

ภาคผนวก จ

ใบรับรองเอกสารการสอบเทียบเครื่องมือตรวจวิเคราะห์



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รายการเครื่องมือที่ใช้ในการตรวจวัด / หมายเหตุ

Sample Name	Parameter	Equipment Name	ID No.	Calibrated Date	Next Cal.	Freq. Calibrate (Months)
Ambient	Total Suspended Particulate	High Volume	BKK-FS0344	-	-	On use Calibration
Ambient	Total Suspended Particulate	High Volume	BKK-FS0372	-	-	On use Calibration
Ambient	Total Suspended Particulate	High Volume	BKK-FS0358	-	-	On use Calibration
Ambient	Total Suspended Particulate	High Volume	BKK-FS0359	-	-	On use Calibration
Ambient	Total Suspended Particulate	Digital Balance	BKK-FS0304	8-Feb-23	8-Feb-24	12
Ambient	Particulate Matter (PM-10)	High Volume	BKK-FS0389	-	-	On use Calibration
Ambient	Particulate Matter (PM-10)	High Volume	BKK-FS0389	-	-	On use Calibration
Ambient	Particulate Matter (PM-10)	High Volume	BKK-FS0381	-	-	On use Calibration
Ambient	Particulate Matter (PM-10)	Digital Balance	BKK-FS0381	8-Feb-23	8-Feb-24	12
Ambient	Hydrogen Dioxide	NO ₂ Analyzer	BKK-FS0702	3-Jan-23	3-Jul-23	6
Ambient	Hydrogen Dioxide	NO ₂ Analyzer	BKK-FS0708	3-Jan-23	3-Jul-23	6
Ambient	Hydrogen Dioxide	NO ₂ Analyzer	BKK-FS0783	3-Jan-23	3-Jul-23	6
Ambient	Hydrogen Dioxide	NO ₂ Analyzer	BKK-FS0779	3-Jan-23	3-Jul-23	6
Ambient	Sulfur Dioxide	SO ₂ Analyzer	BKK-FS1091	4-Jan-23	4-Jul-23	6
Ambient	Sulfur Dioxide	SO ₂ Analyzer	BKK-FS0727	4-Jan-23	4-Jul-23	6
Ambient	Sulfur Dioxide	SO ₂ Analyzer	BKK-FS0784	4-Jan-23	4-Jul-23	6
Ambient	Sulfur Dioxide	SO ₂ Analyzer	BKK-FS0778	4-Jan-23	4-Jul-23	6
Ambient	Wind Speed / Wind Direction	Wind Speed / Wind Direction	BKK-FS0774	13-Feb-23	13-Feb-24	12
Ambient	Wind Speed / Wind Direction	Wind Speed / Wind Direction	BKK-FS1213	17-Jun-22	17-Jun-24	18
Ambient	Wind Speed / Wind Direction	Wind Speed / Wind Direction	IPA-FS0939	10-Dec-22	10-Jun-24	18
Ambient	Wind Speed / Wind Direction	Wind Speed / Wind Direction	AVG-FS0435	31-Jan-22	27-Jul-23	18
Ambient	Temperature	Temperature Sensor	BKK-FS0704	13-Feb-23	13-Feb-24	12
Ambient	Temperature	Temperature Sensor	BKK-FS1213	17-Jun-22	17-Jun-24	18
Ambient	Temperature	Temperature Sensor	IPA-FS0939	10-Dec-22	10-Jun-24	18
Ambient	Temperature	Temperature Sensor	BKK-FS0435	31-Jan-22	27-Jul-23	18
Stack (CEMS)	Carbon Monoxide	Analyzer - System calibration, Site	-	-	-	-
Stack (CEMS)	Oxides of Nitrogen	Analyzer - System calibration, Site	-	-	-	-
Stack (CEMS)	Sulfur Dioxide	Analyzer - System calibration, Site	-	-	-	-
Stack (CEMS)	Fluegas	Analyzer - System calibration, Site	-	-	-	-
Stack (CEMS)	Pressure	Analyzer - System calibration, Site	-	-	-	-
Stack	Total Suspended Particulate	Denutrie Control Unit	BKK-FS0607	3-Jan-23	3-Jul-23	6
Stack	Total Suspended Particulate	Denutrie Control Unit	BKK-FS0496	3-Jan-23	3-Jul-23	6
Stack	Total Suspended Particulate	Denutrie Control Unit	BKK-FS1092	3-Jan-23	3-Jul-23	6
Stack	Total Suspended Particulate	Denutrie Control Unit	BKK-FS0485	3-Jan-23	3-Jul-23	6
Stack	Total Suspended Particulate	Denutrie Control Unit	BKK-FS0356	3-Jan-23	3-Jul-23	6
Stack	Total Suspended Particulate	Flue gas Analyzer	BKK-FS1154	4-Dec-22	4-Dec-23	12
Stack	Total Suspended Particulate	Flue gas Analyzer	BKK-FS1091	4-Dec-22	4-Dec-23	12
Stack	Total Suspended Particulate	Flue gas Analyzer	BKK-FS1095	25-Jun-22	25-Jun-23	12
Stack	Total Suspended Particulate	Flue gas Analyzer	BKK-FS0002	8-Feb-23	8-Feb-24	12
Noise	Leq 24 Hrs	Sound Calibration	BKK-FS1121	14-Jun-22	14-Jun-23	12
Noise	Leq 24 Hrs	Sound Level Meter	BKK-FS0925	18-Oct-22	18-Oct-23	12
Noise	Leq 24 Hrs	Sound Level Meter	BKK-FS0927	18-Oct-22	18-Oct-23	12
Noise	Leq 24 Hrs	Sound Level Meter	BKK-FS0929	19-Jun-23	19-Jun-24	12
Noise	Leq 8 Hrs	Sound Calibration	BKK-FS1017	9-Sep-22	9-Sep-23	12
Noise	Leq 8 Hrs	Sound Level Meter	BKK-FS0908	11-Jul-22	11-Jul-23	12
Noise	Leq 8 Hrs	Sound Level Meter	BKK-FS0116	3-Jan-23	3-Jan-24	12
Noise	Leq 8 Hrs	Sound Level Meter	BKK-FS0115	3-Jan-23	3-Jan-24	12
Noise	Leq 8 Hrs	Sound Level Meter	BKK-FS0874	3-Jan-23	3-Jan-24	12
Noise	Leq 8 Hrs	Sound Level Meter	BKK-FS0879	21-Jun-22	21-Jun-23	12
Noise	Leq 8 Hrs	Sound Level Meter	BKK-FS0924	22-Dec-22	22-Dec-23	12
Noise	Leq 8 Hrs	Sound Level Meter	BKK-FS0927	18-Oct-22	18-Oct-23	12
Noise	Leq 8 Hrs	Sound Level Meter	BKK-FS0929	19-Jun-23	19-Jun-24	12
Noise	Leq 8 Hrs	Sound Level Meter	BKK-FS0970	18-Jan-23	18-Jan-24	12
Noise	Leq 8 Hrs	Sound Level Meter	BKK-FS0991	18-Jan-23	18-Jan-24	12
Noise	Leq 8 Hrs	Sound Level Meter	BKK-FS0909	11-Jul-22	11-Jul-23	12

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รายการเครื่องมือที่ใช้ในการตรวจวัด / หมายเหตุ

Sample Name	Parameter	Equipment Name	ID No.	Calibrated Date	Next Cal.	Freq. Calibrate (Months)
Drum Acid	Leq 8 Hrs	Sound Level Meter	BKK-FS0108	15-Jan-23	15-Jan-24	12
Drum Acid	Leq 8 Hrs	Sound Level Meter	BKK-FS0925	18-Oct-22	18-Oct-23	12
Water Lab	pH in 25 °C	pH meter	BKK-FS0072	12-Sep-22	12-Sep-24	18
Water Lab	Refract. Free Chlorine	Chlorine Meter	BKK-FS0040	27-Aug-22	27-Aug-23	12
Water Lab	Oil & Grease	Electronic Top-Loading Balance	BKK-FS0092	8-Feb-23	8-Feb-24	12
Water Lab	Oil & Grease	Electronic Top-Loading Balance	BKK-FS0148	30-Jan-22	30-Jan-23	18
Water Lab	Total Dissolved Solids (TDS)	Electronic Top-Loading Balance	BKK-FS0062	8-Feb-23	8-Feb-24	12
Water Lab	Total Dissolved Solids (TDS)	Electronic Top-Loading Balance	BKK-FS0271	25-Jun-22	25-Jun-23	18
Water Lab	Temperature	pH meter	BKK-FS0013	19-Feb-23	19-Feb-24	12
Water Lab	Copper	ICP-MS	BKK-FS0626	14-Jun-22	14-Jun-23	18
Water Lab	Copper	ICP-MS	BKK-FS0624	14-Jun-22	14-Jun-23	18
Water Lab	Copper	ICP-MS	BKK-FS0617	14-Jun-22	14-Jun-23	18
Water Lab	Zinc	ICP-MS	BKK-FS0626	14-Jun-22	14-Jun-23	18
Water Lab	Zinc	ICP-MS	BKK-FS0624	14-Jun-22	14-Jun-23	18
Water Lab	Zinc	ICP-MS	BKK-FS0617	14-Jun-22	14-Jun-23	18

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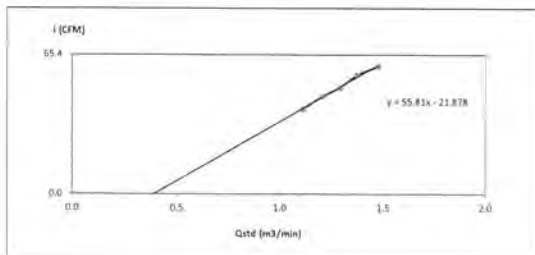
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High Volume Air Sampler Calibration Worksheet

Project Site: Gulf IP UT Co., Ltd. Barometric Pressure (mm Hg): 757
 Calibrate Location: โรงงานปูนซีเมนต์ Temperature (°C): 32
 Calibrate Date: 16-Mar-23 High Volume ID: BKK-FS0364
 Calibration Sheet No.: C-160323-BKK-FS0364 High Volume Model: TE-5009X
 Calibrator ID: RYG-FS0415 High Volume S/N: 4154
 Calibrator Model: TE-5028A Calibrator Slope: 1.64572
 Calibrator S/N: 3494 Calibrator Intercept: -0.01006

Test No.	Delta H ₂ O (inch)	Q _{vol} (m ³ /min)	I: Chart (CFM)	Linear Regression
1	3.4	1.1154	40	Slope: 55.8101
2	4.0	1.2089	46	Intercept: -21.8777
3	4.6	1.2957	50	Correlation Coefficient: 0.9961
4	5.2	1.3770	56	
5	6.0	1.4784	60	



Calibrated by: Pom Srit
 (Mr. Prommee Sritprattet)
 Field Scientist(2)

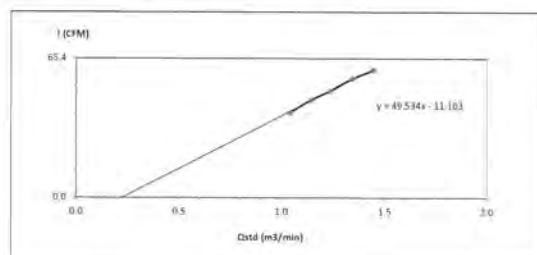
Approved by: Noppong Jantarapan
 (Mr. Noppong Jantarapan)
 Environ Field Coordinator Scientist(3)



High Volume Air Sampler Calibration Worksheet

Project Site: Gulf IP UT Co., Ltd. Barometric Pressure (mm Hg): 757
 Calibrate Location: โรงงานปูนซีเมนต์ Temperature (°C): 35
 Calibrate Date: 16-Mar-23 High Volume ID: BKK-FS0372
 Calibration Sheet No.: C-160323-BKK-FS0372 High Volume Model: TE-5009X
 Calibrator ID: RYG-FS0415 High Volume S/N: 5332
 Calibrator Model: TE-5028A Calibrator Slope: 1.64572
 Calibrator S/N: 3494 Calibrator Intercept: -0.01006

Test No.	Delta H ₂ O (inch)	Q _{vol} (m ³ /min)	I: Chart (CFM)	Linear Regression
1	3.0	1.0482	40	Slope: 49.5341
2	3.6	1.1419	46	Intercept: -11.1030
3	4.2	1.2325	50	Correlation Coefficient: 0.9976
4	5.0	1.3439	56	
5	5.8	1.4466	60	



Calibrated by: Pom Srit
 (Mr. Prommee Sritprattet)
 Field Scientist(2)

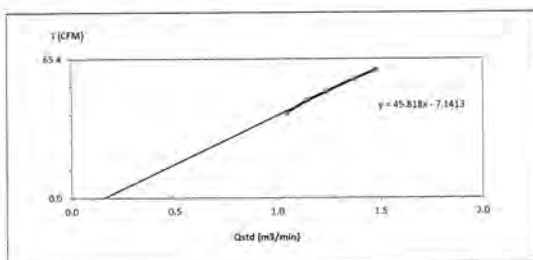
Approved by: Noppong Jantarapan
 (Mr. Noppong Jantarapan)
 Environ Field Coordinator Scientist(3)



High Volume Air Sampler Calibration Worksheet

Project Site: Gulf IP UT Co., Ltd. Barometric Pressure (mm Hg): 757
 Calibrate Location: กรุงเทพมหานคร Calibrate Location: 14
 Calibrate Date: 16-Mar-23 High Volume ID: BKK_F5035H
 Calibration Sheet No.: C-160323-BKK_F5035H High Volume Model: TB-5009X
 Calibrator ID: RYG_F50415 High Volume S/N: 5193
 Calibrator Model: TE-5028A Calibrator Slope: 1.64572
 Calibrator S/N: 3494 Calibrator Intercept: -0.01006

Test No.	Delta H ₂ O (inch)	Q _{std} (m ³ /min)	I: Chart (CFM)	Linear Regression
1	3.0	1.0466	40	Slope: 45.8176
2	3.6	1.1455	46	Intercept: -7.1413
3	4.2	1.2365	50	Correlation Coefficient: 0.9968
4	5.2	1.3747	56	
5	6.0	1.4769	60	



Calibrated by: *Poomsri*
 (Mr. Poomsri Sripant)
 Field Scientist (2)

Approved by: *[Signature]*
 (Mr. Noppong Jintaraporn)
 Senior Field Coordinator Scientist (3)

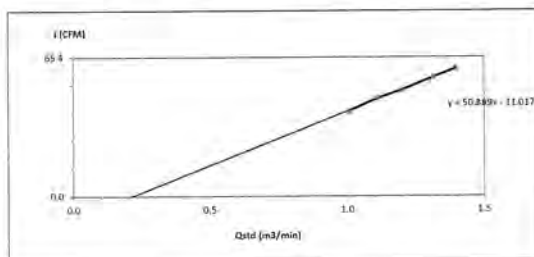
FORM NO.: F-06-073 REVISION NO.: ISSUE DATE: 14/03/16



High Volume Air Sampler Calibration Worksheet

Project Site: Gulf IP UT Co., Ltd. Barometric Pressure (mm Hg): 757
 Calibrate Location: กรุงเทพมหานคร Calibrate Location: 14
 Calibrate Date: 16-Mar-23 High Volume ID: BKK_F5035H
 Calibration Sheet No.: C-160323-BKK_F5035H High Volume Model: TB-5009X
 Calibrator ID: RYG_F50415 High Volume S/N: 5194
 Calibrator Model: TE-5028A Calibrator Slope: 1.64572
 Calibrator S/N: 3494 Calibrator Intercept: -0.01006

Test No.	Delta H ₂ O (inch)	Q _{std} (m ³ /min)	I: Chart (CFM)	Linear Regression
1	2.8	1.0082	40	Slope: 50.8994
2	3.4	1.1100	46	Intercept: -11.0174
3	4.0	1.2031	50	Correlation Coefficient: 0.9992
4	4.8	1.3169	56	
5	5.4	1.3962	60	



Calibrated by: *Poomsri*
 (Mr. Poomsri Sripant)
 Field Scientist (2)

Approved by: *[Signature]*
 (Mr. Noppong Jintaraporn)
 Senior Field Coordinator Scientist (3)

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

Sartorius (Thailand) Co., Ltd.
 129 Rama 8 Road, Huaykwang, Huaykwang, Bangkok 10310
 Tel: +66 2543 8361-5, e-mail: service.thailand@sartorius.com

NSC-TSI-TS 17025
CALIBRATION 0425

SARTORIUS

Certificate of Calibration

Model Number: XP105DU Certificate No.: 23BC10071
 Description: Semi-micro Balance Issued Date: Monday, February 13, 2023
 Serial Number: 1123091884 Reference No.: 203245
 ID No. BKK_EN0004
 Manufacturer: Mettler Toledo Page No.: 1 of 3

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

Calibrated Place: Balance Room.

Calibrated By: Mr. Chonchai Inthana 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: 31/120 g Readability: 0.0001 g
 Ambient Conditions: Temperature: 21.0 °C ± 3.0 °C
 Humidity: 85.0 % RH ± 5.0 % RH
 Pressure: ±

Reasons for calibration

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

Equipment Condition: ☒ Good Operate ☐ fail

Measurement Method UKAS Publication Ref: Lab 14

The measurement uncertainty stated is the expanded uncertainty which is obtained from the standard uncertainty multiplied by the coverage factor (k=2) to provide a level of confidence of approximately 95%. It is determined in accordance with the Guide to Expression of Uncertainty in Measurement (GUM). The calibration certificate documents the traceability to National Standards, which realize 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 - 1kg E2 in 37629119	SPC-RT	C02212565	14-Sep-2023
MHB-382SD	Humidity/Barometer/Temp. Lutron MHB-382SD	DKSH	C19220444	5-Sep-2023

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

Mr. Chonchai Inthana (Technical Manager)



SOP FM 33 03 February 2022

Sartorius (Thailand) Co., Ltd.
 129 Rama 8 Road, Huaykwang, Huaykwang, Bangkok 10310
 Tel: +66 2543 8361-5 Fax: +66 2543 8367

SARTORIUS

Certificate of Calibration

Model Number: XP105DU Certificate No.: 23BC10071
 Description: Semi-micro Balance Issued Date: Monday, February 13, 2023
 Serial Number: 1123091884 Reference No.: 203245
 ID No. BKK_EN0004
 Manufacturer: Mettler Toledo Page No.: 2 of 3

Calibration Results : Without Adjustment

Repeatability			Eccentricity (Off-center loading error)		
The repeatability is the ability of a weighing instrument to display nearly identical readings under constant test conditions when the same load within a measurement range is placed repeatedly on the weighing pan in the same manner. The standard deviation is used to express repeatability quantitatively.			The off-center loading error is yielded by the difference between the reading of the load 1: 10 or 1/4 of maximum capacity placed in the middle of the weighing pan and between each of four additional measurement points (positions outlined according to OIML R110).		
Nominal Value : (Low Load)	2.00002 g	20.00002 g	Nominal value :	20 g	
Tolerance	2.00001 g	20.00001 g	Tolerance	N/A g	
	2.00002 g	20.00002 g			
	2.00002 g	20.00002 g			
	2.00002 g	20.00002 g			
Nominal Value : (High Load)	2.00002 g	20.00002 g			
Tolerance	2.00002 g	20.00002 g			
	2.00002 g	20.00002 g			
	2.00001 g	20.00001 g			
	2.00001 g	20.00001 g			
Standard Deviation	0.000005	0.000007			

Linearity

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

Tolerance	N/A g			
Nominal Value	Conventional Mass Value	Displayed Value	Deviation	Uncertainty
(g)	(g)	(g)	(g)	(g)
0.1	0.10000	0.10000	0.00000	0.00002
0.5	0.50001	0.50000	-0.00001	0.00003
1	1.00000	1.00000	0.00000	0.00004
2	2.00002	2.00001	-0.00001	0.00006
5	5.00002	5.00002	0.00000	0.00010
10	10.00002	10.00002	0.00000	0.00015
15	15.00004	15.00004	0.00000	0.00013
20	20.00006	20.00000	0.00000	0.00013
25	25.00002	25.00002	0.00000	0.00019
30	30.00002	30.00004	0.00002	0.00019

SOP FM 33 03 February 2022

Certificate of Calibration

Model Number : XS105DU
Description : Semi-micro Balance
Serial Number : 1123081884
ID No. : BKK_EN0004
Manufacturer : Mettler Toledo

Certificate No. : Z3BC10071
Issued Date : Monday, February 13, 2023
Reference No. : 203245
Page No. : 3 of 3

Calibration Results : Without Adjustment

Repeatability		Eccentricity (Off-center loading error)	
The repeatability is the ability of a weighing instrument to display nearly identical readings under constant test conditions when the same load within a measurement range is placed repeatedly on the weighing pan in the same manner. The standard deviation is used to express repeatability quantitatively.		The off-center loading error is yielded by the difference between the result of the test, i.e. 1/2 or 1/4 of maximum capacity, placed in the middle of the weighing pan and between each of four additional measurement points (positions defined according to OIML R111).	
Nominal Value : (Low Load)	100.0000	Nominal value :	g
Tolerance	g	Tolerance	N/A
N/A	g		
Nominal Value : (High Load)	100.0000		
Tolerance	g		
N/A	g		
Standard Deviation	0.00003		

Linearity	
The linearity, also called linearity error, describes the deviation of the characteristic curve of a weighing instrument from the linear slope.	
Tolerance	N/A
N/A	g
Nominal Value	Conventional Mass Value
(g)	(g)
50	50.0000
55	55.0000
60	60.0000
65	65.0001
70	70.0000
80	80.0000
90	90.0001
100	100.0000
110	110.0000
120	120.0000

End of Report

SOP FM 33 03 February 2022

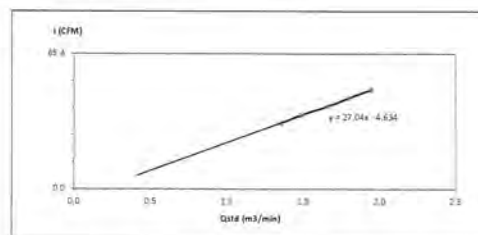


High Volume Air Sampler Calibration Worksheet

Project Site : Gulf IP UT Co., Ltd.
Calibrate Location : Sriracha
Calibrate Date : 16-Mar-23
Calibration Sheet No. : C-160323-BKK FS0380
Calibrator ID : RYG FS0415
Calibrator Model : TE-5028A
Calibrator S/N : 3494

Barometric Pressure (mm Hg) : 757
Temperature (°C) : 32
High Volume ID : BKK FS0380
High Volume Model : TE-5009X
High Volume S/N : 4163
Calibrator Slope : 1.03079
Calibrator Intercept : -0.00629

Test No.	Delta H ₂ O (inch)	Q _{air} (m ³ /min)	I : Chart (CFM)	Linear Regression
1	2.8	1.3597	32	Slope: 27.0397
2	2.4	1.4089	36	Intercept: -4.6340
3	3.8	1.6639	40	Correlation Coefficient: 0.9991
4	3.5	1.7967	44	
5	4.1	1.9441	48	



Calibrated by : *Poomsri*
(Mr. Poomsri Sriprattet)
Field Scientist(2)

Approved by : *Mr. Noppong Jantaraporn*
(Mr. Noppong Jantaraporn)
Enviro Field Coordinator Scientist (3)

FORM NO. : E-00-074 REVISION NO. : ISSUE DATE : 14/07/16

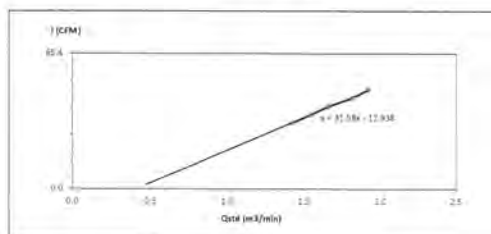


High Volume Air Sampler Calibration Worksheet

Project Site : Gulf IP UT Co., Ltd.
Calibrate Location : Sriracha
Calibrate Date : 16-Mar-23
Calibration Sheet No. : C-160323-BKK FS0380
Calibrator ID : RYG FS0415
Calibrator Model : TE-5028A
Calibrator S/N : 3494

Barometric Pressure (mm Hg) : 757
Temperature (°C) : 32
High Volume ID : BKK FS0380
High Volume Model : TE-5009X
High Volume S/N : 5329
Calibrator Slope : 1.03079
Calibrator Intercept : -0.00629

Test No.	Delta H ₂ O (inch)	Q _{air} (m ³ /min)	I : Chart (CFM)	Linear Regression
1	2.3	1.4258	32	Slope: 31.5797
2	2.6	1.5495	36	Intercept: -12.0288
3	3.0	1.6639	40	Correlation Coefficient: 0.9981
4	3.6	1.9221	44	
5	4.0	1.9204	48	



Calibrated by : *Poomsri*
(Mr. Poomsri Sriprattet)
Field Scientist(2)

Approved by : *Mr. Noppong Jantaraporn*
(Mr. Noppong Jantaraporn)
Enviro Field Coordinator Scientist (3)

FORM NO. : E-00-074 REVISION NO. : ISSUE DATE : 14/07/16

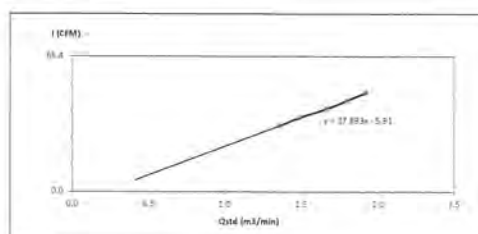


High Volume Air Sampler Calibration Worksheet

Project Site : Gulf IP UT Co., Ltd.
Calibrate Location : Sriracha
Calibrate Date : 16-Mar-23
Calibration Sheet No. : C-160323-BKK FS1061
Calibrator ID : RYG FS0415
Calibrator Model : TE-5028A
Calibrator S/N : 3494

Barometric Pressure (mm Hg) : 757
Temperature (°C) : 32
High Volume ID : BKK FS1061
High Volume Model : TE-5009X
High Volume S/N : 5584
Calibrator Slope : 1.03079
Calibrator Intercept : -0.00629

Test No.	Delta H ₂ O (inch)	Q _{air} (m ³ /min)	I : Chart (CFM)	Linear Regression
1	2.8	1.3597	32	Slope: 27.0397
2	2.4	1.4089	36	Intercept: -5.9100
3	3.8	1.6639	40	Correlation Coefficient: 0.9989
4	3.5	1.7967	44	
5	4.0	1.9204	48	



Calibrated by : *Poomsri*
(Mr. Poomsri Sriprattet)
Field Scientist(2)

Approved by : *Mr. Noppong Jantaraporn*
(Mr. Noppong Jantaraporn)
Enviro Field Coordinator Scientist (3)

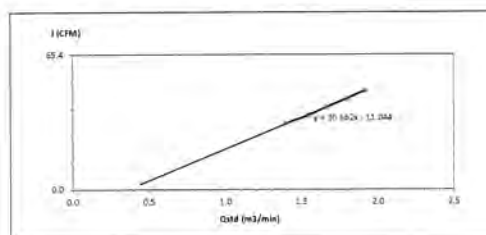
FORM NO. : E-00-074 REVISION NO. : ISSUE DATE : 14/07/16



High Volume Air Sampler Calibration Worksheet

Project Site : Golf/PUT Co., Ltd. Barometric Pressure (mm Hg) : 757
 Calibrate Location : สนามกอล์ฟ/พอร์ทโค. ลิมิเตด 1-4 Temperature (°C) : 32
 Calibrate Date : 16-Mar-23 High Volume ID : BKK_F50301
 Calibration Sheet No. : C-160323-BKK_F50301 High Volume Model : TE-5090X
 Calibrator ID : BYG_F50415 High Volume S/N : 4163
 Calibrator Model : TE-5028A Calibrator Slope : 1.93079
 Calibrator S/N : 3454 Calibrator Intercept : -0.00629

Test No.	Delta H ₂ O (inch)	Q _{std} (m ³ /min)	1 - Chart (CFM)	Linear Regression
1	2.1	1.7932	32	Slope: 39.6622 Intercept: -11.0442 Correlation Coefficient: 0.9999
2	2.6	1.5495	36	
3	3.9	1.6609	40	
4	3.5	1.7967	44	
5	-4.0	1.9204	48	



Calibrated By: Bomlir
 (Mr. Ponnemee Sripanont)
 Field Scientist (2)

Approved By: 20.000
 (Mr. Wipong Jantaraporn)
 Enviro Field Coordinator Scientist (1)

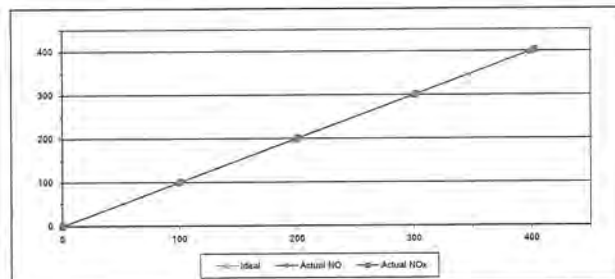
FORM NO. F 06-078 REVISION NO. 1 ISSUE DATE 14/03/16



MULTIPOINT CALIBRATION REPORT

Calibration Date : 5-Jan-23 Equipment Name : NOx Analyzer
 Manufacturer : HORIBA Model : APNA-370
 Serial No. : XLTRBBSJ Equipment ID : BKK_FS1092
 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	99.70	-0.30	-0.30	101.00	1.00	1.00
2	200.00	198.10	-1.90	-0.95	201.00	1.00	0.50
3	300.00	299.10	-0.90	-0.30	301.40	1.40	0.47
4	400.00	398.20	-1.80	-0.45	402.80	2.80	0.70
AVERAGE (%)				-0.38			0.55



Calibrated By

Approved By

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

(Mr. Sarayuth Jitranont)
 Assistant General Manager

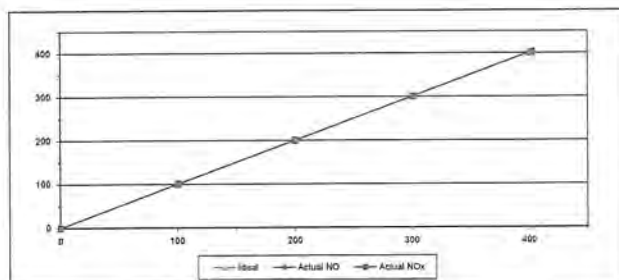
ALS Laboratory Group
 FORM NO. F 06-058 REVISION NO. 1 ISSUE DATE 02/04/12



MULTIPOINT CALIBRATION REPORT

Calibration Date : 5-Jan-23 Equipment Name : NOx Analyzer
 Manufacturer : Teledyne API Model : T200
 Serial No. : 1993 Equipment ID : BKK_F50728
 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	100.10	0.10	0.10	101.10	1.10	1.10
2	200.00	199.40	-0.60	-0.30	200.40	0.40	0.20
3	300.00	299.60	-0.40	-0.13	301.00	1.00	0.33
4	400.00	400.30	0.30	0.08	402.20	2.20	0.55
AVERAGE (%)				-0.03			0.46



Calibrated By

Approved By

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

(Mr. Sarayuth Jitranont)
 Assistant General Manager

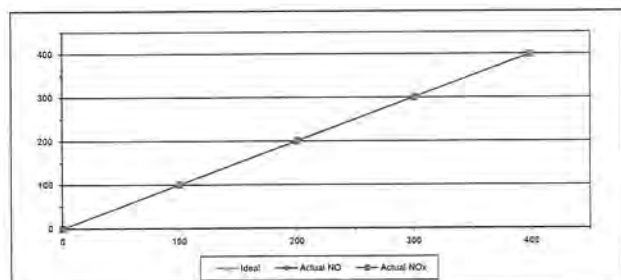
ALS Laboratory Group
 FORM NO. F 06-058 REVISION NO. 1 ISSUE DATE 02/04/12



MULTIPOINT CALIBRATION REPORT

Calibration Date : 5-Jan-23 Equipment Name : NOx Analyzer
 Manufacturer : HORIBA Model : APNA-370
 Serial No. : TLTATGDW Equipment ID : BKK_F50785
 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	99.00	-1.00	-1.00	100.50	0.50	0.50
2	200.00	199.50	-0.50	-0.25	200.70	0.70	0.35
3	300.00	299.00	-1.00	-0.33	301.10	1.10	0.37
4	400.00	398.70	-1.30	-0.33	399.00	-1.00	-0.25
AVERAGE (%)				-0.36			0.21



Calibrated By

Approved By

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

(Mr. Sarayuth Jitranont)
 Assistant General Manager

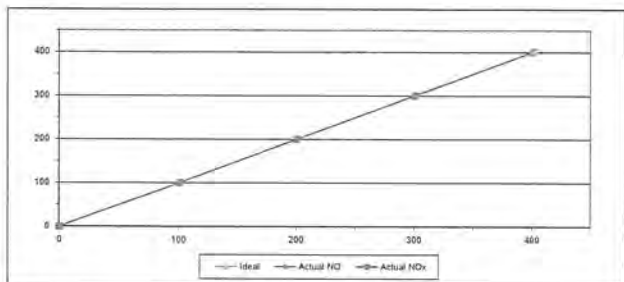
ALS Laboratory Group
 FORM NO. F 06-058 REVISION NO. 1 ISSUE DATE 02/04/12



MULTIPOINT CALIBRATION REPORT

Calibration Date 5-Jan-23 Equipment Name NOx Analyzer
 Manufacturer HORIBA Model APNA-370
 Serial No. VJVGBEEP Equipment ID BKK_FS0779
 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	100.10	0.10	0.10	101.00	1.00	1.00
2	200.00	199.80	-0.20	-0.10	200.50	0.50	0.25
3	300.00	299.60	-0.40	-0.13	301.20	1.20	0.40
4	400.00	400.50	0.50	0.13	402.20	2.20	0.55
AVERAGE (%)				0.02			0.48



Calibrated By

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

Approved By

(Mr.Sarayuth Jitranont)
Assistant General Manager

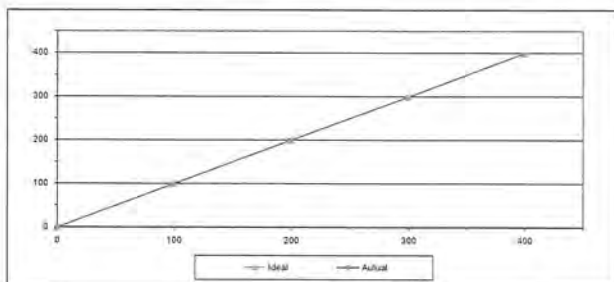
ALS Laboratory Group
FORM/NO: F-06-056 REVISION NO: - ISSUE DATE 02/04/12



MULTIPOINT CALIBRATION REPORT

Calibration Date 4-Jan-23 Equipment Name SO2 Analyzer
 Manufacturer HORIBA Model APSA-370
 Serial No. 8BVW9P1K Equipment ID BKK_FS1081
 Calibrator Manufacturer Teledyne API Model 700
 Serial No. 947
 Std. Gas Concentration (PPM) 56.3 Cylinder No. GN0027222
 Cylinder Pressure (psi) 1800 Certified By Airgas Inc.
 Certified Date 9-Feb-22 Expired Date 9-Feb-30

Point	CALIBRATION RESULTS			
	Ideal	Actual	Error	%Error
ZERO	0.00	0.10	0.10	0.10
1	100.00	98.50	-1.50	-1.50
2	200.00	198.30	-1.70	-0.85
3	300.00	297.90	-2.10	-0.70
4	400.00	398.50	-1.50	-0.38
AVERAGE (%)				-0.67



Calibrated By

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

Approved By

(Mr.Sarayuth Jitranont)
Assistant General Manager

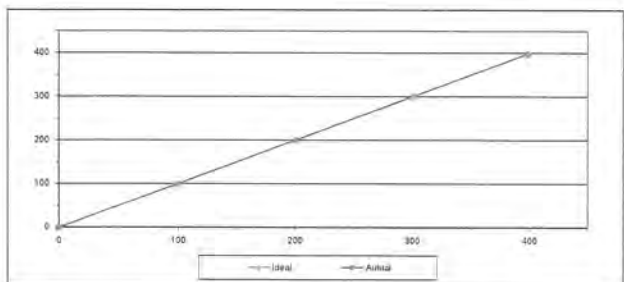
ALS Laboratory Group
FORM/NO: F-06-056 REVISION NO: - ISSUE DATE 02/04/12



MULTIPOINT CALIBRATION REPORT

Calibration Date 4-Jan-23 Equipment Name SO2 Analyzer
 Manufacturer Teledyne API Model T100
 Serial No. 1809 Equipment ID BKK_FS0727
 Calibrator Manufacturer Teledyne API Model 700
 Serial No. 947
 Std. Gas Concentration (PPM) 56.3 Cylinder No. GN0027222
 Cylinder Pressure (psi) 1800 Certified By Airgas Inc.
 Certified Date 9-Feb-22 Expired Date 9-Feb-30

Point	CALIBRATION RESULTS			
	Ideal	Actual	Error	%Error
ZERO	0.00	0.10	0.10	0.10
1	100.00	98.10	-1.90	-1.90
2	200.00	200.80	0.80	0.40
3	300.00	302.00	2.00	0.67
4	400.00	397.70	-2.30	-0.58
AVERAGE (%)				-0.28



Calibrated By

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

Approved By

(Mr.Sarayuth Jitranont)
Assistant General Manager

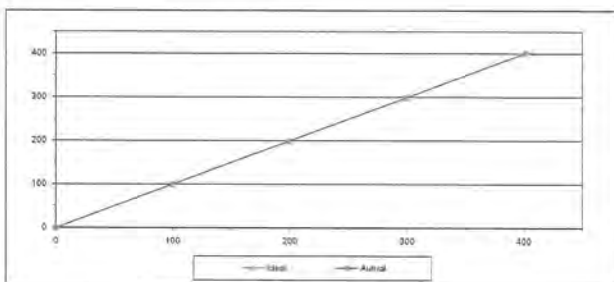
ALS Laboratory Group
FORM/NO: F-06-056 REVISION NO: - ISSUE DATE 02/04/12



MULTIPOINT CALIBRATION REPORT

Calibration Date 4-Jan-23 Equipment Name SO2 Analyzer
 Manufacturer HORIBA Model APSA-370
 Serial No. 3C72K8HB Equipment ID BKK_FS0784
 Calibrator Manufacturer Teledyne API Model 700
 Serial No. 947
 Std. Gas Concentration (PPM) 56.3 Cylinder No. GN0027222
 Cylinder Pressure (psi) 1800 Certified By Airgas Inc.
 Certified Date 9-Feb-22 Expired Date 9-Feb-30

Point	CALIBRATION RESULTS			
	Ideal	Actual	Error	%Error
ZERO	0.00	0.10	0.10	0.10
1	100.00	99.60	-0.40	-0.40
2	200.00	198.50	-1.50	-0.75
3	300.00	297.90	-2.10	-0.70
4	400.00	401.50	1.50	0.38
AVERAGE (%)				-0.28



Calibrated By

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

Approved By

(Mr.Sarayuth Jitranont)
Assistant General Manager

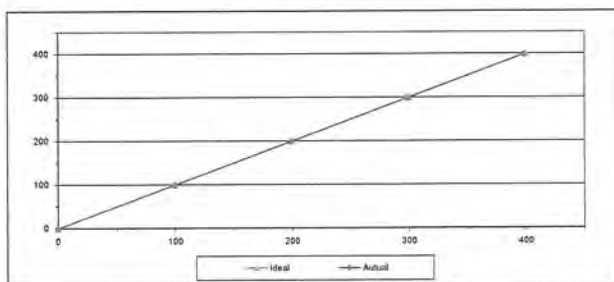
ALS Laboratory Group
FORM/NO: F-06-056 REVISION NO: - ISSUE DATE 02/04/12



MULTIPOINT CALIBRATION REPORT

Calibration Date	4-Jan-23	Equipment Name	SO2 Analyzer
Manufacturer	HORIBA	Model	APSA-370
Serial No.	VXABVTRT	Equipment ID	BKK_F80778
Calibrator Manufacturer	Teledyne API	Model	700
Serial No.	947		
Std. Gas Concentration (PPM)	56.3	Cylinder No.	GN0027222
Cylinder Pressure (psi)	1800	Certified By	Algas 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	198.70	-1.30	-0.65
3	300.00	298.10	-1.90	-0.63
4	400.00	398.20	-1.80	-0.45
AVERAGE (%)				-0.53



Calibrated By

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

Approved By

(Mr. Sarayuth Jitranont)
Assistant General Manager

ALS Laboratory Group
FORM NO. F-06-055 REVISION NO. 18-SUE DATE: 02/04/12



Jiraratree Associates Co., Ltd.
43/14-15, 41/35-36
Petchburi 7/11, Rd. Wornthung, Bangkok
Bangkok 10600 (Thailand)
Tel: +662-082812
Mobile: +662-082813
Email: jnc@jiraratree.com
jiraratree.com

Accredited calibration laboratory
ISO/IEC 17025:2017
MSC-1701-TIS 17025
CALIBRATION 0367

Air speed measurement laboratory
Calibration services department



Certificate Number

CL-022-66

CERTIFICATE OF CALIBRATION

Page 1 of 2 Pages

MEASUREMENT ITEM

MANUFACTURER

MODEL/TYPE

SERIAL NUMBER

ID NUMBER

CONDITION AS-RECEIVED

CUSTOMER

Cup anemometer

Noveltype

Sensor: WS-02F

Data logger: 110-WS-250L-D

Sensor: WSO-001

Data logger: AS438

BKK_F80778

New item

ALS laboratory group (Thailand) Co., Ltd.

104 Phatthanakan Rd, Phatthanakan Rd, Khwaeng Suan Luang,

Khet Suan Luang, Bangkok 10250 Thailand.

Calibration procedure:

The cup anemometer was calibrated against Standard air velocity transducer model: 8455-32 and pitot tube with precision differential pressure meter model: DPA2500 in an open test section of Effel-type wind tunnel with 300 cm² cross test section area. The WS-02F based on IEC 61400-12-1, Wind energy generation systems - Part 12-1: Power performance measurements of electricity producing wind turbines, March 2017 was used as a calibration guideline.

Traceability:

This certificate provides a traceability of the measurement to recognized the national standards, and to recognition of the international system of units (SI) through the NMVT (National Metrology Institute of Thailand) via Certificate number: MW-002-21 and MW-006-22

Uncertainty of Measurement:

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

RECEIVED DATE

08 Feb 2023

MEASUREMENT DATE

13 Feb 2023

ISSUE DATE

13 Feb 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 Jiraratree Associates Co., Ltd.

CALIBRATION CONDITIONS

Wind tunnel cross-section area¹300 cm²Win direction frontal area²100 cm²Diameter of mounting pipe³

mm

Blockage ratio of test object⁴

0.111

Preconditioning

24 hours at ambient conditions

Measurement Condition

The average values during measurement are (23.0) °C, (55.3) %RH and (1011.5) hPa.

TABULATION OF RESULTS:

The table on next page give the measured values.

Calibrated by:

Mr. Sorawit Thichakul

Miss Jiraporn Jiraratree



Approved signature:

Mr. Pannaya Booncharoen
Calibration Department Manager

Remark:

¹ Inside cross-section area of the wind tunnel² Freely flow cross-section area of the tested object include mounting pipe³ Diameter of mounting pipe⁴ Ratio is 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

CL-022-66

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 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 _u (m/s)	Error (m/s)	U (k=2) (m/s)
0.565	23.68	23.60	0.9	-0.3	0.15
2.033	23.54	23.60	1.9	-0.1	0.18
3.046	23.68	23.60	3.0	-0.1	0.19
4.144	23.66	23.60	3.9	-0.2	0.21
5.03	23.50	23.60	4.9	-0.1	0.18
5.98	23.50	23.60	5.9	-0.1	0.18
7.05	23.36	23.60	7.0	0.1	0.18
8.18	23.54	23.60	8.0	-0.2	0.20
9.10	23.30	23.60	8.9	-0.2	0.20
10.10	23.50	23.60	10.0	-0.1	0.19
11.14	23.28	23.60	11.0	-0.1	0.21
12.12	23.40	23.60	11.9	-0.2	0.21
13.19	23.10	23.60	13.0	-0.2	0.26
14.25	23.40	23.60	14.0	-0.2	0.29
15.20	23.10	23.60	15.0	-0.2	0.23
16.31	23.26	23.60	16.1	-0.2	0.24

Remark:

¹ Calibration results may vary due to the test circumstances and environmental conditions during which calibration was performed.² Velocity of standard³ Velocity of Unit Under Calibration

PHOTO OF CALIBRATION SET-UP



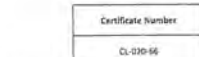
Calibration set-up of the cup anemometer calibration in the wind tunnel of Jiraratree Associates Co., Ltd. The cup anemometer shown may differ from the calibrated one. Remark: The proportion of the set-up is not true to scale due to missing proximity



Jiraratree Associates Co., Ltd.
43/14-15, 41/35-36
Petchburi 7/11, Rd. Wornthung, Bangkok
Bangkok 10600 (Thailand)
Tel: +662-082812
Mobile: +662-082813
Email: jnc@jiraratree.com
jiraratree.com

Accredited calibration laboratory
ISO/IEC 17025:2017
MSC-1701-TIS 17025
CALIBRATION 0367

Air speed measurement laboratory
Calibration services department



Certificate Number

CL-020-66

CERTIFICATE OF CALIBRATION

Page 1 of 2 Pages

MEASUREMENT ITEM

MANUFACTURER

MODEL/TYPE

SERIAL NUMBER

ID NUMBER

CONDITION AS-RECEIVED

CUSTOMER

Wind Direction Sensor

Noveltype

Sensor: WS-02F

Data logger: 110-WS-250L-D

Sensor: WSO-001

Data logger: AS438

BKK_F80778

New item

ALS laboratory group (Thailand) Co., Ltd.

104 Phatthanakan Rd, Phatthanakan Rd, Khwaeng Suan Luang,

Khet Suan Luang, Bangkok 10250 Thailand.

Calibration procedure:

The wind direction sensor was calibrated against Standard Rotary Encoder model: AX40975-DN40-F5-5-U0 in an open test-section of Effel-type wind tunnel with 300 cm² cross test section area. The WS-02F based on IEC 61400-12-1, Wind energy generation systems - Part 12-1: Power performance measurements of electricity producing wind turbines, March 2017 was used as a calibration guideline.

Traceability:

This certificate provides a traceability of the measurement to recognized the national standards, and to recognition of the international system of units (SI) through the NMVT (National Metrology Institute of Thailand) via Certificate number: D4-0043-22

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 data: Guide to the expression of uncertainty in measurement

RECEIVED DATE

08 Feb 2023

MEASUREMENT DATE

13 Feb 2023

ISSUE DATE

13 Feb 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 Jiraratree Associates Co., Ltd.

CALIBRATION CONDITION

Wind tunnel cross-section area¹300 cm²Win direction frontal area²129 cm²Diameter of mounting pipe³

mm

Blockage ratio of test object⁴

0.143

Preconditioning

24 hours at ambient conditions

Measurement Condition

The average values during measurement are (23.0) °C, (48.8) %RH and (1011.4) hPa.

TABULATION OF RESULTS:

The table on next page give the measured values.

Calibrated by:

Mr. Sorawit Thichakul

Miss Jiraporn Jiraratree



Approved signature:

Mr. Pannaya Booncharoen
Calibration Department Manager

Remark:

¹ Inside cross-section area of the wind tunnel² Freely flow cross-section area of the tested object include mounting pipe³ Diameter of mounting pipe⁴ Ratio is 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

CL-000-66

Page 2 of 2 Pages

MEASUREMENT RESULTS¹

¹The 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 about 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 (°)
0.000	0	0	0	0.54
45.000	44	44	-1	0.74
90.000	88	88	-2	0.74
135.000	133	133	-2	0.74
180.000	180	180	0	0.74
225.000	225	225	0	0.74
270.000	270	270	0	0.68
315.000	314	314	0	0.58

Remark:

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

² Direction of standard

³ Direction of Unit Under Calibration



End of Certificate of Calibration



Accredited calibration laboratory
ISO/IEC 17025:2017
NSC-TISI-TIS 17025
CALIBRATION 0367
Pressure measurement laboratory
Calibration Services department
Website: www.jiranatee.com



Accredited calibration laboratory
ISO/IEC 17025:2017
NSC-TISI-TIS 17025
CALIBRATION 0367
Pressure measurement laboratory
Calibration Services department
Website: www.jiranatee.com

CERTIFICATE OF CALIBRATION

Certificate No. : CL-005-66

Page 1 of 2 Pages

MEASUREMENT ITEM : Digital barometer
MANUFACTURER : Novamex
MODEL/TYPE : 110-WS-258P
SERIAL NUMBER : AS439
ID NUMBER : BDK_F50874
CONDITION AS-RECEIVED : Used item
CUSTOMER : A/S Laboratory group (Thailand) Co., Ltd
104 Phatthanasukan 40, Phatthanasukan Rd,
Khwaeng Suan Luang, Khet Suan Luang,
Bangkok 10250 Thailand.

Calibration procedure:
The pressure calibration was done by in-house calibration method as per CL-003 according to comparison method with Digital pressure calibrator based on OGD-R 8-2.

Traceability:
The measurement results are traceable to the international system of units (SI) through the NIMT (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, providing a level of confidence of approximately 95%.

RECEIVED DATE : 08 Feb 2023
MEASUREMENT DATE : 13 Feb 2023
ISSUE DATE : 13 Feb 2023

CONDITION OF THIS RESULT OF CALIBRATION:

1. Reference Standard Instrument:

Instrument	Model	Serial No.	Certificate No.	Due Date
Absolute Pressure Transducer	CPG2500	41001267	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 UUC² was used as the reference level.
3. Calibration conditions:
4. Condition: ☒ Normal ☐ Abnormal
Pressure transmitting medium: Air
p_h (20°C, 1 bar): 1.19 kg/m³
H_{max}: (55±15) %
T_{max}: (23±3) °C
P_{max}: (1010±10) mbar
5. The certificate is valid only to the item calibrated on date and place of calibration.



Calibrated by:
☒ Mr. Sornwan Thachalad
☐ Miss Jitragorn Lertsomphol

Approved signature:
Mr. Pannay Bunchcharoen
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



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NSC-TISI-TIS 17025
CALIBRATION 0367
Pressure measurement laboratory
Calibration Services department
Website: www.jiranatee.com



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Pressure measurement laboratory
Calibration Services department
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CERTIFICATE OF CALIBRATION

Certificate No. : CL-005-66

Page 2 of 2 Pages

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

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

STD (mbar)	UUC ¹ (mbar)	Error (mbar)	Uncertainty (k=2) (mbar)
950.13	950.3	0.8	0.50
970.13	970.7	0.6	0.76
990.18	990.4	0.3	0.53
1010.09	1010.3	0.2	0.42
1030.03	1030.0	-0.1	0.39
1050.06	1049.8	-0.3	0.48

Note: UUC¹ Unit Under Calibration

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



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CERTIFICATE OF CALIBRATION

Page 1 of 2 Pages

MEASUREMENT ITEM : Wind Direction Sensor
MANUFACTURER : Novamex
MODEL/TYPE : Sensor: WS-02
Data logger: 110-WS-258D-D
Sensor: WS-02-1
Data logger: AS508
SERIAL NUMBER : BDK_F51213
ID NUMBER : New item
CONDITION AS-RECEIVED : New item
CUSTOMER : A/S Laboratory group (Thailand) Co., Ltd
104 Phatthanasukan 40, Phatthanasukan Rd, Khwaeng Suan Luang,
Khet Suan Luang, Bangkok 10250 Thailand

Calibration procedure:
The wind direction sensor was calibrated against standard rotary encoder model: AR600175-0103 P 3.140 m on scale and section of 1/100 degree wind sensor with 300 cm² cross section area. The WS-02 DOR based on IEC 61400-12-1. Wind direction generation system - Port 18.1. Power performance measurement of electrically produced wind turbines, March 2012 was used as a calibration guide.

Traceability:
This certificate provides a traceability of the measurement to the national standard system of units (SI) through the NIMT (National Metrology Institute of Thailand) via Certificate number: DA 0041-22.

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

ENVIRONMENTAL CONDITIONS:

Ambient condition in the laboratory are as follows:

Temperature	23.0 ± 0.5 °C
Relative Humidity	55.0 ± 15.0 %RH
Atmospheric Pressure	1010 ± 10 hPa

PLACE OF CALIBRATION : Efflu-type wind tunnel of Jiranatee Associates Co., Ltd

CALIBRATION CONDITION : Wind tunnel cross-section area¹ : 900 cm²
Wind direction frontal area² : 125 cm²
Diameter of measuring pipe³ : 10 mm
Blockage ratio of test object⁴ : 0.143 [1]

Preconditioning : 24 hours at ambient conditions
Measurement Condition : The average values during measurement are (24.0°C, (49.7) %RH and (1008.5) hPa

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

Calibrated by:
☒ Mr. Sornwan Thachalad
☐ Miss Jitragorn Lertsomphol



Approved signature:
Mr. Pannay Bunchcharoen
Calibration Department Manager

Remark:
¹ Inside cross-section area of the wind tunnel
² Projected cross-section area of the tested object inside measuring pipe
³ Diameter of measuring pipe
⁴ Ratio [1]

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Certificate Number
CL-001-65

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 counter clockwise directions after offset adjustments had 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 ₂₀₀ Degree (°)	Error Degree (°)	U (k=2) Degree (°)
	0.001	0	0	0.58
	45.001	45	0	0.68
	90.000	89	-1	0.74
	135.000	133	-2	0.74
	180.000	177	-3	0.68
	225.000	223	-2	0.74
	270.001	271	1	0.68
	315.001	316	1	0.68

Remark:
Calibration results only valid for the tested circumstances and environmental conditions during which calibration took place.
Directional standard
Direction of Unit Under Calibration



Accredited calibration laboratory
ISO/IEC 17025:2017
NSC-159 IS 17025
CALIBRATION 0367

An special measurement laboratory
Calibration services department

Jiranan Associates Co., Ltd.
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Petchburi Road, 10100 Bangkok
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Fax: +66(0)26880861
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Website: www.jiranan.co.th

Certificate Number
CL-001-65

CERTIFICATE OF CALIBRATION

Page 1 of 2 Pages

MEASUREMENT ITEM MANUFACTURER MODEL/TYPE

SERIAL NUMBER

ID NUMBER CONDITION AS RECEIVED CUSTOMER

Cup anemometer
Novatex
Sensor: WS-03F
Data logger: 110-WS-25DL-D
Sensor: WSD-011
Data logger: AS506
BXK-FS1213
New item
ALS Laboratory group (Thailand) Co., Ltd.
104 Phatthana Road, Khwaeng Suan Luang,
Khet Suan Luang, Bangkok 10250 Thailand

RECEIVED DATE MEASUREMENT DATE ISSUE DATE

09 Nov 2022
17 Nov 2022
23 Nov 2022

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: 1020 ± 10 hPa

PLACE OF CALIBRATION

Cup-type wind tunnel of Jiranan Associates Co., Ltd.

CALIBRATION CONDITIONS

Wind tunnel cross-section area¹: 300 m²
Wind direction frontal area²: 100 cm²
Diameter of mounting pipe³: 10 mm
Blockage ratio of test object⁴: 0.111 %

Preconditioning Measurement Condition

24 hours at ambient condition
The average values during measurement are (73.8) °C, (49.3) %RH and (1027.7) hPa

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



Approved Signatory

Mr. Panya Booncharoen
Calibration Department Manager

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

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Certificate Number
CL-001-65

Page 2 of 2 Pages

MEASUREMENT RESULTS¹

The cup anemometer, Unit (Type 1 calibration point) was carried out at 10 m/s for 5 minutes prior to calibration being performed. The standard air velocity 10 m/s in 5 m/s was calculated by a standard air velocity transducer, and above 5 m/s to 10 m/s was calculated by a pitot tube with pressure differential pressure meter which was installed 40 mm (or 300 mm) respectively away from wind tunnel nozzle. UWC 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 (k=2) (m/s)
0.975	24.02	23.75	0.8	-0.3	0.16
2.073	23.54	23.75	1.9	-0.3	0.16
3.068	24.02	23.75	2.8	-0.2	0.21
4.180	23.84	23.75	3.8	-0.3	0.20
5.01	23.92	23.75	4.8	0.2	0.17
6.00	23.96	23.75	5.8	-0.2	0.18
7.07	23.84	23.75	6.9	0.2	0.19
8.20	23.86	23.75	7.9	-0.3	0.19
9.11	23.80	23.75	8.9	-0.2	0.22
10.10	23.92	23.75	9.8	-0.3	0.21
11.16	23.82	23.75	10.9	-0.2	0.20
12.14	23.96	23.75	11.9	-0.3	0.21
13.20	23.90	23.75	12.9	-0.3	0.21
14.27	23.94	23.75	14.0	-0.3	0.25
15.18	23.90	23.75	14.8	-0.2	0.22
16.32	23.90	23.75	16.1	-0.3	0.26

Remark:
Calibration results only valid 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 Jiranan Associates Co., Ltd. The cup anemometer (shown may B&K type) was calibrated true. Remark: The proportion of the set-up is not true to scale due to imaging proximity



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CERTIFICATE OF CALIBRATION

Certificate No. CL-001-65
Page 1 of 2

Equipment Name: Data Logger with Temperature Sensor
Manufacturer: Novatex
Model: 110-WS-25DL-D
Serial No.: AS506
ID No.: BXK-FS1213

Customer
Name: ALS Laboratory group (Thailand) Co., Ltd.
Address: 104 Phatthana Road, Khwaeng Suan Luang,
Khet Suan Luang, Bangkok 10250 Thailand

Received date: 09 Nov 2022
Calibration date: 18 Nov 2022
Issue date: 23 Nov 2022

Reference Used During Calibration
1. Standard Temperature Probe Model: SPS-100A (B&K)
Serial No.: 667862-09 Due date: 23 Mar 2023
2. Digital Temperature Indicator Model: DI-1000-AIR
II, Serial No.: 01407-00501 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 WCL 001 according to comparison method with standard digital temperature indicator and standard temperature probe. The temperature scale was based on ITS 90.

Traceability
The measurement results are traceable to the international system of units (SI) through National Institute of Metrology (NIM) Certificate number: T10034 22, Certificate number: CR 0002-22

Calibrated by
G. M. Somchai Thongkiet
+ Miss Jiranan Jiranan



Approved Signatory

Mr. Panya Booncharoen
Calibration Department Manager

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TABLE NO. JAC-CL-154-1-1
Page 2 of 2

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

Function:

This equipment was connected with temperature sensor Model HM150 S/N UD041972.

Dimension: Diameter 12 mm, Length 80 mm

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
60	20.60	19.9	-0.7	0.30
60	24.06	24.8	0.7	0.30
60	30.00	29.4	-0.6	0.30
60	36.00	34.9	-1.1	0.30
60	40.00	39.5	-0.5	0.30

UUC's Unit Under Calibration

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

★ End of Certificate ★



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CERTIFICATE OF CALIBRATION

Calibration No.: R4-01112022
Page 1 of 1 Pages

Measurement Item: Relative humidity with data logger
Manufacturer: Novapex
Model/Type: 110 WS-2508 B
Serial Number: A55008
ID No: 006 P51213
Customer: A15 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 ± 0.3 °C and relative humidity of $(50 \pm 1)\%$.

Measurement Method:

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

Traceability:

This instrument was calibrated using standard equipment whose accuracy is traceability through National Institute of Standards and Technology to the international system of units (SI) via MCS Calibration, Inc. Certificate number: 20314 1G1, Date: Mar 14, 2023.

Measurement Date: Nov 18, 2022
Issue Date: Nov 23, 2022

Measurement Results:

This equipment was connected with indoor air quality probe and Display (HID) for display Model H00061, Serial number: U2641221.

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	19.93	17.6	-2.3	0.61
60	60.45	47.7	-12.8	0.57
80	80.30	77.6	-2.7	0.55

Performed by:
☒ Mr. Sorawat Thachalad
☐ Miss Jitraporn Jitwongkiet



Approved Signature:
Mr. Panyin Booncharon
Calibration Department Manager

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JIRANATEE ASSOCIATES CO., LTD.

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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

CL-016-65

CERTIFICATE OF CALIBRATION

Page 1 of 2 Pages

MEASUREMENT ITEM

MANUFACTURER

MODEL/TYPE

SERIAL NUMBER

ID NUMBER

CONDITION AS RECEIVED

CUSTOMER

Cup anemometer

Novapex

Sensor: WS-02F

Data logger: 110 WS-2508-B

Sensor: WS0-005

Data logger: AS447

SKU: T50039

Used item

ALS laboratory group (Thailand) Co., Ltd.

104 Phatthanakan 40, Phatthanakan Rd, Khwaeng Suan Luang,

Khet Suan Luang, Bangkok 10250 Thailand.

Calibration procedure:

The cup anemometer was calibrated against standard air velocity transducer model: B455-02 and pitot tube with precision differential pressure meter model: DPM2100 in an open test section of Effie-type wind tunnel with 900 cm² cross test section area. The Win-C1-007 based on IEC 61400-12-2, Wind energy generation system - Part 12-2, Power performance measurements of electricity producing wind turbines, March 2017 was used for calibration guideline.

Traceability:

This certificate provides a traceability of the measurement to recognized the national standards and to realization of the international system of units (SI) through the NMV (National Metrology Institute of Thailand) via Certificate number: MN-0012-21 and MW-0006-22.

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".
Note: Guide to the expression of uncertainty in measurement.

RECEIVED DATE

MEASUREMENT DATE

ISSUE DATE

ENVIRONMENTAL CONDITIONS:

Ambient condition in the laboratory are as follow:

Temperature: 23.0 ± 1.0 °C

Relative Humidity: 85.0 ± 15.0 %RH

Atmospheric Pressure: 1010 ± 10 hPa

PLACE OF CALIBRATION

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

CALIBRATION CONDITIONS

Wind tunnel cross-section area¹

900 cm²

Win. direction frontal area²

100 cm²

Diameter of mounting post³

mm

Blockage ratio of test object⁴

0.11 [-]

Preconditioning

24 hours at ambient conditions.

Measurement Condition

The average values during measurement are 24.1 °C, (87.2) %RH and (1009.8) hPa.

TABULATION OF RESULTS:

The table on next page give the measured values.

Calibrated by:

Mr. Sorawat Thachalad

Miss Jitraporn Jitwongkiet

Approved signature:

Mr. Panyin Booncharon
Calibration Department Manager

Remark:

¹ Facility cross-section area of the wind tunnel

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

³ Diameter of mounting pipe

⁴ Ratio γ/a



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Certificate Number

CL-016-65

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 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 uncertainty are reported in the table below.

V_{ref} (m/s)	Temp. wind tunnel (°C)	Temp. room (°C)	V_{UUC} (m/s)	Error (m/s)	U (k=2) (m/s)
0.985	23.94	24.05	0.8	-0.2	0.14
2.050	24.10	24.05	1.9	-0.2	0.18
3.026	23.92	24.05	2.9	-0.1	0.17
4.234	24.20	24.05	3.9	-0.3	0.20
5.09	23.80	24.05	4.9	-0.1	0.18
6.02	24.10	24.05	5.9	-0.3	0.18
7.07	23.76	24.05	6.9	-0.2	0.17
8.18	23.76	24.05	8.1	-0.1	0.19
9.11	23.48	24.05	8.9	-0.2	0.19
10.09	23.78	24.05	10.0	-0.3	0.22
11.18	23.90	24.05	11.8	-0.3	0.21
12.13	23.76	24.05	12.1	0.0	0.20
13.20	23.90	24.05	13.0	-0.2	0.25
14.26	23.88	24.05	14.0	-0.2	0.30
15.25	24.00	24.05	14.9	-0.3	0.23
16.31	24.00	24.05	16.0	-0.3	0.26

Remark:

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

² Velocity of standard

³ Velocity of Unit Under Calibration

PHOTO OF CALIBRATION SET-UP



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

End of Certificate of Calibration



JIRANATEE ASSOCIATES CO., LTD.

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Accredited calibration laboratory
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NSC-TIS-TIS 17025
CALIBRATION 0367

Air speed measurement laboratory
Calibration services department

Certificate Number

CL-016-65

CERTIFICATE OF CALIBRATION

Page 1 of 2 Pages

MEASUREMENT ITEM MANUFACTURER MODEL/TYPE

Wind Direction Sensor
Novallux
Sensor: WS-02F
Data logger: 110-WS-250L-D

SERIAL NUMBER

Sensor: WS0-005

ID NUMBER

Data logger: AS4K7

CONDITION AS-RECEIVED CUSTOMER

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

RECEIVED DATE

07 Dec 2022

MEASUREMENT DATE

12 Dec 2022

ISSUE DATE

12 Dec 2022

ENVIRONMENTAL CONDITIONS:

Ambient condition in the laboratory are as follow:

Temperature: 23.0 ± 1.0 °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 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 (24.0)°C, (50.1) %RH and (1011.8) hPa.

TABULATION OF RESULTS:

The table on next page give the measured values.

Calibrated by:

☒ Mr. Sorawit Thichakul
☐ Miss Jiraporn Lertsomphol

Approved signature:

Mr. Parinya Booncharoen
Calibration Department Manager

Remarks:

¹ Hoely 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 A_o/A_t

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Certificate Number

CL-016-65

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	D ⁺ _{rot}	D ⁺ _{enc}	Error	U (k=2)
m/s	Degree (°)	Degree (°)	Degree (°)	Degree (°)
	0.001	0	0	0.58
	45.000	41	-4	0.74
	90.001	87	-3	0.68
	135.000	133	-2	0.74
	180.001	181	1	0.68
	225.000	229	3	0.76
	270.001	275	5	0.74
	315.000	320	5	0.74

Remarks:

¹ Calibration results only count 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



JIRANATEE ASSOCIATES CO., LTD.

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CALIBRATION 0367

Pressure measurement laboratory
Calibration services department



NSC - TIS - TIS 17025
CALIBRATION 0367

CERTIFICATE OF CALIBRATION

Certificate No. : CL-019-65

Page 2 of 2 Pages

MEASUREMENT ITEM

Digital barometer

MANUFACTURER

Novalux

MODEL/TYPE

110-WS-25BP

SERIAL NUMBER

AS4A7

ID NUMBER

SGK_F50039

CONDITION AS-RECEIVED

Used item

CUSTOMER

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

RECEIVED DATE

07 Dec 2022

MEASUREMENT DATE

10 Dec 2022

ISSUE DATE

12 Dec 2022

Calibration procedure:

The pressure calibration was done by in-house calibration method as WI-C-003 according to comparison method with Digital pressure calibrator based on OXO-II & 2

Traceability:

The measurement results are traceable to the international system of units (SI) through MEMSOR which complies with the requirements of ISO/IEC 17025:2017, ANSI/NCCL 2540-1 via Certificate number: 201479

The reported uncertainty is based on a statistical 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	410018L1	201479	13 Sep 2022

2. Calibration effort for calibration sequence A

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: Air
 p_h (20°C, 1 bar): 1.15 kg/m^3
 p_{atm} : (50±15) %
 T_{amb} : (23±3) °C
 p_{unc} : (1010±10) mbar

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

Calibrated by:

☒ Mr. Sorawit Thichakul
☐ Miss Jiraporn Lertsomphol

Approved signature:

Mr. Parinya Booncharoen
Calibration Department Manager

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JIRANATEE ASSOCIATES CO., LTD.

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

Pressure measurement laboratory
Calibration services department



NSC - TIS - TIS 17025
CALIBRATION 0367

CERTIFICATE OF CALIBRATION

Certificate No. : CL-019-65

Page 2 of 2 Pages

MEASUREMENT RESULTS

☒ Without adjustment ☐ With adjustment

CALIBRATION IN THE RANGE OF

: 950 – 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)
950.00	950.4	0.4	0.61
970.00	970.2	0.2	0.48
990.00	990.0	0.0	0.37
1010.00	1009.7	-0.3	0.52
1030.00	1029.5	-0.5	0.66
1050.00	1049.2	-0.8	0.95

Note: UUC* Unit Under Calibration

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

*End of certificate



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CERTIFICATE OF CALIBRATION

Certificate No. W5 04012022
Page 1 of 2 pages

Measurement Item: Wind anemometer with data logger

Manufacturer: Data logger, Novakym
Wind anemometer, Novakym

Model/Type: Data logger: 110 WS 250, D
Cap anemometer: WS-02F

Serial Number: Data logger: A5444
Cap anemometer: WS-032

ID No: Data logger: R01 030405
Cap anemometer

Customer: A/S Sanyang Group (Thailand) Co., Ltd.
104 Petchkasem Rd, Petchkasem Rd, Bangkok Sanyang Group (Thailand) Co., Ltd.
Bangkok

Test Conditions: Wind speed measurement unit: m/s
Anemometer scale: 0-20
Direction of blowing: 0-360
Reference: 100% of test object

Test Conditions: Air temperature: 24.4 ± 0.5 °C
Air pressure: 1011.8 ± 0.4 hPa
Relative humidity: 68.8 ± 1.0 %RH

Calibration Procedure: Calibration was carried out using the
GC 61420 (2.1.10) 2005 Edition: Performance Measurement of Accuracy, Precision and
Stability
NIST/UKAS Calibration Procedure - Version 2.0005

Traceability: The calibration documents are traceable to the National Institute of Standards and Technology (NIST) and the International System of Units (SI) through the use of the
NIST/UKAS Calibration Procedure (NIST)

Measurement Date: 2022-01-20
Issued Date: 2022-01-20

Calibrated by:
☒ Mr. Jiranatee
☐ Mr. Jiranatee



Approved Signatory: Mr. Jiranatee
Calibration Department Manager

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Continuation of Certificate of Calibration Number

Certificate No. W5 04012022
Page 2 of 2 Pages

Result of calibration: ☒ Without adjustment ☐ With adjustment
Calibration in the range of 0 - 10 m/s at a calibration interval of 1 m/s
The results of calibration and associated measurement uncertainties are recorded in the table below:

Wind Reading m/s	Wind Reading m/s	Error m/s	Uncertainty m/s
0.0	0.0	-0.1	0.4
1.0	1.0	0.0	0.4
2.0	2.0	0.0	0.4
3.0	3.0	0.0	0.4
4.0	4.0	0.0	0.4
5.0	5.0	0.0	0.4
6.0	6.0	0.0	0.4
7.0	7.0	0.0	0.4
8.0	8.0	0.0	0.4
9.0	9.0	0.0	0.4
10.0	10.0	0.0	0.4
11.0	11.0	0.0	0.4
12.0	12.0	0.0	0.4
13.0	13.0	0.0	0.4
14.0	14.0	0.0	0.4
15.0	15.0	0.0	0.4
16.0	16.0	0.0	0.4
17.0	17.0	0.0	0.4
18.0	18.0	0.0	0.4
19.0	19.0	0.0	0.4
20.0	20.0	0.0	0.4

UUC: 10% Under Calibration
The reported expanded uncertainty is based on standard uncertainty multiplied by a coverage factor k=2, providing a level of
confidence of approximately 95%.

