298	-2	±3	Pass
	500	498	-2	±3	Pass
Probe	100	99	-1	±3	Pass
	120	119	-1	±3	Pass
	140	139	-1	±3	Pass
Oven	100	99	-1	±3	Pass
	120	119	-1	±3	Pass
	140	139	-1	±3	Pass
Filter	100	99	-1	±3	Pass
	120	119	-1	±3	Pass
	140	139	-1	±3	Pass
Exit	0	1	1	±3	Pass
	10	10	0	±3	Pass
	20	20	0	±3	Pass
Meter	0	0	0	±3	Pass
	25	25	0	±3	Pass
	50	50	0	±3	Pass
AUX	0	0	0	±3	Pass
	25	25	0	±3	Pass
	50	50	0	±3	Pass

MPE : (Maximum permissible error of measurement) ค่าความคลาดเคลื่อนสูงสุดที่อนุญาต

Calibrated by : Prasert S. Approved by : S.P.
 (Mr. Prasert Surakhan) (Mr. Samart Roongnan)
 Field Specialist (2) Specialist (1)

FORM NO. : F-06-124 REVISION NO. : 0 ISSUE DATE : 8 Feb 73

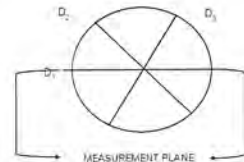


PROBE NOZZLE DIAMETER CALIBRATION DATA SHEET

Calibration Date : 4 Jan 24	Nozzle Set ID : BKK_FS0485				
Calibration Sheet No. : C-040124-BKK_FS0485	Vernier Caliper ID : RYQ_FS0539				
Nozzle ID :	Nozzle Diameter (cm.)			Ri - Lo	$(D_1 - D_2 - D_3) / 3$
	D ₁	D ₂	D ₃	ΔD	D _{avg}
1	0.315	0.315	0.315	0.000	0.315
2	0.475	0.475	0.475	0.000	0.475
3	0.530	0.530	0.530	0.000	0.530
4	0.635	0.635	0.635	0.000	0.635
5	0.750	0.750	0.750	0.000	0.750
6	0.950	0.950	0.950	0.000	0.950
7	1.110	1.110	1.110	0.000	1.110
8	1.270	1.270	1.270	0.000	1.270
9	1.600	1.600	1.600	0.000	1.600

Where :

- D₁, D₂, D₃ : Three different nozzle diameters at 90 degrees to each other each measuring the smallest 0.025 mm.
- ΔD : Maximum distance between any two diameters. Must be ≤ 0.100 mm.
- D_{avg} : (D₁ + D₂ + D₃) / 3

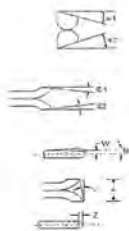


Calibrated by : Worawich T. Approved by : S.P.
 (Mr. Worawich Tongpoom) (Mr. Samart Roongnan)
 Field Scientist (2) Field Specialist (1)



Type S Pitot Tube Calibration

Date Calibration 4-Jan-24 Due Date 4-Jul-24
 Pitot ID BKK_FS0501 Inclinator ID BKK_FS1131
 Pitot SN - Vernier ID SGK_FS0113



Parameter	Value	Allowable Range	Check
α1	-1.4	-10° < α1 < +10°	OK
α2	1	-10° < α2 < +10°	OK
β1	-0.2	-5° < β1 < +5°	OK
β2	-1.8	-5° < β2 < +5°	OK
γ	-0.3	-	-
θ	-0.5	-	-
Z = A tan γ	-0.005	Z ≤ 0.125"	OK
W = A tan θ	-0.008	W ≤ 0.031"	OK
Dt	0.375	0.188" to 0.375"	OK
A/2Dt	1.227	1.05 ≤ PA/Dt ≤ 1.5	OK
A	0.92	2.1Dt ≤ A ≤ 3Dt	OK

Certify that pitot tube/probe meets or exceeds all specifications, criteria and/or applicable design features and is hereby assigned a pitot tube certification fact of 0.84 . See 40 CFR Pt. 60, App. A, EPA Method 2.

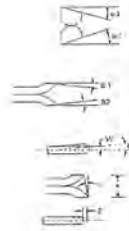
Calibrated by : Prasert S. Approved by : S.P.
 (Mr. Prasert Surakhan) (Mr. Samart Roongnan)
 Enviro Field Services Scientist (3) Enviro Field Services Specialist (1)

FORM NO. : F-06-124 REVISION NO. : 0 ISSUE DATE : 25/12/73



Type S Pitot Tube Calibration

Date Calibration 4-Jan-24 Due Date 4-Jul-24
 Pitot ID BKK_FS0511 Inclinator ID BKK_FS1131
 Pitot SN - Vernier ID SGK_FS0113



Parameter	Value	Allowable Range	Check
α1	-1.8	-10° < α1 < +10°	OK
α2	-1.4	-10° < α2 < +10°	OK
β1	-1.7	-5° < β1 < +5°	OK
β2	-2	-5° < β2 < +5°	OK
γ	-1.3	-	-
θ	-0.4	-	-
Z = A tan γ	-0.021	Z ≤ 0.125"	OK
W = A tan θ	-0.006	W ≤ 0.031"	OK
Dt	0.330	0.188" to 0.375"	OK
A/2Dt	1.394	1.05 ≤ PA/Dt ≤ 1.5	OK
A	0.92	2.1Dt ≤ A ≤ 3Dt	OK

Certify that pitot tube/probe meets or exceeds all specifications, criteria and/or applicable design features and is hereby assigned a pitot tube certification fact of 0.84 . See 40 CFR Pt. 60, App. A, EPA Method 2.

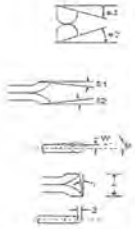
Calibrated by : Prasert S. Approved by : S.P.
 (Mr. Prasert Surakhan) (Mr. Samart Roongnan)
 Enviro Field Services Scientist (3) Enviro Field Services Specialist (1)

FORM NO. : F-06-124 REVISION NO. : 0 ISSUE DATE : 25/12/73



Type S Pitot Tube Calibration

Date Calibration 3-Jan-24 Due Date 3-Jul-24
Pitot ID BKK_FS0432 Inclinator ID BKK_FS1131
Pitot SN Vernier ID SGK_FS0113



Parameter	Value	Allowable Range	Check
$\alpha 1$	-1.4	$-10^\circ < \alpha 1 < +10^\circ$	OK
$\alpha 2$	-0.2	$-10^\circ < \alpha 2 < +10^\circ$	OK
$\beta 1$	0.8	$-5^\circ < \beta 1 < +5^\circ$	OK
$\beta 2$	-0.4	$-5^\circ < \beta 2 < +5^\circ$	OK
γ	0.8	-	-
θ	0.5	-	-
$Z = A \tan \gamma$	0.013	$Z \leq 0.125''$	OK
$W = A \tan \theta$	0.008	$W \leq 0.031''$	OK
Dt	0.310	$0.188'' \text{ to } 0.375''$	OK
A/2Dt	1.484	$1.05 \leq \text{PA/Dt} \leq 1.5$	OK
A	0.92	$2.10 \leq A \leq 3.0$	OK

Certify that pitot tube/porbe meets or exceeds all specifications, criteria and/or applicable design features and is hereby assigned a pitot tube certification fact of 0.84. See 40 CFR Pt. 60, App. A, EPA Method 2.

Calibrated by:
(Mr. Prasert Surakhan)
Enviro Field Services Scientist (3)

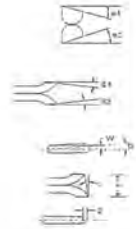
Approved By:
(Mr. Samart Roo-ngan)
Enviro Field Services Specialist (1)

FORM NO. 1-06-124 REVISION NO. 0 ISSUE DATE: 15/12/23



Type S Pitot Tube Calibration

Date Calibration 3-Jan-24 Due Date 3-Jul-24
Pitot ID BKK_FS0454 Inclinator ID BKK_FS1131
Pitot SN Vernier ID SGK_FS0113



Parameter	Value	Allowable Range	Check
$\alpha 1$	-1.1	$-10^\circ < \alpha 1 < +10^\circ$	OK
$\alpha 2$	-1.9	$-10^\circ < \alpha 2 < +10^\circ$	OK
$\beta 1$	-0.3	$-5^\circ < \beta 1 < +5^\circ$	OK
$\beta 2$	0.2	$-5^\circ < \beta 2 < +5^\circ$	OK
γ	-0.6	-	-
θ	1.2	-	-
$Z = A \tan \gamma$	-0.010	$Z \leq 0.125''$	OK
$W = A \tan \theta$	0.019	$W \leq 0.031''$	OK
Dt	0.310	$0.188'' \text{ to } 0.375''$	OK
A/2Dt	1.484	$1.05 \leq \text{PA/Dt} \leq 1.5$	OK
A	0.92	$2.10 \leq A \leq 3.0$	OK

Certify that pitot tube/porbe meets or exceeds all specifications, criteria and/or applicable design features and is hereby assigned a pitot tube certification fact of 0.84. See 40 CFR Pt. 60, App. A, EPA Method 2.

Calibrated by:
(Mr. Prasert Surakhan)
Enviro Field Services Scientist (3)

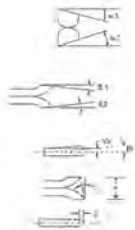
Approved By:
(Mr. Samart Roo-ngan)
Enviro Field Services Specialist (1)

FORM NO. 1-06-124 REVISION NO. 0 ISSUE DATE: 15/12/23



Type S Pitot Tube Calibration

Date Calibration 3-Jan-24 Due Date 3-Jul-24
Pitot ID BKK_FS0552 Inclinator ID BKK_FS1131
Pitot SN Vernier ID SGK_FS0113



Parameter	Value	Allowable Range	Check
$\alpha 1$	2.5	$-10^\circ < \alpha 1 < +10^\circ$	OK
$\alpha 2$	1.4	$-10^\circ < \alpha 2 < +10^\circ$	OK
$\beta 1$	-0.8	$-5^\circ < \beta 1 < +5^\circ$	OK
$\beta 2$	-0.4	$-5^\circ < \beta 2 < +5^\circ$	OK
γ	0.3	-	-
θ	0.2	-	-
$Z = A \tan \gamma$	0.005	$Z \leq 0.125''$	OK
$W = A \tan \theta$	0.003	$W \leq 0.031''$	OK
Dt	0.310	$0.188'' \text{ to } 0.375''$	OK
A/2Dt	1.484	$1.05 \leq \text{PA/Dt} \leq 1.5$	OK
A	0.92	$2.10 \leq A \leq 3.0$	OK

Certify that pitot tube/porbe meets or exceeds all specifications, criteria and/or applicable design features and is hereby assigned a pitot tube certification fact of 0.84. See 40 CFR Pt. 60, App. A, EPA Method 2.

Calibrated by:
(Mr. Prasert Surakhan)
Enviro Field Services Scientist (3)

Approved By:
(Mr. Samart Roo-ngan)
Enviro Field Services Specialist (1)

FORM NO. 1-06-124 REVISION NO. 0 ISSUE DATE: 15/12/23



Calibration Certificate

Certificate No: G 560800
Date of issue: 15-Dec-23

Instrument description: 1 Fluor Gas Analyzer
Instrument model: 2 Test 340
Control unit serial no.: 3
Instrument serial no.: 4 63119036
ID no. or control no.: 5 BKK_FS1131
Manufacturer: 6 Testo SE & Co. KGaA
Probe description: 7
Probe model: 8
Probe serial no.: 9
Customer name: 10 KLS LABORATORY GROUP (THAI) LTD.
Customer address: 11 104 Phatthanasak 40, Phatthanasak Road, Klongkum Phatthanasak, Khet Suan Luang, Bangkok, 10250 Thailand
Total pages of certificate: 12 Pages
Receiving no.: 13 1734388
Receiving date: 14 12 Dec 23
Parameter of calibration: 15 Gas Calibration (Oxygen 2.50, 10.04, 21.01 %vol, Carbon Monoxide 10.14, 30.2, 100.3 ppm), Nitric Oxide 30.01, 151.5, 322.5 ppm, Sulphur Dioxide 50.36, 100.8, 600.8 ppm)
Condition of UUC: 16 Used
Ambient condition: 17 All of the Measurement were carried out in the stabilized laboratory
Temperature: 18 23.45 °C
Humidity: 19 55.15 %RH
Calibration place: 20 17/11 Soi Ngumwongwan 47 Yaen AB, Toongsoonghong, Lakki, Bangkok 10210
Calibration procedure no.: 21 This instrument was calibrated by comparison with standard gas mixture according to Calibration Work Instruction no. WI-CL-25-C

The calibration certificate expanded uncertainty of measurement is stated as the standard uncertainty of measure multiplied by coverage factor k=2, which for a normal distribution corresponds to a coverage probability of approximately 95%. This certificate is applied only to the item under test Environmental condition.
This Calibration Certificate may not be reproduced or used in full or in part without the permission of the issuing laboratory.
Calibration certificates without signature are not valid and the results shall only be the items tested/calibrated.
The calibration certificate documents are traceable to national standards, which ensure measurement accuracy to the International System of Units (SI).
Date of calibration: 22 14 Dec 23

Ms. Kwanchai Sarnonobun
Calibration Technician

Mrs. Nongkai Yongsattien
Technical Manager

ENTECH 2 Rev.4

Page 1 of 2

Issue Date 23/02/24

Entech Industrial Solution Co., Ltd.

17/1111 Soi Ngumwongwan 47, Yaen AB, Toongsoonghong, Lakki, Bangkok 10210 Thailand
Tel: +66 2 65555555 Fax: +66 2 65555555 Email: info@entech.co.th

Standard References (Table 1)

Standard	Certificate No.	Vendor	Due date
Oxygen (O ₂) 2.50 % Vol	2412/23	Linde	27-Aug-27
Oxygen (O ₂) 10.04 % Vol	CG-0153-21	None	18-Nov-26
Oxygen (O ₂) 21.02 % Vol	CG-0041-32	None	19-Feb-27
Carbon monoxide (CO) 80.14 ppm	CG-0040-32	None	14-Feb-27
Carbon monoxide (CO) 362 ppm	1915/23	Linde	16-Jun-25
Carbon monoxide (CO) 1003 ppm	2584/23	Linde	10-Sep-25
Nitric Oxide (NO) 30.01 ppm	CG-0014-33	None	19-Feb-25
Nitric Oxide (NO) 151.5 ppm	0161/23	Linde	22-Jun-25
Nitric Oxide (NO) 322.5 ppm	1974/23	Linde	17-Jul-25
Sulphur Dioxide (SO ₂) 50.36 ppm	2004/23	Linde	17-Jul-25
Sulphur Dioxide (SO ₂) 100.8 ppm	3507/23	Linde	09-Nov-24
Sulphur Dioxide (SO ₂) 600.8 ppm	2003/23	Linde	17-Jul-25

Measured room conditions

Temperature : 23.1 °C Humidity : 59.3 %RH Pressure : 1010.8 mbar

Calibration conditions

Gas Temperature : 23 °C Flow Rate : 600 ml/min Gas Pressure : 1013.7 mbar

Calibration Results (Without adjustment) (Table 2)

Parameter of Standard	Standard Values	Mean of Values	Error	Uncertainty
O ₂ (%Vol)	2.50	2.44	-0.06	0.15
O ₂ (%Vol)	10.04	9.92	-0.12	0.29
O ₂ (%Vol)	21.02	21.07	0.05	0.30
CO (ppm)	80.14	82	1.86	3.0
CO (ppm)	362	364	2	6.0
CO (ppm)	1003	1008	5	12
NO (ppm)	30.01	31	0.99	8.0
NO (ppm)	151.5	153	1.5	8.0
NO (ppm)	322.5	320	-2.5	12
SO ₂ (ppm)	50.36	52	1.64	6.0
SO ₂ (ppm)	100.8	101	0.2	6.0
SO ₂ (ppm)	600.8	598	-2.8	12

Remark : 1 cmol/mol = 1 %Vol, 3 cmol/mol = 1 ppm

End of Report

154-2100 China

154-2100 China

154-2100 China

Entech Industrial Solution Co., Ltd.

17-121, Sothorn Road, Bangkok 10110, Thailand
Tel: +66 2643 8361-6 Fax: +66 2643 8367-7 E-mail: service.thailand@sartorius.com

Sartorius (Thailand) Co., Ltd.

121 Rama 9 Road, Huaykwang, Huaykwang, Bangkok 10310
Tel: +66 2643 8361-6 E-mail: service.thailand@sartorius.com



SARTORIUS

Certificate of Calibration

REVIEW BY : Y. A. J.
APPROVED BY : S. K. T.
NEXT CAL DATE : 30/11/24

Model Number : SECURA224-1S Certificate No. : 23BC0465
Description : Analytical Balance Issued Date : Friday, December 01, 2023
Serial Number : 0038304165 Reference No. : 223958
ID No. : BKK_EN0309
Manufacturer : Sartorius Page No. : 1 of 2

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

Calibrated Place : Lab Room

Calibrated By : Mr Chonchai Inthana
Calibration Date : Thursday, November 30, 2023
Calibration Procedure No. : This calibration was conducted by
Using in-house calibration procedure number (WI-003)
Based on UKAS LAB 14 : 2019

Metrological data : Capacity : 220 g Readability : 0.0001 g
Ambient Conditions : Temperature : 21.1 °C ± 5.0 °C
Humidity : 58.0 % RH ± 10.0 % RH
Pressure : ±
Reasons for calibration : ☐ New Installation ☐ Service / Repair ☒ Re-calibration / Maintenance
Equipment Condition : ☒ Good Operation ☐ Fair

Measurement Method UKAS Publication Ref : Lab 14

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

Traceability:

Model Number	Description	Traceability	Certificate No.	Due Date
YCS011-522-00	Sartorius weight set 1mg - 5000g E2 YCS011-522-00	TCS	M2308197S	23-Aug-2025
MHB-382SD	Humidity/Balometer/Temp Luton MHB-382SD	DKSH	C1923184S	23-Aug-2024

This certificate relates and apply this equipment only.

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

Chonchai Inthana

Mr Chonchai Inthana (Technical Manager)

SOP FM 33 03 February 2022



Sartorius (Thailand) Co., Ltd.

121 Rama 9 Road, Huaykwang, Huaykwang, Bangkok 10310
Tel: +66 2643 8361-6 Fax: +66 2643 8367-7 E-mail: service.thailand@sartorius.com

SARTORIUS

Certificate of Calibration

Model Number : SECURA224-1S Certificate No. : 23BC0465
Description : Analytical Balance Issued Date : Friday, December 01, 2023
Serial Number : 0038304165 Reference No. : 223958
ID No. : BKK_EN0309
Manufacturer : Sartorius Page No. : 2 of 2

Calibration Results : Without Adjustment

Repeatability			Eccentricity (Off-center loading error)		
The repeatability is the ability of a weighing instrument to display nearly identical readouts under constant test conditions when the same load within a measurement series is placed repeatedly on the weighing pan in the same manner. The standard deviation is used to express repeatability quantitatively.			The off-center loading error is yielded by the difference between the result of the load, i.e. 1/3 or 1/4 of maximum capacity, placed in the middle of the weighing pan and between each of four additional measurement points (positions defined according to OIML R110).		
Nominal Value : (Low Load)	20.0000	199.9999	Nominal value :	100	g
20 g	20.0000	200.0000	Tolerance	0.0004	g
Tolerance	0.0001	g			
Nominal Value : (High Load)	200.0000	199.9999			
200 g	200.0000	200.0000			
Tolerance	0.0001	g			
Standard Deviation	0.00005	0.00005			

Linearity

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

Tolerance 0.0002 g				
Nominal Value	Conventional Mass Value	Displayed Value	Deviation	Uncertainty
0.01	0.0100	0.0100	0.0000	0.00014
0.05	0.0500	0.0500	0.0000	0.00014
0.1	0.1000	0.1000	0.0000	0.00014
0.5	0.5000	0.5000	0.0000	0.00014
1	1.0000	1.0000	0.0000	0.00014
2	2.0000	2.0000	0.0000	0.00014
5	5.0000	5.0000	0.0000	0.00014
10	10.0000	10.0000	0.0000	0.00014
20	20.0000	20.0000	0.0000	0.00014
200	200.0000	200.0000	0.0000	0.00029

End of Report

SOP FM 33 03 February 2022

SITHIPORN ASSOCIATES CO., LTD.
CALIBRATION LABORATORY

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



Cert. No. : ACC23046
Pages : 1 of 3

Calibration Certificate

Equipment : SOUND CALIBRATOR
Manufacturer : RION
Model : NC-74
Serial No. : 34425567
ID No. : BKK_FS0618

Condition As Found : GOOD

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

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

Received Date : 28 NOVEMBER 2023
Calibration Date : 19 DECEMBER 2023
Date of Issue : 22 DECEMBER 2023

Calibrated by : Nathakorn Phisupaisan

Approved by : T. Petchur
(Thanakul Petchur)

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

QF-TS12-04-04-020664

Continuation of Calibration Certificate

Cert. No. : ACC23046
Job No. : VC67AC0035
Pages : 2 of 3

Calibration Procedure : CP-AC-03

Calibration Method :

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

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

Condition of this result of calibration :

1. Reference Standard Instruments :

Instrument	Model	Serial No.	Cert. No.	Due Date
Waveform Generator	33511B	MY52302742	EF-0010-23	07-FEB-24
Digital Multimeter	33461A	MY53220104	EEL-BP 30/0266	13-FEB-24
Digital Multimeter	33461A	MY53220076	EEL-BP 30/0267	13-FEB-24
Digital Multimeter	33461A	MY60024273	EEL-BP 31/0266	14-FEB-24
Programmable Attenuator	MAT-1070	62100114	EF-0011-23	08-FEB-24
Condenser Microphone	4180	2977900	AA-1001-23	14-FEB-24
Measuring Amplifier	NA-42KA1	34560495	AA-3002-23	14-FEB-24
Audio Analyzer	AVR-3360A	V744B6069	EF-0012-23	10-FEB-24

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

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

3.1 National Institute of Metrology (Thailand).

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

QF-TS12-04-04-020664

Continuation of Calibration Certificate

Cert. No. : ACC23046
Job No. : VC67AC0035
Pages : 3 of 3

Result of calibration :

1. Sound pressure level

Specified sound pressure level (dB)	Measured value (dB)	Deviated value (dB)	Uncertainty (dB)	Acceptance limit (dB)
94	94.03	0.03	0.14	0.40

2. Frequency

Specified Frequency (Hz)	Measured value (Hz)	Deviated value (%)	Uncertainty (%)	Acceptance limit (%)
1000	1004.3	0.4	0.1	1.0

3. Total distortion

Measured value (%)	Uncertainty (%)	Acceptance limit (%)
1.86	0.10	3.0

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

End of Calibration Certificate

QF-TS12-04-04-020664

451-451/1 Sathorn Road, Bangburu, Bangkok, 10700 Thailand
Tel : +66 2432 8331 Email : calibration@sithiporn.comCert. No. : ACL24085
Pages : 1 of 8

Calibration Certificate

Equipment : SOUND LEVEL METER
Manufacturer : RION
Model : NL-42 / Microphone UC-52 / Preamplifier NH-24
Serial No. : 00858519 / 171618 / 72790
ID No. : BKK_FS0109

Condition As Found : GOOD

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

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

Received Date : 11 JANUARY 2024
Calibration Date : 22-24 JANUARY 2024
Date of Issue : 24 JANUARY 2024

Calibrated by : Natthakorn Pitsupassan

Approved by :

T. Petchum
(Thanakul Petchum)

This certificate is issued in accordance with the requirements of ISO/IEC 17025 standard, may not be reproduced either in full or in part without the prior written approval of the head of Calibration Laboratory.

