

# ภาคผนวก ง

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ใบรับรองการสอบเทียบเครื่องมือ



รายการเครื่องมือที่ใช้ในการวิเคราะห์ / ทดสอบ

Sample Name	Parameter	Equipment Name	ID No.	Calibrated Date	Next Cal	Freq. Calibrate (Months)
Stack	Sulfur Dioxide	Console Control Unit	RYG_FS0315	13-Jan-23	13-Jul-23	6
Stack	Sulfur Dioxide	Flue gas Analyzer	RYG_FS0464	23-Jan-23	23-Jan-24	12
Stack	Sulfur Dioxide	Dry Gas	RYG_FS0317	13-Jan-23	13-Jul-23	6
Stack	Total Suspended Particulate	Console Control Unit	RYG_FS0315	13-Jan-23	13-Jul-23	6
Stack	Total Suspended Particulate	Flue gas Analyzer	RYG_FS0464	23-Jan-23	23-Jan-24	12
Stack	Total Suspended Particulate	Digital Balance	RYG_EN0003	1-Mar-23	1-Mar-24	12
Stack	Oxides of Nitrogen	Console Control Unit	RYG_FS0315	13-Jan-23	13-Jul-23	6
Stack	Oxides of Nitrogen	Flue gas Analyzer	RYG_FS0464	23-Jan-23	23-Jan-24	12
Stack	Oxides of Nitrogen	Vacuum Gauge	RYG_FS0333	6-Oct-21	6-Apr-23	18
Stack	Oxides of Nitrogen	SPECTROPHOTOMETER	RYG_EN0179	27-Sep-22	27-Sep-23	12
Ambient	Sulfur Dioxide	SO <sub>2</sub> Analyzer	RYG_FS0460	4-Jan-23	4-Jul-23	6
Ambient	Sulfur Dioxide	SO <sub>2</sub> Analyzer	RYG_FS0523	4-Jan-23	4-Jul-23	6
Ambient	Sulfur Dioxide	SO <sub>2</sub> Analyzer	RYG_FS0464	4-Jan-23	4-Jul-23	6
Ambient	Sulfur Dioxide	SO <sub>2</sub> Analyzer	RYG_FS0466	4-Jan-23	4-Jul-23	6
Ambient	Nitrogen Dioxide	NO <sub>2</sub> Analyzer	RYG_FS0461	5-Jan-23	5-Jul-23	6
Ambient	Nitrogen Dioxide	NO <sub>2</sub> Analyzer	RYG_FS0264	5-Jan-23	5-Jul-23	6
Ambient	Nitrogen Dioxide	NO <sub>2</sub> Analyzer	RYG_FS0455	5-Jan-23	5-Jul-23	6
Ambient	Nitrogen Dioxide	NO <sub>2</sub> Analyzer	RYG_FS0457	5-Jan-23	5-Jul-23	6
Ambient	Particulate Matter (PM-10)	High Volume	RYG_FS0190	-	-	On site Calibration
Ambient	Particulate Matter (PM-10)	High Volume	RYG_FS0398	-	-	On site Calibration
Ambient	Particulate Matter (PM-10)	High Volume	RYG_FS0397	-	-	On site Calibration
Ambient	Particulate Matter (PM-10)	High Volume	RYG_FS0295	-	-	On site Calibration
Ambient	Particulate Matter (PM-10)	Digital Balance	RYG_EN0001	1-Mar-23	1-Mar-24	12
Ambient	Total Suspended Particulate	High Volume	RYG_FS0182	-	-	On site Calibration
Ambient	Total Suspended Particulate	High Volume	RYG_FS0291	-	-	On site Calibration
Ambient	Total Suspended Particulate	High Volume	RYG_FS0176	-	-	On site Calibration
Ambient	Total Suspended Particulate	High Volume	RYG_FS0181	-	-	On site Calibration
Ambient	Total Suspended Particulate	Digital Balance	RYG_EN0001	1-Mar-23	1-Mar-24	12
Ambient	Wind Speed / Wind Direction	Wind Speed / Wind Direct	RYG_FS0081	18-Jan-23	18-Jul-24	18
Ambient	Wind Speed / Wind Direction	Wind Speed / Wind Direct	RYG_FS0087	19-Jul-24	-	18
Ambient	Wind Speed / Wind Direction	Wind Speed / Wind Direct	BKK_FS0141	5-Jan-23	5-Jul-24	18
Ambient	Wind Speed / Wind Direction	Wind Speed / Wind Direct	RYG_FS0413	10-Feb-23	10-Aug-24	18
Noise	Leq 24 hrs	Sound Calibrator	RYG_FS0215	31-Aug-22	31-Aug-23	12
Noise	Leq 24 hrs	Sound Level Meter	RYG_FS0022	25-Jan-23	25-Jan-24	12
Noise	Leq 24 hrs	Sound Level Meter	RYG_FS0023	13-Jan-23	13-Jan-24	12
Noise	Leq 24 hrs	Sound Calibrator	RYG_FS0096	17-Jan-23	17-Jan-24	12
Noise	Leq 24 hrs	Sound Level Meter	RYG_FS0024	16-Dec-22	16-Dec-23	12
Noise	Leq 8 hrs	Sound Calibrator	RYG_FS0496	17-Jan-23	17-Jan-24	12
Noise	Leq 8 hrs	Sound Level Meter	RYG_FS0614	12-Oct-22	12-Oct-23	12
Noise	Leq 8 hrs	Sound Level Meter	RYG_FS0616	12-Oct-22	12-Oct-23	12
Noise	Leq 8 hrs	Sound Level Meter	RYG_FS0612	12-Oct-22	12-Oct-23	12
Workplace	Sulfuric Acid	Field Rotameter	BKK_FS1004	1-Apr-23	1-Jul-23	3
Workplace	Sulfuric Acid	Ion Chromatography	BKK_EN0069	12-Jan-23	12-Jan-24	12
Workplace	Phosphoric Acid	Field Rotameter	BKK_FS1004	1-Apr-23	1-Jul-23	3
Workplace	Phosphoric Acid	Ion Chromatography	BKK_EN0069	12-Jan-23	12-Jan-24	12
Workplace	Ethanolamine	Field Rotameter	BKK_FS1006	1-Apr-23	1-Jul-23	3
Workplace	Hydrochloric Acid	Field Rotameter	BKK_FS1004	1-Apr-23	1-Jul-23	3
Workplace	Hydrochloric Acid	Ion Chromatography	BKK_EN0069	12-Jan-23	12-Jan-24	12
Workplace	Sodium hydroxide as NaOH	Field Rotameter	RYG_FS0198	1-Apr-23	1-Jul-23	3
Workplace	Chlorine	Field Rotameter	RYG_FS0198	1-Apr-23	1-Jul-23	3
Workplace	Zinc Chloride (Inhalable dust)	Field Rotameter	RYG_FS0198	1-Apr-23	1-Jul-23	3
Workplace	Zinc Chloride (Inhalable dust)	ICP-OES	BKK_EL0037	20-Mar-23	19-Sep-24	18
Workplace	Total Hydrocarbon as Methane	Total Hydrocarbon Analyzer	RYG_EN0038	25-Jan-23	25-Jan-24	12