Appendix 1: Information

NO	Device	Manufacturer	Model/Type	Calibration Date	Certificate Report Number	Range
1	Wind anemometer	NOVA	NOVA 110 WS 250, D	Aug 17, 2021	W5 04012021	0 - 20 m/s
2	Pressure differential pressure sensor	NOVA	NOVA WS-02F	Aug 17, 2021	W5 04012021	0 - 20 hPa
3	4-in velocity sensor (m/s)	NOVA	NOVA WS-02F	Aug 17, 2021	W5 04012021	0 - 20 m/s
4	Temperature	NOVA	NOVA WS-02F	Aug 17, 2021	W5 04012021	0 - 20 °C
5	Relative humidity	NOVA	NOVA WS-02F	Aug 17, 2021	W5 04012021	0 - 100 %RH
6	Atmospheric pressure	NOVA	NOVA WS-02F	Aug 17, 2021	W5 04012021	0 - 1100 hPa
7	Wind tunnel	NOVA	NOVA WS-02F	Aug 17, 2021	W5 04012021	0 - 20 m/s

End of certificate of calibration



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CERTIFICATE OF CALIBRATION

Certificate No. W5 04012022
Page 1 of 2 pages

Measurement Item: Wind direction sensor with data logger

Manufacturer: Data logger, Novakym
Wind direction sensor, Novakym

Model/Type: Data logger: 110 WS 250, D
Wind direction sensor: WS-02F

Serial Number: Data logger: A5444
Wind direction sensor: WS-032

ID No: Data logger: R01 030405
Wind direction sensor

Customer: A/S Sanyang Group (Thailand) Co., Ltd.
104 Petchkasem Rd, Petchkasem Rd, Bangkok Sanyang Group (Thailand) Co., Ltd.
Bangkok

Environmental Condition: The measurement was carried out in a laboratory environment of 23.0 ± 0.5 °C and relative humidity of 68.8 ± 1.0 %RH.

Measurement Method: The wind direction sensor was calibrated using the comparison method with the reference sensor (wind direction sensor) and the reference sensor (wind direction sensor). The measurement was carried out at 35° intervals, 0°, 30°, 60°, 90°, 120°, 150°, 180°, 210°, 240°, 270°, and 300°.

Note: The UUC was verified up to 10% under calibration.

Traceability: The measurement method was traced to the International System of Units (SI) through the use of the
NIST/UKAS Calibration Procedure (NIST)

Measurement Date: 2022-01-20
Issued Date: 2022-01-20

Performed by:
☒ Mr. Jiranatee
☐ Mr. Jiranatee



Approved Signatory: Mr. Jiranatee
Calibration Department Manager

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Continuation of Certificate of Calibration Number

Certificate No. W5 04012022
Page 2 of 2 pages

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

NO	Tuning Direction	Nominal Angle °	Standard Reading °	UUC* Reading °	Error °	Uncertainty °
1	Clockwise	0.00	0	0	0	0.0
2		45	45	45	-4	0.0
3		90	90	90	-3	0.0
4		135	135	135	-2	0.0
5		180	180	180	0	0.0
6	Counter Clockwise	225	225	225	2	0.0
7		270	270	270	2	0.0
8		315	315	315	-2	0.0
9		0.00	0	0	0	0.0
10		45	45	45	-4	0.0
11	Clockwise	90	90	90	-3	0.0
12		135	135	135	-2	0.0
13		180	180	180	0	0.0
14		225	225	225	2	0.0
15		270	270	270	2	0.0
16	Counter Clockwise	315	315	315	-2	0.0

UUC: 10% Under Calibration The reported expanded uncertainty is based on standard uncertainty multiplied by a coverage factor k=2, providing a level of confidence of approximately 95%.

End of Certificate of Calibration





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CALIBRATION REPORT

Calibration No. : RH-04012022
Page 1 of 1 Pages

Measurement Item	Relative humidity with data logger
Manufacturer	Data logger: Novalyne Relative humidity sensor: Novalyne
Model/Type	Data logger: 110 WS-258R-D Relative humidity sensor: HM260
Serial Number	Data logger: A5444 Relative humidity sensor: R1131112
ID No	Data logger: RH-050435 Relative humidity sensor:
Customer	ALS laboratory group (Thailand) Co., Ltd. 104 Phothachon Road, Phothachon Road, Suay Luang, Khwaeng Suay Luang, Bangkok 10250 Thailand

Environmental Condition

The measurement was carried out in an ambient temperature of (25.4°C) and relative humidity of (59.18%).

Measurement Method

The Relative humidity with data logger Unit Under Calibration (UUC) was calibrated by comparison method with the equivalent of standard rain solution (HYGRO-Potassium Acetate, Methyl Magnesium Chloride, Potassium Chloride) to determine the error.

Measurement Date : JAN 24, 2022
Issued Date : JAN 25, 2022

Measurement Results

The results of calibration are reported in table below.

Standard salt solution	Standard (RH%)	UUC Reading	Error
CH ₃ COOK, Potassium Acetate	22.51	22.2	-0.2
MgCl ₂ Magnesium Chloride	57.69	52.5	-5.4
KCl, Potassium Chloride	84.34	84.1	-0.2

Performed by

- ☐ Mr. Soravit Thachalad
☒ Miss Oratai Wiwatwitraysa



Approved Signatory

[Signature]

Mr. Parinya Bounchaoon
Calibration Department Manager

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CALIBRATION REPORT

Calibration Number : RH-04012022
Page 1 of 2 Pages

Measurement Item	Rain gauge with data logger
Manufacturer	Data logger: Novalyne Rain gauge: Novalyne
Model/Type	Data logger: 110 WS-258R-D Rain gauge: 110 WS-258R
Serial Number	Data logger: A5444 Rain gauge: RH0502
ID NO	RHG_F50435
Customer	ALS laboratory group (Thailand) Co., Ltd. 104 Phothachon Road, Phothachon Road, Suay Luang, Khwaeng Suay Luang, Bangkok 10250 Thailand

Environmental Condition

The measurement was carried out in an ambient temperature of (25.4°C) and relative humidity of (59.18%).

Measurement Method

The Rain gauge Unit Under Calibration (UUC) was calibrated by Precipitation Reference Gauge with flow meter under rate 45.4 mm per minute for 1 tipping every 20 seconds. The tipping number was determined by gravimetric method.

- 1. Check rain gauge unit area
- 2. Rain gauge should be level $\pm 0.1^\circ$ or ± 0.1 mm/m
- 3. Rain gauge area: 14.644 cm² (5.75 in²)
- 4. Rain gauge area: 14.644 cm² (5.75 in²)
- 5. Calibration procedure: Rain gauge calibration using 45.4 mm per minute and 20 seconds of rain
- 6. UUC Reading: 22.2 mm (0.874 in) Rain gauge area: 14.644 cm² (5.75 in²)
- 7. UUC Reading: 52.5 mm (2.067 in) Rain gauge area: 14.644 cm² (5.75 in²)
- 8. UUC Reading: 84.1 mm (3.311 in) Rain gauge area: 14.644 cm² (5.75 in²)

Note: Rain gauge is fully cleaned and leveling prior the calibration performed.

Measurement Date : JAN 25, 2022
Issued Date : JAN 31, 2022

Performed by

- ☒ Mr. Soravit Thachalad
☐ Miss Oratai Wiwatwitraysa



Approved Signatory

[Signature]

Mr. Parinya Bounchaoon
Calibration Department Manager



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Continuation of Calibration of Calibration Number:

Calibration Number: RH-04012022
Page 2 of 2 Pages

Result of Calibration: ☒ Without Adjustment ☐ With Adjustment

The results of calibration are reported in table below.

Quantity of H ₂ O (ml)	Determined Tipping	Tipping count	Acceptable Tipping count
500	62	24	60 ± 6
500	62	23	60 ± 6
500	62	22	60 ± 6
500	62	21	60 ± 6
500	62	20	60 ± 6

Remark: The procedure is made to verify the correct tipping on the unit when calibration rain gauge with a known volume of water flow should come the trigger but the function of tipping which has been 200 standard flow rate to tipping correct range 10-24 tipping it means that the rain gauge must be malfunction available (not).

Continuation of Calibration report



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Accredited calibration laboratory
ISO/IEC 17025:2017
Pressure measurement laboratory
NIST-751-TIS 17025
CALIBRATION 0367

CERTIFICATE OF CALIBRATION

Certificate No. : CL-005-65

Page 1 of 2 Pages

MEASUREMENT ITEM	Digital barometer	Calibration procedure:
MANUFACTURER	Novalyne	The pressure calibration was done by In-house calibration method as WI-CI-002 according to comparison method with Digital pressure calibrator based on DHD-R 6.1
MODEL/TYPE	110 WS-258R	
SERIAL NUMBER	A5444	
ID NUMBER	RHG_F50435	
CUSTOMER	ALS laboratory group (Thailand) Co., Ltd. 104 Phothachon Road, Phothachon Road, Suay Luang, Khwaeng Suay Luang, Bangkok 10250 Thailand	Traceability:
RECEIVED DATE	12 Jan 2022	The measurement results are traceable to the international system of units (SI) through MENSOR which complies with the requirements of (ISO/IEC) 17025:2017, ANSI/NCI 2540-1 via Certificate number, 201479
MEASUREMENT DATE	12 Jan 2022	
ISSUE DATE	31 Jan 2022	The reported uncertainty is based on a standard uncertainty multiplied by a coverage factor, providing a level of confidence of approximately 95%.

CONDITION OF THIS RESULT OF CALIBRATION:

- Reference Standard instrument.
- The UUC* was installed in vertical orientation above reference standard instrument and center of UUC* was used as the reference level.
- Calibration conditions
- Pressure transmitting medium: Air
- Pressure: 1.19 kg/m²
- Height: -0.080 m
- Temperature: (23.2) °C
- Pressure: 1009.5 mbar
- The certificate is valid only to the item calibrated on date and place of calibration.

Calibrated by:

- ☒ Mr. Soravit Thachalad
☐ Miss Oratai Wiwatwitraysa



Approved signatory

[Signature]

Mr. Parinya Bounchaoon
Calibration Department Manager

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MEASUREMENT RESULTS

10 Without adjustment 11 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 (mbar)	UUC ¹ (mbar)	Error (mbar)	Uncertainty(k=2) (mbar)
950.32	951.181	0.866	1.3
970.14	970.682	0.538	0.70
990.05	990.524	0.470	0.58
1009.95	1010.106	0.157	0.14
1029.84	1029.946	0.107	0.25
1049.78	1049.594	0.190	0.35

Note: UUC¹ Unit Under Calibration

End of certificate



CERTIFICATE OF CALIBRATION

Certificate No. CL-004-65
Page 1 of 2

Equipment Name: Data Logger with Temperature

Model: 110-W5-1-CL-2

Serial No: A5444

ID No: MYG_F90438

Customer

Name: ALS Laboratory (Thailand) Co. Ltd.

Address: 104 Phromma Road, Phromma, Bangkok

10250 Thailand

Received date: 12 JAN 2022

Calibration date: 24 JAN 2022

Issue date: 25 JAN 2022

Reference Used During Calibration

1. Standard Temperature Probe Model: STS-103 A500

Serial No: 667652-09; Date Recd: 25 Mar 2022

2. Digital Temperature Indicator Model: DTI-1000 A-1A

Serial No: 671407-00591; Date Recd: 04 Jan 2022

Calibration Condition

Temperature: (23±3) °C

Relative Humidity: (53±15)%

Calibration Procedure

The temperature calibration was done by In-House calibration, using as a reference standard digital temperature indicator and standard temperature probe. The temperature scale 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 0035-21, Certificate number: ET-0033-21

Calibrated by

Mr. Soravit Thongchai

6 Miss Disha Nambure



Approved Signatory:

Mr. Panyai Boonluekorn

Calibration Department Manager

FORM NO. F-04-002, REVISED NO. 2, ISSUE DATE: 200/18
ALS Laboratory Group

Certificate No. CL-004-65
Page 2 of 2

Result of Calibration: 10 Without Adjustment 11 With Adjustment

Calibration Range: 20 - 40 °C

Function:

This equipment was connected with temperature sensor Model: HMP60 S/N: R1131114

Dimension: Diameter 12mm, Length 50 mm

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
60	20.053	19.8	-0.3	0.099
60	25.008	24.9	-0.5	0.099
60	29.995	29.9	-0.5	0.099
60	34.976	34.8	-0.6	0.099
60	39.951	39.8	-0.7	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%



Lot No. 2327849-1

ANALYZER CALIBRATION DATA

Client: Gulf JP UT Co., Ltd. Location: HRSG 11
Date: 31 Mar 23 Test Operator: Usanee N.
Q₁ ANALYZER Model: TELEDYNE API 200EH Serial No: 648
Span (%): 25

	Cylinder Value (%)	Initial Analyzers Calibration Response (%)	Final Analyzers Calibration Response (%)	Difference (Percent of Span)
Zero Gas	0.00	0.02	0.02	0.00
Low-Level Gas	9.05	9.03	9.03	0.00
Span Gas	16.08	16.08	16.08	0.00

NO₂ ANALYZER

Model: TELEDYNE API 200EH

Span (ppm): 200

Serial No: 648

	Cylinder Value (ppm)	Initial Analyzers Calibration Response (ppm)	Final Analyzers Calibration Response (ppm)	Difference (Percent of Span)
Zero Gas	0.00	0.03	0.03	0.00
Low-Level Gas	50.32	50.13	50.04	0.05
Span Gas	158.20	157.79	157.65	0.07

SO₂ ANALYZER

Model: TELEDYNE API 100EH

Span (ppm): 200

Serial No: 282

	Cylinder Value (ppm)	Initial Analyzers Calibration Response (ppm)	Final Analyzers Calibration Response (ppm)	Difference (Percent of Span)
Zero Gas	0.00	0.04	0.04	0.00
Low-Level Gas	50.27	49.96	49.77	0.09
Span Gas	161.60	160.12	160.07	0.03

CO ANALYZER

Model: TELEDYNE API 300EM

Span (ppm): 200

Serial No: 300

	Cylinder Value (ppm)	Initial Analyzers Calibration Response (ppm)	Final Analyzers Calibration Response (ppm)	Difference (Percent of Span)
Zero Gas	0.00	0.03	0.03	0.00
Low-Level Gas	49.99	48.74	48.48	0.13
Span Gas	157.50	156.98	157.11	0.08

Calibrated by

Usanee Nambure

(Mr. Usanee Nambure)
Environmental Field Scientist (4)



Lot No. 2327849-1

SYSTEM CALIBRATION BIAS AND DRIFT DATA

Client: Gulf JIP UT Co., Ltd. Location: HRSG 11
Date: 31 Mar 23 Test Operator: Usanee N.O₂ ANALYZER
Cylinder Conc. (%) : 18.08 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	0.02	0.02	0.00	0.02	0.00	0.00
Upstate Gas	16.08	16.10	0.08	16.10	0.08	0.00

NO_x ANALYZER
Cylinder Conc. (ppm) : 158.20 Span (ppm) : 200

	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	0.03	0.03	0.00	0.03	0.00	0.00
Upstate Gas	157.79	157.10	0.34	156.85	0.47	0.13

SO₂ ANALYZER
Cylinder Conc. (ppm) : 181.80 Span (ppm) : 200

	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	0.04	0.05	0.01	0.05	0.01	0.00
Upstate Gas	180.12	158.52	0.80	158.03	1.05	0.25

CO ANALYZER
Cylinder Conc. (ppm) : 187.80 Span (ppm) : 200

	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	0.03	0.04	0.01	0.04	0.01	0.00
Upstate Gas	156.95	155.61	0.17	156.53	0.22	0.04

Calibrated by

(Mr. Usanee Namburee)

Environmental Field Scientist (4)

FORM NO. F-06-02 REVISION NO. 2 ISSUE DATE 2001-10

ALS Laboratory Group



EMISSION TEST RESULT

Client: Gulf JIP UT Co., Ltd. Location: HRSG 11
Date: 31 Mar 23 Test Operator: Usanee N.
Start Time: 8:40 Finish Time: 10:00
SO₂ Analyzer Model: TELEDYNE API 100EH Serial No.: 282
NO_x/O₂ Analyzer Model: TELEDYNE API 200EH Serial No.: 548
CO/CO₂ Analyzer Model: TELEDYNE API 300EM Serial No.: 300

Time (min)	O ₂ (%)	CO ₂ (%)	NO _x (ppm)	SO ₂ (ppm)	CO (ppm)	Remark
9:40	13.45	4.20	25.33	0.21	2.05	
9:41	13.39	4.22	26.13	0.23	2.09	
9:42	13.38	4.30	26.42	0.19	2.22	
9:43	13.36	4.27	26.69	0.23	1.83	
9:44	13.31	4.25	26.91	0.25	1.80	
9:45	13.31	4.31	26.71	0.26	1.67	
9:46	13.32	4.32	26.01	0.27	1.65	
9:47	13.33	4.29	25.97	0.25	1.69	
9:48	13.32	4.29	26.23	0.23	1.58	
9:49	13.29	4.33	26.50	0.26	1.44	
9:50	13.27	4.31	26.21	0.26	1.29	
9:51	13.28	4.29	26.54	0.28	1.33	
9:52	13.29	4.28	24.88	0.26	1.26	
9:53	13.30	4.28	24.63	0.27	1.25	
9:54	13.28	4.31	25.27	0.28	1.24	
9:55	13.28	4.31	26.47	0.27	1.28	
9:56	13.30	4.29	25.37	0.26	1.26	
9:57	13.31	4.28	25.22	0.28	1.28	
9:58	13.34	4.24	25.18	0.27	1.50	
9:59	13.34	4.29	25.33	0.30	1.49	
10:00	13.37	4.29	25.78	0.29	1.57	
Average	13.32	4.28	25.43	0.26	1.57	

(Mr. Usanee Namburee)

Environmental Field Scientist (4)

FORM NO. F-06-02 REVISION NO. 2 ISSUE DATE 2001-10

ALS Laboratory Group



EMISSION TEST RESULT

Client: Gulf JIP UT Co., Ltd. Location: HRSG 11
Date: 31 Mar 23 Test Operator: Usanee N.
Start Time: 10:01 Finish Time: 10:42
SO₂ Analyzer Model: TELEDYNE API 100EH Serial No.: 282
NO_x/O₂ Analyzer Model: TELEDYNE API 200EH Serial No.: 548
CO/CO₂ Analyzer Model: TELEDYNE API 300EM Serial No.: 300

Time (min)	O ₂ (%)	CO ₂ (%)	NO _x (ppm)	SO ₂ (ppm)	CO (ppm)	Remark
10:01	13.35	4.34	25.94	0.31	1.81	
10:02	13.37	4.25	26.00	0.28	1.62	
10:03	13.39	4.27	26.26	0.29	1.65	
10:04	13.41	4.22	26.30	0.31	1.77	
10:05	13.50	4.18	25.85	0.29	2.44	
10:06	13.62	4.16	24.88	0.30	3.37	
10:07	13.73	4.09	23.43	0.29	4.38	
10:08	13.82	4.01	22.61	0.28	6.19	
10:09	13.89	3.98	21.63	0.25	7.53	
10:10	13.97	3.96	20.80	0.26	8.28	
10:11	14.02	3.95	20.76	0.25	8.27	
10:12	14.04	3.93	21.05	0.25	8.58	
10:13	14.06	3.92	21.61	0.25	7.88	
10:14	14.05	3.97	22.08	0.28	7.13	
10:15	14.02	3.93	22.42	0.29	7.25	
10:16	14.19	3.88	22.21	0.29	12.84	
10:17	14.17	3.84	21.43	0.27	13.56	
10:18	14.08	3.67	21.67	0.28	7.81	
10:19	14.02	3.98	20.88	0.30	8.80	
10:20	13.88	4.03	20.27	0.33	5.79	
10:21	13.99	3.95	22.65	0.31	6.35	
Average	13.84	4.04	22.12	0.28	8.25	

(Mr. Usanee Namburee)

Environmental Field Scientist (4)

FORM NO. F-06-02 REVISION NO. 2 ISSUE DATE 2001-10

ALS Laboratory Group



EMISSION TEST RESULT

Client: Gulf JIP UT Co., Ltd. Location: HRSG 11
Date: 31 Mar 23 Test Operator: Usanee N.
Start Time: 10:22 Finish Time: 10:42
SO₂ Analyzer Model: TELEDYNE API 100EH Serial No.: 282
NO_x/O₂ Analyzer Model: TELEDYNE API 200EH Serial No.: 548
CO/CO₂ Analyzer Model: TELEDYNE API 300EM Serial No.: 300

Time (min)	O ₂ (%)	CO ₂ (%)	NO _x (ppm)	SO ₂ (ppm)	CO (ppm)	Remark
10:22	13.39	4.01	22.17	0.31	5.86	
10:23	13.56	4.05	22.21	0.32	5.05	
10:24	13.88	4.03	22.76	0.33	4.19	
10:25	13.80	4.13	23.13	0.32	3.10	
10:26	13.76	4.08	23.99	0.35	3.07	
10:27	13.80	4.08	23.50	0.34	4.00	
10:28	13.80	4.11	23.41	0.35	3.37	
10:29	13.78	4.10	23.47	0.35	2.95	
10:30	13.69	4.17	24.50	0.36	2.19	
10:31	13.58	4.23	25.83	0.43	1.38	
10:32	13.52	4.25	26.91	0.39	1.42	
10:33	13.56	4.22	26.45	0.38	1.74	
10:34	13.65	4.14	26.04	0.35	3.34	
10:35	13.70	4.15	24.29	0.35	5.05	
10:36	13.63	4.18	24.46	0.39	2.00	
10:37	13.63	4.15	25.27	0.37	2.13	
10:38	13.54	4.15	25.45	0.40	2.19	
10:39	13.62	4.11	25.49	0.42	1.90	
10:40	13.68	4.11	25.17	0.40	3.14	
10:41	13.74	4.13	23.85	0.39	3.32	
10:42	13.66	4.15	23.69	0.43	2.31	
Average	13.72	4.13	24.35	0.37	2.93	

(Mr. Usanee Namburee)

Environmental Field Scientist (4)

FORM NO. F-06-02 REVISION NO. 2 ISSUE DATE 2001-10

ALS Laboratory Group



Lot No. 2327850-1

ANALYZER CALIBRATION DATA

Client : Gulf JP UT Co., Ltd. Location : HRSG 12
Date : 03 Apr 23 Test Operator : Usanee N.
O₂ ANALYZER :
Model : TELEDYNE API 200EH Serial No. : 549
Span (%) : 25

	Cylinder Value (%)	Initial Analyzers Calibration Response (%)	Final Analyzers Calibration Response (%)	Difference (Percent of Span)
Zero Gas	0.00	0.03	0.03	0.00
Low-Level Gas	8.05	8.05	8.07	0.04
Span Gas	16.08	16.08	16.09	0.04

NO_x ANALYZER :
Model : TELEDYNE API 200EH Serial No. : 549
Span (ppm) : 200

	Cylinder Value (ppm)	Initial Analyzers Calibration Response (ppm)	Final Analyzers Calibration Response (ppm)	Difference (Percent of Span)
Zero Gas	0.00	0.05	0.04	0.01
Low-Level Gas	50.32	50.04	50.00	0.02
Span Gas	158.20	157.64	157.69	0.03

SO₂ ANALYZER :
Model : TELEDYNE API 100EH Serial No. : 282
Span (ppm) : 200

	Cylinder Value (ppm)	Initial Analyzers Calibration Response (ppm)	Final Analyzers Calibration Response (ppm)	Difference (Percent of Span)
Zero Gas	0.00	0.03	0.04	0.01
Low-Level Gas	50.27	49.73	49.70	0.01
Span Gas	161.80	160.48	160.55	0.04

CO ANALYZER :
Model : TELEDYNE API 300EM Serial No. : 300
Span (ppm) : 200

	Cylinder Value (ppm)	Initial Analyzers Calibration Response (ppm)	Final Analyzers Calibration Response (ppm)	Difference (Percent of Span)
Zero Gas	0.00	0.04	0.04	0.00
Low-Level Gas	49.99	49.62	49.46	0.08
Span Gas	157.50	156.89	156.97	0.04

Calibrated by

(Mr. Usanee Namburee)

Environmental Field Scientist (4)

FORM NO. F-05-002 REVISION NO. 2 ISSUE DATE 2009/10

ALS Laboratory Group



Lot No. 2327850-1

SYSTEM CALIBRATION BIAS AND DRIFT DATA

Client : Gulf JP UT Co., Ltd. Location : HRSG 12
Date : 03 Apr 23 Test Operator : Usanee N.
O₂ ANALYZER :
Cylinder Conc. (%) : 16.08 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	0.03	0.03	0.00	0.03	0.03	0.00	0.00	0.00
Upscale Gas	16.08	16.10	0.08	16.11	0.12	0.04	0.04	0.04

NO_x ANALYZER :
Cylinder Conc. (ppm) : 158.20 Span (ppm) : 200

	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	0.05	0.05	0.00	0.05	0.00	0.00	0.00	0.00
Upscale Gas	157.64	157.00	0.32	156.70	0.47	0.15	0.15	0.15

SO₂ ANALYZER :
Cylinder Conc. (ppm) : 161.80 Span (ppm) : 200

	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	0.03	0.04	0.01	0.04	0.01	0.01	0.01	0.00
Upscale Gas	160.48	158.38	1.05	158.23	1.13	0.08	0.08	0.08

CO ANALYZER :
Cylinder Conc. (ppm) : 157.50 Span (ppm) : 200

	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	0.04	0.04	0.00	0.04	0.00	0.00	0.00	0.00
Upscale Gas	156.89	156.45	0.22	156.31	0.29	0.07	0.07	0.07

Calibrated by

(Mr. Usanee Namburee)

Environmental Field Scientist (4)

FORM NO. F-06-002 REVISION NO. 2 ISSUE DATE 2009/10

ALS Laboratory Group



EMISSION TEST RESULT

Client : Gulf JP UT Co., Ltd. Run # : 1
Date : 03 Apr 23 Location : HRSG 12
Start Time : 10:30 Test Operator : Usanee N.
End Time : 10:50
SO₂ Analyzer Model : TELEDYNE API 100EH Serial No. : 282
NO_x/O₂ Analyzer Model : TELEDYNE API 200EH Serial No. : 549
CO/CO₂ Analyzer Model : TELEDYNE API 300EM Serial No. : 300

Time (min)	O ₂ (%)	CO ₂ (%)	NO _x (ppm)	SO ₂ (ppm)	CO (ppm)	Remark
10:30	14.56	3.61	18.73	0.25	13.22	
10:31	14.26	3.78	19.17	0.25	12.97	
10:32	14.26	3.78	19.01	0.25	13.19	
10:33	14.26	3.78	20.31	0.40	12.79	
10:34	14.24	3.79	20.47	0.29	12.31	
10:35	14.23	3.74	20.43	0.28	12.73	
10:36	14.23	3.76	20.37	0.30	12.58	
10:37	14.23	3.79	20.42	0.29	12.55	
10:38	14.24	3.76	20.48	0.28	11.25	
10:39	14.24	3.77	20.58	0.27	12.00	
10:40	14.24	3.78	20.66	0.28	12.29	
10:41	14.24	3.79	20.75	0.28	12.09	
10:42	14.25	3.79	20.80	0.30	12.20	
10:43	14.25	3.77	20.56	0.28	12.08	
10:44	14.23	3.81	20.80	0.31	12.19	
10:45	14.24	3.80	20.62	0.30	12.14	
10:46	14.22	3.82	20.70	0.32	11.46	
10:47	14.23	3.79	20.80	0.31	11.17	
10:48	14.23	3.80	21.01	0.29	11.62	
10:49	14.23	3.81	21.07	0.30	11.64	
10:50	14.20	3.84	21.20	0.31	10.61	
Average	14.25	3.78	20.48	0.29	12.24	

(Mr. Usanee Namburee)

Environmental Field Scientist (4)

FORM NO. F-05-002 REVISION NO. 2 ISSUE DATE 2009/10

ALS Laboratory Group



EMISSION TEST RESULT

Client : Gulf JP UT Co., Ltd. Run # : 2
Date : 03 Apr 23 Location : HRSG 12
Start Time : 10:51 Test Operator : Usanee N.
End Time : 11:11
SO₂ Analyzer Model : TELEDYNE API 100EH Serial No. : 282
NO_x/O₂ Analyzer Model : TELEDYNE API 200EH Serial No. : 549
CO/CO₂ Analyzer Model : TELEDYNE API 300EM Serial No. : 300

Time (min)	O ₂ (%)	CO ₂ (%)	NO _x (ppm)	SO ₂ (ppm)	CO (ppm)	Remark
10:51	14.18	3.84	21.20	0.32	10.44	
10:52	14.24	3.83	21.21	0.31	13.19	
10:53	14.26	3.79	20.90	0.32	12.83	
10:54	14.27	3.78	20.68	0.32	12.24	
10:55	14.28	3.77	20.89	0.34	12.39	
10:56	14.27	3.81	21.07	0.38	12.17	
10:57	14.26	3.84	21.23	0.31	11.51	
10:58	14.26	3.81	21.38	0.34	11.02	
10:59	14.28	3.80	21.43	0.20	10.83	
11:00	14.27	3.80	21.40	0.25	11.08	
11:01	14.27	3.80	21.38	0.22	11.95	
11:02	14.28	3.84	21.36	0.29	12.43	
11:03	14.25	3.79	21.17	0.18	13.42	
11:04	14.25	3.78	21.16	0.27	11.75	
11:05	14.26	3.82	21.47	0.36	11.20	
11:06	14.26	3.83	21.75	0.26	11.01	
11:07	14.26	3.89	21.81	0.26	10.79	
11:08	14.26	3.81	21.78	0.21	10.91	
11:09	14.25	3.77	21.82	0.23	10.64	
11:10	14.25	3.82	21.85	0.28	10.30	
11:11	14.24	3.85	22.03	0.27	9.68	
Average	14.28	3.81	21.38	0.27	11.61	

(Mr. Usanee Namburee)

Environmental Field Scientist (4)

FORM NO. F-05-002 REVISION NO. 2 ISSUE DATE 2009/10

ALS Laboratory Group



EMISSION TEST RESULT

Client: Gulf JP UT Co., Ltd.
Date: 03 Apr 23
Start Time: 11:12
SO₂ Analyzer Model: TELEDYNE API 100EH
NO_x/O₂ Analyzer Model: TELEDYNE API 200EH
CO/CO₂ Analyzer Model: TELEDYNE API 300EM

Run #: 2
Location: HRSG 12
Test Operator: Usasara N.
Finish Time: 11:32
Serial No.: 282
Serial No.: 549
Serial No.: 300

Time (min)	O ₂ (%)	CO ₂ (%)	NO _x (ppm)	SO ₂ (ppm)	CO (ppm)	Remark
11:12	14.28	3.80	22.14	0.25	10.51	
11:13	14.27	3.78	22.09	0.25	10.76	
11:14	14.27	3.79	22.08	0.27	10.68	
11:15	14.26	3.80	22.13	0.26	10.02	
11:16	14.28	3.78	22.15	0.27	10.84	
11:17	14.28	3.77	22.02	0.27	10.91	
11:18	14.28	3.82	21.80	0.27	10.64	
11:19	14.28	3.78	21.92	0.30	10.81	
11:20	14.28	3.79	21.88	0.29	10.81	
11:21	14.27	3.82	21.87	0.28	10.40	
11:22	14.28	3.78	21.84	0.27	10.65	
11:23	14.26	3.80	21.97	0.27	10.81	
11:24	14.27	3.82	21.91	0.29	11.53	
11:25	14.29	3.82	21.68	0.28	12.48	
11:26	14.30	3.81	21.54	0.28	14.60	
11:27	14.30	3.76	21.39	0.30	14.18	
11:28	14.29	3.85	21.40	0.28	13.03	
11:29	14.30	3.84	21.45	0.27	12.67	
11:30	14.30	3.82	21.50	0.30	12.35	
11:31	14.28	3.81	21.48	0.28	12.15	
11:32	14.28	3.83	21.60	0.30	11.71	
Average	14.28	3.80	21.80	0.27	11.54	

(Mr. Usasara Hambore)

Environmental Field Scientist (4)

FORM NO. F-08-02 REVISION NO. 2 ISSUE DATE 2019/11

ALS Laboratory Group



ANALYZER CALIBRATION DATA

Lot No. 2327851-1

Client: Gulf JP UT Co., Ltd. Location: HRSG 21
Date: 18 Mar 23 Test Operator: Worawich T.
SO₂ ANALYZER Model: TELEDYNE API T200H Serial No.: 482
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	8.02	8.03	8.05	0.08
Span Gas	16.02	16.02	16.07	0.20

NO_x ANALYZER Model: TELEDYNE API T200H Serial No.: 482
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	54.84	54.66	54.62	0.04
Span Gas	81.85	81.66	81.68	0.02

SO₂ ANALYZER Model: TELEDYNE API T100H Serial No.: 324
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	54.34	54.32	54.27	0.05
Span Gas	79.82	79.90	79.88	0.02

CO ANALYZER Model: TELEDYNE API T300M Serial No.: 377
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	0.01	0.01
Low-Level Gas	54.42	54.37	54.40	0.03
Span Gas	79.73	79.92	79.84	0.06

Calibrated by

Worawich T.

(Mr. Worawich Tongsom)

Environmental Field Scientist (2)

FORM NO. F-08-02 REVISION NO. 2 ISSUE DATE 2019/11

ALS Laboratory Group



SYSTEM CALIBRATION BIAS AND DRIFT DATA

Lot No. 2327851-1

Client: Gulf JP UT Co., Ltd. Location: HRSG 21
Date: 18 Mar 23 Test Operator: Worawich T.

O₂ ANALYZER Cylinder Conc. (%) : 16.02 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	0.01	0.04	0.00	0.06	0.04
Upscale Gas	16.02	16.09	0.28	16.06	0.16	0.12

NO_x ANALYZER Cylinder Conc. (ppm) : 81.85 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	0.03		0.02	0.02	0.01
	81.85	81.77	0.09	81.81	0.05	0.04

SO₂ ANALYZER Cylinder Conc. (ppm) : 79.82 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
Span Gas	79.80	79.57	0.33	79.69	0.21	0.12

CO ANALYZER Cylinder Conc. (ppm) : 79.73 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	0.01	0.01	0.01	0.01	0.00
Uranium Gas	79.82	79.81	0.11	79.85	0.07	0.04

Calibrated by

Worawich T.

(Mr. Worawich Tongsom)

Environmental Field Scientist (2)

FORM NO. F-08-02 REVISION NO. 2 ISSUE DATE 2019/11

ALS Laboratory Group



EMISSION TEST RESULT

Client: Gulf JP UT Co., Ltd. Location: HRSG 21
Date: 18 Mar 23 Test Operator: Worawich T.
Start Time: 11:40
SO₂ Analyzer Model: TELEDYNE API T100H Serial No.: 324
NO_x/O₂ Analyzer Model: TELEDYNE API T200H Serial No.: 482
CO/CO₂ Analyzer Model: TELEDYNE API T300M Serial No.: 377

Time (min)	O ₂ (%)	CO ₂ (%)	NO _x (ppm)	SO ₂ (ppm)	CO (ppm)	Remark
11:40	14.31	3.20	14.02	0.24	5.48	
11:41	14.31	3.21	14.19	0.24	5.56	
11:42	14.32	3.21	14.19	0.25	5.72	
11:43	14.33	3.17	14.19	0.25	5.62	
11:44	14.32	3.20	14.20	0.25	5.62	
11:45	14.33	3.22	14.27	0.22	5.90	
11:46	14.33	3.24	14.26	0.22	5.90	
11:47	14.32	3.20	14.26	0.22	5.77	
11:48	14.32	3.21	14.32	0.23	5.81	
11:49	14.32	3.19	14.34	0.19	6.08	
11:50	14.33	3.21	14.24	0.21	6.23	
11:51	14.32	3.23	14.22	0.21	5.86	
11:52	14.32	3.20	14.21	0.20	5.80	
11:53	14.33	3.21	14.27	0.19	5.74	
11:54	14.32	3.16	14.30	0.19	5.58	
11:55	14.32	3.19	14.34	0.21	5.66	
11:56	14.31	3.21	14.48	0.16	4.67	
11:57	14.30	3.21	14.57	0.18	4.56	
11:58	14.31	3.18	14.57	0.16	4.63	
11:59	14.32	3.23	14.46	0.18	5.08	
12:00	14.32	3.17	14.40	0.16	4.82	
Average	14.32	3.20	14.20	0.21	5.63	

Worawich T.

(Mr. Worawich Tongsom)

Environmental Field Scientist (2)

FORM NO. F-08-02 REVISION NO. 2 ISSUE DATE 2019/11

ALS Laboratory Group



EMISSION TEST RESULT

Client	Gulf JP UT Co., Ltd.	Run #	2
Date	16 Mar 23	Location	HRSG 21
Start Time	12:01	Test Operator	Worawich T.
SO ₂ Analyzer Model	TELEDYNE API T100H	Finish Time	12:21
NO _x /O ₂ Analyzer Model	TELEDYNE API T200H	Serial No.	324
CO/CO ₂ Analyzer Model	TELEDYNE API T300M	Serial No.	482
		Serial No.	377

Time (min)	O ₂ (%)	CO ₂ (%)	NO _x (ppm)	SO ₂ (ppm)	CO (ppm)	Remark
12:01	14.33	5.25	14.40	0.14	4.80	
12:02	14.32	5.18	14.30	0.14	4.88	
12:03	14.34	5.17	14.40	0.22	5.18	
12:04	14.35	5.19	14.35	0.24	5.48	
12:05	14.36	5.15	14.22	0.26	5.56	
12:06	14.36	5.14	14.11	0.24	5.69	
12:07	14.36	5.17	14.10	0.32	5.44	
12:08	14.38	5.19	14.14	0.35	5.41	
12:09	14.35	5.18	14.19	0.34	5.29	
12:10	14.34	5.22	14.23	0.30	4.85	
12:11	14.35	5.19	14.30	0.33	5.04	
12:12	14.36	5.20	14.25	0.34	5.11	
12:13	14.34	5.18	14.33	0.31	5.17	
12:14	14.35	5.18	14.29	0.29	5.71	
12:15	14.27	5.18	14.24	0.30	5.63	
12:16	14.36	5.19	14.31	0.29	5.18	
12:17	14.35	5.18	14.36	0.30	5.10	
12:18	14.35	5.23	14.41	0.29	5.37	
12:19	14.36	5.18	14.37	0.27	5.29	
12:20	14.36	5.18	14.34	0.28	5.05	
12:21	14.34	5.21	14.36	0.25	4.54	
Average	14.35	5.18	14.29	0.29	5.22	

Worawich T.

(Mr. Worawich Tongpoom)

Environmental Field Scientist (2)

FORMING F-08-002 REVISION NO. 2 (ISSUE DATE 2009/10)

ALS Laboratory Group



EMISSION TEST RESULT

Client	Gulf JP UT Co., Ltd.	Run #	3
Date	16 Mar 23	Location	HRSG 21
Start Time	12:22	Test Operator	Worawich T.
SO ₂ Analyzer Model	TELEDYNE API T100H	Finish Time	12:42
NO _x /O ₂ Analyzer Model	TELEDYNE API T200H	Serial No.	324
CO/CO ₂ Analyzer Model	TELEDYNE API T300M	Serial No.	482
		Serial No.	377

Time (min)	O ₂ (%)	CO ₂ (%)	NO _x (ppm)	SO ₂ (ppm)	CO (ppm)	Remark
12:22	14.35	5.21	14.38	0.27	4.97	
12:23	14.35	5.17	14.35	0.25	4.78	
12:24	14.34	5.23	14.38	0.25	4.58	
12:25	14.34	5.19	14.41	0.23	4.37	
12:26	14.34	5.17	14.49	0.22	4.48	
12:27	14.35	5.17	14.45	0.21	4.80	
12:28	14.35	5.15	14.39	0.22	4.72	
12:29	14.35	5.14	14.29	0.21	4.77	
12:30	14.35	5.18	14.29	0.19	4.69	
12:31	14.35	5.18	14.30	0.17	4.72	
12:32	14.35	5.19	14.34	0.18	4.63	
12:33	14.35	5.18	14.37	0.20	4.58	
12:34	14.36	5.17	14.43	0.25	4.70	
12:35	14.37	5.16	14.38	0.25	4.68	
12:36	14.37	5.16	14.30	0.24	5.04	
12:37	14.37	5.14	14.28	0.23	5.14	
12:38	14.37	5.16	14.31	0.22	4.71	
12:39	14.37	5.19	14.29	0.20	4.35	
12:40	14.35	5.15	14.43	0.19	4.20	
12:41	14.36	5.18	14.41	0.22	4.10	
12:42	14.36	5.18	14.44	0.21	4.03	
Average	14.35	5.17	14.37	0.22	4.63	

Worawich T.

(Mr. Worawich Tongpoom)

Environmental Field Scientist (2)

FORMING F-08-002 REVISION NO. 2 (ISSUE DATE 2009/10)

ALS Laboratory Group



Lot No. 2327852-1

ANALYZER CALIBRATION DATA

Client	Gulf JP UT Co., Ltd.	Location	HRSG 22
Date	20 Mar 23	Test Operator	Worawich T.
O ₂ ANALYZER Model	TELEDYNE API T200H	Serial No.	482
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	8.02	8.02	8.04	0.08
Span Gas	16.02	16.03	16.06	0.12

NO _x ANALYZER Model	TELEDYNE API T200H	Serial No.	482
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	54.64	54.62	54.60	0.02
Span Gas	81.85	81.86	81.82	0.04

SO ₂ ANALYZER Model	TELEDYNE API T100H	Serial No.	324
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	54.34	54.33	54.27	0.06
Span Gas	79.92	79.91	79.88	0.03

CO ANALYZER Model	TELEDYNE API T300M	Serial No.	377
Span (ppm)	100		

	Cylinder Value (ppm)	Initial Analyzers Calibration Response (ppm)	Final Analyzers Calibration Response (ppm)	Difference (Percent of Span)
Zero Gas	0.00	0.01	0.02	0.01
Low-Level Gas	54.42	54.40	54.39	0.01
Span Gas	79.73	79.71	79.80	0.09

Calibrated by

Worawich T.

(Mr. Worawich Tongpoom)

Environmental Field Scientist (2)

FORMING F-08-002 REVISION NO. 2 (ISSUE DATE 2009/10)

ALS Laboratory Group



Lot No. 2327852-1

SYSTEM CALIBRATION BIAS AND DRIFT DATA

Client	Gulf JP UT Co., Ltd.	Location	HRSG 22
Date	20 Mar 23	Test Operator	Worawich T.

O ₂ ANALYZER Cylinder Conc. (%)	16.02	Span (%)	25
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	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	0.01	0.04	0.04
Up-scale Gas	16.03	16.09	0.24	16.11	0.32	0.08

NO _x ANALYZER Cylinder Conc. (ppm)	81.85	Span (ppm)	100
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	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	0.02	0.02	0.01
Up-scale Gas	81.86	81.74	0.12	81.78	0.10	0.02

SO ₂ ANALYZER Cylinder Conc. (ppm)	79.82	Span (ppm)	100
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	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
Up-scale Gas	79.81	79.85	0.05	79.83	0.08	0.03

CO ANALYZER Cylinder Conc. (ppm)	79.73	Span (ppm)	100
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	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	0.01	0.03	0.02	0.01	0.00	0.02
Up-scale Gas	79.71	79.70	0.01	79.68	0.03	0.02

Calibrated by

Worawich T.

(Mr. Worawich Tongpoom)

Environmental Field Scientist (2)

FORMING F-08-002 REVISION NO. 2 (ISSUE DATE 2009/10)

ALS Laboratory Group



EMISSION TEST RESULT

Client	Gulf JP UT Co., Ltd.	Run #	1
Date	20 Mar 23	Location	HR80 22
Start Time	10:40	Test Operator	Worawich T.
SO ₂ Analyzer Model	TELEDYNE API T100H	Serial No.	324
NO _x /O ₂ Analyzer Model	TELEDYNE API T200H	Serial No.	482
CO/CO ₂ Analyzer Model	TELEDYNE API T300M	Serial No.	377

Time (min)	O ₂ (%)	CO ₂ (%)	NO _x (ppm)	SO ₂ (ppm)	CO (ppm)	Remark
10:40	14.23	5.32	15.59	0.36	2.60	
10:41	14.24	5.32	15.71	0.35	2.60	
10:42	14.23	5.30	15.65	0.37	2.58	
10:43	14.22	5.36	15.79	0.35	2.60	
10:44	14.24	5.32	15.78	0.35	2.60	
10:45	14.24	5.33	15.68	0.38	2.61	
10:46	14.23	5.33	15.70	0.50	2.61	
10:47	14.23	5.33	15.77	0.50	2.61	
10:48	14.24	5.35	15.82	0.50	2.63	
10:49	14.24	5.33	15.80	0.48	2.61	
10:50	14.23	5.36	15.73	0.48	2.64	
10:51	14.22	5.32	15.79	0.49	2.60	
10:52	14.22	5.30	15.82	0.47	2.58	
10:53	14.24	5.37	15.77	0.49	2.64	
10:54	14.24	5.36	15.63	0.49	2.64	
10:55	14.23	5.34	15.80	0.47	2.62	
10:56	14.22	5.35	15.77	0.47	2.64	
10:57	14.21	5.34	15.97	0.48	2.65	
10:58	14.23	5.33	16.00	0.45	2.61	
10:59	14.23	5.34	15.87	0.47	2.62	
11:00	14.25	5.31	15.74	0.47	2.60	
Average	14.23	5.34	15.77	0.48	2.61	

Worawich T.

(Mr. Worawich Tongpoom)

Environmental Field Scientist (2)

FORMAQC-F-06-002 REVISION/REV: 2 ISSUE DATE: 09/18
ALS Laboratory Group

EMISSION TEST RESULT

Client	Gulf JP UT Co., Ltd.	Run #	2
Date	20 Mar 23	Location	HR80 22
Start Time	11:01	Test Operator	Worawich T.
SO ₂ Analyzer Model	TELEDYNE API T100H	Serial No.	324
NO _x /O ₂ Analyzer Model	TELEDYNE API T200H	Serial No.	482
CO/CO ₂ Analyzer Model	TELEDYNE API T300M	Serial No.	377

Time (min)	O ₂ (%)	CO ₂ (%)	NO _x (ppm)	SO ₂ (ppm)	CO (ppm)	Remark
11:01	14.23	5.34	15.71	0.47	2.62	
11:02	14.25	5.32	15.71	0.47	2.62	
11:03	14.25	5.31	15.73	0.47	2.59	
11:04	14.23	5.33	15.82	0.45	2.61	
11:05	14.23	5.36	15.88	0.45	2.64	
11:06	14.24	5.37	15.87	0.45	2.64	
11:07	14.22	5.37	15.88	0.45	2.64	
11:08	14.23	5.35	15.93	0.48	2.63	
11:09	14.23	5.31	15.98	0.44	2.58	
11:10	14.24	5.38	15.92	0.48	2.63	
11:11	14.23	5.37	15.85	0.44	2.64	
11:12	14.24	5.38	15.85	0.43	2.64	
11:13	14.24	5.34	15.84	0.43	2.60	
11:14	14.25	5.35	15.75	0.42	2.63	
11:15	14.24	5.34	15.69	0.44	2.62	
11:16	14.24	5.37	15.71	0.50	2.64	
11:17	14.24	5.33	15.75	0.48	2.61	
11:18	14.25	5.40	15.69	0.49	2.67	
11:19	14.24	5.36	15.67	0.49	2.64	
11:20	14.24	5.35	15.72	0.48	2.60	
11:21	14.24	5.35	15.85	0.47	2.63	
Average	14.24	5.35	15.80	0.48	2.63	

Worawich T.

(Mr. Worawich Tongpoom)

Environmental Field Scientist (2)

FORMAQC-F-06-002 REVISION/REV: 2 ISSUE DATE: 09/18
ALS Laboratory Group

EMISSION TEST RESULT

Client	Gulf JP UT Co., Ltd.	Run #	3
Date	20 Mar 23	Location	HR80 22
Start Time	11:22	Test Operator	Worawich T.
SO ₂ Analyzer Model	TELEDYNE API T100H	Serial No.	324
NO _x /O ₂ Analyzer Model	TELEDYNE API T200H	Serial No.	482
CO/CO ₂ Analyzer Model	TELEDYNE API T300M	Serial No.	377

Time (min)	O ₂ (%)	CO ₂ (%)	NO _x (ppm)	SO ₂ (ppm)	CO (ppm)	Remark
11:22	14.23	5.37	15.97	0.48	2.64	
11:23	14.23	5.39	16.01	0.49	2.65	
11:24	14.22	5.38	16.06	0.49	2.65	
11:25	14.24	5.37	15.98	0.48	2.64	
11:26	14.23	5.36	15.90	0.47	2.64	
11:27	14.23	5.40	15.89	0.48	2.67	
11:28	14.24	5.38	15.96	0.48	2.64	
11:29	14.26	5.35	15.85	0.47	2.63	
11:30	14.24	5.37	15.83	0.46	2.64	
11:31	14.23	5.34	15.85	0.47	2.62	
11:32	14.22	5.37	16.03	0.47	2.64	
11:33	14.23	5.30	16.05	0.47	2.58	
11:34	14.24	5.29	16.09	0.45	2.61	
11:35	14.24	5.34	16.08	0.45	2.62	
11:36	14.24	5.35	16.07	0.44	2.63	
11:37	14.25	5.35	16.04	0.45	2.64	
11:38	14.24	5.34	15.97	0.45	2.62	
11:39	14.24	5.35	16.00	0.48	2.63	
11:40	14.25	5.37	16.00	0.44	2.64	
11:41	14.24	5.39	15.93	0.43	2.66	
11:42	14.23	5.37	16.01	0.44	2.64	
Average	14.24	5.38	16.08	0.48	2.64	

Worawich T.

(Mr. Worawich Tongpoom)

Environmental Field Scientist (2)

FORMAQC-F-06-002 REVISION/REV: 2 ISSUE DATE: 09/18
ALS Laboratory Group

ANALYZER CALIBRATION DATA

Lot No: 2327841-1

Client	Gulf JP UT Co., Ltd.	Location	HR80 11
Date	31 Mar 23	Test Operator	Usanee N.

O ₂ ANALYZER	TELEDYNE API 200EH	Serial No.	548
Model	200		
Span (%)	25		

	Cylinder Value (%)	Initial Analyzers Calibration Response (%)	Final Analyzers Calibration Response (%)	Difference (Percent of Span)
Zero Gas	0.00	0.02	0.02	0.00
Low-Level Gas	6.05	6.03	6.03	0.00
Span Gas	16.08	16.06	16.08	0.00

NO _x ANALYZER	TELEDYNE API 200EH	Serial No.	548
Model	200		
Span (ppm)	200		

	Cylinder Value (ppm)	Initial Analyzers Calibration Response (ppm)	Final Analyzers Calibration Response (ppm)	Difference (Percent of Span)
Zero Gas	0.00	0.03	0.03	0.00
Low-Level Gas	50.32	50.13	50.04	0.05
Span Gas	156.20	157.79	157.65	0.07

SO ₂ ANALYZER	TELEDYNE API 100EH	Serial No.	382
Model	200		
Span (ppm)	200		

	Cylinder Value (ppm)	Initial Analyzers Calibration Response (ppm)	Final Analyzers Calibration Response (ppm)	Difference (Percent of Span)
Zero Gas	0.00	0.04	0.04	0.00
Low-Level Gas	20.77	49.96	49.77	0.09
Span Gas	157.80	160.12	160.07	0.03

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

	Cylinder Value (ppm)	Initial Analyzers Calibration Response (ppm)	Final Analyzers Calibration Response (ppm)	Difference (Percent of Span)
Zero Gas	0.00	0.01	0.01	0.00
Low-Level Gas	20.77	48.74	48.48	0.13
Span Gas	157.80	156.98	157.11	0.08

CO ₂ ANALYZER	TELEDYNE API 300EM	Serial No.	300
Model	25		
Span (%)	25		

	Cylinder Value (%)	Initial Analyzers Calibration Response (%)	Final Analyzers Calibration Response (%)	Difference (Percent of Span)
Zero Gas	0.00	0.01	0.01	0.00
Low-Level Gas	10.23	15.01	15.01	0.00
Span Gas	22.84	30.79	30.74	0.20

Calibrated by

Usanee N.

(Mr. Usanee Nambornae)
Environmental Field Scientist (4)FORMAQC-F-06-004 REVISION/REV: 2 ISSUE DATE: 09/18
ALS Laboratory Group

SYSTEM CALIBRATION BIAS AND DRIFT DATA

Client	:	Gulf JP UT Co., Ltd.	Location	:	HRSQ 11
Date	:	31 Mar 23	Test Operator	:	Usama N.

O₂ ANALYZER
Cylinder Conc. (%) : 16.06 Span (%) : 28

	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	0.02	0.02	0.00	0.02	0.00	0.00
Ultraclean Gas	16.08	16.10	0.08	16.10	0.08	0.00

NO_x ANALYZER
Cylinder Conc. (ppm) : 168.20 Scan (ppm) : 200

	NO _x Analyzer Calibration Response	Initial Values		Final Values		Drift (% of Span)
		System Calibration Response	System Cel Bias (% of Span)	System Calibration Response	System Cel Bias (% of Span)	
Zero Gas	0.03	0.03	0.00	0.03	0.00	0.00
Upscale Gas	157.79	157.10	0.34	166.88	0.47	0.1%

SO ₂ ANALYZER	
Cylinder Conc. (pphm)	: 161.60
Span (pphm)	: 200

	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	0.04	0.05	0.01	0.05	0.01	0.00
Upstream Gas	160.12	158.52	0.80	158.03	1.05	0.25

CO ANALYZER
Cylinder Conc. (ppm) : 157.60 Span (ppm) : 200

	CO Analyzer Calibration Response	Initial Values		Final Values		Drift (% of Span)
		System Calibration Response	System Cel Bias (% of Span)	System Calibration Response	System Cel Bias (% of Span)	
Zero Gas	0.03	0.04	0.01	0.04	0.01	0.00
Microleak Gas	156.93	156.64	0.17	156.63	0.09	0.04

CO2 ANALYZER	
Oxider Conc. (%)	: 22.84
Span (%)	: 28

	CO2 Analyzer Calibration Response	Initial Values		Final Values		Drift (% of Span)
		System Calibration Response	System Cal Bias (% of Span)	System Calibration Response	System Cal Bias (% of Span)	
Zero Gas	0.01	0.01	0.00	0.01	0.00	0.00
Headspace Gas	22.84	22.84	0.20	23.22	0.38	0.26

Calibrated by

(Mr. Ussama Nambiar)

Environmental Field Scientist (4)

ALD Language Group



CEMs Data

Client Name	Gulf J.R. UT Co., Ltd.	Date	11 Mar 23
Plant Name	OUT	Location	HR503 11

Run No. 1	Time Base: 21 min	Run No. 2	Time Base: 21 min
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Run No. 1											Time Base: 21 sec					Run No. 2											Time Base: 21 sec				
Swk	Time	SW1	SW2	SW3	SW4	SW5	SW6	SW7	SW8	SW9	SW10	Time	SW1	SW2	SW3	SW4	SW5	SW6	SW7	SW8	SW9	SW10									
1 Mar 21	8:40	8:23	14:02	8:20	18:78							8:40	12:21	1:01	1:17	2:18	5:00	1:44													
1 Mar 21	8:41	8:16	14:01	8:05	18:81							8:40	12:52	1:01	1:17	2:18	5:00	1:43													
1 Mar 21	8:42	8:16	14:01	8:05	18:84							8:40	13:02	1:00	1:16	2:17	5:00	1:43													
1 Mar 21	8:43	8:16	14:01	8:05	18:85							8:40	13:04	1:00	1:16	2:17	5:00	1:43													
1 Mar 21	8:44	8:16	14:01	8:05	18:86							8:40	13:05	1:00	1:16	2:17	5:00	1:43													
1 Mar 21	8:45	8:16	14:01	8:05	18:87							8:40	13:06	1:00	1:16	2:17	5:00	1:43													
1 Mar 21	8:46	8:16	14:01	8:05	18:88							8:40	13:07	1:00	1:16	2:17	5:00	1:43													
1 Mar 21	8:47	8:16	14:01	8:05	18:89							8:40	13:08	1:00	1:16	2:17	5:00	1:43													
1 Mar 21	8:48	8:16	14:01	8:05	18:90							8:40	13:09	1:00	1:16	2:17	5:00	1:43													
1 Mar 21	8:49	8:16	14:01	8:05	18:91							8:40	13:10	1:00	1:16	2:17	5:00	1:43													
1 Mar 21	8:50	8:16	14:01	8:05	18:92							8:40	13:11	1:00	1:16	2:17	5:00	1:43													
1 Mar 21	8:51	8:16	14:01	8:05	18:93							8:40	13:12	1:00	1:16	2:17	5:00	1:43													
1 Mar 21	8:52	8:16	14:01	8:05	18:94							8:40	13:13	1:00	1:16	2:17	5:00	1:43													
1 Mar 21	8:53	8:16	14:01	8:05	18:95							8:40	13:14	1:00	1:16	2:17	5:00	1:43													
1 Mar 21	8:54	8:16	14:01	8:05	18:96							8:40	13:15	1:00	1:16	2:17	5:00	1:43													
1 Mar 21	8:55	8:16	14:01	8:05	18:97							8:40	13:16	1:00	1:16	2:17	5:00	1:43													
1 Mar 21	8:56	8:16	14:01	8:05	18:98							8:40	13:17	1:00	1:16	2:17	5:00	1:43													
1 Mar 21	8:57	8:16	14:01	8:05	18:99							8:40	13:18	1:00	1:16	2:17	5:00	1:43													
1 Mar 21	8:58	8:16	14:01	8:05	19:00							8:40	13:19	1:00	1:16	2:17	5:00	1:43													
1 Mar 21	8:59	8:16	14:01	8:05	19:01							8:40	13:20	1:00	1:16	2:17	5:00	1:43													
Max	8:59	8:28	14:09	8:24	19:01							Max	8:55	2:08	2:09	3:26	6:26	2:01													

Time Range 21:00-01										Time Range 21:00-01									
Day	Time	R12	W15	R12	W15	G12	W15	Day	Time	R12	W15	R12	W15	Day	Time	R12	W15	R12	W15
11 Nov 21	18:25	5.28	18.86	5.47	18.21			11 Nov 21	19:49	5.12	18.74	5.17	18.07	12 Nov	18:25	5.14	18.76	5.07	18.16
11 Nov 21	18:28	5.21	18.76	5.47	18.41			11 Nov 21	19:46	5.14	18.76	5.01	18.16	12 Nov	18:28	5.14	18.76	5.07	18.16
11 Nov 21	18:31	5.16	18.76	5.47	18.41			11 Nov 21	19:43	5.14	18.76	5.01	18.16	12 Nov	18:31	5.14	18.76	5.07	18.16
11 Nov 21	18:34	5.16	18.76	5.47	18.41			11 Nov 21	19:40	5.14	18.76	5.01	18.16	12 Nov	18:34	5.14	18.76	5.07	18.16
11 Nov 21	18:37	5.16	18.76	5.47	18.41			11 Nov 21	19:37	5.14	18.76	5.01	18.16	12 Nov	18:37	5.14	18.76	5.07	18.16
11 Nov 21	18:40	5.16	18.76	5.47	18.41			11 Nov 21	19:34	5.14	18.76	5.01	18.16	12 Nov	18:40	5.14	18.76	5.07	18.16
11 Nov 21	18:43	5.16	18.76	5.47	18.41			11 Nov 21	19:31	5.14	18.76	5.01	18.16	12 Nov	18:43	5.14	18.76	5.07	18.16
11 Nov 21	18:46	5.16	18.76	5.47	18.41			11 Nov 21	19:28	5.14	18.76	5.01	18.16	12 Nov	18:46	5.14	18.76	5.07	18.16
11 Nov 21	18:49	5.16	18.76	5.47	18.41			11 Nov 21	19:25	5.14	18.76	5.01	18.16	12 Nov	18:49	5.14	18.76	5.07	18.16
11 Nov 21	18:52	5.16	18.76	5.47	18.41			11 Nov 21	19:22	5.14	18.76	5.01	18.16	12 Nov	18:52	5.14	18.76	5.07	18.16
11 Nov 21	18:55	5.16	18.76	5.47	18.41			11 Nov 21	19:19	5.14	18.76	5.01	18.16	12 Nov	18:55	5.14	18.76	5.07	18.16
11 Nov 21	18:58	5.16	18.76	5.47	18.41			11 Nov 21	19:16	5.14	18.76	5.01	18.16	12 Nov	18:58	5.14	18.76	5.07	18.16
11 Nov 21	19:01	5.16	18.76	5.47	18.41			11 Nov 21	19:13	5.14	18.76	5.01	18.16	12 Nov	19:01	5.14	18.76	5.07	18.16
11 Nov 21	19:04	5.16	18.76	5.47	18.41			11 Nov 21	19:10	5.14	18.76	5.01	18.16	12 Nov	19:04	5.14	18.76	5.07	18.16
11 Nov 21	19:07	5.16	18.76	5.47	18.41			11 Nov 21	19:07	5.14	18.76	5.01	18.16	12 Nov	19:07	5.14	18.76	5.07	18.16
11 Nov 21	19:10	5.16	18.76	5.47	18.41			11 Nov 21	19:04	5.14	18.76	5.01	18.16	12 Nov	19:10	5.14	18.76	5.07	18.16
11 Nov 21	19:13	5.16	18.76	5.47	18.41			11 Nov 21	19:01	5.14	18.76	5.01	18.16	12 Nov	19:13	5.14	18.76	5.07	18.16
11 Nov 21	19:16	5.16	18.76	5.47	18.41			11 Nov 21	18:58	5.14	18.76	5.01	18.16	12 Nov	19:16	5.14	18.76	5.07	18.16
11 Nov 21	19:19	5.16	18.76	5.47	18.41			11 Nov 21	18:55	5.14	18.76	5.01	18.16	12 Nov	19:19	5.14	18.76	5.07	18.16
11 Nov 21	19:22	5.16	18.76	5.47	18.41			11 Nov 21	18:52	5.14	18.76	5.01	18.16	12 Nov	19:22	5.14	18.76	5.07	18.16
11 Nov 21	19:25	5.16	18.76	5.47	18.41														

Run No.		Time Base 21 sec						Time Base 21 sec							
Run	Time	2002	2003	2004	2005	2006	2007	Run	Time	2002	2003	2004	2005	2006	2007
11 Mar	11	0.04	0.26	0.24	0.02	0.07	0.07	11 Mar	11	0.29	0.20	0.20	0.03	0.02	0.02
11 Mar	12	0.01	0.26	0.02	0.02	0.02	0.02	11 Mar	12	0.02	0.20	0.20	0.03	0.02	0.02
11 Mar	13	0.06	0.18	0.04	0.02	0.02	0.02	11 Mar	13	0.07	0.20	0.20	0.03	0.02	0.02
11 Mar	14	0.07	0.09	0.03	0.02	0.02	0.02	11 Mar	14	0.09	0.18	0.20	0.03	0.02	0.02
11 Mar	15	0.08	0.04	0.02	0.02	0.02	0.02	11 Mar	15	0.08	0.18	0.20	0.03	0.02	0.02
11 Mar	16	0.10	0.21	0.04	0.02	0.03	0.03	11 Mar	16	0.10	0.20	0.20	0.03	0.02	0.02
11 Mar	17	0.10	0.20	0.10	0.04	0.04	0.04	11 Mar	17	0.10	0.20	0.20	0.03	0.02	0.02
11 Mar	18	0.12	0.21	0.08	0.03	0.04	0.04	11 Mar	18	0.12	0.20	0.20	0.03	0.02	0.02
11 Mar	19	0.14	0.18	0.08	0.03	0.04	0.04	11 Mar	19	0.14	0.20	0.20	0.03	0.02	0.02
11 Mar	20	0.14	0.18	0.08	0.03	0.04	0.04	11 Mar	20	0.14	0.20	0.20	0.03	0.02	0.02
11 Mar	21	0.16	0.20	0.08	0.03	0.04	0.04	11 Mar	21	0.16	0.20	0.20	0.03	0.02	0.02
11 Mar	22	0.17	0.20	0.08	0.03	0.04	0.04	11 Mar	22	0.17	0.20	0.20	0.03	0.02	0.02
11 Mar	23	0.17	0.20	0.08	0.03	0.04	0.04	11 Mar	23	0.17	0.20	0.20	0.03	0.02	0.02
11 Mar	24	0.17	0.20	0.08	0.03	0.04	0.04	11 Mar	24	0.17	0.20	0.20	0.03	0.02	0.02
11 Mar	25	0.17	0.20	0.08	0.03	0.04	0.04	11 Mar	25	0.17	0.20	0.20	0.03	0.02	0.02
11 Mar	26	0.17	0.20	0.08	0.03	0.04	0.04	11 Mar	26	0.17	0.20	0.20	0.03	0.02	0.02
11 Mar	27	0.17	0.20	0.08	0.03	0.04	0.04	11 Mar	27	0.17	0.20	0.20	0.03	0.02	0.02
11 Mar	28	0.17	0.20	0.08	0.03	0.04	0.04	11 Mar	28	0.17	0.20	0.20	0.03	0.02	0.02
11 Mar	29	0.17	0.20	0.08	0.03	0.04	0.04	11 Mar	29	0.17	0.20	0.20	0.03	0.02	0.02
11 Mar	30	0.17	0.20	0.08	0.03	0.04	0.04	11 Mar	30	0.17	0.20	0.20	0.03	0.02	0.02
11 Mar	31	0.17	0.20	0.08	0.03	0.04	0.04	11 Mar	31	0.17	0.20	0.20	0.03	0.02	0.02
11 Mar	32	0.17	0.20	0.08	0.03	0.04	0.04	11 Mar	32	0.17	0.20	0.20	0.03	0.02	0.02
11 Mar	33	0.17	0.20	0.08	0.03	0.04	0.04	11 Mar	33	0.17	0.20	0.20	0.03	0.02	0.02
11 Mar	34	0.17	0.20	0.08	0.03	0.04	0.04	11 Mar	34	0.17	0.20	0.20	0.03	0.02	0.02
11 Mar															



CEMs Data

Client Name: Dulip PVT Co. Ltd. Date: 31 Mar 21
 Main Office: Coast Location: Coast

Run Name	Time taken (s)	Run Name	Time taken (s)
Run 7	Time taken (s)	Run 8	Time taken (s)

Run No. 7					Time Base: 21 sec					Run No. 8					Time Base: 21 sec				
Zone	Time	DO1	DO2	DO3	DO4	DO5	DO6	DO7	DO8	Zone	Time	DO1	DO2	DO3	DO4	DO5	DO6	DO7	DO8
21 May 23	14:46	8.72	12.08	12.82	13.32	14.32				21 May 23	15:07	8.32	11.88	12.48	13.48	14.48			
21 May 22	14:47	8.22	12.02	12.82	13.32	14.32				21 May 23	15:09	8.32	11.78	12.48	13.48	14.48			
21 May 22	14:48	8.28	12.08	12.82	13.32	14.32				21 May 23	15:10	8.32	11.78	12.48	13.48	14.48			
21 May 22	14:49	8.22	12.02	12.82	13.32	14.32				21 May 23	15:11	8.32	11.78	12.48	13.48	14.48			
21 May 22	14:50	8.28	12.08	12.82	13.32	14.32				21 May 23	15:12	8.32	11.78	12.48	13.48	14.48			
21 May 22	14:51	8.28	12.08	12.82	13.32	14.32				21 May 23	15:13	8.32	11.78	12.48	13.48	14.48			
21 May 22	14:52	8.22	12.02	12.82	13.32	14.32				21 May 23	15:14	8.32	11.78	12.48	13.48	14.48			
21 May 22	14:53	8.28	12.08	12.82	13.32	14.32				21 May 23	15:15	8.32	11.78	12.48	13.48	14.48			
21 May 22	14:54	8.28	12.08	12.82	13.32	14.32				21 May 23	15:16	8.32	11.78	12.48	13.48	14.48			
21 May 22	14:55	8.28	12.08	12.82	13.32	14.32				21 May 23	15:17	8.32	11.78	12.48	13.48	14.48			
21 May 22	14:56	8.28	12.08	12.82	13.32	14.32				21 May 23	15:18	8.32	11.78	12.48	13.48	14.48			
21 May 22	14:57	8.28	12.08	12.82	13.32	14.32				21 May 23	15:19	8.32	11.78	12.48	13.48	14.48			
21 May 22	14:58	8.28	12.08	12.82	13.32	14.32				21 May 23	15:20	8.32	11.78	12.48	13.48	14.48			
21 May 22	14:59	8.28	12.08	12.82	13.32	14.32				21 May 23	15:21	8.32	11.78	12.48	13.48	14.48			
21 May 22	15:00	8.28	12.08	12.82	13.32	14.32				21 May 23	15:22	8.32	11.78	12.48	13.48	14.48			
21 May 22	15:01	8.28	12.08	12.82	13.32	14.32				21 May 23	15:23	8.32	11.78	12.48	13.48	14.48			
21 May 22	15:02	8.28	12.08	12.82	13.32	14.32				21 May 23	15:24	8.32	11.78	12.48	13.48	14.48			
21 May 22	15:03	8.28	12.08	12.82	13.32	14.32				21 May 23	15:25	8.32	11.78	12.48	13.48	14.48			
21 May 22	15:04	8.28	12.08	12.82	13.32	14.32				21 May 23	15:26	8.32	11.78	12.48	13.48	14.48			
21 May 22	15:05	8.28	12.08	12.82	13.32	14.32				21 May 23	15:27	8.32	11.78	12.48	13.48	14.48			
21 May 22	15:06	8.28	12.08	12.82	13.32	14.32				21 May 23	15:28	8.32	11.78	12.48	13.48	14.48			
21 May 22	15:07	8.28	12.08	12.82	13.32	14.32				21 May 23	15:29	8.32	11.78	12.48					

Run File 8							Time Base 27 min							Run File 10							Time Base 27 min						
Run	Time	h	m	s	ms	μs	Run	Time	h	m	s	ms	μs	Run	Time	h	m	s	ms	μs	Run	Time	h	m	s	ms	μs
1	0:00:00	0	0	0	0	0	1	0:00:00	0	0	0	0	0	1	0:00:00	0	0	0	0	0	1	0:00:00	0	0	0	0	0
2	0:00:01	0	0	1	00	00	2	0:00:01	0	0	1	00	00	2	0:00:01	0	0	1	00	00	2	0:00:01	0	0	1	00	00
3	0:00:02	0	0	2	00	00	3	0:00:02	0	0	2	00	00	3	0:00:02	0	0	2	00	00	3	0:00:02	0	0	2	00	00
4	0:00:03	0	0	3	00	00	4	0:00:03	0	0	3	00	00	4	0:00:03	0	0	3	00	00	4	0:00:03	0	0	3	00	00
5	0:00:04	0	0	4	00	00	5	0:00:04	0	0	4	00	00	5	0:00:04	0	0	4	00	00	5	0:00:04	0	0	4	00	00
6	0:00:05	0	0	5	00	00	6	0:00:05	0	0	5	00	00	6	0:00:05	0	0	5	00	00	6	0:00:05	0	0	5	00	00
7	0:00:06	0	0	6	00	00	7	0:00:06	0	0	6	00	00	7	0:00:06	0	0	6	00	00	7	0:00:06	0	0	6	00	00
8	0:00:07	0	0	7	00	00	8	0:00:07	0	0	7	00	00	8	0:00:07	0	0	7	00	00	8	0:00:07	0	0	7	00	00
9	0:00:08	0	0	8	00	00	9	0:00:08	0	0	8	00	00	9	0:00:08	0	0	8	00	00	9	0:00:08	0	0	8	00	00
10	0:00:09	0	0	9	00	00	10	0:00:09	0	0	9	00	00	10	0:00:09	0	0	9	00	00	10	0:00:09	0	0	9	00	00
11	0:00:10	0	0	10	00	00	11	0:00:10	0	0	10	00	00	11	0:00:10	0	0	10	00	00	11	0:00:10	0	0	10	00	00
12	0:00:11	0	0	11	00	00	12	0:00:11	0	0	11	00	00	12	0:00:11	0	0	11	00	00	12	0:00:11	0	0	11	00	00
13	0:00:12	0	0	12	00	00	13	0:00:12	0	0	12	00	00	13	0:00:12	0	0	12	00	00	13	0:00:12	0	0	12	00	00
14	0:00:13	0	0	13	00	00	14	0:00:13	0	0	13	00	00	14	0:00:13	0	0	13	00	00	14	0:00:13	0	0	13	00	00
15	0:00:14	0	0	14	00	00	15	0:00:14	0	0	14	00	00	15	0:00:14	0	0	14	00	00	15	0:00:14	0	0	14	00	00
16	0:00:15	0	0	15	00	00	16	0:00:15	0	0	15	00	00	16	0:00:15	0	0	15	00	00	16	0:00:15	0	0	15	00	00
17																											

Run File 11		Time Base: 21 mm						Run File 12		Time Base: 21 mm							
Run	Time	SSE	MSD	QD	MS	SSE	MSD	QD	MS	SSE	MSD	QD	MS	SSE	MSD	QD	MS
21 Mar 25	14.18	1.15	23.57	4.00	15.80	1.15	23.57	4.00	15.80	21 Mar 25	13.91	0.21	28.48	4.00	13.85	0.21	28.48
21 Mar 25	15.11	0.33	24.80	4.00	16.27	0.33	24.80	4.00	16.27	21 Mar 25	14.04	0.14	28.84	4.00	14.04	0.14	28.84
21 Mar 25	15.12	0.32	24.79	4.00	16.14	0.32	24.79	4.00	16.14	21 Mar 25	14.03	0.13	28.79	4.00	14.03	0.13	28.79
21 Mar 25	15.13	0.33	24.81	4.00	16.16	0.33	24.81	4.00	16.16	21 Mar 25	14.04	0.14	28.84	4.00	14.04	0.14	28.84
21 Mar 25	15.14	0.34	24.82	4.00	16.18	0.34	24.82	4.00	16.18	21 Mar 25	14.05	0.15	28.89	4.00	14.05	0.15	28.89
21 Mar 25	15.15	0.35	24.83	4.00	16.20	0.35	24.83	4.00	16.20	21 Mar 25	14.06	0.16	28.94	4.00	14.06	0.16	28.94
21 Mar 25	15.16	0.36	24.84	4.00	16.22	0.36	24.84	4.00	16.22	21 Mar 25	14.07	0.17	28.99	4.00	14.07	0.17	28.99
21 Mar 25	15.17	0.37	24.85	4.00	16.24	0.37	24.85	4.00	16.24	21 Mar 25	14.08	0.18	29.04	4.00	14.08	0.18	29.04
21 Mar 25	15.18	0.38	24.86	4.00	16.26	0.38	24.86	4.00	16.26	21 Mar 25	14.09	0.19	29.09	4.00	14.09	0.19	29.09
21 Mar 25	15.19	0.39	24.87	4.00	16.28	0.39	24.87	4.00	16.28	21 Mar 25	14.10	0.20	29.14	4.00	14.10	0.20	29.14
21 Mar 25	15.20	0.40	24.88	4.00	16.30	0.40	24.88	4.00	16.30	21 Mar 25	14.11	0.21	29.19	4.00	14.11	0.21	29.19
21 Mar 25	15.21	0.41	24.89	4.00	16.32	0.41	24.89	4.00	16.32	21 Mar 25	14.12	0.22	29.24	4.00	14.12	0.22	29.24
21 Mar 25	15.22	0.42	24.90	4.00	16.34	0.42	24.90	4.00	16.34	21 Mar 25	14.13	0.23	29.29	4.00	14.13	0.23	29.29
21 Mar 25	15.23	0.43	24.91	4.00	16.36	0.43	24.91	4.00	16.36	21 Mar 25	14.14	0.24	29.34	4.00	14.14	0.24	29.34
21 Mar 25	15.24	0.44	24.92	4.00	16.38	0.44	24.92	4.00	16.38	21 Mar 25	14.15	0.25	29.39	4.00	14.15	0.25	29.39
21 Mar 25	15.25	0.45	24.93	4.00	16.40	0.45	24.93	4.00	16.40	21 Mar 25	14.16	0.26	29.44	4.00	14.16	0.26	29.44
21 Mar 25	15.26	0.46	24.94	4.00	16.42	0.46	24.94	4.00	16.42	21 Mar 25	14.17	0.27	29.49	4.00	14.17	0.27	29.49
21 Mar 25	15.27	0.47	24.95	4.00	16.44	0.47	24.95	4.00	16.44	21 Mar 25	14.18	0.28	29.54	4.00	14.18	0.28	29.54
21 Mar 25	15.28	0.48	24.96	4.00	16.46	0.48	24.96	4.00	16.46	21 Mar 25	14.19	0.29	29.59	4.00	14.19	0.29	29.59
21 Mar 25	15.29	0.49	24.97	4.00	16.48	0.											