451-451/1 Sathorn Road, Bangburu, Bangkok, 10700 Thailand
Tel : +66 2432 8331 Email : calibration@sithiporn.comCert. No. : ACL24085
Job No. : VC67AC0055
Pages : 2 of 8

Calibration Procedure : CP-AC-01

Calibration Method :

This equipment was calibrated by follow 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 item were made by observation of each Instruments display and also with SLM's display.

Condition of this result of calibration :

1. Reference Standard Instruments :

Instrument	Model	Serial No.	Cert. No.	Due Date
Waveform Generator	33210A	MY48017076	EF-0009-23	07-FEB-24
Waveform Generator	33511B	MY52302742	EF-0010-23	07-FEB-24
Digital Multimeter	33461A	MY53220104	EEL-BP 30/0266	13-FEB-24
Digital Multimeter	33461A	MY53220076	EEL-BP 29/0266	13-FEB-24
Digital Multimeter	34461A	MY60024273	EEL-BP 31/0266	14-FEB-24
Programmable Attenuator	MAT-1070	62100114	EF-0011-23	08-FEB-24
Condenser Microphone	4180	2977900	AA-1001-23	14-FEB-24
Measuring Amplifier	NA-42KA1	34560495	AA-3002-23	14-FEB-24

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

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

3.1 National Institute of Metrology (Thailand).

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

T. Petchum

SITHIPORN ASSOCIATES CO., LTD.
CALIBRATION LABORATORY

451-451/1 Srinthorn Road, Bangbunru, Bangkok, 10700 Thailand
Tel: +66 2433 8331 Email: calibration@sithiporn.com



Cert. No. : ACL24085
Job No. : VC67AC0055
Pages : 3 of 8

Summary of Measurement Result :

Parameter	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

T. Petch

SITHIPORN ASSOCIATES CO., LTD.
CALIBRATION LABORATORY

451-451/1 Srinthorn Road, Bangbunru, Bangkok, 10700 Thailand
Tel: +66 2433 8331 Email: calibration@sithiporn.com



Cert. No. : ACL24085
Job No. : VC67AC0055
Pages : 4 of 8

Result of calibration :

1. Absolute sensitivity

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

2. Self-generated noise

2.1 Normal test

Measured Value (dB)
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	22.3

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	0.3	0.4	0.4	± 1.5
1000	0.1	0.1	0.1	± 1.0
8000	0.0	0.0	0.1	± 0.9

T. Petch

SITHIPORN ASSOCIATES CO., LTD.
CALIBRATION LABORATORY

451-451/1 Srinthorn Road, Bangbunru, Bangkok, 10700 Thailand
Tel: +66 2433 8331 Email: calibration@sithiporn.com



Cert. No. : ACL24085
Job No. : VC67AC0055
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	-0.1	0.0	-0.1	±1.5
500	0.0	0.0	-0.1	±1.5
1000	0.0	0.0	0.0	±1.0
2000	0.0	0.0	0.0	±2.0
4000	0.0	0.0	0.0	±3.0
8000	0.0	0.0	0.0	±5.0

5. Frequency and time weightings at 1 kHz

5.1 Frequency weightings at 1 kHz

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

5.2 Time weighting at 1 kHz

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

6. Long - term stability

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

T. Petch

SITHIPORN ASSOCIATES CO., LTD.
CALIBRATION LABORATORY

451-451/1 Srinthorn Road, Bangbunru, Bangkok, 10700 Thailand
Tel: +66 2433 8331 Email: calibration@sithiporn.com



Cert. No. : ACL24085
Job No. : VC67AC0055
Pages : 6 of 8

7. Level linearity on the reference level range

Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
137.0	137.1	0.1	± 1.1
136.0	136.1	0.1	± 1.1
135.0	135.1	0.1	± 1.1
134.0	134.1	0.1	± 1.1
133.0	133.0	0.0	± 1.1
132.0	132.0	0.0	± 1.1
131.0	131.0	0.0	± 1.1
129.0	129.1	0.1	± 1.1
124.0	124.0	0.0	± 1.1
119.0	119.1	0.1	± 1.1
114.0	114.1	0.1	± 1.1
109.0	109.0	0.0	± 1.1
104.0	104.1	0.1	± 1.1
99.0	99.1	0.1	± 1.1
94.0	94.0	0.0	± 1.1
89.0	89.0	0.0	± 1.1
84.0	84.0	0.0	± 1.1
79.0	79.0	0.0	± 1.1
74.0	74.0	0.0	± 1.1
69.0	69.0	0.0	± 1.1
64.0	64.0	0.0	± 1.1
59.0	59.0	0.0	± 1.1
54.0	54.0	0.0	± 1.1
49.0	49.0	0.0	± 1.1
44.0	44.0	0.0	± 1.1
39.0	39.0	0.0	± 1.1
34.0	34.0	0.0	± 1.1
30.0	29.9	-0.1	± 1.1
29.0	28.9	-0.1	± 1.1
28.0	27.9	-0.1	± 1.1
27.0	26.9	-0.1	± 1.1
26.0	25.9	-0.1	± 1.1
25.0	24.9	-0.1	± 1.1

T. Petch

SITHIPORN ASSOCIATES CO., LTD.
CALIBRATION LABORATORY

451-451/1 Sirinthorn Road, Bangbunru, Bangkok, 10700 Thailand
Tel: +66 2423 8331 Email: calibration@sithiporn.com



Cert. No. : ACL24085
Job No. : VC67AC0055
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, T _b (ms)	Cycle	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Fast	0.25	1	108.0	107.9	-0.1	1.5 ; -5.0
	2	8	117.0	116.9	-0.1	1.0 ; -2.5
	200	800	134.0	134.0	0.0	±1.0
Slow	2	8	108.0	108.0	0.0	1.5 ; -5.0
	200	800	127.6	127.6	0.0	±1.0
SEL	0.25	1	99.0	98.8	-0.2	1.5 ; -5.0
	2	8	108.0	107.9	-0.1	1.0 ; -2.5
	200	800	128.0	128.0	0.0	±1.0

10. Peak C sound level

Number of cycle in test signal	Anticipated Value (dB)	Measured Value, Lepeak (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.0	0.0	±3.0
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	±2.0
Positive half cycle	135.4	135.1	-0.3	±2.0
Negative half cycle	135.4	135.1	-0.3	±2.0

T. Petchum

SITHIPORN ASSOCIATES CO., LTD.
CALIBRATION LABORATORY

451-451/1 Sirinthorn Road, Bangbunru, Bangkok, 10700 Thailand
Tel: +66 2423 8331 Email: calibration@sithiporn.com



Cert. No. : ACL24085
Job No. : VC67AC0055
Pages : 8 of 8

11. Overload indication

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

12. High level stability

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

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

End of Calibration Certificate

T. Petchum

SITHIPORN ASSOCIATES CO., LTD.
CALIBRATION LABORATORY

451-451/1 Sirinthorn Road, Bangbunru, Bangkok, 10700 Thailand
Tel: +66 2423 8331 Email: calibration@sithiporn.com



Cert. No. : ACL24019
Pages : 1 of 8

Calibration Certificate

Equipment : SOUND LEVEL METER
Manufacturer : RION
Model : NL-42 / Microphone UC-52 / Preamplifier NH-24
Serial No.: 00858520 / 158771 / 58772
ID No.: BKK_FS0110

Condition As Found : GOOD

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

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

Received Date : 22 DECEMBER 2023
Calibration Date : 10-11 JANUARY 2024
Date of Issue : 12 JANUARY 2024

Calibrated by : Nathakorn Pitsupaisan

Approved by :

T. Petchum
(Thanakul Petchumai)

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

SITHIPORN ASSOCIATES CO., LTD.
CALIBRATION LABORATORY

451-451/1 Sirinthorn Road, Bangbunru, Bangkok, 10700 Thailand
Tel: +66 2423 8331 Email: calibration@sithiporn.com



Cert. No. : ACL24019
Job No. : VC67AC0045
Pages : 2 of 8

Calibration Procedure : CP-AC-01

Calibration Method :

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

Condition of this result of calibration :

1. Reference Standard Instruments :

Instrument	Model	Serial No.	Cert. No.	Due Date
Waveform Generator	33210A	MY48017076	EE-0009-23	07-FEB-24
Waveform Generator	33511B	MY52302742	EF-0010-23	07-FEB-24
Digital Multimeter	33461A	MY53220104	EELBP 30/0266	13-FEB-24
Digital Multimeter	33461A	MY53220076	EELBP 29/0266	13-FEB-24
Digital Multimeter	34461A	MY60024273	EELBP 31/0266	14-FEB-24
Programmable Attenuator	MAT-1070	62100114	EF-0011-23	08-FEB-24
Condenser Microphone	4180	2977900	AA-1001-23	14-FEB-24
Measuring Amplifier	NA-12KA1	34560495	AA-3002-23	14-FEB-24

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

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

3.1 National Institute of Metrology (Thailand).

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

T. Petchum

SITHIPORN ASSOCIATES CO., LTD.
CALIBRATION LABORATORY

451-451/ Sirinthorn Road, Bangbunru, Bangkok, 10700 Thailand
Tel: +66 2433 8331 Email: calibration@sithiporn.com



Cert. No. : ACL24019
Job No. : VC67AC0045
Pages : 3 of 8

Summary of Measurement Result:

Parameter	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

T. Petchar

SITHIPORN ASSOCIATES CO., LTD.
CALIBRATION LABORATORY

451-451/ Sirinthorn Road, Bangbunru, Bangkok, 10700 Thailand
Tel: +66 2433 8331 Email: calibration@sithiporn.com



Cert. No. : ACL24019
Job No. : VC67AC0045
Pages : 4 of 8

Result of calibration:

1. Absolute sensitivity

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

2. Self-generated noise

2.1 Normal test

Measured Value (dB)
16.1

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

Frequency Weighting	Measured value (dB)
A - weight	10.8
C - weight	16.8
Flat	22.6

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	0.3	0.4	0.4	± 1.5
1000	0.0	0.0	0.0	± 1.0
8000	-0.2	-0.2	-0.2	± 5.0

T. Petchar

SITHIPORN ASSOCIATES CO., LTD.
CALIBRATION LABORATORY

451-451/ Sirinthorn Road, Bangbunru, Bangkok, 10700 Thailand
Tel: +66 2433 8331 Email: calibration@sithiporn.com



Cert. No. : ACL24019
Job No. : VC67AC0045
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	0.0	±1.5
1000	0.0	0.0	0.0	±1.0
2000	0.0	0.0	0.0	±2.0
4000	0.0	0.0	0.0	±3.0
8000	0.0	0.1	0.1	±5.0

5. Frequency and time weightings at 1 kHz

5.1 Frequency weightings at 1 kHz

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

5.2 Time weighting at 1 kHz

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

6. Long - term stability

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

T. Petchar

SITHIPORN ASSOCIATES CO., LTD.
CALIBRATION LABORATORY

451-451/ Sirinthorn Road, Bangbunru, Bangkok, 10700 Thailand
Tel: +66 2433 8331 Email: calibration@sithiporn.com



Cert. No. : ACL24019
Job No. : VC67AC0045
Pages : 6 of 8

7. Level linearity on the reference level range

Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
137.0	137.0	0.0	± 1.1
136.0	136.0	0.0	± 1.1
135.0	135.0	0.0	± 1.1
134.0	134.0	0.0	± 1.1
133.0	133.0	0.0	± 1.1
132.0	131.9	-0.1	± 1.1
131.0	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

T. Petchar

SITHIPORN ASSOCIATES CO., LTD.
CALIBRATION LABORATORY

451-451/1 Srinthorn Road, Bangpurnu, Bangkok, 10700 Thailand
Tel: +66 2432 8331 Email: calibration@sithiporn.com



Cert. No. : ACL24019
Job No. : VC67AC0045
Pages : 7 of 8

8. Level linearity including the level range control

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

9. Tone burst response

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

10. Peak C sound level

Number of cycle in test signal	Anticipated Value (dB)	Measured Value, L _{peak} (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.0	0.0	±3.0
One	136.4	135.5	-0.9	±3.0

Number of cycle in test signal	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.0	0.0	±2.0
Positive half cycle	135.4	135.1	-0.3	±2.0
Negative half cycle	135.4	135.2	-0.2	±3.0

T. Petchurai

SITHIPORN ASSOCIATES CO., LTD.
CALIBRATION LABORATORY

451-451/1 Srinthorn Road, Bangpurnu, Bangkok, 10700 Thailand
Tel: +66 2432 8331 Email: calibration@sithiporn.com



Cert. No. : ACL24019
Job No. : VC67AC0045
Pages : 8 of 8

11. Overload indication

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

12. High level stability

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

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

End of Calibration Certificate

T. Petchurai

SITHIPORN ASSOCIATES CO., LTD.
CALIBRATION LABORATORY

451-451/1 Srinthorn Road, Bangpurnu, Bangkok, 10700 Thailand
Tel: +66 2432 8331 Email: calibration@sithiporn.com



Cert. No. : ACL24006
Pages : 1 of 8

Calibration Certificate

Equipment : SOUND LEVEL METER
Manufacturer : RION
Model : NL-42 / Microphone UC-52 / Preampifier NH-24
Serial No.: 00858521 / 158765 / 58767
ID No.: BKK_F50111

Condition As Found : GOOD

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

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

Received Date : 19 DECEMBER 2023
Calibration Date : 05-08 JANUARY 2024
Date of Issue : 08 JANUARY 2024

Calibrated by : Natthakorn Pissupaisan

Approved by :

T. Petchurai
(Thanakul Petchurai)

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

SITHIPORN ASSOCIATES CO., LTD.
CALIBRATION LABORATORY

451-451/1 Srinthorn Road, Bangpurnu, Bangkok, 10700 Thailand
Tel: +66 2432 8331 Email: calibration@sithiporn.com



Cert. No. : ACL24006
Job No. : VC67AC0043
Pages : 2 of 8

Calibration Procedure : CP-AC-01

Calibration Method :

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

Condition of this result of calibration :

1. Reference Standard Instruments :

Instrument	Model	Serial No.	Cert. No.	Due Date
Waveform Generator	33210A	MY48017076	EF-0009-23	07-FEB-24
Waveform Generator	33511B	MY52302742	EF-0010-23	07-FEB-24
Digital Multimeter	33461A	MY53220104	EEL-BP 30/0266	13-FEB-24
Digital Multimeter	33461A	MY53220076	EEL-BP 29/0266	13-FEB-24
Digital Multimeter	34461A	MY60024273	EEL-BP 31/0266	14-FEB-24
Programmable Attenuator	MAT-1070	62100114	EF-0011-23	08-FEB-24
Condenser Microphone	#180	2977900	AA-1001-23	14-FEB-24
Measuring Amplifier	NA-42KA1	34560495	AA-3002-23	14-FEB-24

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

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

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

T. Petchurai

SITHIPORN ASSOCIATES CO., LTD. CALIBRATION LABORATORY

451-451/1 Srinthorn Road, Bangbunru, Bangkok, 10700 Thailand
Tel: +66 2433 8331 Email: calibration@sithiporn.com

SITHIPORN
ASSOCIATES



Cert. No. : ACL24006
Job No. : VC67AC0043
Pages : 3 of 8

Summary of Measurement Result :

Parameter	Uncertainty	Maximum-permitted
	(dB)	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

T. Petch

SITHIPORN ASSOCIATES CO., LTD. CALIBRATION LABORATORY

451-451/1 Srinthorn Road, Bangbunru, Bangkok, 10700 Thailand
Tel: +66 2433 8331 Email: calibration@sithiporn.com

SITHIPORN
ASSOCIATES



Cert. No. : ACL24006
Job No. : VC67AC0043
Pages : 4 of 8

Result of calibration :

1. Absolute sensitivity

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

2. Self-generated noise

2.1 Normal test

Measured Value (dB)
14.6

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

Frequency Weighting	Measured value (dB)
A - weight	12.6
C - weight	19.2
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	0.5	± 1.5
1000	0.0	0.0	0.0	± 1.0
8000	-1.5	-1.5	-1.4	± 5.0

T. Petch

SITHIPORN ASSOCIATES CO., LTD. CALIBRATION LABORATORY

451-451/1 Srinthorn Road, Bangbunru, Bangkok, 10700 Thailand
Tel: +66 2433 8331 Email: calibration@sithiporn.com

SITHIPORN
ASSOCIATES



Cert. No. : ACL24006
Job No. : VC67AC0043
Pages : 5 of 8

4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

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

5. Frequency and time weightings at 1 kHz

5.1 Frequency weightings at 1 kHz

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

5.2 Time weighting at 1 kHz

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

6. Long - term stability

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

T. Petch

SITHIPORN ASSOCIATES CO., LTD. CALIBRATION LABORATORY

451-451/1 Srinthorn Road, Bangbunru, Bangkok, 10700 Thailand
Tel: +66 2433 8331 Email: calibration@sithiporn.com

SITHIPORN
ASSOCIATES



Cert. No. : ACL24006
Job No. : VC67AC0043
Pages : 6 of 8

7. Level linearity on the reference level range

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

T. Petch

SITHIPORN ASSOCIATES CO., LTD. CALIBRATION LABORATORY

457-459/1 Sirithorn Road, Bangkokmu, Bangkok, 10700 Thailand
Tel: +66 2433 8331 Email: calibration@sithiporn.com



Cert. No. : ACL24006
Job No. : VC67AC0043
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, T _b (ms)	Cycle	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Fast	0.25	1	108.0	107.9	-0.1	1.5; -5.0
	2	8	117.0	117.0	0.0	1.0; -2.5
	200	800	134.0	134.1	0.1	±1.0
Slow	2	8	108.0	108.0	0.0	1.5; -5.0
	200	800	127.6	127.6	0.0	±1.0
	0.25	1	99.0	98.9	-0.1	1.5; -5.0
SEL	2	8	108.0	108.0	0.0	1.0; -2.5
	200	800	128.0	128.0	0.0	±1.0

10. Peak C sound level

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

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

7. Retu-

SITHIPORN ASSOCIATES CO., LTD. CALIBRATION LABORATORY

457-459/1 Sirithorn Road, Bangkokmu, Bangkok, 10700 Thailand
Tel: +66 2433 8331 Email: calibration@sithiporn.com