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Sample Name	Parameter	Equipment Name	ID No.	Calibrated Date	Next Cal	Freq. Calibrate (Months)
Workplace	Respirable Dust	Field Rotameter	RYG_FS0198	1-Apr-23	1-Jul-23	3
Workplace	Respirable Dust	Digital Balance	RYG_EN0004	1-Mar-23	1-Mar-24	12
Workplace	Total Dust	Field Rotameter	RYG_FS0198	1-Apr-23	1-Jul-23	3
Workplace	Total Dust	Digital Balance	RYG_EN0004	1-Mar-23	1-Mar-24	12
Workplace	Oxalic acid	Field Rotameter	RYG_FS0198	1-Apr-23	1-Jul-23	3
Workplace	Oxalic acid	Ion Chromatography	BKK_EN0069	12-Jan-23	12-Jan-24	12
Workplace	Ethanol	Field Rotameter	BKK_FS1006	1-Apr-23	1-Jul-23	3
Workplace	Ethanol	GC-FID	BKK_EN0126	21-Apr-23	21-Oct-24	18
Workplace	Isopropyl Alcohol	Field Rotameter	BKK_FS1006	1-Apr-23	1-Jul-23	3
Workplace	Isopropyl Alcohol	GC-FID	BKK_EN0126	21-Apr-23	21-Oct-24	18
Workplace	Potassium Chromate	Field Rotameter	RYG_FS0198	1-Apr-23	1-Jul-23	3
Workplace	Potassium Chromate	ICP-OES	BKK_EL0037	20-Mar-23	19-Sep-24	18
Workplace	Sodium hydrosulphite (Na2S2O4)	Field Rotameter	RYG_FS0198	1-Apr-23	1-Jul-23	3
Workplace	Sodium hydrosulphite (Na2S2O4)	ICP-OES	BKK_EL0037	20-Mar-23	19-Sep-24	18
Workplace	Flow rate	INDOOR AIR QUALITY MET	BKK_FS0933	28-Feb-23	28-Aug-24	18
Indoor Air	Air movement	INDOOR AIR QUALITY MET	BKK_FS0933	28-Feb-23	28-Aug-24	18
Heat	Heat Stress	Heat Stress Monitor	RYG_FS0524	28-Feb-23	28-Feb-24	12
Noise	Noise Dose, TWA	Dose Badge Reader	RYG_FS0211	1-Nov-22	1-Nov-23	12
Rayong Lab	pH at 25 °C	pH Meter	RYG_EN0152	22-Dec-22	22-Dec-23	12
Rayong Lab	BOD	DO meter with Sensor	RYG_EN0032	14-Feb-22	15-Aug-23	18
Rayong Lab	BOD	Incubator	RYG_EN0154	22-Apr-22	21-Oct-23	18
Rayong Lab	COD	Spectrophotometer	RYG_EN0037	27-Sep-22	27-Mar-24	18
Rayong Lab	Total Suspended Solids	Electronic Balance	RYG_EN0002	1-Mar-23	1-Mar-24	12
Rayong Lab	Total Suspended Solids	Hot Air Oven	RYG_EN0010	20-Oct-22	20-Apr-24	18
Rayong Lab	Total Dissolved Solids 180°C	Electronic Balance	RYG_EN0002	1-Mar-23	1-Mar-24	12
Rayong Lab	Total Dissolved Solids 180°C	Hot Air Oven	RYG_EN0010	20-Oct-22	20-Apr-24	18
Rayong Lab	Oil & Grease	Electronic Balance	RYG_EN0002	1-Mar-23	1-Mar-24	12
Rayong Lab	Oil & Grease	Hot Air Oven	RYG_EN0006	20-Oct-22	20-Apr-24	18
Rayong Lab	Oil & Grease	Water Bath	RYG_EN0061	20-Oct-22	20-Apr-24	18
Rayong Lab	Temperature	Digital Thermometer With	RYG_FS0618	31-Aug-22	31-Aug-23	12
Rayong Lab	Temperature	pH meter	RYG_FS0549	18-Aug-22	18-Aug-23	12

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# CONSOLE CONTROL UNIT CALIBRATION TEST REPORT

Calibration of Date : 13-Jan-23  
 Next Cal. Date : 13-Jul-23

Barometric Pressure (mmHg):  
 Relative Humidity (%)  
 Temperature (C°)  
**Reference Dry Gas Meter Data**  
 Reference Dry Gas Meter ID  
 Serial No.  
 Correction Factor (Y)  
 Next Calibration Date

C-130123-RYG\_FS0315  
 RYG\_FS0315  
 1706091  
 XC-572-V

ΔH (mm H <sub>2</sub> O)	Θ Minutes	Reference Dry Gas Meter Calibration				Console Control : Drygas Meter			
		Vr (Liters)		Tr (C°)		Vm (Liters)		Tt (C°)	
		Final	Initial	Total		Final	Initial	Total	
15	12.16	150.00	0.00	150.00	36.0	1659065.4	1659020.0	146.40	34.0
25	9.33	150.00	0.00	150.00	36.0	1659215.2	1659070.0	146.20	36.0
50	6.61	150.00	0.00	150.00	36.0	1659626.2	1659380.0	146.20	36.0
80	6.20	150.00	0.00	150.00	36.0	1660006.0	1659860.0	146.00	36.0
120	4.21	150.00	0.00	150.00	37.0	1660164.0	1660020.0	144.00	37.0

Y Ratio of reading of reference to dry gas meter : tolerance for individual values ± 0.02 from average  
 ΔHig Office pressure differential that equates to 21.24 in of air @ 25°C and 750 mmHg of mercury, mmH2O : tolerance for individual values  
 Procedure: 40 CFR 60 APP A METH. SEC 6.3 & 7  
 Calibrated by: *Saksit Phaisanphit*  
 (Mr. Saksit Phaisanphit)  
 Field Scientist(4)  
 Approved by: *Nattapon Jengwarewong*  
 (MCN)



## DIGITAL TEMPERATURE CALIBRATION DATA SHEET

Calibration Date : 13/01/23		Ambient Temperature (°C) 30	
Calibration sheet No. : C-130123-RYG_FS0316		Relative Humidity (%) : 55	
Digital Temperature ID : RYG_FS0316		Reference Temperature ID : BKK_FS0609	
Console Serial No. : 1706091		Serial No. : 7688004	
Model : XC-572-V		Model : FLUKE 714	
		Last Calibrate : 1/25/22	

Location	Reference Temperature °C	Digital Temperature °C	Error °C	Remark
Stack	0	1	1	
	25	26	1	
	50	51	1	
	100	101	1	
	150	151	1	
	200	201	1	
	250	251	1	
	300	301	1	
	500	501	1	
	1000	1001	1	
Probe	1200	1201	1	
	100	101	1	
	120	121	1	
	140	141	1	
Filter	100	101	1	
	120	121	1	
	140	141	1	
Exit	0	1	1	
	10	11	1	
	20	21	1	
Meter	0	1	1	
	25	26	1	
	50	51	1	
AUX	0	1	1	
	25	26	1	
	50	51	1	

Calibrated by: *Saksit Phaisanphit*  
 Mr. Saksit Phaisanphit  
 Field Scientist (4)

Approved by: *Nattapon Jengwarewong*  
 Mr. Nattapon Jengwarewong  
 Specialist (1)



PROBE NOZZLE DIAMETER  
CALIBRATION DATA SHEET

Calibration Date : 13 Jan 23 Nozzle Set ID. : RYG\_FS0319  
Calibration Sheet No. : C-130123-RYG\_FS0319 Vernier Caliper ID.: BKK\_FS1123

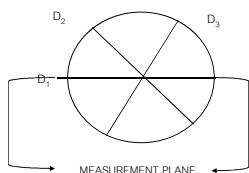
Nozzle ID #	Nozzle Diameter (cm.)			Hi - Lo $\Delta D$	$(D_1 + D_2 + D_3) / 3$ $D_{avg}$
	$D_1$	$D_2$	$D_3$		
1	0.300	0.300	0.300	0.000	0.300
2	0.470	0.465	0.465	0.005	0.467
3	0.600	0.600	0.600	0.000	0.600
4	0.770	0.760	0.755	0.015	0.762
5	0.920	0.930	0.930	0.010	0.927
6	1.080	1.080	1.085	0.005	1.082
7	1.240	1.230	1.235	0.010	1.235
8	1.594	1.598	1.597	0.004	1.596

Where :

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

$\Delta D$  = Maximum distance between any two diameters, must be  $\leq 0.100$  mm.

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



Calibrated by : Saksit Phaisanphiset

( Mr. Saksit Phaisanphiset )

Field Scientist (4)

Approved by : Nattapon Jengwareewong

( Mr. Nattapon Jengwareewong )

Field Specialist (1)

FORM NO: F 06-026 REVISION NO: 1 ISSUE DATE: 30 Jun 22



Pitot Tube Calibration Data

Pitot Tube Identification Number : RYG\_FS0320 Calibration Date : 13 Jan 23  
Lab test duct Number : 258-1-13-01 Standard Pitot ID : BKK\_FS0441  
Calibration Sheet No. : C-130123-RYG\_FS0320 Cp Standard : 0.99

Type S Pitot Tube Coefficient Data					
	Type s pitot tube Leg A,B	Standard pitot tube ( $\Delta P$ , mm.H <sub>2</sub> O)	Type s pitot tube ( $\Delta P$ , mm.H <sub>2</sub> 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

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

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

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

Calibrated by : Saksit Phaisanphiset

( Mr. Saksit Phaisanphiset )

Field Scientist (4)

Approved by : Nattapon Jengwareewong

( Mr. Nattapon Jengwareewong )

Specialist (1)

FORM NO: F 06-025 REVISION NO: 1 ISSUE DATE: 30 Jun 22



Pitot Tube Calibration Data

Pitot Tube Identification Number : RYG\_FS0321 Calibration Date : 13 Jan 23  
Lab test duct Number : 258-1-13-01 Standard Pitot ID : BKK\_FS0441  
Calibration Sheet No. : C-130123-RYG\_FS0321 Cp Standard : 0.99

Type S Pitot Tube Coefficient Data					
	Type s pitot tube Leg A,B	Standard pitot tube ( $\Delta P$ , mm.H <sub>2</sub> O)	Type s pitot tube ( $\Delta P$ , mm.H <sub>2</sub> 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

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

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

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

Calibrated by : Saksit Phaisanphiset

( Mr. Saksit Phaisanphiset )

Field Scientist (4)

Approved by : Nattapon Jengwareewong

( Mr. Nattapon Jengwareewong )

Specialist (1)