Reference Method Data

Client Name Gulf P/P UT Co., Ltd Date 31 Mar 03
 Ward Number 0017 Location 000000 0.0

Panel Name: GOT Location: HRSG 31

Run No: 1 Time Elap: 21 min Run No: 2 Time Elap: 21 min

Plant Name		GWT					Location		HPSG 31				
Run No.	Time	Time	Time	Time	Time	Time	Run No.	Time	Time	Time	Time	Time	
Run No.	Time	Time	Time	Time	Time	Time	Run No.	Time	Time	Time	Time	Time	
11 May 21	6:40	1:14	2:05	1:15	1:36	4:00	11 May 21	6:40	1:14	2:05	1:15	1:36	
11 May 21	6:41	1:15	2:06	1:16	1:37	4:01	11 May 21	6:41	1:15	2:06	1:16	1:37	
11 May 21	6:42	1:16	2:07	1:17	1:38	4:02	11 May 21	6:42	1:16	2:07	1:17	1:38	
11 May 21	6:43	1:17	2:08	1:18	1:39	4:03	11 May 21	6:43	1:17	2:08	1:18	1:39	
11 May 21	6:44	1:18	2:09	1:19	1:40	4:04	11 May 21	6:44	1:18	2:09	1:19	1:40	
11 May 21	6:45	1:19	2:10	1:20	1:41	4:05	11 May 21	6:45	1:19	2:10	1:20	1:41	
11 May 21	6:46	1:20	2:11	1:21	1:42	4:06	11 May 21	6:46	1:20	2:11	1:21	1:42	
11 May 21	6:47	1:21	2:12	1:22	1:43	4:07	11 May 21	6:47	1:21	2:12	1:22	1:43	
11 May 21	6:48	1:22	2:13	1:23	1:44	4:08	11 May 21	6:48	1:22	2:13	1:23	1:44	
11 May 21	6:49	1:23	2:14	1:24	1:45	4:09	11 May 21	6:49	1:23	2:14	1:24	1:45	
11 May 21	6:50	1:24	2:15	1:25	1:46	4:10	11 May 21	6:50	1:24	2:15	1:25	1:46	
11 May 21	6:51	1:25	2:16	1:26	1:47	4:11	11 May 21	6:51	1:25	2:16	1:26	1:47	
11 May 21	6:52	1:26	2:17	1:27	1:48	4:12	11 May 21	6:52	1:26	2:17	1:27	1:48	
11 May 21	6:53	1:27	2:18	1:28	1:49	4:13	11 May 21	6:53	1:27	2:18	1:28	1:49	
11 May 21	6:54	1:28	2:19	1:29	1:50	4:14	11 May 21	6:54	1:28	2:19	1:29	1:50	
11 May 21	6:55	1:29	2:20	1:30	1:51	4:15	11 May 21	6:55	1:29	2:20	1:30	1:51	
11 May 21	6:56	1:30	2:21	1:31	1:52	4:16	11 May 21	6:56	1:30	2:21	1:31	1:52	
11 May 21	6:57	1:31	2:22	1:32	1:53	4:17	11 May 21	6:57	1:31	2:22	1:32	1:53	
11 May 21	6:58	1:32	2:23	1:33	1:54	4:18	11 May 21	6:58	1:32	2:23	1:33	1:54	
11 May 21	6:59	1:33	2:24	1:34	1:55	4:19	11 May 21	6:59	1:33	2:24	1:34	1:55	
11 May 21	7:00	1:34	2:25	1:35	1:56	4:20	11 May 21	7:00	1:34	2:25	1:35	1:56	
11 May 21	7:01	1:35	2:26	1:36	1:57	4:21	11 May 21	7:01	1:35	2:26	1:36	1:57	
11 May 21	7:02	1:36	2:27	1:37	1:58	4:22	11 May 21	7:02	1:36	2:27	1:37	1:58	
11 May 21	7:03	1:37	2:28	1:38	1:59	4:23	11 May 21	7:03	1:37	2:28	1:38	1:59	
11 May 21	7:04	1:38	2:29	1:39	2:00	4:24	11 May 21	7:04	1:38	2:29	1:39	2:00	
11 May 21	7:05	1:39	2:30	1:40	2:01	4:25	11 May 21	7:05	1:39	2:30	1:40	2:01	
11 May 21	7:06	1:40	2:31	1:41	2:02	4:26	11 May 21	7:06	1:40	2:31	1:41	2:02	
11 May 21	7:						11 May 21	7:					

Run No. 3						Run No. 4						Run No. 5					
Date		Time		Time Base		Time Base		Time Base		Time Base		Time Base		Time Base			
Day	Time	SSD	Mils	AS	CS	Day	Time	SSD	Mils	AS	CS	Day	Time	SSD	Mils	AS	CS
11 Mar 25	10:22	1.84	22.27	1.84	18.94	11 Mar 25	10:45	1.84	22.27	1.84	18.94	11 Mar 25	10:45	1.84	22.27	1.84	18.94
11 Mar 25	10:23	1.82	22.27	1.82	18.94	11 Mar 25	10:46	1.84	22.27	1.84	18.94	11 Mar 25	10:46	1.84	22.27	1.84	18.94
11 Mar 25	10:24	1.82	22.27	1.82	18.94	11 Mar 25	10:47	1.84	22.27	1.84	18.94	11 Mar 25	10:47	1.84	22.27	1.84	18.94
11 Mar 25	10:25	1.82	22.27	1.82	18.94	11 Mar 25	10:48	1.84	22.27	1.84	18.94	11 Mar 25	10:48	1.84	22.27	1.84	18.94
11 Mar 25	10:26	1.82	22.27	1.82	18.94	11 Mar 25	10:49	1.84	22.27	1.84	18.94	11 Mar 25	10:49	1.84	22.27	1.84	18.94
11 Mar 25	10:27	1.84	22.27	1.84	18.94	11 Mar 25	10:50	1.84	22.27	1.84	18.94	11 Mar 25	10:50	1.84	22.27	1.84	18.94
11 Mar 25	10:28	1.84	22.27	1.84	18.94	11 Mar 25	10:51	1.84	22.27	1.84	18.94	11 Mar 25	10:51	1.84	22.27	1.84	18.94
11 Mar 25	10:29	1.84	22.27	1.84	18.94	11 Mar 25	10:52	1.84	22.27	1.84	18.94	11 Mar 25	10:52	1.84	22.27	1.84	18.94
11 Mar 25	10:30	1.84	22.27	1.84	18.94	11 Mar 25	10:53	1.84	22.27	1.84	18.94	11 Mar 25	10:53	1.84	22.27	1.84	18.94
11 Mar 25	10:31	1.84	22.27	1.84	18.94	11 Mar 25	10:54	1.84	22.27	1.84	18.94	11 Mar 25	10:54	1.84	22.27	1.84	18.94
11 Mar 25	10:32	1.84	22.27	1.84	18.94	11 Mar 25	10:55	1.84	22.27	1.84	18.94	11 Mar 25	10:55	1.84	22.27	1.84	18.94
11 Mar 25	10:33	1.84	22.27	1.84	18.94	11 Mar 25	10:56	1.84	22.27	1.84	18.94	11 Mar 25	10:56	1.84	22.27	1.84	18.94
11 Mar 25	10:34	1.84	22.27	1.84	18.94	11 Mar 25	10:57	1.84	22.27	1.84	18.94	11 Mar 25	10:57	1.84	22.27	1.84	18.94
11 Mar 25	10:35	1.84	22.27	1.84	18.94	11 Mar 25	10:58	1.84	22.27	1.84	18.94	11 Mar 25	10:58	1.84	22.27	1.84	18.94
11 Mar 25	10:36	1.84	22.27	1.84	18.94	11 Mar 25	10:59	1.84	22.27	1.84	18.94	11 Mar 25	10:59	1.84	22.27	1.84	18.94
11 Mar 25	10:37	1.84	22.27	1.84	18.94	11 Mar 25	11:00	1.84	22.27	1.84	18.94	11 Mar 25	11:00	1.84	22.27	1.84	18.94
11 Mar 25	10:38	1.84	22.27	1.84	18.94	11 Mar 25	11:01	1.84	22.27	1.84	18.94	11 Mar 25	11:01	1.84	22.27	1.84	18.94
11 Mar 25	10:39	1.84	22.27	1.84	18.94	11 Mar 25	11:02	1.84	22.27	1.84	18.94	11 Mar 25	11:02	1.84	22.27	1.84	18.94
11 Mar 25	10:40	1.84	22.27	1.84	18.94	11 Mar 25	11:03	1.84	22.27	1.84	18.94	11 Mar 25	11:03	1.84			

Run No. 1							Run No. 2						
Date		Time Base 21 min					Date		Time Base 21 min				
Day	Year	SSD	NO ₂	CO	PM ₁₀	PM _{2.5}	Day	Year	SSD	NO ₂	CO	PM ₁₀	PM _{2.5}
11 Nov 12	11 Nov	1.60	23.96	0.47	13.41	4.32	11 Nov 12	11 Nov	1.67	24.67	0.40	14.26	4.61
12 Nov 12	11 Nov	1.67	23.96	0.47	13.41	4.32	12 Nov 12	11 Nov	1.70	23.96	0.47	13.41	4.32
13 Nov 12	11 Nov	1.66	24.20	0.49	13.37	4.33	13 Nov 12	11 Nov	1.67	24.67	0.40	14.26	4.61
14 Nov 12	11 Nov	1.60	23.96	0.47	13.41	4.32	14 Nov 12	11 Nov	1.69	24.67	0.40	14.26	4.61
15 Nov 12	11 Nov	1.66	24.20	0.49	13.37	4.33	15 Nov 12	11 Nov	1.67	24.67	0.40	14.26	4.61
16 Nov 12	11 Nov	1.60	23.96	0.47	13.41	4.32	16 Nov 12	11 Nov	1.68	24.67	0.40	14.26	4.61
17 Nov 12	11 Nov	1.66	24.20	0.49	13.37	4.33	17 Nov 12	11 Nov	1.67	24.67	0.40	14.26	4.61
18 Nov 12	11 Nov	1.60	23.96	0.47	13.41	4.32	18 Nov 12	11 Nov	1.67	24.67	0.40	14.26	4.61
19 Nov 12	11 Nov	1.66	24.20	0.49	13.37	4.33	19 Nov 12	11 Nov	1.67	24.67	0.40	14.26	4.61
20 Nov 12	11 Nov	1.60	23.96	0.47	13.41	4.32	20 Nov 12	11 Nov	1.67	24.67	0.40	14.26	4.61
21 Nov 12	11 Nov	1.66	24.20	0.49	13.37	4.33	21 Nov 12	11 Nov	1.67	24.67	0.40	14.26	4.61
22 Nov 12	11 Nov	1.60	23.96	0.47	13.41	4.32	22 Nov 12	11 Nov	1.67	24.67	0.40	14.26	4.61
23 Nov 12	11 Nov	1.66	24.20	0.49	13.37	4.33	23 Nov 12	11 Nov	1.67	24.67	0.40	14.26	4.61
24 Nov 12	11 Nov	1.60	23.96	0.47	13.41	4.32	24 Nov 12	11 Nov	1.67	24.67	0.40	14.26	4.61
25 Nov 12	11 Nov	1.66	24.20	0.49	13.37	4.33	25 Nov 12	11 Nov	1.67	24.67	0.40	14.26	4.61
26 Nov 12	11 Nov	1.60	23.96	0.47	13.41	4.32	26 Nov 12	11 Nov	1.67	24.67	0.40	14.26	4.61
27 Nov 12	11 Nov	1.66	24.20	0.49	13.37	4.33	27 Nov 12	11 Nov	1.67	24.67	0.40	14.26	4.61
28 Nov 12	11 Nov	1.60	23.96	0.47	13.41	4.32	28 Nov 12	11 Nov	1.67	24.67	0.40	14.26	4.61
29 Nov 12	11 Nov	1.66	24.20	0.49	13.37	4.33	29 Nov 12	11 Nov	1.67	24.67	0.40	14.26	4.61
30 Nov 12	11 Nov	1.60	23.96	0.47	13.41	4.32	30 Nov 12	11 Nov	1.67	24.67	0.40	14.26	4.61
1 Dec 12	11 Nov	1.66	24.20	0.49	13.37	4.33	1 Dec 12	11 Nov	1.67	24.67	0.40	14.26	4.61
2 Dec 12	11 Nov	1.60	23.96	0.47	13.41	4.32	2 Dec 12	11 Nov	1.67	24.67	0.40	14.26	4.61
3 Dec 12	11 Nov	1.66	24.20	0.49	13.37	4.33	3 Dec 12	11 Nov	1.67	24.67	0.40	14.26	4.61
4 Dec 12	11 Nov	1.60	23.96	0.47	13.41	4.32	4 Dec 12	11 Nov	1.67	24.67	0.40	14.26	4.61
5 Dec 12	11 Nov	1.66	24.20	0.49	13.37	4.33	5 Dec 12	11 Nov	1.67	24.67	0.40	14.26	4.61
6 Dec 12	11 Nov												

Reference Method Data

Client Name	OUT / F UT Ch. Lst
Plant Name	OUT

Date	31 Mar 2
Location	HRSD 1

31 MAY 2005
HRSD 1

Date	31 Mar 2
Location	HRSD 1

Run No. 7						Time Base: 21 min						Run No. 8						Time Base: 21 min					
Date	Time	SSD	HQ	DO	DO ₂	Date	Time	SSD	HQ	DO	DO ₂	Date	Time	SSD	HQ	DO	DO ₂	Date	Time	SSD	HQ	DO	DO ₂
5 May	11:40	8.63	20.88	8.15	14.52	5 May	12:05	8.45	20.88	8.15	14.52	5 May	12:05	8.45	20.88	8.15	14.52	5 May	12:05	8.45	20.88	8.15	14.52
5 May	11:41	8.22	20.88	8.15	14.52	5 May	12:06	8.45	20.88	8.15	14.52	5 May	12:06	8.45	20.88	8.15	14.52	5 May	12:06	8.45	20.88	8.15	14.52
5 May	11:42	8.43	20.88	8.15	14.52	5 May	12:07	8.45	20.88	8.15	14.52	5 May	12:07	8.45	20.88	8.15	14.52	5 May	12:07	8.45	20.88	8.15	14.52
5 May	11:43	8.43	20.88	8.15	14.52	5 May	12:08	8.45	20.88	8.15	14.52	5 May	12:08	8.45	20.88	8.15	14.52	5 May	12:08	8.45	20.88	8.15	14.52
5 May	11:44	8.43	20.88	8.15	14.52	5 May	12:09	8.45	20.88	8.15	14.52	5 May	12:09	8.45	20.88	8.15	14.52	5 May	12:09	8.45	20.88	8.15	14.52
5 May	11:45	8.43	20.88	8.15	14.52	5 May	12:10	8.45	20.88	8.15	14.52	5 May	12:10	8.45	20.88	8.15	14.52	5 May	12:10	8.45	20.88	8.15	14.52
5 May	11:46	8.43	20.88	8.15	14.52	5 May	12:11	8.45	20.88	8.15	14.52	5 May	12:11	8.45	20.88	8.15	14.52	5 May	12:11	8.45	20.88	8.15	14.52
5 May	11:47	8.43	20.88	8.15	14.52	5 May	12:12	8.45	20.88	8.15	14.52	5 May	12:12	8.45	20.88	8.15	14.52	5 May	12:12	8.45	20.88	8.15	14.52
5 May	11:48	8.43	20.88	8.15	14.52	5 May	12:13	8.45	20.88	8.15	14.52	5 May	12:13	8.45	20.88	8.15	14.52	5 May	12:13	8.45	20.88	8.15	14.52
5 May	11:49	8.43	20.88	8.15	14.52	5 May	12:14	8.45	20.88	8.15	14.52	5 May	12:14	8.45	20.88	8.15	14.52	5 May	12:14	8.45	20.88	8.15	14.52
5 May	11:50	8.43	20.88	8.15	14.52	5 May	12:15	8.45	20.88	8.15	14.52	5 May	12:15	8.45	20.88	8.15	14.52	5 May	12:15	8.45	20.88	8.15	14.52
5 May	11:51	8.43	20.88	8.15	14.52	5 May	12:16	8.45	20.88	8.15	14.52	5 May	12:16	8.45	20.88	8.15	14.52	5 May	12:16	8.45	20.88	8.15	14.52
5 May	11:52	8.43	20.88	8.15	14.52	5 May	12:17	8.45	20.88	8.15	14.52	5 May	12:17	8.45	20.88	8.15	14.52	5 May	12:17	8.45	20.88	8.15	14.52
5 May	11:53	8.43	20.88	8.15	14.52	5 May	12:18	8.45	20.88	8.15	14.52	5 May	12:18	8.45	20.88	8.15	14.52	5 May	12:18	8.45	20.88	8.15	14.52
5 May	11:54	8.43	20.88	8.15	14.52	5 May	12:19	8.45	20.88	8.15	14.52	5 May	12:19	8.45	20.88	8.15	14.52	5 May	12:19	8.45	20.88	8.15	14.52
5 May	11:55	8.43	20.88	8.15	14.52	5 May	12:20	8.45	20.88	8.15	14.52	5 May	12:20	8.45	20.88	8.15	14.52	5 May	12:20	8.45	20.88	8.15	14.52
5 May	11:56	8.43	20.88	8.15	14.52	5 May	12:21	8.45	20.88	8.15	14.52	5 May	12:21	8.45									

Run No.	Time Base = 21 min					Run No.	Time Base = 21 min				
Date	Time	EOI	NOx	CO	CO2	Date	Time	EOI	NOx	CO	CO2
11/19/23	12:28	8.47	17.22	16.48	9.47	11/19/23	12:40	8.47	17.22	16.48	9.47
11/19/23	12:31	8.44	17.18	16.48	9.47	11/19/23	12:43	8.44	17.18	16.48	9.47
11/19/23	12:34	8.48	17.19	16.50	9.47	11/19/23	12:46	8.51	17.21	16.51	9.47
11/19/23	12:37	8.48	17.20	16.50	9.47	11/19/23	12:49	8.51	17.21	16.51	9.47
11/19/23	12:40	8.47	17.23	16.48	9.47	11/19/23	12:52	8.48	17.27	16.58	9.48
11/19/23	12:43	8.44	17.21	16.51	9.46	11/19/23	12:55	8.49	17.28	16.59	9.48
11/19/23	12:46	8.48	17.20	16.50	9.47	11/19/23	12:58	8.51	17.29	16.61	9.48
11/19/23	12:49	8.48	17.20	16.50	9.47	11/19/23	13:01	8.52	17.31	16.62	9.48
11/19/23	12:52	8.47	17.23	16.48	9.47	11/19/23	13:04	8.52	17.31	16.62	9.48
11/19/23	12:55	8.47	17.23	16.48	9.47	11/19/23	13:07	8.51	17.28	16.59	9.47
11/19/23	12:58	8.47	17.23	16.48	9.47	11/19/23	13:10	8.51	17.28	16.59	9.47
11/19/23	13:01	8.47	17.23	16.48	9.47	11/19/23	13:13	8.52	17.30	16.61	9.48
11/19/23	13:04	8.49	17.24	16.51	9.47	11/19/23	13:16	8.52	17.30	16.61	9.48
11/19/23	13:07	8.49	17.24	16.51	9.47	11/19/23	13:19	8.52	17.30	16.61	9.48
11/19/23	13:10	8.49	17.24	16.51	9.47	11/19/23	13:22	8.52	17.30	16.61	9.48
11/19/23	13:13	8.49	17.24	16.51	9.47	11/19/23	13:25	8.52	17.30	16.61	9.48
11/19/23	13:16	8.49	17.24	16.51	9.47	11/19/23	13:28	8.52	17.30	16.61	9.48
11/19/23	13:19	8.49	17.24	16.51	9.47	11/19/23	13:31	8.52	17.30	16.61	9.48
11/19/23	13:22	8.49	17.24	16.51	9.47	11/19/23	13:34	8.52	17.30	16.61	9.48
11/19/23	13:25	8.49	17.24	16.51	9.47	11/19/23	13:37	8.52	17.30	16.61	9.48
11/19/23	13:28	8.49	17.24	16.51	9.47	11/19/23	13:40	8.52	17.30	16.61	9.48
11/19/23	13:31	8.49	17.24	16.51	9.47	11/19/23	13:43	8.52	17.30	16.61	9.48
11/19/23	13:34	8.49	17.24	16.51	9.47	11/19/23	13:46	8.52	17.30	16.61	9.48
11/19/23	13:37	8.49	17.24	16.51	9.47	11/19/23	13:49	8.52	17.30	16.61	9.48
11/19/23	13:40	8.49	17.24	16.51	9.47	11/19/23	13:52	8.52	17.30	16.61	9.48
11/19/23	13:43	8.49	17.24	16.51	9.47	11/19/23	13:55	8.52	17.30	16.61	9.48
11/19/23	13:46	8.49	17.24	16.51	9.47	11/19/23	13:58	8.52	17.30	16.61	9.48
11/19/23	13:49	8.49	17.24	16.51	9.47	11/19/23	14:01	8.52	17.30	16.61	9.48
11/19/23	13:52	8.49	17.24	16.51	9.47	11/19/23	14:04	8.52	17.30	16.61	9.48
11/19/23	13:55	8.49	17.24	16.51	9.47	11/19/23	14:07	8.52	17.30	16.61	9.48
11/19/23	13:58	8.									

[illegible]

CEMs Data

Client Name Gulf JP UT Co Ltd

Location HRSG 11

Client Name Gulf JP UT Co Ltd

Location HRSG 11[illegible]

CEMs Data

Client name Gulf JP UT Co Ltd

Indicator _____ HRSQ 11

Indicator _____ HRSQ 11

Indicator _____ HRSQ 11

Plant Name				Run #				Run #				Run #			
Run # 5				Run # 6				Run # 7				Run # 8			
Date	Time	Flowrate	Temperature	Date	Time	Flowrate	Temperature	Date	Time	Flowrate	Temperature	Date	Time	Flowrate	Temperature
3/26/02	12:25	1824	108.8	3/26/02	12:47	1888.5	108.9	3/26/02	12:27	1820	108.8	3/26/02	12:28	1836.58	108.8
3/26/02	12:26	1879.91	108.8	3/26/02	12:48	1889.11	108.9	3/26/02	12:28	1827.96	108.8	3/26/02	12:29	1848.41	108.8
3/26/02	12:27	1878.58	108.8	3/26/02	12:49	1888.73	108.9	3/26/02	12:29	1827.39	108.8	3/26/02	12:30	1847.53	108.8
3/26/02	12:28	1880.29	108.8	3/26/02	12:50	1888.35	108.9	3/26/02	12:30	1826.82	108.8	3/26/02	12:31	1846.55	108.8
3/26/02	12:29	1881.24	108.8	3/26/02	12:51	1887.77	108.9	3/26/02	12:31	1826.25	108.8	3/26/02	12:32	1845.58	108.8
3/26/02	12:30	1882.09	108.8	3/26/02	12:52	1887.20	108.9	3/26/02	12:32	1825.68	108.8	3/26/02	12:33	1844.61	108.8
3/26/02	12:31	1882.94	108.8	3/26/02	12:53	1886.62	108.9	3/26/02	12:33	1825.11	108.8	3/26/02	12:34	1843.64	108.8
3/26/02	12:32	1883.79	108.8	3/26/02	12:54	1886.05	108.9	3/26/02	12:34	1824.54	108.8	3/26/02	12:35	1842.67	108.8
3/26/02	12:33	1884.64	108.8	3/26/02	12:55	1885.47	108.9	3/26/02	12:35	1823.97	108.8	3/26/02	12:36	1841.70	108.8
3/26/02	12:34	1885.49	108.8	3/26/02	12:56	1884.90	108.9	3/26/02	12:36	1823.40	108.8	3/26/02	12:37	1840.73	108.8
3/26/02	12:35	1886.34	108.8	3/26/02	12:57	1884.32	108.9	3/26/02	12:37	1822.83	108.8	3/26/02	12:38	1839.76	108.8
3/26/02	12:36	1887.19	108.8	3/26/02	12:58	1883.75	108.9	3/26/02	12:38	1822.26	108.8	3/26/02	12:39	1838.79	108.8
3/26/02	12:37	1888.04	108.8	3/26/02	12:59	1883.17	108.9	3/26/02	12:39	1821.69	108.8	3/26/02	12:40	1837.82	108.8
3/26/02	12:38	1888.89	108.8	3/26/02	13:00	1882.60	108.9	3/26/02	12:40	1821.12	108.8	3/26/02	12:41	1836.85	108.8
3/26/02	12:39	1889.74	108.8	3/26/02	13:01	1882.02	108.9	3/26/02	12:41	1820.55	108.8	3/26/02	12:42	1835.88	108.8
3/26/02	12:40	1890.59	108.8	3/26/02	13:02	1881.45	108.9	3/26/02	12:42	1819.98	108.8	3/26/02	12:43	1834.91	108.8
3/26/02	12:41	1891.44	108.8	3/26/02	13:03	1880.87	108.9	3/26/02	12:43	1819.41	108.8	3/26/02	12:44	1833.94	108.8
3/26/02	12:42	1892.29	108.8	3/26/02	13:04	1880.30	108.9	3/26/02	12:44	1818.84	108.8	3/26/02	12:45	1832.97	108.8
3/26/02	12:43	1893.14	108.8	3/26/02	13:05	1879.72	108.9	3/26/02	12:45	1818.27	108.8	3/26/02	12:46	1832.00	108.8
3/26/02	12:44	1893.99	108.8	3/26/02	13:06										



CEMs Data

Client Name	Gulf JP UT Co. Ltd
Plant Name	OUT

Location HR50

Client Name	Gulf JP UT Co. Ltd
Plant Name	OUT

Location HR50

Run #10				Run #12				Run #13				Run #14			
Date	Time	Fluence [mJ/cm ²]	Temperature [°C]	Date	Time	Fluence [mJ/cm ²]	Temperature [°C]	Date	Time	Fluence [mJ/cm ²]	Temperature [°C]	Date	Time	Fluence [mJ/cm ²]	Temperature [°C]
3-Mar-13	21:45	1977.00	-	3-Mar-13	21:05	1987.75	-	3-Mar-13	21:22	1934.00	-	3-Mar-13	14:47	1697.00	-
3-Mar-13	21:46	1987.27	-	3-Mar-13	21:20	1997.00	-	3-Mar-13	21:23	1937.00	-	3-Mar-13	14:48	1697.27	-
3-Mar-13	21:48	1997.54	-	3-Mar-13	21:27	2007.27	-	3-Mar-13	21:24	1947.27	-	3-Mar-13	14:49	1697.54	-
3-Mar-13	21:49	2007.81	-	3-Mar-13	21:30	2017.54	-	3-Mar-13	21:25	1957.54	-	3-Mar-13	14:50	1697.81	-
3-Mar-13	21:50	2018.08	-	3-Mar-13	21:33	2027.81	-	3-Mar-13	21:26	1967.81	-	3-Mar-13	14:51	1698.08	-
3-Mar-13	21:51	2028.35	-	3-Mar-13	21:37	2038.08	-	3-Mar-13	21:27	1977.08	-	3-Mar-13	14:52	1698.35	-
3-Mar-13	21:52	2038.62	-	3-Mar-13	21:42	2048.35	-	3-Mar-13	21:28	1987.35	-	3-Mar-13	14:53	1698.62	-
3-Mar-13	21:53	2048.89	-	3-Mar-13	21:47	2058.62	-	3-Mar-13	21:29	1997.62	-	3-Mar-13	14:54	1698.89	-
3-Mar-13	21:54	2059.16	-	3-Mar-13	21:52	2068.89	-	3-Mar-13	21:30	2007.89	-	3-Mar-13	14:55	1699.16	-
3-Mar-13	21:55	2069.43	-	3-Mar-13	21:57	2079.16	-	3-Mar-13	21:31	2018.16	-	3-Mar-13	14:56	1699.43	-
3-Mar-13	21:56	2079.70	-	3-Mar-13	22:02	2089.43	-	3-Mar-13	21:32	2028.43	-	3-Mar-13	14:57	1699.70	-
3-Mar-13	21:57	2089.97	-	3-Mar-13	22:07	2099.70	-	3-Mar-13	21:33	2038.70	-	3-Mar-13	14:58	1699.97	-
3-Mar-13	21:58	2099.24	-	3-Mar-13	22:12	2109.97	-	3-Mar-13	21:34	2048.97	-	3-Mar-13	14:59	1700.24	-
3-Mar-13	21:59	2109.51	-	3-Mar-13	22:17	2119.24	-	3-Mar-13	21:35	2059.24	-	3-Mar-13	15:00	1700.51	-
3-Mar-13	22:00	2119.78	-	3-Mar-13	22:22	2129.51	-	3-Mar-13	21:36	2069.51	-	3-Mar-13	15:01	1700.78	-
3-Mar-13	22:01	2129.05	-	3-Mar-13	22:27	2139.78	-	3-Mar-13	21:37	2079.78	-	3-Mar-13	15:02	1701.05	-
3-Mar-13	22:02	2139.32	-	3-Mar-13	22:32	2149.05	-	3-Mar-13	21:38	2089.05	-	3-Mar-13	15:03	1701.32	-
3-Mar-13	22:03	2149.59	-	3-Mar-13	22:37	2159.32	-	3-Mar-13	21:39	2099.32	-	3-Mar-13	15:04	1701.59	-
3-Mar-13	22:04	2159.86	-	3-Mar-13	22:42	2169.59	-	3-Mar-13	21:40	2109.59	-	3-Mar-13	15:05	1701.86	-
3-Mar-13	22:05	2169.13	-	3-Mar-13	22:47	2179.86	-	3-Mar-13	21:41	2119.86	-	3-Mar-13	15:06	1702.13	-
3-Mar-13	22:06	2179.40	-	3-Mar-13	22:52	2189.13	-	3-Mar-13	21:42	2129.13	-	3-Mar-13	15:07	1702.40	-
3-Mar-13	22:07	2189.67	-	3-Mar-13	22:57	2199.40	-	3-Mar-13	21:43	2139.40	-	3-Mar-13	15:08	1702.67	-
3-Mar-13	22:08	2199.94	-	3-Mar-13	23:02										



ANALYZER CALIBRATION DATA

Lot No. 2227642-1

Client : Gulf JP UT Co., Ltd. Location : HRSG 12
Date : 03 Apr 23 Test Operator : Usamee N.

O₂ ANALYZER
Model : TELEDYNE API 200EH Serial No. : 548
Span (%) : 25

	Cylinder Value (%)	Initial Analyze Calibration Response (%)	Final Analyze Calibration Response (%)	Difference (Percent of Span)
Zero Gas	0.00	0.03	0.03	0.00
Low-Level Gas	8.00	8.06	8.07	0.04
Span Gas	16.00	16.08	16.09	0.04

NO_x ANALYZER
Model : TELEDYNE API 200EH Serial No. : 548
Span (ppm) : 200

	Cylinder Value (ppm)	Initial Analyze Calibration Response (ppm)	Final Analyze Calibration Response (ppm)	Difference (Percent of Span)
Zero Gas	0.00	0.00	0.04	0.01
Low-Level Gas	50.00	50.04	50.00	0.02
Span Gas	150.00	157.64	157.69	0.03

SO₂ ANALYZER
Model : TELEDYNE API 100EH Serial No. : 282
Span (ppm) : 200

	Cylinder Value (ppm)	Initial Analyze Calibration Response (ppm)	Final Analyze Calibration Response (ppm)	Difference (Percent of Span)
Zero Gas	0.00	0.00	0.04	0.01
Low-Level Gas	50.00	49.73	49.75	0.01
Span Gas	150.00	150.48	150.55	0.04

CO ANALYZER
Model : TELEDYNE API 300EH Serial No. : 300
Span (ppm) : 200

	Cylinder Value (ppm)	Initial Analyze Calibration Response (ppm)	Final Analyze Calibration Response (ppm)	Difference (Percent of Span)
Zero Gas	0.00	0.04	0.04	0.00
Low-Level Gas	40.00	40.12	40.46	0.06
Span Gas	157.00	156.68	156.97	0.06

CO₂ ANALYZER
Model : TELEDYNE API 300EH Serial No. : 300
Span (%) : 25

	Cylinder Value (%)	Initial Analyze Calibration Response (%)	Final Analyze Calibration Response (%)	Difference (Percent of Span)
Zero Gas	0.00	0.00	0.01	0.04
Low-Level Gas	15.00	15.01	15.01	0.00
Span Gas	22.00	22.77	22.74	0.12

Calibrated by

(Mr. Usamee Namburee)
Environmental Field Scientist (4)

FORM NO. P-56-124 (REVISION NO. 1) ISSUE DATE: 03B-18

ALS Laboratory Group



SYSTEM CALIBRATION BIAS AND DRIFT DATA

Lot No. 2227642-1

Client : Gulf JP UT Co., Ltd. Location : HRSG 12
Date : 03 Apr 23 Test Operator : Usamee N.

O₂ ANALYZER
Cylinder Conc. (%) : 16.00 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	0.03	0.03	0.00	0.03	0.00	0.00
Upscale Gas	16.08	16.10	0.08	16.11	0.12	0.04

NO_x ANALYZER
Cylinder Conc. (ppm) : 158.20 Span (ppm) : 200

	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	0.05	0.05	0.00	0.05	0.00	0.00
Upscale Gas	157.64	157.50	0.32	156.70	0.47	0.15

SO₂ ANALYZER
Cylinder Conc. (ppm) : 161.60 Span (ppm) : 200

	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	0.03	0.04	0.01	0.04	0.01	0.00
Upscale Gas	160.48	158.38	1.05	158.33	1.13	0.08

CO ANALYZER
Cylinder Conc. (ppm) : 167.60 Span (ppm) : 200

	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	0.04	0.04	0.00	0.04	0.00	0.00
Upscale Gas	156.89	156.45	0.22	156.31	0.29	0.07

CO₂ ANALYZER
Cylinder Conc. (%) : 22.84 Span (%) : 25

	CO 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	0.01	0.04	0.00
Upscale Gas	22.77	22.72	0.20	22.72	0.20	0.00

Calibrated by

(Mr. Usamee Namburee)
Environmental Field Scientist (4)

FORM NO. P-56-124 (REVISION NO. 1) ISSUE DATE: 03B-18

ALS Laboratory Group



CEMS Data

Client Name : Gulf JP UT Co., Ltd.
Plant Name : QUT Location : HRSG 12

Run No. 1					Time Base: 11 min					Run No. 2					Time Base: 21 min				
Time	Time	Time	Time	Time	Time	Time	Time	Time	Time	Time	Time	Time	Time	Time	Time	Time	Time		
00:00	00:00	00:00	00:00	00:00	00:00	00:00	00:00	00:00	00:00	00:00	00:00	00:00	00:00	00:00	00:00	00:00	00:00		
00:11	00:11	00:11	00:11	00:11	00:11	00:11	00:11	00:11	00:11	00:11	00:11	00:11	00:11	00:11	00:11	00:11	00:11		
00:22	00:22	00:22	00:22	00:22	00:22	00:22	00:22	00:22	00:22	00:22	00:22	00:22	00:22	00:22	00:22	00:22	00:22		
00:33	00:33	00:33	00:33	00:33	00:33	00:33	00:33	00:33	00:33	00:33	00:33	00:33	00:33	00:33	00:33	00:33	00:33		
00:44	00:44	00:44	00:44	00:44	00:44	00:44	00:44	00:44	00:44	00:44	00:44	00:44	00:44	00:44	00:44	00:44	00:44		
00:55	00:55	00:55	00:55	00:55	00:55	00:55	00:55	00:55	00:55	00:55	00:55	00:55	00:55	00:55	00:55	00:55	00:55		
01:06	01:06	01:06	01:06	01:06	01:06	01:06	01:06	01:06	01:06	01:06	01:06	01:06	01:06	01:06	01:06	01:06	01:06		
01:17	01:17	01:17	01:17	01:17	01:17	01:17	01:17	01:17	01:17	01:17	01:17	01:17	01:17	01:17	01:17	01:17	01:17		
01:28	01:28	01:28	01:28	01:28	01:28	01:28	01:28	01:28	01:28	01:28	01:28	01:28	01:28	01:28	01:28	01:28	01:28		
01:39	01:39	01:39	01:39	01:39	01:39	01:39	01:39	01:39	01:39	01:39	01:39	01:39	01:39	01:39	01:39	01:39	01:39		
01:50	01:50	01:50	01:50	01:50	01:50	01:50	01:50	01:50	01:50	01:50	01:50	01:50	01:50	01:50	01:50	01:50	01:50		
02:01	02:01	02:01	02:01	02:01	02:01	02:01	02:01	02:01	02:01	02:01	02:01	02:01	02:01	02:01	02:01	02:01	02:01		
02:12	02:12	02:12	02:12	02:12	02:12	02:12	02:12	02:12	02:12	02:12	02:12	02:12	02:12	02:12	02:12	02:12	02:12		
02:23	02:23	02:23	02:23	02:23	02:23	02:23	02:23	02:23	02:23	02:23	02:23	02:23	02:23	02:23	02:23	02:23	02:23		
02:34	02:34	02:34	02:34	02:34	02:34	02:34	02:34	02:34	02:34	02:34	02:34	02:34	02:34	02:34	02:34	02:34	02:34		
02:45	02:45	02:45	02:45	02:45	02:45	02:45	02:45	02:45	02:45	02:45	02:45	02:45	02:45	02:45	02:45	02:45	02:45		
02:56	02:56	02:56	02:56	02:56	02:56	02:56	02:56	02:56	02:56	02:56	02:56	02:56	02:56	02:56	02:56	02:56	02:56		
03:07	03:07	03:07	03:07	03:07	03:07	03:07	03:07	03:07	03:07	03:07	03:07	03:07	03:07	03:07	03:07	03:07	03:07		
03:18	03:18	03:18	03:18	03:18	03:18	03:18	03:18	03:18	03:18	03:18	03:18	03:18	03:18	03:18	03:18	03:18	03:18		
03:29	03:29	03:29	03:29	03:29	03:29	03:29	03:29	03:29	03:29	03:29	03:29	03:29	03:29	03:29	03:29	03:29	03:29		
03:40	03:40	03:40	03:40	03:40	03:40	03:40	03:40	03:40	03:40	03:40	03:40	03:40	03:40	03:40	03:40	03:40	03:40		
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07:31	07:31	07:31	07:31	07:31	07:31	07:31	07:31	07:31	07:31	07:31	07:31	07:31	07:31	07:31	07:31	07:31	07:31		
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08:26	08:26	08:26	08:26	08:26	08:26	08:26	08:26	08:26	08:26	08:26	08:26	08:26	08:26	08:26	08:26	08:26	08:26		
08:37	08:37	08:37	08:37	08:37	08:37	08:37	08:37	08:37	08:37	08:37	08:37	08:37	08:37	08:37	08:37	08:37	08:37		
08:48	08:48	08:48	08:48	08:48	08:48	08:48	08:48	08:48	08:48	08:48	08:48	08:48	08:48	08:48	08:48	08:48	08:48		
08:59	08:59	08:59	08:59	08:59	08:59	08:59	08:59	08:59	08:59	08:59	08:59	08:59	08:59	08:59	08:59	08:59	08:59		
09:10	09:10	09:10	09:10	09:10	09:10	09:10	09:10	09:10	09:10	09:10	09:10	09:10	09:10	09:10	09:10	09:10	09:10		
09:21	09:21	09:21	09:21	09:21	09:21	09:21	09:21	09:21	09:21	09:21	09:21	09:21	09:21	09:21	09:21	09:21	09:21		
09:32	09:32	09:32	09:32	09:32	09:32	09:32	09:32	09:32	09:32	09:32	09:32	09:32	09:32	09:32	09:32	09:32	09:32		
09:43	09:43	09:43	09:43	09:43	09:43	09:43	09:43	09:43	09:43	09:43	09:43	09:43	09:43	09:43	09:43	09:43	09:43		
09:54	09:54	09:54	09:54	09:54	09:54	09:54	09:54	09:54	09:54	09:54	09:54	09:54	09:54	09:54	09:54	09:54	09:54		
10:05	10:05	10:05	10:05	10:05	10:05	10:05	10:05	10:05	10:05	10:05	10:05	10:05	10:05	10:05	10:05	10:05	10:05		
10:16	10:16	10:16	10:16	10:16	10:16	10:16	10:16	10:16	10:16	10:16	10:16	10:16	10:16	10:16	10:16	10:16	10:16		
10:27	10:27	10:27	10:27	10:27	10:27	10:27	10:27	10:27	10:27	10:27	10:27	10:27	10:27	10:27	10:27	10:27	10:27		
10:38	10:38	10:38	10:38	10:38	10:38	10:38	10:38	10:38	10:38	10:38	10:38	10:38	10:38	10:38	10:38	10:38	10:38		
10:49	10:49	10:49	10:49	10:49	10:49	10:49	10:49	10:49	10:49	10:49	10:49	10:49	10:49	10:49	10:49	10:49	10:49		
11:00	11:00	11:00	11:00	11:00	11:00	11:00	11:00	11:00	11:00	11:00	11:00	11:00	11:00	11:00	11:00	11:00	11:00		
11:11	11:11	11:11	11:11	11:11	11:11	11:11	11:11	11:11	11:11	11:11	11:11	11:11	11:11	11:11	11:11	11:11	11:11		
11:22	11:22	11:22	11:22	11:22	11:22	11:22	11:22	11:22	11:22	11:22									



CEMs Data

Client Name: Gulf JP UT Co. Ltd.

Location: HRSG 12

Run No. 9

Run No. 10

Run No. 11

Run No. 12

Date	Time	Flowrate m³/h	Temperature °C	Date	Time	Flowrate m³/h	Temperature °C	Date	Time	Flowrate m³/h	Temperature °C	Date	Time	Flowrate m³/h	Temperature °C
18-Apr-23	12:29	1207.85	118.82	18-Apr-23	12:30	1209.85	118.82	18-Apr-23	12:31	1211.28	118.82	18-Apr-23	12:32	1212.89	118.82
18-Apr-23	12:32	1208.78	118.82	18-Apr-23	12:33	1209.78	118.82	18-Apr-23	12:34	1210.47	118.82	18-Apr-23	12:35	1211.87	118.82
18-Apr-23	12:36	1209.78	118.82	18-Apr-23	12:37	1210.78	118.82	18-Apr-23	12:38	1211.44	118.82	18-Apr-23	12:39	1212.77	118.82
18-Apr-23	12:40	1212.85	118.82	18-Apr-23	12:41	1213.85	118.82	18-Apr-23	12:42	1214.44	118.82	18-Apr-23	12:43	1215.79	118.82
18-Apr-23	12:44	1217.79	118.82	18-Apr-23	12:45	1218.80	118.82	18-Apr-23	12:46	1219.85	118.82	18-Apr-23	12:47	1220.87	118.82
18-Apr-23	12:48	1221.79	118.82	18-Apr-23	12:49	1222.80	118.82	18-Apr-23	12:50	1223.85	118.82	18-Apr-23	12:51	1224.87	118.82
18-Apr-23	12:52	1225.79	118.82	18-Apr-23	12:53	1226.80	118.82	18-Apr-23	12:54	1227.85	118.82	18-Apr-23	12:55	1228.87	118.82
18-Apr-23	12:56	1229.79	118.82	18-Apr-23	12:57	1230.80	118.82	18-Apr-23	12:58	1231.85	118.82	18-Apr-23	12:59	1232.87	118.82
18-Apr-23	13:00	1233.79	118.82	18-Apr-23	13:01	1234.80	118.82	18-Apr-23	13:02	1235.85	118.82	18-Apr-23	13:03	1236.87	118.82
18-Apr-23	13:04	1237.79	118.82	18-Apr-23	13:05	1238.80	118.82	18-Apr-23	13:06	1239.85	118.82	18-Apr-23	13:07	1240.87	118.82
18-Apr-23	13:08	1241.79	118.82	18-Apr-23	13:09	1242.80	118.82	18-Apr-23	13:10	1243.85	118.82	18-Apr-23	13:11	1244.87	118.82
18-Apr-23	13:12	1245.79	118.82	18-Apr-23	13:13	1246.80	118.82	18-Apr-23	13:14	1247.85	118.82	18-Apr-23	13:15	1248.87	118.82
18-Apr-23	13:16	1249.79	118.82	18-Apr-23	13:17	1250.80	118.82	18-Apr-23	13:18	1251.85	118.82	18-Apr-23	13:19	1252.87	118.82
18-Apr-23	13:20	1253.79	118.82	18-Apr-23	13:21	1254.80	118.82	18-Apr-23	13:22	1255.85	118.82	18-Apr-23	13:23	1256.87	118.82
18-Apr-23	13:24	1257.79	118.82	18-Apr-23	13:25	1258.80	118.82	18-Apr-23	13:26	1259.85	118.82	18-Apr-23	13:27	1260.87	118.82
18-Apr-23	13:28	1261.79	118.82	18-Apr-23	13:29	1262.80	118.82	18-Apr-23	13:30	1263.85	118.82	18-Apr-23	13:31	1264.87	118.82
18-Apr-23	13:32	1265.79	118.82	18-Apr-23	13:33	1266.80	118.82	18-Apr-23	13:34	1267.85	118.82	18-Apr-23	13:35	1268.87	118.82
18-Apr-23	13:36	1269.79	118.82	18-Apr-23	13:37	1270.80	118.82	18-Apr-23	13:38	1271.85	118.82	18-Apr-23	13:39	1272.87	118.82
18-Apr-23	13:40	1273.79	118.82	18-Apr-23	13:41	1274.80	118.82	18-Apr-23	13:42	1275.85	118.82	18-Apr-23	13:43	1276.87	118.82
18-Apr-23	13:44	1277.79	118.82	18-Apr-23	13:45	1278.80	118.82	18-Apr-23	13:46	1279.85	118.82	18-Apr-23	13:47	1280.87	118.82
18-Apr-23	13:48	1281.79	118.82	18-Apr-23	13:49	1282.80	118.82	18-Apr-23	13:50	1283.85	118.82	18-Apr-23	13:51	1284.87	118.82
18-Apr-23	13:52	1285.79	118.82	18-Apr-23	13:53	1286.80	118.82	18-Apr-23	13:54	1287.85	118.82	18-Apr-23	13:55	1288.87	118.82
18-Apr-23	13:56	1289.79	118.82	18-Apr-23	13:57	1290.80	118.82	18-Apr-23	13:58	1291.85	118.82	18-Apr-23	13:59	1292.87	118.82
18-Apr-23	14:00	1293.79	118.82	18-Apr-23	14:01	1294.80	118.82	18-Apr-23	14:02	1295.85	118.82	18-Apr-23	14:03	1296.87	118.82
18-Apr-23	14:04	1297.79	118.82	18-Apr-23	14:05	1298.80	118.82	18-Apr-23	14:06	1299.85	118.82	18-Apr-23	14:07	1300.87	118.82
18-Apr-23	14:08	1301.79	118.82	18-Apr-23	14:09	1302.80	118.82	18-Apr-23	14:10	1303.85	118.82	18-Apr-23	14:11	1304.87	118.82
18-Apr-23	14:12	1305.79	118.82	18-Apr-23	14:13	1306.80	118.82	18-Apr-23	14:14	1307.85	118.82	18-Apr-23	14:15	1308.87	118.82
18-Apr-23	14:16	1309.79	118.82	18-Apr-23	14:17	1310.80	118.82	18-Apr-23	14:18	1311.85	118.82	18-Apr-23	14:19	1312.87	118.82
18-Apr-23	14:20	1313.79	118.82	18-Apr-23	14:21	1314.80	118.82	18-Apr-23	14:22	1315.85	118.82	18-Apr-23	14:23	1316.87	118.82
18-Apr-23	14:24	1317.79	118.82	18-Apr-23	14:25	1318.80	118.82	18-Apr-23	14:26	1319.85	118.82	18-Apr-23	14:27	1320.87	118.82
18-Apr-23	14:28	1321.79	118.82	18-Apr-23	14:29	1322.80	118.82	18-Apr-23	14:30	1323.85	118.82	18-Apr-23	14:31	1324.87	118.82
18-Apr-23	14:32	1325.79	118.82	18-Apr-23	14:33	1326.80	118.82	18-Apr-23	14:34	1327.85	118.82	18-Apr-23	14:35	1328.87	118.82
18-Apr-23	14:36	1329.79	118.82	18-Apr-23	14:37	1330.80	118.82	18-Apr-23	14:38	1331.85	118.82	18-Apr-23	14:39	1332.87	118.82
18-Apr-23	14:40	1333.79	118.82	18-Apr-23	14:41	1334.80	118.82	18-Apr-23	14:42	1335.85	118.82	18-Apr-23	14:43	1336.87	118.82
18-Apr-23	14:44	1337.79	118.82	18-Apr-23	14:45	1338.80	118.82	18-Apr-23	14:46	1339.85	118.82	18-Apr-23	14:47	1340.87	118.82
18-Apr-23	14:48	1341.79	118.82	18-Apr-23	14:49	1342.80	118.82	18-Apr-23	14:50	1343.85	118.82	18-Apr-23	14:51	1344.87	118.82
18-Apr-23	14:52	1345.79	118.82	18-Apr-23	14:53	1346.80	118.82	18-Apr-23	14:54	1347.85	118.82	18-Apr-23	14:55	1348.87	118.82
18-Apr-23	14:56	1349.79	118.82	18-Apr-23	14:57	1350.80	118.82	18-Apr-23	14:58	1351.85	118.82	18-Apr-23	14:59	1352.87	118.82
18-Apr-23	15:00	1353.79	118.82	18-Apr-23	15:01	1354.80	118.82	18-Apr-23	15:02	1355.85	118.82	18-Apr-23	15:03	1356.87	118.82
18-Apr-23	15:04	1357.79	118.82	18-Apr-23	15:05	1358.80	118.82	18-Apr-23	15:06	1359.85	118.82	18-Apr-23	15:07	1360.87	118.82
18-Apr-23	15:08	1361.79	118.82	18-Apr-23	15:09	1362.80	118.82	18-Apr-23	15:10	1363.85	118.82	18-Apr-23	15:11	1364.87	118.82
18-Apr-23	15:12	1365.79	118.82	18-Apr-23	15:13	1366.80	118.82	18-Apr-23	15:14	1367.85	118.82	18-Apr-23	15:15	1368.87	118.82
18-Apr-23	15:16	1369.79	118.82	18-Apr-23	15:17	1370.80	118.82	18-Apr-23	15:18	1371.85	118.82	18-Apr-23	15:19	1372.87	118.82
18-Apr-23	15:20	1373.79	118.82	18-Apr-23	15:21	1374.80	118.82	18-Apr-23	15:22	1375.85	118.82	18-Apr-23	15:23	1376.87	118.82
18-Apr-23	15:24	1377.79	118.82	18-Apr-23	15:25	1378.80	118.82	18-Apr-23	15:26	1379.85	118.82	18-Apr-23	15:27	1380.87	118.82
18-Apr-23	15:28	1381.79	118.82	18-Apr-23	15:29	1382.80	118.82	18-Apr-23	15:30	1383.85	118.82	18-Apr-23	15:31	1384.87	118.82
18-Apr-23	15:32	1385.79	118.82	18-Apr-23	15:33	1386.80	118.82	18-Apr-23	15:34	1387.85	118.82	18-Apr-23	15:35	1388.87	118.82
18-Apr-23	15:36	1389.79	118.82	18-Apr-23	15:37	1390.80	118.82	18-Apr-23	15:38	1391.85	118.82	18-Apr-23	15:39	1392.87	118.82
18-Apr-23	15:40	1393.79	118.82	18-Apr-23	15:41	1394.80	118.82	18-Apr-23	15:42	1395.85	118.82	18-Apr-23	15:43	1396.87	118.82
18-Apr-23	15:44	1397.79	118.82	18-Apr-23	15:45	1398.80	118.82	18-Apr-23	15:46	1399.85	118.82	18-Apr-23	15:47	1400.87	118.82
18-Apr-23	15:48	1401.79	118.82	18-Apr-23	15:49	1402.80	118.82	18-Apr-23	15:50	1403.85	118.82	18-Apr-23	15:51	1404.87	118.82
18-Apr-23	15:52	1405.79	118.82	18-Apr-23	15:53	1406.80	118.82	18-Apr-23	15:54	1407.85	118.82	18-Apr-23	15:55	1408.87	118.82
18-Apr-23	15:56	1409.79	118.82	18-Apr-23	15:57	1410.80	118.82	18-Apr-23	15:58	1411.85	118.82	18-Apr-23	15:59	1412.87	118.82
18-Apr-23	16:00	1413.79	118.82	18-Apr-23	16:01	1414.80	118.82	18-Apr-23	16:02	1415.85	118.82	18-Apr-23	16:03	1416.87	118.82
18-Apr-23	16:04	1417.79	118.82	18-Apr-23	16:05	1418.80	118.82	18-Apr-23	16:06	1419.85	118.82	18-Apr-23	16:07	1420.87	118.82
18-Apr-23	16:08	1421.79	118.82	18-Apr-23	16:09	1422.80	118.82	18-Apr-23	16:10	1423.85	118.82	18-Apr-23	16:11	1424.87	118.82
18-Apr-23	16:12	1425.79	118.82	18-Apr-23	16:13	1426.80	118.82	18-Apr-23	16:14	1427.85	118.82	18-Apr-23	16:15	1428.87	118.82
18-Apr-23	16:16	1429.79	118.82	18-Apr-23	16:17	1430.80	118.82	18-Apr-23	16:18	1431.85	118.82	18-Apr-23	16:19	1432.87	118.82
18-Apr-23	16:20	1433.79	118.82	18-Apr-23	16:21	1434.80	118.82	18-Apr-23	16:22	1435.85	118.82	18-Apr-23	16:23	1436.87	118.82
18-Apr-23	16:24	1437.79	118.82	18-Apr-23	16:25	1438.80	118.82	18-Apr-23	16:26	1439.85	118.82	18-Apr-23	16:27	1440.87	118.82
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18-Apr-23	16:32	1445.79	118.82	18-Apr-23	16:33	1446.80	118.82	18-Apr-23	16:34	1447.85	118.82	18-Apr-23	16:35	1448.87	118.82
18-Apr-23	16:36	1449.79	118.82	18-Apr-23	16:37	1450.80	118.82	18-Apr-23	16:38	1451.85	118.82	18-Apr-23	16:39	1452.87	118.82
18-Apr-23	16:40	1453.79	118.82	18-Apr-23	16:41	1454.80	118.82	18-Apr-23	16:42	1455.85	118.82	18-Apr-23	16:43	1456.87	118.82
18-Apr-23	16:44	1457.79	118.82	18-Apr-23	16:45	1458.80	118.82	18-Apr-23	16:46	1459.85	118.82	18-Apr-23	16:47	1460.87	118.82
18-Apr-23	16:48	1461.79	118.82	18-Apr-23	16:49	1462.80	118.82	18-Apr-23	16:50	1463.85	118.82	18-Apr-23	16:51	1464.87	118.