Cert. No. : ACL24006
Job No. : VC67AC0043
Pages : 8 of 8

11. Overload indication

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

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	±0.2

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

7. Retu-

INNOVATIVE INSTRUMENT CALIBRATION LAB
INNOVATIVE INSTRUMENT CO., LTD. HEAD OFFICE
71/100/11-12/13/14/15/16/17/18/19/20/21/22/23/24/25/26/27/28/29/30/31/32/33/34/35/36/37/38/39/40/41/42/43/44/45/46/47/48/49/50/51/52/53/54/55/56/57/58/59/60/61/62/63/64/65/66/67/68/69/70/71/72/73/74/75/76/77/78/79/80/81/82/83/84/85/86/87/88/89/90/91/92/93/94/95/96/97/98/99/100/101/102/103/104/105/106/107/108/109/110/111/112/113/114/115/116/117/118/119/120/121/122/123/124/125/126/127/128/129/130/131/132/133/134/135/136/137/138/139/140/141/142/143/144/145/146/147/148/149/150/151/152/153/154/155/156/157/158/159/160/161/162/163/164/165/166/167/168/169/170/171/172/173/174/175/176/177/178/179/180/181/182/183/184/185/186/187/188/189/190/191/192/193/194/195/196/197/198/199/200/201/202/203/204/205/206/207/208/209/210/211/212/213/214/215/216/217/218/219/220/221/222/223/224/225/226/227/228/229/230/231/232/233/234/235/236/237/238/239/240/241/242/243/244/245/246/247/248/249/250/251/252/253/254/255/256/257/258/259/260/261/262/263/264/265/266/267/268/269/270/271/272/273/274/275/276/277/278/279/280/281/282/283/284/285/286/287/288/289/290/291/292/293/294/295/296/297/298/299/300/301/302/303/304/305/306/307/308/309/310/311/312/313/314/315/316/317/318/319/320/321/322/323/324/325/326/327/328/329/330/331/332/333/334/335/336/337/338/339/340/341/342/343/344/345/346/347/348/349/350/351/352/353/354/355/356/357/358/359/360/361/362/363/364/365/366/367/368/369/370/371/372/373/374/375/376/377/378/379/380/381/382/383/384/385/386/387/388/389/390/391/392/393/394/395/396/397/398/399/400/401/402/403/404/405/406/407/408/409/410/411/412/413/414/415/416/417/418/419/420/421/422/423/424/425/426/427/428/429/430/431/432/433/434/435/436/437/438/439/440/441/442/443/444/445/446/447/448/449/450/451/452/453/454/455/456/457/458/459/460/461/462/463/464/465/466/467/468/469/470/471/472/473/474/475/476/477/478/479/480/481/482/483/484/485/486/487/488/489/490/491/492/493/494/495/496/497/498/499/500/501/502/503/504/505/506/507/508/509/510/511/512/513/514/515/516/517/518/519/520/521/522/523/524/525/526/527/528/529/530/531/532/533/534/535/536/537/538/539/540/541/542/543/544/545/546/547/548/549/550/551/552/553/554/555/556/557/558/559/560/561/562/563/564/565/566/567/568/569/570/571/572/573/574/575/576/577/578/579/580/581/582/583/584/585/586/587/588/589/590/591/592/593/594/595/596/597/598/599/600/601/602/603/604/605/606/607/608/609/610/611/612/613/614/615/616/617/618/619/620/621/622/623/624/625/626/627/628/629/630/631/632/633/634/635/636/637/638/639/640/641/642/643/644/645/646/647/648/649/650/651/652/653/654/655/656/657/658/659/660/661/662/663/664/665/666/667/668/669/670/671/672/673/674/675/676/677/678/679/680/681/682/683/684/685/686/687/688/689/690/691/692/693/694/695/696/697/698/699/700/701/702/703/704/705/706/707/708/709/710/711/712/713/714/715/716/717/718/719/720/721/722/723/724/725/726/727/728/729/730/731/732/733/734/735/736/737/738/739/740/741/742/743/744/745/746/747/748/749/750/751/752/753/754/755/756/757/758/759/760/761/762/763/764/765/766/767/768/769/770/771/772/773/774/775/776/777/778/779/780/781/782/783/784/785/786/787/788/789/790/791/792/793/794/795/796/797/798/799/800/801/802/803/804/805/806/807/808/809/810/811/812/813/814/815/816/817/818/819/820/821/822/823/824/825/826/827/828/829/830/831/832/833/834/835/836/837/838/839/840/841/842/843/844/845/846/847/848/849/850/851/852/853/854/855/856/857/858/859/860/861/862/863/864/865/866/867/868/869/870/871/872/873/874/875/876/877/878/879/880/881/882/883/884/885/886/887/888/889/890/891/892/893/894/895/896/897/898/899/900/901/902/903/904/905/906/907/908/909/910/911/912/913/914/915/916/917/918/919/920/921/922/923/924/925/926/927/928/929/930/931/932/933/934/935/936/937/938/939/940/941/942/943/944/945/946/947/948/949/950/951/952/953/954/955/956/957/958/959/960/961/962/963/964/965/966/967/968/969/970/971/972/973/974/975/976/977/978/979/980/981/982/983/984/985/986/987/988/989/990/991/992/993/994/995/996/997/998/999/1000/1001/1002/1003/1004/1005/1006/1007/1008/1009/1010/1011/1012/1013/1014/1015/1016/1017/1018/1019/1020/1021/1022/1023/1024/1025/1026/1027/1028/1029/1030/1031/1032/1033/1034/1035/1036/1037/1038/1039/1040/1041/1042/1043/1044/1045/1046/1047/1048/1049/1050/1051/1052/1053/1054/1055/1056/1057/1058/1059/1060/1061/1062/1063/1064/1065/1066/1067/1068/1069/1070/1071/1072/1073/1074/1075/1076/1077/1078/1079/1080/1081/1082/1083/1084/1085/1086/1087/1088/1089/1090/1091/1092/1093/1094/1095/1096/1097/1098/1099/1100/1101/1102/1103/1104/1105/1106/1107/1108/1109/1110/1111/1112/1113/1114/1115/1116/1117/1118/1119/1120/1121/1122/1123/1124/1125/1126/1127/1128/1129/1130/1131/1132/1133/1134/1135/1136/1137/1138/1139/1140/1141/1142/1143/1144/1145/1146/1147/1148/1149/1150/1151/1152/1153/1154/1155/1156/1157/1158/1159/1160/1161/1162/1163/1164/1165/1166/1167/1168/1169/1170/1171/1172/1173/1174/1175/1176/1177/1178/1179/1180/1181/1182/1183/1184/1185/1186/1187/1188/1189/1190/1191/1192/1193/1194/1195/1196/1197/1198/1199/1200/1201/1202/1203/1204/1205/1206/1207/1208/1209/1210/1211/1212/1213/1214/1215/1216/1217/1218/1219/1220/1221/1222/1223/1224/1225/1226/1227/1228/1229/1230/1231/1232/1233/1234/1235/1236/1237/1238/1239/1240/1241/1242/1243/1244/1245/1246/1247/1248/1249/1250/1251/1252/1253/1254/1255/1256/1257/1258/1259/1260/1261/1262/1263/1264/1265/1266/1267/1268/1269/1270/1271/1272/1273/1274/1275/1276/1277/1278/1279/1280/1281/1282/1283/1284/1285/1286/1287/1288/1289/1290/1291/1292/1293/1294/1295/1296/1297/1298/1299/1300/1301/1302/1303/1304/1305/1306/1307/1308/1309/1310/1311/1312/1313/1314/1315/1316/1317/1318/1319/1320/1321/1322/1323/1324/1325/1326/1327/1328/1329/1330/1331/1332/1333/1334/1335/1336/1337/1338/1339/1340/1341/1342/1343/1344/1345/1346/1347/1348/1349/1350/1351/1352/1353/1354/1355/1356/1357/1358/1359/1360/1361/1362/1363/1364/1365/1366/1367/1368/1369/1370/1371/1372/1373/1374/1375/1376/1377/1378/1379/1380/1381/1382/1383/1384/1385/1386/1387/1388/1389/1390/1391/1392/1393/1394/1395/1396/1397/1398/1399/1400/1401/1402/1403/1404/1405/1406/1407/1408/1409/1410/1411/1412/1413/1414/1415/1416/1417/1418/1419/1420/1421/1422/1423/1424/1425/1426/1427/1428/1429/1430/1431/1432/1433/1434/1435/1436/1437/1438/1439/1440/1441/1442/1443/1444/1445/1446/1447/1448/1449/1450/1451/1452/1453/1454/1455/1456/1457/1458/1459/1460/1461/1462/1463/1464/1465/1466/1467/1468/1469/1470/1471/1472/1473/1474/1475/1476/1477/1478/1479/1480/1481/1482/1483/1484/1485/1486/1487/1488/1489/1490/1491/1492/1493/1494/1495/1496/1497/1498/1499/1500/1501/1502/1503/1504/1505/1506/1507/1508/1509/1510/1511/1512/1513/1514/1515/1516/1517/1518/1519/1520/1521/1522/1523/1524/1525/1526/1527/1528/1529/1530/1531/1532/1533/1534/1535/1536/1537/1538/1539/1540/1541/1542/1543/1544/1545/1546/1547/1548/1549/1550/1551/1552/1553/1554/1555/1556/1557/1558/1559/1560/1561/1562/1563/1564/1565/1566/1567/1568/1569/1570/1571/1572/1573/1574/1575/1576/1577/1578/1579/1580/1581/1582/1583/1584/1585/1586/1587/1588/1589/1590/1591/1592/1593/1594/1595/1596/1597/1598/1599/1600/1601/1602/1603/1604/1605/1606/1607/1608/1609/1610/1611/1612/1613/1614/1615/1616/1617/1618/1619/1620/1621/1622/1623/1624/1625/1626/1627/1628/1629/1630/1631/1632/1633/1634/1635/1636/1637/1638/1639/1640/1641/1642/1643/1644/1645/1646/1647/1648/1649/1650/1651/1652/1653/1654/1655/1656/1657/1658/1659/1660/1661/1662/1663/1664/1665/1666/1667/1668/1669/1670/1671/1672/1673/1674/1675/1676/1677/1678/1679/1680/1681/1682/1683/1684/1685/1686/1687/1688/1689/1690/1691/1692/1693/1694/1695/1696/1697/1698/1699/1700/1701/1702/1703/1704/1705/1706/1707/1708/1709/1710/1711/1712/1713/1714/1715/1716/1717/1718/1719/1720/1721/1722/1723/1724/1725/1726/1727/1728/1729/1730/1731/1732/1733/1734/1735/1736/1737/1738/1739/1740/1741/1742/1743/1744/1745/1746/1747/1748/1749/1750/1751/1752/1753/1754/1755/1756/1757/1758/1759/1760/1761/1762/1763/1764/1765/1766/1767/1768/1769/1770/1771/1772/1773/1774/1775/1776/1777/1778/1779/1780/1781/1782/1783/1784/1785/1786/1787/1788/1789/1790/1791/1792/1793/1794/1795/1796/1797/1798/1799/1800/1801/1802/1803/1804/1805/1806/1807/1808/1809/1810/1811/1812/1813/1814/1815/1816/1817/1818/1819/1820/1821/1822/1823/1824/1825/1826/1827/1828/1829/1830/1831/1832/1833/1834/1835/1836/1837/1838/1839/1840/1841/1842/1843/1844/1845/1846/1847/1848/1849/1850/1851/1852/1853/1854/1855/1856/1857/1858/1859/1860/1861/1862/1863/1864/1865/1866/1867/1868/1869/1870/1871/1872/1873/1874/1875/1876/1877/1878/1879/1880/1881/1882/1883/1884/1885/1886/1887/1888/1889/1890/1891/1892/1893/1894/1895/1896/1897/1898/1899/1900/1901/1902/1903/1904/1905/1906/1907/1908/1909/1910/1911/1912/1913/1914/1915/1916/1917/1918/1919/1920/1921/1922/1923/1924/1925/1926/1927/1928/1929/1930/1931/1932/1933/1934/1935/1936/1937/1938/1939/1940/1941/1942/1943/1944/1945/1946/1947/1948/1949/1950/1951/1952/1953/1954/1955/1956/1957/1958/1959/1960/1961/1962/1963/1964/1965/1966/1967/1968/1969/1970/1971/1972/1973/1974/1975/1976/1977/1978/1979/1980/1981/1982/1983/1984/1985/1986/1987/1988/1989/1990/1991/1992/1993/1994/1995/1996/1997/1998/1999/2000/2001/2002/2003/2004/2005/2006/2007/2008/2009/2010/2011/2012/2013/2014/2015/2016/2017/2018/2019/2020/2021/2022/2023/2024/2025/2026/2027/2028/2029/2030/2031/2032/2033/2034/2035/2036/2037/2038/2039/2040/2041/2042/2043/2044/2045/2046/2047/2048/2049/2050/2051/2052/2053/2054/2055/2056/2057/2058/2059/2060/2061/2062/2063/2064/2065/2066/2067/2068/2069/2070/2071/2072/2073/2074/2075/2076/2077/2078/2079/2080/2081/2082/2083/2084/2085/2086/2087/2088/2089/2090/2091/2092/2093/2094/2095/2096/2097/2098/2099/2100/2101/2102/2103/2104/2105/2106/2107/2108/2109/2110/2111/2112/2113/2114/2115/2116/2117/2118/2119/2120/2121/2122/2123/2124/2125/2126/2127/2128/2129/2130/2131/2132/2133/2134/2135/2136/2137/2138/2139/2140/2141/2142/2143/2144/2145/2146/2147/2148/2149/2150/2151/2152/2153/2154/2155/2156/2157/2158/2159/2160/2161/2162/2163/2164/2165/2166/2167/2168/2169/2170/2171/2172/2173/2174/2175/2176/2177

Certificate No : 24-SLM-019
Request No : Req-2023-2672

5. Electrical signal test of frequency weightings, Weighting network response with relative to 1 kHz

UUC Setting	Deviation from various Frequency			UNCERTAINTY	Acceptance Limit
FAST / 30-130	Weighting Response curve				
STD Setting	A (dB)	C (dB)	Z (dB)	(\pm dB)	(\pm dB)
63 Hz	-0.2	-0.1	-0.1	0.20	2.0
125 Hz	-0.1	0.0	0.0		1.5
250 Hz	-0.1	0.0	0.0		1.5
500 Hz	0.0	0.0	0.0		1.3
1000 Hz	0.0	0.0	0.0		1.0
2000 Hz	0.0	0.0	0.0		2.0
4000 Hz	0.0	0.0	0.0		3.0
8000 Hz	0.0	0.1	0.0		5.0
16000 Hz	-1.4	-1.4	0.0		-5, -10

6. Frequency and time weightings at 1 kHz

UUC Setting	STD	Measured		UNCERTAINTY (\pm dB)	Acceptance Limit (\pm dB)
FAST / 30-130	REF	UUC	ERR		
UUC Weighting	(dB)	(dB)	(dB)	0.20	0.20
A	114.00	114.0	0.0		
C	114.00	114.0	0.0		
Z	114.00	114.0	0.0		

UUC Setting	STD	Measured		UNCERTAINTY (\pm dB)	Acceptance Limit (\pm dB)
30-130 / A	REF	UUC	ERR		
UUC Time Response	(dB)	(dB)	(dB)	0.20	0.10
Fast	114.00	114.0	0.0		
Slow	114.00	114.0	0.0		
Log	114.00	114.0	0.0		

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the Innovator Instrument Co., Ltd.

136/98333401 Rev 02 Issue date: 11/23

Page: 3/6

Certificate No : 24-SLM-019
Request No : Req-2023-2672

7. Long Term Stability

UUC Setting	Measured	UNCERTAINTY (\pm dB)	Acceptance Limit (\pm dB)
FAST / A / 30-130	UUC		
STD Setting	(dB)	0.10	0.30
Initial	114.0		
Final	114.0		
Deviated	0.0		

8. Level linearity on the reference level range

UUC Setting	Anticipated	Deviation		UNCERTAINTY (\pm dB)	Acceptance Limit (\pm dB)
FAST / A / 30-130	REF	UUC	ERR		
STD dB	(dB)	(dB)	(dB)	0.30	1.1
130.00	130	130.0	0.0		
134.00	134	134.0	0.0		
129.00	129	129.0	0.0		
124.00	124	124.0	0.0		
119.00	119	119.0	0.0		
114.00	114	114.0	0.0		
109.00	109	109.0	0.0		
104.00	104	104.1	0.1		
99.00	99	99.0	0.0		
94.00	94	94.0	0.0		
89.00	89	89.1	0.1		
84.00	84	84.1	0.1		
79.00	79	79.0	0.0		
74.00	74	74.1	0.1		
69.00	69	69.1	0.1		
64.00	64	64.0	0.0		
59.00	59	59.1	0.1		
54.00	54	54.0	0.0		
49.00	49	49.1	0.1		
44.00	44	44.1	0.1		
39.00	39	39.1	0.1		
34.00	34	34.1	0.1		
29.00	29	29.1	0.1		
24.00	24	24.1	0.1		

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the Innovator Instrument Co., Ltd.

136/98333401 Rev 02 Issue date: 11/23

Page: 4/6

Certificate No : 24-SLM-019
Request No : Req-2023-2672

9. Level linearity including the level range control

UUC Setting	STD	Measured		UNCERTAINTY (\pm dB)	Acceptance Limit (\pm dB)
FAST / A	REF	UUC	ERR		
UUC Range	(dB)	(dB)	(dB)	0.30	1.1
30-130	29.40	29.5	0.1		
	114	114.0	0.0		

10. Tone burst response

UUC Setting	STD	Anticipated	Measured		UNCERTAINTY (\pm dB)	Acceptance Limit (\pm dB)
A / 30-130	Timeburst	Ref	UUC	ERR		
UUC Time Response	(ms)	(dB)	(dB)	(dB)	0.20	1.0
Fast	200	126.0	126.0	0.0		
	2	109.0	109.0	0.0		
	0.25	100.0	99.9	-0.1		
Slow	200	119.6	119.6	0.0		
	2	100.0	100.0	0.0		
	0.25	91.0	90.9	-0.1		
St-1	200	120.0	120.0	0.0		
	2	100.0	100.0	0.0		
	0.25	91.0	90.9	-0.1		

11. Peak C Sound level

UUC Setting	Anticipated	Measured		UNCERTAINTY (\pm dB)	Acceptance Limit (\pm dB)
FAST / C / 55-141	REF	UUC	ERR		
STD Setting	(dB)	(dB)	(dB)	0.20	2.0
Complete cycle	136.4	136.4	0.00		
Positive half cycle	135.4	135.3	-0.30		
Negative half cycle	135.4	135.3	-0.30		

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the Innovator Instrument Co., Ltd.

136/98333401 Rev 02 Issue date: 11/23

Page: 5/6

Certificate No : 24-SLM-019
Request No : Req-2023-2672

12. Overload indication

UUC Setting	Measured	UNCERTAINTY (\pm dB)	Acceptance Limit (\pm dB)
FAST / A / 30-130	UUC		
STD Setting	(dB)	0.20	1.5
Positive one-half cycle	139.4		
Negative one-half cycle	139.4		
Deviated	0.0		

13. High Level Stability

UUC Setting	Measured	UNCERTAINTY (\pm dB)	Acceptance Limit (\pm dB)
FAST / A / 30-130	UUC		
STD Setting	(dB)	0.10	0.30
Initial	129.0		
Final	129.0		
Deviated	0.0		

Note :

Function	Maximum-permitted Uncertainty of measurement
1. Indication at the calibration check frequency	Not applicable
2. Self-generated noise. Microphone installed	Not applicable
3. Self-generated noise. Microphone replaced by the electrical input signal device	Not applicable
4. Acoustic signal test of frequency weightings at 10 Hz to 4 kHz	0.60 dB
4. Acoustic signal test of frequency weightings at ~4 kHz to 10 kHz	0.70 dB
5. Electrical signal test of frequency weightings. Weighting network response with relative to 1 kHz	0.20 dB
6. Frequency and time weightings at 1 kHz	0.20 dB
7. Long Term Stability	0.10 dB
8. Level linearity on the reference level range	0.30 dB
9. Level linearity including the level range control	0.30 dB
10. Tone burst response	0.30 dB
11. Peak C Sound level	0.35 dB
12. Overload indication	0.25 dB
13. High Level Stability	0.10 dB

* Acceptance limit and Maximum-permitted Uncertainty was REC 610/0-1-2013

End of Certificate

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the Innovator Instrument Co., Ltd.

136/98333401 Rev 02 Issue date: 11/23

Page: 6/6

SITHIPORN ASSOCIATES CO.,LTD. CALIBRATION LABORATORY

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



Cert. No. : ACL23309
Pages : 1 of 8

Calibration Certificate

Equipment : SOUND LEVEL METER
Manufacturer : RION
Model : NL-42/ Microphone LC-52 / Pre-amplifier SP-24
Serial No. : 00584983 / (5778) 48096
ID No. : BKK_F50926

Condition As Found : GOOD

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

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

Received Date : 22 SEPTEMBER 2023
Calibration Date : 16-18 OCTOBER 2023
Date of Issue : 19 OCTOBER 2023

Calibrated by : Nathakorn Pisutpaisan

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

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

QF-TS12-04-04-020664

SITHIPORN ASSOCIATES CO.,LTD. CALIBRATION LABORATORY

Continuation of Calibration Certificate

Cert. No. : ACL23309
Job No. : VC66AC0101
Pages : 2 of 8

Calibration Procedure : CP-AC-01

Calibration Method :

This equipment was calibrated by based on IEC-61672-3 (20)3) Standard for sound level meter (SLM).
The SLM had tests to Acoustical and Electrical signal tests of frequency weighting with Anechoic chamber and Reference Standard Instruments.
For tests results of each items were made by observation of each Instruments display and also with SLM's display.