FORM NO: F 06-025 REVISION NO: 1 ISSUE DATE: 30 Jun 22

ENTECH

Calibration Certificate



Certificate No: G 660042  
Date of issue : 24-Jan-23

Instrument description : Flue gas Analyzer  
Instrument model : Testo 350 New  
Instrument serial no. : 62087344  
ID no. or control no. : RYG\_FS0464  
Manufacturer : Testo SE & Co. KGaA  
Probe description :  
Probe model :  
Probe serial :  
Customer name : ALS LABORATORY (THAILAND) CO., LTD.  
Customer address : 104 Phatthanasarak 40, Phatthanasarak Road, Khwaeng Phatthanasarak, Khet Suan Luang, Bangkok, 10250 Thailand  
Total pages of certificate : 3 Pages  
Receiving no. : 1-230167  
Receiving date : 20-Jan-23  
Parameter of calibration : Gas Calibration(Oxygen 2.496,10.04,21.02 %vol, Oxygen Monoxide 50.14,399.9,1003 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 stabilized laboratory  
Temperature : 23  $\pm$  5 °C  
Humidity : 55  $\pm$  15 %RH  
Calibration place : 17/121 Soi Nongwongwan 47 Yaek 48, Toongsonghong, Laksa, Bangkok 10210

Calibration procedure no. : W-CL-25-C

The calibration certificate expanded uncertainty of measurement is stated as the standard uncertainty of measurment 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 : 23-Jan-23

Saksit Phaisanphiset  
Mr. Saksit Phaisanphiset  
Calibration Technician

Nattapon Jengwareewong  
Mrs. Nongluck Wongkietee  
Technical Manager

FM-CL-06-C Rev.8

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Issued Date 28/02/16

Entech Industrial Solution Co., Ltd.

17/121 Soi Nongwongwan 47 Yaek 48, Toongsonghong, Laksa, Bangkok 10210 THAILAND Tel.01-2779-8888 | Calibration@entech.co.th  
Fax.01-0106536935591 | www.entech.co.th



Standard References (Table 1)

Standard	Certificate No.	Vendor	Due date
Oxygen ( O <sub>2</sub> ) 2.498 % Vol	4219/21	Linde	30-Sep-25
Oxygen ( O <sub>2</sub> ) 10.04 % Vol	CG-0153-21	Nimet	18-Nov-26
Oxygen ( O <sub>2</sub> ) 21.02 % Vol	CG-0041-22	Nimet	10-Feb-27
Carbon monoxide ( CO ) 80.14 ppm	CG-0040-22	Nimet	14-Feb-27
Carbon monoxide ( CO ) 309.9 ppm	2803/21	Linde	22-Jun-23
Carbon monoxide ( CO ) 1003 ppm	2583/22	Linde	09-Aug-24
Nitrogen Dioxide ( NO <sub>2</sub> ) 30.34 ppm	2703/22	Linde	22-Aug-24
Nitrogen Dioxide ( NO <sub>2</sub> ) 80.96 ppm	2041/22	Linde	26-Jun-24
Nitrogen Dioxide ( NO <sub>2</sub> ) 202.2 ppm	3239/21	Linde	20-Jun-23
Nitric Oxide ( NO ) 30.06 ppm	CG-0059-22	Nimet	13-Jun-24
Nitric Oxide ( NO ) 150.9 ppm	3047/21	Linde	25-Jun-23
Nitric Oxide ( NO ) 320.6 ppm	2944/21	Linde	02-Jul-23
Sulphur Dioxide ( SO <sub>2</sub> ) 50.04 ppm	3205/21	Linde	25-Jul-23
Sulphur Dioxide ( SO <sub>2</sub> ) 100.8 ppm	3507/22	Linde	09-Nov-24
Sulphur Dioxide ( SO <sub>2</sub> ) 601.1 ppm	3204/21	Linde	20-Jul-23

Measured room conditions:

Temperature : 22.2 °C Humidity : 58.9 %RH Pressure : 1014.9 mbar

Calibration conditions

Gas Temperature : 23 °C Flow rate : 1,200 ml/min Gas pressure : 1021.9 mbar

Calibration Results Before Adjustment (Table 2)

Parameter of Standard	Standard Values	Mean of UUC	Error	Uncertainty (1)
O <sub>2</sub> (%Vol)	2.498	2.47	-0.028	0.20
O <sub>2</sub> (%Vol)	10.04	9.95	-0.09	0.40
O <sub>2</sub> (%Vol)	21.02	21.08	0.06	0.80
CO (ppm)	80.14	80	-0.14	3.0
CO (ppm)	309.9	306	-3.9	6.0
CO (ppm)	1003	995	-8	12
NO <sub>2</sub> (ppm)	30.34	27.9	-2.44	6.6
NO <sub>2</sub> (ppm)	80.96	74.4	-6.56	8.0
NO <sub>2</sub> (ppm)	202.2	195.1	-7.1	12
NO (ppm)	150.9	153	2.1	8.0
NO (ppm)	320.6	319	-0.6	12
NO (ppm)	50.04	49	-1.04	6.0
SO <sub>2</sub> (ppm)	100.8	101	0.2	6.0
SO <sub>2</sub> (ppm)	601.1	603	1.9	12



Calibration Results After Adjustment (Table 3)

Parameter of Standard	Standard Values	Mean of UUC	Error	Uncertainty (1)
O <sub>2</sub> (%Vol)	2.498	2.47	-0.028	0.20
O <sub>2</sub> (%Vol)	10.04	9.95	-0.09	0.40
O <sub>2</sub> (%Vol)	21.02	21.08	0.06	0.80
CO (ppm)	80.14	80	-0.14	3.0
CO (ppm)	309.9	306	-3.9	6.0
CO (ppm)	1003	995	-8	12
NO <sub>2</sub> (ppm)	30.34	29.2	-1.14	6.6
NO <sub>2</sub> (ppm)	80.96	81.3	0.34	8.0
NO <sub>2</sub> (ppm)	202.2	204.4	2.2	12
NO (ppm)	150.9	153	2.1	8.0
NO (ppm)	320.6	315	-5.6	12
NO (ppm)	50.04	49	-1.04	6.0
SO <sub>2</sub> (ppm)	100.8	101	0.2	6.0
SO <sub>2</sub> (ppm)	601.1	603	1.9	12

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

End of Report



DRY GAS METER CALIBRATION TEST REPORT

Calibration of Date : 13-Jan-23 Barometric Pressure ( mm.Hg ) : 760  
Next Calibration Date : 13-Jul-23 Relative Humidity ( % ) : 55.0  
Temperature ( °C ) : 30.0

Dry Gas Meter Data Reference Dry Gas Meter Data  
Calibration sheet No. : C-130123-RYG\_FS0317 Reference Dry Gas Meter ID : BKK\_FS1122  
Dry Gas Meter ID : RYG\_FS0317 Serial No. : A2003240  
Serial No. : 1706003 Correction Factor (Y) : 1.0160  
Model No. : XC-62-CV Next Calibration Date : 27 May 23

Reference Dry Gas Meter Calibration				Dry Gas Meter						Dry Gas Meter Correction
Vr (Liters)			Tr (°C)	Vm (Liters)			Ti (°C)	To (°C)	Avg. Tm (°C)	Factor (Y)
Final	Initial	Total		Final	Initial	Total				
30.00	0.00	30.00	27.0	30.10	0.00	30.10	27.0	27.0	27.0	1.0126
30.00	0.00	30.00	29.0	30.27	0.00	30.27	29.0	29.0	29.0	1.0069
60.00	0.00	60.00	30.0	60.11	0.00	60.11	30.0	30.0	30.0	1.0141
60.00	0.00	60.00	31.0	60.10	0.00	60.10	31.0	31.0	31.0	1.0143
90.00	0.00	90.00	31.0	89.78	0.00	89.78	31.0	31.0	31.0	1.0185
90.00	0.00	90.00	32.0	89.77	0.00	89.77	32.0	32.0	32.0	1.0186
Avg.										1.0142

Y = Ratio of reading of reference dry gas meter to dry gas meter ; tolerance for individual  $\pm$  0.05 from average.