CEMs Data

Client Name	GULF UT Co-Lib	Date	18 Mar 2018
Plant Name	GULF	Location	WASCO

Run No. 7							Time Base: 21 min							Run No. 8							Time Base: 21 min						
Date	Time	800	1000	800	1000	800	1000	Date	Time	800	1000	800	1000	800	1000	800	1000	Date	Time	800	1000	800	1000	800	1000		
14 Nov 20	14:26	8.80	10.87	8.57	10.47			14 Nov 20	14:47	8.21	10.36	8.98	10.42					14 Nov 20	14:57	8.21	10.36	8.98	10.42				
14 Nov 20	14:27	8.90	10.82	8.91	10.46			14 Nov 20	14:48	8.19	10.29	8.91	10.41					14 Nov 20	14:58	8.21	10.36	8.91	10.41				
14 Nov 20	14:28	8.90	10.82	8.91	10.46			14 Nov 20	14:49	8.19	10.29	8.91	10.41					14 Nov 20	14:59	8.21	10.36	8.91	10.41				
14 Nov 20	14:29	8.90	10.75	8.87	10.46			14 Nov 20	14:50	8.19	10.29	8.91	10.41					14 Nov 20	15:00	8.21	10.36	8.91	10.41				
14 Nov 20	14:30	8.90	10.69	8.90	10.46			14 Nov 20	14:51	8.19	10.29	8.91	10.41					14 Nov 20	15:01	8.21	10.36	8.91	10.41				
14 Nov 20	14:31	8.90	10.71	8.87	10.46			14 Nov 20	14:52	8.19	10.29	8.91	10.41					14 Nov 20	15:02	8.21	10.36	8.91	10.41				
14 Nov 20	14:32	1.08	10.50	8.78	10.47			14 Nov 20	14:53	8.20	10.34	8.94	10.40					14 Nov 20	15:03	8.21	10.36	8.94	10.40				
14 Nov 20	14:33	1.09	10.48	8.96	10.47			14 Nov 20	14:54	8.20	10.34	8.94	10.40					14 Nov 20	15:04	8.21	10.36	8.94	10.40				
14 Nov 20	14:34	1.09	10.46	8.93	10.47			14 Nov 20	14:55	8.20	10.34	8.94	10.40					14 Nov 20	15:05	8.21	10.36	8.94	10.40				
14 Nov 20	14:35	1.09	10.44	8.91	10.47			14 Nov 20	14:56	8.20	10.34	8.94	10.40					14 Nov 20	15:06	8.21	10.36	8.94	10.40				
14 Nov 20	14:36	1.09	10.42	8.89	10.47			14 Nov 20	14:57	8.20	10.34	8.94	10.40					14 Nov 20	15:07	8.21	10.36	8.94	10.40				
14 Nov 20	14:37	1.09	10.41	8.87	10.46			14 Nov 20	14:58	8.20	10.34	8.94	10.40					14 Nov 20	15:08	8.21	10.36	8.94	10.40				
14 Nov 20	14:38	1.09	10.40	8.87	10.46			14 Nov 20	14:59	8.20	10.34	8.94	10.40					14 Nov 20	15:09	8.21	10.36	8.94	10.40				
14 Nov 20	14:39	1.09	10.39	8.87	10.46			14 Nov 20	15:00	8.20	10.34	8.94	10.40					14 Nov 20	15:10	8.21	10.36	8.94	10.40				
14 Nov 20	14:40	1.09	10.38	8.87	10.46			14 Nov 20	15:01	8.20	10.34	8.94	10.40					14 Nov 20	15:11	8.21	10.36	8.94	10.40				
14 Nov 20	14:41	1.12	10.37	8.88	10.46			14 Nov 20	15:02	8.20	10.34	8.94	10.40					14 Nov 20	15:12	8.21	10.36	8.94	10.40				
14 Nov 20	14:42	1.12	10.35	8.87	10.46			14 Nov 20	15:03	8.20	10.34	8.94	10.40					14 Nov 20	15:13	8.21	10.36	8.94	10.40				
14 Nov 20	14:43	1.10	10.34	8.71	10.41			14 Nov 20	15:04	8.21	10.35	8.93	10.40					14 Nov 20	15:14	8.21	10.36	8.93	10.40				
14 Nov 20	14:44	1.10	10.33	8.69	10.41			14 Nov 20	15:05	8.19	10.30	8.91	10.41					14 Nov 20	15:15	8.21	10.36	8.91	10.41				
14 Nov 20	14:45	1.10	10.32	8.68	10.41			14 Nov 20	15:06	8.19	10.30	8.91	10.41					14 Nov 20	15:16	8.21	10.36	8.91	10.41				
14 Nov 20	14:46	1.10	10.31	8.67	10.41			14 Nov 20	15:07	8.19	10.30	8.91	10.41					14 Nov 20	15:17	8.21	10.36	8.91	10.41				
14 Nov 20	14:47	1.10	10.30	8.66	10.41			14 Nov 20	15:08	8.19	10.30	8.91	10.41					14 Nov 20	15:18	8.21	10.36	8.91	10.41				
14 Nov 20	14:48	1.10	10.29	8.65	10.41			14 Nov 20	15:09	8.19	10.30	8.91	10.41					14 Nov 20	15:19	8.21	10.36	8.91	10.41				
14 Nov 20	14:49	1.10	10.28	8.64	10.41			14 Nov 20	15:10	8.19	10.30	8.91	10.41					14 Nov 20	15:20	8.21	10.36	8.91	10.41				
14 Nov 20	14:50	1.10	10.27	8.63	10.41			14 Nov 20	15:11	8.19	10.30	8.91	10.41					14 Nov 20	15:21	8.21	10.36	8.91	10.41				
14 Nov 20	14:51	1.10	10.26	8.62	10.41			14 Nov 20	15:12	8.19	10.30	8.91	10.41					14 Nov 20	15:22	8.21	10.36	8.91	10.41				
14 Nov 20	14:52	1.10	10.25	8.61	10.41			14 Nov 20	15:13	8.19	10.30	8.91	10.41					14 Nov 20	15:23	8.21	10.36	8.91	10.41				
14 Nov 20	14:53	1.10	10.24	8.60	10.41			14 Nov 20	15:14	8.19	10.30	8.91	10.41					14 Nov 20	15:24	8.21	10.36	8.91	10.41				
14 Nov 20	14:54	1.10	10.23	8.59	10.41			14 Nov 20	15:15	8.19	10.30	8.91	10.41					14 Nov 20	15:25	8.21	10.36	8.91	10.41				
14 Nov 20	14:55	1.10	10.22	8.58	10.41			14 Nov 20	15:16	8.19	10.30	8.91	10.41					14 Nov 20	15:26	8.21	10.36	8.91	10.41				
14 Nov 20	14:56	1.10	10.21	8.57	10.41			14 Nov 20	15:17	8.19	10.30	8.91	10.41					14 Nov 20	15:27	8.21	10.36	8.91	10.41				
14 Nov 20	14:57	1.10	10.20	8.56	10.41			14 Nov 20	15:18	8.19	10.30	8.91	10.41					14 Nov 20	15:28	8.21	10.36	8.91	10.41				
14 Nov 20	14:58	1.10	10.19	8.55	10.41			14 Nov 20	15:19	8.19	10.30	8.91	10.41					14 Nov 20	15:29	8.21	10.36	8.91	10.41				
14 Nov 20	14:59	1.10	10.18	8.54	10.41			14 Nov 20	15:20	8.19	10.30	8.91	10.41					14 Nov 20	15:30	8.21	10.36	8.91	10.41				
14 Nov 20	15:00	1.10	10.17	8.53	10.41			14 Nov 20	15:21	8.19	10.30	8.91	10.41					14 Nov 20	15:31	8.21	10.36	8.91	10.41				
14 Nov 20	15:01	1.10	10.16	8.52	10.41			14 Nov 20	15:22	8.19	10.30	8.91	10.41					14 Nov 20	15:32	8.21	10.36	8.91	10.41				
14 Nov 20	15:02	1.10	10.15	8.51	10.41			14 Nov 20	15:23	8.19	10.30	8.91	10.41					14 Nov 20	15:33	8.21	10.36	8.91	10.41				
14 Nov 20	15:03	1.10	10.14	8.50	10.41			14 Nov 20	15:24	8.19	10.30	8.91	10.41					14 Nov 20	15:34	8.21	10.36	8.91	10.41				
14 Nov 20	15:04	1.10	10.13	8.49	10.41			14 Nov 20	15:25	8.19	10.30	8.91	10.41					14 Nov 20	15:35	8.21	10.36	8.91	10.41				
14 Nov 20	15:05	1.10	10.12	8.48	10.41			14 Nov 20	15:26	8.19	10.30	8.91	10.41					14 Nov 20	15:36	8.21	10.36	8.91	10.41				
14 Nov 20	15:06	1.10	10.11	8.47	10.41			14 Nov 20	15:27	8.19	10.30	8.91	10.41					14 Nov 20	15:37	8.21	10.36	8.91	10.41				
14 Nov 20	15:07	1.10	10.10	8.46	10.41			14 Nov 20	15:28	8.19	10.30	8.91	10.41					14 Nov 20	15:38	8.21	10.36	8.91	10.41				
14 Nov 20	15:08	1.10	10.09	8.45	10.41			14 Nov 20	15:29	8.19	10.30	8.91	10.41					14 Nov 20	15:39	8.21	10.36	8.91	10.41				
14 Nov 20	15:09	1.10	10.08	8.44	10.41			14 Nov 20	15:30	8.19	10.30	8.91	10.41					14 Nov 20	15:40	8.21	10.36	8.91	10.41				
14 Nov 20	15:10	1.10	10.07	8.43	10.41			14 Nov 20	15:31	8.19	10.30	8.91	10.41					14 Nov 20	15:41	8.21	10.36	8.91	10.41				
14 Nov 20	15:11	1.10	10.06	8.42	10.41			14 Nov 20	15:32	8.19	10.30	8.91	10.41					14 Nov 20	15:42	8.21	10.36	8.91	10.41				
14 Nov 20	15:12	1.10	10.05	8.41	10.41			14 Nov 20	15:33	8.19	10.30	8.91	10.41					14 Nov 20	15:43	8.21	10.36	8.91	10.41				
14 Nov 20	15:13	1.10	10.04	8.40	10.41			14 Nov 20	15:34	8.19	10.30	8.91	10.41					14 Nov 20	15:44	8.21	10.36	8.91	10.41				
14 Nov 20	15:14	1.10	10.03	8.39	10.41			14 Nov 20	15:35	8.19	10.30	8.91	10.41					14 Nov 20	15:45	8.21	10.36	8.91	10.41				
14 Nov 20	15:15	1.10	10.02	8.38	10.41			14 Nov 20	15:36	8.19	10.30	8.91	10.41					14 Nov 20	15:46	8.21	10.36	8.91	10.41				
14 Nov 20	15:16	1.10	10.01	8.37	10.41			14 Nov 20	15:37	8.19	10.30	8.91	10.41					14 Nov 20	15:47	8.21	10.36	8.91	10.41				
14 Nov 20	15:17	1.10	10.00	8.36	10.41			14 Nov 20	15:38	8.19	10.30	8.91	10.41					14 Nov 20	15:48	8.21	10.36	8.91	10.41				
14 Nov 20	15:18	1.10	9.99	8.35	10.41			14 Nov 20	15:39	8.19	10.30	8.91	10.41					14 Nov 20	15:49	8.21	10.36	8.91	10.41				
14 Nov 20	15:19	1.10	9.98	8.34	10.41			14 Nov 20	15:40	8.19	10.30	8.91	10.41					14 Nov 20	15:50	8.21	10.36	8.91	10.41				
14 Nov 20	15:20	1.10	9.97	8.33	10.41			14 Nov 20	15:41	8.19	10.30	8.91	10.41					14 Nov 20	15:51	8.21	10.36	8.91	10.41				
14 Nov 20	15:21	1.10	9.96	8.32	10.41			14 Nov 20	15:42	8.19	10.30	8.91	10.41					14 Nov 20	15:52	8.21	10.36	8.91	10.41				
14 Nov 20	15:22	1.10	9.95	8.31	10.41			14 Nov 20	15:43	8.19	10.30	8.91	10.41					14 Nov 20	15:53	8.21	10.36	8.91					

[illegible]

Run for 11										Time Base 24/min										Run for 12										Time Base 25/min									
State	Time	POS	TRK	CR	SR	POS	TRK	CR	SR	State	Time	POS	TRK	CR	SR	POS	TRK	CR	SR	State	Time	POS	TRK	CR	SR	POS	TRK	CR	SR										
		Lat	Long		Lat	Long		Lat	Long			Lat	Long		Lat	Long		Lat	Long			Lat	Long		Lat	Long		Lat	Long										
18 Nov 23	15:58	8.00	18.91	3.88	18.90					18 Nov 23	16:11	3.28	18.88	8.80	18.88					18 Nov 23	16:11	3.28	18.88	8.80	18.88														
18 Nov 23	15:51									18 Nov 23	16:18	3.48	18.88	9.00	18.88					18 Nov 23	16:18	3.48	18.88	9.00	18.88														
18 Nov 23	15:52	8.01	18.91	3.88	18.91					18 Nov 23	16:19	3.28	18.88	8.80	18.88					18 Nov 23	16:19	3.28	18.88	8.80	18.88														
18 Nov 23	15:53	8.02	18.91	3.88	18.91					18 Nov 23	16:20	3.48	18.88	9.00	18.88					18 Nov 23	16:20	3.48	18.88	9.00	18.88														
18 Nov 23	15:54	8.03	18.91	3.88	18.91					18 Nov 23	16:21	3.28	18.88	8.80	18.88					18 Nov 23	16:21	3.28	18.88	8.80	18.88														
18 Nov 23	15:55	8.04	18.91	3.88	18.91					18 Nov 23	16:22	3.48	18.88	9.00	18.88					18 Nov 23	16:22	3.48	18.88	9.00	18.88														
18 Nov 23	15:56	8.05	18.91	3.88	18.91					18 Nov 23	16:23	3.28	18.88	8.80	18.88					18 Nov 23	16:23	3.28	18.88	8.80	18.88														
18 Nov 23	15:57	8.06	18.91	3.88	18.91					18 Nov 23	16:24	3.48	18.88	9.00	18.88					18 Nov 23	16:24	3.48	18.88	9.00	18.88														
18 Nov 23	15:58	8.07	18.91	3.88	18.91					18 Nov 23	16:25	3.28	18.88	8.80	18.88					18 Nov 23	16:25	3.28	18.88	8.80	18.88														
18 Nov 23	15:59	8.08	18.91	3.88	18.91					18 Nov 23	16:26	3.48	18.88	9.00	18.88					18 Nov 23	16:26	3.48	18.88	9.00	18.88														
18 Nov 23	16:00	8.09	18.91	3.88	18.91					18 Nov 23	16:27	3.28	18.88	8.80	18.88					18 Nov 23	16:27	3.28	18.88	8.80	18.88														
18 Nov 23	16:01	8.10	18.91	3.88	18.91					18 Nov 23	16:28	3.48	18.88	9.00	18.88					18 Nov 23	16:28	3.48	18.88	9.00	18.88														
18 Nov 23	16:02	8.11	18.91	3.88	18.91					18 Nov 23	16:29	3.28	18.88	8.80	18.88					18 Nov 23	16:29	3.28	18.88	8.80	18.88														
18 Nov 23	16:03	8.12	18.91	3.88	18.91					18 Nov 23	16:30	3.48	18.88	9.00	18.88					18 Nov 23	16:30	3.48	18.88	9.00	18.88														
18 Nov 23	16:04	8.13	18.91	3.88	18.91					18 Nov 23	16:31	3.28	18.88	8.80	18.88					18 Nov 23	16:31	3.28	18.88	8.80	18.88														
18 Nov 23	16:05	8.14	18.91	3.88	18.91					18 Nov 23	16:32	3.48	18.88	9.00	18.88					18 Nov 23	16:32	3.48	18.88	9.00	18.88														
18 Nov 23	16:06	8.15	18.91	3.88	18.91					18 Nov 23	16:33	3.28	18.88	8.80	18.88					18 Nov 23	16:33	3.28	18.88	8.80	18.88														
18 Nov 23	16:07	8.16	18.91	3.88	18.91					18 Nov 23	16:34	3.48	18.88	9.00	18.88					18 Nov 23	16:34	3.48	18.88	9.00	18.88														
18 Nov 23	16:08	8.17	18.91	3.88	18.91					18 Nov 23	16:35	3.28	18.88	8.80	18.88					18 Nov 23	16:35	3.28	18.88	8.80	18.88														
18 Nov 23	16:09	8.18	18.91	3.88	18.91					18 Nov 23	16:36	3.48	18.88	9.00	18.88					18 Nov 23	16:36	3.48	18.88	9.00	18.88														
18 Nov 23	16:10	8.19	18.91	3.88	18.91					18 Nov 23	16:37	3.28	18.88	8.80	18.88					18 Nov 23	16:37	3.28	18.88	8.80	18.88														
18 Nov 23	16:11	8.20	18.91	3.88	18.91					18 Nov 23	16:38	3.48	18.88	9.00	18.88					18 Nov 23	16:38	3.48	18.88	9.00	18.88														
18 Nov 23	16:12	8.21	18.91	3.88	18.91					18 Nov 23	16:39	3.28	18.88	8.80	18.88					18 Nov 23	16:39	3.28	18.88	8.80	18.88														
18 Nov 23	16:13	8.22	18.91	3.88	18.91					18 Nov 23	16:40	3.48	18.88	9.00	18.88					18 Nov 23	16:40	3.48	18.88	9.00	18.88														
18 Nov 23	16:14	8.23	18.91	3.88	18.91					18 Nov 23	16:41	3.28	18.88	8.80	18.88					18 Nov 23	16:41	3.28	18.88	8.80	18.88														
18 Nov 23	16:15	8.24	18.91	3.88	18.91					18 Nov 23	16:42	3.48	18.88	9.00	18.88					18 Nov 23	16:42	3.48	18.88	9.00	18.88														
18 Nov 23	16:16	8.25	18.91	3.88	18.91					18 Nov 23	16:43	3.28	18.88	8.80	18.88					18 Nov 23	16:43	3.28	18.88	8.80	18.88														
18 Nov 23	16:17	8.26	18.91	3.88	18.91					18 Nov 23	16:44	3.48	18.88	9.00	18.88					18 Nov 23	16:44	3.48	18.88	9.00	18.88														
18 Nov 23	16:18	8.27	18.91	3.88	18.91					18 Nov 23	16:45	3.28	18.88	8.80	18.88					18 Nov 23	16:45	3.28	18.88	8.80	18.88														
18 Nov 23	16:19	8.28	18.91	3.88	18.91					18 Nov 23	16:46	3.48	18.88	9.00	18.88					18 Nov 23	16:46	3.48	18.88	9.00	18.88														
18 Nov 23	16:20	8.29	18.91	3.88	18.91					18 Nov 23	16:47	3.28	18.88	8.80	18.88					18 Nov 23	16:47	3.28	18.88	8.80	18.88														
18 Nov 23	16:21	8.30	18.91	3.88	18.91					18 Nov 23	16:48	3.48	18.88	9.00	18.88					18 Nov 23	16:48	3.48	18.88	9.00	18.88														
18 Nov 23	16:22	8.31	18.91	3.88	18.91					18 Nov 23	16:49	3.28	18.88	8.80	18.88					18 Nov 23	16:49	3.28	18.88	8.80	18.88														
18 Nov 23	16:23	8.32	18.91	3.88	18.91					18 Nov 23	16:50	3.48	18.88	9.00	18.88					18 Nov 23	16:50	3.48	18.88	9.00	18.88														
18 Nov 23	16:24	8.33	18.91	3.88	18.91					18 Nov 23	16:51	3.28	18.88	8.80	18.88					18 Nov 23	16:51	3.28	18.88	8.80	18.88														
18 Nov 23	16:25	8.34	18.91	3.88	18.91					18 Nov 23	16:52	3.48	18.88	9.00	18.88					18 Nov 23	16:52	3.48	18.88	9.00	18.88														
18 Nov 23	16:26	8.35	18.91	3.88	18.91					18 Nov 23	16:53	3.28	18.88	8.80	18.88					18 Nov 23	16:53	3.28	18.88	8.80	18.88														
18 Nov 23	16:27	8.36	18.91	3.88	18.91					18 Nov 23	16:54	3.48	18.88	9.00	18.88					18 Nov 23	16:54	3.48	18.88	9.00	18.88														
18 Nov 23	16:28	8.37	18.91	3.88	18.91					18 Nov 23	16:55	3.28	18.88	8.80	18.88					18 Nov 23	16:55	3.28	18.88	8.80	18.88														
18 Nov 23	16:29	8.38	18.91	3.88	18.91					18 Nov 23	16:56	3.48	18.88	9.00	18.88					18 Nov 23	16:56	3.48	18.88	9.00	18.88														
18 Nov 23	16:30	8.39	18.91	3.88	18.91					18 Nov 23	16:57	3.28	18.88	8.80	18.88					18 Nov 23	16:57	3.28	18.88	8.80	18.88														
18 Nov 23	16:31	8.40	18.91	3.88	18.91					18 Nov 23	16:58	3.48	18.88	9.00	18.88					18 Nov 23	16:58	3.48	18.88	9.00	18.88														
18 Nov 23	16:32	8.41	18.91	3.88	18.91					18 Nov 23	16:59	3.28	18.88	8.80	18.88					18 Nov 23	16:59	3.28	18.88	8.80	18.88														
18 Nov 23	16:33	8.42	18.91	3.88	18.91					18 Nov 23	17:00	3.48	18.88	9.00	18.88					18 Nov 23	17:00	3.48	18.88	9.00	18.88														
18 Nov 23	16:34	8.43	18.91	3.88	18.91					18 Nov 23	17:01	3.28	18.88	8.80	18.88					18 Nov 23	17:01	3.28	18.88	8.80	18.88														
18 Nov 23	16:35	8.44	18.91	3.88	18.91					18 Nov 23	17:02	3.48	18.88	9.00	18.88					18 Nov 23	17:02	3.48	18.88	9.00	18.88														
18 Nov 23	16:36	8.45	18.91	3.88	18.91					18 Nov 23	17:03	3.28	18.88	8.80	18.88					18 Nov 23	17:03	3.28	18.88	8.80	18.88														
18 Nov 23	16:37	8.46	18.91	3.88	18.91					18 Nov 23	17:04	3.48	18.88	9.00	18.88					18 Nov 23	17:04	3.48	18.88	9.00	18.88														
18 Nov 23	16:38	8.47	18.91	3.88	18.91					18 Nov 23	17:05	3.28	18.88	8.80	18.88					18 Nov 23	17:05	3.28	18.88	8.80	18.88														
18 Nov 23	16:39	8.48	18.91	3.88	18.91					18 Nov 23	17:06	3.48	18.88	9.00	18.88					18 Nov 23	17:06	3.48	18.88	9.00	18.88														
18 Nov 23	16:40	8.49	18.91	3.88	18.91					18 Nov 23	17:07	3.28	18.88	8.80	18.88					18 Nov 23	17:07	3.28	18.88	8.80	18.88														
18 Nov 23	16:41	8.50	18.91	3.88	18.91					18 Nov 23	17:08	3.48	18.88	9.00	18.88					18 Nov 23	17:08	3.48	18.88	9.00	18.88														
18 Nov 23	16:42	8.51	18.91	3.88	18.91					18 Nov 2																													



Reference Method Data

Client Name	Gulf IP UT Co Ltd	Date	15 Mar
Client Name	CUIT	Location	HRSD

Run Num	Time Base: 21 min					Run Date	Time Base: 21 min					
Draw	Flow	Temp	CO ₂	DO	DO ₂	Draw	Flow	Temp	DO	DO ₂		
18-00-21	10.18	0.10	10.23	18.9	14.28	0.18	11-04-21	16.47	0.10	13.31	23.88	0.18
18-00-22	14.27	0.10	10.24	19.2	14.28	0.22	11-04-21	14.04	0.09	13.41	23.89	0.18
18-00-23	14.29	0.09	10.24	19.2	14.28	0.22	11-04-21	14.05	0.09	13.41	23.89	0.18
18-00-24	14.29	0.09	10.24	19.2	14.28	0.22	11-04-21	14.02	0.08	13.39	23.81	0.19
18-00-25	14.30	0.09	10.22	19.22	14.27	0.21	11-04-21	14.01	0.08	13.42	23.80	0.19
18-00-26	14.30	0.09	10.22	19.22	14.27	0.21	11-04-21	14.02	0.08	13.42	23.80	0.19
18-00-27	14.30	0.09	10.22	19.22	14.27	0.21	11-04-21	14.03	0.08	13.42	23.80	0.19
18-00-28	14.30	0.09	10.22	19.22	14.27	0.21	11-04-21	14.03	0.08	13.42	23.80	0.19
18-00-29	14.31	0.09	10.22	19.22	14.27	0.21	11-04-21	14.04	0.08	13.42	23.80	0.19
18-00-30	14.31	0.09	10.22	19.22	14.27	0.21	11-04-21	14.04	0.08	13.42	23.80	0.19
18-00-31	14.31	0.09	10.22	19.22	14.27	0.21	11-04-21	14.04	0.08	13.42	23.80	0.19
18-00-32	14.31	0.09	10.22	19.22	14.27	0.21	11-04-21	14.04	0.08	13.42	23.80	0.19
18-00-33	14.31	0.09	10.22	19.22	14.27	0.21	11-04-21	14.04	0.08	13.42	23.80	0.19
18-00-34	14.31	0.09	10.22	19.22	14.27	0.21	11-04-21	14.04	0.08	13.42	23.80	0.19
18-00-35	14.31	0.09	10.22	19.22	14.27	0.21	11-04-21	14.04	0.08	13.42	23.80	0.19
18-00-36	14.31	0.09	10.22	19.22	14.27	0.21	11-04-21	14.04	0.08	13.42	23.80	0.19
18-00-37	14.31	0.09	10.22	19.22	14.27	0.21	11-04-21	14.04	0.08	13.42	23.80	0.19
18-00-38	14.31	0.09	10.22	19.22	14.27	0.21	11-04-21	14.04	0.08	13.42	23.80	0.19
18-00-39	14.31	0.09	10.22	19.22	14.27	0.21	11-04-21	14.04	0.08	13.42	23.80	0.19
18-00-40	14.31	0.09	10.22	19.22	14.27	0.21	11-04-21	14.04	0.08	13.42	23.80	0.19
18-00-41	14.31	0.09	10.22	19.22	14.27	0.21	11-04-21	14.04	0.08	13.42	23.80	0.19
18-00-42	14.31	0.09	10.22	19.22	14.27	0.21	11-04-21	14.04	0.08	13.42	23.80	0.19
18-00-43	14.31	0.09	10.22	19.22	14.27	0.21	11-04-21	14.04	0.08	13.42	23.80	0.19
18-00-44	14.31	0.09	10.22	19.22	14.27	0.21	11-04-21	14.04	0.08	13.42	23.80	0.19
18-00-45	14.31	0.09	10.22	19.22	14.27	0.21	11-04-21	14.04	0.08	13.42	23.80	0.19
18-00-46	14.31	0.09	10.22	19.22	14.27	0.21	11-04-21	14.04	0.08	13.42	23.80	0.19
18-00-47	14.31	0.09	10.22	19.22	14.27	0.21	11-04-21	14.04	0.08	13.42	23.80	0.19
18-00-48	14.31	0.09	10.22	19.22	14.27	0.21	11-04-21	14.04	0.08	13.42	23.80	0.19
18-00-49	14.31	0.09	10.22	19.22	14.27	0.21	11-04-21	14.04	0.08	13.42	23.80	0.19
18-00-50	14.31	0.09	10.22	19.22	14.27	0.21	11-04-21	14.04	0.08	13.42	23.80	0.19
18-00-51	14.31	0.09	10.22	19.22	14.27	0.21	11-04-21	14.04	0.08	13.42	23.80	0.19
18-00-52	14.31	0.09	10.22	19.22	14.27	0.21	11-04-21	14.04	0.08	13.42	23.80	0.19
18-00-53	14.31	0.09	10.22	19.22	14.27	0.21	11-04-21	14.04	0.08	13.42	23.80	0.19
18-00-54	14.31	0.09	10.22	19.22	14.27	0.21	11-04-21	14.04	0.08	13.42	23.80	0.19
18-00-55	14.31	0.09	10.22	19.22	14.27	0.21	11-04-21	14.04	0.08	13.42	23.80	0.19
18-00-56	14.31	0.09	10.22	19.22	14.27	0.21	11-04-21	14.04	0.08	13.42	23.80	0.19
18-00-57	14.31	0.09	10.22	19.22	14.27	0.21	11-04-21	14.04	0.08	13.42	23.80	0.19
18-00-58	14.31	0.09	10.22	19.22	14.27	0.21	11-04-21	14.04	0.08	13.42	23.80	0.19
18-00-59	14.31	0.09	10.22	19.22	14.27	0.21	11-04-21	14.04	0.08	13.42	23.80	0.19
18-00-60	14.31	0.09	10.22	19.22	14.27	0.21	11-04-21	14.04	0.08	13.42	23.80	0.19
18-00-61	14.31	0.09	10.22	19.22	14.27	0.21	11-04-21	14.04	0.08	13.42	23.80	0.19
18-00-62	14.31	0.09	10.22	19.22	14.27	0.21	11-04-21	14.04	0.08	13.42	23.80	0.19
18-00-63	14.31	0.09	10.22	19.22	14.27	0.21	11-04-21	14.04	0.08	13.42	23.80	0.19
18-00-64	14.31	0.09	10.22	19.22	14.27	0.21	11-04-21	14.04	0.08	13.42	23.80	0.19
18-00-65	14.31	0.09	10.22	19.22	14.27	0.21	11-04-21	14.04	0.08	13.42	23.80	0.19
18-00-66	14.31	0.09	10.22	19.22	14.27	0.21	11-04-21	14.04	0.08	13.42	23.80	0.19
18-00-67	14.31	0.09	10.22	19.22	14.27	0.21	11-04-21	14.04	0.08	13.42	23.80	0.19
18-00-68	14.31	0.09	10.22	19.22	14.27	0.21	11-04-21	14.04	0.08	13.42	23.80	0.19
18-00-69	14.31	0.09	10.22	19.22	14.27	0.21	11-04-21	14.04	0.08	13.42	23.80	0.19
18-00-70	14.31	0.09	10.22	19.22	14.27	0.21	11-04-21	14.04	0.08	13.42	23.80	0.19
18-00-71	14.31	0.09	10.22	19.22	14.27	0.21	11-04-21	14.04	0.08	13.42	23.80	0.19
18-00-72	14.31	0.09	10.22	19.22	14.27	0.21	11-04-21	14.04	0.08	13.42	23.80	0.19
18-00-73	14.31	0.09	10.22	19.22	14.27	0.21	11-04-21	14.04	0.08	13.42	23.80	0.19
18-00-74	14.31	0.09	10.22	19.22	14.27	0.21	11-04-21	14.04	0.08	13.42	23.80	0.19
18-00-75	14.31	0.09	10.22	19.22	14.27	0.21	11-04-21	14.04	0.08	13.42	23.80	0.19
18-00-76	14.31	0.09	10.22	19.22	14.27	0.21	11-04-21	14.04	0.08	13.42	23.80	0.19
18-00-77	14.31	0.09	10.22	19.22	14.27	0.21	11-04-21	14.04	0.08	13.42	23.80	0.19
18-00-78	14.31	0.09	10.22	19.22	14.27	0.21	11-04-21	14.04	0.08	13.42	23.80	0.19
18-00-79	14.31	0.09	10.22	19.22	14.27	0.21	11-04-21	14.04	0.08	13.42	23.80	0.19
18-00-80	14.31	0.09	10.22	19.22	14.27	0.21	11-04-21	14.04	0.08	13.42	23.80	0.19
18-00-81	14.31	0.09	10.22	19.22	14.27	0.21	11-04-21	14.04	0.08	13.42	23.80	0.19
18-00-82	14.31	0.09	10.22	19.22	14.27	0.21	11-04-21	14.04	0.08	13.42	23.80	0.19
18-00-83	14.31	0.09	10.22	19.22	14.27	0.21	11-04-21	14.04	0.08	13.42	23.80	0.19
18-00-84	14.31	0.09	10.22	19.22	14.27	0.21	11-04-21	14.04	0.08	13.42	23.80	0.19
18-00-85	14.31	0.09	10.22	19.22	14.27	0.21	11-04-21	14.04	0.08	13.42	23.80	0.19
18-00-86	14.31	0.09	10.22	19.22	14.27	0.21	11-04-21	14.04	0.08	13.42	23.80	0.19
18-00-87	14.31	0.09	10.22	19.22	14.27	0.21	11-04-21	14.04	0.08	13.42	23.80	0.19
18-00-88	14.31	0.09	10.22	19.22	14.27	0.21	11-04-21	14.04	0.08	13.42	23.80	0.19
18-00-89	14.31	0.09	10.22	19.22	14.27	0.21	11-04-21	14.04	0.08	13.42	23.80	0.19
18-00-90	14.31	0.09	10.22	19.22	14.27	0.21	11-04-21	14.04	0.08	13.42	23.80	0.19
18-00-91	14.31	0.09	10.22	19.22	14.27	0.21	11-04-21	14.04	0.08	13.42	23.80	0.19
18-00-92	14.31	0.09	10.22	19.22	14.27	0.21	11-04-21	14.04	0.08	13.42	23.80	0.19
18-00-93	14.31	0.09	10.22	19.22	14.27	0.21	11-04-21	14.04	0.08	13.42	23.80	0.19
18-00-94	14.31	0.09	10.22	19.22	14.27	0.21	11-04-21	14.04	0.08	13.42	23.80	0.19
18-00-95	14.31	0.09	10.22	19.22	14.27	0.21	11-04-21	14.04	0.08	13.42	23.80	0.19
18-00-96	14.31	0.09	10.22	19.22	14.27	0.21	11-04-21	14.04	0.08	13.42	23.80	0.19
18-00-97	14.31	0.09	10.22	19.22	14.27	0.21	11-04-21	14.04	0.08	13.42	23.80	0.19
18-00-98	14.31	0.09	10.22	19.22	14.27	0.21	11-04-21	14.04	0.08	13.42	23.80	0.19
18-00-99	14.31	0.09	10.22	19.22	14.27	0.21	11-04-21	14.04	0.08	13.42	23.80	0.19
18-00-100	14.31	0.09	10.22	19.22	14.27	0.21	11-04-21	14.04	0.08	13.42	23.80	0.19
18-00-101	14.31	0.09	10.22	19.22	14.27	0.21	11-04-21	14.04	0.08	13.42	23.80	0.19
18-00-102	14.31	0.09	10.22	19.22	14.27	0.21	11-04-21	14.04	0.08	13.42	23.80	0.19
18-00-103	14.31	0.09	10.22	19.22	14.27	0.21	11-04-21	14.04	0.08	13.42	23.80	0.19
18-00-104	14.31	0.09	10.22	19.22	14.27	0.21	11-04-21	14.04	0.08	13.42	23.80	0.19
18-00-105	14.31	0.09	10.22	19.22	14.27	0.21	11-04-21	14.04	0.08	13.42	23.80	0.19
18-00-106	14.31	0.09	10.22	19.22	14.27	0.21	11-04-21	14.04	0.08	13.42	23.80	0.19
18-00-107	14.31	0.09	10.22	19.22	14.27	0.21	11-04-21	14.04	0.08	13.42	23.80	0.19
18-00-108	14.31	0.09	10.22	19.22	14.27	0.21	11-04-21	14.04	0.08	13.42	23.80	0.19
18-00-109	14.31	0.09	10.22	19.22	14.27	0.21	11-04-21	14.04	0.08	13.42	23.80	0.19
18-00-110	14.31	0.09	10.22	19.22	14.27	0.21	11-04-21	14.04	0.08	13.42	23.80	0.19

[illegible][illegible]

Reference Method Data

Client Name	Gulf PVT Co Ltd	Date	16 Mar
Plant Name	GUT	Location	HRSC

Run Day 1												Time Base: 21 mins												Run Day 2												Time Base: 21 mins											
Time	Temp	100%	200%	300%	400%	500%	600%	700%	800%	900%	1000%	Time	Temp	100%	200%	300%	400%	500%	600%	700%	800%	900%	1000%	Time	Temp	100%	200%	300%	400%	500%	600%	700%	800%	900%	1000%												
11 Mar 12	12.22	8.23	14.34	9.32	14.30	9.18						11 Mar 13	12.41	8.22	14.41	9.39	14.33	9.43	14.31	9.18				11 Mar 14	12.41	8.22	14.41	9.39	14.33	9.43	14.31	9.18															
11 Mar 12	12.21	8.27	14.36	9.34	14.30	9.18						11 Mar 13	12.40	8.25	14.40	9.39	14.31	9.43	14.30	9.18				11 Mar 14	12.40	8.25	14.40	9.39	14.31	9.43	14.30	9.18															
11 Mar 12	12.22	8.27	14.38	9.38	14.30	9.31						11 Mar 13	12.40	8.19	14.37	9.35	14.30	9.18						11 Mar 14	12.40	8.19	14.37	9.35	14.30	9.18																	
11 Mar 12	12.23	8.29	14.36	9.34	14.30	9.15						11 Mar 13	12.44	8.16	14.38	9.30	14.31	9.18						11 Mar 14	12.44	8.16	14.38	9.30	14.31	9.18																	
11 Mar 12	12.24	8.34	14.36	9.34	14.30	9.18						11 Mar 13	12.44	8.16	14.38	9.30	14.31	9.18						11 Mar 14	12.44	8.16	14.38	9.30	14.31	9.18																	
11 Mar 12	12.25	8.34	14.41	9.31	14.30	9.18						11 Mar 13	12.46	8.19	14.36	9.30	14.31	9.18						11 Mar 14	12.46	8.19	14.36	9.30	14.31	9.18																	
11 Mar 12	12.24	8.22	14.46	9.35	14.30	9.17						11 Mar 13	12.47	8.16	14.36	9.33	14.31	9.18						11 Mar 14	12.47	8.16	14.36	9.33	14.31	9.18																	
11 Mar 12	12.24	8.22	14.46	9.35	14.30	9.17						11 Mar 13	12.47	8.16	14.36	9.33	14.31	9.18						11 Mar 14	12.47	8.16	14.36	9.33	14.31	9.18																	
11 Mar 12	12.24	8.22	14.46	9.35	14.30	9.17						11 Mar 13	12.49	8.19	14.35	9.33	14.31	9.18						11 Mar 14	12.49	8.19	14.35	9.33	14.31	9.18																	
11 Mar 12	12.25	8.27	14.49	9.39	14.30	9.14						11 Mar 13	12.50	8.16	14.34	9.33	14.31	9.18						11 Mar 14	12.50	8.16	14.34	9.33	14.31	9.18																	
11 Mar 12	12.26	8.27	14.49	9.39	14.30	9.14						11 Mar 13	12.52	8.16	14.34	9.33	14.31	9.18						11 Mar 14	12.52	8.16	14.34	9.33	14.31	9.18																	
11 Mar 12	12.27	8.31	14.48	9.40	14.30	9.14						11 Mar 13	12.53	8.17	14.34	9.33	14.31	9.18						11 Mar 14	12.53	8.17	14.34	9.33	14.31	9.18																	
11 Mar 12	12.28	8.31	14.48	9.40	14.30	9.14						11 Mar 13	12.53	8.17	14.34	9.33	14.31	9.18						11 Mar 14	12.53	8.17	14.34	9.33	14.31	9.18																	
11 Mar 12	12.29	8.31	14.48	9.40	14.30	9.14						11 Mar 13	12.53	8.17	14.34	9.33	14.31	9.18						11 Mar 14	12.53	8.17	14.34	9.33	14.31	9.18																	
11 Mar 12	12.30	8.31	14.48	9.40	14.30	9.14						11 Mar 13	12.53	8.17	14.34	9.33	14.31	9.18						11 Mar 14	12.53	8.17	14.34	9.33	14.31	9.18																	
11 Mar 12	12.31	8.31	14.48	9.40	14.30	9.14						11 Mar 13	12.53	8.17	14.34	9.33	14.31	9.18						11 Mar 14	12.53	8.17	14.34	9.33	14.31	9.18																	
11 Mar 12	12.32	8.31	14.48	9.40	14.30	9.14						11 Mar 13	12.53	8.17	14.34	9.33	14.31	9.18						11 Mar 14	12.53	8.17	14.34	9.33	14.31	9.18																	
11 Mar 12	12.33	8.31	14.48	9.40	14.30	9.14						11 Mar 13	12.53	8.17	14.34	9.33	14.31	9.18						11 Mar 14	12.53	8.17	14.34	9.33	14.31	9.18																	
11 Mar 12	12.34	8.31	14.48	9.40	14.30	9.14						11 Mar 13	12.53	8.17	14.34	9.33	14.31	9.18						11 Mar 14	12.53	8.17	14.34	9.33	14.31	9.18																	
11 Mar 12	12.35	8.31	14.48	9.40	14.30	9.14						11 Mar 13	12.53	8.17	14.34	9.33	14.31	9.18						11 Mar 14	12.53	8.17	14.34	9.33	14.31	9.18																	
11 Mar 12	12.36	8.31	14.48	9.40	14.30	9.14						11 Mar 13	12.53	8.17	14.34	9.33	14.31	9.18						11 Mar 14	12.53	8.17	14.34	9.33	14.31	9.18																	
11 Mar 12	12.37	8.31	14.48	9.40	14.30	9.14						11 Mar 13	12.53	8.17	14.34	9.33	14.31	9.18						11 Mar 14	12.53	8.17	14.34	9.33	14.31	9.18																	
11 Mar 12	12.38	8.31	14.48	9.40	14.30	9.14						11 Mar 13	12.53	8.17	14.34	9.33	14.31	9.18						11 Mar 14	12.53	8.17	14.34	9.33	14.31	9.18																	
11 Mar 12	12.39	8.31	14.48	9.40	14.30	9.14						11 Mar 13	12.53	8.17	14.34	9.33	14.31	9.18						11 Mar 14	12.53	8.17	14.34	9.33	14.31	9.18																	
11 Mar 12	12.40	8.31	14.48	9.40	14.30	9.14						11 Mar 13	12.53	8.17	14.34	9.33	14.31	9.18						11 Mar 14	12.53	8.17	14.34	9.33	14.31	9.18																	
11 Mar 12	12.41	8.31	14.48	9.40	14.30	9.14						11 Mar 13	12.53	8.17	14.34	9.33	14.31	9.18						11 Mar 14	12.53	8.17	14.34	9.33	14.31	9.18																	
11 Mar 12	12.42	8.31	14.48	9.40	14.30	9.14						11 Mar 13	12.53	8.17	14.34	9.33	14.31	9.18						11 Mar 14	12.53	8.17	14.34	9.33	14.31	9.18																	
11 Mar 12	12.43	8.31	14.48	9.40	14.30	9.14						11 Mar 13	12.53	8.17	14.34	9.33	14.31	9.18						11 Mar 14	12.53	8.17	14.34	9.33	14.31	9.18																	
11 Mar 12	12.44	8.31	14.48	9.40	14.30	9.14						11 Mar 13	12.53	8.17	14.34	9.33	14.31	9.18						11 Mar 14	12.53	8.17	14.34	9.33	14.31	9.18																	
11 Mar 12	12.45	8.31	14.48	9.40	14.30	9.14						11 Mar 13	12.53	8.17	14.34	9.33	14.31	9.18						11 Mar 14	12.53	8.17	14.34	9.33	14.31	9.18																	
11 Mar 12	12.46	8.31	14.48	9.40	14.30	9.14						11 Mar 13	12.53	8.17	14.34	9.33	14.31	9.18						11 Mar 14	12.53	8.17	14.34	9.33	14.31	9.18																	
11 Mar 12	12.47	8.31	14.48	9.40	14.30	9.14						11 Mar 13	12.53	8.17	14.34	9.33	14.31	9.18						11 Mar 14	12.53	8.17	14.34	9.33	14.31	9.18																	
11 Mar 12	12.48	8.31	14.48	9.40	14.30	9.14						11 Mar 13	12.53	8.17	14.34	9.33	14.31	9.18						11 Mar 14	12.53	8.17	14.34	9.33	14.31	9.18																	
11 Mar 12	12.49	8.31	14.48	9.40	14.30	9.14						11 Mar 13	12.53	8.17	14.34	9.33	14.31	9.18						11 Mar 14	12.53	8.17	14.34	9.33	14.31	9.18																	
11 Mar 12	12.50	8.31	14.48	9.40	14.30	9.14						11 Mar 13	12.53	8.17	14.34	9.33	14.31	9.18						11 Mar 14	12.53	8.17	14.34	9.33	14.31	9.18																	
11 Mar 12	12.51	8.31	14.48	9.40	14.30	9.14						11 Mar 13	12.53	8.17	14.34	9.33	14.31	9.18						11 Mar 14	12.53	8.17	14.34	9.33	14.31	9.18																	
11 Mar 12	12.52	8.31	14.48	9.40	14.30	9.14						11 Mar 13	12.53	8.17	14.34	9.33	14.31	9.18						11 Mar 14	12.53	8.17	14.34	9.33	14.31	9.18																	
11 Mar 12	12.53	8.31	14.48	9.40	14.30	9.14						11 Mar 13	12.53	8.17	14.34	9.33	14.31	9.18						11 Mar 14	12.53	8.17	14.34	9.33	14.31	9.18																	
11 Mar 12	12.54	8.31	14.48	9.40	14.30	9.14						11 Mar 13	12.53	8.17	14.34	9.33	14.31	9.18						11 Mar 14	12.53	8.17	14.34	9.33	14.31	9.18																	
11 Mar 12	12.55	8.31	14.48	9.40	14.30	9.14						11 Mar 13	12.53	8.17	14.34	9.33	14.31	9.18						11 Mar 14	12.53	8.17	14.34	9.33	14.31	9.18																	
11 Mar 12	12.56	8.31	14.48	9.40	14.30	9.14						11 Mar 13	12.53	8.17	14.34	9.33	14.31	9.18						11 Mar 14	12.53	8.17	14.34	9.33	14.31	9.18																	
11 Mar 12	12.57	8.31	14.48	9.40	14.30	9.14						11 Mar 13	12.53	8.17	14.34	9.33	14.31	9.18						11 Mar 14	12.53	8.17	14.34	9.33	14.31	9.18																	
11 Mar 12	12.58	8.31	14.48	9.40	14.30	9.14						11 Mar 13	12.53	8.17	14.34	9.33	14.31	9.18						11 Mar 14	12.53	8.17	14.34	9.33	14.31	9.18																	
11 Mar 12	12.59	8.31	14.48	9.40	14.30	9.14						11 Mar 13	12.53	8.17	14.34	9.33	14.31	9.18						11 Mar 14	12.53	8.17	14.34	9.33	14.31	9.18																	
11 Mar 12	13.00	8.31	14.48	9.40	14.30	9.14						11 Mar 13	12.53	8.17	14.34	9.33	14.31	9.18						11 Mar 14	12.53																						

Site	Time	SW2	SW3	SW4	SW5	SW6	SW7	SW8	SW9	SW10	Time	SW11	SW12	SW13	SW14	SW15	SW16	SW17	SW18	SW19	SW20
1 May 21	08:00	0.02	0.12	0.10	0.18	0.14	0.16	0.18	0.16	0.16	1 May 22	10:01	0.10	0.11	0.10	0.10	0.10	0.10	0.10	0.10	0.10
1 May 21	08:03	0.02	0.12	0.10	0.18	0.14	0.16	0.18	0.16	0.16	1 May 22	10:04	0.10	0.11	0.10	0.10	0.10	0.10	0.10	0.10	0.10
1 May 21	08:06	0.02	0.12	0.10	0.18	0.14	0.16	0.18	0.16	0.16	1 May 22	10:07	0.10	0.11	0.10	0.10	0.10	0.10	0.10	0.10	0.10
1 May 21	08:09	0.02	0.12	0.10	0.18	0.14	0.16	0.18	0.16	0.16	1 May 22	10:10	0.10	0.11	0.10	0.10	0.10	0.10	0.10	0.10	0.10
1 May 21	08:12	0.02	0.12	0.10	0.18	0.14	0.16	0.18	0.16	0.16	1 May 22	10:13	0.10	0.11	0.10	0.10	0.10	0.10	0.10	0.10	0.10
1 May 21	08:15	0.02	0.12	0.10	0.18	0.14	0.16	0.18	0.16	0.16	1 May 22	10:16	0.10	0.11	0.10	0.10	0.10	0.10	0.10	0.10	0.10
1 May 21	08:18	0.02	0.12	0.10	0.18	0.14	0.16	0.18	0.16	0.16	1 May 22	10:19	0.10	0.11	0.10	0.10	0.10	0.10	0.10	0.10	0.10
1 May 21	08:21	0.02	0.12	0.10	0.18	0.14	0.16	0.18	0.16	0.16	1 May 22	10:22	0.10	0.11	0.10	0.10	0.10	0.10	0.10	0.10	0.10
1 May 21	08:24	0.02	0.12	0.10	0.18	0.14	0.16	0.18	0.16	0.16	1 May 22	10:25	0.10	0.11	0.10	0.10	0.10	0.10	0.10	0.10	0.10
1 May 21	08:27	0.02	0.12	0.10	0.18	0.14	0.16	0.18	0.16	0.16	1 May 22	10:28	0.10	0.11	0.10	0.10	0.10	0.10	0.10	0.10	0.10
1 May 21	08:30	0.02	0.12	0.10	0.18	0.14	0.16	0.18	0.16	0.16	1 May 22	10:31	0.10	0.11	0.10	0.10	0.10	0.10	0.10	0.10	0.10
1 May 21	08:33	0.02	0.12	0.10	0.18	0.14	0.16	0.18	0.16	0.16	1 May 22	10:34	0.10	0.11	0.10	0.10	0.10	0.10	0.10	0.10	0.10
1 May 21	08:36	0.02	0.12	0.10	0.18	0.14	0.16	0.18	0.16	0.16	1 May 22	10:37	0.10	0.11	0.10	0.10	0.10	0.10	0.10	0.10	0.10
1 May 21	08:39	0.02	0.12	0.10	0.18	0.14	0.16	0.18	0.16	0.16	1 May 22	10:40	0.10	0.11	0.10	0.10	0.10	0.10	0.10	0.10	0.10
1 May 21	08:42	0.02	0.12	0.10	0.18	0.14	0.16	0.18	0.16	0.16	1 May 22	10:43	0.10	0.11	0.10	0.10	0.10	0.10	0.10	0.10	0.10
1 May 21	08:45	0.02	0.12	0.10	0.18	0.14	0.16	0.18	0.16	0.16	1 May 22	10:46	0.10	0.11	0.10	0.10	0.10	0.10	0.10	0.10	0.10
1 May 21	08:48	0.02	0.12	0.10	0.18	0.14	0.16	0.18	0.16	0.16	1 May 22	10:49	0.10	0.11	0.10	0.10	0.10	0.10	0.10	0.10	0.10
1 May 21	08:51	0.02	0.12	0.10	0.18	0.14	0.16	0.18	0.16	0.16	1 May 22	10:52	0.10	0.11	0.10	0.10	0.10	0.10	0.10	0.10	0.10
1 May 21	08:54	0.02	0.12	0.10	0.18	0.14	0.16	0.18	0.16	0.16	1 May 22	10:55	0.10	0.11	0.10	0.10	0.10	0.10	0.10	0.10	0.10
1 May 21	08:57	0.02	0.12	0.10	0.18	0.14	0.16	0.18	0.16	0.16	1 May 22	10:58	0.10	0.11	0.10	0.10	0.10	0.10	0.10	0.10	0.10
1 May 21	09:00	0.02	0.12	0.10	0.18	0.14	0.16	0.18	0.16	0.16	1 May 22	11:01	0.10	0.11	0.10	0.10	0.10	0.10	0.10	0.10	0.10
1 May 21	09:03	0.02	0.12	0.10	0.18	0.14	0.16	0.18	0.16	0.16	1 May 22	11:04	0.10	0.11	0.10	0.10	0.10	0.10	0.10	0.10	0.10
1 May 21	09:06	0.02	0.12	0.10	0.18	0.14	0.16	0.18	0.16	0.16	1 May 22	11:07	0.10	0.11	0.10	0.10	0.10	0.10	0.10	0.10	0.10
1 May 21	09:09	0.02	0.12	0.10	0.18	0.14	0.16	0.18	0.16	0.16	1 May 22	11:10	0.10	0.11	0.10	0.10	0.10	0.10	0.10	0.10	0.10
1 May 21	09:12	0.02	0.12	0.10	0.18	0.14	0.16	0.18	0.16	0.16	1 May 22	11:13	0.10	0.11	0.10	0.10	0.10	0.10	0.10	0.10	0.10
1 May 21	09:15	0.02	0.12	0.10	0.18	0.14	0.16	0.18	0.16	0.16	1 May 22	11:16	0.10	0.11	0.10	0.10	0.10	0.10	0.10	0.10	0.10
1 May 21	09:18	0.02	0.12	0.10	0.18	0.14	0.16	0.18	0.16	0.16	1 May 22	11:19	0.10	0.11	0.10	0.10	0.10	0.10	0.10	0.10	0.10
1 May 21	09:21	0.02	0.12	0.10	0.18	0.14	0.16	0.18	0.16	0.16	1 May 22	11:22	0.10	0.11	0.10	0.10	0.10	0.10	0.10	0.10	0.10
1 May 21	09:24	0.02	0.12	0.10	0.18	0.14	0.16	0.18	0.16	0.16	1 May 22	11:25	0.10	0.11	0.10	0.10	0.10	0.10	0.10	0.10	0.10
1 May 21	09:27	0.02	0.12	0.10	0.18	0.14	0.16	0.18	0.16	0.16	1 May 22	11:28	0.10	0.11	0.10	0.10	0.10	0.10	0.10	0.10	0.10
1 May 21	09:30	0.02	0.12	0.10	0.18	0.14	0.16	0.18	0.16	0.16	1 May 22	11:31	0.10	0.11	0.10	0.10	0.10	0.10	0.10	0.10	0.10
1 May 21	09:33	0.02	0.12	0.10	0.18	0.14	0.16	0.18	0.16	0.16	1 May 22	11:34	0.10	0.11	0.10	0.10	0.10	0.10	0.10	0.10	0.10
1 May 21	09:36	0.02	0.12	0.10	0.18	0.14	0.16	0.18	0.16	0.16	1 May 22	11:37	0.10	0.11	0.10	0.10	0.10	0.10	0.10	0.10	0.10
1 May 21	09:39	0.02	0.12	0.10	0.18	0.14	0.16	0.18	0.16	0.16	1 May 22	11:40	0.10	0.11	0.10	0.10	0.10	0.10	0.10	0.10	0.10
1 May 21	09:42	0.02	0.12	0.10	0.18	0.14	0.16	0.18	0.16	0.16	1 May 22	11:43	0.10	0.11	0.10	0.10	0.10	0.10	0.10	0.10	0.10
1 May 21	09:45	0.02	0.12	0.10	0.18	0.14	0.16	0.18	0.16	0.16	1 May 22	11:46	0.10	0.11	0.10	0.10	0.10	0.10	0.10	0.10	0.10
1 May 21	09:48	0.02	0.12	0.10	0.18	0.14	0.16	0.18	0.16	0.16	1 May 22	11:49	0.10	0.11	0.10	0.10	0.10	0.10	0.10	0.10	0.10
1 May 21	09:51	0.02	0.12	0.10	0.18	0.14	0.16	0.18	0.16	0.16	1 May 22	11:52	0.10	0.11	0.10	0.10	0.10	0.10	0.10	0.10	0.10
1 May 21	09:54	0.02	0.12	0.10	0.18	0.14	0.16	0.18	0.16	0.16	1 May 22	11:55	0.10	0.11	0.10	0.10	0.10	0.10	0.10	0.10	0.10
1 May 21	09:57	0.02	0.12	0.10	0.18	0.14	0.16	0.18	0.16	0.16	1 May 22	11:58	0.10	0.11	0.10	0.10	0.10	0.10	0.10	0.10	0.10
1 May 21	10:00	0.02	0.12	0.10	0.18	0.14	0.16	0.18	0.16	0.16	1 May 22	12:01	0.10	0.11	0.10	0.10	0.10	0.10	0.10	0.10	0.10
1 May 21	10:03	0.02	0.12	0.10	0.18	0.14	0.16	0.18	0.16	0.16	1 May 22	12:04	0.10	0.11	0.10	0.10	0.10	0.10	0.10	0.10	0.10
1 May 21	10:06	0.02	0.12	0.10	0.18	0.14	0.16	0.18	0.16	0.16	1 May 22	12:07	0.10	0.11	0.10	0.10	0.10	0.10	0.10	0.10	0.10
1 May 21	10:09	0.02	0.12	0.10	0.18	0.14	0.16	0.18	0.16	0.16	1 May 22	12:10	0.10	0.11	0.10	0.10	0.10	0.10	0.10	0.10	0.10
1 May 21	10:12	0.02	0.12	0.10	0.18	0.14	0.16	0.18	0.16	0.16	1 May 22	12:13	0.10	0.11	0.10	0.10	0.10	0.10	0.10	0.10	0.10
1 May 21	10:15	0.02	0.12	0.10	0.18	0.14	0.16	0.18	0.16	0.16	1 May 22	12:16	0.10	0.11	0.10	0.10	0.10	0.10	0.10	0.10	0.10
1 May 21	10:18	0.02	0.12	0.10	0.18	0.14	0.16	0.18	0.16	0.16	1 May 22	12:19	0.10	0.11	0.10	0.10	0.10	0.10	0.10	0.10	0.10
1 May 21	10:21	0.02	0.12	0.10	0.18	0.14	0.16	0.18	0.16	0.16	1 May 22	12:22	0.10	0.11	0.10	0.10	0.10	0.10	0.10	0.10	0.10
1 May 21	10:24	0.02	0.12	0.10	0.18	0.14	0.16	0.18	0.16	0.16	1 May 22	12:25	0.10	0.11	0.10	0.10	0.10	0.10	0.10	0.10	0.10
1 May 21	10:27	0.02	0.12	0.10	0.18	0.14	0.16	0.18	0.16	0.16	1 May 22	12:28	0.10	0.11	0.10	0.10	0.10	0.10	0.10	0.10	0.10
1 May 21	10:30	0.02	0.12	0.10	0.18	0.14	0.16	0.18	0.16	0.16	1 May 22	12:31	0.10	0.11	0.10	0.10	0.10	0.10	0.10	0.10	0.10
1 May 21	10:33	0.02	0.12	0.10	0.18	0.14	0.16	0.18	0.16	0.16	1 May 22	12:34	0.10	0.11	0.10	0.10	0.10	0.10	0.10	0.10	0.10
1 May 21	10:36	0.02	0.12	0.10	0.18	0.14	0.16	0.18	0.16	0.16	1 May 22	12:37	0.10	0.11	0.10	0.10	0.10	0.10	0.10	0.10	0.10
1 May 21	10:39	0.02	0.12	0.10	0.18	0.14	0.16	0.18	0.16	0.16	1 May 22	12:40	0.10	0.11	0.10	0.10	0.10	0.10	0.10	0.10	0.10
1 May 21	10:42	0.02	0.12	0.10	0.18	0.14	0.16	0.18	0.16	0.16	1 May 22	12:43	0.10	0.11	0.10	0.10	0.10	0.10	0.10	0.10	0.10
1 May 21	10:45	0.02	0.12	0.10	0.18	0.14	0.16	0.18	0.16	0.16	1 May 22	12:46	0.10	0.11	0.10	0.10	0.10	0.10	0.10	0.10	0.10
1 May 21	10:48	0.02	0.12	0.10	0.18	0.14	0.16	0.18	0.16	0.16	1 May 22	12:49	0.10	0.11	0.10	0.10	0.10	0.10	0.10	0.10	0.10
1 May 21	10:51	0.02	0.12	0.10	0.18	0.14	0.16	0.18	0.16	0.16	1 May 22	12:52	0.10	0.11	0.10	0.10	0.10	0.10	0.10	0.10	0.10
1 May 21	10:54	0.02	0.12	0.10	0.18	0.14	0.16	0.18	0.16	0.16	1 May 22	12:55	0.10	0.11	0.10	0.10	0.10	0.10	0.10	0.10	0.10
1 May 21	10:57	0.02	0.12	0.10	0.18	0.															

[illegible]

CEMs Data

Client Name	Client P/LT Co. Ltd.	Location	HR
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Plant Name: Q37															
Run No. 1				Run No. 2				Run No. 3				Run No. 4			
Date	Time	Flowrate kg/hr	Temperature °C	Date	Time	Flowrate kg/hr	Temperature °C	Date	Time	Flowrate kg/hr	Temperature °C	Date	Time	Flowrate kg/hr	Temperature °C
21-Aug-17	18:48	1334.47	118.0	21-Aug-17	18:48	1334.47	118.0	21-Aug-17	11:28	1357.84	118.0	21-Aug-17	11:40	1407.25	118.0
21-Aug-17	18:49	1334.23	118.0	21-Aug-17	11:51	1334.23	118.0	21-Aug-17	11:29	1358.44	118.0	21-Aug-17	11:41	1407.86	118.0
21-Aug-17	18:50	1437.86	118.0	21-Aug-17	12:02	1334.23	118.0	21-Aug-17	11:30	1358.44	118.0	21-Aug-17	11:42	1408.47	118.0
21-Aug-17	18:51	1438.33	118.0	21-Aug-17	12:13	1334.23	118.0	21-Aug-17	11:31	1358.44	118.0	21-Aug-17	11:43	1409.08	118.0
21-Aug-17	18:52	1438.80	118.0	21-Aug-17	12:24	1334.23	118.0	21-Aug-17	11:32	1358.44	118.0	21-Aug-17	11:44	1409.69	118.0
21-Aug-17	18:53	1439.37	118.0	21-Aug-17	12:35	1334.23	118.0	21-Aug-17	11:33	1358.44	118.0	21-Aug-17	11:45	1410.30	118.0
21-Aug-17	18:54	1439.94	118.0	21-Aug-17	12:46	1334.23	118.0	21-Aug-17	11:34	1358.44	118.0	21-Aug-17	11:46	1410.91	118.0
21-Aug-17	18:55	1440.51	118.0	21-Aug-17	12:57	1334.23	118.0	21-Aug-17	11:35	1358.44	118.0	21-Aug-17	11:47	1411.52	118.0
21-Aug-17	18:56	1441.08	118.0	21-Aug-17	13:08	1334.23	118.0	21-Aug-17	11:36	1358.44	118.0	21-Aug-17	11:48	1412.13	118.0
21-Aug-17	18:57	1441.65	118.0	21-Aug-17	13:19	1334.23	118.0	21-Aug-17	11:37	1358.44	118.0	21-Aug-17	11:49	1412.74	118.0
21-Aug-17	18:58	1442.22	118.0	21-Aug-17	13:30	1334.23	118.0	21-Aug-17	11:38	1358.44	118.0	21-Aug-17	11:50	1413.35	118.0
21-Aug-17	18:59	1442.79	118.0	21-Aug-17	13:41	1334.23	118.0	21-Aug-17	11:39	1358.44	118.0	21-Aug-17	11:51	1413.96	118.0
21-Aug-17	19:00	1443.36	118.0	21-Aug-17	13:52	1334.23	118.0	21-Aug-17	11:40	1358.44	118.0	21-Aug-17	11:52	1414.57	118.0
21-Aug-17	19:01	1443.93	118.0	21-Aug-17	14:03	1334.23	118.0	21-Aug-17	11:41	1358.44	118.0	21-Aug-17	11:53	1415.18	118.0
21-Aug-17	19:02	1444.50	118.0	21-Aug-17	14:14	1334.23	118.0	21-Aug-17	11:42	1358.44	118.0	21-Aug-17	11:54	1415.79	118.0
21-Aug-17	19:03	1445.07	118.0	21-Aug-17	14:25	1334.23	118.0	21-Aug-17	11:43	1358.44	118.0	21-Aug-17	11:55	1416.40	118.0
21-Aug-17	19:04	1445.64	118.0	21-Aug-17	14:36	1334.23	118.0	21-Aug-17	11:44	1358.44	118.0	21-Aug-17	11:56	1417.01	118.0
21-Aug-17	19:05	1446.21	118.0	21-Aug-17	14:47	1334.23	118.0	21-Aug-17	11:45	1358.44	118.0	21-Aug-17	11:57	1417.62	118.0
21-Aug-17	19:06	1446.78	118.0	21-Aug-17	14:58	1334.23	118.0	21-Aug-17	11:46	1358.44	118.0	21-Aug-17	11:58	1418.23	118.0
21-Aug-17	19:07	1447.35	118.0	21-Aug-17	15:09	1334.23	118.0	21-Aug-17	11:47	1358.44	118.0	21-Aug-17	11:59	1418.84	118.0
21-Aug-17	19:08	1447.92	118.0	21-Aug-17	15:20	1334.23	118.0	21-Aug-17	11:48	1358.44	118.0	21-Aug-17	12:00	1419.45	118.0
21-Aug-17	19:09	1448.49	118.0	21-Aug-17	15:31	1334.23	118.0	21-Aug-17	11:49	1358.44	118.0	21-Aug-17	12:01	1420.06	118.0
21-Aug-17	19:10	1449.06	118.0	21-Aug-17	15:42	1334.23	118.0	21-Aug-17	11:50	1358.44	118.0	21-Aug-17	12:02	1420.67	118.0
21-Aug-17	19:11	1449.63	118.0	21-Aug-17	15:53	1334.23	118.0	21-Aug-17	11:51	1358.44	118.0	21-Aug-17	12:03	1421.28	118.0
21-Aug-17	19:12	1450.20	118.0	21-Aug-17	16:04	1334.23	118.0	21-Aug-17	11:52	1358.44	118.0	21-Aug-17	12:04	1421.89	118.0
21-Aug-17	19:13	1450.77	118.0	21-Aug-17	16:15	1334.23	118.0	21-Aug-17	11:53	1358.44	118.0	21-Aug-17	12:05	1422.50	118.0
21-Aug-17	19:14	1451.34	118.0	21-Aug-17	16:26	1334.23	118.0	21-Aug-17	11:54	1358.44	118.0	21-Aug-17	12:06	1423.11	118.0
21-Aug-17	19:15	1451.91	118.0	21-Aug-17	16:37	1334.23	118.0	21-Aug-17	11:55	1358.44	118.0	21-Aug-17	12:07	1423.72	118.0
21-Aug-17	19:16	1452.48	118.0	21-Aug-17	16:48	1334.23	118.0	21-Aug-17	11:56	1358.44	118.0	21-Aug-17	12:08	1424.33	118.0
21-Aug-17	19:17	1453.05	118.0	21-Aug-17	16:59	1334.23	118.0	21-Aug-17	11:57	1358.44	118.0	21-Aug-17	12:09	1424.94	118.0
21-Aug-17	19:18	1453.62	118.0	21-Aug-17	17:10	1334.23	118.0	21-Aug-17	11:58	1358.44	118.0	21-Aug-17	12:10	1425.55	118.0
21-Aug-17	19:19	1454.19	118.0	21-Aug-17	17:21	1334.23	118.0	21-Aug-17	11:59	1358.44	118.0	21-Aug-17	12:11	1426.16	118.0
21-Aug-17	19:20	1454.76	118.0	21-Aug-17	17:32	1334.23	118.0	21-Aug-17	12:00	1358.44	118.0	21-Aug-17	12:12	1426.77	118.0
21-Aug-17	19:21	1455.33	118.0	21-Aug-17	17:43	1334.23	118.0	21-Aug-17	12:01	1358.44	118.0	21-Aug-17	12:13	1427.38	118.0
21-Aug-17	19:22	1455.90	118.0	21-Aug-17	17:54	1334.23	118.0	21-Aug-17	12:02	1358.44	118.0	21-Aug-17	12:14	1427.99	118.0
21-Aug-17	19:23	1456.47	118.0	21-Aug-17	18:05	1334.23	118.0	21-Aug-17	12:03	1358.44	118.0	21-Aug-17	12:15	1428.60	118.0
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CEMs Data

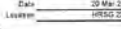
Client Name: Gulf JP UT Co. Ltd.
Plant Name: GUT

Location: HRSG 21

Run No. 9				Run No. 10				Run No. 11				Run No. 12			
Date	Time	Flowrate (Nm ³ /hr)	Temperature (°C)	Date	Time	Flowrate (Nm ³ /hr)	Temperature (°C)	Date	Time	Flowrate (Nm ³ /hr)	Temperature (°C)	Date	Time	Flowrate (Nm ³ /hr)	Temperature (°C)
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21-Apr-23	19:10	1489.44	-	21-Apr-23	19:41	1489.42	-	21-Apr-23	20:06	1489.55	-	21-Apr-23	20:32	1485.89	-
21-Apr-23	19:15	1484.95	-	21-Apr-23	19:46	1489.55	-	21-Apr-23	20:11	1489.68	-	21-Apr-23	20:37	1485.93	-
21-Apr-															



Run Date		Time Base 21 min						Run Date		Time Base 21 min					
Date	Time	SSD	NSD	ISD	OSD	SSD	OSD	Date	Time	SSD	NSD	ISD	OSD	SSD	OSD
		km/h	km/h	km/h	km/h	km/h	km/h			km/h	km/h	km/h	km/h	km/h	km/h
29 Nov 13	12:40	19.61	17.85	17.54	18.89	-	0.00	29 Nov 13	13:03	18.67	17.34	17.34	17.95	18.95	-
29 Nov 13	12:45	12.64	12.64	12.64	12.64	14.53	-	29 Nov 13	13:08	17.89	17.89	17.89	17.89	18.95	-
29 Nov 13	12:48	13.48	13.48	13.48	13.48	14.89	-	29 Nov 13	13:10	17.87	17.87	17.87	17.87	18.95	-
29 Nov 13	12:49	13.64	13.64	13.64	13.64	14.89	-	29 Nov 13	13:15	17.87	17.87	17.87	17.87	18.95	-
29 Nov 13	12:50	13.56	13.56	13.56	13.56	14.89	-	29 Nov 13	13:17	17.87	17.87	17.87	17.87	18.95	-
29 Nov 13	12:51	13.96	13.96	13.96	13.96	14.89	-	29 Nov 13	13:18	17.89	17.89	17.89	17.89	18.95	-
29 Nov 13	12:52	14.16	14.16	14.16	14.16	14.89	-	29 Nov 13	13:20	17.89	17.89	17.89	17.89	18.95	-
29 Nov 13	12:53	14.76	14.76	14.76	14.76	14.89	-	29 Nov 13	13:24	17.89	17.89	17.89	17.89	18.95	-
29 Nov 13	12:54	15.07	15.07	15.07	15.07	14.89	-	29 Nov 13	13:25	17.87	17.87	17.87	17.87	18.95	-
29 Nov 13	12:55	15.19	15.19	15.19	15.19	14.89	-	29 Nov 13	13:26	17.87	17.87	17.87	17.87	18.95	-
29 Nov 13	12:56	15.87	15.87	15.87	15.87	14.89	-	29 Nov 13	13:27	17.87	17.87	17.87	17.87	18.95	-
29 Nov 13	12:57	15.97	15.97	15.97	15.97	14.89	-	29 Nov 13	13:28	17.87	17.87	17.87	17.87	18.95	-
29 Nov 13	12:58	16.03	16.03	16.03	16.03	14.89	-	29 Nov 13	13:29	17.87	17.87	17.87	17.87	18.95	-
29 Nov 13	12:59	16.03	16.03	16.03	16.03	14.89	-	29 Nov 13	13:30	17.87	17.87	17.87	17.87	18.95	-
29 Nov 13	13:00	16.03	16.03	16.03	16.03	14.89	-	29 Nov 13	13:31	17.87	17.87	17.87	17.87	18.95	-
29 Nov 13	13:01	16.03	16.03	16.03	16.03	14.89	-	29 Nov 13	13:32	17.87	17.87	17.87	17.87	18.95	-
29 Nov 13	13:02	16.03	16.03	16.03	16.03	14.89	-	29 Nov 13	13:33	17.87	17.87	17.87	17.87	18.95	-
29 Nov 13	13:03	16.03	16.03	16.03	16.03	14.89	-	29 Nov 13	13:34	17.87	17.87	17.87	17.87	18.95	-
29 Nov 13	13:04	16.03	16.03	16.03	16.03	14.89	-	29 Nov 13	13:35	17.87	17.87	17.87	17.87	18.95	-
29 Nov 13	13:05	16.03	16.03	16.03	16.03	14.89	-	29 Nov 13	13:36	17.87	17.87	17.87	17.87	18.95	-
29 Nov 13	13:06	16.03	16.03	16.03	16.03	14.89	-	29 Nov 13	13:37	17.87	17.87	17.87	17.87	18.95	-
29 Nov 13	13:07	16.03	16.03	16.03	16.03	14.89	-	29 Nov 13	13:38	17.87	17.87	17.87	17.87	18.95	-
29 Nov 13	13:08	16.03	16.03	16.03	16.03	14.89	-	29 Nov 13	13:39	17.87	17.87	17.87	17.87	18.95	-
29 Nov 13	13:09	16.03	16.03	16.03	16.03	14.89	-	29 Nov 13	13:40	17.87	17.87	17.87	17.87	18.95	-
29 Nov 13	13:10	16.03	16.03	16.03	16.03	14.89	-	29 Nov 13	13:41	17.87	17.87	17.87	17.87	18.95	-
29 Nov 13	13:11	16.03	16.03	16.03	16.03	14.89	-	29 Nov 13	13:42	17.87	17.87	17.87	17.87	18.95	-
29 Nov 13	13:12	16.03	16.03	16.03	16.03	14.89	-	29 Nov 13	13:43	17.87	17.87	17.87	17.87	18.95	-
29 Nov 13	13:13	16.03	16.03	16.03	16.03	14.89	-	29 Nov 13	13:44	17.87	17.87	17.87	17.87	18.95	-
29 Nov 13	13:14	16.03	16.03	16.03	16.03	14.89	-	29 Nov 13	13:45	17.87	17.87	17.87	17.87	18.95	-
29 Nov 13	13:15	16.03	16.03	16.03	16.03	14.89	-	29 Nov 13	13:46	17.87	17.87	17.87	17.87	18.95	-
29 Nov 13	13:16	16.03	16.03	16.03	16.03	14.89	-	29 Nov 13	13:47	17.87	17.87	17.87	17.87	18.95	-
29 Nov 13	13:17	16.03	16.03	16.03	16.03	14.89	-	29 Nov 13	13:48	17.87	17.87	17.87	17.87	18.95	-
29 Nov 13	13:18	16.03	16.03	16.03	16.03	14.89	-	29 Nov 13	13:49	17.87	17.87	17.87	17.87	18.95	-
29 Nov 13	13:19	16.03	16.03	16.03	16.03	14.89	-	29 Nov 13	13:50	17.87	17.87	17.87	17.87	18.95	-
29 Nov 13	13:20	16.03	16.03	16.03	16.03	14.89	-	29 Nov 13	13:51	17.87	17.87	17.87	17.87	18.95	-
29 Nov 13	13:21	16.03	16.03	16.03	16.03	14.89	-	29 Nov 13	13:52	17.87	17.87	17.87	17.87	18.95	-
29 Nov 13	13:22	16.03	16.03	16.03	16.03	14.89	-	29 Nov 13	13:53	17.87	17.87	17.87	17.87	18.95	-
29 Nov 13	13:23	16.03	16.03	16.03	16.03	14.89	-	29 Nov 13	13:54	17.87	17.87	17.87	17.87	18.95	-
29 Nov 13	13:24	16.03	16.03	16.03	16.03	14.89	-	29 Nov 13	13:55	17.87	17.87	17.87	17.87	18.95	-
29 Nov 13	13:25	16.03	16.03	16.03	16.03	14.89	-	29 Nov 13	13:56	17.87	17.87	17.87	17.87	18.95	-
29 Nov 13	13:26	16.03	16.03	16.03	16.03	14.89	-	29 Nov 13	13:57	17.87	17.87	17.87	17.87	18.95	-
29 Nov 13	13:27	16.03	16.03	16.03	16.03	14.89	-	29 Nov 13	13:58	17.87	17.87	17.87	17.87	18.95	-
29 Nov 13	13:28	16.03	16.03	16.03	16.03	14.89	-	29 Nov 13	13:59	17.87	17.87	17.87	17.87	18.95	-
29 Nov 13	13:29	16.03	16.03	16.03	16.03	14.89	-	29 Nov 13	14:00	17.87	17.87	17.87	17.87	18.95	-
29 Nov 13	13:30	16.03	16.03	16.03	16.03	14.89	-	29 Nov 13	14:01	17.87	17.87	17.87	17.87	18.95	-
29 Nov 13	13:31	16.03	16.03	16.03	16.03	14.89	-	29 Nov 13	14:02	17.87	17.87	17.87	17.87	18.95	-
29 Nov 13	13:32	16.03	16.03	16.03	16.03	14.89	-	29 Nov 13	14:03	17.87	17.87	17.87	17.87	18.95	-
29 Nov 13	13:33	16.03	16.03	16.03	16.03	14.89	-	29 Nov 13	14:04	17.87	17.87	17.87	17.87	18.95	-
29 Nov 13	13:34	16.03	16.03	16.03	16.03	14.89	-	29 Nov 13	14:05	17.87	17.87	17.87	17.87	18.95	-
29 Nov 13	13:35	16.03	16.03	16.03	16.03	14.89	-	29 Nov 13	14:06	17.87	17.87	17.87	17.87	18.95	-
29 Nov 13	13:36	16.03	16.03	16.03	16.03	14.89	-	29 Nov 13	14:07	17.87	17.87	17.87	17.87	18.95	-
29 Nov 13	13:37	16.03	16.03	16.03	16.03	14.89	-	29 Nov 13	14:08	17.87	17.87	17.87	17.87	18.95	-
29 Nov 13	13:38	16.03	16.03	16.03	16.03	14.89	-	29 Nov 13	14:09	17.87	17.87	17.87	17.87	18.95	-
29 Nov 13	13:39	16.03	16.03	16.03	16.03	14.89	-	29 Nov 13	14:10	17.87	17.87	17.87	17.87	18.95	-
29 Nov 13	13:40	16.03	16.03	16.03	16.03	14.89	-	29 Nov 13	14:11	17.87	17.87	17.87	17.87	18.95	-
29 Nov 13	13:41	16.03	16.03	16.03	16.03	14.89	-	29 Nov 13	14:12	17.87	17.87	17.87	17.87	18.95	-
29 Nov 13	13:42	16.03	16.03	16.03	16.03	14.89	-	29 Nov 13	14:13	17.87	17.87	17.87	17.87	18.95	-
29 Nov 13	13:43	16.03	16.03	16.03	16.03	14.89	-	29 Nov 13	14:14	17.87	17.87	17.87	17.87	18.95	-
29 Nov 13	13:44	16.03	16.03	16.03	16.03	14.89	-	29 Nov 13	14:15	17.87	17.87	17.87	17.87	18.95	-
29 Nov 13	13:45	16.03	16.03	16.03	16.03	14.89	-	29 Nov 13	14:16	17.87	17.87	17.87	17.87	18.95	-
29 Nov 13	13:46	16.03	16.03	16.03	16.03	14.89	-	29 Nov 13	14:17	17.87	17.87	17.87	17.87	18.95	-
29 Nov 13	13:47	16.03	16.03	16.03	16.03	14.89	-	29 Nov 13	14:18	17.87	17.87	17.87	17.87	18.95	-
29 Nov 13	13:48	16.03	16.03	16.03	16.03	14.89	-	29 Nov 13	14:19	17.87	17.87	17.87	17.87	18.95	-
29 Nov 13	13:49	16.03	16.03	16.03	16.03	14.89	-	29 Nov 13	14:20	17.87	17.87	17.87	17.87	18.95	-
29 Nov 13	13:50	16.03	16.03	16.03	16.03	14.89	-	29 Nov 13	14:21	17.87	17.87	17.87	17.87	18.95	-
29 Nov 13	13:51	16.03	16.03	16.03	16.03	14.89	-	29 Nov 13	14:22	17.87	17.87	17.87	17.87	18.95	-
29 Nov 13	13:52	16.03	16.03	16.03	16.03	14.89	-	29 Nov 13	14:23	17.87	17.87	17.87	17.87	18.95	-
29 Nov 13	13:53	16.03	16.03	16.03	16.03	14.89	-	29 Nov 13	14:24	17.87	17.87	17.87	17.87	18.95	-
29 Nov 13	13:54	16.03	16.03	16.03	16.03	14.89	-	29 Nov 13	14:25	17.87	17.87	17.87	17.87	18.95	-
29 Nov 13	13:55	16.03	16.03	16.03	16.03	14.89	-	29 Nov 13	14:26	17.87	17.87	17.87	17.87	18.95	-
29 Nov 13	13:56	16.03	16.03	16.03	16.03	14.89	-	29 Nov 13	14:27	17.87	17.87	17.87	17.87	18.95	-
29 Nov 13	13:57	16.03	16.03	16.03	16.03	14.89	-	29 Nov 13	14:28	17.87	17.87	17.87	17.87	18.95	-
29 Nov 13	13:58	16.03	16.03	16.03	16.03	14.89	-	29 Nov 13	14:29	17.87	17.87	17.87	17.87	18.95	-
29 Nov 13	13:59	16.03	16.03	16.03	16.03	14.89	-	29 Nov 13	14:30	17.87	17.87	17.87	17.87	18.95	-
29 Nov 13	14:00	16.03	16.03	16.03	16.03	14.89	-	29 Nov 13	14:31	17.87	17.87	17.87	17.87	18.95	-
29 Nov 13	14:01	16.03	16.03	16.03	16.03	14.89	-	29 Nov 13	14:32	17.87	17.87	17.87	17.87	18.95	-
29 Nov 13	14:02	16.03	16.03	16.03	16.03	14.89	-	29 Nov 13	14:33	17.87	17.87	17.87	17.87	18.95	-
29 Nov 13	14:03	16.03	16.03	16.03	16.03	14.89	-	29 Nov 13	14:34	17.8					