Condition of this result of calibration :

1. Reference Standard Instruments :

Instrument	Model	Serial No.	Cert. No.	Due Date
Waveform Generator	33210A	MY48017076	EF-0009-23	07-FEB-24
Waveform Generator	33511B	MY52302742	EF-0010-23	07-FEB-24
Digital Multimeter	33461A	MY53220104	EEL-BP-3010266	13-FEB-24
Digital Multimeter	33461A	MY53220076	EEL-BP-3010266	13-FEB-24
Digital Multimeter	34461A	MY60024273	EEL-BP-3100266	14-FEB-24
Programmable Attenuator	MAT-1070	62100114	EF-0011-23	08-FEB-24
Condenser Microphone	4180	2977900	AA-1001-23	14-FEB-24
Measuring Amplifier	NA-42KAJ	34560495	AA-3002-23	14-FEB-24

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

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

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

QF-TS12-04-04-020664

T. Petchur

SITHIPORN ASSOCIATES CO.,LTD. CALIBRATION LABORATORY

Continuation of Calibration Certificate

Cert. No. : ACL23309
Job No. : VC66AC0101
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	✓	-	0.3	0.1

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

QF-TS12-04-04-020664

T. Petchur

SITHIPORN ASSOCIATES CO.,LTD. CALIBRATION LABORATORY

Continuation of Calibration Certificate

Cert. No. : ACL23309
Job No. : VC66AC0101
Pages : 4 of 8

Result of calibration :

1. Absolute sensitivity

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

2. Self-generated noise

2.1 Normal test

Measured Value (dB)
16.5

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

Frequency Weighting	Measured value (dB)
A-weight	12.6
C-weight	18.8
Flat	24.5

3. Acoustical signal tests of frequency weightings

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

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)			
	Flat	C-weight	A-weight	Acceptance Limits
125	0.3	0.4	0.3	± 1.5
1000	0.0	0.0	0.0	± 1.0
8000	-0.3	-0.2	-0.2	± 5.0

QF-TS12-04-04-020664

T. Petchur

Continuation of Calibration Certificate

Cert. No. : ACL23309
Job No. : VC66AC0101
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	0.0	±2.0
125	0.0	0.0	0.0	±1.5
250	0.0	0.0	-0.1	±1.5
500	0.0	0.0	0.0	±1.5
1000	0.0	0.0	0.0	±1.0
2000	0.0	0.0	0.0	±2.0
4000	0.0	0.0	0.0	±3.0
8000	0.0	0.1	0.1	±5.0

5. Frequency and time weightings at 1 kHz

5.1 Frequency weightings at 1 kHz

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

5.2 Time weighting at 1 kHz

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

6. Long - term stability

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

QF-TS12-04-04-020664

T. Petch

Continuation of Calibration Certificate

Cert. No. : ACL23309
Job No. : VC66AC0101
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	79.0	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	27.0	0.0	± 1.1
26.0	26.0	0.0	± 1.1
25.0	25.0	0.0	± 1.1

QF-TS12-04-04-020664

T. Petch

Continuation of Calibration Certificate

Cert. No. : ACL23309
Job No. : VC66AC0101
Pages : 7 of 8

8. Level linearity including the level range control

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

9. Tone burst response

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

10. Peak C sound level

Number of cycle in test signal	Anticipated Value (dB)	Measured Value, L _{peak} (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.1	0.1	± 3.0
One	136.4	136.0	-0.4	± 3.0

Number of cycle in test signal	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.1	0.1	± 2.0
Positive half cycle	135.4	135.3	-0.1	± 2.0
Negative half cycle	135.4	135.3	-0.1	± 2.0

QF-TS12-04-04-020664

T. Petch

Continuation of Calibration Certificate

Cert. No. : ACL23309
Job No. : VC66AC0101
Pages : 8 of 8

11. Overload indication

Measured value (dB)		Deviated Value (dB)	Acceptance Limits (dB)
Positive one-half cycle	Negative one-half cycle		
89.5	89.7	0.2	± 1.5

12. High level stability

Frequency Weighting	SLM Display at initial (dB)	SLM Display at final (dB)	Deviated Value (dB)	Acceptance Limits (dB)
A - weight	137.0	137.0	0.0	± 0.5

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

End of Calibration Certificate

QF-TS12-04-04-020664

T. Petch

SITHIPORN ASSOCIATES CO.,LTD. CALIBRATION LABORATORY

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



Cert. No. : ACL23370
Pages : 1 of 8

Calibration Certificate

Equipment : SOUND LEVEL METER
Manufacturer : RION
Model : NL-42 / Microphone UC-52 / Preamplifier N13-24
Serial No. : 01122547 / 143452 / 22584
ID No. : BKK_FS0034

Condition As Found : GOOD

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

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

Received Date : 07 NOVEMBER 2023
Calibration Date : 29-30 NOVEMBER 2023
Date of Issue : 06 DECEMBER 2023

Calibrated by : Nathakorn Pichupaisan

Approved by :

T. Pichupaisan
(Thanakul Pichupaisan)

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

QF-TS12-04-04-020664

SITHIPORN ASSOCIATES CO.,LTD. CALIBRATION LABORATORY

Continuation of Calibration Certificate

Cert. No. : ACL23370
Job No. : VC67AC0025
Pages : 2 of 8

Calibration Procedure : CP-AC-01

Calibration Method :

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

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

Condition of this result of calibration :

1. Reference Standard Instruments :

Instrument	Model	Serial No.	Cert. No.	Due Date
Waveform Generator	33210A	MY48017076	EF-0009-23	07-FEB-24
Waveform Generator	33511B	MY52302742	EF-0010-23	07-FEB-24
Digital Multimeter	33461A	MY53220104	EEL_BP 30/0266	13-FEB-24
Digital Multimeter	33461A	MY53220076	EEL_BP 29/0266	13-FEB-24
Digital Multimeter	34461A	MY60024273	EEL_BP 31/0266	14-FEB-24
Programmable Attenuator	MAT-1070	62100114	EF-0011-23	08-FEB-24
Condenser Microphone	4180	2977900	AA-1001-23	14-FEB-24
Measuring Amplifier	NA-42KA1	34560495	AA-3002-23	14-FEB-24

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

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

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

QF-TS12-04-04-020664

T. Pichupaisan

SITHIPORN ASSOCIATES CO.,LTD. CALIBRATION LABORATORY

Continuation of Calibration Certificate

Cert. No. : ACL23370
Job No. : VC67AC0025
Pages : 3 of 8

Summary of Measurement Result :

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

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

QF-TS12-04-04-020664

T. Pichupaisan

SITHIPORN ASSOCIATES CO.,LTD. CALIBRATION LABORATORY

Continuation of Calibration Certificate

Cert. No. : ACL23370
Job No. : VC67AC0025
Pages : 4 of 8

Result of calibration :

1. Absolute sensitivity

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

2. Self-generated noise

2.1 Normal test

Measured Value (dB)
15.6

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

Frequency Weighting	Measured value (dB)
A - weight	10.8
C - weight	17.0
Flat	22.9

3. Acoustical signal tests of frequency weightings

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

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)			
	Flat	C-weight	A-weight	Acceptance Limits
125	0.9	1.0	-0.9	±1.5
1000	0.1	0.1	0.1	±1.0
8000	-1.7	-1.7	-1.6	±5.0

QF-TS12-04-04-020664

T. Pichupaisan

Continuation of Calibration Certificate

Cert. No. : ACL23370
Job No. : VC67AC0025
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	0.0	±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	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
A - weight	94.0	94.0	0.0	±0.2
C - weight	94.0	94.0	0.0	±0.2
Flat	94.0	94.0	0.0	±0.2

5.2 Time weighting at 1 kHz

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

6. Long-term stability

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

QF-TS12-04-04-020664

T. Petch

Continuation of Calibration Certificate

Cert. No. : ACL23370
Job No. : VC67AC0025
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	34.0	0.0	±1.1
30.0	30.0	0.0	±1.1
29.0	29.0	0.0	±1.1
28.0	28.0	0.0	±1.1
27.0	27.0	0.0	±1.1
26.0	26.0	0.0	±1.1
25.0	25.0	0.0	±1.1

QF-TS12-04-04-020664

T. Petch

Continuation of Calibration Certificate

Cert. No. : ACL23370
Job No. : VC67AC0025
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	±3.0
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	±2.0
Positive half cycle	135.4	135.2	-0.2	±2.0
Negative half cycle	135.4	135.2	-0.2	±2.0

QF-TS12-04-04-020664

T. Petch

Continuation of Calibration Certificate

Cert. No. : ACL23370
Job No. : VC67AC0025
Pages : 8 of 8

11. Overload indication

Measured value (dB)		Deviated Value (dB)	Acceptance Limits (dB)
Positive one-half cycle	Negative one-half cycle		
89.7	89.8	0.1	±1.5

12. High level stability

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

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

End of Calibration Certificate

QF-TS12-04-04-020664

T. Petch

SITHIPORN ASSOCIATES CO.,LTD. CALIBRATION LABORATORY

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



Cert. No. : ACL23193
Pages : 1 of 8

Calibration Certificate

Equipment : SOUND LEVEL METER
Manufacturer : RION
Model : NL-42/ Microphone UC-53 / Preamplifier NH-24
Serial No. : 00710645 / 136966 / 10646
ID No. : BKK_FS0029

Condition As Found : GOOD

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

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

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

Calibrated by : Nattakorn Pisuatpisan

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

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

QF-TS12-04-04-020664

SITHIPORN ASSOCIATES CO.,LTD. CALIBRATION LABORATORY

Continuation of Calibration Certificate

Cert. No. : ACL23193
Job No. : VC66AC0066
Pages : 2 of 8

Calibration Procedure : CP-AC-01

Calibration Method :

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

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

Condition of this result of calibration :

1. Reference Standard Instruments :

Instrument	Model	Serial No.	Cert. No.	Due Date
Waveform Generator	33210A	MY48017076	EF-0009-23	07-FEB-24
Waveform Generator	33511B	MY52302742	EF-0010-23	07-FEB-24
Digital Multimeter	33461A	MY53220104	EEL-BP 30.0266	13-FEB-24
Digital Multimeter	33461A	MY53220076	EEL-BP 29.0266	13-FEB-24
Digital Multimeter	34461A	MY60024273	EEL-BP 31.0266	14-FEB-24
Programmable Attenuator	MAT-1070	62100114	EF-0011-23	08-FEB-24
Condenser Microphone	4180	2977900	AA-1001-23	14-FEB-24
Measuring Amplifier	NA-42KAI	34560495	AA-3002-23	14-FEB-24

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

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

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

QF-TS12-04-04-020664

T. Petchum

SITHIPORN ASSOCIATES CO.,LTD. CALIBRATION LABORATORY

Continuation of Calibration Certificate

Cert. No. : ACL23193
Job No. : VC66AC0066
Pages : 3 of 8

Summary of Measurement Result :

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

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

QF-TS12-04-04-020664

T. Petchum

SITHIPORN ASSOCIATES CO.,LTD. CALIBRATION LABORATORY

Continuation of Calibration Certificate

Cert. No. : ACL23193
Job No. : VC66AC0066
Pages : 4 of 8

Result of calibration :

1. Absolute sensitivity

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

2. Self-generated noise

2.1 Normal test

Measured Value (dB)
14.4

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

Frequency Weighting	Measured value (dB)
A-weight	12.6
C-weight	19.5
Flat	24.9

3. Acoustical signal tests of frequency weightings

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

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)			Acceptance Limits
	Flat	C-weight	A-weight	
125	0.1	0.1	0.1	±1.5
1000	0.0	0.0	0.0	±1.0
8000	-0.2	-0.3	-0.1	±5.0

QF-TS12-04-04-020664

T. Petchum

Continuation of Calibration Certificate

Cert. No. : ACL23193
Job No. : VC66AC0066
Pages : 5 of 8

4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

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

5. Frequency and time weightings at 1 kHz

5.1 Frequency weightings at 1 kHz

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

5.2 Time weighting at 1 kHz

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

6. Long-term stability

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

QF-TS12-04-04-020664

P.T.L.

Continuation of Calibration Certificate

Cert. No. : ACL23193
Job No. : VC66AC0066
Pages : 6 of 8

7. Level linearity on the reference level range

Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
137.0	137.0	0.0	±1.1
136.0	136.0	0.0	±1.1
135.0	135.0	0.0	±1.1
134.0	134.0	0.0	±1.1
133.0	133.0	0.0	±1.1
132.0	132.0	0.0	±1.1
131.0	131.0	0.0	±1.1
129.0	129.0	0.0	±1.1
124.0	124.0	0.0	±1.1
119.0	119.1	0.1	±1.1
114.0	114.0	0.0	±1.1
109.0	109.0	0.0	±1.1
104.0	104.1	0.1	±1.1
99.0	99.0	0.0	±1.1
94.0	94.0	0.0	±1.1
89.0	89.0	0.0	±1.1
84.0	84.0	0.0	±1.1
79.0	79.0	0.0	±1.1
74.0	74.0	0.0	±1.1
69.0	69.0	0.0	±1.1
64.0	64.0	0.0	±1.1
59.0	59.0	0.0	±1.1
54.0	54.0	0.0	±1.1
49.0	49.0	0.0	±1.1
44.0	44.0	0.0	±1.1
39.0	39.0	0.0	±1.1
34.0	34.0	0.0	±1.1
30.0	29.9	-0.1	±1.1
29.0	28.9	-0.1	±1.1
28.0	27.9	-0.1	±1.1
27.0	26.9	-0.1	±1.1
26.0	25.9	-0.1	±1.1
25.0	24.8	-0.2	±1.1

QF-TS12-04-04-020664

P.T.L.

Continuation of Calibration Certificate

Cert. No. : ACL23193
Job No. : VC66AC0066
Pages : 7 of 8

8. Level linearity including the level range control

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

9. Tone burst response

Time Weighting	Tone burst duration, Tb (ms)	Cycle	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Fast	0.25	1	108.0	107.9	-0.1	1.5 ; -5.0
	2	8	117.0	116.9	-0.1	1.0 ; -2.5
	200	800	134.0	134.0	0.0	±1.0
Slow	2	8	108.0	107.9	-0.1	1.5 ; -5.0
	200	800	127.6	127.5	-0.1	±1.0
	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	±3.0
One	136.4	135.6	-0.8	±3.0

Number of cycle in test signal	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	132.9	-0.1	±2.0
Positive half cycle	135.4	135.1	-0.3	±2.0
Negative half cycle	135.4	135.1	-0.3	±2.0

QF-TS12-04-04-020664

P.T.L.

Continuation of Calibration Certificate

Cert. No. : ACL23193
Job No. : VC66AC0066
Pages : 8 of 8

11. Overload indication

Measured value (dB)		Deviated Value (dB)	Acceptance Limits (dB)
Positive one-half cycle	Negative one-half cycle		
89.5	89.7	0.2	±1.5

12. High level stability

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

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

End of Calibration Certificate

QF-TS12-04-04-020664

P.T.L.

SITHIPORN ASSOCIATES CO.,LTD. CALIBRATION LABORATORY

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



Cert. No. : ACL23371
Pages : 1 of 8

Calibration Certificate

Equipment : SOUND LEVEL METER
Manufacturer : RION
Model : NL-42 / Microphone UC-52 / Preamplifier NH-24
Serial No. : 01122504 / 169436 / 72457
ID No. : BKK_FS0033

Condition As Found : GOOD

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

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

Received Date : 07 NOVEMBER 2023
Calibration Date : 29-30 NOVEMBER 2023
Date of Issue : 06 DECEMBER 2023

Calibrated by : Nathakorn Pisutpakorn

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

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

QI-TS12-04-04-020664

SITHIPORN ASSOCIATES CO.,LTD. CALIBRATION LABORATORY

Continuation of Calibration Certificate

Cert. No. : ACL23371
Job No. : VC67AC0025
Pages : 2 of 8

Calibration Procedure : CP-AC-01

Calibration Method :

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

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

Condition of this result of calibration :

1. Reference Standard Instruments :

Instrument	Model	Serial No.	Cert. No.	Due Date
Waveform Generator	33210A	MY48017076	EF-0009-23	07-FEB-24
Waveform Generator	33511B	MY52302742	EF-0010-23	07-FEB-24
Digital Multimeter	33461A	MY53220104	EEL-BP 30/0266	13-FEB-24
Digital Multimeter	33461A	MY53220076	EEL-BP 29/0266	13-FEB-24
Digital Multimeter	34461A	MY60024273	EEL-BP 31/0266	14-FEB-24
Programmable Attenuator	MAT-1070	62100114	EF-0011-23	08-FEB-24
Condenser Microphone	4180	2977900	AA-1001-23	14-FEB-24
Measuring Amplifier	NA-42KAJ	34560495	AA-3002-23	14-FEB-24

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

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

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

QI-TS12-04-04-020664

T. Petchum

SITHIPORN ASSOCIATES CO.,LTD. CALIBRATION LABORATORY

Continuation of Calibration Certificate

Cert. No. : ACL23371
Job No. : VC67AC0025
Pages : 3 of 8

Summary of Measurement Result :

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

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

QI-TS12-04-04-020664

T. Petchum

SITHIPORN ASSOCIATES CO.,LTD. CALIBRATION LABORATORY

Continuation of Calibration Certificate

Cert. No. : ACL23371
Job No. : VC67AC0025
Pages : 4 of 8

Result of calibration :

1. Absolute sensitivity

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

2. Self-generated noise

2.1 Normal test

Measured Value (dB)
16.1

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

Frequency Weighting	Measured value (dB)
A-weight	13.5
C-weight	19.8
Flat	25.6

3. Acoustical signal tests of frequency weightings

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

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

QI-TS12-04-04-020664

T. Petchum

Continuation of Calibration Certificate

Cert. No. : ACL23371
Job No. : VC67AC0025
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	0.1	0.0	±1.5
250	0.0	0.0	0.0	±1.5
500	0.0	0.1	0.0	±1.5
1000	0.0	0.0	0.0	±1.0
2000	0.0	0.1	0.0	±2.0
4000	0.0	0.1	0.0	±3.0
8000	0.0	0.1	0.1	±5.0

5. Frequency and time weightings at 1 kHz

5.1 Frequency weightings at 1 kHz

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

5.2 Time weighting at 1 kHz

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

6. Long - term stability

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

QP-TS12-04-04-020664

T. Petch

Continuation of Calibration Certificate

Cert. No. : ACL23371
Job No. : VC67AC0025
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	119.1	0.1	± 1.1
114.0	114.0	0.0	± 1.1
109.0	109.0	0.0	± 1.1
104.0	104.0	0.0	± 1.1
99.0	99.0	0.0	± 1.1
94.0	94.0	0.0	± 1.1
89.0	89.0	0.0	± 1.1
84.0	84.0	0.0	± 1.1
79.0	79.0	0.0	± 1.1
74.0	74.0	0.0	± 1.1
69.0	69.0	0.0	± 1.1
64.0	64.0	0.0	± 1.1
59.0	59.0	0.0	± 1.1
54.0	54.0	0.0	± 1.1
49.0	49.0	0.0	± 1.1
44.0	44.0	0.0	± 1.1
39.0	38.9	-0.1	± 1.1
34.0	33.9	-0.1	± 1.1
30.0	29.9	-0.1	± 1.1
29.0	28.9	-0.1	± 1.1
28.0	27.8	-0.2	± 1.1
27.0	26.9	-0.1	± 1.1
26.0	25.9	-0.1	± 1.1
25.0	24.8	-0.2	± 1.1

QP-TS12-04-04-020664

T. Petch

Continuation of Calibration Certificate

Cert. No. : ACL23371
Job No. : VC67AC0025
Pages : 7 of 8

8. Level linearity including the level range control

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

9. Tone burst response

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

10. Peak C sound level

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

Number of cycle in test signal	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	132.9	-0.1	±2.0
Positive half cycle	135.4	135.1	-0.3	±2.0
Negative half cycle	135.4	135.1	-0.3	±2.0

QP-TS12-04-04-020664

T. Petch

Continuation of Calibration Certificate

Cert. No. : ACL23371
Job No. : VC67AC0025
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

QP-TS12-04-04-020664

T. Petch

SITHIPORN ASSOCIATES CO.,LTD. CALIBRATION LABORATORY



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

ISO 17025
CALIBRATION 0354

Cert. No. : ACL23342
Pages : 1 of 8

Calibration Certificate

Equipment : SOUND LEVEL METER
Manufacturer : RION
Model : NL-42 / Microphone UC-52 / Preamplifier NH-24
Serial No. : 00584982 / 175177 / 85722
ID No. : BKK_FS0925

Condition As Found : GOOD

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

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

Received Date : 01 NOVEMBER 2023
Calibration Date : 07-08 NOVEMBER 2023
Date of Issue : 14 NOVEMBER 2023

Calibrated by : Nathakorn Pisutpaisan

Approved by :

T. Petchur
(Thanakul Petchur)

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

QF-TS12-04-04-020664

SITHIPORN ASSOCIATES CO.,LTD. CALIBRATION LABORATORY

Continuation of Calibration Certificate

Cert. No. : ACL23342
Job No. : VC67AC0022
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 test results of each items were made by observation of each Instruments display and also with SLM's display.