Calibrate by :

Mr.(Tinnakorn Kulchart)  
Field Scientist (1)

Approved by :

Mr.(Nattapol Jengwareewong)  
Specialist (1)



DIGITAL TEMPERATURE CALIBRATION DATA SHEET

Calibration Date : 13 Jan 23		Ambient Temperature (°C) 30		
Calibration sheet No. : C-130123-RYG_FS0317		Relative Humidity (%): 55		
Digital Temperature ID : RYG_FS0317		Reference Temperature ID BKK_FS0609		
Console Serial No. :		Serial No. : 7688004		
Model : XC-62-CV		Model : FLUKE 714		
		Last Calibrate : 25-Jan-23		
Location	Reference Temperature °C	Digital Temperature °C	Error °C	Remark
Stack	0	0	0	
	25	25	0	
	50	50	0	
	100	100	0	
	150	150	0	
	200	200	0	
	250	250	0	
	300	301	1	
	500	501	1	
	1000	1002	2	
Probe	1200	1203	3	
	100	100	0	
	120	120	0	
Filter	140	140	0	
	100	100	0	
	120	120	0	
Exit	140	140	0	
	0	0	0	
	10	10	0	
Meter	20	20	0	
	0	0	0	
	25	25	0	
AUX	50	50	0	
	0	0	0	
	25	25	0	
	50	50	0	

Calibrated by :

Mr.Tinnakorn Kulchart  
Field Scientist (1)

Approved by :

Mr.Nattapol Jengwareewong  
Specialist (1)







Cert No.: 21P3344  
Page: 2 of 2

#### Result of calibration: Without adjustment

Function: Vacuum Pressure Measurement

Range: 0 inHg to -30 inHg

Scale Interval: 0.5 inHg (The Fifth Estimate)

#### Increasing Pressure

Applied Pressure (inHg)	0.00	-4.97	-9.97	-14.97	-19.99	-26.02
UUC* Indication (inHg)	0.0	-5.0	-10.0	-15.0	-20.0	-26.0
Error (inHg)	0.00	-0.03	-0.03	-0.03	-0.01	0.02

#### Decreasing Pressure

Applied Pressure (inHg)	-26.00	-19.97	-14.95	-9.96	-4.97	0.00
UUC* Indication (inHg)	-26.0	-20.0	-15.0	-10.0	-5.0	0.0
Error (inHg)	0.00	-0.03	-0.05	-0.04	-0.03	0.00

The uncertainty of measurement was  $\pm 0.12$  inHg

\* UUC = Unit Under Calibration

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

-000-

11749-1 P

1075035



## Certificate of Calibration

Equipment: SPECTROPHOTOMETER  
Model: DK3900  
Serial No. (or ID.): 2021761 (RYG\_EN0179)  
Manufacturer: HACH  
Condition: In Condition

Certificate No.: C06220465  
Issued Date: 27 September 2022  
Job No.: KSPR2212225  
Page: 1 of 3

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

REVIEW BY: N. S. A. N. F.  
APPROVED BY: [Signature]  
NEED CAL. DATE: 27/9/23

Environment Condition: Temperature 22.5 °C  $\pm$  1.5 °C  
Humidity 67.5 %RH  $\pm$  1.5 %RH

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

Calibration By: Mr. Chaituphon Foltong  
Calibration Date: 27 September 2022  
The Method used: In house method, CAL-WI-24, base on ASTM E 275-06 and ASTM E 387-04  
Traceability: This certificate is traceable to the CRM maintained by National Institute of Standards and Technology (NIST) through Starna Scientific Limited.

The standard for Wavelength Certificate No. 91418 and 91435  
The standard for Photometric Certificate No. 91441  
The standard for Stray light Certificate No. 101040

(Mr. Chaituphon Foltong)

Person in charge

(Mr. Thalerngkeat Pongngam)

Authorized signatory

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

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

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

DKSH Technology Limited  
3533 Sukhumvit Road, Bangkok, Thailand 10260  
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CALFM-C06-13: 20 Jul 2022



Certificate No.: C06220465 Page 2 of 3

#### Calibration Results:

##### Without Adjustment

Wavelength Accuracy (nm), The spectral bandwidth of Sld at 5 nm and UUC at 5 nm

Standard Wavelength	Unit Under Calibration	Correction	Uncertainty
418.40	418	0.40	0.58
537.00	536	1.00	0.58
636.00	636	0.00	0.58
747.61	746	-0.39	0.58
807.04	807	0.04	0.59

#### Photometric Accuracy (Absorbance)

Wavelength	Standard absorbance	Unit Under Calibration	Correction	Uncertainty
420 nm	0.0000	0.000	0.0000	0.0045
	0.5605	0.562	-0.0015	0.0045
	0.7334	0.735	-0.0016	0.0045
	1.0534	1.054	-0.0006	0.0045
440 nm	0.0000	0.000	0.0000	0.0045
	0.5503	0.550	0.0003	0.0045
	0.7178	0.718	-0.0001	0.0045
	1.0312	1.031	0.0002	0.0045
465 nm	0.0000	0.000	0.0000	0.0045
	0.5024	0.505	-0.0028	0.0045
	0.6893	0.671	-0.0017	0.0045
	0.9604	0.964	-0.0036	0.0045
546.1 nm	0.0000	0.000	0.0000	0.0045
	0.5166	0.519	-0.0022	0.0045
	0.6903	0.691	-0.0007	0.0045
	0.9904	0.992	-0.0016	0.0045
590 nm	0.0000	0.000	0.0000	0.0045
	0.5525	0.553	-0.0005	0.0045
	0.7175	0.717	0.0005	0.0045
	1.0301	1.030	0.0001	0.0045
635 nm	0.0000	0.000	0.0000	0.0045
	0.5367	0.536	-0.0013	0.0045
	0.6847	0.685	-0.0003	0.0045
	0.9823	0.983	-0.0007	0.0045

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CALFM-C06-13: 20 Jul 2022



Certificate No.: C06220465 Page 3 of 3

#### Calibration Results:

##### Without Adjustment

Stray light \*

Standard: cut-off	UUC: Wavelength (nm)	UUC: Transmittance (%T)	Absorbance (A)
391.84 $\pm$ 0.11 nm	392	4.1	1.387

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

The End of Certificate

DKSH Technology Limited  
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CALFM-C06-13: 20 Jul 2022





## ใบตรวจสอบสภาพเครื่องวัดสิ่งแวดล้อม

เลขที่ใบงาน: KQPF2212225

ชนิดเครื่องมือ: SPECTROPHOTOMETER

รุ่น: DR3800

หมายเลขเครื่อง: 2021761

ตรวจสอบ (รับ)	ตรวจสอบ (ส่ง)	หมายเหตุ
27 Sep 2022	27 Sep 2022	
ปกติ	ปกติ	
General		
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	1. ความสมบูรณ์เครื่อง
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	2. ความสะอาด (ช่องใส่ตัวอย่าง, ภายใน-นอกเครื่อง)
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	3. สวิตช์ เปิด - ปิด เครื่อง (On-Off Switch)
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	4. ปุ่มกด (Keypad)
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	5. หน้าจอ (Display, Screen Contrast)
Spectrophotometer		
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	6. แบตเตอรี่สำรอง (Battery Backup) >= 2.5 VDC
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	7. ตัวควบคุมความยาวคลื่น (Wavelength Control)
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	8. ความยาวคลื่น (Wavelength Check) 807 ± 0.07 nm
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	9. แสงยูวี (UV < 3,000 hour)
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	10. แสงที่มองเห็น (Visible < 5,000 hour)
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	11. ช่องใส่ตัวอย่าง (Carousel Module)
pH Meter and Conductivity Meter		
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	12. อิเล็กโทรด (Electrode and Connection Cable)
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	13. ระดับสารละลายใน Electrode (Level KCl)
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	14. ฝาปิดกันปลาย Electrode (Dust Protection Hood)
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	15. ขาจับอิเล็กโทรด (Stand)
Turbidimeter		
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	16. ค่าความขุ่นที่ต่ำสุด (No Sample)
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	17. ระดับการไหลของน้ำ (Flow Rate >= 2.5 ไม่เกิน 3.0)
Automatic titrator		
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	18. สภาพ Piston Burettes
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	19. Function Rinsing and Dosing
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	20. ระบบท่อสายยางและอุปกรณ์ประกอบ

แจ้งปริมาณตัวอย่าง :

Mr. Chetuphon Foithong  
Service Engineer

DKSH Technology Limited  
2533 ถนนสุขุมวิท แขวงคลองเตย เขตคลองเตย กรุงเทพมหานคร 10260  
Phone: +66 2539 7000 Email: info@dksh.com Website: www.dksh.com

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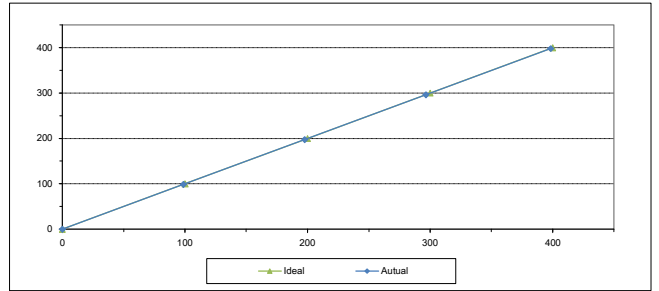
CAL-FM-R31-03: 20 Jul 2022



## MULTIPOINT CALIBRATION REPORT

Calibration Date	4-Jan-23	Equipment Name	SO2 Analyzer
Manufacturer	HORIBA	Model	APSA-370
Serial No.	VABF9LSH	Equipment ID	RYG_FS0460
Calibrator Manufacturer	Teledyne API	Model	700
Serial No.	947		
Std. Gas Concentration (PPM)	56.3	Cylinder No.	GN0027222
Cylinder Pressure (psi)	1800	Certified By	Algass 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	98.70	-1.30	-1.30
2	200.00	197.80	-2.20	-1.10
3	300.00	296.50	-3.50	-1.17
4	400.00	398.30	-1.70	-0.42
AVERAGE (%)				-0.78