[illegible][illegible][illegible]

Run No.		Time Base: 21 min										Run No.		Time Base: 21 min									
Run	Time	SO2	SO2	NO	NO	CO2	CO2	PM10	PM10	PM10	PM10	Run	Time	SO2	SO2	NO	NO	CO2	CO2	PM10	PM10	PM10	PM10
		ppm	ppm	ppb	ppb	ppm	ppm	µg/m ³	µg/m ³	µg/m ³	µg/m ³			ppm	ppm	ppb	ppb	ppm	ppm	µg/m ³	µg/m ³	µg/m ³	µg/m ³
25 Nov 21	11:29	0.60	0.48	0.77	0.57	1424	8.34	2.30	2.30	2.30	2.30	25 Nov 21	11:30	0.53	0.37	0.69	0.59	1394	7.49	1.49	1.49	1.49	1.49
25 Nov 21	11:32	0.48	0.42	0.63	0.47	1420	7.90	2.40	2.40	2.40	2.40	25 Nov 21	11:32	0.53	0.37	0.69	0.59	1394	7.49	1.49	1.49	1.49	1.49
25 Nov 21	11:35	0.50	0.44	0.71	0.61	1421	8.41	2.30	2.30	2.30	2.30	25 Nov 21	11:35	0.51	0.35	0.66	0.56	1374	7.54	1.49	1.49	1.49	1.49
25 Nov 21	11:39	0.46	0.39	0.74	0.59	1420	8.20	2.30	2.30	2.30	2.30	25 Nov 21	11:39	0.50	0.34	0.68	0.58	1376	7.46	1.49	1.49	1.49	1.49
25 Nov 21	11:42	0.50	0.44	0.70	0.60	1421	8.30	2.30	2.30	2.30	2.30	25 Nov 21	11:42	0.48	0.32	0.65	0.55	1372	7.42	1.49	1.49	1.49	1.49
25 Nov 21	11:43	0.46	0.42	0.76	0.61	1421	8.59	2.30	2.30	2.30	2.30	25 Nov 21	11:44	0.46	0.30	0.62	0.52	1378	7.43	1.49	1.49	1.49	1.49
25 Nov 21	11:44	0.46	0.42	0.77	0.62	1420	8.59	2.30	2.30	2.30	2.30	25 Nov 21	11:46	0.49	0.35	0.65	0.55	1372	7.42	1.49	1.49	1.49	1.49
25 Nov 21	11:45	0.46	0.42	0.76	0.61	1421	8.59	2.30	2.30	2.30	2.30	25 Nov 21	11:48	0.48	0.34	0.64	0.54	1372	7.42	1.49	1.49	1.49	1.49
25 Nov 21	11:46	0.46	0.42	0.76	0.61	1421	8.59	2.30	2.30	2.30	2.30	25 Nov 21	11:50	0.47	0.33	0.63	0.53	1374	7.44	1.49	1.49	1.49	1.49
25 Nov 21	11:47	0.46	0.42	0.76	0.61	1421	8.59	2.30	2.30	2.30	2.30	25 Nov 21	11:52	0.46	0.32	0.62	0.52	1378	7.48	1.49	1.49	1.49	1.49
25 Nov 21	11:48	0.46	0.42	0.76	0.61	1421	8.59	2.30	2.30	2.30	2.30	25 Nov 21	11:53	0.46	0.31	0.61	0.51	1377	7.43	1.49	1.49	1.49	1.49
25 Nov 21	11:49	0.46	0.42	0.76	0.61	1421	8.59	2.30	2.30	2.30	2.30	25 Nov 21	11:54	0.46	0.31	0.61	0.51	1377	7.43	1.49	1.49	1.49	1.49
25 Nov 21	11:50	0.46	0.42	0.76	0.61	1421	8.59	2.30	2.30	2.30	2.30	25 Nov 21	11:56	0.46	0.31	0.61	0.51	1377	7.43	1.49	1.49	1.49	1.49
25 Nov 21	11:51	0.46	0.42	0.76	0.61	1421	8.59	2.30	2.30	2.30	2.30	25 Nov 21	11:57	0.46	0.31	0.61	0.51	1377	7.43	1.49	1.49	1.49	1.49
25 Nov 21	11:52	0.46	0.42	0.76	0.61	1421	8.59	2.30	2.30	2.30	2.30	25 Nov 21	11:58	0.46	0.31	0.61	0.51	1377	7.43	1.49	1.49	1.49	1.49
25 Nov 21	11:53	0.46	0.42	0.76	0.61	1421	8.59	2.30	2.30	2.30	2.30	25 Nov 21	11:59	0.46	0.31	0.61	0.51	1377	7.43	1.49	1.49	1.49	1.49
25 Nov 21	11:54	0.46	0.42	0.76	0.61	1421	8.59	2.30	2.30	2.30	2.30	25 Nov 21	12:00	0.46	0.31	0.61	0.51	1377	7.43	1.49	1.49	1.49	1.49
25 Nov 21	11:55	0.46	0.42	0.76	0.61	1421	8.59	2.30	2.30	2.30	2.30	25 Nov 21	12:01	0.46	0.31	0.61	0.51	1377	7.43	1.49	1.49	1.49	1.49
25 Nov 21	11:56	0.46	0.42	0.76	0.61	1421	8.59	2.30	2.30	2.30	2.30	25 Nov 21	12:02	0.46	0.31	0.61	0.51	1377	7.43	1.49	1.49	1.49	1.49
25 Nov 21	11:57	0.46	0.42	0.76	0.61	1421	8.59	2.30	2.30	2.30	2.30	25 Nov 21	12:03	0.46	0.31	0.61	0.51	1377	7.43	1.49	1.49	1.49	1.49
25 Nov 21	11:58	0.46	0.42	0.76	0.61	1421	8.59	2.30	2.30	2.30	2.30	25 Nov 21	12:04	0.46	0.31	0.61	0.51	1377	7.43	1.49	1.49	1.49	1.49
25 Nov 21	11:59	0.46	0.42	0.76	0.61	1421	8.59	2.30	2.30	2.30	2.30	25 Nov 21	12:05	0.46	0.31	0.61	0.51	1377	7.43	1.49	1.49	1.49	1.49
25 Nov 21	12:00	0.46	0.42	0.76	0.61	1421	8.59	2.30	2.30	2.30	2.30	25 Nov 21	12:06	0.46	0.31	0.61	0.51	1377	7.43	1.49	1.49	1.49	1.49
25 Nov 21	12:01	0.46	0.42	0.76	0.61	1421	8.59	2.30	2.30	2.30	2.30	25 Nov 21	12:07	0.46	0.31	0.61	0.51	1377	7.43	1.49	1.49	1.49	1.49
25 Nov 21	12:02	0.46	0.42	0.76	0.61	1421	8.59	2.30	2.30	2.30	2.30	25 Nov 21	12:08	0.46	0.31	0.61	0.51	1377	7.43	1.49	1.49	1.49	1.49
25 Nov 21	12:03	0.46	0.42	0.76	0.61	1421	8.59	2.30	2.30	2.30	2.30	25 Nov 21	12:09	0.46	0.31	0.61	0.51	1377	7.43	1.49	1.49	1.49	1.49
25 Nov 21	12:04	0.46	0.42	0.76	0.61	1421	8.59	2.30	2.30	2.30	2.30	25 Nov 21	12:10	0.46	0.31	0.61	0.51	1377	7.43	1.49	1.49	1.49	1.49
25 Nov 21	12:05	0.46	0.42	0.76	0.61	1421	8.59	2.30	2.30	2.30	2.30	25 Nov 21	12:11	0.46	0.31	0.61	0.51	1377	7.43	1.49	1.49	1.49	1.49
25 Nov 21	12:06	0.46	0.42	0.76	0.61	1421	8.59	2.30	2.30	2.30	2.30	25 Nov 21	12:12	0.46	0.31	0.61	0.51	1377	7.43	1.49	1.49	1.49	1.49
25 Nov 21	12:07	0.46	0.42	0.76	0.61	1421	8.59	2.30	2.30	2.30	2.30	25 Nov 21	12:13	0.46	0.31	0.61	0.51	1377	7.43	1.49	1.49	1.49	1.49
25 Nov 21	12:08	0.46	0.42	0.76	0.61	1421	8.59	2.30	2.30	2.30	2.30	25 Nov 21	12:14	0.46	0.31	0.61	0.51	1377	7.43	1.49	1.49	1.49	1.49
25 Nov 21	12:09	0.46	0.42	0.76	0.61	1421	8.59	2.30	2.30	2.30	2.30	25 Nov 21	12:15	0.46	0.31	0.61	0.51	1377	7.43	1.49	1.49	1.49	1.49
25 Nov 21	12:10	0.46	0.42	0.76	0.61	1421	8.59	2.30	2.30	2.30	2.30	25 Nov 21	12:16	0.46	0.31	0.61	0.51	1377	7.43	1.49	1.49	1.49	1.49
25 Nov 21	12:11	0.46	0.42	0.76	0.61	1421	8.59	2.30	2.30	2.30	2.30	25 Nov 21	12:17	0.46	0.31	0.61	0.51	1377	7.43	1.49	1.49	1.49	1.49
25 Nov 21	12:12	0.46	0.42	0.76	0.61	1421	8.59	2.30	2.30	2.30	2.30	25 Nov 21	12:18	0.46	0.31	0.61	0.51	1377	7.43	1.49	1.49	1.49	1.49
25 Nov 21	12:13	0.46	0.42	0.76	0.61	1421	8.59	2.30	2.30	2.30	2.30	25 Nov 21	12:19	0.46	0.31	0.61	0.51	1377	7.43	1.49	1.49	1.49	1.49
25 Nov 21	12:14	0.46	0.42	0.76	0.61	1421	8.59	2.30	2.30	2.30	2.30	25 Nov 21	12:20	0.46	0.31	0.61	0.51	1377	7.43	1.49	1.49	1.49	1.49
25 Nov 21	12:15	0.46	0.42	0.76	0.61	1421	8.59	2.30	2.30	2.30	2.30	25 Nov 21	12:21	0.46	0.31	0.61	0.51	1377	7.43	1.49	1.49	1.49	1.49
25 Nov 21	12:16	0.46	0.42	0.76	0.61	1421	8.59	2.30	2.30	2.30	2.30	25 Nov 21	12:22	0.46	0.31	0.61	0.51	1377	7.43	1.49	1.49	1.49	1.49
25 Nov 21	12:17	0.46	0.42	0.76	0.61	1421	8.59	2.30	2.30	2.30	2.30	25 Nov 21	12:23	0.46	0.31	0.61	0.51	1377	7.43	1.49	1.49	1.49	1.49
25 Nov 21	12:18	0.46	0.42	0.76	0.61	1421	8.59	2.30	2.30	2.30	2.30	25 Nov 21	12:24	0.46	0.31	0.61	0.51	1377	7.43	1.49	1.49	1.49	1.49
25 Nov 21	12:19	0.46	0.42	0.76	0.61	1421	8.59	2.30	2.30	2.30	2.30	25 Nov 21	12:25	0.46	0.31	0.61	0.51	1377	7.43	1.49	1.49	1.49	1.49
25 Nov 21	12:20	0.46	0.42	0.76	0.61	1421	8.59	2.30	2.30	2.30	2.30	25 Nov 21	12:26	0.46	0.31	0.61	0.51	1377	7.43	1.49	1.49	1.49	1.49
25 Nov 21	12:21	0.46	0.42	0.76	0.61	1421	8.59	2.30	2.30	2.30	2.30	25 Nov 21	12:27	0.46	0.31	0.61	0.51	1377	7.43	1.49	1.49	1.49	1.49
25 Nov 21	12:22	0.46	0.42	0.76	0.61	1421	8.59	2.30	2.30	2.30	2.30	25 Nov 21	12:28	0.46	0.31	0.61	0.51	1377	7.43	1.49	1.49	1.49	1.49
25 Nov 21	12:23	0.46	0.42	0.76	0.61	1421	8.59	2.30	2.30	2.30	2.30	25 Nov 21	12:29	0.46	0.31	0.61	0.51	1377	7.43	1.49	1.49	1.49	1.49
25 Nov 21	12:24	0.46	0.42	0.76	0.61	1421	8.59	2.30	2.30	2.30	2.30	25 Nov 21	12:30	0.46	0.31	0.61	0.51	1377	7.43	1.49	1.49	1.49	1.49
25 Nov 21	12:25	0.46	0.42	0.76	0.61	1421	8.59	2.30	2.30	2.30	2.30	25 Nov 21	12:31	0.46	0.31	0.61	0.51	1377	7.43	1.49	1.49	1.49	1.49
25 Nov 21	12:26	0.46	0.42	0.76	0.61	1421	8.59	2.30	2.30	2.30	2.30	25 Nov 21	12:32	0.46	0.31	0.61	0.51	1377	7.43	1.49	1.49	1.49	1.49
25 Nov 21	12:27	0.46	0.42	0.76	0.61	1421	8.59	2.30	2.30	2.30	2.30	25 Nov 21	12:33	0.46	0.31	0.61	0.51	1377	7.43	1.49	1.49	1.49	1.49
25 Nov 21	12:28	0.46	0.42	0.76	0.61	1421	8.59	2.30	2.30	2.30	2.30	25 Nov 21	12:34	0.46	0.31	0.61	0.51	1377	7.43	1.49	1.49	1.49	1.49
25 Nov 21	12:29	0.46	0.42	0.76	0.61	1421	8.59	2.30	2.30	2.30	2.30	25 Nov 21	12:35	0.46	0.31	0.61	0.51	1377	7.43	1.49	1.49	1.49	1.49
25 Nov 21	12:30	0.46	0.42	0.76	0.61	1421	8.59	2.30	2.30	2.30	2.30	25 Nov 21	12:36	0.46	0.31	0.61	0.51	1377	7.43</				

Run #11					Time Base 21 mps					Run #12					Time Base 21 mps				
Date	Time	HR	HR	HR	HR	HR	HR	HR	HR	Date	Time	HR	HR	HR	HR	HR	HR	HR	HR
		min	sec	min	sec	min	sec	min	sec			min	sec	min	sec	min	sec	min	sec
20 Nov 19	14:05	148	04	149	26	150	28	151	31	20 Nov 20	14:01	154	03	155	10	156	23	157	26
20 Nov 19	14:11	147	04	148	13	149	22	150	32	20 Nov 20	14:02	153	03	154	10	155	24	156	29
20 Nov 19	14:16	146	04	147	13	148	22	149	31	20 Nov 20	14:03	152	03	153	10	154	24	155	29
20 Nov 19	14:21	145	04	146	13	147	22	148	31	20 Nov 20	14:04	151	03	152	10	153	24	154	29
20 Nov 19	14:26	144	04	145	13	146	22	147	31	20 Nov 20	14:05	150	03	151	10	152	24	153	29
20 Nov 19	14:31	143	04	144	13	145	22	146	31	20 Nov 20	14:06	149	03	150	10	151	24	152	29
20 Nov 19	14:36	142	04	143	13	144	22	145	31	20 Nov 20	14:07	148	03	149	10	150	24	151	29
20 Nov 19	14:41	141	04	142	13	143	22	144	31	20 Nov 20	14:08	147	03	148	10	149	24	150	29
20 Nov 19	14:46	140	04	141	13	142	22	143	31	20 Nov 20	14:09	146	03	147	10	148	24	149	29
20 Nov 19	14:51	139	04	140	13	141	22	142	31	20 Nov 20	14:10	145	03	146	10	147	24	148	29
20 Nov 19	14:56	138	04	139	13	140	22	141	31	20 Nov 20	14:11	144	03	145	10	146	24	147	29
20 Nov 19	15:01	137	04	138	13	139	22	140	31	20 Nov 20	14:12	143	03	144	10	145	24	146	29
20 Nov 19	15:06	136	04	137	13	138	22	139	31	20 Nov 20	14:13	142	03	143	10	144	24	145	29
20 Nov 19	15:11	135	04	136	13	137	22	138	31	20 Nov 20	14:14	141	03	142	10	143	24	144	29
20 Nov 19	15:16	134	04	135	13	136	22	137	31	20 Nov 20	14:15	140	03	141	10	142	24	143	29
20 Nov 19	15:21	133	04	134	13	135	22	136	31	20 Nov 20	14:16	139	03	140	10	141	24	142	29
20 Nov 19	15:26	132	04	133	13	134	22	135	31	20 Nov 20	14:17	138	03	139	10	140	24	141	29
20 Nov 19	15:31	131	04	132	13	133	22	134	31	20 Nov 20	14:18	137	03	138	10	139	24	140	29
20 Nov 19	15:36	130	04	131	13	132	22	133	31	20 Nov 20	14:19	136	03	137	10	138	24	139	29
20 Nov 19	15:41	129	04	130	13	131	22	132	31	20 Nov 20	14:20	135	03	136	10	137	24	138	29
20 Nov 19	15:46	128	04	129	13	130	22	131	31	20 Nov 20	14:21	134	03	135	10	136	24	137	29
20 Nov 19	15:51	127	04	128	13	129	22	130	31	20 Nov 20	14:22	133	03	134	10	135	24	136	29
20 Nov 19	15:56	126	04	127	13	128	22	129	31	20 Nov 20	14:23	132	03	133	10	134	24	135	29
20 Nov 19	16:01	125	04	126	13	127	22	128	31	20 Nov 20	14:24	131	03	132	10	133	24	134	29
20 Nov 19	16:06	124	04	125	13	126	22	127	31	20 Nov 20	14:25	130	03	131	10	132	24	133	29
20 Nov 19	16:11	123	04	124	13	125	22	126	31	20 Nov 20	14:26	129	03	130	10	131	24	132	29
20 Nov 19	16:16	122	04	123	13	124	22	125	31	20 Nov 20	14:27	128	03	129	10	130	24	131	29
20 Nov 19	16:21	121	04	122	13	123	22	124	31	20 Nov 20	14:28	127	03	128	10	129	24	130	29
20 Nov 19	16:26	120	04	121	13	122	22	123	31	20 Nov 20	14:29	126	03	127	10	128	24	129	29
20 Nov 19	16:31	119	04	120	13	121	22	122	31	20 Nov 20	14:30	125	03	126	10	127	24	128	29
20 Nov 19	16:36	118	04	119	13	120	22	121	31	20 Nov 20	14:31	124	03	125	10	126	24	127	29
20 Nov 19	16:41	117	04	118	13	119	22	120	31	20 Nov 20	14:32	123	03	124	10	125	24	126	29
20 Nov 19	16:46	116	04	117	13	118	22	119	31	20 Nov 20	14:33	122	03	123	10	124	24	125	29
20 Nov 19	16:51	115	04	116	13	117	22	118	31	20 Nov 20	14:34	121	03	122	10	123	24	124	29
20 Nov 19	16:56	114	04	115	13	116	22	117	31	20 Nov 20	14:35	120	03	121	10	122	24	123	29
20 Nov 19	17:01	113	04	114	13	115	22	116	31	20 Nov 20	14:36	119	03	120	10	121	24	122	29
20 Nov 19	17:06	112	04	113	13	114	22	115	31	20 Nov 20	14:37	118	03	119	10	120	24	121	29
20 Nov 19	17:11	111	04	112	13	113	22	114	31	20 Nov 20	14:38	117	03	118	10	119	24	120	29
20 Nov 19	17:16	110	04	111	13	112	22	113	31	20 Nov 20	14:39	116	03	117	10	118	24	119	29
20 Nov 19	17:21	109	04	110	13	111	22	112	31	20 Nov 20	14:40	115	03	116	10	117	24	118	29
20 Nov 19	17:26	108	04	109	13	110	22	111	31	20 Nov 20	14:41	114	03	115	10	116	24	117	29
20 Nov 19	17:31	107	04	108	13	109	22	110	31	20 Nov 20	14:42	113	03	114	10	115	24	116	29
20 Nov 19	17:36	106	04	107	13	108	22	109	31	20 Nov 20	14:43	112	03	113	10	114	24	115	29
20 Nov 19	17:41	105	04	106	13	107	22	108	31	20 Nov 20	14:44	111	03	112	10	113	24	114	29
20 Nov 19	17:46	104	04	105	13	106	22	107	31	20 Nov 20	14:45	110	03	111	10	112	24	113	29
20 Nov 19	17:51	103	04	104	13	105	22	106	31	20 Nov 20	14:46	109	03	110	10	111	24	112	29
20 Nov 19	17:56	102	04	103	13	104	22	105	31	20 Nov 20	14:47	108	03	109	10	110	24	111	29
20 Nov 19	18:01	101	04	102	13	103	22	104	31	20 Nov 20	14:48	107	03	108	10	109	24	110	29
20 Nov 19	18:06	100	04	101	13	102	22	103	31	20 Nov 20	14:49	106	03	107	10	108	24	109	29
20 Nov 19	18:11	99	04	100	13	101	22	102	31	20 Nov 20	14:50	105	03	106	10	107	24	108	29
20 Nov 19	18:16	98	04	99	13	100	22	101	31	20 Nov 20	14:51	104	03	105	10	106	24	107	29
20 Nov 19	18:21	97	04	98	13	99	22	100	31	20 Nov 20	14:52	103	03	104	10	105	24	106	29
20 Nov 19	18:26	96	04	97	13	98	22	99	31	20 Nov 20	14:53	102	03	103	10	104	24	105	29
20 Nov 19	18:31	95	04	96	13	97	22	98	31	20 Nov 20	14:54	101	03	102	10	103	24	104	29
20 Nov 19	18:36	94	04	95	13	96	22	97	31	20 Nov 20	14:55	100	03	101	10	102	24	103	29
20 Nov 19	18:41	93	04	94	13	95	22	96	31	20 Nov 20	14:56	99	03	100	10	101	24	102	29
20 Nov 19	18:46	92	04	93	13	94	22	95	31	20 Nov 20	14:57	98	03	99	10	100	24	101	29
20 Nov 19	18:51	91	04	92	13	93	22	94	31	20 Nov 20	14:58	97	03	98	10	99	24	100	29
20 Nov 19	18:56	90	04	91	13	92	22	93	31	20 Nov 20	14:59	96	03	97	10	98	24	99	29
20 Nov 19	19:01	89	04	90	13	91	22	92	31	20 Nov 20	15:00	95	03	96	10	97	24	98	29
20 Nov 19	19:06	88	04	89	13	90	22	91	31	20 Nov 20	15:01	94	03	95	10	96	24	97	29
20 Nov 19	19:11	87	04	88	13	89	22	90	31	20 Nov 20	15:02	93	03	94	10	95	24	96	29
20 Nov 19	19:16	86	04	87	13	88	22	89	31	20 Nov 20	15:03	92	03	93	10	94	24	95	29
20 Nov 19	19:21	85	04	86	13	87	22	88	31	20 Nov 20	15:04	91	03	92	10	93	24	94	29
20 Nov 19	19:26	84	04	85	13	86	22	87	31	20 Nov 20	15:05	90	03	91	10	92	24	93	29
20 Nov 19	19:31	83	04	84	13	85	22	86	31	20 Nov 20	15:06	89	03	90	10	91	24	92	29
20 Nov 19	19:36	82	04	83	13	84	22	85	31	20 Nov 20	15:07	88	03	89	10	90	24	91	29
20 Nov 19	19:41	81	04	82	13	83	22	84	31	20 Nov 20	15:08	87	03	88	10	89	24	90	29
20 Nov 19	19:46	80	04	81	13	82	22	83	31	20 Nov 20	15:09	86	03	87	10	88	24	89	29
20 Nov 19	19:51	79	04	80	13	81	22	82	31	20 Nov 20	15:10	85	03	86	10	87	24	88	29
20 Nov 19	19:56	78	04	79	13	80	22	81	31	20 Nov 20	15:11	84	03	85	10	86	24	87	29
20 Nov 19	20:01	77	04	78	13	79	22	80	31	20 Nov 20	15:12	83	03	84	10	85	24	86	29
20 Nov 19	20:06	76	04	77	13	78	22	79	31	20 Nov 20	15:13	82	03	83	10	84	24	85	29
20 Nov 19	20:11	75	04	76	13	77	22	78	31	20 Nov 20	15:14	81	03	82	1				

CERTIFICATE OF ANALYSIS

Grade of Product: EPA Protocol

Part Number: E04N199E3HA0023 Reference Number: 160-401754137-1
Cylinder Number: GNO024388 Cylinder Volume: 247.2 CF
Laboratory: 124 - Plymouthville - PA Cylinder Pressure: 2215 PSIG
PGVP Number: A12020 Valve Outlet: 660
Gas Code: CO,NO,NOX,SO2,BALN Certification Date: Mar 26, 2020
Expiration Date: Mar 26, 2028

Certification performed in accordance with EPA Traceability Protocol for Assay and Certification of Gaseous Calibration Standards (May 2012) document EPA 600/R-12/031, using the assay procedures listed. Analytical Methodology does not require correction for analytical interference. This cylinder has a full 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. 6.7 megapascals

ANALYTICAL RESULTS				
Component	Requested Concentration	Actual Concentration	Protocol Method	Total Relative Uncertainty
NOX	50.00 PPM	50.32 PPM	G1	+/- 0.6% NIST Traceable
CARBON MONOXIDE	50.00 PPM	49.55 PPM	G1	+/- 0.5% NIST Traceable
NITRIC OXIDE	50.00 PPM	50.00 PPM	G1	+/- 0.5% NIST Traceable
SULFUR DIOXIDE	50.00 PPM	50.27 PPM	G1	+/- 0.6% NIST Traceable
NITROGEN	Balance			

CALIBRATION STANDARDS				
Type	Lot ID	Cylinder No	Concentration	Uncertainty
NTRM	11010130	KAL004530	97.31 PPM CARBON MONOXIDE/NITROGEN	+/- 0.4%
NTRM	13010405	KAL003984	97.60 PPM NITRIC OXIDE/NITROGEN	+/- 0.8%
NTRM	13010405	KAL003984	97.60 PPM NOX/NITROGEN	+/- 0.8%
NTRM	16010235	KAL004419	97.69 PPM SULFUR DIOXIDE/NITROGEN	+/- 0.8%

ANALYTICAL EQUIPMENT		
Instrument/Make/Model	Analytical Principle	Last Multi-Point Calibration
MKS FTR - CO - 000928781	FTR	Mar 12, 2020
MKS FTR - NO - 00028781	FTR	Mar 05, 2020
MKS FTR - NOX - 000928781	FTR	Mar 05, 2020
MKS FTR - SO2 - 000928781	FTR	Mar 19, 2020

Triad Data Available Upon Request

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



Michael A. Huber
Approved for Release

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CERTIFICATE OF ANALYSIS

Grade of Product: EPA Protocol

Part Number: E04N199E15A0664 Reference Number: 160-401907846-1
Cylinder Number: EB0136205 Cylinder Volume: 144.4 CF
Laboratory: 124 - Plymouthville - PA Cylinder Pressure: 2015 PSIG
PGVP Number: A12020 Valve Outlet: 660
Gas Code: CO,NO,NOX,SO2,BALN Certification Date: Oct 06, 2020
Expiration Date: Oct 06, 2028

Certification performed in accordance with EPA Traceability Protocol for Assay and Certification of Gaseous Calibration Standards (May 2012) document EPA 600/R-12/031, using the assay procedures listed. Analytical Methodology does not require correction for analytical interference. This cylinder has a full 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. 6.7 megapascals

ANALYTICAL RESULTS				
Component	Requested Concentration	Actual Concentration	Protocol Method	Total Relative Uncertainty
NOX	55.00 PPM	54.64 PPM	G1	+/- 1.3% NIST Traceable
CARBON MONOXIDE	55.00 PPM	54.42 PPM	G1	+/- 0.8% NIST Traceable
NITRIC OXIDE	55.00 PPM	54.94 PPM	G1	+/- 1.3% NIST Traceable
SULFUR DIOXIDE	55.00 PPM	54.34 PPM	G1	+/- 1.0% NIST Traceable
NITROGEN	Balance			

CALIBRATION STANDARDS				
Type	Lot ID	Cylinder No	Concentration	Uncertainty
NTRM	11010130	KAL004530	97.31 PPM CARBON MONOXIDE/NITROGEN	+/- 0.4%
PRM	12386	D63525	9.91 PPM AIR/NITROGEN DIOXIDE	2.0%
NTRM	17060226	EB0075103	100.3 PPM NITRIC OXIDE/NITROGEN	+/- 1.0%
GMIS	12420884	CC323707	4.028 PPM NITROGEN DIOXIDE/NITROGEN	2.1%
NTRM	11010416	KAL004402	99.6 PPM SULFUR DIOXIDE/NITROGEN	+/- 0.8%
NTRM	16010203	KAL003987	97.69 PPM SULFUR DIOXIDE/NITROGEN	+/- 0.8%

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

ANALYTICAL EQUIPMENT		
Instrument/Make/Model	Analytical Principle	Last Multi-Point Calibration
Nicolet ISO FTR AUP2010245 CO	FTR	Sep 21, 2020
Nicolet ISO FTR AUP2010245 NO	FTR	Sep 14, 2020
Nicolet ISO FTR AUP2010245 NO2	FTR	Sep 22, 2020
Nicolet ISO FTR AUP2010245 SO2	FTR	Sep 16, 2020

Triad Data Available Upon Request

NOTES: Gross Weight: 27.8 Kg Net Weight: 4.6 Kg



Michael A. Huber
Approved for Release

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CERTIFICATE OF ANALYSIS

Grade of Product: EPA Protocol

Part Number: E04N199E3HA0002 Reference Number: 160-402138465-1
Cylinder Number: ND11218 Cylinder Volume: 247.2 Cubic Feet
Laboratory: 124 - Plymouthville - PA Cylinder Pressure: 2215 PSIG
PGVP Number: A12021 Valve Outlet: 660
Gas Code: CO,NO,NOX,SO2,BALN Certification Date: Jul 15, 2021
Expiration Date: Jul 15, 2029

Certification performed in accordance with EPA Traceability Protocol for Assay and Certification of Gaseous Calibration Standards (May 2012) document EPA 600/R-12/031, using the assay procedures listed. Analytical Methodology does not require correction for analytical interference. This cylinder has a full 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. 6.7 megapascals

ANALYTICAL RESULTS				
Component	Requested Concentration	Actual Concentration	Protocol Method	Total Relative Uncertainty
NOX	80.00 PPM	81.85 PPM	G1	+/- 1.4% NIST Traceable
CARBON MONOXIDE	80.00 PPM	79.73 PPM	G1	+/- 0.9% NIST Traceable
NITRIC OXIDE	80.00 PPM	81.85 PPM	G1	+/- 1.1% NIST Traceable
SULFUR DIOXIDE	80.00 PPM	79.92 PPM	G1	+/- 0.9% NIST Traceable
NITROGEN	Balance			

CALIBRATION STANDARDS				
Type	Lot ID	Cylinder No	Concentration	Uncertainty
NTRM	11010130	KAL004530	97.31 PPM CARBON MONOXIDE/NITROGEN	+/- 0.4%
PRM	12386	D63525	9.91 PPM AIR/NITROGEN DIOXIDE	2.0%
NTRM	200610-50	CC733426	98.91 PPM NITRIC OXIDE/NITROGEN	+/- 0.9%
GMIS	12420884	CC323707	4.028 PPM NITROGEN DIOXIDE/NITROGEN	2.1%
NTRM	16010224	KAL003938	97.69 PPM SULFUR DIOXIDE/NITROGEN	+/- 0.8%

ANALYTICAL EQUIPMENT		
Instrument/Make/Model	Analytical Principle	Last Multi-Point Calibration
Nicolet ISO FTR AUP2010245 CO	FTR	Jun 24, 2021
Nicolet ISO FTR AUP2010245 NO	FTR	Jul 01, 2021
Nicolet ISO FTR AUP2010245 NO2	FTR	Jun 30, 2021
Nicolet ISO FTR AUP2010245 SO2	FTR	Jul 09, 2021

Triad Data Available Upon Request

NOTES:
Gross Weight: 48.0 Kg
Net Weight: 7.8 Kg



Michael A. Huber
Approved for Release

Page 1 of 160-402138465-1



CERTIFICATE OF ANALYSIS

Company Details ALS Laboratory Group (Thailand) Certificate Number: 3883/17 Certificate Number: 40233 Nominal Cylinder Content: 6.520 M ³ Nominal Pressure: 145.0 Bar Valve Outlet: CGA 590 BRASS		Product Details Product Name: Steel 47L Material: Steel Certificate Number: 3883/17 Certificate Number: 40233 Nominal Cylinder Content: 6.520 M ³ Nominal Pressure: 145.0 Bar Valve Outlet: CGA 590 BRASS
Customer Details Customer Name: Linde (Thailand) Public Company Limited Customer Address: 15/1 Moo 1, Bangna-Phra Pradaeng Road, Bang Na District, Bangkok 10700, Thailand Customer Contact: Mr. Pichai Pichai Customer Phone: +66 (0) 2746 1111 Customer Email: pichai.pichai@linde.co.th		Analysis Details Analysis: Steel 47L Analysis Date: 07-Dec-2025 Analysis Result: 3883/17 Analysis Result: 40233 Analysis Result: 6.520 M ³ Analysis Result: 145.0 Bar Analysis Result: CGA 590 BRASS

CONSOLE CONTROL UNIT: CALIBRATION TEST REPORT

Commissioning Date: 1 Jan 23

Work Order No: 6 Jan 23

Calibration Unit: C-50028-BV-150007

Dry Gas Meter ID: BKH-FS0607

Serial No: 1503017

Model No: 1503017

Expected Pressure (mmHg): 75.8

Expected Humidity (%): 55.8

Temperature (°C): 23.8

Reference Dry Gas Meter Data: BKH-FS0607

Reference Dry Gas Meter ID: BKH-FS0607

Calibration Factor (CF): 1.0000

Next Calibration Date: 8 Dec 23



ΔH (mmHg)	R (mmHg)	Reference Gas Meter Data				Client Data				Dry Gas Meter	Correction Factor	Error (mmHg)	Pass / Fail
		Temp (°C)	Pressure (mmHg)	Humidity (%)	Flow (L/min)	Temp (°C)	Pressure (mmHg)	Humidity (%)	Flow (L/min)				
0	75.8	23.8	75.8	55.8	23.8	75.8	55.8	23.8	75.8	1.0000	0.0000	Pass	
10	85.8	23.8	85.8	55.8	23.8	85.8	55.8	23.8	85.8	1.0000	0.0000	Pass	
20	95.8	23.8	95.8	55.8	23.8	95.8	55.8	23.8	95.8	1.0000	0.0000	Pass	
30	105.8	23.8	105.8	55.8	23.8	105.8	55.8	23.8	105.8	1.0000	0.0000	Pass	
40	115.8	23.8	115.8	55.8	23.8	115.8	55.8	23.8	115.8	1.0000	0.0000	Pass	
50	125.8	23.8	125.8	55.8	23.8	125.8	55.8	23.8	125.8	1.0000	0.0000	Pass	
60	135.8	23.8	135.8	55.8	23.8	135.8	55.8	23.8	135.8	1.0000	0.0000	Pass	
70	145.8	23.8	145.8	55.8	23.8	145.8	55.8	23.8	145.8	1.0000	0.0000	Pass	
80	155.8	23.8	155.8	55.8	23.8	155.8	55.8	23.8	155.8	1.0000	0.0000	Pass	
90	165.8	23.8	165.8	55.8	23.8	165.8	55.8	23.8	165.8	1.0000	0.0000	Pass	
100	175.8	23.8	175.8	55.8	23.8	175.8	55.8	23.8	175.8	1.0000	0.0000	Pass	

Notes: 1. All measurements were taken at the same time and place. 2. The calibration factor is 1.0000. 3. The next calibration date is 8 Dec 23.

Calibrated by: Prasert S. Approved by: S.P.

Field Scientist (3) Specialist (1)

Next Calibration: 31 Jan 23

Location	Reference Temperature °C	Digital Temperature °C	Error °C	MPE	Pass / Fail
Stack	0	0	0	±3	Pass
	25	25	0	±3	Pass
	50	51	1	±3	Pass
	100	101	1	±3	Pass
	150	151	1	±3	Pass
	200	201	1	±3	Pass
	250	252	2	±3	Pass
	300	302	2	±3	Pass
	500	503	3	±3	Pass
Probe	100	101	1	±3	Pass
	120	121	1	±3	Pass
	140	141	1	±3	Pass
Oven	100	100	0	±3	Pass
	120	121	1	±3	Pass
	140	141	1	±3	Pass
Filter	100	100	0	±3	Pass
	120	121	1	±3	Pass
	140	142	2	±3	Pass
Exit	0	1	1	±3	Pass
	10	11	1	±3	Pass
	20	21	1	±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) ค่าความคลาดเคลื่อนที่อนุญาต

Calibrated by: Prasert S. Approved by: S.P.

(Mr. Prasert Surakhan) (Mr. Samart Roo-ngan)

Field Scientist (3) Specialist (1)

FORM NO. F-06-027 REVISION NO. 2 ISSUE DATE: 8 Feb 23

Stopwatch ID No.: E18061 Dry Gas Meter No.: BKH-FS0607

Model: F808 Model: XC-572-V

Serial No.: - Serial No.: 1503017

Calibration Date: 8 Sep 20

Certificate No.: E-2009018

Run No.	Time Actual (m:ss.ms)	Time Reading (m:ss)	Diff. (ms)	Diff. (min)
1	5:00:11	5:00	11	0.00018
2	5:00:12	5:00	12	0.00020
3	5:00:11	5:00	11	0.00016
4	5:00:09	5:00	9	0.00015
5	5:00:07	5:00	7	0.00012
6	5:00:11	5:00	11	0.00018
7	5:00:11	5:00	11	0.00018
8	5:00:09	5:00	9	0.00015
9	5:00:11	5:00	11	0.00018
10	5:00:12	5:00	12	0.00020
Average				0.00017
SD				0.00003

Calibrated by: Prasert S. Approved by: S.P.

Mr. Prasert Surakhan Mr. Samart Roo-ngan

Field Scientist (3) Specialist (1)

Type S Pitot Tube Coefficient Data

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

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

$$[Cp(s) - Cp(B)] \text{ must BE } \leq 0.01$$

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

Calibrated by: Worachit Approved by: S.P.

(Mr. Worachit Tongsom) (Mr. Samart Roo-ngan)

Field Scientist (2) Specialist (1)

FORM NO. F-06-027 REVISION NO. 1 ISSUE DATE: 30 Jan 23



Pitot Tube Calibration Data

Pitot Tube Identification Number : BKK_FS0512 Calibration Date : 3 Jan 23
Lab test duct Number : 258-1-13-01 Standard Pitot ID : BKK_FS0441
Calibration Sheet No. : C-030123-BKK_FS0512 Cp Standard : 0.99

Type S Pitot Tube Coefficient Data

	Type s pitot tube Leg A,B	Standard pitot tube (ΔP, mm.H ₂ O)	Type s pitot tube (ΔP, mm.H ₂ O)	Cp (s) Leg A	Cp (s) Leg B
Test 1	A	12.00	17.00	0.840	-
	B	12.00	17.00	-	0.840
Test 2	A	12.00	17.00	0.840	-
	B	12.00	17.00	-	0.840
Test 3	A	12.00	16.80	0.845	-
	B	12.00	16.80	-	0.845
\bar{C}_p				0.842	0.842

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

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

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

Calibrated by Worachit
(Mr. Worachit Tengsom)
Field Scientist (2)

Approved by S.P.
(Mr. Samart Roongnan)
Specialist (1)

(PIT044) (PIT049) (PIT049) (PIT049) (PIT049) (PIT049) (PIT049) (PIT049) (PIT049) (PIT049)



PROBE NOZZLE DIAMETER CALIBRATION DATA SHEET

Calibration Date : 3 Jan 23 Nozzle Set ID : BKK_FS0513
Calibration Sheet No. : C-030123-BKK_FS0513 Vermer Caliper ID : RYG_FS0559

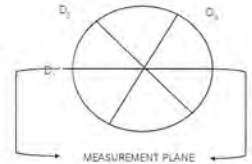
Nozzle ID	Nozzle Diameter (cm.)			Hi - Lo ΔD	(D ₁ + D ₂ + D ₃) / 3
	D ₁	D ₂	D ₃		
1	0.315	0.315	0.315	0.000	0.315
2	0.475	0.475	0.475	0.000	0.475
3	0.635	0.635	0.635	0.000	0.635
4	0.790	0.790	0.790	0.000	0.790
5	0.950	0.950	0.950	0.000	0.950
6	1.110	1.110	1.110	0.000	1.110
7	1.270	1.270	1.270	0.000	1.270
8	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 Worachit
(Mr. Worachit Tengsom)
Field Scientist (2)

Approved by S.P.
(Mr. Samart Roongnan)
Field Specialist (1)

(PIT044) (PIT049) (PIT049) (PIT049) (PIT049) (PIT049) (PIT049) (PIT049) (PIT049) (PIT049)



Stopwatch Calibration Test Report

Calibration Date : 3 Jan 23 Next Cal. Date : 3 Jul 23
Barometric Pressure (mmHg) : 759 Temperature (°C) : 27.0
Relative Humidity (%) : 58.0

Reference Stopwatch Data

Stopwatch ID No. : E16051
Model : F806
Serial No. : -
Calibration Date : 8 Sep 20
Certificate No. : S-2009018

Console Control Meter Data

Dry Gas Meter No. : BKK_FS0499
Model : KC-672-V
Serial No. : 1452087

Run No.	Time Actual (m:ss.ms)	Time Reading (m:ss)	Diff. (ms)	Diff. (min)
1	5:00:09	5:00	9	0.00015
2	5:00:10	5:00	10	0.00017
3	5:00:12	5:00	12	0.00020
4	5:00:11	5:00	11	0.00018
5	5:00:10	5:00	10	0.00017
6	5:00:10	5:00	10	0.00017
7	5:00:08	5:00	8	0.00013
8	5:00:11	5:00	11	0.00018
9	5:00:09	5:00	9	0.00015
10	5:00:10	5:00	10	0.00017
Average			10	0.00017
SD				0.00002

Calibrate by Prasert S.
Mr. Prasert Surakhan
Field Scientist (3)

Approved by S.P.
Mr. Samart Roongnan
Specialist (1)

CONSOLE CONTROL UNIT CALIBRATION TEST REPORT

Reference Data		Reference Data	
Stopwatch ID No.	E16051	Stopwatch ID No.	E16051
Model	F806	Model	F806
Serial No.	-	Serial No.	-
Calibration Date	8 Sep 20	Calibration Date	8 Sep 20
Certificate No.	S-2009018	Certificate No.	S-2009018

Calibrated by Prasert S.
Mr. Prasert Surakhan
Field Scientist (3)

Approved by S.P.
Mr. Samart Roongnan
Specialist (1)



DIGITAL TEMPERATURE CALIBRATION DATA SHEET

Calibration Date : 3 Jan 23	Ambient Temperature (°C) 30
Calibration sheet No. : C-030123-BKK_FS0497	Relative Humidity (%) : 62
Digital Temperature ID : BKK_FS0497	Reference Temperature ID : BKK_FS1144
Serial No. : 1412087	Serial No. : 201090000013
Model : XC-572-V	Model : Digicon-CC-VT-M5
	Next Calibrate : 31 Jan 23

Location	Reference Temperature °C	Digital Temperature °C	Error °C	MPE	Pass / Fail
Stick	0	0	0	±3	Pass
	25	25	0	±3	Pass
	50	50	0	±3	Pass
	100	100	0	±3	Pass
	150	150	0	±3	Pass
	200	199	-1	±3	Pass
	250	249	-1	±3	Pass
	300	299	-1	±3	Pass
	500	498	-2	±3	Pass
	100	101	1	±3	Pass
Probe	120	121	1	±3	Pass
	140	142	2	±3	Pass
	100	100	0	±3	Pass
	120	121	1	±3	Pass
Oven	140	142	2	±3	Pass
	100	100	0	±3	Pass
	120	121	1	±3	Pass
	140	142	2	±3	Pass
Filter	100	100	0	±3	Pass
	120	121	1	±3	Pass
	140	142	2	±3	Pass
	0	1	1	±3	Pass
Exit	10	11	1	±3	Pass
	20	21	1	±3	Pass
	0	1	1	±3	Pass
	25	26	1	±3	Pass
Meter	50	51	1	±3	Pass
	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. Samant Roong-ngan)
Field Scientist (3) Specialist (1)

FORM NO. F-08-027 REVISION NO. 2 ISSUE DATE 8 Feb 23



Pitot Tube Calibration Data

Pitot Tube Identification Number : BKK_FS0500	Calibration Date : 3 Jan 23
Lab test duct Number : 258-1-13-01	Standard Pitot ID : BKK_FS0441
Calibration Sheet No. : C-030123-BKK_FS0500	Cp Standard : 0.99

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

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

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

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

Calibrated by : Worachit Approved by : S.P.
(Mr. Worachit Tongpoom) (Mr. Samant Roong-ngan)
Field Scientist (2) Specialist (1)

FORM NO. F-08-028 REVISION NO. 1 ISSUE DATE 30 Jan 22



Pitot Tube Calibration Data

Pitot Tube Identification Number : BKK_FS0501	Calibration Date : 3 Jan 23
Lab test duct Number : 258-1-13-01	Standard Pitot ID : BKK_FS0441
Calibration Sheet No. : C-030123-BKK_FS0501	Cp Standard : 0.99

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

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

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

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

Calibrated by : Worachit Approved by : S.P.
(Mr. Worachit Tongpoom) (Mr. Samant Roong-ngan)
Field Scientist (2) Specialist (1)

FORM NO. F-08-028 REVISION NO. 1 ISSUE DATE 30 Jan 22



PROBE NOZZLE DIAMETER CALIBRATION DATA SHEET

Calibration Date : 3 Jan 23	Nozzle Set ID : BKK_FS0502
Calibration Sheet No. : C-030123-BKK_FS0502	Vernier Caliper ID : RYG_FS0539

Nozzle ID #	Nozzle Diameter (cm.)			Hi - Lo ΔD	(D ₁ - D ₂ - D ₃) / 3
	D ₁	D ₂	D ₃		
1	0.315	0.315	0.315	0.000	0.315
2	0.475	0.475	0.475	0.000	0.475
3	0.635	0.635	0.635	0.000	0.635
4	0.790	0.790	0.790	0.000	0.790
5	0.950	0.950	0.950	0.000	0.950
6	1.110	1.110	1.110	0.000	1.110
7	1.270	1.270	1.270	0.000	1.270
8	1.600	1.600	1.600	0.000	1.600

Where :

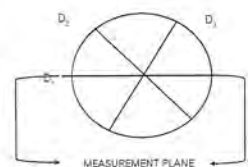
D₁, D₂, D₃ : Three different nozzle diameters at 60 degrees to

each other, each measured the nearest 0.025 mm.

ΔD : Maximum distance between any two diameters.

Must be ≤ 0.100 mm.

D_{ave} : (D₁ + D₂ + D₃) / 3



Calibrated by : Worachit Approved by : S.P.
(Mr. Worachit Tongpoom) (Mr. Samant Roong-ngan)
Field Scientist (2) Field Specialist (1)

FORM NO. F-08-029 REVISION NO. 1 ISSUE DATE 30 Jan 22

CONSOLE CONTROL UNIT - CALIBRATION TEST REPORT

Calibration Date: 1 Apr 20
Next Cal. Date: 2 Jul 23


Console Control Meter Data

Serial No.: 000003-BK-K-521009
Dry Gas Meter ID: BKK_FS1009
Date No.: 1706090
Model No.: XC-572-V

Electronic Pressure (mmHg): 758
Relative Humidity (%): 59.0
Temperature (°C): 27.0

Reference Dry Gas Meter Data

Reference Dry Gas Meter ID: BKK_521009
Serial No.: 1706090
Connection Factor (1): 1.0000
Next Calibration Due: 9 Dec 23



Alt (m)	θ (deg)	Reference Dry Gas Meter Calibration				Console Control - Dry Gas Meter										Printed Meter Calibration Factor (1)	Serial Factor (1)	
		Obs	True	Total	TD	Obs	True	Total	TD	Obs	True	Total	TD	Obs	True			Total
0	12.41	150.00	0.00	150.00	94.0	1000.00	0.00	1000.00	140.00	95.0	1000.00	0.00	1000.00	140.00	95.0	1000.00	0.00	1000.00
25	12.55	150.00	0.00	150.00	94.0	1000.00	0.00	1000.00	140.00	95.0	1000.00	0.00	1000.00	140.00	95.0	1000.00	0.00	1000.00
50	12.70	150.00	0.00	150.00	94.0	1000.00	0.00	1000.00	140.00	95.0	1000.00	0.00	1000.00	140.00	95.0	1000.00	0.00	1000.00
75	12.85	150.00	0.00	150.00	94.0	1000.00	0.00	1000.00	140.00	95.0	1000.00	0.00	1000.00	140.00	95.0	1000.00	0.00	1000.00
100	13.00	150.00	0.00	150.00	94.0	1000.00	0.00	1000.00	140.00	95.0	1000.00	0.00	1000.00	140.00	95.0	1000.00	0.00	1000.00
125	13.15	150.00	0.00	150.00	94.0	1000.00	0.00	1000.00	140.00	95.0	1000.00	0.00	1000.00	140.00	95.0	1000.00	0.00	1000.00
150	13.30	150.00	0.00	150.00	94.0	1000.00	0.00	1000.00	140.00	95.0	1000.00	0.00	1000.00	140.00	95.0	1000.00	0.00	1000.00

1. If the pressure of reference to any gas meter, transfer to pressure (mmHg) from total weight.
 2. If the pressure of reference to any gas meter, transfer to pressure (mmHg) from total weight.
 3. If the pressure of reference to any gas meter, transfer to pressure (mmHg) from total weight.

On Station: Prasert S. (Mr. Prasert Surakhan) Field Scientist (2)
 Submitted by: S.P. (Mr. Samant Ro-ngan) Specialist (1)

Next Calibrate : 31 Jan 23

Location	Reference Temperature °C	Digital Temperature °C	Error °C	MPE	Pass / Fail
Stack	0	0	0	±3	Pass
	25	25	0	±3	Pass
	50	50	0	±3	Pass
	100	100	0	±3	Pass
	150	150	0	±3	Pass
	200	200	0	±3	Pass
Probe	250	249	-1	±3	Pass
	300	299	-1	±3	Pass
	500	498	-2	±3	Pass
	100	100	0	±3	Pass
	120	120	0	±3	Pass
	140	141	1	±3	Pass
Oven	100	100	0	±3	Pass
	120	120	0	±3	Pass
Filter	140	141	1	±3	Pass
	100	100	0	±3	Pass
Exit	120	120	0	±3	Pass
	140	141	1	±3	Pass
Meter	0	0	0	±3	Pass
	25	25	0	±3	Pass
	50	50	0	±3	Pass
	AUX	0	0	0	±3
	25	25	0	±3	Pass
	50	50	0	±3	Pass

MPE : (Maximum permissible error of measurement) ค่าความคลาดเคลื่อนสูงสุดที่อนุญาต

Calibrated by : Prasert S. (Mr. Prasert Surakhan) Field Scientist (2)
 Approved by : S.P. (Mr. Samant Ro-ngan) Specialist (1)

FORM NO. : F-08-027 REVISION NO. 2 ISSUE DATE : 2 Feb 23

Stopwatch ID No. : E18061 Dry Gas Meter No. : BKK_FS1009
 Model : F808 Model : XC-572-V
 Serial No. : Serial No. : 1706090
 Calibration Date : 8 Sep 20
 Certificate No. : E-2009018

Run No.	Time Actual (m:ss.ms)	Time Reading (m:ss)	Diff. (ms)	Diff. (min)
1	5:00.11	5:00	11	0.00018
2	5:00.10	5:00	10	0.00017
3	5:00.11	5:00	11	0.00018
4	5:00.10	5:00	10	0.00017
5	5:00.12	5:00	12	0.00020
6	5:00.12	5:00	12	0.00020
7	5:00.10	5:00	10	0.00017
8	5:00.10	5:00	10	0.00017
9	5:00.08	5:00	8	0.00013
10	5:00.09	5:00	9	0.00015
			Average	0.00017
			SD	0.00002

Calibrated by : Prasert S. (Mr. Prasert Surakhan) Field Scientist (2)
 Approved by : S.P. (Mr. Samant Ro-ngan) Specialist (1)

Type S Pitot Tube Coefficient Data

	Type s pitot tube (Leg A,B)	Standard pitot tube (ΔP, mm H ₂ O)	Type s pitot tube (ΔP, mm H ₂ O)	Cp (s) Leg A	Cp (s) Leg B
Test 1	A	12.00	17.00	0.840	-
	B	12.00	17.00	-	0.840
Test 2	A	12.00	17.00	0.840	-
	B	12.00	17.00	-	0.840
Test 3	A	12.00	16.80	0.845	-
	B	12.00	16.80	-	0.845
\bar{C}_p				0.842	0.842

$$C_{p(S)} = \bar{C}_p - \sqrt{\frac{\Delta P (std)}{\Delta P (s)}}$$

$$[C_{p(A)} - C_{p(B)}] \text{ must } BE \leq 0.01$$

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

Calibrated by : Worawich T. (Mr. Worawich Tongsom) Field Scientist (2)
 Approved by : S.P. (Mr. Samant Ro-ngan) Specialist (1)

FORM NO. : F-08-027 REVISION NO. 1 ISSUE DATE : 2 Feb 23



Pitot Tube Calibration Data

Pitot Tube Identification Number : BKK_FS1105 Calibration Date : 3 Jan 23
Lab test duct Number : 258-1-13-01 Standard Pitot ID : BKK_FS0441
Calibration Sheet No : C-030123-BKK_FS1105 Cp Standard : 0.99

Type S Pitot Tube Coefficient Data					
	Type s pitot tube Leg A,B	Standard pitot tube (ΔP , mm H ₂ O)	Type s pitot tube (ΔP , mm H ₂ O)	Cp (s) Leg A	Cp (s) Leg B
Test 1	A	12.00	18.80	0.845	-
	B	12.00	16.80	-	0.845
Test 2	A	12.00	17.20	0.835	-
	B	12.00	17.20	-	0.835
Test 3	A	12.00	16.80	0.845	-
	B	12.00	16.80	-	0.845
\bar{C}_p				0.842	0.842

$$C_p(s) = C_p - \sqrt{\frac{\Delta P(s)}{\Delta P(s)}}$$

$$|C_p(s) - \bar{C}_p(s)|_{\text{max}} \leq 0.01$$

$$\text{Average deviation (A or B)} = \frac{\sum |C_p(s) - \bar{C}_p(s)|}{s} \text{ must be } \leq 0.01$$

Calibrated by Worachit
(Mr. Worachit Tengsom)
Field Scientist (2)

Approved by S.P.
(Mr. Samart Roengnan)
Specialist (1)

FORM-001-2 Rev-01 08/09/2023 00:00:00 (0.00)



PROBE NOZZLE DIAMETER CALIBRATION DATA SHEET

Calibration Date : 3 Jan 23 Nozzle Ser ID : BKK_FS1099
Calibration Sheet No. : C-030123-BKK_FS1106 Vernier Caliper ID : RYG_FS0539

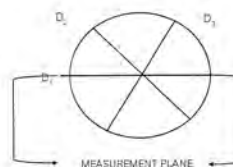
Nozzle ID =	Nozzle Diameter (cm.)			Hi - Lo ΔD	$(D_1 + D_2 + D_3) / 3$
	D_1	D_2	D_3		
1	0.300	0.300	0.300	0.000	0.300
2	0.450	0.450	0.450	0.000	0.450
3	0.600	0.600	0.600	0.000	0.600
4	0.750	0.750	0.750	0.000	0.750
5	0.950	0.950	0.950	0.000	0.950
6	1.090	1.090	1.090	0.000	1.090
7	1.250	1.250	1.250	0.000	1.250
8	1.600	1.600	1.600	0.000	1.600

Where :

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

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

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



Calibrated by Worachit
(Mr. Worachit Tengsom)
Field Scientist (2)

Approved by S.P.
(Mr. Samart Roengnan)
Field Specialist (1)

FORM-002-2 Rev-01 08/09/2023 00:00:00 (0.00)



Stopwatch Calibration Test Report

Calibration Date : 3 Jan 23 Next Cal. Date : 3 Jul 23
Barometric Pressure (mmHg) : 759 Temperature (°C) : 27.0
Relative Humidity (%) : 58.0

Reference Stopwatch Data

Stopwatch ID No : E18061
Model : F808
Serial No :
Calibration Date : 8 Sep 20
Certificate No : E-2009018

Console Control Meter Data

Dry Gas Meter No : BKK_FS0485
Model : XC-572-V
Serial No : 1310065

Run No.	Time Actual (m:ss.ms)	Time Reading (m:ss)	Diff. (ms)	Diff. (min)
1	5:00:09	5:00	9	0.00015
2	5:00:11	5:00	11	0.00018
3	5:00:09	5:00	9	0.00015
4	5:00:11	5:00	11	0.00018
5	5:00:10	5:00	10	0.00017
6	5:00:08	5:00	8	0.00013
7	5:00:08	5:00	8	0.00013
8	5:00:11	5:00	11	0.00018
9	5:00:10	5:00	10	0.00017
10	5:00:11	5:00	11	0.00018
Average				0.00016
SD				0.00002

Calibrate by Prasert S.
Mr. Prasert Surakhan
Field Scientist (3)

Approved by S.P.
Mr. Samart Roengnan
Specialist (1)

CONSOLE CONTROL UNIT CALIBRATION TEST REPORT

Calibration Date : 3 Jan 23 Barometric Pressure (mmHg) : 759
Lab test duct Number : 258-1-13-01 Temperature (°C) : 27.0
Calibration Sheet No : C-030123-BKK_FS1105
Lab test duct Number : 258-1-13-01
Calibration Date : 8 Sep 20
Certificate No : E-2009018

Run No.	Time Actual (m:ss.ms)	Time Reading (m:ss)	Diff. (ms)	Diff. (min)
1	5:00:09	5:00	9	0.00015
2	5:00:11	5:00	11	0.00018
3	5:00:09	5:00	9	0.00015
4	5:00:11	5:00	11	0.00018
5	5:00:10	5:00	10	0.00017
6	5:00:08	5:00	8	0.00013
7	5:00:08	5:00	8	0.00013
8	5:00:11	5:00	11	0.00018
9	5:00:10	5:00	10	0.00017
10	5:00:11	5:00	11	0.00018

1. After a series of three (3) gas meter, the console control unit was calibrated to the gas meter.

2. The console control unit was calibrated to the gas meter by the following method:

3. The console control unit was calibrated to the gas meter by the following method:

4. The console control unit was calibrated to the gas meter by the following method:

5. The console control unit was calibrated to the gas meter by the following method:

6. The console control unit was calibrated to the gas meter by the following method:

7. The console control unit was calibrated to the gas meter by the following method:

8. The console control unit was calibrated to the gas meter by the following method:

9. The console control unit was calibrated to the gas meter by the following method:

10. The console control unit was calibrated to the gas meter by the following method:



DIGITAL TEMPERATURE CALIBRATION DATA SHEET

Calibration Date :	3 Jan 23	Ambient Temperature (°C)	30
Calibration sheet No. :	C-030123-BKK_FS0486	Relative Humidity (%) :	62
Digital Temperature ID :	BKK_FS0486	Reference Temperature ID :	BKK_FS1144
Serial No. :	1310055	Serial No. :	201090000013
Model :	XC-572-V	Model :	Digicon-CC-VT-MS
Next Calibrate :		31 Jan 23	

Location	Reference Temperature °C	Digital Temperature °C	Error °C	MPE	Pass / Fail
Stack	0	0	0	±3	Pass
	25	25	0	±3	Pass
	50	49	-1	±3	Pass
	100	99	-1	±3	Pass
	150	149	-1	±3	Pass
	200	199	-1	±3	Pass
Probe	250	249	-1	±3	Pass
	300	298	-2	±3	Pass
	500	498	-2	±3	Pass
	100	98	-2	±3	Pass
	120	120	0	±3	Pass
	140	141	1	±3	Pass
Oven	100	101	1	±3	Pass
	120	121	1	±3	Pass
	140	141	1	±3	Pass
Filter	100	101	1	±3	Pass
	120	121	1	±3	Pass
	140	141	1	±3	Pass
Exit	0	0	0	±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
ALUX	0	0	0	±3	Pass
	25	25	0	±3	Pass
	50	50	0	±3	Pass

MPE : (Maximum permissible error of measurement) ค่าที่ยอมรับได้ของค่าการวัด

Calibrated by :

P. S.

(Mr. Pisanet Surakhan)
Field Scientist (3)

Approved by :

S. P.

(Mr. Samart Roon-ngan)
Specialist (1)

FORM NO. F-06-027 REVISION NO. 2 ISSUE DATE 3 Feb 23



Pitot Tube Calibration Data

Pitot Tube Identification Number : BKK_FS0489 Calibration Date : 3 Jan 23
Lab test duct Number : 258-1-13-01 Standard Pitot ID : BKK_FS0441
Calibration Sheet No. : C-030123-BKK_FS0489 Cp Standard : 0.99

Type S Pitot Tube Coefficient Data					
	Type s pitot tube Leg A,B	Standard pitot tube (ΔP, mm.H ₂ O)	Type s pitot tube (ΔP, mm.H ₂ O)	Cp (s) Leg A	Cp (s) Leg B
Test 1	A	12.00	17.00	0.840	-
	B	12.00	17.00	-	0.840
Test 2	A	12.00	17.00	0.840	-
	B	12.00	17.00	-	0.840
Test 3	A	12.00	16.60	0.845	-
	B	12.00	16.60	-	0.845
	Cp			0.842	0.842

$$C_{p(S)} = C_p - \sqrt{\frac{\Delta P_{(std)}}{\Delta P_{(s)}}}$$

$$\left[\bar{C}_{p(A)} - \bar{C}_{p(B)} \right]_{max} BE \leq 0.01$$

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

Calibrated by :

W. T.

(Mr. Worawich Tongpoom)
Field Scientist (2)

Approved by :

S. P.

(Mr. Samart Roon-ngan)
Specialist (1)

FORM NO. F-06-028 REVISION NO. 1 ISSUE DATE 10 Jan 23



Pitot Tube Calibration Data

Pitot Tube Identification Number : BKK_FS0490 Calibration Date : 3 Jan 23
Lab test duct Number : 258-1-13-01 Standard Pitot ID : BKK_FS0441
Calibration Sheet No. : C-030123-BKK_FS0490 Cp Standard : 0.99

Type S Pitot Tube Coefficient Data					
	Type s pitot tube Leg A,B	Standard pitot tube (ΔP, mm.H ₂ O)	Type s pitot tube (ΔP, mm.H ₂ O)	Cp (s) Leg A	Cp (s) Leg B
Test 1	A	12.00	17.00	0.840	-
	B	12.00	17.00	-	0.840
Test 2	A	12.00	17.00	0.840	-
	B	12.00	17.00	-	0.840
Test 3	A	12.00	16.60	0.845	-
	B	12.00	16.60	-	0.845
	Cp			0.842	0.842

$$C_{p(S)} = C_p - \sqrt{\frac{\Delta P_{(std)}}{\Delta P_{(s)}}}$$

$$\left[\bar{C}_{p(A)} - \bar{C}_{p(B)} \right]_{max} BE \leq 0.01$$

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

Calibrated by :

W. T.

(Mr. Worawich Tongpoom)
Field Scientist (2)

Approved by :

S. P.

(Mr. Samart Roon-ngan)
Specialist (1)

FORM NO. F-06-029 REVISION NO. 1 ISSUE DATE 10 Jan 23



PROBE NOZZLE DIAMETER CALIBRATION DATA SHEET

Calibration Date : 3 Jan 23 Nozzle Set ID : BKK_FS0486
Calibration Sheet No. : C-030123-BKK_FS0486 Verner Caliper ID : RYG_FS0539

Nozzle ID :	Nozzle Diameter (cm.)			Hi - Lo ΔD	D ₁ - D ₂ - D ₃ / 3 D _{avg}
	D ₁	D ₂	D ₃		
1	0.315	0.315	0.315	0.000	0.315
2	0.475	0.475	0.475	0.000	0.475
3	0.635	0.635	0.635	0.000	0.635
4	0.790	0.790	0.790	0.000	0.790
5	0.950	0.950	0.950	0.000	0.950
6	1.110	1.110	1.110	0.000	1.110
7	1.270	1.270	1.270	0.000	1.270
8	1.600	1.600	1.600	0.000	1.600

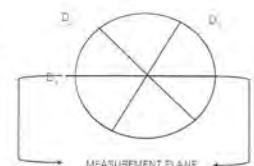
Where :

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 :

W. T.

(Mr. Worawich Tongpoom)
Field Scientist (2)

Approved by :

S. P.

(Mr. Samart Roon-ngan)
Field Specialist (1)


FORM NO. F-06-030 REVISION NO. 1 ISSUE DATE 10 Jan 23

CONSOLE CONTROL UNIT CALIBRATION TEST REPORT

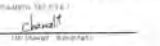
Calibration Date: 8/09/23
Field Lab No: 31023