Condition of this result of calibration :

1. Reference Standard Instruments :

Instrument	Model	Serial No.	Cert. No.	Due Date
Waveform Generator	33210A	MY48017076	EF-0009-23	07-FEB-24
Waveform Generator	33511B	MY52302742	EF-0010-23	07-FEB-24
Digital Multimeter	33461A	MY53220104	EEL-BP 30/0266	13-FEB-24
Digital Multimeter	33461A	MY53220076	EEL-BP 29/0266	13-FEB-24
Digital Multimeter	34461A	MY60024273	EEL-BP 31/0266	14-FEB-24
Programmable Attenuator	MAT-1070	62100114	EF-0011-23	08-FEB-24
Condenser Microphone	4180	2977900	AA-1001-23	14-FEB-24
Measuring Amplifier	NA-42KAI	34560495	AA-3002-23	14-FEB-24

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

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

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

QF-TS12-04-04-020664

T. Petchur

SITHIPORN ASSOCIATES CO.,LTD. CALIBRATION LABORATORY

Continuation of Calibration Certificate

Cert. No. : ACL23342
Job No. : VC67AC0022
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	0.35
12. High level stability	✓	-	0.1	0.1

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

QF-TS12-04-04-020664

T. Petchur

SITHIPORN ASSOCIATES CO.,LTD. CALIBRATION LABORATORY

Continuation of Calibration Certificate

Cert. No. : ACL23342
Job No. : VC67AC0022
Pages : 4 of 8

Result of calibration :

1. Absolute sensitivity

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

2. Self-generated noise

2.1 Normal test

Measured Value (dB)
14.6

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

Frequency Weighting	Measured value (dB)
A-weight	10.8
C-weight	16.9
Flat	22.5

3. Acoustical signal tests of frequency weightings

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

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)			
	Flat	C-weight	A-weight	Acceptance Limits
125	0.2	0.2	0.2	± 1.5
1000	0.0	0.0	0.0	± 1.0
8000	0.5	0.6	0.6	± 5.0

QF-TS12-04-04-020664

T. Petchur

Continuation of Calibration Certificate

Cert. No. : ACL23342
Job No. : VC67AC0022
Pages : 5 of 8

4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

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

5. Frequency and time weightings at 1 kHz

5.1 Frequency weightings at 1 kHz

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

5.2 Time weighting at 1 kHz

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

6. Long - term stability

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

QF-TS12-04-04-020664

7. Peterh

Continuation of Calibration Certificate

Cert. No. : ACL23342
Job No. : VC67AC0022
Pages : 6 of 8

7. Level linearity on the reference level range

Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
137.0	137.1	0.1	± 1.1
136.0	136.1	0.1	± 1.1
135.0	135.1	0.1	± 1.1
134.0	134.1	0.1	± 1.1
133.0	133.0	0.0	± 1.1
132.0	132.0	0.0	± 1.1
131.0	131.0	0.0	± 1.1
129.0	129.1	0.1	± 1.1
124.0	124.0	0.0	± 1.1
119.0	119.1	0.1	± 1.1
114.0	114.1	0.1	± 1.1
109.0	109.1	0.1	± 1.1
104.0	104.1	0.1	± 1.1
99.0	99.1	0.1	± 1.1
94.0	94.0	0.0	± 1.1
89.0	89.0	0.0	± 1.1
84.0	84.0	0.0	± 1.1
79.0	79.0	0.0	± 1.1
74.0	74.0	0.0	± 1.1
69.0	69.0	0.0	± 1.1
64.0	64.0	0.0	± 1.1
59.0	59.0	0.0	± 1.1
54.0	54.0	0.0	± 1.1
49.0	49.0	0.0	± 1.1
44.0	44.0	0.0	± 1.1
39.0	39.0	0.0	± 1.1
34.0	34.0	0.0	± 1.1
30.0	29.9	-0.1	± 1.1
29.0	28.9	-0.1	± 1.1
28.0	27.9	-0.1	± 1.1
27.0	27.0	0.0	± 1.1
26.0	25.9	-0.1	± 1.1
25.0	24.9	-0.1	± 1.1

QF-TS12-04-04-020664

7. Peterh

Continuation of Calibration Certificate

Cert. No. : ACL23342
Job No. : VC67AC0022
Pages : 7 of 8

8. Level linearity including the level range control

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

9. Tone burst response

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

10. Peak C sound level

Number of cycle in test signal	Anticipated Value (dB)	Measured Value, L _{peak} (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.0	0.0	±3.0
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	±2.0
Positive half cycle	135.4	135.1	-0.3	±2.0
Negative half cycle	135.4	135.1	-0.3	±2.0

QF-TS12-04-04-020664

7. Peterh

Continuation of Calibration Certificate

Cert. No. : ACL23342
Job No. : VC67AC0022
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

QF-TS12-04-04-020664

7. Peterh

CALIBRATION CERTIFICATE

Submitted by : ALS Laboratory Group (Thailand) Co., Ltd.
Address : 104 Phatthanasak 40, Phatthanasak Rd., Khwaeng Phatthanasak, Khet Suan Luang, Bangkok, 10250
Calibrated at : Electrical and Electronic Standards Laboratory, Industrial Metrology and Testing Service Centre,
Sri IC, Bangpoo Industrial Estate, Sukhumvit Rd., A-Muang, Samutprakan 10280.

Instrument Calibrated : Ambient Environment
Description : Sound Level Meter Temperature : (23 ± 3) °C
Manufacturer : Rion Relative Humidity : (50 ± 15) %
Model : NL-42 Ambient Pressure : (101.325 ± 1.5) kPa
Serial No. : 00672789 (ID : BKK_FS0929)
Microphone : UC-52 No.170666
Preamplifier : NH-24 No.73129

Standards used :

1. Band Pass Filter Wavelec 752A S/N 90010494
2. Condenser Microphone Brüel&Kjær 4180 S/N 2889871
3. Decade Attenuator Ando AI-205 S/N 00464602
4. Function/Arbitrary Waveform Generator Agilent 33220A S/N MY44042668
5. Digital Function Synthesizer NF Electronic Instruments DF-193A S/N 122037
6. Digital Multimeter Fluke 8520A S/N 4985007
7. Pistonphone Rion NC-72 S/N 00402446
8. Measuring Amplifier Brüel&Kjær 2636 S/N 1537484

Date of Receipt : 24 Jan. 2024

Date of Calibration : 21 Feb. 2024

1 / 9

The results shown in this certificate are based on values assigned.

Adopting the Report/Certificate and publicity of the results shown in full are prohibited unless written permission is obtained from the provider of TISTR.

FM.BI.MTC.002 Rev.4

Head Office : 35 Mu 3 Tambon Khlong Ha Amphoe Khlong Luang, Changwat Pathumthani 12120, Thailand
Tel: (66) 0 2577 9000
Fax: (66) 0 2577 9009
E-mail: info@tistr.or.th

Office/Laboratory : Sri IC, Bangpoo Industrial Estate, Sukhumvit Road, Amphoe Muang, Changwat Samutprakan 10280, Thailand
Tel: (66) 0 2323 1672-80 ext. 115, 116
Fax: (66) 0 2323 9145
E-mail: info@tistr.or.th

Office : 196 Phahonyothin Road, Chatuchak, Bangkok 10900, Thailand
Tel: (66) 0 2579 1121, 50 ext. 5219, 5225, 5217
Fax: (66) 0 2579 8592
E-mail: info@tistr.or.th

9. Power Amplifier Brüel&Kjær 2706 S/N 1517650
10. Speaker Tannoy Limited, Great Britain British Patent No. 215300
11. Digital Multimeter Agilent 34401A S/N MY44005560
12. Programmable Attenuator Tannagawa TPA-303A S/N 2212

Calibration Procedure :

This instrument was calibrated by using calibration procedures no CP-102-02 and CP-102-03, which were based on IEC 61672-3 Electroacoustics - Sound Level Meters - Part 3 : Periodic tests (2013). These calibration procedures were related to the electrical and acoustic signal tests. The electrical signal test was carried out with the direct measurement method. The acoustic signal test was performed in an anechoic room with the comparison measurement method.

This instrument has been calibrated against standards maintained at the Electrical and Electronic Standards Laboratory (EEL), which are traceable to the International System of Units through the National Institute of Metrology (Thailand).

The information on actual reading is attached herewith and the uncertainty limits quoted refer to the measured values only.

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

Date of Calibration : 21 Feb. 2024

2 / 9

The results shown in this certificate are based on values assigned.

Adopting the Report/Certificate and publicity of the results shown in full are prohibited unless written permission is obtained from the provider of TISTR.

FM.BI.MTC.002 Rev.4

Head Office : 35 Mu 3 Tambon Khlong Ha Amphoe Khlong Luang, Changwat Pathumthani 12120, Thailand
Tel: (66) 0 2577 9000
Fax: (66) 0 2577 9009
E-mail: info@tistr.or.th

Office/Laboratory : Sri IC, Bangpoo Industrial Estate, Sukhumvit Road, Amphoe Muang, Changwat Samutprakan 10280, Thailand
Tel: (66) 0 2323 1672-80 ext. 115, 116
Fax: (66) 0 2323 9145
E-mail: info@tistr.or.th

Office : 196 Phahonyothin Road, Chatuchak, Bangkok 10900, Thailand
Tel: (66) 0 2579 1121, 50 ext. 5219, 5225, 5217
Fax: (66) 0 2579 8592
E-mail: info@tistr.or.th

1. Absolute Sensitivity

Reference Acoustic Signal (dB)	Measured value (dB)	Deviation value (dB)	Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
113.91	Before adjust 114.7 After adjust 113.9	0.0	1.0	0.30	N/A

Note: The external calibration adjustment was firstly performed. The internal calibration adjustment was then completed at the display of 113.9 dB.

2. Self-generated noise

2.1 Normal test

Measured value (dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
26.2	0.10	N/A

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

Frequency Weighting	Measured value (dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
A-Weight	12.5	0.10	N/A
C-Weight	17.9	0.10	N/A
Flat	22.4	0.10	N/A

Date of Calibration : 21 Feb. 2024

3 / 9

The results shown in this certificate are based on values assigned.

Adopting the Report/Certificate and publicity of the results shown in full are prohibited unless written permission is obtained from the provider of TISTR.

FM.BI.MTC.002 Rev.4

Head Office : 35 Mu 3 Tambon Khlong Ha Amphoe Khlong Luang, Changwat Pathumthani 12120, Thailand
Tel: (66) 0 2577 9000
Fax: (66) 0 2577 9009
E-mail: info@tistr.or.th

Office/Laboratory : Sri IC, Bangpoo Industrial Estate, Sukhumvit Road, Amphoe Muang, Changwat Samutprakan 10280, Thailand
Tel: (66) 0 2323 1672-80 ext. 115, 116
Fax: (66) 0 2323 9145
E-mail: info@tistr.or.th

Office : 196 Phahonyothin Road, Chatuchak, Bangkok 10900, Thailand
Tel: (66) 0 2579 1121, 50 ext. 5219, 5225, 5217
Fax: (66) 0 2579 8592
E-mail: info@tistr.or.th

3. Acoustical signal test of frequency weightings

Frequency (Hz)	Deviation from frequency response curve (dB)	Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
125	A-weight: 0.1 C-weight: 0.3 Flat: 0.3	1.5	0.45	0.6
1 000	0.1 0.0 0.0	1.0	0.45	0.6
8 000	-0.7 -0.7 -0.7	5.0	0.45	0.7

4. Electrical signal test of frequency weightings

Frequency (Hz)	Deviation from frequency response curve (dB)	Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
63	0.0 0.1 0.0	2.0	0.20	0.6
125	0.0 0.1 0.0	1.5	0.20	0.6
250	0.0 0.1 0.0	1.5	0.20	0.6
500	0.0 0.1 0.0	1.5	0.20	0.6
1 000	0.0 0.0 0.0	1.0	0.20	0.6
2 000	-0.1 -0.1 -0.2	2.0	0.20	0.6
4 000	-0.2 -0.3 -0.3	3.0	0.20	0.6
8 000	0.0 0.0 0.0	5.0	0.20	0.7

Date of Calibration : 21 Feb. 2024

4 / 9

The results shown in this certificate are based on values assigned.

Adopting the Report/Certificate and publicity of the results shown in full are prohibited unless written permission is obtained from the provider of TISTR.

FM.BI.MTC.002 Rev.4

Head Office : 35 Mu 3 Tambon Khlong Ha Amphoe Khlong Luang, Changwat Pathumthani 12120, Thailand
Tel: (66) 0 2577 9000
Fax: (66) 0 2577 9009
E-mail: info@tistr.or.th

Office/Laboratory : Sri IC, Bangpoo Industrial Estate, Sukhumvit Road, Amphoe Muang, Changwat Samutprakan 10280, Thailand
Tel: (66) 0 2323 1672-80 ext. 115, 116
Fax: (66) 0 2323 9145
E-mail: info@tistr.or.th

Office : 196 Phahonyothin Road, Chatuchak, Bangkok 10900, Thailand
Tel: (66) 0 2579 1121, 50 ext. 5219, 5225, 5217
Fax: (66) 0 2579 8592
E-mail: info@tistr.or.th

5. Long-term stability

Time	Measured value (dB)	Deviated value (dB)	Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
Begin	94.0	0.0	0.3	0.10	0.1
End	94.0				

6. Frequency and time weightings at 1 kHz

6.1 Frequency weightings at 1 kHz

Frequency Weighting	Measured value (dB)	Deviated value (dB)	Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
A-weight	94.0	0.0	0.2	0.20	0.2
C-weight	94.0	0.0	0.2	0.20	0.2
Flat	94.0	0.0	0.2	0.20	0.2

6.2 Time weightings at 1 kHz

Frequency Weighting	Measured value (dB)	Deviated value (dB)	Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
Fast	94.0	0.0	0.1	0.20	0.2
Slow	94.0	0.0	0.1	0.20	0.2
Leq	94.0	0.0	0.1	0.20	0.2

Date of Calibration : 21 Feb. 2024

5 / 9

The results relate only to the items tested/calibrated or value assigned.

17025

Adopting the Report/Certificate and publicity of the results except in full are prohibited unless written permission is obtained from the governor of TISTR.

FM/BL/MTC.002 Rev.A

Head Office
33 Mu 3 Tambon Khlong Ha, Amphoe Khlong Luang,
Changwat Pathumthani 12120, Thailand
Tel: (66) 0 2577 9000
Fax: (66) 0 2577 9009
E-mail: kumpasat@tistr.go.th / Website: www.tistr.go.th

Office/Laboratory
Box 1C, Bangpoo Industrial Estate, Sukhumvit Road,
Amphoe Muang, Changwat Samutprakan 10280, Thailand
Tel: (66) 0 2323 1672 ext. 115, 116
Fax: (66) 0 2323 9165
E-mail: mtr@tistr.go.th

Office
196 Phahonyothin Road, Chatuchak, Bangkok 10900,
Thailand
Tel: (66) 0 2579 1121 ext. 5219, 5225, 5217
Fax: (66) 0 2579 8552
E-mail: tms@tistr.go.th

7. Level linearity on the reference level range

Anticipated value (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
137	137.0	0.0	1.1	0.30	0.3
136	136.0	0.0	1.1	0.30	0.3
135	135.0	0.0	1.1	0.30	0.3
134	134.0	0.0	1.1	0.30	0.3
129	129.0	0.0	1.1	0.30	0.3
124	124.0	0.0	1.1	0.30	0.3
119	119.0	0.0	1.1	0.30	0.3
114	114.0	0.0	1.1	0.30	0.3
109	109.0	0.0	1.1	0.30	0.3
104	104.0	0.0	1.1	0.30	0.3
99	99.0	0.0	1.1	0.30	0.3
94	94.0	0.0	1.1	0.30	0.3
89	89.0	0.0	1.1	0.30	0.3
84	84.0	0.0	1.1	0.30	0.3
79	79.0	0.0	1.1	0.30	0.3
74	74.0	0.0	1.1	0.30	0.3
69	69.0	0.0	1.1	0.30	0.3
64	63.9	-0.1	1.1	0.30	0.3

Date of Calibration : 21 Feb. 2024

6 / 9

The results relate only to the items tested/calibrated or value assigned.

17025

Adopting the Report/Certificate and publicity of the results except in full are prohibited unless written permission is obtained from the governor of TISTR.

FM/BL/MTC.002 Rev.A

Head Office
33 Mu 3 Tambon Khlong Ha, Amphoe Khlong Luang,
Changwat Pathumthani 12120, Thailand
Tel: (66) 0 2577 9000
Fax: (66) 0 2577 9009
E-mail: kumpasat@tistr.go.th / Website: www.tistr.go.th

Office/Laboratory
Box 1C, Bangpoo Industrial Estate, Sukhumvit Road,
Amphoe Muang, Changwat Samutprakan 10280, Thailand
Tel: (66) 0 2323 1672 ext. 115, 116
Fax: (66) 0 2323 9165
E-mail: mtr@tistr.go.th

Office
196 Phahonyothin Road, Chatuchak, Bangkok 10900,
Thailand
Tel: (66) 0 2579 1121 ext. 5219, 5225, 5217
Fax: (66) 0 2579 8552
E-mail: tms@tistr.go.th

7. Level linearity on the reference level range (cont.)

Anticipated value (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
59	58.9	-0.1	1.1	0.30	0.3
54	53.9	-0.1	1.1	0.30	0.3
49	48.9	-0.1	1.1	0.30	0.3
44	43.9	-0.1	1.1	0.30	0.3
39	38.9	-0.1	1.1	0.30	0.3
34	33.9	-0.1	1.1	0.30	0.3
29	28.9	-0.1	1.1	0.30	0.3
28	28.0	0.0	1.1	0.30	0.3
27	26.9	-0.1	1.1	0.30	0.3
26	25.9	-0.1	1.1	0.30	0.3
25	24.9	-0.1	1.1	0.30	0.3

8. Level linearity including the level range control

At reference sound level on the reference level range

Range	Anticipated value (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
30-130	94.0	94.0	0.0	1.1	0.30	0.3

Date of Calibration : 21 Feb. 2024

7 / 9

The results relate only to the items tested/calibrated or value assigned.

17025

Adopting the Report/Certificate and publicity of the results except in full are prohibited unless written permission is obtained from the governor of TISTR.

FM/BL/MTC.002 Rev.A

Head Office
33 Mu 3 Tambon Khlong Ha, Amphoe Khlong Luang,
Changwat Pathumthani 12120, Thailand
Tel: (66) 0 2577 9000
Fax: (66) 0 2577 9009
E-mail: kumpasat@tistr.go.th / Website: www.tistr.go.th

Office/Laboratory
Box 1C, Bangpoo Industrial Estate, Sukhumvit Road,
Amphoe Muang, Changwat Samutprakan 10280, Thailand
Tel: (66) 0 2323 1672 ext. 115, 116
Fax: (66) 0 2323 9165
E-mail: mtr@tistr.go.th

Office
196 Phahonyothin Road, Chatuchak, Bangkok 10900,
Thailand
Tel: (66) 0 2579 1121 ext. 5219, 5225, 5217
Fax: (66) 0 2579 8552
E-mail: tms@tistr.go.th

8. Level linearity including the level range control

At reference level at 5 dB greater than the under-range on a level range

Range	Anticipated value (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
30-130	35	35.0	0.0	1.1	0.30	0.3

9. Tone burst response

Time Weighting	Toneburst Duration, Tbl(ms)	Measured value (dB)	Deviated value (dB)	Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
Fast	200	126.0	0.0	±1.0	0.20	0.3
	2	108.9	-0.1	+1.0; -2.5	0.20	0.3
	0.25	99.8	-0.2	+1.5; -5.0	0.20	0.3
Slow	200	119.5	-0.1	±1.0	0.20	0.3
	2	99.9	-0.1	+1.0; -5.0	0.20	0.3
SEL	200	120.0	0.0	±1.0	0.20	0.3
	2	99.9	-0.1	+1.0; -2.5	0.20	0.3
	0.25	90.8	-0.2	+1.5; -5.0	0.20	0.3

Date of Calibration : 21 Feb. 2024

8 / 9

The results relate only to the items tested/calibrated or value assigned.

17025

Adopting the Report/Certificate and publicity of the results except in full are prohibited unless written permission is obtained from the governor of TISTR.

FM/BL/MTC.002 Rev.A

Head Office
33 Mu 3 Tambon Khlong Ha, Amphoe Khlong Luang,
Changwat Pathumthani 12120, Thailand
Tel: (66) 0 2577 9000
Fax: (66) 0 2577 9009
E-mail: kumpasat@tistr.go.th / Website: www.tistr.go.th

Office/Laboratory
Box 1C, Bangpoo Industrial Estate, Sukhumvit Road,
Amphoe Muang, Changwat Samutprakan 10280, Thailand
Tel: (66) 0 2323 1672 ext. 115, 116
Fax: (66) 0 2323 9165
E-mail: mtr@tistr.go.th

Office
196 Phahonyothin Road, Chatuchak, Bangkok 10900,
Thailand
Tel: (66) 0 2579 1121 ext. 5219, 5225, 5217
Fax: (66) 0 2579 8552
E-mail: tms@tistr.go.th



THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-67/0231

MTC No. EEL-BP. 165/0167

10. Peak C sound level

Number of cycles in test signal	Anticipated value (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
Complete cycle	125.4	125.3	-0.1	3.0	0.20	0.35
Positive half cycle	124.4	124.1	-0.3	2.0	0.20	0.35
Negative half cycle	124.4	124.1	-0.3	2.0	0.20	0.35

11. Overload indication

Measured value (dB)		Deviated value (dB)	Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
Positive one-half cycle	Negative one-half cycle				
137.0	137.0	0.0	1.5	0.20	0.25

12. High-level stability

Time	Measured value (dB)	Deviated value (dB)	Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
Begin	129.0	-0.0	0.3	0.10	0.1
End	129.0				

Calibrated by:

(Mr. Witawal Supanich)

Approved by:

(Mr. Petchuraj Petchuraj)

Date of Calibration : 21 Feb. 2024
Date of Issue : 22 Feb. 2024

Electrical and Electronic Standards Laboratory
Industrial Metrology and Testing Service Centre
Ref: 2011267012400346003

End of Certificate 9/9

SITHIPORN ASSOCIATES CO., LTD. CALIBRATION LABORATORY

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



Cert. No. : ACL23336
Pages : 1 of 8

Calibration Certificate

Equipment : SOUND LEVEL METER
Manufacturer : RION
Model : NL-42 / Microphone UC-52 / Preamplifier NH-24
Serial No.: 00572609 / 170133 / 72947
ID No.: BKK_FS0924

Condition As Found : GOOD

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

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

Received Date : 20 OCTOBER 2023
Calibration Date : 01-02 NOVEMBER 2023
Date of Issue : 03 NOVEMBER 2023

Calibrated by : Naitakorn Pisupaisan

Approved by :

(Thanakul Petchuraj)

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.