Calibrated By

Approved By

(Mr. Jirawut Sakam)  
Field Environmental Scientist (3)(Mr. Sarayuth Jitranont)  
Assistant General Manager

ALS Laboratory Group

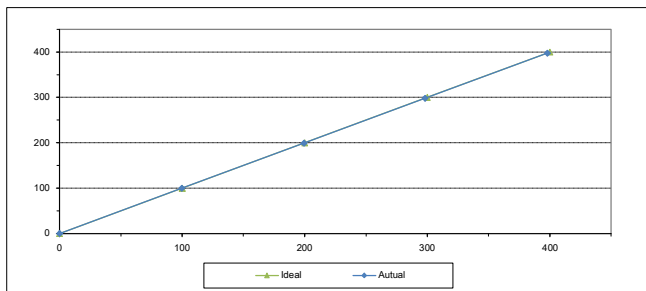
FORM NO.: F 06-056 REVISION NO.: ISSUE DATE: 02/04/12



## MULTIPOINT CALIBRATION REPORT

Calibration Date	4-Jan-23	Equipment Name	SO2 Analyzer
Manufacturer	HORIBA	Model	APSA-370
Serial No.	YPRXJ20	Equipment ID	RYG_FS0263
Calibrator Manufacturer	Teledyne API	Model	700
Serial No.	947		
Std. Gas Concentration (PPM)	56.3	Cylinder No.	GN0027222
Cylinder Pressure (psi)	1800	Certified By	Algass 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	99.80	-0.20	-0.20
2	200.00	199.40	-0.60	-0.30
3	300.00	298.20	-1.80	-0.60
4	400.00	398.00	-2.00	-0.50
AVERAGE (%)				-0.30



Calibrated By

Approved By

(Mr. Jirawut Sakam)  
Field Environmental Scientist (3)(Mr. Sarayuth Jitranont)  
Assistant General Manager

ALS Laboratory Group

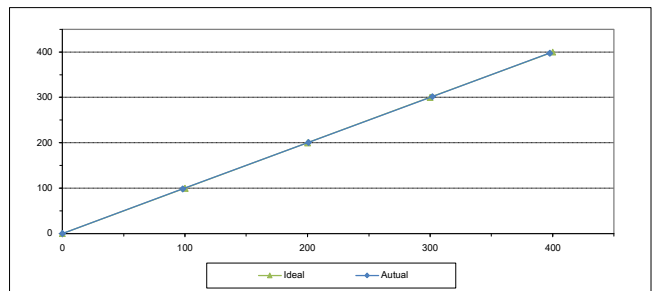
FORM NO.: F 06-056 REVISION NO.: ISSUE DATE: 02/04/12



## MULTIPOINT CALIBRATION REPORT

Calibration Date	4-Jan-23	Equipment Name	SO2 Analyzer
Manufacturer	HORIBA	Model	APSA-370
Serial No.	H0S3D9FA	Equipment ID	RYG_FS0464
Calibrator Manufacturer	Teledyne API	Model	700
Serial No.	947		
Std. Gas Concentration (PPM)	56.3	Cylinder No.	GN0027222
Cylinder Pressure (psi)	1800	Certified By	Algass 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	98.30	-1.70	-1.70
2	200.00	200.80	0.80	0.40
3	300.00	301.90	1.90	0.63
4	400.00	397.50	-2.50	-0.63
AVERAGE (%)				-0.24



Calibrated By

Approved By

(Mr. Jirawut Sakam)  
Field Environmental Scientist (3)(Mr. Sarayuth Jitranont)  
Assistant General Manager

ALS Laboratory Group

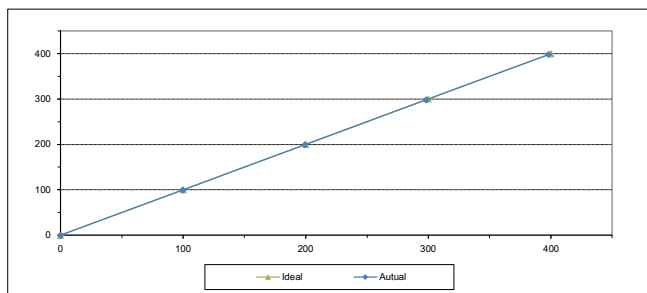
FORM NO.: F 06-056 REVISION NO.: ISSUE DATE: 02/04/12



### MULTIPOINT CALIBRATION REPORT

Calibration Date 4-Jan-23 Equipment Name SO2 Analyzer  
Manufacturer HORIBA Model APSA-370  
Serial No. R0HWYDVW Equipment ID RYG\_FS0456  
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	99.70	-0.30	-0.30
2	200.00	199.50	-0.50	-0.25
3	300.00	298.30	-1.70	-0.57
4	400.00	398.10	-1.90	-0.47
AVERAGE (%)				-0.30



Calibrated By

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

Approved By

(Mr. Sarayuth Jitranont)  
Assistant General Manager

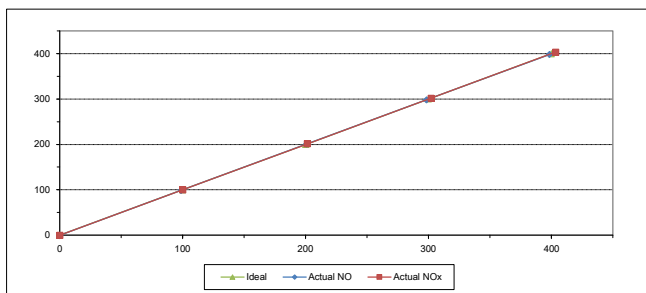
ALS Laboratory Group  
FORM NO.: F 06-056 REVISION NO.: - ISSUE DATE: 02/04/12



### MULTIPOINT CALIBRATION REPORT

Calibration Date 5-Jan-23 Equipment Name NOx Analyzer  
Manufacturer HORIBA Model APNA-370  
Serial No. T96HWM41 Equipment ID RYG\_FS0461  
Calibrator Manufacturer Teledyne API Model 700  
Serial No. 947  
Std. Gas Concentration (PPM) 55.88 Cylinder No. GN0027222  
Cylinder Pressure (psi) 1800 Certified By Airgas Inc.  
Certified Date 9-Feb-22 Expired Date 9-Feb-30

Point	CALIBRATION RESULTS						
	Ideal	Actual NO	Error NO	%Error NO	Actual NOx	Error NOx	%Error NOx
ZERO	0.00	0.10	0.10	0.10	0.10	0.10	0.10
1	100.00	98.70	-1.30	-1.30	100.10	0.10	0.10
2	200.00	201.00	1.00	0.50	201.40	1.40	0.70
3	300.00	298.30	-1.70	-0.57	302.10	2.10	0.70
4	400.00	398.40	-1.60	-0.40	403.50	3.50	0.88
AVERAGE (%)				-0.33			0.60



Calibrated By

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

Approved By

(Mr. Sarayuth Jitranont)  
Assistant General Manager

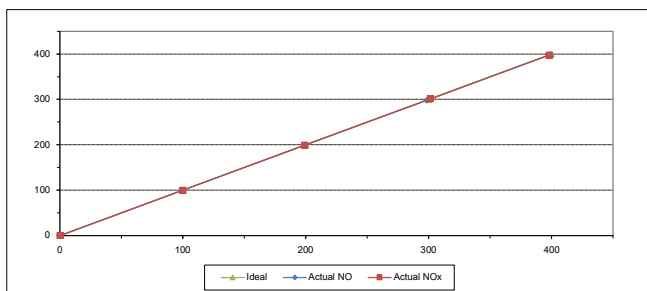
ALS Laboratory Group  
FORM NO.: F 06-056 REVISION NO.: - ISSUE DATE: 02/04/12



### MULTIPOINT CALIBRATION REPORT

Calibration Date 5-Jan-23 Equipment Name NOx Analyzer  
Manufacturer HORIBA Model APNA-370  
Serial No. 8G314J3K Equipment ID RYG\_FS0264  
Calibrator Manufacturer Teledyne API Model 700  
Serial No. 947  
Std. Gas Concentration (PPM) 55.88 Cylinder No. GN0027222  
Cylinder Pressure (psi) 1800 Certified By Airgas Inc.  
Certified Date 9-Feb-22 Expired Date 9-Feb-30

Point	CALIBRATION RESULTS						
	Ideal	Actual NO	Error NO	%Error NO	Actual NOx	Error NOx	%Error NOx
ZERO	0.00	0.05	0.05	0.05	0.10	0.10	0.10
1	100.00	99.20	-0.80	-0.80	100.10	0.10	0.10
2	200.00	198.40	-1.60	-0.80	199.10	-0.90	-0.45
3	300.00	298.60	-1.40	-0.47	301.50	1.50	0.50
4	400.00	398.10	-1.90	-0.47	398.00	-2.00	-0.50
AVERAGE (%)				-0.50			-0.05