Check Control: **MMAL/DNA**
Calibration Unit: C-00113, B-1-250103
Dry Gas Meter ID: B-1-250336
Sample No: 110884
Vial No: 104774

Equipment: Pressure Unit (kg)
Hydram: Gravity (g)
Temperature: (°C)
Reference Dry Gas Meter Data
Reference Dry Gas Meter ID: B-1-250336
Serial No: 100000
Correction Factor (g): 1.0000
Test Calibration Date: 8/09/23



SI	R	Reference (g) (Reference Temperature)				Corrected Factor (g) (Corrected Temperature)								Dry Gas Meter Calibration Factor	Overall Correction Factor
		Temp (°C)	Temp (°C)	Temp (°C)	Temp (°C)	Temp (°C)	Temp (°C)	Temp (°C)	Temp (°C)	Temp (°C)	Temp (°C)				
1	17.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
2	17.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
3	17.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
4	17.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
5	17.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
6	17.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
7	17.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
8	17.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
9	17.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
10	17.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
		Average				100.00				100.00				100.00	100.00
		SD				0.0000				0.0000				0.0000	0.0000

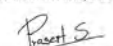
Approved by: 
Mr. Prasert Surakhian
Field Scientist (3)


Approved by: 
Mr. Samart Roo-ngan
Specialist (1)

Next Calibrate: 31 Jan 23

Location	Reference Temperature °C	Digital Temperature °C	Error °C	MPE	Pass / Fail
Stack	0	0	0	±3	Pass
	25	25	0	±3	Pass
	50	50	0	±3	Pass
	100	100	0	±3	Pass
	150	150	0	±3	Pass
	200	199	-1	±3	Pass
Probe	250	249	-1	±3	Pass
	300	299	-1	±3	Pass
	400	398	-2	±3	Pass
	500	498	-2	±3	Pass
	600	598	-2	±3	Pass
	700	698	-2	±3	Pass
Oven	100	101	1	±3	Pass
	120	121	1	±3	Pass
	140	141	1	±3	Pass
	160	161	1	±3	Pass
	180	181	1	±3	Pass
	200	201	1	±3	Pass
Filter	100	101	1	±3	Pass
	120	121	1	±3	Pass
	140	141	1	±3	Pass
	160	161	1	±3	Pass
	180	181	1	±3	Pass
	200	201	1	±3	Pass
Exit	0	0	0	±3	Pass
	10	10	0	±3	Pass
	20	21	1	±3	Pass
	30	31	1	±3	Pass
	40	41	1	±3	Pass
	50	51	1	±3	Pass
Meter	0	0	0	±3	Pass
	25	25	0	±3	Pass
	50	50	0	±3	Pass
	75	75	0	±3	Pass
	100	100	0	±3	Pass
	125	125	0	±3	Pass
AUX	0	0	0	±3	Pass
	25	25	0	±3	Pass
	50	50	0	±3	Pass
	75	75	0	±3	Pass
	100	100	0	±3	Pass
	125	125	0	±3	Pass

MPE: (Maximum permissible error of measurement) ค่าความคลาดเคลื่อนสูงสุดที่อนุญาต

Calibrated by:  (Mr. Prasert Surakhian)
Field Scientist (3)


Approved by:  (Mr. Samart Roo-ngan)
Specialist (1)

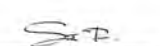
FORM NO. F-06-027 REVISION NO. 2 ISSUE DATE 8 Feb 23

Stopwatch ID No.: E18061
Model: F608
Serial No.: 1924
Calibration Date: 8 Sep 20
Certificate No.: E-2009016

Dry Gas Meter No.: BKK_FS0536
Model: XC-572-V
Serial No.: 1924

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	5:00:09	5:00	9	0.00015
4	5:00:08	5:00	8	0.00013
5	5:00:11	5:00	11	0.00016
6	5:00:10	5:00	10	0.00017
7	5:00:11	5:00	11	0.00018
8	5:00:12	5:00	12	0.00020
9	5:00:12	5:00	12	0.00020
10	5:00:12	5:00	12	0.00020
			Average	0.00018
			SD	0.00002

Calibrate by: 
Mr. Prasert Surakhian
Field Scientist (3)

Approved by: 
Mr. Samart Roo-ngan
Specialist (1)


Type 5 Pitot Tube Coefficient Data


	Type 5 pitot tube Leg A,B	Standard pitot tube (ΔP, mm.H ₂ O)	Type 5 pitot tube (ΔP, mm.H ₂ O)	Cp (s)	
				Leg A	Leg B
Test 1	A	12.00	17.00	0.840	-
	B	12.00	17.00	-	0.840
Test 2	A	12.00	17.00	0.840	-
	B	12.00	17.00	-	0.840
Test 3	A	12.00	16.80	0.845	-
	B	12.00	16.80	-	0.845
				Cp	0.842

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

$$[Cp(s) - Cp(s)]_{must BE \leq 0.01}$$

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

Calibrated by:  (Mr. Worachit Tongpoom)
Field Scientist (2)

Approved by:  (Mr. Samart Roo-ngan)
Specialist (1)

(ฉบับแก้ไข) : 12/01/2565 8/13/2565 8/13/2565 8/13/2565 8/13/2565 8/13/2565 8/13/2565 8/13/2565 8/13/2565 8/13/2565



Pitot Tube Calibration Data

Pitot Tube Identification Number: BKK_F50541 Calibration Date: 3 Jan 23
Lab test duct Number: 255-1-13-01 Standard Pitot ID: BKK_F50441
Calibration Sheet No.: C-030123-BKK_F50541 Cp Standard: 0.99

Type S Pitot Tube Coefficient Data					
	Type S pitot tube Leg A/B	Standard pitot tube (ΔP , mm.H ₂ O)	Type S pitot tube (ΔP , mm.H ₂ O)	Cp (s) Leg A	Cp (s) Leg B
Test 1	A	12.00	17.00	0.640	-
	B	12.00	17.00	-	0.640
Test 2	A	12.00	17.00	0.640	-
	B	12.00	17.00	-	0.640
Test 3	A	12.00	16.80	0.645	-
	B	12.00	16.80	-	0.645
\bar{C}_p				0.642	0.642

$$C_{p(S)} = C_p = \sqrt{\frac{\Delta P_{(S)}}{\Delta P_{(R)}}}$$

$$[C_{p(A)} - C_{p(B)}]_{max} RE \leq 0.01$$

$$Average deviation (A or B) = \frac{\sum [C_p(A) - C_{p(A or B)}]}{3} \text{ must } RE \leq 0.01$$

Calibrated by: Worawich T.
(Mr. Worawich Tongpoom)
Field Scientist (2)

Approved by: S.P.
(Mr. Saman Rong-ngan)
Specialist (1)

Approved by: Samran P.
(Mr. Samran Rong-ngan)
Specialist (1)



PROBE NOZZLE DIAMETER CALIBRATION DATA SHEET

Calibration Date: 3 Jan 23 Nozzle Set ID: BKK_F50542
Calibration Sheet No.: C-030123-BKK_F50542 Verifier Caliper ID: RYG_F50509

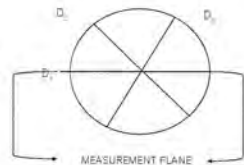
Nozzle ID	Nozzle Diameter (cm)			HH - Lb	(D ₁ + D ₂ + D ₃) / 3
	D ₁	D ₂	D ₃	ΔD	D _{avg}
1	0.315	0.315	0.315	0.000	0.315
2	0.475	0.475	0.475	0.000	0.475
3	0.635	0.635	0.635	0.000	0.635
4	0.790	0.790	0.790	0.000	0.790
5	0.950	0.950	0.950	0.000	0.950
6	1.110	1.110	1.110	0.000	1.110
7	1.270	1.270	1.270	0.000	1.270
8	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 to 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: Worawich T.
(Mr. Worawich Tongpoom)
Field Scientist (2)

Approved by: S.P.
(Mr. Saman Rong-ngan)
Field Specialist (1)



Calibration Certificate



Certificate No: G 650947
Date of issue: 05-Dec-22

Instrument description: Fluor gas Analyzer
Instrument model: Testo 350 New
Instrument serial no.: 62985022
ID no. or control no.: BKK_F51156
Manufacturer: Testo SE & Co. KGaA
Probe description: Fluor
Probe model: Fluor
Probe serial: Fluor
Customer name: ALS LABORATORY GROUP (THAILAND) CO., LTD.
Customer address: 104 Prachinburi 40, Prachinburi Road, Khwaeng Prachinburi,
Khet Suan Luang, Bangkok, 10250 Thailand
Total pages of certificate: 3 Pages
Receiving no.: I-234282
Receiving date: 07-Dec-22
Parameter of calibration: Gas Calibration (Oxygen 2.496, 10.04, 21.02 %Vol, Carbon Monoxide 80.14, 309.9, 1003 ppm,
Nitrogen Dioxide 30.34, 80.96, 202.2 ppm, Nitric Oxide 30.06, 150.9, 320.5 ppm,
Sulphur Dioxide 50.04, 100.8, 601.1 ppm)
Condition of UUC: Used
Ambient condition: All of the Measurement were carried out the stabilized laboratory
Temperature: 23.45 °C
Humidity: 55 ± 15 %RH
Calibration place: 17/121 So Ngamwongwan 43 Yank 48, Toongsonghong, Lakki, Bangkok 10210
Calibration procedure no.: WJ-CL-28-C

The calibration certificate expanded uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by coverage factor k=2, which for a normal distribution corresponds to a coverage probability of approximately 95%.
This certificate is applied only to item under test Environmental condition.
This Calibration Certificate may not be reproduced other than in full except with the permission of the issuing laboratory.
Calibration certificates without signature and seal are not valid.
This calibration certificate documents are traceability to national standards, which realize measurement according to the International System of Units (SI).
Date of calibration: 06-Dec-22

Samran P.
Mr. Samran Rong-ngan
Calibration Technician

Worawich T.
Mr. Worawich Tongpoom
Technical Manager



Calibration Certificate



Certificate No.: G 650947

Standard References (Table 1)

Standard	Certificate No.	Vender	Due date
Oxygen (O ₂) 2.496 % Vol	4219/21	Linde	30-Sep-25
Oxygen (O ₂) 10.04 % Vol	CG-0153-21	Nem	18-Nov-26
Oxygen (O ₂) 21.02 % Vol	CG-0041-22	Nem	10-Feb-27
Carbon monoxide (CO) 80.14 ppm	CG-0040-22	Nem	14-Feb-27
Carbon monoxide (CO) 309.9 ppm	2803/21	Linde	27-Jun-23
Carbon monoxide (CO) 1003 ppm	2583/22	Linde	09-Aug-24
Nitrogen Dioxide (NO ₂) 30.34 ppm	2703/22	Linde	27-Aug-24
Nitrogen Dioxide (NO ₂) 80.96 ppm	2041/22	Linde	26-Jun-24
Nitrogen Dioxide (NO ₂) 202.2 ppm	3739/21	Linde	20-Jul-23
Nitric Oxide (NO) 30.06 ppm	CG-0069-22	Nem	13-Jun-24
Nitric Oxide (NO) 150.9 ppm	2857/21	Linde	27-Jun-23
Nitric Oxide (NO) 320.5 ppm	2944/21	Linde	02-Jul-23
Sulphur Dioxide (SO ₂) 50.04 ppm	3205/21	Linde	25-Jul-23
Sulphur Dioxide (SO ₂) 100.8 ppm	3507/22	Linde	09-Nov-24
Sulphur Dioxide (SO ₂) 601.1 ppm	3704/21	Linde	20-Jul-23

Measured room conditions

Temperature: 23.4 °C Humidity: 57.5 %RH Pressure: 1016.2 mbar

Calibration conditions

Gas Temperature: 23 °C Flow rate: 1,200 ml/min Gas pressure: 1016.6 mbar

Calibration Results Before Adjustment (Table 2)

Parameter of Standard	Standard Values	Mean of UUC	Error	Uncertainty (±)
O ₂ (%Vol)	2.496	2.48	-0.018	0.20
O ₂ (%Vol)	10.04	9.94	-0.10	0.40
O ₂ (%Vol)	21.02	21.09	0.07	0.60
CO (ppm)	80.14	82	1.86	3.0
CO (ppm)	309.9	313	3.1	6.0
CO (ppm)	1003	1010	7	12
NO ₂ (ppm)	30.34	23.6	-6.74	8.0
NO ₂ (ppm)	80.96	63.2	-17.76	8.0
NO ₂ (ppm)	202.2	173.6	-28.6	12
NO (ppm)	30.06	27	-3.06	8.0
NO (ppm)	150.9	148	-2.9	8.0
NO (ppm)	320.6	302	-18.6	12
SO ₂ (ppm)	50.04	44	-6.04	8.0
SO ₂ (ppm)	100.8	96	-4.8	6.0
SO ₂ (ppm)	601.1	592	-9.1	12



Calibration Results After Adjustment (Table 3)

Parameter of Standard	Standard Values	Mean of UUC	Error	Uncertainty (1)
O ₂ (%Vol)	2.498	2.48	-0.018	0.20
O ₂ (%Vol)	10.04	9.94	-0.10	0.40
O ₂ (%Vol)	21.02	21.09	0.07	0.80
CO (ppm)	80.14	82	1.86	3.0
CO (ppm)	309.9	313	3.1	6.0
CO (ppm)	1003	1010	7	12
NO ₂ (ppm)	30.34	31.1	0.76	8.0
NO ₂ (ppm)	90.96	82.1	-8.86	8.0
NO ₂ (ppm)	202.2	205.4	3.2	12
NO (ppm)	30.08	29	-1.08	8.0
NO (ppm)	150.9	150	-0.9	8.0
NO (ppm)	320.6	316	-4.6	12
SO ₂ (ppm)	50.04	50	-0.04	6.0
SO ₂ (ppm)	100.8	100	-0.8	6.0
SO ₂ (ppm)	601.1	599	-2.1	13

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

End of Report



Instrument description : Fuel gas Analyser

Instrument model : Testo 340

Instrument serial no. : 62097093

ID no. or control no. : BKK_F51096

Manufacturer : Testo SE & Co. KGaA

Probe description : -

Probe model : -

Probe serial : -

Customer name : ALS LABORATORY GROUP (THAILAND) CO., LTD.

Customer address : 104 Phatthanaikan 40, Phatthanaikan Road, Khwaeng Phatthanaikan,
Khet Suan Luang, Bangkok, 10250 Thailand

Total pages of certificate : 3 Pages

Receiving no. : I-234280

Receiving date : 07-Dec-22

Parameter of calibration : Gas Calibration (Oxygen 2.498, 10.04, 21.02 %Vol, Carbon Monoxide 80.14, 309.9, 1003 ppm,
Nitric Oxide 30.08, 150.9, 320.6 ppm, Sulphur Dioxide 50.04, 100.8, 601.1 ppm)

Condition of UUC : Used

Ambient condition : All of the Measurement were carried out the stabilized laboratory

Temperature : 23 ± 5 °C

Humidity : 55 ± 15 %RH

Calibration place : 17/121 So Niamwongwan 47 Yakh 48, Toongphong, Laksi, Bangkok 10210

Calibration procedure ref. : WI-CL-28-C

The calibration certificate expanded uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by coverage factor k=2, which for a normal distribution corresponds to a coverage probability of approximately 95%. This certificate is applied only to item under test Environmental conditions.

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

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

Date of calibration : 08-Dec-22

Mr. Sattawit Huatthong

Calibration Technician

Mrs. Nongluck Wongsooee

Technical Manager



Standard References (Table 1)

Standard	Certificate No.	Vendor	Due date
Oxygen (O ₂) 2.498 % Vol	4219/21	Linde	30-Sep-25
Oxygen (O ₂) 10.04 % Vol	CG-0153-21	Nimet	18-Nov-26
Oxygen (O ₂) 21.02 % Vol	CG-0041-22	Nimet	19-Feb-27
Carbon monoxide (CO) 80.14 ppm	CG-0040-22	Nimet	14-Feb-27
Carbon monoxide (CO) 309.9 ppm	2803/21	Linde	32-Jun-23
Carbon monoxide (CO) 1003 ppm	2583/22	Linde	09-Aug-24
Nitric Oxide (NO) 30.08 ppm	CG-0089-22	Nimet	13-Jun-24
Nitric Oxide (NO) 150.9 ppm	2857/21	Linde	27-Jun-23
Nitric Oxide (NO) 320.6 ppm	2944/21	Linde	02-Jul-23
Sulphur Dioxide (SO ₂) 50.04 ppm	3205/21	Linde	25-Jul-21
Sulphur Dioxide (SO ₂) 100.8 ppm	3587/22	Linde	09-Nov-24
Sulphur Dioxide (SO ₂) 601.1 ppm	3204/21	Linde	20-Jul-23

Measured room conditions

Temperature : 23.4 °C Humidity : 54.1 %RH Pressure : 1015.6 mbar

Calibration conditions

Gas Temperature : 23 °C Flow rate : 600 ml/min Gas pressure : 1021.8 mbar

Calibration Results Before Adjustment (Table 2)

Parameter of Standard	Standard Values	Mean of UUC	Error	Uncertainty (1)
O ₂ (%Vol)	2.498	2.47	-0.028	0.20
O ₂ (%Vol)	10.04	9.92	-0.12	0.40
O ₂ (%Vol)	21.02	21.13	0.11	0.80
CO (ppm)	80.14	85	4.86	3.0
CO (ppm)	309.9	320	10.1	6.0
CO (ppm)	1003	1036	33	12
NO (ppm)	30.08	27	-3.08	8.0
NO (ppm)	150.9	145	-5.9	8.0
NO (ppm)	320.6	298	-22.6	12
SO ₂ (ppm)	50.04	41	-9.04	6.0
SO ₂ (ppm)	100.8	97	-3.8	6.0
SO ₂ (ppm)	601.1	594	-7.1	13



Calibration Results After Adjustment (Table 3)

Parameter of Standard	Standard Values	Mean of UUC	Error	Uncertainty (1)
O ₂ (%Vol)	2.498	2.47	-0.028	0.20
O ₂ (%Vol)	10.04	9.92	-0.12	0.40
O ₂ (%Vol)	21.02	21.13	0.11	0.80
CO (ppm)	80.14	82	1.86	3.0
CO (ppm)	309.9	311	1.1	6.0
CO (ppm)	1003	1001	-2	12
NO (ppm)	30.08	30	-0.08	8.0
NO (ppm)	150.9	149	-1.9	8.0
NO (ppm)	320.6	314	-6.6	12
SO ₂ (ppm)	50.04	49	-1.04	6.0
SO ₂ (ppm)	100.8	100	-0.8	6.0
SO ₂ (ppm)	601.1	598	-3.1	13

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

End of Report



Certificate No.: G 650808
Date of issue : 29-Nov-22

Instrument description : Fuel gas Analyser
Instrument model : Testo 350 New
Instrument serial no. : 62087398
ID no. or control no. : B06_F51095
Manufacturer : Temp SE & Co. KG
Probe description :
Probe model :
Probe serial :
Customer name : ALS LABORATORY GROUP (THAILAND) CO., LTD.
Customer address : 104 Phatthanakan 40, Phatthanakan Road, Khwaeng Phatthanakan,
Khet Suan Luang, Bangkok, 10250 Thailand
Total pages of certificate : 3 Pages
Receiving no. : L-231157
Receiving date : 25-Nov-22
Parameter of calibration : Gas Calibration (Oxygen 2.458, 10.04, 21.02 %Vol, Carbon Monoxide 80.14, 309.9, 1003 ppm)
Nitrogen Dioxide 30.34, 80.96, 202.2 ppm Nitric Oxide 30.08, 150.9, 320.6 ppm,
Sulphur Dioxide 50.04, 100.8, 601.1 ppm)

Condition of UUC : Used
Ambient condition : All of the Measurement were carried out in the stockized laboratory
Temperature : 23 ± 5 °C
Humidity : 55 ± 15 %RH
Calibration place : 17/121 Soi Ngamwongwan 47 Yakh 48, Thungsoenghong, Lakki, Bangkok 10210
Calibration procedure no. : WICL-29-C

The calibration certificate expanded uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by coverage factor $k=2$, which for a normal distribution corresponds to a coverage probability of approximately 95%.
This certificate is applied only to item under test Environmental condition.
This Calibration Certificate may not be reproduced other than in full except with the permission of the issuing laboratory.
Calibration certificates without signature and seal are not valid.
This calibration certificate documents are traceability to national standards which realize measurement according to the International System of Units (SI).
Date of calibration : 28-Nov-22

Mr. Sattawat Huatrong
Calibration Technician

Mr. Nongluck Wongkittae
Technical Manager

ENTECH-08-C Rev B

Page 1 of 3

Issued Date 26/02/26

Entech Industrial Solution Co., Ltd.

17/121 Soi Ngamwongwan 47 Yakh 48, Thungsoenghong, Lakki, Bangkok 10210 THAILAND Tel: 0-2779-8888 Calibration@entech.co.th
Fax: 02-0105536035551 www.entech.co.th



Certificate No.: G 650808

Standard References: (Table 1)

Standard	Certificate No.	Vendor	Due date
Oxygen (O2) 2.458 % Vol	4219/21	Unite	30-Sep-25
Oxygen (O2) 10.04 % Vol	CG-0153-21	Nim	18-Nov-26
Oxygen (O2) 21.02 % Vol	CG-0041-22	Nim	10-Feb-27
Carbon monoxide (CO) 80.14 ppm	CG-0040-22	Nim	14-Feb-27
Carbon monoxide (CO) 309.9 ppm	3603/21	Unite	22-Jun-23
Carbon monoxide (CO) 1003 ppm	2583/22	Unite	09-Aug-24
Nitrogen Dioxide (NO2) 30.34 ppm	2703/22	Unite	22-Aug-24
Nitrogen Dioxide (NO2) 80.96 ppm	2041/22	Unite	26-Jun-24
Nitrogen Dioxide (NO2) 202.2 ppm	3239/21	Unite	20-Jul-23
Nitric Oxide (NO) 30.08 ppm	CG-0069-22	Nim	13-Jun-24
Nitric Oxide (NO) 150.9 ppm	2857/21	Unite	27-Jun-25
Nitric Oxide (NO) 320.6 ppm	2944/21	Unite	02-Jul-23
Sulphur Dioxide (SO2) 50.04 ppm	3205/21	Unite	25-Jul-23
Sulphur Dioxide (SO2) 100.8 ppm	3307/22	Unite	09-Nov-24
Sulphur Dioxide (SO2) 601.1 ppm	3204/21	Unite	20-Jul-23

Measured room conditions

Temperature : 23.4 °C Humidity : 54.1 %RH Pressure : 1015.6 mbar

Calibration conditions

Gas Temperature : 23 °C Flow rate : 1,200 ml/min Gas pressure : 1021.8 mbar

Calibration Results Before Adjustment (Table 2)

Parameter of Standard	Standard Values	Mean of UUC	Error	Uncertainty (1)
O2 (%Vol)	2.458	2.53	0.032	0.20
O2 (%Vol)	10.04	10.09	0.05	0.40
O2 (%Vol)	21.02	21.10	0.08	0.80
CO (ppm)	80.14	80	-0.14	3.0
CO (ppm)	309.9	307	-2.9	6.0
CO (ppm)	1003	995	-8	12
NO2 (ppm)	30.34	27.3	-3.04	8.0
NO2 (ppm)	80.96	70.5	-10.46	8.0
NO2 (ppm)	202.2	189.8	-12.4	12
NO (ppm)	30.08	28	-2.08	8.0
NO (ppm)	150.9	148	-2.9	8.0
NO (ppm)	320.6	311	-9.6	12
SO2 (ppm)	50.04	49	-1.04	6.0
SO2 (ppm)	100.8	99	-1.8	6.0
SO2 (ppm)	601.1	599	-2.1	12

ENTECH-08-C Rev B

Page 2 of 3

Issued Date 26/02/26

Entech Industrial Solution Co., Ltd.

17/121 Soi Ngamwongwan 47 Yakh 48, Thungsoenghong, Lakki, Bangkok 10210 THAILAND Tel: 0-2779-8888 Calibration@entech.co.th
Fax: 02-0105536035551 www.entech.co.th



Certificate No.: G 650808

Calibration Results After Adjustment (Table 3)

Parameter of Standard	Standard Values	Mean of UUC	Error	Uncertainty (1)
O2 (%Vol)	2.458	2.53	0.032	0.20
O2 (%Vol)	10.04	10.09	0.05	0.40
O2 (%Vol)	21.02	21.10	0.08	0.80
CO (ppm)	80.14	80	-0.14	3.0
CO (ppm)	309.9	307	-2.9	6.0
CO (ppm)	1003	995	-8	12
NO2 (ppm)	30.34	27.3	-3.04	8.0
NO2 (ppm)	80.96	70.5	-10.46	8.0
NO2 (ppm)	202.2	189.8	-12.4	12
NO (ppm)	30.08	28	-2.08	8.0
NO (ppm)	150.9	148	-2.9	8.0
NO (ppm)	320.6	311	-9.6	12
SO2 (ppm)	50.04	49	-1.04	6.0
SO2 (ppm)	100.8	99	-1.8	6.0
SO2 (ppm)	601.1	599	-2.1	12

Remark : 1 ppm/mol = 1 %Vol, 1 umol/mol = 1 ppm

End of Report

ENTECH-08-C Rev B

Page 3 of 3

Issued Date 26/02/26

Entech Industrial Solution Co., Ltd.

17/121 Soi Ngamwongwan 47 Yakh 48, Thungsoenghong, Lakki, Bangkok 10210 THAILAND Tel: 0-2779-8888 Calibration@entech.co.th
Fax: 02-0105536035551 www.entech.co.th

Sartorius (Thailand) Co., Ltd.

728 Ram 6 Road, Huaykwang, Huaykwang, Bangkok 10310
Tel: +66 2642 9381-9, e-mail: service.thailand@sartorius.com



SARTORIUS

Certificate of Calibration

REVIEW BY: Sritut P.
APPROVED BY: K.L.A.
NEXT CAL DATE: 8/2/24

Model Number : MSE224S-100-DU
Description : Analytical Balance
Serial Number : 26207042
ID No : BKK_EN0002
Manufacturer : Sartorius
Certificate No : 23800072
Issued Date : Monday, February 13, 2023
Reference No : 203245
Page No : 1 of 2

Customer Name : ALS Laboratory Group (Thailand) Co., Ltd.
104 Phatthanakan 40, Phatthanakan Rd., Khwaeng Phatthanakan, Khet Suan Luang, Bangkok 10260.
Calibrated Place : Balance Room

Calibrated By : Mr. Chonchai Inthana
Calibration Date : Wednesday, February 08, 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
Reasons for calibration : ☐ New Installation ☐ Service / Repair ☒ Re-calibration / Maintenance
Ambients Conditions : Temperature : 23.2 °C ± 5.0 °C
Humidity : 60.0 % RH ± 10.0 % RH
Pressure : ±
Equipment Condition : ☒ Good Options ☐ 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.

Model Number	Description	Traceability	Certificate No.	Due Date
YCS011-522-00	Sartorius weight set 1mg - 5000g E2 YCS011-522-00	SPC-RT	CG2212565	14-Sep-2023
MHB-342SD	Humidity/Bariometer/Temp. Lubon MHB-342SD	DKSH	C19220444	5-Sep-2023

This certificate relate and apply this equipment only.
This certificate may not be reproduced other than in full except with the prior written approval of the Verification Operation Division.
Sartorius (Thailand) Co., Ltd.
SOP FM 33 03 February 2022
Mr. Chonchai Inthana (Technical Manager)



Certificate of Calibration

Model Number: MSE224S-100-DU
Description: Analytical Balance
Serial Number: 26207042
ID No.: BKK_EN0002
Manufacturer: Sartorius

Certificate No.: 238C10072
Issued Date: Monday, February 13, 2023
Reference No.: 203245
Page No.: 2 of 2

Calibration Results : Without Adjustment

Repeatability			Eccentricity (Off-center loading error)		
The reproducibility is the ability of a weighing instrument to display nearly identical readings under constant test conditions when the same load within a measurement series is placed repeatedly on the weighing pan in the same manner. The standard deviation is used to express reproducibility quantitatively.			The off-center loading error is yielded by the difference between the result of the load, i.e. 1/10 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	200.0000	Nominal value:	50	g
20 g	20.0000	199.9999	Tolerance	0.0004	g
Tolerance	20.0000	200.0000	Difference		
0.0001 g	20.0000	199.9999	1	-	-
	20.0001	200.0000	2	-0.0001	-
Nominal Value: (High Load)	20.0000	200.0000	3	0.0000	-
200 g	20.0000	199.9999	4	0.0001	-
Tolerance	20.0000	199.9999	5	0.0000	-
0.0001 g	20.0000	200.0000	6	-	-
	20.0001	199.9999			
Standard Deviation	0.00004	0.00005			

Linearity				
The linearity, also called linearity error, describes the deviation of the characteristic curve of a weighing instrument from the linear shape.				
Tolerance	0.0002 g			
Nominal Value	Conventional Mass Value	Displayed Value	Deviation	Uncertainty
(g)	(g)	(g)	(g)	(g)
0.01	0.0100	0.0100	0.0000	0.00014
0.1	0.1000	0.1000	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
50	50.0000	50.0000	0.0000	0.00015
100	100.0000	100.0000	0.0000	0.00019
200	200.0000	199.9999	-0.0001	0.00030

End of Report

SOP FM 33 03 February 2022

SITHIPORN ASSOCIATES CO.,LTD. CALIBRATION LABORATORY

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



Cert. No.: ACC22040
Pages: 1 of 3

Calibration Certificate

Equipment: SOUND CALIBRATOR
Manufacturer: RION
Model: NC-75
Serial No.: 35024431
ID No.: 14/11/23

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: 03 NOVEMBER 2022
Calibration Date: 14 NOVEMBER 2022
Date of Issue: 15 NOVEMBER 2022

Calibrated by: Nathakorn Pisulpaisan

Approved by: T. Petchurai
(Thanakul Petchurai)

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

QF-TS12-04-04-020664

SITHIPORN ASSOCIATES CO.,LTD. CALIBRATION LABORATORY

Continuation of Calibration Certificate

Cert. No.: ACC22040
Job No.: VC66AC0006
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	MY53202742	EF-0008-22	04-Feb-23
Digital Multimeter	33461A	MY53220104	EEL-BP_04/0265	09-Feb-23
Digital Multimeter	33461A	MY53220076	EEL-BP_03/0265	09-Feb-23
Digital Multimeter	33461A	MY60024273	EEL-BP_05/0265	09-Feb-23
Programmable Attenuator	MAT-1070	62100114	EF-0009-22	07-Feb-23
Condenser Microphone	4180	2977900	AA-1013-22	24-Feb-23
Measuring Amplifier	NA-42KAI	34560495	AA-3005-22	22-Feb-23
Audio Analyzer	AVR-3360A	V74486069	EF-0010-22	07-Feb-23

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

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

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

QF-TS12-04-04-020664

SITHIPORN ASSOCIATES CO.,LTD. CALIBRATION LABORATORY

Continuation of Calibration Certificate

Cert. No.: ACC22040
Job No.: VC66AC0006
Pages: 3 of 3

Result of calibration:

1. Sound pressure level

Specified sound pressure level (dB)	Measured value (dB)	Deviated value (dB)	Uncertainty (dB)	Tolerance limit (dB)
94	93.94	-0.06	0.40	0.40

2. Frequency

Specified Frequency (Hz)	Measured value (Hz)	Deviated value (%)	Uncertainty (%)	Tolerance limit (%)
1000	999.9	0.0	0.1	1.0

3. Total distortion

Measured value (%)	Uncertainty (%)	Tolerance limit (%)
0.31	0.10	3.0

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

End of Calibration Certificate

QF-TS12-04-04-020664

SITHIPORN ASSOCIATES CO.,LTD. CALIBRATION LABORATORY

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



Cert. No. : ACL22232
Pages : 1 of 8

Calibration Certificate

Equipment : SOUND LEVEL METER
Manufacturer : RION
Model : NL-42/ Microphone UC-52 / Preamplifier NH-24
Serial No. : 00584982 / 157781 / 48096
ID No. : BKK_FS0925

Condition As Found : GOOD

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

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

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

Calibrated by : Nabhakorn Pisupaisan

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. : ACL22232
Job No. : VC65AC0088
Pages : 2 of 8

Calibration Procedure : CP-AC-01

Calibration Method :

This equipment was calibrated by based on IEC-61672-3 (2013) Standard for sound level meter (SLM).
The SLM had tests 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-0007-22	04-Feb-23
Waveform Generator	33511B	MY52302742	EF-0008-22	04-Feb-23
Digital Multimeter	33461A	MY53220104	EEL-BP_04/0265	09-Feb-23
Digital Multimeter	33461A	MY53220076	EEL-BP_03/0265	09-Feb-23
Digital Multimeter	34461A	MY60024273	EEL-BP_05/0265	09-Feb-23
Programmable Attenuator	MAT-1070	62100114	EF-0009-22	07-Feb-23
Condenser Microphone	4180	2977900	AA-1013-22	24-Feb-23
Measuring Amplifier	NA-42KA1	34560495	AA-3005-22	22-Feb-23

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

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

3.1 National Institute of Metrology (Thailand).

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

QI-TS12-04-04-020664

T. Petchurai

SITHIPORN ASSOCIATES CO.,LTD. CALIBRATION LABORATORY

Continuation of Calibration Certificate

Cert. No. : ACL22232
Job No. : VC65AC0088
Pages : 3 of 8

Summary of Measurement Result :

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

QI-TS12-04-04-020664

T. Petchurai

SITHIPORN ASSOCIATES CO.,LTD. CALIBRATION LABORATORY

Continuation of Calibration Certificate

Cert. No. : ACL22232
Job No. : VC65AC0088
Pages : 4 of 8

Result of calibration :

1. Absolute sensitivity

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

2. Self-generated noise

2.1 Normal test

Measured Value (dB)
17.3

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

Frequency Weighting	Measured value (dB)
A-weight	13.1
C-weight	19.0
Flat	24.7

3. Acoustical signal tests of frequency weightings

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

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)			
	Flat	C-weight	A-weight	Acceptance limits
125	0.3	0.3	0.4	± 1.5
1000	0.0	0.0	0.0	± 1.0
8000	-0.3	-0.4	-0.4	± 5.0

QI-TS12-04-04-020664

T. Petchurai

Continuation of Calibration Certificate

Cert. No. : ACL22232
Job No. : VC65AC0088
Pages : 5 of 8

4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

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

5. Frequency and time weightings at 1 kHz

5.1 Frequency weightings at 1 kHz

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

5.2 Time weighting at 1 kHz

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

6. Long-term stability

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

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T. Petch

Continuation of Calibration Certificate

Cert. No. : ACL22232
Job No. : VC65AC0088
Pages : 6 of 8

7. Level linearity on the reference level range

Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
137.0	137.0	0.0	±1.1
136.0	136.0	0.0	±1.1
135.0	135.0	0.0	±1.1
134.0	134.0	0.0	±1.1
133.0	133.0	0.0	±1.1
132.0	132.0	0.0	±1.1
131.0	131.0	0.0	±1.1
129.0	129.0	0.0	±1.1
124.0	124.0	0.0	±1.1
119.0	119.1	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

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T. Petch

Continuation of Calibration Certificate

Cert. No. : ACL22232
Job No. : VC65AC0088
Pages : 7 of 8

8. Level linearity including the level range control

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

9. Tone burst response

Time Weighting	Tone burst duration, Tb (ms)	Cycle	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Fast	0.25	1	108.0	108.0	0.0	1.5 ; -5.0
	2	8	117.0	117.0	0.0	1.0 ; -2.5
	200	800	124.0	124.1	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	-
One	136.4	135.6	-0.8	±3.0

Number of cycle in test signal	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.0	0.0	-
Positive half cycle	135.4	135.1	-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. : ACL22232
Job No. : VC65AC0088
Pages : 8 of 8

11. Overload indication

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

12. High level stability

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

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

End of Calibration Certificate

QF-TS12-04-04-020664

T. Petch

SITHIPORN ASSOCIATES CO.,LTD. CALIBRATION LABORATORY

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



Cert. No. : ACL22233
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,
KHUWAENG PHATTHANAKAN, KHET SUAN LUANG,
BANGKOK, 10250 THAILAND.

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

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

Calibrated by : Nathakorn Pisutpaisan

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. : ACL22233
Job No. : VC65AC0088
Pages : 2 of 8

Calibration Procedure : CP-AC-01

Calibration Method :

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

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

Condition of this result of calibration :

1. Reference Standard Instruments :

Instrument	Model	Serial No.	Cert. No.	Due Date
Waveform Generator	33210A	MY48017076	EF-0007-22	04-Feb-23
Waveform Generator	33511B	MY52302742	EF-0008-22	04-Feb-23
Digital Multimeter	33461A	MY53220104	EEL-BP, 04/0265	09-Feb-23
Digital Multimeter	33461A	MY53220076	EEL-BP, 03/0265	09-Feb-23
Digital Multimeter	34461A	MY60024273	EEL-BP, 05/0265	09-Feb-23
Programmable Attenuator	MAT-1070	62100114	EF-0009-22	07-Feb-23
Condenser Microphone	4180	2977900	AA-1013-22	24-Feb-23
Measuring Amplifier	NA-42KA1	34560495	AA-3005-22	22-Feb-23

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

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

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

QF-TS12-04-04-020664

T. Petchum

SITHIPORN ASSOCIATES CO.,LTD. CALIBRATION LABORATORY

Continuation of Calibration Certificate

Cert. No. : ACL22233
Job No. : VC65AC0088
Pages : 3 of 8

Summary of Measurement Result :

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

QF-TS12-04-04-020664

T. Petchum

SITHIPORN ASSOCIATES CO.,LTD. CALIBRATION LABORATORY

Continuation of Calibration Certificate

Cert. No. : ACL22233
Job No. : VC65AC0088
Pages : 4 of 8

Result of calibration :

1. Absolute sensitivity

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

2. Self-generated noise

2.1 Normal test

Measured Value (dB)
15.5

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

Frequency Weighting	Measured value (dB)
A-weight	10.8
C-weight	17.1
Flat	22.9

3. Acoustical signal tests of frequency weightings

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

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)			
	Flat	C-weight	A-weight	Acceptance Limits
125	0.3	0.3	0.3	±1.5
1000	0.0	0.0	0.0	±1.0
8000	-0.6	-0.5	-0.6	±5.0

QF-TS12-04-04-020664

T. Petchum

Continuation of Calibration Certificate

Cert. No. : ACL22233
Job No. : VC65AC0088
Pages : 5 of 8

4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

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

5. Frequency and time weightings at 1 kHz

5.1 Frequency weightings at 1 kHz

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

5.2 Time weighting at 1 kHz

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

6. Long-term stability

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

QF-TS12-04-04-020664

T. Petch.

Continuation of Calibration Certificate

Cert. No. : ACL22233
Job No. : VC65AC0088
Pages : 6 of 8

7. Level linearity on the reference level range

Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
137.0	137.0	0.0	±1.1
136.0	136.0	0.0	±1.1
135.0	135.0	0.0	±1.1
134.0	134.0	0.0	±1.1
133.0	133.0	0.0	±1.1
132.0	132.0	0.0	±1.1
131.0	131.0	0.0	±1.1
129.0	129.0	0.0	±1.1
124.0	124.0	0.0	±1.1
119.0	119.0	0.0	±1.1
114.0	114.0	0.0	±1.1
109.0	109.0	0.0	±1.1
104.0	104.0	0.0	±1.1
99.0	99.0	0.0	±1.1
94.0	94.0	0.0	±1.1
89.0	89.0	0.0	±1.1
84.0	84.0	0.0	±1.1
79.0	79.0	0.0	±1.1
74.0	74.0	0.0	±1.1
69.0	69.0	0.0	±1.1
64.0	64.0	0.0	±1.1
59.0	59.0	0.0	±1.1
54.0	54.0	0.0	±1.1
49.0	49.0	0.0	±1.1
44.0	44.0	0.0	±1.1
39.0	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. : ACL22233
Job No. : VC65AC0088
Pages : 7 of 8

8. Level linearity including the level range control

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

9. Tone burst response

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

10. Peak C sound level

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

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

QF-TS12-04-04-020664

T. Petch.

Continuation of Calibration Certificate

Cert. No. : ACL22233
Job No. : VC65AC0088
Pages : 8 of 8

11. Overload indication

Measured value (dB)		Deviated Value (dB)	Acceptance Limits (dB)
Positive one-half cycle	Negative one-half cycle		
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 $k \approx 2$
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 Sirinthorn Rd, Bangbunru, Bangplue Bangkok 10700 THAILAND.
Tel:0-2435-8800 Fax:0-2433-1679 e-mail:center@sithiporn.com http://www.sithiporn.com



Cert. No. : ACL23055
Pages : 1 of 8

Calibration Certificate

Equipment : SOUND LEVEL METER
Manufacturer : RION
Model : NL-42/ Microphone UC-52 / Preamplifier NH-24
Serial No.: 00672789 / 170665 / 73129
ID No.: BKK_FS0929

Condition As Found : GOOD

Customer : AJS 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 : 17 JANUARY 2023
Calibration Date : 19-20 JANUARY 2023
Date of Issue : 23 JANUARY 2023

Calibrated by : Nathakorn Pisupaisan

Approved by :

T. Petchurai
(Thanakul Petchurai)

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

QF-TS12-04-04-020664

SITHIPORN ASSOCIATES CO.,LTD. CALIBRATION LABORATORY

Continuation of Calibration Certificate

Cert. No. : ACL23055
Job No. : VC66AC0026
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-0007-22	04-Feb-23
Waveform Generator	33511B	MY52302742	EF-0008-22	04-Feb-23
Digital Multimeter	33461A	MY53220104	EEL-BP_04/0265	09-Feb-23
Digital Multimeter	33461A	MY53220076	EEL-BP_03/0265	09-Feb-23
Digital Multimeter	34461A	MY60024273	EEL-BP_05/0265	09-Feb-23
Programmable Attenuator	MAT-1070	62100114	EF-0009-22	07-Feb-23
Condenser Microphone	4180	2977900	AA-1013-22	24-Feb-23
Measuring Amplifier	NA-42KA1	34560495	AA-3005-22	22-Feb-23

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

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

3.1 National Institute of Metrology (Thailand),

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

QF-TS12-04-04-020664

T. Petchurai

SITHIPORN ASSOCIATES CO.,LTD. CALIBRATION LABORATORY

Continuation of Calibration Certificate

Cert. No. : ACL23055
Job No. : VC66AC0026
Pages : 3 of 8

Summary of Measurement Result :

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

QF-TS12-04-04-020664

T. Petchurai

SITHIPORN ASSOCIATES CO.,LTD. CALIBRATION LABORATORY

Continuation of Calibration Certificate

Cert. No. : ACL23055
Job No. : VC66AC0026
Pages : 4 of 8

Result of calibration :

1. Absolute sensitivity

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

2. Self-generated noise

2.1 Normal test

Measured Value (dB)
14.4

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

Frequency Weighting	Measured value (dB)
A-weight	11.6
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	0.1	0.1	0.1	± 1.5
1000	0.0	0.0	0.0	± 1.0
8000	-0.2	-0.1	-0.1	± 5.0

QF-TS12-04-04-020664

T. Petchurai

Continuation of Calibration Certificate

Cert. No. : ACL23055
Job No. : VC66AC0026
Pages : 5 of 8

4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

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

5. Frequency and time weightings at 1 kHz

5.1 Frequency weightings at 1 kHz

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

5.2 Time weighting at 1 kHz

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

6. Long-term stability

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

QF-TS12-04-04-020664

T. Pich.

Continuation of Calibration Certificate

Cert. No. : ACL23055
Job No. : VC66AC0026
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	30.0	0.0	±1.1
29.0	29.0	0.0	±1.1
28.0	28.0	0.0	±1.1
27.0	26.9	-0.1	±1.1
26.0	25.9	-0.1	±1.1
25.0	25.0	0.0	±1.1

QF-TS12-04-04-020664

T. Pich.

Continuation of Calibration Certificate

Cert. No. : ACL23055
Job No. : VC66AC0026
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
	0.25	1	99.0	98.8	-0.2	1.5 ; -5.0
SEL	2	8	108.0	107.9	-0.1	1.0 ; -2.5
	200	800	128.0	128.0	0.0	±1.0

10. Peak C sound level

Number of cycle in test signal	Anticipated Value (dB)	Measured Value, L _{peak} (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.0	0.0	-
One	136.4	135.7	-0.7	±3.0

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

QF-TS12-04-04-020664

T. Pich.

Continuation of Calibration Certificate

Cert. No. : ACL23055
Job No. : VC66AC0026
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

T. Pich.

SITHIPORN ASSOCIATES CO.,LTD. CALIBRATION LABORATORY

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



Cert. No. : ACC22027
Pages : 1 of 3

Calibration Certificate

Equipment : SOUND CALIBRATOR
Manufacturer : RION
Model : NC-74
Serial No. : 34425566
ID No. : BKK_FS0617

Condition As Found : GOOD

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

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

Received Date : 06 SEPTEMBER 2022
Calibration Date : 09 SEPTEMBER 2022
Date of Issue : 14 SEPTEMBER 2022



Calibrated by : Nathorn Pisutpaisan

Approved by :

T. Petchurai
(Thanakul Petchurai)

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QF-TS12-04-04-020664

SITHIPORN ASSOCIATES CO.,LTD. CALIBRATION LABORATORY

Continuation of Calibration Certificate

Cert. No. : ACC22027
Job No. : VC65AC0081
Pages : 2 of 3

Calibration Procedure : CP-AC-03

Calibration Method :

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

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

Condition of this result of calibration :

1. Reference Standard Instruments :

Instrument	Model	Serial No.	Cert. No.	Due Date
Waveform Generator	33511B	MY52302742	EF-0008-22	04-Feb-23
Digital Multimeter	33461A	MY53220104	EEL.BP. 04/0265	09-Feb-23
Digital Multimeter	33461A	MY53220076	EEL.BP. 03/0265	09-Feb-23
Digital Multimeter	33461A	MY60024273	EEL.BP. 05/0265	09-Feb-23
Programmable Attenuator	MAT-1070	62100114	EF-0009-22	07-Feb-23
Condenser Microphone	4180	2977900	AA-1013-22	24-Feb-23
Measuring Amplifier	NA-42KA1	34560495	AA-3005-22	22-Feb-23
Audio Analyzer	AVR-3360A	V744B6069	EF-0010-22	07-Feb-23

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

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

3.1 National Institute of Metrology (Thailand).

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

QF-TS12-04-04-020664

T. Petchurai

SITHIPORN ASSOCIATES CO.,LTD. CALIBRATION LABORATORY

Continuation of Calibration Certificate

Cert. No. : ACC22027
Job No. : VC65AC0081
Pages : 3 of 3

Result of calibration :

1. Sound pressure level

Specified sound pressure level (dB)	Measured value (dB)	Deviated value (dB)	Uncertainty (dB)	Tolerance limit (dB)
94	94.17	0.17	0.14	0.40

2. Frequency

Specified Frequency (Hz)	Measured value (Hz)	Deviated value (%)	Uncertainty (%)	Tolerance limit (%)
1000	1001.9	0.2	0.1	3.0

3. Total distortion

Measured value (%)	Uncertainty (%)	Tolerance limit (%)
1.22	0.10	3.0

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

End of Calibration Certificate

QF-TS12-04-04-020664

T. Petchurai

SITHIPORN ASSOCIATES CO.,LTD. CALIBRATION LABORATORY

451-451/1 Sirinthorn Rd.,Bangbunru, Banglud Bangkok 10700 THAILAND
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Cert. No. : ACL22168
Pages : 1 of 8

Calibration Certificate

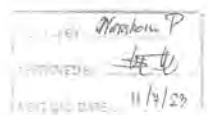
Equipment : SOUND LEVEL METER
Manufacturer : RION
Model : NL-42/ Microphone UC-52 / Preamplifier NH-24
Serial No. : 00658243 / 157783 / 48098
ID No. : BKK_FS0100

Condition As Found : GOOD

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

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

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



Calibrated by : Nathorn Pisutpaisan

Approved by :

T. Petchurai
(Thanakul Petchurai)

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Continuation of Calibration Certificate

Cert. No. : ACL22168
Job No. : VC65AC0069
Pages : 2 of 8

Calibration Procedure : CP-AC-01

Calibration Method :

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

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

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

Condition of this result of calibration :

1. Reference Standard Instruments :

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

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

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

3.1 National Institute of Metrology (Thailand).

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

QF-TS12-04-04-020664

Continuation of Calibration Certificate

Cert. No. : ACL22168
Job No. : VC65AC0069
Pages : 3 of 8

Summary of Measurement Result :

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

QF-TS12-04-04-020664

Continuation of Calibration Certificate

Cert. No. : ACL22168
Job No. : VC65AC0069
Pages : 4 of 8

Result of calibration :

1. Absolute sensitivity

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

2. Self-generated noise

2.1 Normal test

Measured Value (dB)
15.7

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

Frequency Weighting	Measured value (dB)
A - weight	13.1
C - weight	19.1
Flat	25.0

3. Acoustical signal tests of frequency weightings

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

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)			
	Flat	C-weight	A-weight	Acceptance Limits
125	0.2	0.2	0.3	± 1.5
1000	0.0	-0.1	0.0	± 1.0
8000	-1.4	-1.4	-1.4	±5.0

QF-TS12-04-04-020664

Continuation of Calibration Certificate

Cert. No. : ACL22168
Job No. : VC65AC0069
Pages : 5 of 8

4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

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

5. Frequency and time weightings at 1 kHz

5.1 Frequency weightings at 1 kHz

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

5.2 Time weighting at 1 kHz

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

6. Long - term stability

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

QF-TS12-04-04-020664

Continuation of Calibration Certificate

Cert. No. : ACL22168
Job No. : VC65AC0069
Pages : 6 of 8

7. Level linearity on the reference level range

Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
137.0	137.0	0.0	±1.1
136.0	136.0	0.0	±1.1
135.0	135.0	0.0	±1.1
134.0	134.0	0.0	±1.1
133.0	132.9	-0.1	±1.1
132.0	131.9	-0.1	±1.1
131.0	130.9	-0.1	±1.1
129.0	128.9	-0.1	±1.1
124.0	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	30.1	0.1	±1.1
29.0	29.1	0.1	±1.1
28.0	28.0	0.0	±1.1
27.0	27.1	0.1	±1.1
26.0	26.2	0.2	±1.1
25.0	25.2	0.2	±1.1

QF-TS12-04-04-020664

T. Petchur

Continuation of Calibration Certificate

Cert. No. : ACL22168
Job No. : VC65AC0069
Pages : 7 of 8

8. Level linearity including the level range control

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

9. Tone burst response

Time Weighting	Tone burst duration, T ₀ (ms)	Cycle	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Fast	0.25	1	108.0	107.9	-0.1	1.5 ; -5.0
	2	8	117.0	117.0	0.0	1.0 ; -2.5
	200	800	134.0	134.0	0.0	±1.0
Slow	2	8	108.0	108.0	0.0	1.5 ; -5.0
	200	800	127.6	127.6	0.0	±1.0
SEL	0.25	1	99.0	98.9	-0.1	1.5 ; -5.0
	2	8	108.0	108.0	0.0	1.0 ; -2.5
	200	800	128.0	128.0	0.0	±1.0

10. Peak C sound level

Number of cycle in test signal	Anticipated Value (dB)	Measured Value, L _{peak} (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.0	0.0	-
One	136.4	135.6	-0.8	±3.0

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

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T. Petchur

Continuation of Calibration Certificate

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11. Overload indication

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

12. High level stability

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

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

End of Calibration Certificate

QF-TS12-04-04-020664

T. Petchur

451-451/1 Sirinthorn Rd., Bangbunru, Bangkok 10700 THAILAND.
Tel.0-2435-8600 Fax.0-2433-1679 e-mail:cal-center@sithiporn.com http://www.sithiporn.comCert. No. : ACL23004
Pages : 1 of 8

Calibration Certificate

Equipment : SOUND LEVEL METER.
Manufacturer : RION
Model : NL-42/ Microphone UC-52 / Pre-amplifier 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,
KHWAENG PHATTHANAKAN, KHET SUAN LUANG,
BANGKOK, 10250 THAILAND.

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

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

Calibrated by : Nathakorn Pisupaisan

Approved by : T. Petchur

(Thanakul Petchurai)

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

QF-TS12-04-04-020664

Continuation of Calibration Certificate

Cert. No. : ACL23004
Job No. : VC66AC0021
Pages : 2 of 8

Calibration Procedure : CP-AC-01

Calibration Method :

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

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

Condition of this result of calibration :

1. Reference Standard Instruments :

Instrument	Model	Serial No.	Cert. No.	Due Date
Waveform Generator	33210A	MY48017076	EF-0007-22	04-Feb-23
Waveform Generator	33511B	MY52302742	EF-0008-22	04-Feb-23
Digital Multimeter	33461A	MY53220104	EEL.BP. 04-0265	09-Feb-23
Digital Multimeter	33461A	MY53220076	EEL.BP. 03-0265	09-Feb-23
Digital Multimeter	34461A	MY60024273	EEL.BP. 05-0265	09-Feb-23
Programmable Attenuator	MAT-1070	62100114	EF-0009-22	07-Feb-23
Condenser Microphone	4180	2977900	AA-1013-22	24-Feb-23
Measuring Amplifier	NA-42KAI	34560495	AA-3/05-22	22-Feb-23

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

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

3.1 National Institute of Metrology (Thailand).

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

QF-TS12-04-04-020664

Continuation of Calibration Certificate

Cert. No. : ACL23004
Job No. : VC66AC0021
Pages : 3 of 8

Summary of Measurement Result :

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

QF-TS12-04-04-020664

Continuation of Calibration Certificate

Cert. No. : ACL23004
Job No. : VC66AC0021
Pages : 4 of 8

Result of calibration :

1. Absolute sensitivity

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

2. Self-generated noise

2.1 Normal test

Measured Value (dB)
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	12.5
C - weight	18.8
Flat	24.4

3. Acoustical signal tests of frequency weightings

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

Frequency (Hz)	Flat	C-weight	A-weight	Acceptance Limits
125	0.3	0.3	0.4	±1.5
1000	0.0	0.0	0.0	±1.0
8000	-1.4	-1.4	-1.4	±5.0

QF-TS12-04-04-020664

Continuation of Calibration Certificate

Cert. No. : ACL23004
Job No. : VC66AC0021
Pages : 5 of 8

4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz

Frequency (Hz)	Flat	C-weight	A-weight	Acceptance Limits
63	0.0	-0.1	-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	0.3	0.0	±2.0
4000	0.0	0.0	0.0	±3.0
8000	0.0	0.1	0.1	±5.0

5. Frequency and time weightings at 1 kHz

5.1 Frequency weightings at 1 kHz

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

5.2 Time weighting at 1 kHz

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

6. Long - term stability

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

QF-TS12-04-04-020664

Continuation of Calibration Certificate

Cert. No. : ACL23004
Job No. : VC66AC0021
Pages : 6 of 8

7. Level linearity on the reference level range

Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
137.0	137.0	0.0	± 1.1
136.0	136.0	0.0	± 1.1
135.0	135.0	0.0	± 1.1
134.0	134.0	0.0	± 1.1
133.0	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	33.9	-0.1	± 1.1
30.0	29.9	-0.1	± 1.1
29.0	28.9	-0.1	± 1.1
28.0	27.9	-0.1	± 1.1
27.0	26.9	-0.1	± 1.1
26.0	25.9	-0.1	± 1.1
25.0	24.8	-0.2	± 1.1

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T. Petchur

Continuation of Calibration Certificate

Cert. No. : ACL23004
Job No. : VC66AC0021
Pages : 7 of 8

8. Level linearity including the level range control

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

9. Tone burst response

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

10. Peak C sound level

Number of cycle in test signal	Anticipated Value (dB)	Measured Value, L _{peak} (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.0	0.0	-
One	136.4	135.3	-1.1	± 3.0

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

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T. Petchur

Continuation of Calibration Certificate

Cert. No. : ACL23004
Job No. : VC66AC0021
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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	89.7		

12. High level stability

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

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

End of Calibration Certificate

QF-TS12-04-04-020664

T. Petchur

451-451/1 Sirinthorn Rd., Bangumru, Bangkok Bangkok 10700 THAILAND.
Tel: 0-2435-8800 Fax: 0-2435-1679 e-mail: cal-center@sithiporn.com http://www.sithiporn.comCert. No. : ACL23005
Pages : 1 of 8

Calibration Certificate

Equipment : SOUND LEVEL METER
Manufacturer : RION
Model : NL-42/ Microphone UC-52 / Preamplifier NH-24
Serial No. : 00858525 / 170383 / 72889
ID No. : BKK FS0115

Condition As Found : GOOD

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

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

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

Calibrated by : Nathakorn Pisutpaisan

Approved by : T. Petchur
(Thanakul Petchur)

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QF-TS12-04-04-020664

Continuation of Calibration Certificate

Cert. No. : ACL23005
Job No. : VC66AC0021
Pages : 2 of 8

Calibration Procedure : CP-AC-01

Calibration Method :

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

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

For tests results of each items were made by observation of each 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-0007-22	04-Feb-23
Waveform Generator	33511B	MY52302742	EF-0005-22	04-Feb-23
Digital Multimeter	33461A	MY53220104	EEL-BP_04/02/63	09-Feb-23
Digital Multimeter	33461A	MY53220076	EEL-BP_03/02/63	09-Feb-23
Digital Multimeter	34461A	MY60024273	EEL-BP_05/02/63	09-Feb-23
Programmable Attenuator	MAT-1070	62100114	EF-0009-22	07-Feb-23
Condenser Microphone	4180	2977900	AA-1013-22	24-Feb-23
Measuring Amplifier	NA-42KA1	34560495	AA-3005-22	22-Feb-23

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

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

3.1 National Institute of Metrology (Thailand),

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

QF-TS12-04-04-020664

7. Peth

Continuation of Calibration Certificate

Cert. No. : ACL23005
Job No. : VC66AC0021
Pages : 3 of 8

Summary of Measurement Result :

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

QF-TS12-04-04-020664

7. Peth

Continuation of Calibration Certificate

Cert. No. : ACL23005
Job No. : VC66AC0021
Pages : 4 of 8

Result of calibration :

1. Absolute sensitivity

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

2. Self-generated noise

2.1 Normal test

Measured Value (dB)
15.5

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

Frequency Weighting	Measured value (dB)
A-weight	14.2
C-weight	20.4
Flat	25.9

3. Acoustical signal tests of frequency weightings

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

Frequency (Hz)	Flat	C-weight	A-weight	Acceptance Limits
125	0.2	0.3	0.3	±1.5
1000	-0.1	-0.1	-0.1	±1.0
8000	-1.7	-1.6	-1.6	±5.0

QF-TS12-04-04-020664

7. Peth

Continuation of Calibration Certificate

Cert. No. : ACL23005
Job No. : VC66AC0021
Pages : 5 of 8

4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

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

5. Frequency and time weightings at 1 kHz

5.1 Frequency weightings at 1 kHz

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

5.2 Time weighting at 1 kHz

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

6. Long-term stability

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

QF-TS12-04-04-020664

7. Peth

Continuation of Calibration Certificate

Cert. No. : ACL23005
Job No. : VC66AC0021
Pages : 6 of 8

7. Level linearity on the reference level range

Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
137.0	137.0	0.0	±1.1
136.0	136.0	0.0	±1.1
135.0	135.0	0.0	±1.1
134.0	134.0	0.0	±1.1
133.0	133.0	0.0	±1.1
132.0	132.0	0.0	±1.1
131.0	131.0	0.0	±1.1
129.0	129.0	0.0	±1.1
124.0	124.0	0.0	±1.1
119.0	119.0	0.0	±1.1
114.0	114.0	0.0	±1.1
109.0	109.0	0.0	±1.1
104.0	104.0	0.0	±1.1
99.0	99.0	0.0	±1.1
94.0	94.0	0.0	±1.1
89.0	89.0	0.0	±1.1
84.0	84.1	0.1	±1.1
79.0	79.0	0.0	±1.1
74.0	74.1	0.1	±1.1
69.0	69.0	0.0	±1.1
64.0	64.0	0.0	±1.1
59.0	59.0	0.0	±1.1
54.0	54.0	0.0	±1.1
49.0	49.0	0.0	±1.1
44.0	44.0	0.0	±1.1
39.0	39.0	0.0	±1.1
34.0	34.0	0.0	±1.1
30.0	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. Petchur

Continuation of Calibration Certificate

Cert. No. : ACL23005
Job No. : VC66AC0021
Pages : 7 of 8

8. Level linearity including the level range control

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

9. Tone burst response

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

10. Peak C sound level

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

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

QF-TS12-04-04-020664

T. Petchur

Continuation of Calibration Certificate

Cert. No. : ACL23005
Job No. : VC66AC0021
Pages : 8 of 8

11. Overload indication

Measured value (dB)		Deviated Value (dB)	Acceptance Limits (dB)
Positive one-half cycle	Negative one-half cycle	0.0	±1.5
89.5	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	±0.3

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

End of Calibration Certificate

QF-TS12-04-04-020664

T. Petchur

451-451/1 Sirinthorn Rd., Bangumnu, Bangkok 10700 THAILAND.
Tel:0-2435-8800 Fax:0-2433-1679 e-mail:cal-center@sithiporn.com http://www.sithiporn.comNSC-TS12-TS 17025
CALIBRATION 0334Cert. No. : ACL23001
Pages : 1 of 8

Calibration Certificate

Equipment : SOUND LEVEL METER
Manufacturer : RION
Model : NL-42/ Microphone UC-52 / Preamplifier NH-24
Serial No.: 00572565 / 170402 / 72903
ID No.: BKK_FS0874

Condition As Found : GOOD

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

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

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

Calibrated by : Nathakorn Pisutpaisan

Approved by :

T. Petchur
(Thanakul Petchurai)

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

QF-TS12-04-04-020664

Continuation of Calibration Certificate

Cert. No. : ACL23001
Job No. : VC66AC0021
Pages : 2 of 8

Calibration Procedure : CP-AC-01

Calibration Method :

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

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

Condition of this result of calibration :

1. Reference Standard Instruments :

Instrument	Model	Serial No.	Cert. No.	Due Date
Waveform Generator	33210A	MY48017076	EF-0007-22	04-Feb-23
Waveform Generator	33511B	MY52302742	EF-0008-22	04-Feb-23
Digital Multimeter	33461A	MY53220104	EEL.BP. 04/0265	09-Feb-23
Digital Multimeter	33461A	MY53220076	EEL.BP. 03/0265	09-Feb-23
Digital Multimeter	34461A	MY60024273	EEL.BP. 05/0265	09-Feb-23
Programmable Attenuator	MA1-1070	62100114	EF-0009-22	07-Feb-23
Condenser Microphone	4180	2977900	AA-1013-22	24-Feb-23
Measuring Amplifier	NA-42KAI	34560495	AA-3005-22	22-Feb-23

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

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

3.1 National Institute of Metrology (Thailand),

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

QF-TS12-04-04-020664

P.T.A.

Continuation of Calibration Certificate

Cert. No. : ACL23001
Job No. : VC66AC0021
Pages : 3 of 8

Summary of Measurement Result :

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

QF-TS12-04-04-020664

P.T.A.

Continuation of Calibration Certificate

Cert. No. : ACL23001
Job No. : VC66AC0021
Pages : 4 of 8

Result of calibration :

1. Absolute sensitivity

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

2. Self-generated noise

2.1 Normal test

Measured Value (dB)
17.2

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

Frequency Weighting	Measured value (dB)
A-weight	14.6
C-weight	21.1
Flat	26.6

3. Acoustical signal tests of frequency weightings

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

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

QF-TS12-04-04-020664

P.T.A.

Continuation of Calibration Certificate

Cert. No. : ACL23001
Job No. : VC66AC0021
Pages : 5 of 8

4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

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

5. Frequency and time weightings at 1 kHz

5.1 Frequency weightings at 1 kHz

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

5.2 Time weighting at 1 kHz

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

6. Long-term stability

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

QF-TS12-04-04-020664

P.T.A.

Continuation of Calibration Certificate

Cert. No. : ACL23001
Job No. : VC66AC0021
Pages : 6 of 8

7. Level linearity on the reference level range

Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
137.0	137.0	0.0	± 1.1
136.0	136.0	0.0	± 1.1
135.0	135.0	0.0	± 1.1
134.0	134.0	0.0	± 1.1
133.0	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	26.1	0.1	± 1.1
25.0	24.9	-0.1	± 1.1

QF-TS12-04-04-020664

Continuation of Calibration Certificate

Cert. No. : ACL23001
Job No. : VC66AC0021
Pages : 7 of 8

8. Level linearity including the level range control

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

9. Tone burst response

Time Weighting	Tone burst duration, 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	-
One	136.4	136.4	0.0	± 3.0

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

QF-TS12-04-04-020664

Continuation of Calibration Certificate

Cert. No. : ACL23001
Job No. : VC66AC0021
Pages : 8 of 8

11. Overload indication

Measured value (dB)		Deviated Value (dB)	Acceptance Limits (dB)
Positive one-half cycle	Negative one-half cycle		
89.6	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	136.9	137.0	-0.1	± 0.3

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

End of Calibration Certificate

QF-TS12-04-04-020664

451-451/1 Sirinthorn Rd., Bangbunru, Bangkok Bangkok 10700 THAILAND
Tel:0-2435-8800 Fax:0-2433-1679 e-mail:center@sithiporn.com http://www.sithiporn.comCert. No. : ACL22276
Pages : 1 of 8

Calibration Certificate

Equipment : SOUND LEVEL METER
Manufacturer : RION
Model : NL-42/ Microphone UC-52 / Preampifier NH-24
Serial No. : 00572563 / 170399 / 72900
ID No. : BKK_FS0879

Condition As Found : GOOD

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

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

Received Date : 14 NOVEMBER 2022
Calibration Date : 21 NOVEMBER 2022
Date of Issue : 24 NOVEMBER 2022

Calibrated by : Nathakorn Pisutpaisan

Approved by :
(Thanakul Petchurai)

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QF-TS12-04-04-020664

Continuation of Calibration Certificate

Cert. No. : ACL22276
Job No. : VC66AC0011
Pages : 2 of 8

Calibration Procedure : CP-AC-01

Calibration Method :

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

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

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

Condition of this result of calibration :

1. Reference Standard Instruments :

Instrument	Model	Serial No.	Cert. No.	Due Date
Waveform Generator	33210A	MY48017076	EF-0007-22	04-Feb-23
Waveform Generator	33511B	MY52302742	EF-0008-22	04-Feb-23
Digital Multimeter	33461A	MY53220104	EEL_BP_04/0265	09-Feb-23
Digital Multimeter	33461A	MY53220076	EEL_BP_03/0265	09-Feb-23
Digital Multimeter	34461A	MY60024273	EEL_BP_05/0265	09-Feb-23
Programmable Attenuator	MAT-1070	62100114	EF-0009-22	07-Feb-23
Condenser Microphone	4180	29779900	AA-1013-22	24-Feb-23
Measuring Amplifier	NA-42KA1	34560495	AA-3005-22	22-Feb-23

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

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

3.1 National Institute of Metrology (Thailand).

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

QF-TS12-04-04-020664

Continuation of Calibration Certificate

Cert. No. : ACL22276
Job No. : VC66AC0011
Pages : 3 of 8

Summary of Measurement Result :

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

QF-TS12-04-04-020664

Continuation of Calibration Certificate

Cert. No. : ACL22276
Job No. : VC66AC0011
Pages : 4 of 8

Result of calibration :

1. Absolute sensitivity

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

2. Self-generated noise

2.1 Normal test

Measured Value (dB)
14.6

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

Frequency Weighting	Measured value (dB)
A - weight	9.9
C - weight	16.5
Flat	22.2

3. Acoustical signal tests of frequency weightings

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

Frequency (Hz)	Flat	C-weight	A-weight	Acceptance Limits
125	0.3	0.4	0.4	± 1.5
1000	-0.1	-0.1	-0.1	± 1.0
8000	-2.2	-2.2	-2.2	± 5.0

QF-TS12-04-04-020664

Continuation of Calibration Certificate

Cert. No. : ACL22276
Job No. : VC66AC0011
Pages : 5 of 8

4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

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

5. Frequency and time weightings at 1 kHz

5.1 Frequency weightings at 1 kHz

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

5.2 Time weighting at 1 kHz

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

6. Long - term stability

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

QF-TS12-04-04-020664

Continuation of Calibration Certificate

Cert. No. : ACL22276
Job No. : VC66AC0011
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	74.1	0.1	±1.1
69.0	69.0	0.0	±1.1
64.0	64.0	0.0	±1.1
59.0	59.0	0.0	±1.1
54.0	54.0	0.0	±1.1
49.0	49.0	0.0	±1.1
44.0	44.0	0.0	±1.1
39.0	39.0	0.0	±1.1
34.0	34.0	0.0	±1.1
30.0	30.1	0.1	±1.1
29.0	29.0	0.0	±1.1
28.0	28.1	0.1	±1.1
27.0	27.1	0.1	±1.1
26.0	26.1	0.1	±1.1
25.0	25.1	0.1	±1.1

QF-TS12-04-04-020664

T. Petchur

Continuation of Calibration Certificate

Cert. No. : ACL22276
Job No. : VC66AC0011
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, Lpeak (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	135.0	135.0	0.0	-
One	136.4	136.0	-0.4	±3.0

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

QF-TS12-04-04-020664

T. Petchur

Continuation of Calibration Certificate

Cert. No. : ACL22276
Job No. : VC66AC0011
Pages : 8 of 8

11. Overload indication

Measured value (dB)		Deviated Value (dB)	Acceptance Limits (dB)
Positive one-half cycle	Negative one-half cycle	0.0	±1.5
89.7	89.7		

12. High level stability

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

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

End of Calibration Certificate

QF-TS12-04-04-020664

T. Petchur

451-451/1 Sivinthorn Rd, Bangbunru, Banglud Bangkok 10700 THAILAND
Tel:0-2435-6800 Fax:0-2431-1679 e-mail:cal-center@sithiporn.com http://www.sithiporn.comCert. No. : ACL22245
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 PIATTHANAKAN 30, PIATTHANAKAN ROAD,
KHWAENG PIATTHANAKAN, KHUET SUAN LUANG,
BANGKOK, 10250 THAILAND.