QI-TS12-04-04-020664

Head Office : 451-451/1 Srinthorn Rd., Bangbunru, Bangplud Bangkok 10700 THAILAND.
Tel: 0-2435-8800 Fax: 0-2433-1679 e-mail: cal-center@sithiporn.com
Office/Laboratory : 104 Phatthananakan 40, Phatthananakan Road, Khwaeng Phatthananakan, Khet Suan Luang, Bangkok 10250 THAILAND.
Tel: 0-2433-1679 Fax: 0-2435-8800 e-mail: cal-center@sithiporn.com

SITHIPORN ASSOCIATES CO., LTD. CALIBRATION LABORATORY

Continuation of Calibration Certificate

Cert. No. : ACL23336
Job No. : VC67AC0014
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 test results of each items were made by observation of each Instruments display and also with SLM's display.

Condition of this result of calibration :

1. Reference Standard Instruments :

Instrument	Model	Serial No.	Cert. No.	Due Date
Waveform Generator	33210A	MY48017076	EF-0009-23	07-FEB-24
Waveform Generator	33511B	MY52302742	EF-0010-23	07-FEB-24
Digital Multimeter	33461A	MY53220104	EEL-BP 30/0266	13-FEB-24
Digital Multimeter	33461A	MY53220076	EEL-BP 29/0266	13-FEB-24
Digital Multimeter	34461A	MY60024273	EEL-BP 31/0266	14-FEB-24
Programmable Attenuator	MAT-1070	62100114	EF-0011-23	08-FEB-24
Condenser Microphone	4180	2977900	AA-1001-23	14-FEB-24
Measuring Amplifier	NA-42KAI	34560495	AA-3002-23	14-FEB-24

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

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

3.1 National Institute of Metrology (Thailand).

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

SITHIPORN ASSOCIATES CO., LTD. CALIBRATION LABORATORY

Continuation of Calibration Certificate

Cert. No. : ACL23336
Job No. : VC67AC0014
Pages : 3 of 8

Summary of Measurement Result :

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

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

QI-TS12-04-04-020664

QI-TS12-04-04-020664

Continuation of Calibration Certificate

Cert. No. : ACL23336
Job No. : VC67AC0014
Pages : 4 of 8

Result of calibration :

1. Absolute sensitivity

Reference Acoustic Signal (dB)	Measured Value (dB)	Deviation (dB)	Acceptance Limit (dB)
93.0 (93.98)	93.9	0.0	±0.3

2. Self-generated noise

2.1 Normal test

Measured Value (dB)
15.1

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

Frequency Weighting	Measured value (dB)
A - weight	11.6
C - weight	17.7
Flat	23.5

3. Acoustical signal tests of frequency weightings

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

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)			
	Flat	C-weight	A-weight	Acceptance Limits
125	0.0	0.1	0.1	± 1.5
1000	0.0	0.0	0.0	± 1.0
8000	0.9	0.9	0.9	±5.0

QI-TS12-04-04-020664

T. Petch

Continuation of Calibration Certificate

Cert. No. : ACL23336
Job No. : VC67AC0014
Pages : 5 of 8

4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz

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

5. Frequency and time weightings at 1 kHz

5.1 Frequency weightings at 1 kHz

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

5.2 Time weighting at 1 kHz

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

6. Long - term stability

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

QI-TS12-04-04-020664

T. Petch

Continuation of Calibration Certificate

Cert. No. : ACL23336
Job No. : VC67AC0014
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	27.0	0.0	± 1.1
26.0	25.9	-0.1	± 1.1
25.0	24.9	-0.1	± 1.1

QI-TS12-04-04-020664

T. Petch

Continuation of Calibration Certificate

Cert. No. : ACL23336
Job No. : VC67AC0014
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	±3.0
One	136.4	136.1	-0.3	±3.0

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

QI-TS12-04-04-020664

T. Petch

Continuation of Calibration Certificate

Cert. No. : ACL23336
Job No. : VC67AC0014
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	89.4	-0.1	±1.5

12. High level stability

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

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

End of Calibration Certificate

QF-TS12-04-04-020664

451-451/1 Sidhithorn Rd, Bangbunru, Bangkok Bangkok 10700 THAILAND.
Tel:0-2435-8800 Fax:0-2433-1679 e-mail:center@stithiporn.com http://www.stithiporn.comCert. No. : ACL23194
Pages : 1 of 8

Calibration Certificate

Equipment : SOUND LEVEL METER
Manufacturer : RION
Model : NL-42/ Microphone UC-52 / Preamplifier NH-24
Serial No. : 01022262 / 180410 / 22310
ID No. : BKK_FS003

Condition As Found : GOOD

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

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

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

Calibrated by : Nathakorn Pisupaisan

Approved by :

T. Petchuraj
(Thanakul Petchuraj)

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

QF-TS12-04-04-020664

Continuation of Calibration Certificate

Cert. No. : ACL23194
Job No. : VC66AC0066
Pages : 2 of 8

Calibration Procedure : CP-AC-01

Calibration Method :

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

Condition of this result of calibration :

1. Reference Standard Instruments :

Instrument	Model	Serial No.	Cert. No.	Due Date
Waveform Generator	33210A	MY48017076	EF-0009-23	07-FEB-24
Waveform Generator	33511B	MY52302742	EF-0010-23	07-FEB-24
Digital Multimeter	33461A	MY53220104	EEL-BP 30 0266	13-FEB-24
Digital Multimeter	33461A	MY53220076	EEL-BP 20 0266	13-FEB-24
Digital Multimeter	34461A	MY60024273	EEL-BP 31 0266	14-FEB-24
Programmable Attenuator	MAT-1070	62100114	EF-0011-23	08-FEB-24
Condenser Microphone	4180	2977900	AA-1001-23	14-FEB-24
Measuring Amplifier	NA-42KAI	34560495	AA-3002-23	14-FEB-24

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

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

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

QF-TS12-04-04-020664

Continuation of Calibration Certificate

Cert. No. : ACL23194
Job No. : VC66AC0066
Pages : 3 of 8

Summary of Measurement Result :

Parameter	Pass	Fail	Uncertainty (dB)	Maximum-permitted uncertainty of measurement (dB)
1. Absolute sensitivity	✓	-	0.2	N/A
2. Self-generated noise	✓	-	0.2	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	✓	-	0.1	0.35
11. Overload indication	✓	-	0.2	0.25
12. High level stability	✓	-	0.1	0.1

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

QF-TS12-04-04-020664

Continuation of Calibration Certificate

Cert. No. : ACL23194
Job No. : VC66AC0066
Pages : 4 of 8

Result of calibration :

1. Absolute sensitivity

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

2. Self-generated noise

2.1 Normal test

Measured Value (dB)
21.4

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

Frequency Weighting	Measured value (dB)
A - weight	19.4
C - weight	26.8
Flat	31.5

3. Acoustical signal tests of frequency weightings

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

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)			
	Flat	C-weight	A-weight	Acceptance Limits
125	0.0	0.0	0.0	± 1.5
1000	0.0	0.0	0.0	± 1.0
8000	-0.9	-0.9	-0.9	±5.0

QF-TS12-04-04-020664

T. Petch

Continuation of Calibration Certificate

Cert. No. : ACL23194
Job No. : VC66AC0066
Pages : 5 of 8

4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz

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

5. Frequency and time weightings at 1 kHz

5.1 Frequency weightings at 1 kHz

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

5.2 Time weighting at 1 kHz

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

6. Long - term stability

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

QF-TS12-04-04-020664

T. Petch

Continuation of Calibration Certificate

Cert. No. : ACL23194
Job No. : VC66AC0066
Pages : 6 of 8

7. Level linearity on the reference level range

Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
137.0	137.0	0.0	± 1.1
136.0	136.0	0.0	± 1.1
135.0	135.1	0.1	± 1.1
134.0	134.1	0.1	± 1.1
133.0	133.0	0.0	± 1.1
132.0	132.0	0.0	± 1.1
131.0	131.0	0.0	± 1.1
129.0	129.0	0.0	± 1.1
124.0	124.0	0.0	± 1.1
119.0	119.1	0.1	± 1.1
114.0	114.1	0.1	± 1.1
109.0	109.0	0.0	± 1.1
104.0	104.1	0.1	± 1.1
99.0	99.1	0.1	± 1.1
94.0	94.0	0.0	± 1.1
89.0	89.0	0.0	± 1.1
84.0	84.0	0.0	± 1.1
79.0	79.0	0.0	± 1.1
74.0	74.0	0.0	± 1.1
69.0	69.0	0.0	± 1.1
64.0	64.0	0.0	± 1.1
59.0	59.0	0.0	± 1.1
54.0	54.0	0.0	± 1.1
49.0	49.0	0.0	± 1.1
44.0	44.0	0.0	± 1.1
39.0	39.0	0.0	± 1.1
34.0	34.0	0.0	± 1.1
30.0	30.0	0.0	± 1.1
29.0	29.0	0.0	± 1.1
28.0	28.0	0.0	± 1.1
27.0	27.0	0.0	± 1.1
26.0	26.1	0.1	± 1.1
25.0	25.1	0.1	± 1.1

QF-TS12-04-04-020664

T. Petch

Continuation of Calibration Certificate

Cert. No. : ACL23194
Job No. : VC66AC0066
Pages : 7 of 8

8. Level linearity including the level range control

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

9. Tone burst response

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

10. Peak C sound level

Number of cycle in test signal	Anticipated Value (dB)	Measured Value, L _{peak} (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.0	0.0	±3.0
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	±2.0
Positive half cycle	135.4	135.1	-0.3	±2.0
Negative half cycle	135.4	135.1	-0.3	±2.0

QF-TS12-04-04-020664

T. Petch

Continuation of Calibration Certificate

Cert. No. : ACL23194
Job No. : VC66AC0066
Pages : 8 of 8

11. Overload indication

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

12. High level stability

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

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

End of Calibration Certificate

QF-TS12-04-04-020664

451-451/1 Srinthorn Rd, Bangbunru, Bangplud Bangkok 10700 THAILAND
Tel:0-2435-8800 Fax:0-2433-1679 e-mail:cal-center@sithiporn.com http://www.sithiporn.comCert. No. : ACL23265
Pages : 1 of 8

Calibration Certificate

Equipment : SOUND LEVEL METER
Manufacturer : RION
Model : NL-42 / Microphone UC-52 / Preamplifier NH-24
Serial No. : 01022263 / 136951 / 22311
ID No. : BKK_FS0032

Condition As Found : GOOD

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

Location : -
Ambient Temperature : (23.0 ± 3) °C
Pressure : (101.3 ± 3) kPa
Relative Humidity : (50.0 ± 20) %
Received Date : 23 AUGUST 2023
Calibration Date : 01 SEPTEMBER 2023
Date of Issue : 04 SEPTEMBER 2023

Calibrated by : Nathakorn Pisunpaisan

Approved by :

T. Petchurai
(Thansuk Petchurai)

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

QF-TS12-04-04-020664

Continuation of Calibration Certificate

Cert. No. : ACL23265
Job No. : VC66AC0094
Pages : 2 of 8

Calibration Procedure : CP-AC-01

Calibration Method :

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

Condition of this result of calibration :

1. Reference Standard Instruments :

Instrument	Model	Serial No.	Cert. No.	Due Date
Waveform Generator	33210A	MY48017076	EF-0009-23	07-FEB-24
Waveform Generator	33511B	MY52302742	EF-0010-23	07-FEB-24
Digital Multimeter	33461A	MY53220104	EEL_BP 30/0266	13-FEB-24
Digital Multimeter	33461A	MY53220076	EEL_BP 29/0266	13-FEB-24
Digital Multimeter	34461A	MY60024273	EEL_BP 31/0266	14-FEB-24
Programmable Attenuator	MAT-1070	62100114	EF-0011-23	08-FEB-24
Condenser Microphone	4180	2977900	AA-1001-23	14-FEB-24
Measuring Amplifier	NA-42KA1	34560495	AA-3002-23	14-FEB-24

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

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

3.1 National Institute of Metrology (Thailand),

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

QF-TS12-04-04-020664

Continuation of Calibration Certificate

Cert. No. : ACL23265
Job No. : VC66AC0094
Pages : 3 of 8

Summary of Measurement Result :

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

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

QF-TS12-04-04-020664

Continuation of Calibration Certificate

Cert. No. : ACL23265
Job No. : VC66AC0094
Pages : 4 of 8

Result of calibration :

1. Absolute sensitivity

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

2. Self-generated noise

2.1 Normal test

Measured Value (dB)
16.7

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

Frequency Weighting	Measured value (dB)
A - weight	11.6
C - weight	17.6
Flat	23.4

3. Acoustical signal tests of frequency weightings

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

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)			
	Flat	C-weight	A-weight	Acceptance Limits
125	0.5	0.5	0.5	± 1.5
1000	0.1	0.1	0.1	± 1.0
8000	-1.9	-1.8	-1.8	±5.0

QF-TS12-04-04-020664

7. Petch

Continuation of Calibration Certificate

Cert. No. : ACL23265
Job No. : VC66AC0094
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	0.1	0.0	±2.0
4000	0.0	0.0	0.0	±3.0
8000	0.0	0.1	0.1	±5.0

5. Frequency and time weightings at 1 kHz

5.1 Frequency weightings at 1 kHz

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

5.2 Time weighting at 1 kHz

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

6. Long - term stability

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

QF-TS12-04-04-020664

7. Petch

Continuation of Calibration Certificate

Cert. No. : ACL23265
Job No. : VC66AC0094
Pages : 6 of 8

7. Level linearity on the reference level range

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

QF-TS12-04-04-020664

7. Petch

Continuation of Calibration Certificate

Cert. No. : ACL23265
Job No. : VC66AC0094
Pages : 7 of 8

8. Level linearity including the level range control

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

9. Tone burst response

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

10. Peak C sound level

Number of cycle in test signal	Anticipated Value (dB)	Measured Value, L _{peak} (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.0	0.0	±3.0
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	±2.0
Positive half cycle	135.4	135.2	-0.2	±2.0
Negative half cycle	135.4	135.2	-0.2	±2.0

QF-TS12-04-04-020664

7. Petch

Continuation of Calibration Certificate

Cert. No. : ACL23265
Job No. : VC66AC0094
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

QF-TS12-04-04-020664

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



Cert. No. : ACL23191
Pages : 1 of 8

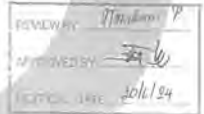
Calibration Certificate

Equipment : SOUND LEVEL METER
Manufacturer : RION
Model : NL-42/ Microphone UC-52 / Preamplifier NH-24
Serial No. : 00710640 / 170325 / 73077
ID No. : BKK_FS0024

Condition As Found : GOOD

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

Location : -
Ambient Temperature : (23.0 ± 3) °C
Pressure : (101.3 ± 3) kPa
Relative Humidity : (50.0 ± 20) %
Received Date : 15 JUNE 2023
Calibration Date : 20-22 JUNE 2023
Date of Issue : 23 JUNE 2023



Calibrated by : Nubakorn Pisutpaisan

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

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

QF-TS12-04-04-020664

Continuation of Calibration Certificate

Cert. No. : ACL23191
Job No. : VC66AC0066
Pages : 2 of 8

Calibration Procedure : CP-AC-01

Calibration Method :

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

Condition of this result of calibration :

1. Reference Standard Instruments :

Instrument	Model	Serial No.	Cert. No.	Due Date
Waveform Generator	33210A	MY48017076	EF-0009-23	07-FEB-24
Waveform Generator	33511B	MY52302742	EF-0010-23	07-FEB-24
Digital Multimeter	33461A	MY53220104	EEL_BP 30-0266	13-FEB-24
Digital Multimeter	33461A	MY53220076	EEL_BP 29-0266	13-FEB-24
Digital Multimeter	34461A	MY60024273	EEL_BP 31-0266	14-FEB-24
Programmable Attenuator	MAT-1070	62100114	EF-0011-23	08-FEB-24
Condenser Microphone	4180	2977900	AA-1001-23	14-FEB-24
Measuring Amplifier	NA-42KAI	34560495	AA-3002-23	14-FEB-24

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

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

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

QF-TS12-04-04-020664

Continuation of Calibration Certificate

Cert. No. : ACL23191
Job No. : VC66AC0066
Pages : 3 of 8

Summary of Measurement Result :

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

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

QF-TS12-04-04-020664

Continuation of Calibration Certificate

Cert. No. : ACL23191
Job No. : VC66AC0066
Pages : 4 of 8

Result of calibration :

1. Absolute sensitivity

Reference Acoustic Signal (dB)	Measured Value (dB)	Deviation (dB)	Acceptance Limits (dB)
93.9 (93.9%)	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	18.3
Flat	24.1

3. Acoustical signal tests of frequency weightings

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

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)				Acceptance Limits
	Flat	C-weight	A-weight		
125	0.2	0.3	0.3		± 1.5
1000	0.0	0.0	0.0		± 1.0
8000	-0.2	-0.2	-0.2		±5.0

QF-TS12-04-04-020664

T. Petch

Continuation of Calibration Certificate

Cert. No. : ACL23191
Job No. : VC66AC0066
Pages : 5 of 8

4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

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

5.2 Time weighting at 1 kHz

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

6. Long - term stability

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

QF-TS12-04-04-020664

T. Petch

Continuation of Calibration Certificate

Cert. No. : ACL23191
Job No. : VC66AC0066
Pages : 6 of 8

7. Level linearity on the reference level range

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

QF-TS12-04-04-020664

T. Petch

Continuation of Calibration Certificate

Cert. No. : ACL23191
Job No. : VC66AC0066
Pages : 7 of 8

8. Level linearity including the level range control

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

9. Tone burst response

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

10. Peak C' sound level

Number of cycle in test signal	Anticipated Value (dB)	Measured Value, Lcpeak (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.0	0.0	±3.0
One	136.4	135.9	-0.5	±3.0

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

QF-TS12-04-04-020664

T. Petch

Continuation of Calibration Certificate

Cert. No. : ACL23191
Job No. : VC66AC0066
Pages : 8 of 8

11. Overload indication

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

QE-TS12-04-020664

451-451/ Siemchorn Road, Bangbunru, Bangkok, 10700 Thailand
Tel : +66 2433 8331 Email : calibration@sithiporn.comCert. No. : ACL24004
Pages : 1 of 8

Calibration Certificate

Equipment : SOUND LEVEL METER
Manufacturer : RION
Model : NL-42 / Microphone UC-52 / Preamplifier NH-24
Serial No. : 00672737 / 158772 / 58773
ID No. : BKK_FS0927

Condition As Found : GOOD

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

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

Received Date : 19 DECEMBER 2023
Calibration Date : 05-08 JANUARY 2024
Date of Issue : 09 JANUARY 2024

Calibrated by : Natchakorn Pisupaisan

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.