Calibrated By

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

Approved By

(Mr. Sarayuth Jitranont)  
Assistant General Manager

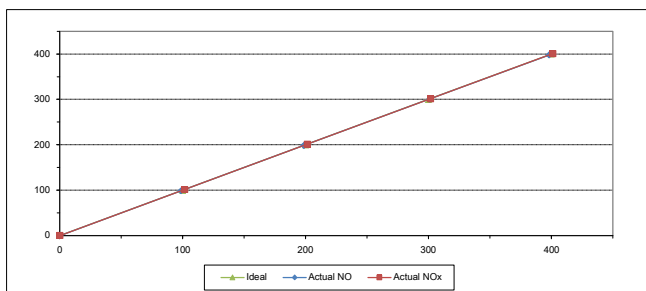
ALS Laboratory Group  
FORM NO.: F 06-056 REVISION NO.: - ISSUE DATE: 02/04/12



### MULTIPOINT CALIBRATION REPORT

Calibration Date 5-Jan-23 Equipment Name NOx Analyzer  
Manufacturer HORIBA Model APNA-370  
Serial No. ALPOVOWY Equipment ID RYG\_FS0455  
Calibrator Manufacturer Teledyne API Model 700  
Serial No. 947  
Std. Gas Concentration (PPM) 55.88 Cylinder No. GN0027222  
Cylinder Pressure (psi) 1800 Certified By Airgas Inc.  
Certified Date 9-Feb-22 Expired Date 9-Feb-30

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



Calibrated By

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

Approved By

(Mr. Sarayuth Jitranont)  
Assistant General Manager

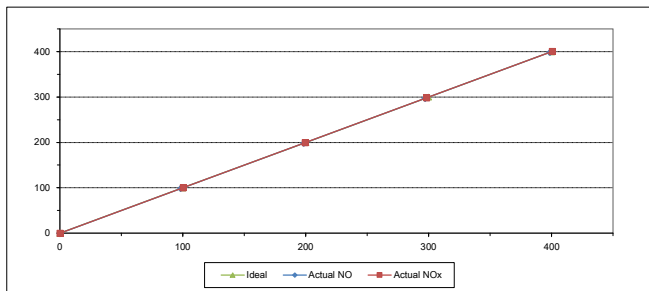
ALS Laboratory Group  
FORM NO.: F 06-056 REVISION NO.: - ISSUE DATE: 02/04/12



## MULTIPOINT CALIBRATION REPORT

Calibration Date	5-Jan-23	Equipment Name	NOx Analyzer
Manufacturer	HORIBA	Model	APNA-370
Serial No.	T2T8YRL	Equipment ID	RYG_FS0457
Calibrator Manufacturer	Teledyne API	Model	700
Serial No.	947		
Std. Gas Concentration (PPM)	55.88	Cylinder No.	GN0027222
Cylinder Pressure (psi)	1800	Certified By	Airgas Inc.
Certified Date	9-Feb-22	Expired Date	9-Feb-30

Point	CALIBRATION RESULTS						
	Ideal	Actual NO	Error NO	%Error NO	Actual NOx	Error NOx	%Error NOx
ZERO	0.00	0.10	0.10	0.10	0.10	0.10	0.10
1	100.00	98.30	-1.70	-1.70	100.20	0.20	0.20
2	200.00	198.40	-1.60	-0.80	199.60	-0.40	-0.20
3	300.00	297.10	-2.90	-0.97	298.50	-1.50	-0.50
4	400.00	398.60	-1.40	-0.35	400.70	0.70	0.17
AVERAGE (%)				-0.74			-0.05



Calibrated By

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

Approved By

(Mr. Sarayuth Jitranont)  
Assistant General Manager

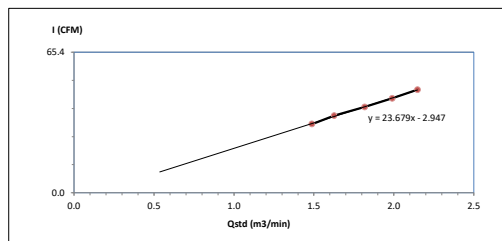
ALS Laboratory Group  
FORM NO.: F 06-056 REVISION NO.: - ISSUE DATE: 02/04/12



## High Volume Air Sampler Calibration Worksheet

Project Site:	Amata B.Grimm Power (Rayong) 3 Limited	Barometric Pressure (mm Hg):	753
Calibrate Location:	โรงไฟฟ้าพลังงานทดแทน ลำนครหลวง	Temperature (°C):	32
Calibrate Date:	21-Mar-23	High Volume ID:	RYG_FS0190
Calibration Sheet No.:	C-210323-RYG_FS0190	High Volume Model:	G1051
Calibrator ID:	RYG_FS0205	High Volume S/N:	1625
Calibrator Model:	TE-5028A	Calibrator Slope:	0.94434
Calibrator S/N:	1166	Calibrator Intercept:	-0.01292

Test No.	Delta H <sub>2</sub> O (inch)	Q <sub>std</sub> (m³/min)	I: Chart (CFM)	Linear Regression
1	2.0	1.4864	32	Slope: 23.6786 Intercept: -2.9470 Correlation Coefficient: 0.9991
2	2.4	1.6270	36	
3	3.0	1.8175	40	
4	3.6	1.9897	44	
5	4.2	2.1481	48	



Calibrated by

(Mr. Nontchai Uppathamp)  
Field Scientist(1)

Approved by:

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

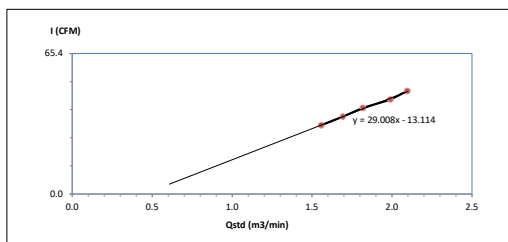
FORM NO.: F 06-074 REVISION NO.: - ISSUE DATE: 14/03/16



## High Volume Air Sampler Calibration Worksheet

Project Site:	Amata B.Grimm Power (Rayong) 3 Limited	Barometric Pressure (mm Hg):	753
Calibrate Location:	โรงไฟฟ้าลำนครหลวง	Temperature (°C):	32
Calibrate Date:	21-Mar-23	High Volume ID:	RYG_FS0398
Calibration Sheet No.:	C-210323-RYG_FS0398	High Volume Model:	TE-5009X
Calibrator ID:	RYG_FS0205	High Volume S/N:	5684
Calibrator Model:	TE-5028A	Calibrator Slope:	0.94434
Calibrator S/N:	1166	Calibrator Intercept:	-0.01292

Test No.	Delta H <sub>2</sub> O (inch)	Q <sub>std</sub> (m³/min)	I: Chart (CFM)	Linear Regression
1	2.2	1.5583	32	Slope: 29.0079 Intercept: -13.1141 Correlation Coefficient: 0.9981
2	2.6	1.6929	36	
3	3.0	1.8175	40	
4	3.6	1.9897	44	
5	4.0	2.0967	48	



Calibrated by

(Mr. Nontchai Uppathamp)  
Field Scientist(1)

Approved by:

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

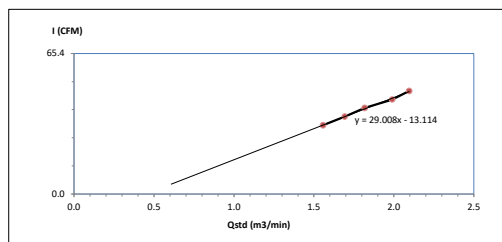
FORM NO.: F 06-074 REVISION NO.: - ISSUE DATE: 14/03/16



## High Volume Air Sampler Calibration Worksheet

Project Site:	Amata B.Grimm Power (Rayong) 3 Limited	Barometric Pressure (mm Hg):	753
Calibrate Location:	โรงไฟฟ้าลำนครหลวง	Temperature (°C):	32
Calibrate Date:	21-Mar-23	High Volume ID:	RYG_FS0397
Calibration Sheet No.:	C-210323-RYG_FS0397	High Volume Model:	TE-5009X
Calibrator ID:	RYG_FS0205	High Volume S/N:	5687
Calibrator Model:	TE-5028A	Calibrator Slope:	0.94434
Calibrator S/N:	1166	Calibrator Intercept:	-0.01292

Test No.	Delta H <sub>2</sub> O (inch)	Q <sub>std</sub> (m³/min)	I: Chart (CFM)	Linear Regression
1	2.2	1.5583	32	Slope: 29.0079 Intercept: -13.1141 Correlation Coefficient: 0.9981
2	2.6	1.6929	36	
3	3.0	1.8175	40	
4	3.6	1.9897	44	
5	4.0	2.0967	48	