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

Received Date : 11 OCTOBER 2022
Calibration Date : 25-26 OCTOBER 2022
Date of Issue : 27 OCTOBER 2022

Calibrated by : Natthakorn Pisurapattan

Approved by : T. Petchur
(Thanakul Petchurai)

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

QF-TS12-04-04-020664

Continuation of Calibration Certificate

Cert. No. : ACL22245
Job No. : VC65AC0090
Pages : 2 of 8

Calibration Procedure : CP-AC-01

Calibration Method :

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

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

Condition of this result of calibration :

1. Reference Standard Instruments :

Instrument	Model	Serial No.	Cert. No.	Due Date
Waveform Generator	33210A	MY48017076	EF-0007-22	04-Feb-23
Waveform Generator	33511B	MY52302742	EF-0008-22	04-Feb-23
Digital Multimeter	33461A	MY53220104	EEL-BP. 04/0265	09-Feb-23
Digital Multimeter	33461A	MY53220076	EEL-BP. 03/0265	09-Feb-23
Digital Multimeter	34461A	MY60024273	EEL-BP. 05/0265	09-Feb-23
Programmable Attenuator	MAT-1070	62100114	EF-0009-22	07-Feb-23
Condenser Microphone	4180	2977900	AA-1013-22	24-Feb-23
Measuring Amplifier	NA-42KA1	34560495	AA-3005-22	22-Feb-23

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

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

3.1 National Institute of Metrology (Thailand).

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

QF-TS12-04-04-020664

Continuation of Calibration Certificate

Cert. No. : ACL22245
Job No. : VC65AC0090
Pages : 3 of 8

Summary of Measurement Result :

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

QF-TS12-04-04-020664

Continuation of Calibration Certificate

Cert. No. : ACL22245
Job No. : VC65AC0090
Pages : 4 of 8

Result of calibration :

1. Absolute sensitivity

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

2. Self-generated noise

2.1 Normal test

Measured Value (dB)
15.1

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

Frequency Weighting	Measured value (dB)
A - weight	11.6
C - weight	17.6
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	0.5	0.6	0.6	±5.0

QF-TS12-04-04-020664

Continuation of Calibration Certificate

Cert. No. : ACL22245
Job No. : VC65AC0090
Pages : 5 of 8

4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

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

5. Frequency and time weightings at 1 kHz

5.1 Frequency weightings at 1 kHz

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

5.2 Time weighting at 1 kHz

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

6. Long - term stability

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

QF-TS12-04-04-020664

Continuation of Calibration Certificate

Cert. No. : ACL22245
Job No. : VC65AC0090
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	34.1	0.1	± 1.1
30.0	30.0	0.0	± 1.1
29.0	29.1	0.1	± 1.1
28.0	28.1	0.1	± 1.1
27.0	27.1	0.1	± 1.1
26.0	26.1	0.1	± 1.1
25.0	25.1	0.1	± 1.1

QF-TS12-04-04-020664

T. Petchuraj

Continuation of Calibration Certificate

Cert. No. : ACL22245
Job No. : VC65AC0090
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	134.0	0.0	± 1.0
Slow	2	8	108.0	108.0	0.0	1.5 ; -5.0
	200	800	127.6	127.6	0.0	± 1.0
SEL	0.25	1	99.0	98.9	-0.1	1.5 ; -5.0
	2	8	108.0	108.0	0.0	1.0 ; -2.5
	200	800	128.0	128.0	0.0	± 1.0

10. Peak C sound level

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

Number of cycle in test signal	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.1	0.1	-
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. Petchuraj

Continuation of Calibration Certificate

Cert. No. : ACL22245
Job No. : VC65AC0090
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	S.L.M Display at initial (dB)	S.L.M 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. Petchuraj

451-451/1 Sirtinthon Rd., Bangbunru, Bangkok 10700 THAILAND
Tel: 0-2435-8800 Fax: 0-2433-1679 e-mail: cal-center@sithiporn.com http://www.sithiporn.comCert. No. : ACL22233
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 : 03 OCTOBER 2022
Calibration Date : 18-19 OCTOBER 2022
Date of Issue : 20 OCTOBER 2022

Calibrated by : Nathakorn Pisutpaisan

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. : ACL22233
Job No. : VC65AC0088
Pages : 2 of 8

Calibration Procedure : CP-AC-01

Calibration Method :

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

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

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

Condition of this result of calibration :

1. Reference Standard Instruments :

Instrument	Model	Serial No.	Cert. No.	Due Date
Waveform Generator	33210A	MY48017076	EF-0007-22	04-Feb-23
Waveform Generator	33511B	MY52302742	EF-0008-22	04-Feb-23
Digital Multimeter	33461A	MY53220104	EEL_BP_04/0265	09-Feb-23
Digital Multimeter	33461A	MY53220076	EEL_BP_03/0265	09-Feb-23
Digital Multimeter	34461A	MY60024273	EEL_BP_05/0265	09-Feb-23
Programmable Attenuator	MAT-1070	62100114	EF-0009-22	07-Feb-23
Condenser Microphone	4180	2977900	AA-1013-22	24-Feb-23
Measuring Amplifier	NA-42KAI	34560495	AA-3005-22	22-Feb-23

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

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

3.1 National Institute of Metrology (Thailand).

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

QF-TS12-04-04-020664

Continuation of Calibration Certificate

Cert. No. : ACL22233
Job No. : VC65AC0088
Pages : 3 of 8

Summary of Measurement Result :

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

QF-TS12-04-04-020664

Continuation of Calibration Certificate

Cert. No. : ACL22233
Job No. : VC65AC0088
Pages : 4 of 8

Result of calibration :

1. Absolute sensitivity

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

2. Self-generated noise

2.1 Normal test

Measured Value (dB)
15.5

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

Frequency Weighting	Measured value (dB)
A - weight	10.8
C - weight	17.1
Flat	22.9

3. Acoustical signal tests of frequency weightings

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

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)			
	Flat	C-weight	A-weight	Acceptance Limits
125	0.3	0.3	0.3	± 1.5
1000	0.0	0.0	0.0	± 1.0
8000	-0.6	-0.5	-0.6	± 5.0

QF-TS12-04-04-020664

Continuation of Calibration Certificate

Cert. No. : ACL22233
Job No. : VC65AC0088
Pages : 5 of 8

4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

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

5. Frequency and time weightings at 1 kHz

5.1 Frequency weightings at 1 kHz

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

5.2 Time weighting at 1 kHz

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

6. Long - term stability

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

QF-TS12-04-04-020664

Continuation of Calibration Certificate

Cert. No. : ACL22233
Job No. : VC65AC0088
Pages : 6 of 8

7. Level linearity on the reference level range

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

Continuation of Calibration Certificate

Cert. No. : ACL22233
Job No. : VC65AC0088
Pages : 7 of 8

8. Level linearity including the level range control

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

9. Tone burst response

Time Weighting	Tone burst duration, T ₀ (ms)	Cycle	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Fast	0.25	1	108.0	107.9	-0.1	1.5 ; -5.0
	2	8	117.0	117.0	0.0	1.0 ; -2.5
	200	800	134.0	134.0	0.0	±1.0
Slow	2	8	108.0	108.0	0.0	1.5 ; -5.0
	200	800	127.6	127.6	0.0	±1.0
SEL	0.25	1	99.0	98.9	-0.1	1.5 ; -5.0
	2	8	108.0	108.0	0.0	1.0 ; -2.5
	200	800	128.0	128.0	0.0	±1.0

10. Peak C sound level

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

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

QF-TS12-04-04-020664

T. Petchuraj

Continuation of Calibration Certificate

Cert. No. : ACL22233
Job No. : VC65AC0088
Pages : 8 of 8

11. Overload indication

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

12. High level stability

Frequency Weighting	S.L.M Display at initial (dB)	S.L.M 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. Petchuraj

451-451/1 Sirinthorn Rd., Bangumru, Bangkok Bangkok 10700 THAILAND
Tel:0-2435-8800 Fax:0-2433-1679 e-mail:cal-center@sithiporn.com http://www.sithiporn.comCert. No. : ACL23055
Pages : 1 of 8

Calibration Certificate

Equipment : SOUND LEVEL METER
Manufacturer : RION
Model : NL-42/ Microphone UC-52 / Preamplifier NH-24
Serial No. : 00672789 / 170666 / 73129
ID No. : BKK_FS0929

Condition As Found : GOOD

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

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

Received Date : 17 JANUARY 2023
Calibration Date : 19-20 JANUARY 2023
Date of Issue : 23 JANUARY 2023

Calibrated by : Nathakorn Pissupaisan

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. : ACL23055
Job No. : VC66AC0026
Pages : 2 of 8

Calibration Procedure : CP-AC-01

Calibration Method :

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

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

Condition of this result of calibration :

1. Reference Standard Instruments :

Instrument	Model	Serial No.	Cert. No.	Due Date
Waveform Generator	33210A	MY48017076	EF-0007-22	04-Feb-23
Waveform Generator	33511B	MY52302742	EF-0008-22	04-Feb-23
Digital Multimeter	33461A	MY53220104	EEL_BP_03/0265	09-Feb-23
Digital Multimeter	33461A	MY53220076	EEL_BP_03/0265	09-Feb-23
Digital Multimeter	34461A	MY60024273	EEL_BP_05/0265	09-Feb-23
Programmable Attenuator	MAT-1070	62100114	EF-0009-22	07-Feb-23
Condenser Microphone	4180	2977900	AA-1013-22	24-Feb-23
Measuring Amplifier	NA-42KAJ	34560495	AA-3005-22	22-Feb-23

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

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

3.1 National Institute of Metrology (Thailand).

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

QF-TS12-04-04-020664

Continuation of Calibration Certificate

Cert. No. : ACL23055
Job No. : VC66AC0026
Pages : 3 of 8

Summary of Measurement Result :

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

QF-TS12-04-04-020664

Continuation of Calibration Certificate

Cert. No. : ACL23055
Job No. : VC66AC0026
Pages : 4 of 8

Result of calibration :

1. Absolute sensitivity

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

2. Self-generated noise

2.1 Normal test

Measured Value (dB)
14.4

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

Frequency Weighting	Measured value (dB)
A - weight	11.6
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	0.1	0.1	0.1	± 1.5
1000	0.0	0.0	0.0	± 1.0
8000	-0.2	-0.1	-0.1	± 5.0

QF-TS12-04-04-020664

Continuation of Calibration Certificate

Cert. No. : ACL23055
Job No. : VC66AC0026
Pages : 5 of 8

4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

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

5. Frequency and time weightings at 1 kHz

5.1 Frequency weightings at 1 kHz

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

5.2 Time weighting at 1 kHz

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

6. Long - term stability

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

QF-TS12-04-04-020664

Continuation of Calibration Certificate

Cert. No. : ACL23055
Job No. : VC66AC0026
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	30.0	0.0	±1.1
29.0	29.0	0.0	±1.1
28.0	28.0	0.0	±1.1
27.0	26.9	-0.1	±1.1
26.0	25.9	-0.1	±1.1
25.0	25.0	0.0	±1.1

QF-TS12-04-04-020664

T. Petch

Continuation of Calibration Certificate

Cert. No. : ACL23055
Job No. : VC66AC0026
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	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
SEL	0.25	1	99.0	98.8	-0.2	1.5 ; -5.0
	2	8	108.0	107.9	-0.1	1.0 ; -2.5
	200	800	128.0	128.0	0.0	±1.0

10. Peak C sound level

Number of cycle in test signal	Anticipated Value (dB)	Measured Value, L _{peak} (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.0	0.0	-
One	136.4	135.7	-0.7	±3.0

Number of cycle in test signal	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.0	0.0	-
Positive half cycle	135.4	135.1	-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. : ACL23055
Job No. : VC66AC0026
Pages : 8 of 8

11. Overload indication

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

12. High level stability

Frequency Weighting	S.L.M Display at initial (dB)	S.L.M 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

451-451/1 Sirinthon Rd, Bangbunma, Bangkok Bangkok 10700 THAILAND
Tel:0-2435-8800 Fax:0-2433-1679 e-mail:cal-center@sithiporn.com http://www.sithiporn.comCert. No. : ACL23051
Pages : 1 of 8

Calibration Certificate

Equipment : SOUND LEVEL METER
Manufacturer : RION
Model : NL-42 / Microphone UC-52 / Preamplifier NH-24
Serial No.: 00296513 / 179115 / 87522
ID No.: BKK_FS0970

Condition As Found : GOOD

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

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

Received Date : 17 JANUARY 2023
Calibration Date : 19-20 JANUARY 2023
Date of Issue : 23 JANUARY 2023

Calibrated by : Nathakorn Pisuapaisan

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. : ACL23051
Job No. : VC66AC0026
Pages : 2 of 8

Calibration Procedure : CP-AC-01

Calibration Method :

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

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

Condition of this result of calibration :

1. Reference Standard Instruments :

Instrument	Model	Serial No.	Cert. No.	Due Date
Waveform Generator	33210A	MY48017076	EF-0007-22	04-Feb-23
Waveform Generator	33511B	MY52302742	EF-0008-22	04-Feb-23
Digital Multimeter	33461A	MY53220104	EEL_BP_04/0265	09-Feb-23
Digital Multimeter	33461A	MY53220076	EEL_BP_03/0265	09-Feb-23
Digital Multimeter	34461A	MY60024273	EEL_BP_05/0265	09-Feb-23
Programmable Attenuator	MAT-1070	62100114	EF-0009-22	07-Feb-23
Condenser Microphone	4180	2977900	AA-1013-22	24-Feb-23
Measuring Amplifier	NA-42KAJ	34560495	AA-3005-22	22-Feb-23

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

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

3.1 National Institute of Metrology (Thailand).

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

QE-TS12-04-04-020664

Continuation of Calibration Certificate

Cert. No. : ACL23051
Job No. : VC66AC0026
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

QE-TS12-04-04-020664

Continuation of Calibration Certificate

Cert. No. : ACL23051
Job No. : VC66AC0026
Pages : 4 of 8

Result of calibration :

1. Absolute sensitivity

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

2. Self-generated noise

2.1 Normal test

Measured Value (dB)
14.6

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

Frequency Weighting	Measured value (dB)
A - weight	10.8
C - weight	16.8
Flat	22.7

3. Acoustical signal tests of frequency weightings

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

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)			
	Flat	C-weight	A-weight	Acceptance Limits
125	0.1	0.2	0.2	± 1.5
1000	0.0	0.0	0.0	± 1.0
8000	-0.4	-0.3	-0.3	± 5.0

QE-TS12-04-04-020664

Continuation of Calibration Certificate

Cert. No. : ACL23051
Job No. : VC66AC0026
Pages : 5 of 8

4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

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

5. Frequency and time weightings at 1 kHz

5.1 Frequency weightings at 1 kHz

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

5.2 Time weighting at 1 kHz

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

6. Long - term stability

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

QE-TS12-04-04-020664

Continuation of Calibration Certificate

Cert. No. : ACL23051
Job No. : VC66AC0026
Pages : 6 of 8

7. Level linearity on the reference level range

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

QF-TS12-04-04-020664

T. Petchur

Continuation of Calibration Certificate

Cert. No. : ACL23051
Job No. : VC66AC0026
Pages : 7 of 8

8. Level linearity including the level range control

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

9. Tone burst response

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

10. Peak C sound level

Number of cycle in test signal	Anticipated Value (dB)	Measured Value, L _{peak} (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.0	0.0	-
One	136.4	135.6	-0.8	±3.0

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

QF-TS12-04-04-020664

T. Petchur

Continuation of Calibration Certificate

Cert. No. : ACL23051
Job No. : VC66AC0026
Pages : 8 of 8

11. Overload indication

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

12. High level stability

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

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

End of Calibration Certificate

QF-TS12-04-04-020664

T. Petchur

451-451/1 Sirinthorn Rd, Bangbunru, Bangkok 10700 THAILAND
Tel:0-2435-8800 Fax:0-2433-1679 e-mail:center@sitiporn.com http://www.sitiporn.comCert. No. : ACL23052
Pages : 1 of 8

Calibration Certificate

Equipment : SOUND LEVEL METER
Manufacturer : RION
Model : NL-42/ Microphone UC-52 / Preamplifier NH-24
Serial No. : 00296514 / 179116 / 87523
ID No. : BKK_FS0971

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 : 17 JANUARY 2023
Calibration Date : 19-20 JANUARY 2023
Date of Issue : 23 JANUARY 2023

Calibrated by : Nathakorn Pisutpaisan

Approved by : T. Petchur
(Thanakul Petchurai)

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QF-TS12-04-04-020664

Continuation of Calibration Certificate

Cert. No. : ACL23052
Job No. : VC66AC0026
Pages : 2 of 8

Calibration Procedure : CP-AC-01

Calibration Method :

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

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

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

Condition of this result of calibration :

1. Reference Standard Instruments :

Instrument	Model	Serial No.	Cert. No.	Due Date
Waveform Generator	33210A	MY48017076	EF-0007-22	04-Feb-23
Waveform Generator	33511B	MY52302742	EF-0008-22	04-Feb-23
Digital Multimeter	33461A	MY53220104	EEL_BP_04/0265	09-Feb-23
Digital Multimeter	33461A	MY53220076	EEL_BP_03/0265	09-Feb-23
Digital Multimeter	34461A	MY60024273	EEL_BP_05/0265	09-Feb-23
Programmable Attenuator	MAT-1070	62100114	EF-0009-22	07-Feb-23
Condenser Microphone	4180	2977900	AA-1013-22	24-Feb-23
Measuring Amplifier	NA-42KAJ	34560495	AA-3005-22	22-Feb-23

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

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

3.1 National Institute of Metrology (Thailand).

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

QF-TS12-04-04-020664

Continuation of Calibration Certificate

Cert. No. : ACL23052
Job No. : VC66AC0026
Pages : 3 of 8

Summary of Measurement Result :

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

QF-TS12-04-04-020664

Continuation of Calibration Certificate

Cert. No. : ACL23052
Job No. : VC66AC0026
Pages : 4 of 8

Result of calibration :

1. Absolute sensitivity

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

2. Self-generated noise

2.1 Normal test

Measured Value (dB)
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	10.8
C-weight	16.7
Flat	22.5

3. Acoustical signal tests of frequency weightings

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

Frequency (Hz)	Flat	C-weight	A-weight	Acceptance Limits
125	0.3	0.4	0.4	±1.5
1000	-0.1	-0.1	-0.1	±1.0
8000	-0.9	-0.9	-0.9	±5.0

QF-TS12-04-04-020664

Continuation of Calibration Certificate

Cert. No. : ACL23052
Job No. : VC66AC0026
Pages : 5 of 8

4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

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

5. Frequency and time weightings at 1 kHz

5.1 Frequency weightings at 1 kHz

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

5.2 Time weighting at 1 kHz

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

6. Long-term stability

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

QF-TS12-04-04-020664

Continuation of Calibration Certificate

Cert. No. : ACL23052
Job No. : VC66AC0026
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	30.1	0.1	±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	25.1	0.1	±1.1

QP-TS12-04-04-020664

T. Petchur

Continuation of Calibration Certificate

Cert. No. : ACL23052
Job No. : VC66AC0026
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	123.0	123.0	0.0	-
One	136.4	135.7	-0.7	±3.0

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

QP-TS12-04-04-020664

T. Petchur

Continuation of Calibration Certificate

Cert. No. : ACL23052
Job No. : VC66AC0026
Pages : 8 of 8

11. Overload indication

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

12. High level stability

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

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

End of Calibration Certificate

QP-TS12-04-04-020664

T. Petchur

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



Cert. No. : ACL23167
Pages : 1 of 8

Calibration Certificate

Equipment : SOUND LEVEL METER
Manufacturer : RUON
Model : NL-42 / Microphone UC-52 / Preamplifier NH-24
Serial No. : 00658242 / 157782 / 48097
ID No. : BKK_FS0099

Condition As Found : GOOD

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

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

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

Calibrated by : Nathakorn Pisutpaisan

Approved by : T. Petchur
(Thanakul Petchur)

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QP-TS12-04-04-020664

Continuation of Calibration Certificate

Cert. No. : ACL22167
Job No. : VC65AC0069
Pages : 2 of 8

Calibration Procedure : CP-AC-01

Calibration Method :

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

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

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

Condition of this result of calibration :

1. Reference Standard Instruments :

Instrument	Model	Serial No.	Cert. No.	Due Date
Waveform Generator	33210A	MY48017076	EF-0007-22	04-Feb-23
Waveform Generator	33511B	MY52302742	EF-0008-22	04-Feb-23
Digital Multimeter	33461A	MY53220104	EEL_BP_04/0265	09-Feb-23
Digital Multimeter	33461A	MY53220076	EEL_BP_03/0265	09-Feb-23
Digital Multimeter	33461A	MY60024273	EEL_BP_05/0265	09-Feb-23
Programmable Attenuator	MAT-J070	62100114	EF-0009-22	07-Feb-23
Condenser Microphone	4180	2977900	AA-1013-22	24-Feb-23
Measuring Amplifier	NA-42KAI	34560495	AA-3005-22	22-Feb-23

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

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

3.1 National Institute of Metrology (Thailand).

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

QF-TS12-04-04-020664

7. Retsh

Continuation of Calibration Certificate

Cert. No. : ACL22167
Job No. : VC65AC0069
Pages : 3 of 8

Summary of Measurement Result :

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

QF-TS12-04-04-020664

7. Retsh

Continuation of Calibration Certificate

Cert. No. : ACL22167
Job No. : VC65AC0069
Pages : 4 of 8

Result of calibration :

1. Absolute sensitivity

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

2. Self-generated noise

2.1 Normal test

Measured Value (dB)
17.7

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

Frequency Weighting	Measured value (dB)
A - weight	16.1
C - weight	21.7
Flat	27.4

3. Acoustical signal tests of frequency weightings

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

Frequency (Hz)	Flat	C-weight	A-weight	Acceptance Limits
125	0.2	0.2	0.2	± 1.5
1000	-0.1	-0.1	-0.1	± 1.0
8000	-1.4	-1.3	-1.3	± 5.0

QF-TS12-04-04-020664

7. Retsh

Continuation of Calibration Certificate

Cert. No. : ACL22167
Job No. : VC65AC0069
Pages : 5 of 8

4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

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

5. Frequency and time weightings at 1 kHz

5.1 Frequency weightings at 1 kHz

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

5.2 Time weighting at 1 kHz

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

6. Long - term stability

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

QF-TS12-04-04-020664

7. Retsh

Continuation of Calibration Certificate

Cert. No. : ACL22167
Job No. : VC65AC0069
Pages : 6 of 8

7. Level linearity on the reference level range

Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
137.0	137.0	0.0	±1.1
136.0	136.0	0.0	±1.1
135.0	135.0	0.0	±1.1
134.0	134.0	0.0	±1.1
133.0	133.0	0.0	±1.1
132.0	132.0	0.0	±1.1
131.0	131.0	0.0	±1.1
129.0	129.0	0.0	±1.1
124.0	124.0	0.0	±1.1
119.0	119.0	0.0	±1.1
114.0	114.0	0.0	±1.1
109.0	109.0	0.0	±1.1
104.0	104.0	0.0	±1.1
99.0	99.0	0.0	±1.1
94.0	94.0	0.0	±1.1
89.0	89.0	0.0	±1.1
84.0	84.0	0.0	±1.1
79.0	79.0	0.0	±1.1
74.0	74.0	0.0	±1.1
69.0	69.0	0.0	±1.1
64.0	64.0	0.0	±1.1
59.0	59.0	0.0	±1.1
54.0	54.0	0.0	±1.1
49.0	49.0	0.0	±1.1
44.0	44.0	0.0	±1.1
39.0	39.0	0.0	±1.1
34.0	34.0	0.0	±1.1
30.0	30.0	0.0	±1.1
29.0	29.0	0.0	±1.1
28.0	27.9	-0.1	±1.1
27.0	27.1	0.1	±1.1
26.0	26.0	0.0	±1.1
25.0	25.1	0.1	±1.1

QP-TS12-04-04-020664

T. Petchur

Continuation of Calibration Certificate

Cert. No. : ACL22167
Job No. : VC65AC0069
Pages : 7 of 8

8. Level linearity including the level range control

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

9. Tone burst response

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

10. Peak C sound level

Number of cycle in test signal	Anticipated Value (dB)	Measured Value, L _{peak} (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.0	0.0	-
One	136.4	135.6	-0.8	±3.0

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

QP-TS12-04-04-020664

T. Petchur

Continuation of Calibration Certificate

Cert. No. : ACL22167
Job No. : VC65AC0069
Pages : 8 of 8

11. Overload indication

Measured value (dB)		Deviated Value (dB)	Acceptance Limits (dB)
Positive one-half cycle	Negative one-half cycle	-0.2	±1.5
89.7	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	±0.3

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. Petchur

451-451/1 Sinitorn Rd., Bangburm, Bangkok 10700 THAILAND.
Tel:0-2435-8800 Fax:0-2433-1679 e-mail:cal-center@sithiporn.com http://www.sithiporn.comCert. No. : ACL23056
Pages : 1 of 8

Calibration Certificate

Equipment : SOUND LEVEL METER
Manufacturer : RJON
Model : NL-42/ Microphone UC-52 / Preamplifier NH-24
Serial No. : 00858518 / 158769 / 58770
ID No. : BKK_FS0108

Condition As Found : GOOD

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

Location :
Ambient Temperature : (23.0 ± 3) °C
Pressure : (101.3 ± 3) kPa
Relative Humidity : (50.0 ± 20) %
Received Date : 17 JANUARY 2023
Calibration Date : 19-20 JANUARY 2023
Date of Issue : 23 JANUARY 2023

Calibrated by : Nathakorn Pitsurpaian

Approved by : T. Petchur
(Thanakul Petchurai)

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QP-TS12-04-04-020664

Continuation of Calibration Certificate

Cert. No. : ACL23056
Job No. : VC66AC0026
Pages : 2 of 8

Calibration Procedure : CP-AC-01

Calibration Method :

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

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

Condition of this result of calibration :

1. Reference Standard Instruments :

Instrument	Model	Serial No.	Cert. No.	Due Date
Waveform Generator	33210A	MY48017076	EF-0007-22	04-Feb-23
Waveform Generator	33511B	MY52302742	EF-0008-22	04-Feb-23
Digital Multimeter	33461A	MY53220104	EEL.BP. 04/0265	09-Feb-23
Digital Multimeter	33461A	MY53220076	EEL.BP. 03/0265	09-Feb-23
Digital Multimeter	34461A	MY60024273	EEL.BP. 05/0265	09-Feb-23
Programmable Attenuator	MAT-1070	62100114	EF-0009-22	07-Feb-23
Condenser Microphone	4180	2977900	AA-1013-22	24-Feb-23
Measuring Amplifier	NA-42KA1	34560495	AA-3005-22	22-Feb-23

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

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

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

QF-TS12-04-04-020664

7. Petch.

Continuation of Calibration Certificate

Cert. No. : ACL23056
Job No. : VC66AC0026
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	0.25
11. Overload indication	✓	-	0.2	0.25
12. High level stability	✓	-	0.1	0.1

QF-TS12-04-04-020664

7. Petch.

Continuation of Calibration Certificate

Cert. No. : ACL23056
Job No. : VC66AC0026
Pages : 4 of 8

Result of calibration :

1. Absolute sensitivity

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

2. Self-generated noise

2.1 Normal test

Measured Value (dB)
17.2

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

Frequency Weighting	Measured value (dB)
A - weight	14.8
C - weight	20.8
Flat	26.6

3. Acoustical signal tests of frequency weightings

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

Frequency (Hz)	Flat	C-weight	A-weight	Acceptance Limits
125	0.2	0.3	0.3	± 1.5
1000	0.0	0.0	0.0	± 1.0
8000	-0.8	-0.7	-0.7	± 5.0

QF-TS12-04-04-020664

7. Petch.

Continuation of Calibration Certificate

Cert. No. : ACL23056
Job No. : VC66AC0026
Pages : 5 of 8

4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

Frequency (Hz)	Flat	C-weight	A-weight	Acceptance Limits
63	0.0	0.0	0.0	±2.0
125	0.0	0.0	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	0.0	0.1	0.1	±5.0

5. Frequency and time weightings at 1 kHz

5.1 Frequency weightings at 1 kHz

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

5.2 Time weighting at 1 kHz

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

6. Long - term stability

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

QF-TS12-04-04-020664

7. Petch.

Continuation of Calibration Certificate

Cert. No. : ACL23056
Job No. : VC66AC0026
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	29.0	0.0	±1.1
28.0	27.9	-0.1	±1.1
27.0	26.9	-0.1	±1.1
26.0	25.9	-0.1	±1.1
25.0	24.8	-0.2	±1.1

QP-TS12-04-04-020664

T. Petchum

Continuation of Calibration Certificate

Cert. No. : ACL23056
Job No. : VC66AC0026
Pages : 7 of 8

8. Level linearity including the level range control

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

9. Tone burst response

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

10. Peak C sound level

Number of cycle in test signal	Anticipated Value (dB)	Measured Value, L _{peak} (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.0	0.0	-
One	136.4	136.2	-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	132.9	-0.1	-
Positive half cycle	135.4	135.1	-0.3	±2.0
Negative half cycle	135.4	135.1	-0.3	±2.0

QP-TS12-04-04-020664

T. Petchum

Continuation of Calibration Certificate

Cert. No. : ACL23056
Job No. : VC66AC0026
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

QP-TS12-04-04-020664

T. Petchum

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.comCert. No. : ACL22190
Pages : 1 of 8

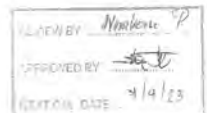
Calibration Certificate

Equipment : SOUND LEVEL METER
Manufacturer : RION
Model : NL-42 / Microphone UC-52 / Preamplifier NH-24
Serial No.: 00584983 / 175177 / 85722
ID No.: BKK_FS0926

Condition As Found : GOOD

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

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



Calibrated by : Naibakorn Pisunpaisan

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.

QP-TS12-04-04-020664

Continuation of Calibration Certificate

Cert. No. : ACL22190
Job No. : VC65AC0081
Pages : 2 of 8

Calibration Procedure : CP-AC-01

Calibration Method :

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

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

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

Condition of this result of calibration :

1. Reference Standard Instruments :

Instrument	Model	Serial No.	Cert. No.	Due Date
Waveform Generator	33210A	MY48017076	EF-0007-22	04-Feb-23
Waveform Generator	33511B	MY52302742	EF-0008-22	04-Feb-23
Digital Multimeter	33461A	MY53220104	EEL_BP_04/0265	09-Feb-23
Digital Multimeter	33461A	MY53220076	EEL_BP_03/0265	09-Feb-23
Digital Multimeter	34461A	MY60024273	EEL_BP_05/0265	09-Feb-23
Programmable Attenuator	MAT-1070	62100114	EF-0009-22	07-Feb-23
Condenser Microphone	4180	2977900	AA-1013-22	24-Feb-23
Measuring Amplifier	NA-42KAJ	34560495	AA-3005-22	22-Feb-23

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

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

3.1 National Institute of Metrology (Thailand).

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

QF-TS12-04-04-020664

Continuation of Calibration Certificate

Cert. No. : ACL22190
Job No. : VC65AC0081
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	0.25
11. Overload indication	✓	-	0.2	0.25
12. High level stability	✓	-	0.1	0.1

QF-TS12-04-04-020664

Continuation of Calibration Certificate

Cert. No. : ACL22190
Job No. : VC65AC0081
Pages : 4 of 8

Result of calibration :

1. Absolute sensitivity

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

2. Self-generated noise

2.1 Normal test

Measured Value (dB)
14.2

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

Frequency Weighting	Measured value (dB)
A - weight	12.4
C - weight	18.8
Flat	24.2

3. Acoustical signal tests of frequency weightings

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

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)			
	Flat	C-weight	A-weight	Acceptance Limits
125	0.2	0.3	0.3	±1.5
1000	0.0	0.0	0.0	±1.0
8000	-0.1	-0.1	-0.1	±5.0

QF-TS12-04-04-020664

Continuation of Calibration Certificate

Cert. No. : ACL22190
Job No. : VC65AC0081
Pages : 5 of 8

4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

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

5. Frequency and time weightings at 1 kHz

5.1 Frequency weightings at 1 kHz

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

5.2 Time weighting at 1 kHz

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

6. Long - term stability

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

QF-TS12-04-04-020664

Continuation of Calibration Certificate

Cert. No. : ACL22190
Job No. : VC65AC0081
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

T. Retch.

Continuation of Calibration Certificate

Cert. No. : ACL22190
Job No. : VC65AC0081
Pages : 7 of 8

8. Level linearity including the level range control

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

9. Tone burst response

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

10. Peak C sound level

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

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

QF-TS12-04-04-020664

T. Retch.

Continuation of Calibration Certificate

Cert. No. : ACL22190
Job No. : VC65AC0081
Pages : 8 of 8

11. Overload indication

Measured value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Positive one-half cycle	Negative one-half cycle	
89.7	89.5	-0.2
		±1.5

12. High level stability

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

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

End of Calibration Certificate

QF-TS12-04-04-020664

T. Retch.



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
CORPORATE SERVICES & EQUIPMENT CALIBRATION AND TESTING SERVICES
334/4 PATTANAKARN ROAD SOI 18, SUAN LUANG, SUANLUANG BANGKOK 10250
TEL: 0-2173-3090-27 FAX: 0-2173-9484



Cert.No.: 22CH1222
Page: 1 of 2

Certificate of Calibration

Equipment : pH Meter
Manufacturer : Mettler Toledo
Model : Seven Compact S220
Serial No. : B520848426
ID No. : BKK_EN0072
Condition As-Received : Used Item
Received Date : 09 September 2022
Calibration Date : 12 September 2022
Reference : 2209-03120SC-1
Submitted by :

REVIEW BY: Gulik P.
APPROVED BY: KL AL
NEXT CAL. DATE: 12/09/24

Submitted by : ALS Laboratory Group (Thailand) Co., Ltd.
104 Phatthanakan 40, Phatthanakan Rd.,
Khaeng Phatthanakan, Khet 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 Lerngagrakul

Approved by : T. Retch.
Approved Signatory

() Malee Butkrues
() Sathip Meangmai
() Warakorn Lerngagrakul

Issue Date : 15 September 2022

The Uncertainties are for a confidence probability of approximately 95 %

This certificate may not be reproduced other than in full, except with the prior written
Approval of the head of Corporate Services 5, Equipment Calibration and Testing Services.



Cert. No.: 22CH1222
Page: 2 of 2

Condition of this calibration result

1. Reference Standard Instrument :-

Instrument Serial No. ID No. Cert. No. Due Date
1) Document Process Calibrator 54030049 130RC116 22E2769 24 Aug 2023
This certification is traceable to the International System of Unit maintained at-
Traceable to National Institute of Metrology (Thailand), NIMT

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

Buffer Solution	Manufacturer	Lot No.	Exp. date
pH 4.008	CPA chem	823320	20 June 2024
pH 6.985	CPA chem	794122	14 Feb 2023
pH 10.008	CPA chem	823323	20 June 2023

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

Calibration Results

Function : mV Measurement

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

Unit Under Calibration	Nominal Value	Standard Voltage Input	Actual Reading	Uncertainty of Measurement	Coverage factor
	pH	mV	mV	(\pm mV)	k
pH Meter	4.000	177.48	177.4	0.058	2.00
S/N: B520948426	7.000	0.00	0.0	0.058	2.00
	10.000	-177.48	-177.5	0.058	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	Uncertainty of pH measurement	Coverage factor
			(mV)	(\pm)	k
pH Electrode	4.008	3.999	153.9	0.0055	2.09
S/N: PCE-86-EX1001	6.985	7.017	-13.7	0.0084	2.00
	10.008	9.998	-179.0	0.0078	2.06

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 %.

-080-

Del.

a 1126274

BKK-LG 0040

HACH COMPANY

1/0 AB Sore (Thailand) Limited, Building D Room No. D3 11, 3rd Floor, No. 735/4, Simakan Road, Pattanakarn, Suanphong, Bangkok
(Phone +66 (0)2 016-3529 Ext. 0 | Fax +66(0)2 016-3572 | www.hach.com)

LAB) 220140

Test Report

Customer	ALS LABORATORY GROUP (THAILAND) CO., LTD.
Equipment	Chlorine Meter
Manufacturer	HACH
Controller Model	DR200
Sensor Model	-
Controller Serial No	19050A000330
Sensor Serial No.	-
Date of test	31/05/2022
Period	1 Year
Environment temperature	24.0 °C
Humidity	60.0 %RH

Results

Item	Characteristic	Before	After	Remarks
1	Visual Inspect	<input checked="" type="checkbox"/> Pass <input type="checkbox"/> Fail	<input checked="" type="checkbox"/> Pass <input type="checkbox"/> Fail	
2	Power Supply (4.5 - 5.0 VDC)	5.7 VDC	5.3 VDC	
3	Display Check	<input checked="" type="checkbox"/> Pass <input type="checkbox"/> Fail	<input checked="" type="checkbox"/> Pass <input type="checkbox"/> Fail	
4	Keyboard Check	<input checked="" type="checkbox"/> Pass <input type="checkbox"/> Fail	<input checked="" type="checkbox"/> Pass <input type="checkbox"/> Fail	
5	Function System Program	<input checked="" type="checkbox"/> Pass <input type="checkbox"/> Fail	<input checked="" type="checkbox"/> Pass <input type="checkbox"/> Fail	

Warning and Error Checklist

Item	Error	Before	After
6	Error list	<input checked="" type="checkbox"/> None <input type="checkbox"/> Appear	<input checked="" type="checkbox"/> None <input type="checkbox"/> Appear

Check with Standard

Item	Concentration	Before	After	Agree
1	DRD-CHLORINE-LR			
7	Blank (0.00 mg/l)	0.00 mg/l	0.00 mg/l	
8	Standard C2 No. 1 (0.23 \pm 0.00 mg/l)	0.24 mg/l	0.23 mg/l	
9	Standard C2 No. 2 (0.88 \pm 0.10 mg/l)	0.90 mg/l	0.90 mg/l	
10	Standard C2 No. 3 (1.84 \pm 0.14 mg/l)	1.73 mg/l	1.85 mg/l	
11	DRD-CHLORINE-HR			
11	Blank (0.00 mg/l)	0.00 mg/l	0.00 mg/l	
12	Standard C2 No. 1 (0.21 \pm 0.02 mg/l)	0.20 mg/l	0.22 mg/l	
13	Standard C2 No. 2 (0.89 \pm 0.03 mg/l)	0.87 mg/l	0.89 mg/l	
14	Standard C2 No. 3 (0.88 \pm 0.06 mg/l)	0.88 mg/l	0.88 mg/l	

REVIEW BY *Chayathorn P.*
APPROVED BY *Chayathorn P.*
NEXT CAL. DATE 31/05/2023



HACH COMPANY
1/0 AB Sore (Thailand) Limited, Building D Room No. D3 11, 3rd Floor, No. 735/4, Simakan Road, Pattanakarn, Suanphong, Bangkok
(Phone +66 (0)2 016-3529 Ext. 0 | Fax +66(0)2 016-3572 | www.hach.com)

LAB) 220140

Summary of checks

- ☒ The instrument can work normally and efficiently. (เครื่องมือสามารถใช้งานได้ปกติและมีประสิทธิภาพ)
☐ The instrument can work well according to calibration. (เครื่องมือวัดสามารถใช้งานได้ผลตามการสอบเทียบ)
☐ The instrument could not work due to reasons. (เครื่องมือวัดไม่สามารถใช้งานได้เนื่องจากเหตุผลอื่น ๆ)

Remark:

Standard Equipment Used

Equipment	Lot No.	Exp. date
Standard Chlorine DRD-CHLORINE-LR	A2121	May 24
Standard Chlorine DRD-CHLORINE-HR	A2104	Apr 24
Digital multi meter	S/N 91270010	Due date 23-Jun-23
Thermometer	S/N 41413545	Due date 17-Aug-23

Test By

WILAILAK S.

(Miss Wilailak Sawangpon)
Service Engineer

Approved by

S. S.

(Mr. Suarun Sarayangkoo)
Assistant Service Division Manager



Metrological Center

SCI ECO Services Company Limited

33/2 Moo 3, T. Banpa, A. Kaengkhro, Saraburi 18110, Thailand
Saraburi Tel: +66 3627 3096 Fax: +66 3627 3100
Bangkok Tel: +668 9205 6851, +668 8247 2360
Website: www.scieco.co.th E-Mail: calibrate@scg.co.th



Certificate No. T220139

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 : 26 January 2022

Calibrated By : Watcharapon Sangtong (Technician)

Approved By : *[Signature]* / Sujjar Naknakred (Site Calibration Manager)

Date of Issue : 08 FEB 2022

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

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

FM-134 (17.0)-02-04

Certificate No. T220139

Page 2 of 3

Calibration Report

Equipment : Liquid Bath (Water)
Date of Calibration : 31 January 2022
Environment : Temperature : 22.4-23.9 °C
Line Voltage : 221.4-225.4 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-T26 (based on ASTM E713-90 (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 M34(CH1-CH5) T210115 3 February 2022
DATA LOGGER 34970A T210115 3 February 2022
- This certificate is traceable to :
National Institute of Metrology (Thailand) through Metrological Center (NSC-TISI-TIS 17025 CALIBRATION 0244)
- Condition of calibrated item : good
Equipment Description :
Time Constant 1 Hour - Minute At 60 °C
- Adjustment :
(X) without adjustment () after adjustment

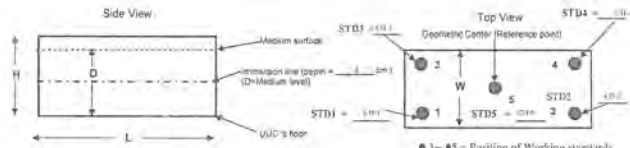
Approved By

FM-L15117/15-05-61

Certificate No. T220139

Page 3 of 3

Calibration Report



- D = Medium level : 8 cm.
- Working space dimension : 62 x 41 x 14 (W x L x H)
- UUC's medium : Water
- Working standards are located at : 2.5 cm away from each corner and wall.

Measurement Results:

Calibration Point	Average Standard Reading at each position (°C)				
	CH-1	CH-2	CH-3	CH-4	CH-5
60	59.95	60.64	60.12	60.01	59.89
85	85.17	84.89	84.34	84.78	84.93
95	93.46	93.14	93.81	93.65	93.28

Setting (°C)	Temperature Distribution				
	Min	Max	Average	Stability (±°C)	Uniformity (±°C)
60.0	60.9	61	61.0	0.10	0.19
86.0	85.9	86.1	86.0	0.12	0.29
95.0	94.8	95.1	94.9	0.14	0.51

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

Approved By

FM-L15117/15-05-61

Certificate No. T222502

Page 1 of 4

Certificate of Calibration

Equipment : Chamber (Oven)
Manufacturer : Memmert
Model : UF 450
Serial No. : B7170531
Customer Code : BKK_EN0273
ID No. : T8042A4
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 : 23 November 2022
Calibrated By : Sujjar Naknakred (Site Calibration Manager)
Approved By : Boonchai Suriyawong (Site Calibration Manager)
Date of Issue : 09 DEC 2022

REVIEW BY : Sukh P.
APPROVED BY : KJ AL
NEXT CAL. DATE : 29/05/24

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-L15117/15-05-61

Certificate No. T222502

Page 2 of 4

Calibration Report

Equipment : Chamber (Oven)
Date of Calibration : 29 November 2022
Environment : Temperature : 29.1-29.6 °C
Line Voltage : 221.3-223.2 V
Relative Humidity : 55 - 65 %RH

Condition of this results of calibration :

- This equipment was calibrated by insert nine resistance thermometer detectors and nine standard thermocouples type T 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 .
- Reference Standard Instrument :
Instrument Model Instrument No. Certificate No. Due Date
RTD 100 ohm 27-(CH1-10) T210004 30 December 2022
TC TYPE T TN261-TN270 T210010 30 December 2022
DATA LOGGER 34970A T149 T210004 30 December 2022
- This certificate is traceable to :
National Institute of Metrology (Thailand) through Metrological Center (NSC-TISI-TIS 17025 CALIBRATION 0244)
- Condition of calibrated item : good
Equipment Description :
Time Constant 1 Hour 49 Minute At 104 °C
Fresh Air Damper ☒ Open ☐ Min ☐ Medium ☒ Max
☐ Close
☐ Not Available
- Adjustment :
() without adjustment (X) after adjustment

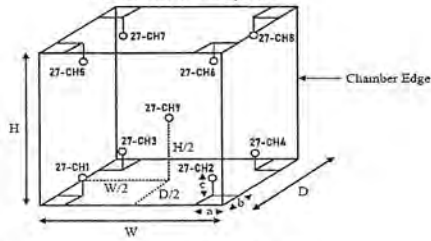
Approved By

FM-L15117/15-05-61

Certificate No. T222502

Page 3 of 4

Calibration Report



Remark :

Internal Dimensions of Chamber: W (Width) = 104 cm, H (Height) = 72 cm, and D (Depth) = 60 cm.
Size of Installed Standard sensor number 27-CH1 to number 27-CH8: $a = 5$ cm, $b = 5$ cm, and $c = 5$ cm.
Size of Installed Standard sensor number 27-CH9: W/2 = 104 cm/2, H/2 = 72 cm/2, and D/2 = 60 cm/2

Measurement Results

Calibration Point	Average Standard Reading at each position (°C)							
	27-CH1	27-CH2	27-CH3	27-CH4	27-CH5	27-CH6	27-CH7	27-CH8
104	104.07	103.40	103.45	104.02	104.47	103.37	104.59	103.78

Chamber (Oven)		Temperature Distribution					
Setting (°C)	Reading (°C)		Average (°C)	Stability (±°C)	Uniformity (°C)	Uncertainty (±°C)	Coverage Factor k
	Min, Max	Average					
104.0	-	104.0	103.97	0.07	0.70	0.42	2.00

* The quoted uncertainty exclude "uniformity"

The calibration result apply only the above calibrated item.

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

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

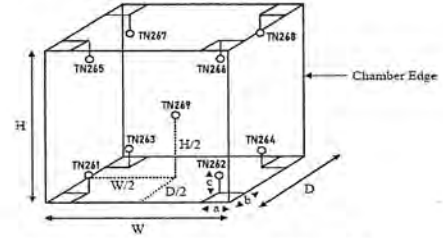
Approved By:

FM-L15 117/15-05-03

Certificate No. T222502

Page 4 of 4

Calibration Report



Remark :

Internal Dimensions of Chamber: W (Width) = 104 cm, H (Height) = 72 cm, and D (Depth) = 60 cm.
Size of Installed Standard sensor number TN261 to number TN268: $a = 5$ cm, $b = 5$ cm, and $c = 5$ cm.
Size of Installed Standard sensor number TN269: W/2 = 104 cm/2, H/2 = 72 cm/2, and D/2 = 60 cm/2

Measurement Results

Calibration Point	Average Standard Reading at each position (°C)							
	TN261	TN262	TN263	TN264	TN265	TN266	TN267	TN268
180	179.14	179.17	179.65	179.26	180.41	179.64	181.15	180.99

Chamber (Oven)		Temperature Distribution					
Setting (°C)	Reading (°C)		Average (°C)	Stability (±°C)	Uniformity (°C)	Uncertainty (±°C)	Coverage Factor k
	Min, Max	Average					
180.0	-	180.0	179.58	0.38	1.78	1.10	2.00

* The quoted uncertainty exclude "uniformity"

The calibration result apply only the above calibrated item.

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

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

Approved By:

FM-L15 117/15-05-03



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
CORPORATE SERVICES, EQUIPMENT CALIBRATION AND TESTING SERVICES
33/2 PATTANAKARN ROAD, SUKHUMVIT 11, BANGKOK 10110, THAILAND
(TEL: 02-257-9000-29) FAX: 02-257-9104



Cert.No.: 23CH132
Page.: 1 of 2

Certificate of Calibration

Equipment : pH Meter
Manufacturer : Mettler Toledo
Model : SevenGo S2
Serial No. : B729397038
ID No. : BKKJG0013
Condition As-Received : Used Item
Received Date : 31 January 2023
Calibration Date : 01 February 2023
Reference : 2301-10290SC-2
Submitted by : ALS Laboratory Group (Thailand) Co., Ltd.
104 Phatthanakan 40, Phatthanakan Rd.,
Khwaeng Phatthanakan, Khet Suan Luang,
Bangkok 10250 Thailand
Ambient Temperature : (25 ± 2.5) °C
Relative Humidity : (50 ± 15) %
Calibration Procedure : In-house method :
- CP-GH5 by direct measurement with standard
voltage calibrator and direct measurement
with certified reference material (CRM)

Calibrated by : Warakorn Lemmagrakul

Approved by :

(/) Males Butruva
(/) Saitup Meangmai
(/) Warakorn Lemmagrakul

Issue Date : 3 February 2023

The Uncertainties are for a confidence probability of approximately 95%

This certificate has been reproduced after this and the party's approval and written
approval of the Metrological Center. (Signature) (Name and Title)

A 0050486



Condition of this calibration result

1. Reference Standard Instrument:

Instrument	Serial No.	ID No.	Cert. No.	Due Date
1) Document Process Calibrator	54030049	130RC116	22E2769	24 Aug 2023

This certification is traceable to the International System of Unit maintained at:-
- Traceable to National Institute of Metrology (Thailand), NIMT2. 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	B26588	09 July 2024
pH 6.987	CPA chem	B26589	09 July 2023
pH 10.008	CPA chem	B26590	09 July 2023

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

Calibration Results

Function : mV Measurement

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

Unit Under Calibration	Nominal Value	Standard Voltage Input		Actual Reading		Uncertainty of Measurement (±mV)	Coverage factor k
		pH	mV	mV	pH		
pH Meter	4.00	177.48	177	4.00	0.58	2.00	
S/N: B729397038	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	4.008	4.02	178	0.0073	2.00
S/N: 0020805	6.987	6.98	8	0.011	2.00
	10.005	10.00	-169	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-

B 1146570



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES
554/4 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG BANGKOK 10250
TEL. +66 (0) 2719 9999-27 FAX. +66 (0) 2719 9494



Cert. No.: 23LM17
Page.: 1 of 2

Certificate of Calibration

Equipment : pH Meter With Sensor
Manufacturer : Mettler Toledo
Model : Seven2 Go S2
Serial No. : B729397038
ID No. : BKK_LG0013
Submitted by : ALS Laboratory Group (Thailand) Co., Ltd.
104 Phatthanakan 40, Phatthanakan Rd.,
Khwaeng Phatthanakan, Khet Suan Luang,
Bangkok 10250 Thailand
Location : TPA On Site Calibration Laboratory
Received Order : 31 January 2023
Calibrated Date : 2 February 2023
Ambient Temperature : (26 ± 10) °C
Relative Humidity : (50 ± 30) %
AC Line Voltage : (220 ± 22) V
Calibrated by : Man Pattanapongpaiboon
Approved by :
() Pornthippa Tameyakul
() Maiee Buikrua
() Suwit Imjai
Issue Date : 3 February 2023

The Uncertainties are for a confidence probability of approximately 95%

This certificate may only be reproduced other than in full, except with the prior written
approval of Thailand Calibration Services Co., Ltd. (TCS) Calibration and Testing Services.

A 0049463



Equipment : pH Meter With Sensor
Condition As-Received : Used Item
Reference : 2301-1029DSC-1
Procedure Used :-

Cert. No.: 23LM17
Page.: 2 of 2

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

The temperature scale used was based on ITS-90.

Condition of this result of calibration

1. Reference standard instrument:-

Instrument	Model	Serial No.	Cert. No.	Due Date
1) Digital Thermometer	1502A	A52847	2211325	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.

Result of Calibration :- (*) Without Adjustment

Function : Temperature measurement.

This instrument was connected with thermistor sensor, S/N: 0020808

Calibration Point (°C)	Immersion Depth (mm)	Standard Temperature (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (± °C)	Coverage Factor k
20.0	100	20.000	20.1	0.100	0.16	2.00
25.0	100	25.002	25.1	0.098	0.16	2.00
30.0	100	30.001	30.1	0.099	0.16	2.00
35.0	100	35.001	35.1	0.099	0.16	2.00
40.0	100	40.002	40.1	0.098	0.16	2.00
45.0	100	45.001	45.2	0.199	0.16	2.00
50.0	100	50.001	50.2	0.199	0.16	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 %.

-00-

1090991

BKK_EL0026

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Agilent CrossLab Compliance Services



Agilent CrossLab Compliance

Qualification Type: ICPMS-QQ
System ID: JP12091612
EQR Name: Agilent Recommended
EQR Revision: ICPMS.02.50
EQR Publish Date: March 2020
Date: June 14, 2022 10:32:16 AM
Report Type: Report
Org. Name: ALS Laboratory Group (Thailand) Co., Ltd.
Org. Location: 104 Phatthanakarn 40, Suan Luang, Bangkok 10250 Thailand

REVIEW BY:
APPROVED BY:
NEXT CAL. DATE: 19.1.23

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Agilent CrossLab Compliance Services

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System ID: JP12091612

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Date: June 14, 2022 10:32:16 AM
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Test Summary

Purpose

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

Details

Test	Status	Runs
AirSampler Check : ASX-520	Pass	1
Integrated Sample Introduction System (ISIS) Check : ISIS2	Pass	1
Autotune : G3281A	Pass	1
Background (No Gas Mode) : G3281A	Pass	1
Background (Gas Mode) : G3281A	Pass	1
20-Minute Stability (No Gas Mode) : G3281A	Pass	1

Overall Qualification Status

Pass

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System ID: JP12091612

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Service Details

Purpose

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

General Details

Service Order No./Request: 6005216484
EOP Name: Agilent Recommended
EOP Revision: ICPMS.02.50
Report Type: Report

Organization Details

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

Local Contact Details

Name: Khan Chelcharit
Job Title: Lab Manager
Qualification Location: Spectro Room

Operator Details

Name: Panthep Kuratathain
Job Title: Field Service Engineer

Data Acquisition Details

Acquisition Software Name: MassHunter
Acquisition Software Revision: D.01.01

Customer Data System (CDS): jcpM6 MassHunter

Date: June 14, 2022 10:32:16 AM
System ID: JP12091612

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Instrument Details

Purpose

This section describes the as found system configuration.

Details

ICP-MS 1

Manufacturer: Agilent Technologies
Name: 7700x
Model Number: G3281A
Detector Type: SQ
Nebulizer: Mist Mist (G3161)
Spray Chamber: Quartz
Torch: Quartz
Sampling Cone: Ni
Skimmer Cone: Ni
Serial Number: JP12091612
Firmware Revision: D.01.01

ISIS 1

Manufacturer: Agilent Technologies
Name: ISIS2
Model Number: G4911A
Installed Options: 4000: 2 pumps, 1 Valve, auto dilution and discrete sampling
Type: Peristaltic pump system

Autosampler 1

Manufacturer: Agilent Technologies
Name: ASX-520
Model Number: G3286A
Serial Number: 031403A520

Chiller 1

Manufacturer: Agilent Technologies
Name: Chiller
Model Number: G3292A
Serial Number: 4N1220700

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Calculation Formulas

Purpose

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

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

Date: June 14, 2022 10:32:16 AM
System ID: JP12091612

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Protocol Details

Purpose

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

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

Date: June 14, 2022 10:32:16 AM
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Autosampler Check

Purpose

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

Setpoint

Results	Criteria	Observed Result	Expected Result	Status
After the self test, is probe in the home position?				
		Yes	Yes	Pass
As commanded, is the probe positioned at vial 2?				
		Yes	Yes	Pass

Setpoint Status: Pass Run: 1

Overall Autosampler Check Test Status

Pass

Date: June 14, 2022 10:32:16 AM
System ID: JP12091612

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Integrated Sample Introduction System (ISIS) Check

Purpose

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

Setpoint

Results	Criteria	Observed Result	Expected Result	Status
As commanded, does the pump rotate?				
		Yes	Yes	Pass
As commanded, do the valves load and inject?				
		Yes	Yes	Pass

Setpoint Status: Pass Run: 1

Overall Integrated Sample Introduction System (ISIS) Check Test Status

Pass

Date: June 14, 2022 10:32:16 AM
System ID: JP12091612

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Autotune

Purpose

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

Setpoint

Results

Peakwidth Mass 7	0.735	AMU
Agilent Recommended:	0.65	
	0.80	
Status:	Pass	
Peakwidth Mass 89	0.732	AMU
Agilent Recommended:	0.65	
	0.80	
Status:	Pass	
Peakwidth Mass 205	0.745	AMU
Agilent Recommended:	0.65	
	0.80	
Status:	Pass	
Mass Axis 7	7.00	AMU
Agilent Recommended:	6.9	
	7.1	
Status:	Pass	
Mass Axis 89	89.00	AMU
Agilent Recommended:	88.9	
	89.1	
Status:	Pass	
Mass Axis 205	205.00	AMU
Agilent Recommended:	204.9	
	205.1	
Status:	Pass	

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Mass 7 Sensitivity No Gas

Agilent Recommended:

Status:

81.18 Mcps/ppm

>= 25.5

Pass

Mass 89 Sensitivity No Gas

Agilent Recommended:

Status:

247.81 Mcps/ppm

>= 85

Pass

Mass 205 Sensitivity No Gas

Agilent Recommended:

Status:

184.87 Mcps/ppm

>= 51

Pass

Mass 59 Sensitivity He

Agilent Recommended:

Status:

84.06 Mcps/ppm

>= 20.4

Pass

Oxide Ratio 159/140

Agilent Recommended:

Status:

1.119 %

<= 1.38

Pass

Doubly Charged Species Ratio 70/140

Agilent Recommended:

Status:

1.140 %

<= 2.3

Pass

Setpoint Status: Pass

Runs: 1

Overall Autotune Test Status:

Pass

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System ID: JP12091612

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Background (No Gas Mode)

Purpose

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

Setpoint

Conditions

Masses:

7 AMU
89 AMU
205 AMU

Measurements and Results

Masses (AMU):

Measured Value:

Agilent Recommended:

Status:

7	89	205
4.900	7.100	15.400 cps
<= 10	<= 10	<= 30
Pass	Pass	Pass

Setpoint Status: Pass

Runs: 1

Overall Background (No Gas Mode) Test Status:

Pass

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Background (Gas Mode)

Purpose

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

Setpoint Gas Mode: Helium

Conditions

Mass:

78 AMU

Integration Time:

1.0 sec

Cycles:

20

Measurements and Results

Mass (AMU):

78

Measured Value:

21,100 cps

Agilent Recommended:

<= 460

Status:

Pass

Setpoint Status: Pass

Runs: 1

Overall Background (Gas Mode) Test Status:

Pass

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20-Minute Stability (No Gas Mode)

Purpose

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

Setpoint

Conditions

Mode:

Spectrum

Masses:

7, 8, 89, 140, 205

Integration Time:

9.99 sec

Peak Pattern:

3 points/peak

Replicates:

20

Sweeps/Replicates:

100

Measurements and Results

Masses (AMU):

Stability RSD:

Agilent Recommended:

Status:

7	89	205
0.2	0.6	0.6 %
<= 3.45	<= 3.45	<= 3.45
Pass	Pass	Pass

Setpoint Status: Pass

Runs: 1

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

Pass

Date: June 14, 2022 10:32:16 AM
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Declaration of Change Control

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

Date: June 14, 2022 10:32:16 AM
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Attachments

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


Location	Category	Document Name	Page
EQR	General	Certificate of System Qualification	17
EQR	General	Operator's training certificate and qualifications	18
EQR	General	Certificate of Qualification for ACE	19
EQR	General	Certificate of Qualification for ACE	20
EQR	General	Tune reports	21
EQR	General	Test Report	24
EQR	General	Test Report	28

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General

Document Name: Certificate of System Qualification

 **Agilent Technologies**

Agilent Compliance Engine Self Qualification

Date: September 14, 2021 4:58:15 PM
Drive Serial #: ADA2309 Platform Revision: ACE 2.11

Individual self-qualification reports for each specific technique installed are also available upon request. They include detailed details, and the general report from the overall summary and are structured by the actual performance challenges during the process. There is still a one-to-one relationship between algorithms and OQ program tests because some algorithms are used by several tests and across multiple similar hardware components of the qualified systems.

Technique Type	Tests Completed	Result
Atomic Absorption	7	Conforms
Capillary Electrophoresis	10	Conforms
Distillation	6	Conforms
Emission Spectroscopy	3	Conforms
Gas Chromatography - GC/MS	17	Conforms
Gas Chromatography	29	Conforms
Gravimetric Chromatography	1	Conforms
ICP-MS	4	Conforms
Infrared Spectroscopy	7	Conforms
Liquid Chromatography	17	Conforms
Liquid Chromatography - LC/MS	4	Conforms
Microparticles	18	Conforms
Sample Preparation - Gas Chromatography	3	Conforms
Sample Preparation - Liquid Chromatography	8	Conforms
Supercritical Fluid Chromatography	13	Conforms
Synthesis	3	Conforms
UV-Vis Spectrophotometry	13	Conforms

Overall Qualification Status:
Conforms.

Date: June 14, 2022 10:32:16 AM
System ID: JP12091612

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General

Document Name: Operator's training certificate and qualifications

 **Agilent Technologies**

Certificate of Completion

Location Name: Perthshire, Kinshasa

Title Of Course: AN-CE-ICPM452-017-IL1700x/7700x ICP-MS Intro - Oper HW SW & OQ/PV

Completion Date: November 30, 2021

Certified By Company: Learning at Agilent

All Services and Support training certificates have the following specific footer text:

A certificate for Service and Support training is only valid while employed by Agilent Technologies or while receiving an on-agilent authorized service provider's support, which the service employee has ongoing access to Agilent's Supply Chain, Service Plans, internal training updates, online training, access documentation, technical support, internal parts, and parts system. Completion of training alone, without being employed by Agilent Technologies, does not qualify an individual to independently service or maintain Agilent products.

Date: June 14, 2022 10:32:16 AM
System ID: JP12091612

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Document Name: Tune reports

Tune Report

PA	PA	PA	PA	PA	PA
PA	PA	PA	PA	PA	PA

1482

2/14/2022 9:03 AM

Date: JUN 14, 2022 10:32:16 AM
System ID: JP12091612

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General

Document Name: Test Report

Batch Summary Report

Batch folder:	Drugline_ServierPMOD_13-4-22UG_Helios
Analysis File:	BQ_13a_batch.bin
Tune File:	#1 file

	App	App Date-Time	Outs File	Sample Name	Type	Level	Studies
1		6/14/2012 10:03:16 AM	00000000	000000	Sample	1000	

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6/18/2022 10:09:08 AM

Date: June 14, 2022 10:32:16 AM
System ID: JP12091612

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Document Name: Test Report

Batch Summary Report

Sample Name		TS (mg)	
		CPS	CPS/TS
1	W101	21,100	18.8

Page 2 of 2

6/14/2022 10:05:04 AM

Date: June 14, 2022 10:32:16 AM
System ID: JP12061612

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General

Document Name: Test Report

Batch Summary Report

Batch Folder	D:\Agilent_Software\MSDCQ 13-6-12\,CQ 30 Min\Batch
Analysis File	CQ 30 Min\Batch.hbin
Time Stamp	#1 Tue Jan 13 2012

Ref	App. Date/Time	Date Filed	Service Name	Type	Level	Solution
	2014-08-20 10:00:00	2014-08-20	IT Service	Normal		100%

View Full Text

8/14/2022 9:55:58 AM

Date: June 14, 2022 10:32:16 AM
System ID: JP12091612

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Document Name: Test Report

Batch Summary Report

1. 1st Gen		2. 2nd Gen		3. 3rd Gen		4. 4th Gen	
Sample Name	CPS	CPS	CPS	CPS	CPS	CPS	CPS
11-20-24	1247.8925	0.75	241.3873	5.6	1620.11023	0.7	2412.14700

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2014/00018/2014

Date: June 14, 2022 10:32:16 AM
System ID: JP12091612

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Electronic Signature

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Details

Full Name of Signer:	Pantshp Kurnasthalin
Logged On User Name:	pantshp_kurnasthalin@agilent.com
Signature Creation Date:	June 14, 2022
Reason for Signature:	Executed protocol and published this original version of document

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Date: June 14, 2022 10:32:16 AM
System ID: JPT2091512

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Mail from: patrick_konrad@nrc.ca
 MessageID: 4756161313

System ID: P12051012
Print Date: June 14, 2022 10:32:20 AM

SLS DDPH T710 14Jun2022 Transaction Log

Date	Transaction State	Activity Performed	Type of Transaction	Detailed Information
June 16, 2022 10:14:43 AM Audit		SessionsCreated	Session	None
June 16, 2022 10:14:43 AM Start		Configuration	Session	None
June 16, 2022 10:14:43 AM Audit		Enrollment	Locking	User is FIDO2PIV user and does not require the unlock code
June 16, 2022 10:18:18 AM Audit		ExpireEvent	Session	EQP details for primary technique (EqPinA) - Flag path: [https://api.pinpoint.gov/Conf/watermark/SIDCWA/02.05.spt, EGP File Name: [eqpinA/02.05.spt], EQP Name: [https://docs.compressed]
June 16, 2022 10:19:26 AM End		Cancellation	Session	None
June 16, 2022 10:19:24 AM Start		Qualification	Session	OQ
June 16, 2022 10:19:24 AM Start		Execution	Autosampler Check : ASD-620 ; Autosampler Check :	None
June 16, 2022 10:19:42 AM End		Execution	Autosampler Check : ASD-620 ; Autosampler Check :	Run Count: 1
June 16, 2022 10:19:43 AM Start		Execution	Integrated Sample Introduction System (ISIS) Check : (SIS); Integrated Sample Introduction System (ISIS) Check :	None
June 16, 2022 10:19:47 AM End		Execution	Integrated Sample Introduction System (ISIS) Check : (SIS); Integrated Sample Introduction System (ISIS) Check :	Run Count: 1
June 16, 2022 10:19:50 AM Start		Execution	Auricle : Q0281X; Auricle 1 :	None
June 16, 2022 10:22:22 AM End		Execution	Auricle : Q0281X; Auricle 1 :	Run Count: 1

Page 2 / 2

Date: June 14, 2022 10:32:15 AM
System ID: JP12091812

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User Name: goethe@birkbeck.ac.uk
Host Name: ABBK09313

System ID: JP12031612
Print Date: June 14, 2022 10:12:20 AM

ALS QGFW 7769 14Jun2022 Transaction log :

Time	Transaction Date	Activity Performed	Type of Transaction	Cumulative Information
June 14, 2022 10:22:34 AM	Start	Execution	Background (Ho Gas Model) Q328(A): Ho Gas Model Background 1	None
June 14, 2022 10:22:48 AM	End	Execution	Background (Ho Gas Model) Q328(A): Ho Gas Model Background 1	Run Count: 1
June 14, 2022 10:22:49 AM	Start	Execution	Endground (Gas Mixture) Q328(A): Gas Model Background (Initial)	None
June 14, 2022 10:23:35 AM	End	Execution	Background (Gas Model) Q328(A): Gas Model Background (Initial)	Run Count: 1
June 14, 2022 10:23:57 AM	Start	Execution	20-Minute Stability (Ho Gas Model) Q328(A): 20-Minute Stability (Ho Gas Model) 1	None
June 14, 2022 10:24:08 AM	End	Execution	20-Minute Stability (Ho Gas Model) Q328(A): 20-Minute Stability (Ho Gas Model) 1	Run Count: 1
June 14, 2022 10:24:08 AM	Start	Qualification	Session	CG
June 14, 2022 10:24:46 AM	Start	Reporting	Session	None
June 14, 2022 10:26:26 AM	End	Reporting	Session	Report Generated: Certificate
June 14, 2022 10:26:30 AM	Start	Reporting	Session	Report Generated: Report

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Date: June 14, 2022 10:32:10 AM
System ID: JP12091612

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Certificate of System Qualification

ICPMS-QQ

System ID: JP12091612
Organization Name: ALS Laboratory Group (Thailand) Co., Ltd.
Organization Location: 104 Phatthanakarn 40, Suan Luang, Bangkok 10250 Thailand.

Date: June 14, 2022 10:32:51 AM
EQP Name: AgilentRecommended
EQP Revision: ICPMS.02.50
Overall Qualification Status: Pass

Autosampler Check

Overall Autosampler Check Test Status

Pass

Integrated Sample Introduction System (ISIS) Check

Overall Integrated Sample Introduction System (ISIS) Check Test Status

Pass

Autotune

Peakwidth Mass 7	Pass
Peakwidth Mass 89	Pass
Peakwidth Mass 205	Pass
Mass Axis 7	Pass
Mass Axis 89	Pass
Mass Axis 205	Pass
Mass 7 Sensitivity No Gas	Pass
Mass 89 Sensitivity No Gas	Pass
Mass 205 Sensitivity No Gas	Pass
Mass 59 Sensitivity He	Pass
Oxide Ratio 156/140	Pass
Doubly Charged Species Ratio 70/140	Pass

Overall Autotune Test Status

Pass

Date: June 14, 2022 10:32:51 AM
System ID: JP12091612

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Background (No Gas Mode)

Setpoint Status: Pass

Masses (AMU):	7	89	205
Measured Value:	4,300	7,100	18,400 cps
Agilent Recommended:	10	10	30
Status:	Pass	Pass	Pass

Overall Background (No Gas Mode) Test Status

Pass

Background (Gas Mode)

Gas Mode: Helium

Setpoint Status: Pass

Mass (AMU):	78
Measured Value:	21,000 cps
Agilent Recommended:	460
Status:	Pass

Overall Background (Gas Mode) Test Status

Pass

20-Minute Stability (No Gas Mode)

Masses (AMU):	7	89	205
Stability RSD:	0.2	0.6	0.6 %
Agilent Recommended:	3.45	3.45	3.45
Status:	Pass	Pass	Pass

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

Pass

Date: June 14, 2022 10:32:51 AM
System ID: JP12091612

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Instrument Details

Purpose

This section describes the as found system configuration.