451-451/ Siemchorn Road, Bangbunru, Bangkok, 10700 Thailand
Tel : +66 2433 8331 Email : calibration@sithiporn.comCert. No. : ACL24004
Job No. : VC67AC0043
Pages : 2 of 8

Calibration Procedure : CP-AC-01

Calibration Method :

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

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

Condition of this result of calibration :

1. Reference Standard Instruments :

Instrument	Model	Serial No.	Cert. No.	Due Date
Waveform Generator	33210A	MY48017076	EF-0009-23	07-FEB-24
Waveform Generator	33511B	MY52302742	EF-0010-23	07-FEB-24
Digital Multimeter	33461A	MY53220104	EEL-BP 30/0266	13-FEB-24
Digital Multimeter	33461A	MY53220076	EEL-BP 29/0266	13-FEB-24
Digital Multimeter	34461A	MY60024273	EEL-BP 31/0266	14-FEB-24
Programmable Attenuator	MAT-1070	62100114	EF-0011-23	08-FEB-24
Condenser Microphone	4180	2977900	AA-1001-23	14-FEB-24
Measuring Amplifier	NA-42KA1	34560495	AA-3002-23	14-FEB-24

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

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

3.1 National Institute of Metrology (Thailand).

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

451-451/ Siemchorn Road, Bangbunru, Bangkok, 10700 Thailand
Tel : +66 2433 8331 Email : calibration@sithiporn.comCert. No. : ACL24004
Job No. : VC67AC0043
Pages : 3 of 8

Summary of Measurement Result :

Parameter	Uncertainty	Maximum-permitted
	(dB)	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
5000 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

SITHIPORN ASSOCIATES CO., LTD.
CALIBRATION LABORATORY

451-451/1 Sinthorn Road, Bangbunru, Bangkok, 10700 Thailand
Tel : +66 2432 8331 Email : calibration@sithiporn.com



Cert. No. : ACL24004
Job No. : VC67AC0043
Pages : 4 of 8

Result of calibration :

1. Absolute sensitivity

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

2. Self-generated noise

2.1 Normal test

Measured Value (dB)
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	16.4
Flat	22.2

3. Acoustical signal tests of frequency weightings

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

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)			
	Flat	C-weight	A-weight	Acceptance Limits
125	0.3	0.3	0.3	± 1.5
1000	0.0	0.0	0.0	± 1.0
8000	-0.6	-0.6	-0.5	±5.0

T. Petch

SITHIPORN ASSOCIATES CO., LTD.
CALIBRATION LABORATORY

451-451/1 Sinthorn Road, Bangbunru, Bangkok, 10700 Thailand
Tel : +66 2432 8331 Email : calibration@sithiporn.com



Cert. No. : ACL24004
Job No. : VC67AC0043
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	-0.1	0.0	-0.1	±1.5
500	0.0	0.0	-0.1	±1.5
1000	0.0	0.0	0.0	±1.0
2000	0.0	0.0	0.0	±2.0
4000	0.0	0.0	0.0	±3.0
8000	0.0	0.0	0.0	±5.0

5. Frequency and time weightings at 1 kHz

5.1 Frequency weightings at 1 kHz

Frequency Weighting	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
A - weight	94.0	93.9	-0.1	± 0.2
C - weight	94.0	93.9	-0.1	± 0.2
Flat	94.0	94.0	0.0	± 0.2

5.2 Time weighting at 1 kHz

Frequency Weighting	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Fast	94.0	93.9	-0.1	± 0.1
Slow	94.0	93.9	-0.1	± 0.1
Leq	94.0	94.0	0.0	± 0.1

6. Long - term stability

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

T. Petch

SITHIPORN ASSOCIATES CO., LTD.
CALIBRATION LABORATORY

451-451/1 Sinthorn Road, Bangbunru, Bangkok, 10700 Thailand
Tel : +66 2432 8331 Email : calibration@sithiporn.com



Cert. No. : ACL24004
Job No. : VC67AC0043
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	136.1	0.1	± 1.1
135.0	135.1	0.1	± 1.1
134.0	134.1	0.1	± 1.1
133.0	133.0	0.0	± 1.1
132.0	132.0	0.0	± 1.1
131.0	131.0	0.0	± 1.1
129.0	129.0	0.0	± 1.1
124.0	124.0	0.0	± 1.1
119.0	119.1	0.1	± 1.1
114.0	114.1	0.1	± 1.1
109.0	109.0	0.0	± 1.1
104.0	104.1	0.1	± 1.1
99.0	99.1	0.1	± 1.1
94.0	94.0	0.0	± 1.1
89.0	89.0	0.0	± 1.1
84.0	84.0	0.0	± 1.1
79.0	79.0	0.0	± 1.1
74.0	74.0	0.0	± 1.1
69.0	69.0	0.0	± 1.1
64.0	64.0	0.0	± 1.1
59.0	59.0	0.0	± 1.1
54.0	54.0	0.0	± 1.1
49.0	49.0	0.0	± 1.1
44.0	44.0	0.0	± 1.1
39.0	39.0	0.0	± 1.1
34.0	34.0	0.0	± 1.1
30.0	30.0	0.0	± 1.1
29.0	29.0	0.0	± 1.1
28.0	28.0	0.0	± 1.1
27.0	26.9	-0.1	± 1.1
26.0	26.0	0.0	± 1.1
25.0	24.9	-0.1	± 1.1

T. Petch

SITHIPORN ASSOCIATES CO., LTD.
CALIBRATION LABORATORY

451-451/1 Sinthorn Road, Bangbunru, Bangkok, 10700 Thailand
Tel : +66 2432 8331 Email : calibration@sithiporn.com



Cert. No. : ACL24004
Job No. : VC67AC0043
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, T _b (ms)	Cycle	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Fast	0.25	1	108.0	107.9	-0.1	1.5 ; -5.0
	2	8	117.0	116.9	-0.1	1.0 ; -2.5
	200	800	134.0	134.0	0.0	±1.0
Slow	2	8	108.0	108.0	0.0	1.5 ; -5.0
	200	800	127.6	127.6	0.0	±1.0
	0.25	1	99.0	98.9	-0.1	1.5 ; -5.0
SEL	2	8	108.0	108.0	0.0	1.0 ; -2.5
	200	800	128.0	128.0	0.0	±1.0

10. Peak C sound level

Number of cycle in test signal	Anticipated Value (dB)	Measured Value, Lepeak (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	135.0	133.0	0.0	±3.0
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	±2.0
Positive half cycle	135.4	135.1	-0.3	±2.0
Negative half cycle	135.4	135.1	-0.3	±2.0

T. Petch

SITHIPORN ASSOCIATES CO., LTD.
CALIBRATION LABORATORY

451-451/1 Srinthorn Road, Bangbunru, Bangkok 10700 Thailand
Tel: 0-2433-8500 Email: calibration@sithiporn.com

SITHIPORN
S I T H I P O R N



Cert. No. : ACL24004
Job No. : VC67AC0043
Pages : 8 of 8

11. Overload indication

Measured value (dB)		Deviated Value (dB)	Acceptance Limits (dB)
Positive one-half cycle	Negative one-half cycle		
89.7	89.5	-0.2	±1.5

12. High level stability

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

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

End of Calibration Certificate

T. Petchurai

SITHIPORN ASSOCIATES CO., LTD.
CALIBRATION LABORATORY

451-451/1 Srinthorn Rd, Bangbunru, Bangkok 10700 THAILAND
Tel: 0-2433-8500 Fax: 0-2433-1679 e-mail: cal-center@sithiporn.com http://www.sithiporn.com



Cert. No. : ACL23334
Pages : 1 of 8

Calibration Certificate

Equipment : SOUND LEVEL METER
Manufacturer : RION
Model : NL-42 / Microphone UC-52 / Preamplifier NH-24
Serial No. : 00572457 / 170214 / 72795
ID No. : BKK_FS0923

Condition As Found : GOOD

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

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

Received Date : 20 OCTOBER 2023
Calibration Date : 01-02 NOVEMBER 2023
Date of Issue : 03 NOVEMBER 2023

Calibrated by : Nithakorn Pisutapassan

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.

QI-TS12-04-04-020664

SITHIPORN ASSOCIATES CO., LTD.
CALIBRATION LABORATORY

Continuation of Calibration Certificate

Cert. No. : ACL23334
Job No. : VC67AC0014
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 instrument's display and also with SLM's display.

Condition of this result of calibration :

1. Reference Standard Instruments :

Instrument	Model	Serial No.	Cert. No.	Due Date
Waveform Generator	33210A	MY48017076	EF-0009-23	07-FEB-24
Waveform Generator	33511B	MY52302742	EF-0010-23	07-FEB-24
Digital Multimeter	33461A	MY53220104	EEL-BP 30/0266	13-FEB-24
Digital Multimeter	33461A	MY53220076	EEL-BP 29/0266	13-FEB-24
Digital Multimeter	34461A	MY60024273	EEL-BP 31/0266	14-FEB-24
Programmable Attenuator	MAT-1070	62100114	EF-0011-23	08-FEB-24
Condenser Microphone	4180	2977900	AA-1001-23	14-FEB-24
Measuring Amplifier	NA-42KAI	34560495	AA-3002-23	14-FEB-24

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

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

3.1 National Institute of Metrology (Thailand).

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

QI-TS12-04-04-020664

T. Petchurai

SITHIPORN ASSOCIATES CO., LTD.
CALIBRATION LABORATORY

Continuation of Calibration Certificate

Cert. No. : ACL23334
Job No. : VC67AC0014
Pages : 3 of 8

Summary of Measurement Result :

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

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

QI-TS12-04-04-020664

T. Petchurai

Continuation of Calibration Certificate

Cert. No. : ACL23334
Job No. : VC67AC0014
Pages : 4 of 8

Result of calibration :

1. Absolute sensitivity

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

2. Self-generated noise

2.1 Normal test

Measured Value (dB)
18.0

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	16.4
Flat	22.4

3. Acoustical signal tests of frequency weightings

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

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)			
	Flat	C-weight	A-weight	Acceptance Limits
125	0.3	0.3	0.3	±1.5
1000	0.0	0.0	0.0	±1.0
8000	-1.7	-1.7	-1.7	±5.0

QP-TS12-04-04-020664

T. Petch.

Continuation of Calibration Certificate

Cert. No. : ACL23334
Job No. : VC67AC0014
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	0.0	±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	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
A-weight	94.0	94.0	0.0	±0.2
C-weight	94.0	94.0	0.0	±0.2
Flat	94.0	94.0	0.0	±0.2

5.2 Time weighting at 1 kHz

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

6. Long-term stability

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

QP-TS12-04-04-020664

T. Petch.

Continuation of Calibration Certificate

Cert. No. : ACL23334
Job No. : VC67AC0014
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	27.0	0.0	±1.1
26.0	25.9	-0.1	±1.1
25.0	25.0	0.0	±1.1

QP-TS12-04-04-020664

T. Petch.

Continuation of Calibration Certificate

Cert. No. : ACL23334
Job No. : VC67AC0014
Pages : 7 of 8

8. Level linearity including the level range control

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

9. Tone burst response

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

10. Peak C sound level

Number of cycle in test signal	Anticipated Value (dB)	Measured Value, Lepeak (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.0	0.0	±3.0
One	136.4	135.7	-0.7	±3.0

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

QP-TS12-04-04-020664

T. Petch.

Continuation of Calibration Certificate

Cert. No. : ACL23334
Job No. : YC67AC0014
Pages : 8 of 8

11. Overload indication

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

12. High level stability

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

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

End of Calibration Certificate

QF-TS17-04-04-02064



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
CORPORATE SERVICES & EQUIPMENT CALIBRATION AND TESTING SERVICES
334/4 PATTANAKARN ROAD SOI 18, SUAN LAD, MUANGKHAO BANGKOK 10250
TEL: 0-2715-0000-29 FAX: 0-2710-8442



Cert.No.: 23CH1399
Page.: 1 of 3

Certificate of Calibration

Equipment : pH Meter
Manufacturer : Hach
Model : HQ411d
Serial No. : 200100031163
ID No. : BKK_EN0342
Condition As-Received : Used Item
Received Date : 26 October 2023
Calibration Date : 27 October 2023
Reference : 2310-0865DSC-3
Submitted by : ALS Laboratory Group (Thailand) Co.,Ltd.
104 Phatthanakan 40, Phatthanakan Rd.,
Khwaeng Phatthanakan, Khet Suan Luang,
Bangkok 10250 Thailand

REVIEW BY	Sulok B.
APPROVED BY	KJ AI
NEXT CAL DATE	23/10/24

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-CHB by comparison with standard thermometer

Calibrated by : Warakorn Lemgagrakul

Approved by : *Sathip*
Approved Signatory

(✓) Sathip Meangmai
() Warakorn Lemgagrakul
() Ponpan Palpin

Issue Date : 31 October 2023

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

This certificate is valid only for the equipment and the conditions stated herein.
Approval of the work of Calibration Services : Issued by : Calibration and Testing Services



Cert.No.: 23CH1369
Page.: 2 of 3

Condition of this calibration result

1. Reference Standard Instrument :-

Instrument	Serial No.	ID No.	Cert. No.	Due Date
1) Ref. Standard Thermometer	4982054	110RC044	231908	26 Jul 2024

This certification is traceable to the International System of Unit maintained through:-
- Technology Promotion Association (Thailand-Japan)

2. Certified Reference Materials : The measurement results are traceable to SI through CPA chem Ltd., ANSI-ASQ National Accreditation Board, Accredited No. AR-1635

Buffer Solution	Manufacturer	Lot No.	Exp. date
pH 4.008	CPA chem	913598	14 July 2025
pH 6.985	CPA chem	913599	14 July 2024
pH 9.997	CPA chem	931961	30 Sep 2024

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

Calibration Results

Function : pH Measurement

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

Unit Under Calibration	Standard pH Buffer Solution	Actual pH Reading	Actual mV Reading (mV)	Uncertainty of pH measurement (±)	Coverage factor k
pH Electrode S/N. 230473042902	4.008	4.002	166.5	0.0044	2.00
	6.985	6.987	-10.4	0.0084	2.00
	9.997	10.005	-189.3	0.0071	2.00

Remark : - Can not connect the BNC because the plug does not match with the socket



Cert.No.: 23CH1369
Page.: 3 of 3

Calibration Results

Function : Temperature Measurement

(*) Without adjustment

This equipment was connected with Temperature Probe:

- Model : PHC281
- Serial No. : 230473042902
Dimension of probe:
- Length : 103 mm
- Diameter : 12 mm
- Immersion Depth : 90 mm

Calibration Point (°C)	Standard Temperature (°C)	UUC* Reading (°C)	Error (°C)	Uncertainty of measurement (± °C)	Coverage factor k
25.0	25.002	25.1	0.098	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 %.

-000-

Sathip

1187344

Sathip

1187343

SCP EM 33, 03 February 2022



Metrological Center

SCI ECO Services Company Limited

33/2 Moo 3, T.Banpa, A.Kaengkhoh, Saraburi 18110, Thailand.
Saraburi Tel : +66 3627 3095 Fax : +66 3627 3100
Bangkok Tel : +668 9205 6851 , +668 6247 2360
Website : www.scieco.co.th E-Mail : calibrate@scg.com

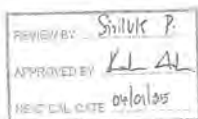


Certificate No. T231303

Page 1 of 3

Certificate of Calibration

Equipment : Liquid Bath (Water)
Manufacturer : MEMMERT
Model : WNB29
Serial No. : L611.0135
Customer Code : BKK_EN0148
ID No. : T6455A4
Customer : ALS Laboratory Group (Thailand) Co.,Ltd.
104 Phatthanakan 40, Phatthanakan Rd., Khwaeng Phatthanakan,
Khet Suan Luang, Bangkok 10250
Customer Location : ORGANIC PREPARATION LAB
Date of Receipt : 27 June 2023
Calibrated By : Sujjar Naknakred (Site Calibration Manager)
Approved By : Boonchai Suriyawong (Site Calibration Manager)
Date of Issue : 1 JUL 2023



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

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

FM-L1010-11-0054



Metrological Center

SCI ECO Services Company Limited

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



Certificate No. T231303

Page 2 of 3

Calibration Report

Equipment : Liquid Bath (Water)
Date of Calibration : 4 July 2023
Environment : Temperature : 22.2-22.5 °C
Line Voltage : 221.6-224.8 V
Relative Humidity : 55 - 65 %RH

Condition of this results of calibration :

- This equipment was calibrated by insert five resistance thermometer detectors into its water bath , the other one thermocouple type T use for ambient temperature measurement . The calibration was done in according to WI-T36 (based on ASTM E715-80 (Reapproved 2001)).
All data show below were final values and the initial data from customer request . The temperature scale used was based on ITS - 90 .
- Reference Standard Instrument :
Instrument Model Instrument No. Certificate No. Due Date
RTD 100 OHM M18 (CH1,CH6-CH7,CH9-CH10) T230545 10 April 2024
DATA LOGGER 34970A T149 T230545 10 April 2024
- This certificate is traceable to :
National Institute of Metrology (Thailand) through Metrological Center (NSC-TIS-TIS 1705 CALIBRATION 0244)
- Condition of calibrated item : gold
Equipment Description :
Time Constant 3 Hour 45 Minute At 60 °C
- Adjustment :
(X) without adjustment () after adjustment

Approved By : Boonchai Suriyawong

FM-L1010-11-0054



Metrological Center

SCI ECO Services Company Limited

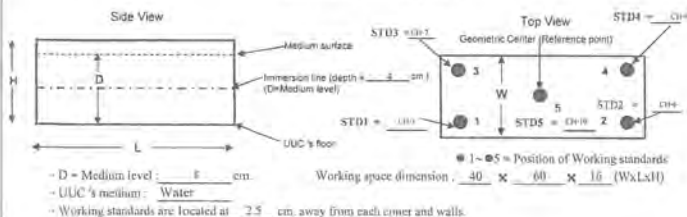
33/2 Moo 3, T.Banpa, A.Kaengkhoh, Saraburi 18110, Thailand.



Certificate No. T231303

Page 3 of 3

Calibration Report



- D = Medium level : 8 cm.
- UUC's medium : Water
- Working standards are located at 2.5 cm. away from each corner and walls.

Measurement Results:

Calibration Point	Average Standard Reading at each position (°C)				
	CH-1	CH-6	CH-7	CH-9	CH-10
60	60.03	60.06	60.24	60.11	60.18
85	84.79	84.83	85.42	85.05	85.20
95	93.71	93.83	94.02	94.15	94.42

Liquid Bath (Water)		Temperature Distribution				
Setting (°C)	Reading (°C)		Average (°C)	Stability (±°C)	Uniformity (±°C)	Uncertainty (±°C)
	Min	Max				
61.0	60.8	61.1	60.92	0.13	0.18	0.29
86.0	85.2	86.2	85.6	0.19	0.47	0.44
95.6	94.8	95	94.9	0.32	0.65	0.55

* The quoted uncertainty exclude "uniformity"

The calibration result apply only the above calibrated item.

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

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

Approved By : Boonchai Suriyawong

FM-L1010-11-0054



Metrological Center

SCI ECO Services Company Limited

33/2 Moo 3, T.Banpa, A.Kaengkhoh, Saraburi 18110, Thailand.
Saraburi Tel : +66 3627 3095 Fax : +66 3627 3100
Bangkok Tel : +668 9205 6851 , +668 6247 2360
Website : www.scieco.co.th E-Mail : calibrate@scg.com

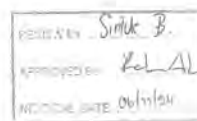


Certificate No. T232009

Page 1 of 3

Certificate of Calibration

Equipment : Chamber (Oven)
Manufacturer : Memmert
Model : UF110
Serial No. : B423.1549
Customer Code : BKK_EN0425
ID No. : T4671A5
Customer : ALS Laboratory Group (Thailand) Co.,Ltd.
104 Phatthanakan 40, Phatthanakan Rd.,
Khwaeng Phatthanakan, Khet Suan Luang, Bangkok 10250
Customer Location : Oven Room
Date of Receipt : 1 November 2023
Calibrated By : Atiphong Rongrat (Technician)
Approved By : Boonchai Suriyawong (Site Calibration Manager)
Date of Issue : 9 NOV 2023



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

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

FM-L1010-11-0054



Metrology

SCI ECO Services Company Limited

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



Certificate No. T232009

Page 2 of 3

Calibration Report

Equipment : Chamber (Oven)
Date of Calibration : 6 November 2023
Environment : Temperature : 27.5-28.1 °C
Line Voltage : 222.7-227.4 V
Relative Humidity : 55 - 65 %RH

Condition of this results of calibration :

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

2. Reference Standard Instrument :

Instrument	Model	Instrument No.	Certificate No.	Due Date
RTD	100 ohm	31-(CH1-10)	T230504	24 March 2024
DATA LOGGER	34970A	T114	T230504	24 March 2024

3. This certificate is traceable to :

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

4. Condition of calibrated item : good

Equipment Description :

Time Constant : 2 Hour 50 Minute At 104 °C
Fresh Air Damper : ☒ Open ☒ Min ☐ Medium ☐ Max
☐ Close
☐ Not Available

5. Adjustment :

(X) without adjustment () after adjustment

Approved By:

FM-L15 118-08-06



Metrology

SCI ECO Services Company Limited

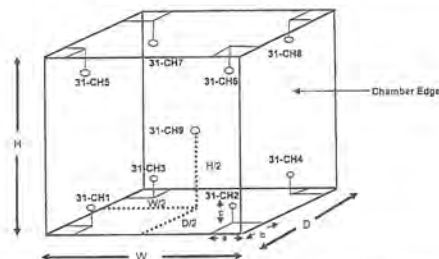
33/2 Moo 3, T.Banpa, A.Kaengkhoh, Saraburi 18110, Thailand.



Certificate No. T232009

Page 3 of 3

Calibration Report



Remark :

Internal Dimensions of Chamber : W (Width) = 56 cm, H (Height) = 41 cm, and D (Depth) = 48 cm.
Size of Installed Standard sensor number 31-CH1 to number 31-CH6 : a = 5 cm, b = 5 cm, and c = 5 cm.
Size of Installed Standard sensor number 31-CH9 : W/2 = 56 cm/2 H/2 = 41 cm/2 and D/2 = 48 cm/2

Measurement Results	Average Standard Reading at each position (°C)								
Calibration Point	31-CH1	31-CH2	31-CH3	31-CH4	31-CH5	31-CH6	31-CH7	31-CH8	31-CH9
104	103.82	104.10	103.74	104.26	103.95	104.31	103.87	104.00	103.81
180	180.04	180.21	179.44	180.31	179.02	180.13	180.17	180.35	179.69

Chamber (Oven)			Temperature Distribution				
Setting (°C)	Reading (°C)		Average (°C)	Stability (±°C)	Uniformity (°C)	Uncertainty (±°C)	Coverage Factor k
	Min	Max					
104.0	-	104.0	103.98	0.14	0.60	0.42	2.00
180.0	-	180.6	179.93	0.35	0.78	0.53	2.00

The calibration result apply only the above calibrated item.