Calibrated by

(Mr. Nontchai Uppathamp)  
Field Scientist(1)

Approved by:

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

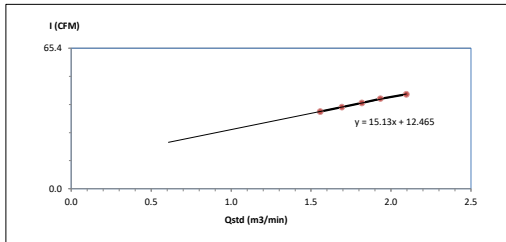
FORM NO.: F 06-074 REVISION NO.: - ISSUE DATE: 14/03/16



## High Volume Air Sampler Calibration Worksheet

Project Site:	Amata B.Grimm Power (Rayong) 3 Limited	Barometric Pressure (mm Hg):	753
Calibrate Location:	ศูนย์พัฒนาสิ่งแวดล้อมอนุรักษ์ธรรมชาติ ถ้ำเขาชะเมา	Temperature (°C):	32
Calibrate Date:	21-Mar-23	High Volume ID:	RYG_FS0295
Calibration Sheet No.:	C-210323-RYG_FS0295	High Volume Model:	TE-5009X
Calibrator ID:	RYG_FS0205	High Volume S/N:	5502
Calibrator Model:	TE-5028A	Calibrator Slope:	0.94434
Calibrator S/N:	1166	Calibrator Intercept:	-0.01292

Test No.	Delta H <sub>2</sub> O (inch)	Q <sub>std</sub> (m <sup>3</sup> /min)	I: Chart (CFM)	Linear Regression
1	2.2	1.5583	36	Slope: 15.1299 Intercept: 12.4653 Correlation Coefficient: 0.9985
2	2.6	1.6929	38	
3	3.0	1.8175	40	
4	3.4	1.9341	42	
5	4.0	2.0967	44	



Calibrated by: *N. Nontachai Uppathamp*  
(Mr. Nontachai Uppathamp)  
Field Scientist(1)

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

FORM NO.: F 06-074 REVISION NO.: - ISSUE DATE: 14/03/16

Sartorius (Thailand) Co., Ltd.  
129 Rama 9 Road, Huaykwang, Huaykwang, Bangkok 10310  
Tel: +66 2643 8361-8, e-mail: service.thailand@sartorius.com



MAC  
KSC 1701 TIS 17025  
CALIBRATION 0426

SARTORIUS

## Certificate of Calibration

REVIEW BY: *Thamit*  
APPROVED BY: *D. Juntarup*  
NEXT CAL DATE: 01/05/24

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

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

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

Calibrated By: Mr Chonchai Inthana  
Calibration Date: Wednesday, March 01, 2023

Calibration Procedure No.: This calibration was conducted by Using in-house calibration procedure number (WI-003)  
Based on UKAS LAB 14 : 2019

Metrological data:		Ambients Conditions:	
Capacity:	150 g	Readability:	0.0001 g
		Temperature:	24.2 °C ± 5.0 °C
		Humidity:	60.0 % RH ± 10.0 % RH
		Pressure:	±
Reasons for calibration:		Equipment Condition:	
<input type="checkbox"/> New Installation <input type="checkbox"/> Service / Repair <input checked="" type="checkbox"/> Re-calibration/ Maintenance		<input checked="" type="checkbox"/> Good Operate <input type="checkbox"/> Fail	

## Measurement Method UKAS Publication Ref : Lab 14

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

## Traceability:

Model Number	Description	Traceability	Certificate No.	Due Date
YC5011-622-00	Sartorius weight set 1mg - 5000g P2 YC5011-622-00	SPC-RT	C02212565	14-Sep-2023
MHB-382SD	Humidity/Barometer/Temp. Lutron MHB-382SD	DKSH	C19220444	5-Sep-2023

This certificate relate and apply this equipment only.

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

*Chonchai Inthana*  
Mr.chonchai.inthana(Technical Manager)



SOP FM 33 03 February 2023

Sartorius (Thailand) Co., Ltd.  
129 Rama 9 Road, Huaykwang, Huaykwang, Bangkok 10310  
Tel: +66 2643 8361-8 Fax: +66 2643-8367, e-mail: service.thailand@sartorius.com

SARTORIUS

## Certificate of Calibration

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

## Calibration Results : Without Adjustment

Repeatability	Eccentricity (Off-center loading error)
The reproducibility is the ability of a weighing instrument to display nearly identical results 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 readout of the load, i.e. 1/3 or 1/4 of maximum capacity, placed in the middle of the weighing pan and between each of four additional measurement points (as depicted defined according to GUM, #18).
Nominal Value: (Low Load)	Nominal value: 50 g
10 g	Tolerance 0.0004 g
Tolerance 0.0001 g	
Nominal Value: (High Load)	
100 g	
Tolerance 0.0001 g	
Standard Deviation	

Linearity

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

Tolerance 0.0002 g

Nominal Value	Conventional Mass Value	Displayed Value	Deviation	Uncertainty
(g)	(g)	(g)	(g)	(g)
0.01	0.0100	0.0100	0.0000	0.00002
0.05	0.0500	0.0500	0.0000	0.000023
0.1	0.1000	0.1000	0.0000	0.000023
0.5	0.5000	0.5000	0.0000	0.000023
1	1.0000	1.0000	0.0000	0.000023
2	2.0000	2.0000	0.0000	0.000023
5	5.0000	5.0000	0.0000	0.000022
10	10.0000	10.0001	0.0001	0.000024
20	20.0000	20.0001	0.0001	0.000023
100	100.0000	100.0002	0.0002	0.000026

End of Report

End of Report

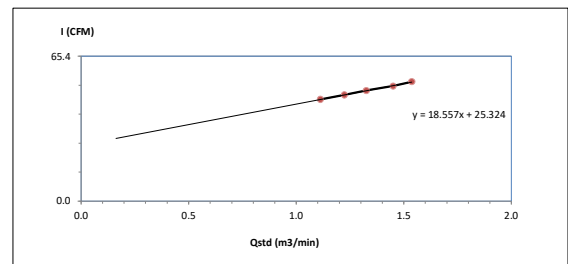
SOP FM 33 03 February 2023



## High Volume Air Sampler Calibration Worksheet

Project Site:	Amata B.Grimm Power (Rayong) 3 Limited	Barometric Pressure (mm Hg):	753
Calibrate Location:	โรงงานผลิตเส้นใยอุตสาหกรรมถ้ำเขาชะเมา	Temperature (°C):	32
Calibrate Date:	21-Mar-23	High Volume ID:	RYG_FS0182
Calibration Sheet No.:	C-210323-RYG_FS0182	High Volume Model:	TE-5170D
Calibrator ID:	RYG_FS0205	High Volume S/N:	5335
Calibrator Model:	TE-5028A	Calibrator Slope:	1.50765
Calibrator S/N:	1166	Calibrator Intercept:	-0.02043

Test No.	Delta H <sub>2</sub> O (inch)	Q <sub>std</sub> (m <sup>3</sup> /min)	I: Chart (CFM)	Linear Regression
1	2.8	1.1124	46	Slope: 18.5566 Intercept: 25.3237 Correlation Coefficient: 0.9989
2	3.4	1.2238	48	
3	4.0	1.3256	50	
4	4.8	1.4502	52	
5	5.4	1.5369	54	



Calibrated by: *N. Nontachai Uppathamp*  
(Mr. Nontachai Uppathamp)  
Field Scientist(1)

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

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

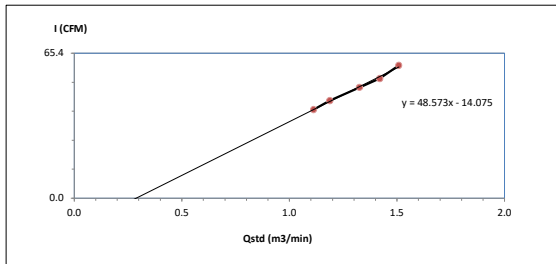




### High Volume Air Sampler Calibration Worksheet

Project Site : Amata B.Grimm Power (Rayong) 3 Limited  
Calibrate Location : โรงเรือนบำบัดน้ำทิ้ง  
Calibrate Date : 21-Mar-23  
CalibrationSheet No.: C-210323-RYG\_FS0291  
Calibrator ID: RYG\_FS0205  
Calibrator Model : TE-5028A  
Calibrator S/N : 1166  
Barometric Pressure (mm Hg) : 753  
Temperature (°C) : 32  
High Volume ID : RYG\_FS0291  
High Volume Model : TE-5170D  
High Volume S/N : 5333  
Calibrator Slope : 1.50765  
Calibrator Intercept : -0.02043

Test No.	Delta H <sub>2</sub> O (inch)	Q <sub>std</sub> (m <sup>3</sup> /min)	I: Chart (CFM)	Linear Regression
1	2.8	1.1124	40	Slope : 48.5726 Intercept : -14.0745 Correlation Coefficient : 0.9966
2	3.2	1.1878	44	
3	4.0	1.3256	50	
4	4.6	1.4201	54	
5	5.2	1.5086	60	