Details

ICP-MS 1

Manufacturer	Agilent Technologies
Name	7700x
Model Number	G3281A
Detector Type	SQ
Nebulizer	Mist Mist (G3101)
Spray Chamber	Quartz
Torch	Quartz
Sampling Cone	Ni
Skimmer Cone	Ni
Serial Number	JP12091612
Firmware Revision	D.01.01

ISIS 1

Manufacturer	Agilent Technologies
Name	ISIS2
Model Number	G4811A
Installed Options	ICD3: 2 pumps, 1 valve, auto dilution and discrete sampling
Type	Peristaltic pump system

Autosampler 1

Manufacturer	Agilent Technologies
Name	ASX-320
Model Number	G3286A
Serial Number	031403A520

Chiller 1

Manufacturer	Agilent Technologies
Name	Chiller
Model Number	G3282A
Serial Number	4N1220720

Date: June 14, 2022 10:32:51 AM
System ID: JP12091612

Page 3 / 7

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Details

Full Name of Signer:	Panthep Kurassathin
Logged On User Name:	panthep_kurassathin@agilent.com
Signature Creation Date:	June 14, 2022
Reason for Signature:	Executed protocol and published this original version of document.

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Date: June 14, 2022 10:32:51 AM
System ID: JP12091612

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User Name: panthap_santaporn
Host Name: ASBKKW313
System ID: JP12091612
Print Date: June 14, 2022 10:32:51 AM

ALS QCMW 7700 14Jun2022 Transaction Log:

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
June 14, 2022 10:14:43 AM	Alert	Session Closed	Session	None
June 14, 2022 10:14:43 AM	Start	Configuration	Session	None
June 14, 2022 10:14:43 AM	Alert	Entitlement	Licensing	User is Field Engineer and does not require an unlock code
June 14, 2022 10:18:18 AM	Alert	Expired	Session	EQP needs for primary technique (top44) File path: F:\ProgramData\Agilent\Compliance\2022\top44\20220614\eqp\EQP File Name: (top44) (20220614).EQP Name: (AgilentRecommended)
June 14, 2022 10:19:20 AM	End	Configuration	Session	None
June 14, 2022 10:19:24 AM	Start	Qualification	Session	OQ
June 14, 2022 10:19:24 AM	Start	Execution	Autosampler Check: ASD-420	None
June 14, 2022 10:19:42 AM	End	Execution	Autosampler Check: ASD-420	Run Count: 1
June 14, 2022 10:19:43 AM	Start	Execution	Integrated Sample Introduction System (SIS) Check: (SIS)	None
June 14, 2022 10:19:43 AM	Start	Execution	Integrated Sample Introduction System (SIS) Check: (SIS)	None
June 14, 2022 10:19:47 AM	End	Execution	Integrated Sample Introduction System (SIS) Check: (SIS)	Run Count: 1
June 14, 2022 10:19:49 AM	Start	Execution	Autosampler Check: ASD-420	None
June 14, 2022 10:22:22 AM	End	Execution	Autosampler Check: ASD-420	Run Count: 1

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Date: June 14, 2022 10:32:51 AM
System ID: JP12091612

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User Name: panthap_santaporn
Host Name: ASBKKW313
System ID: JP12091612
Print Date: June 14, 2022 10:32:51 AM

ALS QCMW 7700 14Jun2022 Transaction Log:

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
June 14, 2022 10:22:24 AM	Start	Execution	Background (No Gas Mode): G2211A: No Gas Mode Background 1	None
June 14, 2022 10:22:48 AM	End	Execution	Background (No Gas Mode): G2211A: No Gas Mode Background 1	Run Count: 1
June 14, 2022 10:22:49 AM	Start	Execution	Background (Gas Mode): G2211A: Gas Mode Background 1	None
June 14, 2022 10:22:50 AM	End	Execution	Background (Gas Mode): G2211A: Gas Mode Background 1	Run Count: 1
June 14, 2022 10:23:37 AM	Start	Execution	20-Minute Stability (No Gas Mode): G2211A: 20-Minute Stability (No Gas Mode) 1	None
June 14, 2022 10:24:08 AM	End	Execution	20-Minute Stability (No Gas Mode): G2211A: 20-Minute Stability (No Gas Mode) 1	Run Count: 1
June 14, 2022 10:24:09 AM	End	Qualification	Session	OQ
June 14, 2022 10:24:58 AM	Start	Reporting	Session	None
June 14, 2022 10:30:26 AM	Alert	Reporting	Session	Report Generated: Certificate
June 14, 2022 10:30:39 AM	Alert	Reporting	Session	Report Generated: Report

Page 2/3

Date: June 14, 2022 10:32:51 AM
System ID: JP12091612

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User Name: panthap_santaporn
Host Name: ASBKKW313
System ID: JP12091612
Print Date: June 14, 2022 10:32:51 AM

ALS QCMW 7700 14Jun2022 Transaction Log:

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
June 14, 2022 10:32:26 AM	Alert	Reporting	Session	Report Signed / Report PDF Name: ALS QCMW 7700 14Jun2022_20220614_OQ_Report_1.pdf User Name: panthap_santaporn@agilent.com Full Name of Signer: Panthap Santaporn Reason for signature: Executed protocol and published this signed version of document

Page 3/3

Date: June 14, 2022 10:32:51 AM
System ID: JP12091612

Page 7/7



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Telephone : +66 2 586 5792-4 Fax : +66 2 586 5109

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

Certificate No. T226730

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. : TS306A3

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

104 Phatthanakan 40, Phatthanakan Rd., Khwaeng Phatthannakan,

Khet Suan Luang, Bangkok 10250

Customer Location : Acid Digestion Lab

Date of Receipt : 30 March 2022

Calibrated By : Watcharapon Sangtong (Technician)

Approved By : / Sujar Naknakred (Site Calibration Manager)

Date of Issue : 17 APR 2022

REVIEW BY	
APPROVED BY	
NEXT CAL DATE	7/10/23

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

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

Certificate No. T220730

Page 2 of 6

Calibration Report

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

Condition of this results of calibration :

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

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

1. Reference Standard Instrument :

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

3. This certificate is traceable to :

National Institute of Metrology (Thailand) through Metrological Center (NSC-TIS-TIS 17025 CALIBRATION (244))

4. Condition of calibrated item : good

Equipment Description :

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

5. Adjustment :

☐ without adjustment ☒ after adjustment

Approved By: _____

FM-1.13 106/30-05-57



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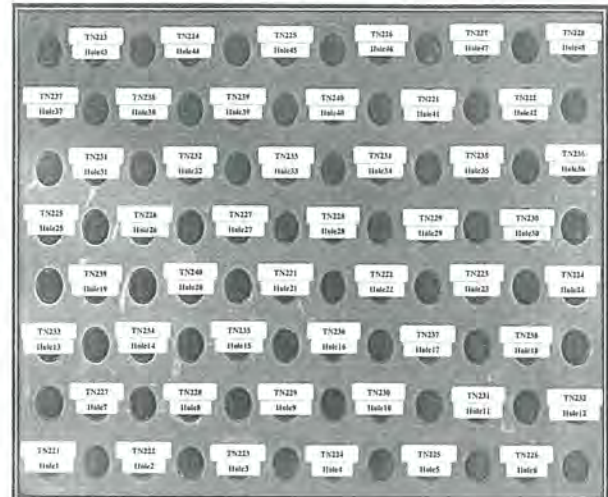
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Certificate No. T220730

Page 3 of 6

Calibration Report



FRONT CONTROL

Approved By: _____

FM-1.13 106/30-05-57



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

Certificate No. T220730

Page 4 of 6

Calibration Report

Measurement Results

Calibration Point	Average Standard Reading at each position (°C)
R1 Hole1-Hole6	TN221 TN222 TN223 TN224 TN225 TN226
CAL POINT: Max	93.60 93.82 94.05 94.20 94.36 94.26
Min	93.07 93.26 93.51 93.66 93.82 93.71
Average	93.33 93.54 93.78 93.93 94.09 93.98
R2 Hole7-Hole12	TN227 TN228 TN229 TN230 TN231 TN232
Max	94.59 94.79 94.83 94.55 94.82 95.00
Min	94.05 94.25 94.08 93.97 94.26 94.44
Average	94.32 94.52 94.36 94.26 94.54 94.72
R3 Hole13-Hole18	TN233 TN234 TN235 TN236 TN237 TN238
Max	95.03 94.24 94.76 94.64 95.06 94.73
Min	94.46 93.98 94.20 94.28 94.49 94.18
Average	94.74 94.26 94.49 94.56 94.78 94.45
R4 Hole19-Hole24	TN239 TN240 TN241 TN242 TN243 TN244
Max	94.89 94.82 95.73 95.85 95.73 96.10
Min	94.33 94.26 95.51 95.62 95.51 95.85
Average	94.61 94.54 95.62 95.73 95.62 95.97
R5 Hole25-Hole30	TN225 TN226 TN227 TN228 TN229 TN230
Max	96.28 96.39 96.27 96.54 96.19 96.04
Min	96.01 96.10 96.02 96.20 95.89 95.71
Average	96.15 96.24 96.20 96.37 96.04 95.88
R6 Hole31-Hole36	TN231 TN232 TN233 TN234 TN235 TN236
Max	96.84 96.97 97.03 96.48 96.33 95.76
Min	96.53 96.65 96.71 96.08 95.98 95.43
Average	96.68 96.81 96.87 96.28 96.16 95.60
R7 Hole37-Hole42	TN237 TN238 TN239 TN240 TN241 TN242
Max	96.46 96.13 96.19 96.06 96.95 97.09
Min	96.13 95.84 95.85 95.72 96.64 96.78
Average	96.30 95.99 96.02 95.89 96.80 96.93
R8 Hole43-Hole48	TN223 TN224 TN225 TN226 TN227 TN228
Max	96.91 96.58 96.13 96.19 96.34 96.19
Min	96.55 96.21 95.80 95.87 96.07 95.88
Average	96.73 96.40 95.96 96.03 96.18 96.03

Approved By: _____

FM-1.13 106/30-05-57



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

Certificate No. T220730

Page 5 of 6

Calibration Report

Measurement Results

Calibration Point	Average Standard Reading at each position (°C)
R1 Hole1-Hole6	TN221 TN222 TN223 TN224 TN225 TN226
CAL POINT: Max	104.47 104.65 104.79 105.31 105.47 105.46
Min	104.15 104.27 104.45 104.98 105.14 105.29
Average	104.31 104.46 104.62 105.15 105.31 105.33
R2 Hole7-Hole12	TN227 TN228 TN229 TN230 TN231 TN232
Max	105.55 105.73 105.85 105.84 105.97 106.07
Min	105.28 105.43 105.55 105.52 105.68 105.83
Average	105.42 105.58 105.50 105.68 105.82 105.95
R3 Hole13-Hole18	TN233 TN234 TN235 TN236 TN237 TN238
Max	106.14 106.06 105.81 106.05 105.81 105.47
Min	105.85 105.81 105.55 105.80 105.53 105.64
Average	106.00 105.94 105.68 105.92 105.67 105.75
R4 Hole19-Hole24	TN239 TN240 TN241 TN242 TN243 TN244
Max	105.86 105.60 104.44 104.31 104.29 104.78
Min	105.61 105.37 104.27 104.35 104.12 104.61
Average	105.74 105.48 104.35 104.43 104.20 104.69
R5 Hole25-Hole30	TN225 TN226 TN227 TN228 TN229 TN230
Max	104.94 104.93 104.97 105.08 104.68 104.65
Min	104.77 104.75 104.76 104.90 104.51 104.49
Average	104.85 104.84 104.86 104.99 104.60 104.59
R6 Hole31-Hole36	TN231 TN232 TN233 TN234 TN235 TN236
Max	105.44 105.45 105.61 104.95 104.84 104.42
Min	105.27 105.27 105.44 104.76 104.66 104.25
Average	105.36 105.36 105.53 104.86 104.75 104.33
R7 Hole37-Hole42	TN237 TN238 TN239 TN240 TN241 TN242
Max	105.17 104.70 104.54 104.51 105.22 105.53
Min	105.00 104.53 104.41 104.35 105.04 105.37
Average	105.08 104.62 104.50 104.43 105.13 105.45
R8 Hole43-Hole48	TN223 TN224 TN225 TN226 TN227 TN228
Max	105.61 105.45 105.03 104.77 104.87 105.03
Min	105.44 105.28 104.92 104.60 104.70 104.85
Average	105.53 105.37 105.01 104.69 104.78 104.93

Approved By: _____

FM-1.13 106/30-05-57



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

Certificate No. T221644

Page 5 of 6

Calibration Report

Measurement Results:

HEATING BLOCK			Temperature Distribution	
Setting (°C)	Reading (°C)		Stability (±°C)	Uncertainty (±°C)
	Min, Max	Average		
100.0	100.0, 100.4	100.1	0.20	0.83
105.0	105.0, 105.4	105.1	0.20	0.70

* The given uncertainty exclude 1° uniformity

The extension term apply only the above calibrated item.

The result of test was found accurate as shown in data and place of test only

The reported expanded uncertainty is based on a standard uncertainty multiplied by a coverage factor k which is a value of approximately 95 %

Approved By: _____

FM-L15 117-05-03-57



Metrological Center

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Saraburi Tel : +66 3627 3096 Fax : +66 3627 3100
Bangkok Tel : +668 9205 6851 , +668 8247 2360
Website : www.scieco.co.th E-Mail : calibrate@scg.co.th



Certificate No. T221644

Page 1 of 4

Certificate of Calibration

Equipment : Chamber (Cold Room)

Manufacturer : KOLDTECH

Model : KM 320

Serial No. : TBN-1012061/05

Customer Code : BKK_EN0167

ID No. : T2463A3

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

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

Customer Location : Environmental Laboratory

Date of Receipt : 27 June 2022

Calibrated By : Sujjar Nakkakred (Site Calibration Manager)

Approved By : _____ / Boonchai Suriyawong (Site Calibration Manager)

Date of Issue : 24 JUL 2022

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FM-L14 11701-02-64



Metrological Center

SCI ECO Services Company Limited

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



Certificate No. T221644

Page 2 of 4

Calibration Report

Equipment : Chamber (Cold Room)

Date of Calibration : 30 June - 1 July 2022

Environment : Temperature : 18.9-23.7 °C

Line Voltage : 222.9-226.5 V

Relative Humidity : 55 - 65 %RH

Condition of this results of calibration :

1. This equipment was calibrated by insert nine standard thermocouples type T into its chamber , the other one standard thermocouples type T use for ambient temperature measurement . The calibration was done in according to WI-T20 (based on ASTM E145-94 (Reapproved 2001) and AS2853-1986) .

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

2. Reference Standard Instrument :

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

3. This certificate is traceable to :

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

4. Condition of calibrated item : good

Equipment Description :

Time Constant : 3 Hour 2 Minute At 3 °C
Fresh Air Damper : ☐ Open ☐ Min ☐ Medium ☐ Max
☐ Close
☒ Not Available

5. Adjustment :

() without adjustment (X) after adjustment

Approved By: _____

FM-L15 117-05-03-63



Metrological Center

SCI ECO Services Company Limited

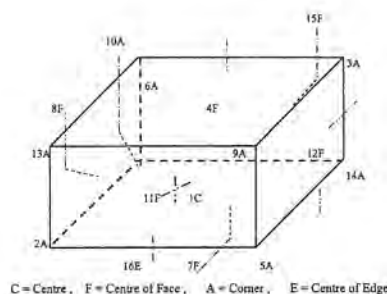
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Certificate No. T221644

Page 3 of 4

Calibration Report



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

1C = TN161	11F = TN171
2A = TN162	12F = TN172
3A = TN163	13A = TN173
4F = TN164	14A = TN174
5A = TN165	15F = TN175
6A = TN166	16E = TN176
7F = TN167	
8F = TN168	
9A = TN169	
10A = TN170	

Approved By: _____

FM-L15 117-05-03-63



Calibration Report

Measurement Results:

Calibration Point	Average Standard Reading at each position (°C)									
	TN161	TN162	TN163	TN164	TN165	TN166	TN167	TN168	TN169	TN170
3	2.71	2.82	2.75	2.89	2.95	3.68	3.02	2.96	3.03	2.85
	TN171	TN172	TN173	TN174	TN175	TN176				
	2.57	3.02	2.89	3.04	2.97	3.33				

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

* The quoted uncertainty exclude " uniformity "

The calibration result apply only the above calibrated item.

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

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

Approved By _____

FM-L15 117/15-05-63

ภาคผนวก ฉ

สำเนาหนังสืออนุญาตขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์เอกชน

๓๒) นายสนบูรณ์ บุกรักษ์
๓๓) นายวิรัตน์ โชนะระ
๓๔) นายอนุพงษ์ เทียน
๓๕) นายจิรณัฐ ขาวระ
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เอกสารแนบท้ายหนังสือรับข้อจากข้อขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์เอกสาร
บริษัท เอเอสเอส แอนด์อาร์ท จำกัด เลขทะเบียน ๖-๒๐๔
ที่ ๑๐๑๑(๑) ๑๐๖๕ ลงวันที่ ๒๕ มกราคม ๒๕๖๕
ขอข่ายสารมลพิษที่ได้รับขึ้นทะเบียนจากกรมโรงงานอุตสาหกรรม จำนวน ๒๒๖ รายการ

ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
1	Aldicarb	High-Performance Liquid Chromatographic Method ^(๑)
2	Aldicarb Sulfone	High-Performance Liquid Chromatographic Method ^(๑)
3	Aldicarb Sulfoxide	High-Performance Liquid Chromatographic Method ^(๑)
4	Aldrin	Liquid-Liquid Extraction, Gas Chromatographic Method ^(๑)
5	Arsenic	1) Digestion, Inductively Coupled Plasma Method ^(๑) 2) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method ^(๑)
6	Barium	1) Digestion, Inductively Coupled Plasma Method ^(๑) 2) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method ^(๑)
7	α-BHC	Liquid-Liquid Extraction, Gas Chromatographic Method ^(๑)
8	β-BHC	Liquid-Liquid Extraction, Gas Chromatographic Method ^(๑)
9	γ-BHC	Liquid-Liquid Extraction, Gas Chromatographic Method ^(๑)
10	Biochemical Oxygen	1) 5-Day BOD Test, Azide Modification Method ^(๑) 2) 5-Day BOD Test, Membrane Electrode Method ^(๑)
11	Demand	High-Performance Liquid Chromatographic Method ^(๑)
12	Carbaryl	High-Performance Liquid Chromatographic Method ^(๑)
13	Carbofuran	High-Performance Liquid Chromatographic Method ^(๑)
14	Cadmium	1) Digestion, Inductively Coupled Plasma Method ^(๑) 2) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method ^(๑)
15	Chemical Oxygen	1) Closed Reflux, Colorimetric Method ^(๑) 2) Closed Reflux, Titrimetric Method ^(๑)
16	Chlordane	Liquid-Liquid Extraction, Gas Chromatographic Method ^(๑)
17	Chromium	1) Digestion, Inductively Coupled Plasma Method ^(๑) 2) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method ^(๑)
18	Color	ADMI Weighted-Ordinate Spectrophotometric Method

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ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
19	Copper	1) Digestion, Inductively Coupled Plasma Method ⁽⁴⁾ 2) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method ⁽⁴⁾
20	Cyanide	Distillation, Colorimetric Method ⁽⁴⁾
21	2,4'-DDD	Liquid-Liquid Extraction, Gas Chromatographic Method ⁽⁴⁾
22	4,4'-DDD	Liquid-Liquid Extraction, Gas Chromatographic Method ⁽⁴⁾
23	2,4'-DDE	Liquid-Liquid Extraction, Gas Chromatographic Method ⁽⁴⁾
24	4,4'-DDE	Liquid-Liquid Extraction, Gas Chromatographic Method ⁽⁴⁾
25	2,4'-DDT	Liquid-Liquid Extraction, Gas Chromatographic Method ⁽⁴⁾
26	4,4'-DDT	Liquid-Liquid Extraction, Gas Chromatographic Method ⁽⁴⁾
27	Dieldrin	Liquid-Liquid Extraction, Gas Chromatographic Method ⁽⁴⁾
28	Endosulfan Sulfate	Liquid-Liquid Extraction, Gas Chromatographic Method ⁽⁴⁾
29	Endosulfan I	Liquid-Liquid Extraction, Gas Chromatographic Method ⁽⁴⁾
30	Endosulfan II	Liquid-Liquid Extraction, Gas Chromatographic Method ⁽⁴⁾
31	Endrin	Liquid-Liquid Extraction, Gas Chromatographic Method ⁽⁴⁾
32	Endrin Aldehyde	Liquid-Liquid Extraction, Gas Chromatographic Method ⁽⁴⁾
33	Formaldehyde	Distillation, Colorimetric Method ⁽⁴⁾
34	Free Chlorine	1) DPD Ferrous Titrimetric Method ⁽⁴⁾ 2) Iodometric Method ⁽⁴⁾
35	Heptachlor	Liquid-Liquid Extraction, Gas Chromatographic Method ⁽⁴⁾
36	Heptachlor epoxide	Liquid-Liquid Extraction, Gas Chromatographic Method ⁽⁴⁾
37	Hexavalent Chromium	Filtration, Colorimetric Method ⁽⁴⁾
38	3-Hydroxycarbofuran	High-Performance Liquid Chromatographic Method ⁽⁴⁾
39	Lead	1) Digestion, Inductively Coupled Plasma Method ⁽⁴⁾ 2) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method ⁽⁴⁾
40	Manganese	1) Digestion, Inductively Coupled Plasma Method ⁽⁵⁾ 2) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method ⁽⁴⁾
41	Mercury	1) Digestion, Cold-Vapor Atomic Absorption Spectrometric Method ⁽⁴⁾ 2) Digestion, Inductively Coupled Plasma/Mass spectrometric Method ⁽⁴⁾
42	Methiocarb	High-Performance Liquid Chromatographic Method ⁽⁴⁾
43	Methoxychlor	Liquid-Liquid Extraction, Gas Chromatographic Method ⁽⁴⁾

อิมพล
(นางสาวอุษณีย์ อัครกุลสุโข)

44 Methomyl...

ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
44	Methomyl	High-Performance Liquid Chromatographic Method ⁽⁴⁾
45	Nickel	1) Digestion, Inductively Coupled Plasma Method ⁽⁴⁾ 2) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method ⁽⁴⁾
46	Oil & Grease	1) Liquid-Liquid, Partition-Gravimetric Method ⁽⁴⁾ 2) Soxhlet Extraction Method ⁽⁴⁾
47	Oxamyl	High-Performance Liquid Chromatographic Method ⁽⁴⁾
48	Propoxur	High-Performance Liquid Chromatographic Method ⁽⁴⁾
49	pH	Electrometric Method ⁽⁴⁾
50	Phenols	1) Distillation, Chloroform Extraction Method ⁽⁴⁾ 2) Distillation, Direct Photometric Method ⁽⁴⁾
51	Selenium	1) Digestion, Inductively Coupled Plasma Method ⁽⁴⁾ 2) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method ⁽⁴⁾
52	Sulfide	Iodometric Method ⁽⁴⁾
53	Temperature	Laboratory and Field Methods ⁽⁴⁾
54	Total Dissolved Solids	Dried at 180 °C ⁽⁴⁾
55	Total Kjeldahl Nitrogen	Semi-Micro Kjeldahl Method ⁽⁴⁾
56	Total Suspended Solids	Dried at 103-105 °C ⁽⁴⁾
57	Toxaphene	Liquid-Liquid Extraction, Gas Chromatographic Method ⁽⁴⁾
58	Trivalent Chromium	1) Digestion, Inductively Coupled Plasma Method; Colorimetric Method; Calculation ⁽⁴⁾ 2) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method; Colorimetric Method; Calculation ⁽⁴⁾
59	Zinc	1) Digestion, Inductively Coupled Plasma Method ⁽⁴⁾ 2) Digestion, Inductively Coupled Plasma/Mass Spectrometric Method ⁽⁴⁾

น้ำดื่ม จำนวน 126 ขวด

ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
1	Acenaphthene	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
2	Acetone	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾

อิมพล
(นางสาวอุษณีย์ อัครกุลสุโข)

3 Aldrin...

ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
3	Aldrin	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
4	Anthracene	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
5	Antimony	1) Digestion, Inductively Coupled Plasma Method ⁽⁴⁾ 2) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method ⁽⁴⁾
6	Arsenic	1) Digestion, Inductively Coupled Plasma Method ⁽⁴⁾ 2) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method ⁽⁴⁾
7	Atrazine	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
8	Barium	1) Digestion, Inductively Coupled Plasma Method ⁽⁴⁾ 2) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method ⁽⁴⁾
9	Benz(a)anthracene	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
10	Benzene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
11	Benzofluoranthene	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
12	Benzokjfluoranthene	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
13	Benzoic Acid	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
14	Benzo(a)pyrene	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
15	Benzo(g,h,i)perylene	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
16	Beryllium	1) Digestion, Inductively Coupled Plasma Method ⁽⁴⁾ 2) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method ⁽⁴⁾
17	Bis(2-chloroethyl)ether	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾

อิมพล
(นางสาวอุษณีย์ อัครกุลสุโข)

18 Bis(2-ethylhexyl)phthalate...

ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
18	Bis(2-ethylhexyl)phthalate	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
19	Bromodichloromethane	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
20	Bromoform	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
21	Butanol	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
22	Butyl Benzyl Phthalate	Equilibrium Headspace, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
23	Cadmium	1) Digestion, Inductively Coupled Plasma Method ⁽⁴⁾ 2) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method ⁽⁴⁾
24	Carbazole	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
25	Carbon Disulfide	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
26	Carbon tetrachloride	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
27	Chlordane	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
28	p-Chloroaniline	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
29	Chlorobenzene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
30	Chlorodibromomethane	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
31	Chloroform	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
32	2-Chlorophenol	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
33	Chromium	1) Digestion, Inductively Coupled Plasma Method ⁽⁴⁾ 2) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method ⁽⁴⁾

อิมพล
(นางสาวอุษณีย์ อัครกุลสุโข)


34 Chromium (III)...

ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
34	Chromium (III)	1) Digestion, Inductively Coupled Plasma Method; Colorimetric Method; Calculation ⁽⁴⁾ 2) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method; Colorimetric Method; Calculation ⁽⁴⁾
35	Chromium (VI)	Colorimetric Method ⁽⁴⁾
36	Chrysene	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
37	Cyanide	Distillation, Colorimetric Method ⁽⁴⁾
38	2,4-D	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
39	DDD	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
40	DDE	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
41	DDT	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
42	Dibenz(a,h)anthracene	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
43	Di-n-Butyl Phthalate	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
44	1,2-Dichlorobenzene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
45	1,3-Dichlorobenzene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
46	1,4-Dichlorobenzene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
47	3,3-Dichlorobenzidine	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
48	1,1-Dichloroethane	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
49	1,2-Dichloroethane	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
50	1,1-Dichloroethylene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾


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
51 cis-1,2-Dichloroethylene...

ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
51	cis-1,2-Dichloroethylene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
52	trans-1,2-Dichloroethylene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
53	2,6-Dichlorophenol	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
54	1,2-Dichloropropane	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
55	1,3-Dichloropropane	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
56	1,3-Dichloropropene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
57	Dieldrin	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
58	Diethyl Phthalate	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
59	2,4-Dimethylphenol	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
60	2,4-Dinitrophenol	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
61	2,4-Dinitrotoluene	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
62	2,6-Dinitrotoluene	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
63	Di-n-Octyl Phthalate	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
64	Endosulfan	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
65	Endrin	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
66	Ethylbenzene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
67	Fluoranthene	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾


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
68 Fluorene...

ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
68	Fluorene	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
69	Heptachlor	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
70	Heptachlor epoxide	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
71	Hexachlorobenzene	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
72	Hexachloro-1,3-butadiene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
73	n-Hexane	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
74	α-HCH	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
75	β-HCH	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
76	γ-HCH	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
77	Hexachlorocyclopentadiene	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
78	Hexachloroethane	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
79	Indeno(1,2,3-cd)pyrene	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
80	Isophorone	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
81	Lead	1) Digestion, Inductively Coupled Plasma Method ⁽⁴⁾ 2) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method ⁽⁴⁾
82	Manganese	1) Digestion, Inductively Coupled Plasma Method ⁽⁴⁾ 2) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method ⁽⁴⁾
83	Mercury	1) Cold Vapor Atomic Absorption Spectrometric Method ⁽⁴⁾ 2) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method ⁽⁴⁾


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84 Methanol...

ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
84	Methanol	1) Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾ 2) Equilibrium Headspace, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
85	Methoxychlor	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
86	Methyl Bromide	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
87	Methylene Chloride	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
88	2-Methylphenol	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
89	2-Methylnaphthalene	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
90	Methyl tert-Butyl Ether	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
91	Naphthalene	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
92	Nickel	1) Digestion, Inductively Coupled Plasma Method ⁽⁴⁾ 2) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method ⁽⁴⁾
93	Nitrobenzene	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
94	N-Nitrosodiphenylamine	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
95	N-Nitrosodi-n-Propylamine	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
96	Polychlorinated Biphenyls - PCB 1016 - PCB 1221 - PCB 1232 - PCB 1242 - PCB 1248 - PCB 1254 - PCB 1260	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾


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 กรมควบคุมมลพิษ

97 Pentachlorophenol...

ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
97	Pentachlorophenol	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ⁽⁶⁾
98	pH	Electrometric Method ⁽²⁾
99	Phenanthrene	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
100	Phenol	1) Distillation, Direct Photometric Method ⁽⁸⁾ 2) Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
101	Pyrene	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
102	Selenium	1) Digestion, Inductively Coupled Plasma Method ⁽⁴⁾ 2) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method ⁽⁴⁾
103	Silver	1) Digestion, Inductively Coupled Plasma Method ⁽⁴⁾ 2) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method ⁽⁴⁾
104	Styrene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
105	1,1,2,2-Tetrachloroethane	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
106	Tetrachloroethylene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
107	Toluene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
108	Toxaphene	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ⁽⁸⁾
109	TPH (C ₈ -C ₉)	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ^(13,24)
110	TPH (C ₁₀ -C ₁₉)	Solvent Extraction, Gas Chromatographic Method ^(9,21)
111	TPH (C ₂₀ -C ₃₀)	Solvent Extraction, Gas Chromatographic Method ^(9,21)
112	1,2,4-Trichlorobenzene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
113	1,1,1-Trichloroethane	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾

114 1,1,2-Trichloroethane...

(นางริกาญจน์ นัครสกุลวิไล)
ผู้อำนวยการศูนย์มาตรฐานวิชาการกรมส่งเสริมการค้าระหว่างประเทศ
กระทรวงพาณิชย์

ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
114	1,1,2-Trichloroethane	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
115	Trichloroethylene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
116	2,4,5-Trichlorophenol	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
117	2,4,6-Trichlorophenol	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
118	1,3,5-Trimethylbenzene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
119	Vanadium	1) Digestion, Inductively Coupled Plasma Method ⁽⁴⁾ 2) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method ⁽⁴⁾
120	Vinyl Acetate	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
121	Vinyl Chloride	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
122	m-Xylene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
123	o-Xylene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
124	p-Xylene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
125	Xylene (Total)	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
126	Zinc	1) Digestion, Inductively Coupled Plasma Method ⁽⁴⁾ 2) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method ⁽⁴⁾

เอกสารสืบ (ปลัดกระทรวง) จำนวน 16 รายการ

ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
1	Antimony	Isokinetic, Digestion, Inductively Coupled Plasma Method ⁽²⁾
2	Arsenic	Isokinetic, Digestion, Inductively Coupled Plasma Method ⁽²⁾

3 Carbon Monoxide...

(นางริกาญจน์ นัครสกุลวิไล)
ผู้อำนวยการศูนย์มาตรฐานวิชาการกรมส่งเสริมการค้าระหว่างประเทศ
กระทรวงพาณิชย์

ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
3	Carbon Monoxide	1) Sampling Bag Non-Dispersive Infrared Method ⁽¹⁾ 2) Non-Dispersive Infrared Method ⁽³⁾ 3) Instrumental Analyzer Method ⁽³⁾
4	Chlorine	1) Absorption Sampling, Ion Chromatographic Method ⁽¹⁾ 2) Isokinetic Sampling, Ion Chromatographic Method ⁽¹⁾
5	Copper	Isokinetic, Digestion, Inductively Coupled Plasma Method ⁽¹⁾
6	Dioxins	Isokinetic Sampling, Analysis by ISO/IEC 17025 Accredited Laboratory or Analysis by Department of Industrial Works Registered Laboratory (Dioxins/Furans Analysis Approved) ⁽¹⁾
7	Hydrogen Chloride	1) Absorption Sampling, Ion Chromatographic Method ⁽¹⁾ 2) Isokinetic Sampling, Ion Chromatographic Method ⁽¹⁾
8	Hydrogen Sulfide	Absorption Sampling, Iodometric Method ⁽¹⁾
9	Lead	Isokinetic, Digestion, Inductively Coupled Plasma Method ⁽¹⁾
10	Mercury	1) Isokinetic Sampling, Digestion, Cold-Vapor Atomic Absorption Spectrometric Method ⁽¹⁾ 2) Isokinetic, Digestion, Inductively Coupled Plasma Method ⁽¹⁾
11	Opacity	Ringelmann's Method ⁽²⁾
12	Oxides of Nitrogen	1) Absorption Sampling, Phenoldisulfuric Acid Method ⁽¹⁾ 2) Chemiluminescence Method ⁽¹⁾ 3) Instrumental Analyzer Method ⁽¹⁾
13	Sulfur Dioxide	1) Absorption Sampling, Barium-Thoron Titrimetric Method ⁽¹⁾ 2) UV Fluorescence Method ⁽¹⁾ 3) Instrumental Analyzer Method ⁽¹⁾
14	Sulfuric Acid	Isokinetic Sampling, Barium-Thoron Titrimetric Method ⁽¹⁾
15	Total Suspended Particulate	Isokinetic Sampling, Gravimetric Method ⁽¹⁾
16	Xylene	Absorption Sampling, Gas Chromatographic Method ⁽¹⁾

สิ่งปฏิกูล...

(นางริกาญจน์ นัครสกุลวิไล)
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กระทรวงพาณิชย์

สิ่งปฏิกูลหรือวัสดุที่ไม่ใช้แล้ว จำนวน 35 รายการ

ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
1	Aldrin	1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ^(1,3,23) 2) Soxhlet Extraction, Gas Chromatographic Method ^(16,23) 3) Automated Soxhlet Extraction, Gas Chromatographic Method ^(23,31)
2	Antimony	1) Waste Extraction, Digestion, Inductively Coupled Plasma Method ^(1,4,15) 2) Waste Extraction, Digestion, Inductively Coupled Plasma/Mass Spectrometric Method ^(1,4,16) 3) Digestion, Inductively Coupled Plasma Method ^(7,23) 4) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method ^(7,14)
3	Arsenic	1) Waste Extraction, Digestion, Inductively Coupled Plasma Method ^(1,4,15) 2) Waste Extraction, Digestion, Inductively Coupled Plasma/Mass Spectrometric Method ^(1,4,16) 3) Digestion, Inductively Coupled Plasma Method ^(7,15) 4) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method ^(7,16)
4	Barium	1) Waste Extraction, Digestion, Inductively Coupled Plasma Method ^(1,4,15) 2) Waste Extraction, Digestion, Inductively Coupled Plasma/Mass Spectrometric Method ^(1,4,16) 3) Digestion, Inductively Coupled Plasma Method ^(7,16) 4) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method ^(7,16)
5	Beryllium	1) Waste Extraction, Digestion, Inductively Coupled Plasma Method ^(1,4,15) 2) Waste Extraction, Digestion, Inductively Coupled Plasma/Mass Spectrometric Method ^(1,4,16) 3) Digestion, Inductively Coupled Plasma Method ^(7,15) 4) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method ^(7,16)

6 Cadmium...

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กระทรวงพาณิชย์

ลำดับที่	สารเคมี	วิธีวิเคราะห์
6	Cadmium	1) Waste Extraction, Digestion, Inductively Coupled Plasma Method ^(1.6.15) 2) Waste Extraction, Digestion, Inductively Coupled Plasma/Mass Spectrometric Method ^(1.6.16) 3) Digestion, Inductively Coupled Plasma Method ^(7.1.9) 4) Digestion, Inductively Coupled Plasma/Mass Spectrometric Method ^(7.1.6)
7	Chlordane	1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ^(1.9.23) 2) Soxhlet Extraction, Gas Chromatographic Method ^(10.22) 3) Automated Soxhlet Extraction, Gas Chromatographic Method ^(22.31)
8	Chromium	1) Waste Extraction, Digestion, Inductively Coupled Plasma Method ^(1.6.18) 2) Waste Extraction, Digestion, Inductively Coupled Plasma/Mass Spectrometric Method ^(1.6.16) 3) Digestion, Inductively Coupled Plasma Method ^(7.1.5) 4) Digestion, Inductively Coupled Plasma/Mass Spectrometric Method ^(7.1.6)
9	Chromium (III)	1) Waste Extraction, Digestion, Inductively Coupled Plasma Method; Waste Extraction, Colorimetric Method; Calculation Method ^(1.6.15, 1.7) 2) Waste Extraction, Digestion, Inductively Coupled Plasma/Mass Spectrometric Method; Waste Extraction, Colorimetric Method; Calculation Method ^(1.6.16, 1.7) 3) Digestion, Inductively Coupled Plasma Method; Alkaline Digestion, Colorimetric Method; Calculation Method ^(7.1.5, 1.7) 4) Digestion, Inductively Coupled Plasma/Mass Spectrometric Method; Alkaline Digestion, Colorimetric Method; Calculation Method ^(7.1.6, 1.7)
10	Chromium (VI)	1) Waste Extraction, Colorimetric Method ^(1.6.17) 2) Alkaline Digestion, Colorimetric Method ^(1.7)

วิธีวิเคราะห์
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11 Cobalt...

ลำดับที่	สารเคมี	วิธีวิเคราะห์
11	Cobalt	1) Waste Extraction, Digestion, Inductively Coupled Plasma Method ^(1.6.15) 2) Waste Extraction, Digestion, Inductively Coupled Plasma/Mass Spectrometric Method ^(1.6.16) 3) Digestion, Inductively Coupled Plasma Method ^(7.1.9) 4) Digestion, Inductively Coupled Plasma/Mass Spectrometric Method ^(7.1.6)
12	Copper	1) Waste Extraction, Digestion, Inductively Coupled Plasma Method ^(1.6.15) 2) Waste Extraction, Digestion, Inductively Coupled Plasma/Mass Spectrometric Method ^(1.6.16) 3) Digestion, Inductively Coupled Plasma Method ^(7.1.9) 4) Digestion, Inductively Coupled Plasma/Mass Spectrometric Method ^(7.1.6)
13	2,4-D	1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ^(1.9.23) 2) Soxhlet Extraction, Gas Chromatographic Method ^(10.22) 3) Automated Soxhlet Extraction, Gas Chromatographic Method ^(22.31)
14	DDD	1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ^(1.9.23) 2) Soxhlet Extraction, Gas Chromatographic Method ^(10.22) 3) Automated Soxhlet Extraction, Gas Chromatographic Method ^(22.31)
15	DDE	1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ^(1.9.23) 2) Soxhlet Extraction, Gas Chromatographic Method ^(10.22) 3) Automated Soxhlet Extraction, Gas Chromatographic Method ^(22.31)
16	DDT	1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ^(1.9.23)

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กระทรวงพาณิชย์

2) Soxhlet...

ลำดับที่	สารเคมี	วิธีวิเคราะห์
17	Dieldrin	2) Soxhlet Extraction, Gas Chromatographic Method ^(10.22) 3) Automated Soxhlet Extraction, Gas Chromatographic Method ^(22.31)
18	Endrin	1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ^(1.9.23) 2) Soxhlet Extraction, Gas Chromatographic Method ^(10.22) 3) Automated Soxhlet Extraction, Gas Chromatographic Method ^(22.31)
19	Heptachlor	1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ^(1.9.23) 2) Soxhlet Extraction, Gas Chromatographic Method ^(10.22) 3) Automated Soxhlet Extraction, Gas Chromatographic Method ^(22.31)
20	Lead	1) Waste Extraction, Digestion, Inductively Coupled Plasma Method ^(1.6.15) 2) Waste Extraction, Digestion, Inductively Coupled Plasma/Mass Spectrometric Method ^(1.6.16) 3) Digestion, Inductively Coupled Plasma Method ^(7.1.5) 4) Digestion, Inductively Coupled Plasma/Mass Spectrometric Method ^(7.1.6)
21	Lindane	1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ^(1.9.23) 2) Soxhlet Extraction, Gas Chromatographic Method ^(10.22) 3) Automated Soxhlet Extraction, Gas Chromatographic Method ^(22.31)
22	Mercury	1) Waste Extraction, Digestion, Cold-Vapor Atomic Absorption Spectrometric Method ^(1.6.18)

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2) Waste Extraction...

ลำดับที่	สารเคมี	วิธีวิเคราะห์
23	Methoxychlor	2) Waste Extraction, Thermal Decomposition Amalgamation and Atomic Absorption Spectrometric Method ^(1.6.19) 3) Waste Extraction, Digestion, Cold-Vapor Atomic Fluorescence Spectrometric Method ^(1.6.20) 4) Digestion, Cold-Vapor Atomic Absorption Spectrometric Method ^(1.6) 5) Thermal Decomposition Amalgamation and Atomic Absorption Spectrometric Method ^(1.6) 6) Digestion, Cold-Vapor Atomic Fluorescence Spectrometric Method ⁽²⁰⁾
24	Mirex	1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ^(1.9.23) 2) Soxhlet Extraction, Gas Chromatographic Method ^(10.22) 3) Automated Soxhlet Extraction, Gas Chromatographic Method ^(22.31)
25	Molybdenum	1) Waste Extraction, Digestion, Inductively Coupled Plasma Method ^(1.6.15) 2) Waste Extraction, Digestion, Inductively Coupled Plasma/Mass Spectrometric Method ^(1.6.16) 3) Digestion, Inductively Coupled Plasma Method ^(7.1.5) 4) Digestion, Inductively Coupled Plasma/Mass Spectrometric Method ^(7.1.6)
26	Nickel	1) Waste Extraction, Digestion, Inductively Coupled Plasma Method ^(1.6.15) 2) Waste Extraction, Digestion, Inductively Coupled Plasma/Mass Spectrometric Method ^(1.6.16) 3) Digestion, Inductively Coupled Plasma Method ^(7.1.5) 4) Digestion, Inductively Coupled Plasma/Mass Spectrometric Method ^(7.1.6)

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
27 Polychlorinated...

ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
27	Polychlorinated biphenyls (PCBs) - Aroclor 1016 - Aroclor 1221 - Aroclor 1232 - Aroclor 1242 - Aroclor 1248 - Aroclor 1254 - Aroclor 1260 - 2-Chlorobiphenyl - 2,3-Dichlorobiphenyl - 2,2',5'-Trichlorobiphenyl - 2,4',5'-Trichlorobiphenyl - 2,2',3,5'-Tetrachlorobiphenyl - 2,2',3,5'-Tetrachlorobiphenyl - 2,3',4,4'-Tetrachlorobiphenyl - 2,2',3,4,5'-Pentachlorobiphenyl - 2,2',4,5,5'-Pentachlorobiphenyl - 2,3,3',4,6-Pentachlorobiphenyl - 2,2',3,4,4',5'-Hexachlorobiphenyl - 2,2',3,4,5,5'-Hexachlorobiphenyl - 2,2',3,5,5',6-Hexachlorobiphenyl - 2,2',4,4',5,5'-Hexachlorobiphenyl - 2,2',3,3',4,4',5-Heptachlorobiphenyl - 2,2',3,4,4',5,5'-Heptachlorobiphenyl - 2,2',3,4,4',5,6-Heptachlorobiphenyl - 2,2',3,4',5,5',6-Heptachlorobiphenyl - 2,2',3,3',4,4',5,6-Heptachlorobiphenyl - 2,2',3,3',4,4',5,5',6-Nonachlorobiphenyl	1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic Method ^(1,5,21) 2) Soxhlet Extraction, Gas Chromatographic Method ^(10,22) 3) Automated Soxhlet Extraction, Gas Chromatographic Method ^(22,31)


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28 Pentachlorophenol...

ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
28	Pentachlorophenol	1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ^(1,9,22) 2) Soxhlet Extraction, Gas Chromatographic Method ^(10,22) 3) Automated Soxhlet Extraction, Gas Chromatographic Method ^(22,31)
29	pH	Electrometric Method ^(29,30)
30	Selenium	1) Waste Extraction, Digestion, Inductively Coupled Plasma Method ^(1,6,13) 2) Waste Extraction, Digestion, Inductively Coupled Plasma/Mass Spectrometric Method ^(1,6,16) 3) Digestion, Inductively Coupled Plasma Method ^(7,13) 4) Digestion, Inductively Coupled Plasma/Mass Spectrometric Method ^(7,16)
31	Silver	1) Waste Extraction, Digestion, Inductively Coupled Plasma Method ^(1,6,15) 2) Waste Extraction, Digestion, Inductively Coupled Plasma/Mass Spectrometric Method ^(1,6,16)
32	Thallium	1) Waste Extraction, Digestion, Inductively Coupled Plasma Method ^(1,6,15) 2) Waste Extraction, Digestion, Inductively Coupled Plasma/Mass Spectrometric Method ^(1,6,16) 3) Digestion, Inductively Coupled Plasma Method ^(7,15) 4) Digestion, Inductively Coupled Plasma/Mass Spectrometric Method ^(7,16)
33	Toxaphene	1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ^(1,9,22) 2) Soxhlet Extraction, Gas Chromatographic Method ^(10,22) 3) Automated Soxhlet Extraction, Gas Chromatographic Method ^(22,31)
34	Vanadium	1) Waste Extraction, Digestion, Inductively Coupled Plasma Method ^(1,6,15) 2) Waste Extraction, Digestion, Inductively Coupled Plasma/Mass Spectrometric Method ^(1,6,16) 3) Digestion, Inductively Coupled Plasma Method ^(7,15)



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4) Digestion...

ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
35	Zinc	4) Digestion, Inductively Coupled Plasma/Mass Spectrometric Method ^(7,16) 1) Waste Extraction, Digestion, Inductively Coupled Plasma Method ^(1,6,15) 2) Waste Extraction, Digestion, Inductively Coupled Plasma/Mass Spectrometric Method ^(1,6,16) 3) Digestion, Inductively Coupled Plasma Method ^(7,15) 4) Digestion, Inductively Coupled Plasma/Mass Spectrometric Method ^(7,16)


สืบ จำนวน 125 รายการ

ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
1	Acenaphthene	Automated Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method ^(25,31)
2	Acetone	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^(14,24)
3	Aldrin	1) Soxhlet Extraction, Gas Chromatographic Method ^(10,22) 2) Automated Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method ^(25,31)
4	Anthracene	Automated Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method ^(25,31)
5	Antimony	1) Digestion, Inductively Coupled Plasma Method ^(7,15) 2) Digestion, Inductively Coupled Plasma/Mass Spectrometric Method ^(7,16)
6	Arsenic	1) Digestion, Inductively Coupled Plasma Method ^(7,15) 2) Digestion, Inductively Coupled Plasma/Mass Spectrometric Method ^(7,16)
7	Atrazine	1) Soxhlet Extraction, Gas Chromatographic Method ^(10,22) 2) Automated Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method ^(25,31)
8	Barium	1) Digestion, Inductively Coupled Plasma Method ^(7,15) 2) Digestion, Inductively Coupled Plasma/Mass Spectrometric Method ^(7,16)


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9 Benz(a)anthracene...

ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
9	Benz(a)anthracene	Automated Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method ^(25,31)
10	Benzene	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^(14,24)
11	Benzo(b)fluoranthene	Automated Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method ^(25,31)
12	Benzo(k)fluoranthene	Automated Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method ^(25,31)
13	Benzic acid	Automated Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method ^(25,31)
14	Benzo(a)pyrene	Automated Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method ^(25,31)
15	Benzog(h,i)perylene	Automated Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method ^(25,31)
16	Beryllium	1) Digestion, Inductively Coupled Plasma Method ^(7,15) 2) Digestion, Inductively Coupled Plasma/Mass Spectrometric Method ^(7,16)
17	Bis(2-chloroethyl)ether	Automated Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method ^(25,31)
18	Bis(2-ethylhexyl)phthalate	Automated Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method ^(25,31)
19	Bromodichloromethane	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^(14,24)
20	Bromoform	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^(14,24)
21	Butanol	Equilibrium Headspace, Gas Chromatographic/Mass Spectrometric Method ^(14,24)
22	Butyl Benzyl Phthalate	Automated Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method ^(25,31)
23	Cadmium	1) Digestion, Inductively Coupled Plasma Method ^(7,15) 2) Digestion, Inductively Coupled Plasma/Mass Spectrometric Method ^(7,16)
24	Carbazole	Automated Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method ^(25,31)
25	Carbon Disulfide	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^(14,24)


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26 Carbon tetrachloride...

ลำดับที่	สารเคมี	วิธีวิเคราะห์
26	Carbon tetrachloride	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ^(14,24)
27	Chlordane	1) Soxhlet Extraction, Gas Chromatographic Method ^(14,22) 2) Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method ^(25,31)
28	p-Chloroaniline	Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method ^(25,31)
29	Chlorobenzene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ^(14,24)
30	Chlorodibromomethane	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ^(14,24)
31	Chloroform	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ^(14,24)
32	2-Chlorophenol	Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method ^(25,31)
33	Chromium	1) Digestion, Inductively Coupled Plasma Method ^(7,15) 2) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method ^(7,14)
34	Chromium (II)	1) Digestion, Inductively Coupled Plasma Method; Alkaline Digestion, Colorimetric Method; Calculation Method ^(7,15,17) 2) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method; Alkaline Digestion, Colorimetric Method; Calculation Method ^(7,16,17)
35	Chromium (VI)	Alkaline Digestion, Colorimetric Method ^(8,17)
36	Chrysene	Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method ^(25,31)
37	Cyanide	Extraction, Distillation, Colorimetric Method ^(26,27,28)
38	2,4-D	1) Soxhlet Extraction, Gas Chromatographic Method ^(14,22) 2) Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method ^(25,31)
39	DDE	1) Soxhlet Extraction, Gas Chromatographic Method ^(14,22) 2) Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method ^(25,31)

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40 DDE...

ลำดับที่	สารเคมี	วิธีวิเคราะห์
40	DDE	1) Soxhlet Extraction, Gas Chromatographic Method ^(14,22) 2) Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method ^(25,31)
41	DDT	1) Soxhlet Extraction, Gas Chromatographic Method ^(14,22) 2) Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method ^(25,31)
42	Dibenz(a,h)anthracene	Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method ^(25,31)
43	Di-n-Butyl Phthalate	Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method ^(25,31)
44	1,2-Dichlorobenzene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ^(14,24)
45	1,3-Dichlorobenzene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ^(14,24)
46	1,4-Dichlorobenzene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ^(14,24)
47	3,3-Dichlorobenzidine	Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method ^(25,31)
48	1,1-Dichloroethane	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ^(14,24)
49	1,2-Dichloroethane	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ^(14,24)
50	1,1-Dichloroethylene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ^(14,24)
51	cis-1,2-Dichloroethylene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ^(14,24)
52	trans-1,2-Dichloroethylene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ^(14,24)
53	2,4-Dichlorophenol	Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method ^(25,31)
54	1,2-Dichloropropane	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ^(14,24)
55	1,3-Dichloropropane	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ^(14,24)
56	1,3-Dichloropropene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ^(14,24)

Signature
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57 Dieldrin...

ลำดับที่	สารเคมี	วิธีวิเคราะห์
57	Dieldrin	1) Soxhlet Extraction, Gas Chromatographic Method ^(14,22) 2) Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method ^(25,31)
58	Diethyl Phthalate	Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method ^(25,31)
59	2,4-Dimethylphenol	Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method ^(25,31)
60	2,4-Dinitrophenol	Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method ^(25,31)
61	2,4-Dinitrotoluene	Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method ^(25,31)
62	2,6-Dinitrotoluene	Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method ^(25,31)
63	Di-n-Octyl Phthalate	Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method ^(25,31)
64	Endosulfan	1) Soxhlet Extraction, Gas Chromatographic Method ^(14,22) 2) Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method ^(25,31)
65	Erdrin	1) Soxhlet Extraction, Gas Chromatographic Method ^(14,22) 2) Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method ^(25,31)
66	Ethylbenzene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ^(14,24)
67	Fluoranthene	Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method ^(25,31)
68	Fluorene	Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method ^(25,31)
69	Heptachlor	1) Soxhlet Extraction, Gas Chromatographic Method ^(14,22) 2) Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method ^(25,31)
70	Heptachlor Epoxide	1) Soxhlet Extraction, Gas Chromatographic Method ^(14,22) 2) Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method ^(25,31)

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71 Hexachlorobenzene...

ลำดับที่	สารเคมี	วิธีวิเคราะห์
71	Hexachlorobenzene	1) Soxhlet Extraction, Gas Chromatographic Method ^(14,22) 2) Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method ^(25,31)
72	Hexachloro-1,3-butadiene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ^(14,24)
73	n-Hexane	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ^(14,24)
74	α-HCH	1) Soxhlet Extraction, Gas Chromatographic Method ^(14,22) 2) Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method ^(25,31)
75	β-HCH	1) Soxhlet Extraction, Gas Chromatographic Method ^(14,22) 2) Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method ^(25,31)
76	γ-HCH	1) Soxhlet Extraction, Gas Chromatographic Method ^(14,22) 2) Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method ^(25,31)
77	Hexachlorocyclopentadiene	Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method ^(25,31)
78	Hexachloroethane	Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method ^(25,31)
79	Indeno(1,2,3-cd)pyrene	Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method ^(25,31)
80	Isophorone	Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method ^(25,31)
81	Lead	1) Digestion, Inductively Coupled Plasma Method ^(7,15) 2) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method ^(7,14)
82	Manganese	1) Digestion, Inductively Coupled Plasma Method ^(7,15) 2) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method ^(7,14)
83	Mercury	1) Digestion, Cold-Vapor Atomic Absorption Spectrometric Method ⁽¹⁴⁾

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2) Thermal...

ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
		2) Thermal Decomposition, Amalgamation, and Atomic Absorption Spectrophotometry ⁽¹⁾⁽⁵⁾ 3) Digestion, Cold-Vapor Atomic Fluorescence Spectrometric Method ⁽²⁾⁽³⁾
84	Methanol	Equilibrium Headspace, Gas Chromatographic/Mass Spectrometric Method ⁽¹⁾⁽²⁾⁽³⁾
85	Methoxychlor	1) Soxhlet Extraction, Gas Chromatographic Method ⁽¹⁾⁽²⁾⁽³⁾ 2) Automated Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽²⁾⁽³⁾⁽¹⁾
86	Methyl Bromide	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ⁽¹⁾⁽²⁾⁽³⁾
87	Methylene Chloride	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ⁽¹⁾⁽²⁾⁽³⁾
88	2-methylphenol	Automated Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽²⁾⁽³⁾⁽¹⁾
89	2-Methylnaphthalene	Automated Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽²⁾⁽³⁾⁽¹⁾
90	Methyl tert-Butyl Ether	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ⁽¹⁾⁽²⁾⁽³⁾
91	Naphthalene	Automated Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽²⁾⁽³⁾⁽¹⁾
92	Nickel	1) Digestion, Inductively Coupled Plasma Method ⁽¹⁾⁽¹⁵⁾ 2) Digestion, Inductively Coupled Plasma/Mass Spectrometric Method ⁽¹⁾⁽¹⁶⁾
93	Nitrobenzene	Automated Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽²⁾⁽³⁾⁽¹⁾
94	N-Nitrosodiphenylamine	Automated Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽²⁾⁽³⁾⁽¹⁾
95	N-Nitrosodi-n-propylamine	Automated Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽²⁾⁽³⁾⁽¹⁾
96	Polychlorinated biphenyls (PCBs) - Aroclor 1016 - Aroclor 1221 - Aroclor 1232	1) Soxhlet Extraction, Gas Chromatographic Method ⁽¹⁾⁽²⁾⁽³⁾ 2) Automated Soxhlet Extraction, Gas Chromatographic Method ⁽²⁾⁽³⁾

อิกพล
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- Aroclor 1242...

ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
	- Aroclor 1242 - Aroclor 1248 - Aroclor 1254 - Aroclor 1260 - 2-Chlorobiphenyl - 2,2',3,5'-Tetrachlorobiphenyl - 2,2',5,5'-Tetrachlorobiphenyl - 2,3,4,4'-Tetrachlorobiphenyl - 2,2,3,4,5'-Pentachlorobiphenyl - 2,2,4,5,5'-Pentachlorobiphenyl - 2,3,3',4',6-Pentachlorobiphenyl - 2,2,3,4,4',5-Hexachlorobiphenyl - 2,2,3,4,5,5'-Hexachlorobiphenyl - 2,2',3,5,5',6-Hexachlorobiphenyl - 2,2',4,4',5,5'-Hexachlorobiphenyl - 2,2',3,3',4,4',5-Heptachlorobiphenyl - 2,2',3,4,4',5,5'-Heptachlorobiphenyl - 2,2',3,4,4',5,5',6-Heptachlorobiphenyl - 2,2',3,4,4',5,5',6-Heptachlorobiphenyl - 2,2',3,3',4,4',5,5',6-Nonachlorobiphenyl	
97	Pentachlorophenol	Automated Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽²⁾⁽³⁾⁽¹⁾
98	Phenanthrene	Automated Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽²⁾⁽³⁾⁽¹⁾
99	Phenol	Automated Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽²⁾⁽³⁾⁽¹⁾
100	Pyrene	Automated Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽²⁾⁽³⁾⁽¹⁾

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และศูนย์วิจัยและพัฒนา

101 Selenium...

ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
101	Selenium	1) Digestion, Inductively Coupled Plasma Method ⁽⁷⁾⁽¹⁵⁾ 2) Digestion, Inductively Coupled Plasma/Mass Spectrometric Method ⁽⁷⁾⁽¹⁶⁾
102	Silver	1) Digestion, Inductively Coupled Plasma Method ⁽⁷⁾⁽¹⁵⁾ 2) Digestion, Inductively Coupled Plasma/Mass Spectrometric Method ⁽⁷⁾⁽¹⁶⁾
103	Styrene	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ⁽¹⁾⁽²⁾⁽³⁾
104	1,1,2,2-Tetrachloroethane	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ⁽¹⁾⁽²⁾⁽³⁾
105	Tetrachloroethylene	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ⁽¹⁾⁽²⁾⁽³⁾
106	Toluene	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ⁽¹⁾⁽²⁾⁽³⁾
107	Toxaphene	1) Soxhlet Extraction, Gas Chromatographic Method ⁽¹⁾⁽²⁾⁽³⁾ 2) Automated Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽²⁾⁽³⁾⁽¹⁾
108	TPH (C ₅ -C ₆)	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ⁽¹⁾⁽²⁾⁽³⁾
109	TPH (C ₈ -C ₁₆)	1) Solvent Extraction, Gas Chromatographic Method ⁽¹⁾⁽¹²⁾ 2) Automated Soxhlet Extraction, Gas Chromatographic Method ⁽²⁾⁽³⁾⁽¹⁾
110	TPH (C ₁₇ -C ₃₃)	1) Solvent Extraction, Gas Chromatographic Method ⁽¹⁾⁽¹²⁾ 2) Automated Soxhlet Extraction, Gas Chromatographic Method ⁽²⁾⁽³⁾⁽¹⁾
111	1,2,4-Trichlorobenzene	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ⁽¹⁾⁽²⁾⁽³⁾
112	1,1,1-Trichloroethane	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ⁽¹⁾⁽²⁾⁽³⁾
113	1,1,2-Trichloroethane	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ⁽¹⁾⁽²⁾⁽³⁾
114	Trichloroethylene	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ⁽¹⁾⁽²⁾⁽³⁾
115	2,4,5-Trichlorophenol	Automated Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽²⁾⁽³⁾⁽¹⁾

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116 2,4,6-Trichlorophenol...

ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
116	2,4,6-Trichlorophenol	Automated Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽²⁾⁽³⁾⁽¹⁾
117	1,3,5-Trimethylbenzene	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ⁽¹⁾⁽²⁾⁽³⁾
118	Vanadium	1) Digestion, Inductively Coupled Plasma Method ⁽⁷⁾⁽¹⁵⁾ 2) Digestion, Inductively Coupled Plasma/Mass Spectrometric Method ⁽⁷⁾⁽¹⁶⁾
119	Vinyl Acetate	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ⁽¹⁾⁽²⁾⁽³⁾
120	Vinyl Chloride	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ⁽¹⁾⁽²⁾⁽³⁾
121	m-Xylene	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ⁽¹⁾⁽²⁾⁽³⁾
122	o-Xylene	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ⁽¹⁾⁽²⁾⁽³⁾
123	p-Xylene	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ⁽¹⁾⁽²⁾⁽³⁾
124	Xylene (Total)	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ⁽¹⁾⁽²⁾⁽³⁾
125	Zinc	1) Digestion, Inductively Coupled Plasma Method ⁽⁷⁾⁽¹⁵⁾ 2) Digestion, Inductively Coupled Plasma/Mass Spectrometric Method ⁽⁷⁾⁽¹⁶⁾


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
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 กรมส่งเสริมการค้าระหว่างประเทศ
 กระทรวงพาณิชย์

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 ผู้อำนวยการศูนย์ปฏิบัติการวิเคราะห์และประเมินผลสิ่งแวดล้อม
 กรมส่งเสริมการค้าระหว่างประเทศ
 กระทรวงพาณิชย์

กลุ่มมาตรฐานวิธีการวิเคราะห์และประเมินผลสิ่งแวดล้อมเพื่อปฏิบัติการ การวิจัยและเฝ้าระวังมลพิษทางอากาศ กรมส่งเสริมการค้าระหว่างประเทศ กระทรวงพาณิชย์ โทร. ๐ ๒๒๖๒-๕๐๐๖, ๕๐๑๖

ที่ ๑๓๒๑๑๑/๑๖ ๕๕๓๓๓



กรมส่งเสริมการค้าระหว่างประเทศ
กรมส่งเสริมการค้าระหว่างประเทศ
กระทรวงพาณิชย์ กรุงเทพมหานคร ๑๐๑๐๐

๑๕ มีนาคม ๒๕๖๖

เรื่อง เปลี่ยนแบบตราประทับเพื่อปฏิบัติการวิเคราะห์

เรียน กรรมการผู้จัดการ บริษัท เอเชีย เอเอเอส แอสโซซิเอตส์ จำกัด (มหาชน) จำกัด

อ้างถึง คำขอขึ้นทะเบียนตราประทับ/เปลี่ยนแบบตราประทับ และขอมติกรรมการเพื่อปฏิบัติการวิเคราะห์และประเมินผลสิ่งแวดล้อม กรมส่งเสริมการค้าระหว่างประเทศ กระทรวงพาณิชย์

ตามที่บริษัท เอเชีย เอเอเอส แอสโซซิเอตส์ จำกัด (มหาชน) ขอขึ้นทะเบียนตราประทับ/เปลี่ยนแบบตราประทับ และขอมติกรรมการเพื่อปฏิบัติการวิเคราะห์และประเมินผลสิ่งแวดล้อม กรมส่งเสริมการค้าระหว่างประเทศ กระทรวงพาณิชย์

กรมส่งเสริมการค้าระหว่างประเทศ กระทรวงพาณิชย์ มีมติเห็นชอบ

๑. โฉนดแบบตราประทับเพื่อปฏิบัติการวิเคราะห์และประเมินผลสิ่งแวดล้อม จำนวน ๑๕ แบบ
- ๑) นายอนุชิต สุธาธรรม
- ๒) นายนิรุฒ มาลีมณี
- ๓) นายอรรถพล นิยมวิภาสิน
- ๔) นางสาวพัชรีมา พงษ์พันธ์
- ๕) นางสาวกัญญา สุวรรณศรี
- ๖) นางสาวศุภรณี มีดี
- ๗) นายสมโภช วันลา
- ๘) นายณัฐวัฒน์ ปานประเสริฐ
- ๙) ราชภัฏธรรมาภรณ์ แสนศรี
- ๑๐) นายณัฐพร หุตศิริ
- ๑๑) นายณัฐชัย เอื้ออรรถ
- ๑๒) นางสาวกัญญา มาลีมณี
- ๑๓) นางสาวศุภรณี นิยมวิภาสิน
- ๑๔) นางสาวกัญญาวัน ศรีนิลา
- ๑๕) นายณัฐวัฒน์ มาลีมณี
- ๑๖) นางสาวกัญญาวัน สุระ
- ๑๗) นางสาวกัญญาวัน สุระ
- ๑๘) นางสาวกัญญาวัน สุระ
- ๑๙) นางสาวกัญญาวัน สุระ


๒. โฉนดแบบตราประทับ

๑. โฉนดแบบตราประทับเพื่อปฏิบัติการวิเคราะห์และประเมินผลสิ่งแวดล้อม จำนวน ๑๕ แบบ
- ๑) นายอนุชิต สุธาธรรม
- ๒) นายนิรุฒ มาลีมณี
- ๓) นายอรรถพล นิยมวิภาสิน
- ๔) นางสาวพัชรีมา พงษ์พันธ์
- ๕) นางสาวกัญญา สุวรรณศรี
- ๖) นางสาวศุภรณี มีดี
- ๗) นายสมโภช วันลา
- ๘) นายณัฐวัฒน์ ปานประเสริฐ
- ๙) ราชภัฏธรรมาภรณ์ แสนศรี
- ๑๐) นายณัฐพร หุตศิริ
- ๑๑) นายณัฐชัย เอื้ออรรถ
- ๑๒) นางสาวกัญญา มาลีมณี
- ๑๓) นางสาวศุภรณี นิยมวิภาสิน
- ๑๔) นางสาวกัญญาวัน ศรีนิลา
- ๑๕) นายณัฐวัฒน์ มาลีมณี
- ๑๖) นางสาวกัญญาวัน สุระ
- ๑๗) นางสาวกัญญาวัน สุระ
- ๑๘) นางสาวกัญญาวัน สุระ
- ๑๙) นางสาวกัญญาวัน สุระ

อนึ่ง บริษัท เอเชีย เอเอเอส แอสโซซิเอตส์ จำกัด (มหาชน) ขอขึ้นทะเบียนตราประทับเพื่อปฏิบัติการวิเคราะห์และประเมินผลสิ่งแวดล้อม กรมส่งเสริมการค้าระหว่างประเทศ กระทรวงพาณิชย์

จึงเรียนมาเพื่อทราบ

ขอแสดงความนับถือ


 (นายศุภชัย ชัยกุลศิริ)
 ผู้อำนวยการศูนย์ปฏิบัติการวิเคราะห์และประเมินผลสิ่งแวดล้อม
 กรมส่งเสริมการค้าระหว่างประเทศ
 กระทรวงพาณิชย์

กองวิจัยและเฝ้าระวังมลพิษทางอากาศ กรมส่งเสริมการค้าระหว่างประเทศ กระทรวงพาณิชย์
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ที่ อภ ๐๓๑๐๑/ ๒๑๒๕



กรมโรงงานอุตสาหกรรม
ถนนพระรามที่ ๖ แขวงทุ่งพญาไท
เขตราชเทวี กรุงเทพฯ ๑๐๕๐๐

๒๑ มีนาคม ๒๕๖๖

เรื่อง เปลี่ยนแปลงบุคลากรของห้องปฏิบัติการวิเคราะห์

เรียน กรรมการผู้จัดการ บริษัท เอแอลเอส แลบบอราทอรี กรุ๊ป (ประเทศไทย) จำกัด

อ้างถึง ค่ะขอเรียนขอแจ้ง/เปลี่ยนแปลงบุคลากร และชนิดสารเคมีของห้องปฏิบัติการวิเคราะห์เฉพาะ ณ วันที่ ๑๐ มีนาคม ๒๕๖๖

ตามหนังสือที่อ้างถึง บริษัท เอแอลเอส แลบบอราทอรี กรุ๊ป (ประเทศไทย) จำกัด ห้องปฏิบัติการวิเคราะห์เอกชน เลขทะเบียน ว-๒๐๔ สดงนที่ดังเลขที่ ๑๐๔ ขอขยพัฒนาการ ๔๐ ถนนพัฒนาการ แขวงพัฒนาการ เขตสวนหลวง กรุงเทพมหานคร ขอเปลี่ยนแปลงบุคลากรของห้องปฏิบัติการวิเคราะห์ ความละเอียดแจ้งแล้ว นั้น

กรมโรงงานอุตสาหกรรมพิจารณาแล้ว ให้นำไปเปลี่ยนแปลงชื่อเจ้าหน้าที่ประจำห้องปฏิบัติการวิเคราะห์ จากเดิม นางสาวสรวิศน์ มงคลเจริญดี ทะเบียนเลขที่ ว-๒๐๔-๔๗๗๙ เป็น นางสาววิบูลธร มงคลเจริญดี ทะเบียนเลขที่ ว-๒๐๔-๔๗๗๙

ทั้งนี้ หากท่านมีความประสงค์จะยื่นคำขอใดๆ สามารถยื่นคำขอผ่านระบบอิเล็กทรอนิกส์ ได้ที่หน้าเว็บไซต์กรมโรงงานอุตสาหกรรม ตาม QR Code ที่แนบมาด้วยนี้

จึงเรียนมาเพื่อทราบ

ขอแสดงความนับถือ

(นายประคม คำคงชาติ)
ผู้อำนวยการกองรังสีและสิ่งแวดล้อม
ผู้ตรวจราชการแผ่นดินกรมโรงงานอุตสาหกรรม

กองวิจัยและพัฒนาผลิตภัณฑ์โรงงาน

(ข้อมูลมาตรฐานวิธีการวิเคราะห์ทดสอบผลิตภัณฑ์และทะเบียนห้องปฏิบัติการ)

โทร. ๐ ๒๕๓๐ ๒๓๑๒ ถึง ๒๕๐๓-๔

โทรสาร ๐ ๒๕๓๐ ๒๓๑๒ ถึง ๒๕๑๓

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