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

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

Approved By:

FM-L15 118-08-06



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
CORPORATE SERVICES & EQUIPMENT CALIBRATION AND TESTING SERVICES
33/4 PATTHANAKAN ROAD, 40, PHATHANAKAN, BANGKOK, THAILAND
TEL. 0-2717 9309-26 FAX. 0-2718 0800



Cert.No.: 23CH1208
Page.: 1 of 2

Certificate of Calibration

Equipment : pH Meter
Manufacturer : Mettler Toledo
Model : SevenGo pH
Serial No. : C117620932
ID No. : BKK_LG0044
Condition As-Received: Used Item
Received Date : 25 September 2023
Calibration Date : 26 September 2023
Reference : 2309-0827DSC-1
Submitted by : ALS Laboratory Group (Thailand) Co., Ltd.
104 Phatthanakan 40, Phatthanakan Rd.,
Khwaeng Phatthanakan, Khut Suan Luang,
Bangkok 10250 Thailand
Ambient Temperature : (25 ± 2.5) °C
Relative Humidity : (50 ± 15) %
Calibration Procedure : In - house method :
- CP-CH5 by direct measurement with standard
voltage calibrator and direct measurement
with certified reference material (CRM)
Calibrated by : Warakorn Lemgagrakul
Approved by :
() Saitip, Meangmai
() Warakorn Lemgagrakul
() Porpan Paipim
Issue Date : 29 September 2023

The Uncertainties are for a confidence probability of approximately 95%

This certificate describes the equipment shown that is fully traceable to the SI units.
Approved by NSC-TISI-TIS 17025 CALIBRATION 0244

A 0058949



Cert. No.: 23CH1208
Page.: 2 of 2

Condition of this calibration result

1. Reference Standard Instrument :
Instrument Serial No. ID No. Cert. No. Due Date
1) Document Process Calibrator 54030049 130RC116 23E2802 27 Aug 2024
This certification is traceable to the International System of Unit maintained through:-
- Technology Promotion Association (Thailand-Japan)

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

Buffer Solution	Manufacturer	Lot No.	Exp. date
pH 4.008	CPA chem	913598	14 July 2025
pH 6.986	CPA chem	863633	28 Dec 2023
pH 9.997	CPA chem	913600	14 July 2024

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

Calibration Results

Function : mV Measurement

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

Unit Under Calibration	Nominal Value	Standard Voltage Input	Actual Reading		Uncertainty of Measurement (±mV)	Coverage factor k
			pH	mV		
pH Meter S/N : C117620932	4.00	177.48	177	4.00	0.58	2.00
	7.00	0.00	0	7.00	0.58	2.00
	10.00	-177.48	-177	10.00	0.58	2.00

Function : pH Measurement

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

Unit Under Calibration	Standard pH Buffer Solution	Actual pH Reading	Actual mV Reading (mV)	Uncertainty of pH measurement (±)	Coverage factor k
pH Electrode S/N : 2354505	4.008	4.01	181	0.0079	2.00
	6.986	7.00	18	0.0093	2.00
	9.997	10.00	-159	0.0095	2.00

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

-000-

Saitip

1182567



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
CORPORATE SERVICES & EQUIPMENT CALIBRATION AND TESTING SERVICES
534-4 PATTANAKARN ROAD SOI 14, SUANLUANG, SUANLUANG, BANGKOK 10250
TEL: 02-2715-3600 FAX: 0-2719-4914



Cert. No.: 23LM164
Page: 1 of 2

Certificate of Calibration

Equipment : pH Meter with Sensor
Manufacturer : Mettler Toledo
Model : SevenGo S2
Serial No. : C117520932
ID No. : BKK_LG0044
Submitted by : ALS Laboratory Group (Thailand) Co., Ltd.
104 Phatthanakan 40, Phatthanakan Rd.,
Khwaeng Phatthanakan, Khet Suan Luang,
Bangkok 10250 Thailand
Location : TPA Chemistry Calibration Laboratory
Received Order : 25 September 2023
Calibrated Date : 29 September 2023
Ambient Temperature : (26 ± 10) °C
Relative Humidity : (50 ± 30) %
AC Line Voltage : (220 ± 22) V
Calibrated by : Krisda Malee
Approved by :
() Pomfipha Tamayakul
() Ponpan Palpin
(x) Suwit Injai
Issue Date : 4 October 2023

The Uncertainties are for a confidence probability of approximately 95%

This is a certified document, and the signatory is responsible for its validity. It is not to be used for any other purpose.
Approved by: BKK Calibration Services Ltd. Equipment Calibration and Testing Services

A 0059004



Equipment : pH Meter with Sensor
Condition As-Received : Used Item
Reference : 2309-0827DSC-2
Procedure Used :-
Cert. No.: 23LM164
Page: 2 of 2

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

Condition of this result of calibration

1. Reference standard instrument:-
- | Instrument | Serial No. | Cert. No. | Traceable | Due Date |
|------------------------|------------|-----------|-----------|-------------|
| 1) Digital Thermometer | A52847 | 221325 | TPA | 31 Oct 2023 |
2. This certificate is valid only to the item calibrated on date and place of calibration.
3. This certification is traceable to the International System of Unit.

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

Result of Calibration : (*) Without Adjustment

Function : Temperature measurement

This instrument was connected with temperature sensor, S/N: 2354505

Calibration Point (°C)	Immersion Depth (mm)	Standard Temperature (°C)	UUC* Reading (°C)	Error (°C)	Uncertainty (± °C)	Coverage Factor k
20.0	100	20.005	19.9	-0.105	0.16	2.00
25.0	100	24.998	25.0	0.002	0.16	2.00
30.0	100	30.001	29.9	-0.101	0.16	2.00
35.0	100	35.001	34.9	-0.101	0.16	2.00
40.0	100	40.005	39.9	-0.105	0.16	2.00
45.0	100	45.001	44.9	-0.101	0.16	2.00
50.0	100	50.004	49.9	-0.104	0.16	2.00

UUC* : Unit Under Calibration

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

-000-

1182983

BKK_EL0043



Agilent Technologies (Thailand) Limited
U CHU LIANG BLDG 22/F UNIT A-3
569 RAMA 4 ROAD, SILEM, BANGKOK
Bangkok 10000 Thailand
Tel: +662 637 4367
Fax: +662 637 4334
Email: cco-smt@agilent.com
Website: www.agilent.com/thailand

Customer Contact:

ALS Laboratory Group (Thailand) Co., Ltd.
Head Office
104 Phatthanakan 40 Phatthanakan Rd
Khwaeng Phatthanakan Khet Suan
TAX ID : 019540004859
bounced-inchom.chanattagarn@aglobal.com
277158760519

Invoice To:

ALS Laboratory Group (Thailand) Co., Ltd.
Head Office
104 Phatthanakan 40 Phatthanakan Rd
Khwaeng Phatthanakan Khet Suan

Delivery Site:

ALS Laboratory Group (Thailand) Co., Ltd.
Head Office
104 Phatthanakan 40 Phatthanakan Rd
Khwaeng Phatthanakan Khet Suan

Location:
Room
Bldg
Lab
Dept

SERVICE REPORT

Customer Purchase Order Number:	Customer Number:
70371013	
Service Request:	Service Request Date:
Service Order:	Service Confirmation:
6006068207	6904837529

REVIEW BY:
APPROVED BY:
NEXT DUE DATE: 06/10/2024

Direct Inquiries to:

Contact Name: Customer Contact Center
Contact E-mail: cco-smt@agilent.com
Contact Telephone: +662 637 6363
Contact Fax: +662 632 4234

Learn more about Agilent's Special Offers, Products, Services and test full range of laboratory analytical solutions optimized for your applications and workflow. Visit us at www.agilent.com/thailand

Agilent Technologies (Thailand) Limited Head Office
U Chu Liang Bldg 22/F Unit A-3
569 Rama 4 Road, Silem, Bangkok
Bangkok 10000 Thailand
Tax ID: 019540004859

Orchard N.A. Bangkok Branch
201 Interchange 21 Building, Sukhumvit Road, Klongtong Nua
Sub-district, Wattana District, Bangkok 10110 Thailand
Acc. No: 012-4402 007
1108 Soong Thai Bank PCL
Siam Square Bldg 118/1-2 Rama 1 Rd, Pathumwan, BKK 10330
Thailand

Service Confirmation Number: 6904837529
Service Confirmation Date: 06.04.2023

Service Instrument:

Model Number	Model Description	Serial Number	System Handle	Parent Asset
SYS-IM-7900	ICP-MS 7900 System			
G8410A	SPS 4 Autosampler	AU15430722	ICP MS 7900	SYS-IM-7900
G8411A	ISIS 3 for Agilent 7850/7900/8900	JP15510227	ICP MS 7900	SYS-IM-7900
G3292A	PSC 6196T Chiller	ZU15A1948	ICP MS 7900	SYS-IM-7900
G8403A	Agilent 7900 ICP-MS	JP15471169	ICP MS 7900	SYS-IM-7900

Service Items:

Item	Service/Part #	Description	Qty	Entitlement	Service Start	Service End
1000	FOO	Enterprise Operational Qualification	1.00	Agreement Entitlement - 100 % covered	06.04.2023	06.04.2023
1010	S185-5850	ICP-MS Checkout Solutions	1.00	Agreement Entitlement - 100 % covered		

Additional Information:

Service Confirmation Number: 8904837529
Service Confirmation Date: 05.04.2023

Service Information:

Problem Description:
WU-S-00-ICP MS 7990-5001/143313

Service Provided:
Test OQ control of instrument ICPMS = BKK_EL0043. After done all instrument test all Pass.

Service Overview Code:
Reason Code: Scheduled Service
Diagnosis Code: Scheduled Service
Resolution Code: Scheduled Service

Reported Hours:
6.0

Travel Hours:
1.0

Customer Field Service
Representative Name:
Pantsep Kurasathain

Customer Field Service
Representative Signature:

Date:
06 Apr 2023

Customer Name:
Anchalee Khamjan

Customer Signature:

Date:
06 Apr 2023

Additional Comments:

Page 3 of 3



Metrological Center

SCI ECO Services Company Limited

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

Telephone : +66 2 586 5792-4 Fax : +66 2 586 5109

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

Certificate No. T231676

Page 1 of 6

Certificate of Calibration

Equipment : HEATING BLOCK

Manufacturer : Environmental Express

Model : SC 196

Serial No. : 6974CECW3285

Customer Code : BKK_EL0054

ID No. : T5306A3

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


104 Phatthanakan 40, Phatthanakan Rd., Khwaeng Phatthanakan,

Khet Suan Luang, Bangkok 10250

Customer Location : Acid Digestion Lab

Date of Receipt : 13 September 2023

Calibrated By : Sanej Musikawan (Site Calibration Manager)

Approved By :  / Sujjar Naknakred (Site Calibration Manager)

Date of Issue : 26 SEP 2023

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

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

FM-L12 109/30-05-57



Metrological Center

SCI ECO Services Company Limited

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

Telephone : +66 2 586 5792-4 Fax : +66 2 586 5109

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

Certificate No. T231676

Page 2 of 6

Calibration Report

Equipment : HEATING BLOCK

Date of Calibration : 22 September 2023

Environment : Temperature : 21.8-23.1 °C

Line Voltage : 221.6-226.3 V

Relative Humidity : 55 - 65 %RH

Condition of this results of calibration :

1. This equipment was calibrated by insert 20 standard thermocouples type T into its chamber , the other one standard thermocouples type T use for ambient temperature measurement . The calibration was done in according to WI-T20.

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

2. Reference Standard Instrument :

Instrument	Model	Instrument No.	Certificate No.	Due Date
TC	TYPE T	TN21-TN30	T230014	17 January 2024
TC	TYPE T	TN31-TN40	T230014	17 January 2024
DATA LOGGER	34970A	T151	T230014	17 January 2024

3. This certificate is traceable to :

National Institute of Metrology (Thailand) through Metrological Center (NSC-TISI-TIS 17625 CALIBRATION 0244.)

4. Condition of calibrated item : good

Equipment Description :

Time Constant : 2 Hour 20 Minute At 95 °C
Fresh Air Damper ☐ Open ☐ Min ☐ Medium ☐ Max
☐ Close
☒ Not Available

5. Adjustment :

() without adjustment (X) after adjustment

Approved By: 

FM-L13 108/30-05-57



Metrological Center

SCI ECO Services Company Limited

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

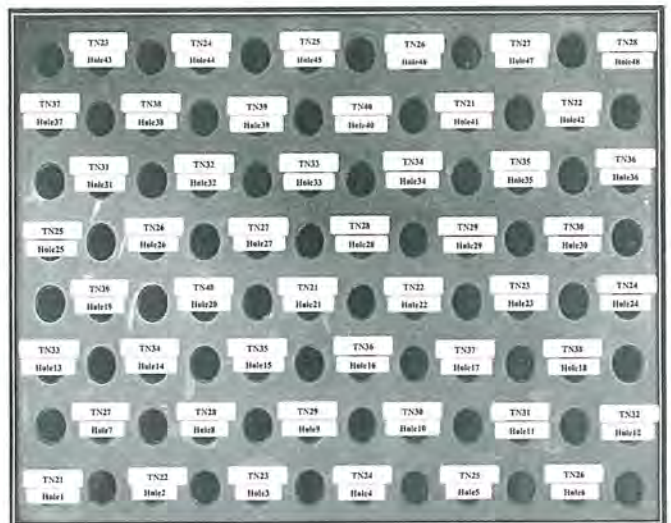
Telephone : +66 2 586 5792-4 Fax : +66 2 586 5109

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

Certificate No. T231676

Page 3 of 6

Calibration Report



FRONT CONTROL

Approved By: 

FM-L13 108/30-05-57

Calibration Report

Measurement Results

Calibration Point		Average Standard Reading at each position (°C)					
R1 Hole1-Hole6		TN21	TN22	TN23	TN24	TN25	TN26
CAL POINT	Max	95.01	94.41	95.20	95.41	94.51	95.17
	Min	94.57	93.95	94.75	94.92	94.00	94.72
	Average	94.76	94.18	94.98	95.17	94.26	94.95
R2 Hole7-Hole12		TN27	TN28	TN29	TN30	TN31	TN32
CAL POINT	Max	95.36	95.43	95.19	95.16	95.35	94.97
	Min	94.94	94.93	94.72	94.71	94.60	94.57
	Average	95.15	95.19	94.96	94.94	95.13	94.77
R3 Hole13-Hole18		TN33	TN34	TN35	TN36	TN37	TN38
CAL POINT	Max	95.17	95.50	95.22	95.21	95.33	95.31
	Min	94.99	95.09	94.78	94.82	94.88	94.96
	Average	95.18	95.30	95.00	95.02	95.11	95.13
R4 Hole19-Hole24		TN39	TN40	TN21	TN22	TN23	TN24
CAL POINT	Max	95.39	94.42	94.52	94.24	94.63	94.67
	Min	95.21	94.06	94.13	93.88	94.28	94.27
	Average	95.40	94.24	94.33	94.06	94.45	94.47
R5 Hole25-Hole30		TN25	TN26	TN27	TN28	TN29	TN30
CAL POINT	Max	95.19	95.38	92.93	95.30	95.14	95.03
	Min	94.83	95.03	92.36	94.95	94.79	94.70
	Average	95.01	95.20	92.75	95.12	94.96	94.87
R6 Hole31-Hole36		TN31	TN32	TN33	TN34	TN35	TN36
CAL POINT	Max	94.63	94.90	94.77	94.31	94.24	93.87
	Min	94.24	94.32	94.44	93.98	93.92	93.56
	Average	94.43	94.72	94.60	94.14	94.08	93.71
R7 Hole37-Hole42		TN37	TN38	TN39	TN40	TN21	TN22
CAL POINT	Max	94.30	94.44	94.04	93.81	94.69	95.35
	Min	93.95	94.05	93.67	93.48	94.39	94.90
	Average	94.13	94.24	93.86	93.65	94.54	95.12
R8 Hole43-Hole48		TN23	TN24	TN25	TN26	TN27	TN28
CAL POINT	Max	95.89	95.63	95.28	95.29	95.45	94.87
	Min	95.57	95.15	94.82	94.84	94.99	94.48
	Average	95.78	95.39	95.05	95.07	95.22	94.68

Approved By. 

FM-L13 (09/30-05-57)

Calibration Report

Measurement Results

Calibration Point		Average Standard Reading at each position (°C)					
R1 Hole1-Hole6		TN21	TN22	TN23	TN24	TN25	TN26
CAL POINT	Max	105.23	104.32	105.43	105.25	104.44	105.37
	Min	104.94	103.95	105.15	105.04	104.11	104.96
	Average	105.09	104.13	105.29	105.15	104.28	105.12
R2 Hole7-Hole12		TN27	TN28	TN29	TN30	TN31	TN32
CAL POINT	Max	105.30	105.12	105.18	105.22	105.12	105.16
	Min	105.11	104.92	104.96	105.00	104.92	104.97
	Average	105.20	105.02	105.07	105.11	105.02	105.06
R3 Hole13-Hole18		TN33	TN34	TN35	TN36	TN37	TN38
CAL POINT	Max	105.37	105.63	105.02	104.80	104.69	105.19
	Min	105.17	105.37	104.75	104.59	104.50	105.00
	Average	105.27	105.50	104.88	104.69	104.60	105.09
R4 Hole19-Hole24		TN39	TN40	TN21	TN22	TN23	TN24
CAL POINT	Max	105.31	104.40	106.41	104.71	105.63	103.83
	Min	105.08	104.22	106.15	104.41	105.37	105.56
	Average	105.19	104.33	106.28	104.56	105.50	105.69
R5 Hole25-Hole30		TN25	TN26	TN27	TN28	TN29	TN30
CAL POINT	Max	104.92	106.26	103.34	105.78	105.59	105.87
	Min	104.67	105.96	103.08	105.56	105.36	105.68
	Average	104.81	106.11	103.21	105.67	105.48	105.77
R6 Hole31-Hole36		TN31	TN32	TN33	TN34	TN35	TN36
CAL POINT	Max	104.75	104.86	104.80	105.20	104.50	104.39
	Min	104.24	104.63	104.39	105.00	104.32	104.18
	Average	104.43	104.75	104.69	105.10	104.41	104.28
R7 Hole37-Hole42		TN37	TN38	TN39	TN40	TN21	TN22
CAL POINT	Max	104.30	104.90	104.85	104.65	104.88	104.85
	Min	104.09	104.72	104.66	104.49	104.63	104.52
	Average	104.19	104.81	104.75	104.57	104.76	104.68
R8 Hole43-Hole48		TN23	TN24	TN25	TN26	TN27	TN28
CAL POINT	Max	105.71	105.85	105.19	105.61	105.42	105.19
	Min	105.45	105.61	105.14	105.27	105.18	104.94
	Average	105.58	105.73	105.17	105.44	105.30	105.07

Approved By. 

FM-L13 (09/30-05-57)

Calibration Report

Measurement Results

HEATING BLOCK			Temperature Distribution	
Settling (°C)	Reading (°C)		Stability (±°C)	Uncertainty (±°C)
	Min, Max	Average		
100.0	100.3, 100.5	100.4	± 0.26	0.81
107.0	107.0, 107.1	107.1	± 0.19	0.79

* The quoted uncertainty includes "uniformity".

The estimation result apply only the above calibrated item.

The result of test was (and accurate as shown on data and photo of test only).

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

Approved By. _____

FM-L13 (09/30-05-57)

Certificate of Calibration

Equipment : Chamber (Cooling Room)

Manufacturer : KOLDTECH

Model : KM 320

Serial No. : TBN-1012061/05

Customer Code : BKK_EN0167

ID No. : T2463A3

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


104 Phatthanakan 40, Phatthanakan Rd., Khwaeng Phatthanakan,

Khet Suan Luang, Bangkok 10250

Customer Location : Laboratory

Date of Receipt : 29 November 2023

Calibrated By : Atiphong Rongrat (Technician)

Approved By :  / Boonchai Suriyawong (Site Calibration Manager)

Date of Issue : 09 JAN 2024

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

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

FM-L14 (19/18-08-66)

Calibration Report

Equipment : Chamber (Cooling Room)
Date of Calibration : 6 December 2023
Environment : Temperature : 23.4-24.9 °C
Line Voltage : 221.4-230.2 V
Relative Humidity : 55 - 65 %RH

Condition of this results of calibration :

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

2. Reference Standard Instrument :

Instrument	Model	Instrument No.	Certificate No.	Due Date
TC	TYPE T	TN161-TN170	T230773	10 April 2024
TC	TYPE T	TN171-TN180	T230773	10 April 2024
DATA LOGGER	34970A	T149	T230773	10 April 2024

3. This certificate is traceable to :

National Institute of Metrology (Thailand) through Metrological Center (NSC-TISI-TIS 17025 CALIBRATION 8244).

4. Condition of calibrated item : good

Equipment Description :

Time Constant: 1 Hour 30 Minute At 3 °C
Fresh Air Damper ☐ Open ☐ Min ☐ Medium ☐ Max

☐ Close
☒ Not Available

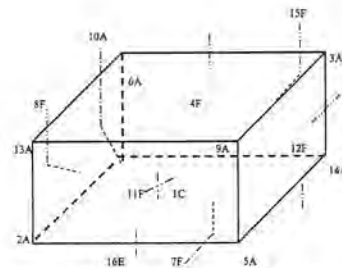
5. Adjustment :

(X) without adjustment () after adjustment

Approved By. 

FM-L15 118/18-08-66

Calibration Report



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

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

Approved By. 

FM-L15 118/18-08-66

Calibration Report

Measurement Results

Calibration Point	Average Standard Reading at each position (°C)											
	TN161	TN162	TN163	TN164	TN165	TN166	TN167	TN168	TN169	TN170	TN171	TN172
3.0	2.83	3.34	2.95	3.46	3.45	3.76	3.25	3.46	3.39	3.50	3.58	3.42
	TN173	TN174	TN175	TN176								
	3.32	3.39	3.15	3.45								

Chamber (Cooling Room)		Temperature Distribution					
Setting (°C)	Reading (°C)		Average (°C)	Stability (±°C)	Uniformity (°C)	Uncertainty (±°C)	Coverage Factor k
	Min	Max					
3.0	2.8	4.1	3.5	0.36	1.10	2.00	1.90

The calibration result apply only the above calibrated item.

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

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

Approved By. 

FM-L15 118/18-08-66