Calibrated by : hilypt  
(Mr.Nontachai Uppathamp)  
Field Scientist(1)

Approved by : 2. Pong  
(Mr. Noppong Juntarupan)  
Enviro Field Coordinator Scientist (3)

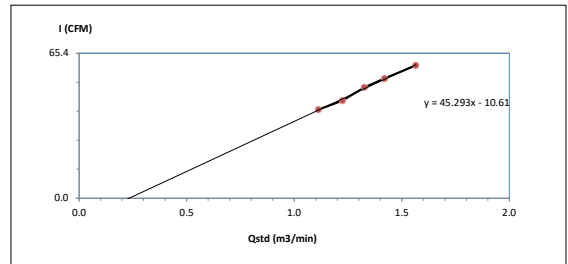
FORM NO.: F 06-073 REVISION NO.: ISSUE DATE: 14/03/16



### High Volume Air Sampler Calibration Worksheet

Project Site : Amata B.Grimm Power (Rayong) 3 Limited  
Calibrate Location : โรงเรือนบำบัดน้ำทิ้ง  
Calibrate Date : 21-Mar-23  
CalibrationSheet No.: C-210323-RYG\_FS0176  
Calibrator ID: RYG\_FS0205  
Calibrator Model : TE-5028A  
Calibrator S/N : 1166  
Barometric Pressure (mm Hg) : 753  
Temperature (°C) : 32  
High Volume ID : RYG\_FS0176  
High Volume Model : TE-5170D  
High Volume S/N : 4802  
Calibrator Slope : 1.50765  
Calibrator Intercept : -0.02043

Test No.	Delta H <sub>2</sub> O (inch)	Q <sub>std</sub> (m <sup>3</sup> /min)	I: Chart (CFM)	Linear Regression
1	2.8	1.1124	40	Slope : 45.2930 Intercept : -10.6096 Correlation Coefficient : 0.9976
2	3.4	1.2238	44	
3	4.0	1.3256	50	
4	4.6	1.4201	54	
5	5.6	1.5648	60	



Calibrated by : hilypt  
(Mr.Nontachai Uppathamp)  
Field Scientist(1)

Approved by : 2. Pong  
(Mr. Noppong Juntarupan)  
Enviro Field Coordinator Scientist (3)

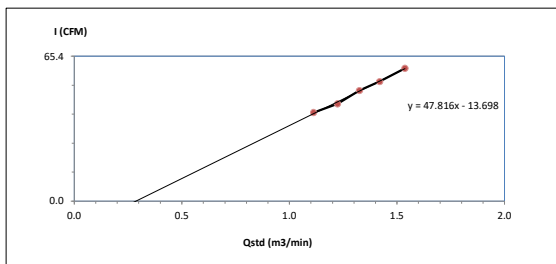
FORM NO.: F 06-073 REVISION NO.: ISSUE DATE: 14/03/16



### High Volume Air Sampler Calibration Worksheet

Project Site : Amata B.Grimm Power (Rayong) 3 Limited  
Calibrate Location : ศูนย์พัฒนาเด็กเล็กองค์การบริหารส่วนตำบล ยางขาว  
Calibrate Date : 21-Mar-23  
CalibrationSheet No.: C-210323-RYG\_FS0181  
Calibrator ID: RYG\_FS0205  
Calibrator Model : TE-5028A  
Calibrator S/N : 1166  
Barometric Pressure (mm Hg) : 753  
Temperature (°C) : 32  
High Volume ID : RYG\_FS0181  
High Volume Model : TE-5170D  
High Volume S/N : 5334  
Calibrator Slope : 1.50765  
Calibrator Intercept : -0.02043

Test No.	Delta H <sub>2</sub> O (inch)	Q <sub>std</sub> (m <sup>3</sup> /min)	I: Chart (CFM)	Linear Regression
1	2.8	1.1124	40	Slope : 47.8162 Intercept : -13.6976 Correlation Coefficient : 0.9978
2	3.4	1.2238	44	
3	4.0	1.3256	50	
4	4.6	1.4201	54	
5	5.4	1.5369	60	



Calibrated by : hilypt  
(Mr.Nontachai Uppathamp)  
Field Scientist(1)

Approved by : 2. Pong  
(Mr. Noppong Juntarupan)  
Enviro Field Coordinator Scientist (3)

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



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

Air speed measurement laboratory  
Calibration services department

IRANATTEE ASSOCIATES CO., LTD.  
63/14-15, 67/10-16  
Pondokwan 1, 1/11, 1/12, 1/13, 1/14, 1/15, 1/16, 1/17, 1/18, 1/19, 1/20, 1/21, 1/22, 1/23, 1/24, 1/25, 1/26, 1/27, 1/28, 1/29, 1/30, 1/31, 1/32, 1/33, 1/34, 1/35, 1/36, 1/37, 1/38, 1/39, 1/40, 1/41, 1/42, 1/43, 1/44, 1/45, 1/46, 1/47, 1/48, 1/49, 1/50, 1/51, 1/52, 1/53, 1/54, 1/55, 1/56, 1/57, 1/58, 1/59, 1/60, 1/61, 1/62, 1/63, 1/64, 1/65, 1/66, 1/67, 1/68, 1/69, 1/70, 1/71, 1/72, 1/73, 1/74, 1/75, 1/76, 1/77, 1/78, 1/79, 1/80, 1/81, 1/82, 1/83, 1/84, 1/85, 1/86, 1/87, 1/88, 1/89, 1/90, 1/91, 1/92, 1/93, 1/94, 1/95, 1/96, 1/97, 1/98, 1/99, 1/100, 1/101, 1/102, 1/103, 1/104, 1/105, 1/106, 1/107, 1/108, 1/109, 1/110, 1/111, 1/112, 1/113, 1/114, 1/115, 1/116, 1/117, 1/118, 1/119, 1/120, 1/121, 1/122, 1/123, 1/124, 1/125, 1/126, 1/127, 1/128, 1/129, 1/130, 1/131, 1/132, 1/133, 1/134, 1/135, 1/136, 1/137, 1/138, 1/139, 1/140, 1/141, 1/142, 1/143, 1/144, 1/145, 1/146, 1/147, 1/148, 1/149, 1/150, 1/151, 1/152, 1/153, 1/154, 1/155, 1/156, 1/157, 1/158, 1/159, 1/160, 1/161, 1/162, 1/163, 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Certificate Number:

CL-009-06

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MEASUREMENT RESULTS<sup>1</sup>

The cup anemometer/Unit Under Calibration (UUC) was checked 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 500 mm respectively away from wind tunnel nozzle. UUC was installed at center of the test section. The calibration was carried out under both rising and falling air velocity in the range of 1 m/s to 16 m/s at calibration interval of 1 m/s. The results of calibration and associated measurement uncertainties are reported in the table below.

$V_{std}$ (m/s)	Temp. wind tunnel (°C)	Temp. room (°C)	$V_{UUC}$ (m/s)	Error (m/s)	$U$ (k=2) (m/s)
0.991	23.56	23.45	0.8	-0.2	0.15
2.032	23.40	23.45	1.9	-0.2	0.16
3.049	23.50	23.45	2.9	-0.2	0.17
4.129	23.50	23.45	3.9	-0.1	0.20
5.163	23.50	23.45	4.8	-0.2	0.21
5.97	23.54	23.45	5.7	0.0	0.17
7.05	23.47	23.45	6.6	-0.1	0.18
8.18	23.50	23.45	7.9	-0.1	0.19
8.10	23.34	23.45	8.0	-0.3	0.19
10.10	23.40	23.45	9.7	-0.4	0.19
11.14	23.40	23.45	10.8	-0.4	0.20
12.13	23.32	23.45	11.8	-0.4	0.20
13.20	23.10	23.45	12.9	-0.3	0.20
14.25	23.16	23.45	13.9	-0.4	0.22
15.24	23.22	23.45	14.8	-0.4	0.21
16.30	23.40	23.45	15.8	-0.5	0.22

## Remarks:

<sup>1</sup> Calibration results only count for the tested circumstances and environmental conditions during which calibration took place

<sup>2</sup> Velocity of standard

<sup>3</sup> Velocity of Unit Under Calibration

## PHOTO OF CALIBRATION SET-UP



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

\*\*\*End of Certificate of Calibration\*\*\*

Page 2 of 2 Pages

MEASUREMENT RESULTS<sup>1</sup>

The wind direction sensor was calibrated against standard rotary encoder by comparison method. During calibration, the measurement was carried out at 45° intervals in clockwise and counter-clockwise directions after offset adjustment has been made. The flow speed of wind tunnel (usually 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	$D_{std}$ Degree (°)	$D_{UUC}$ Degree (°)	Error Degree (°)	$U$ (k=2) Degree (°)
	0.000	0	0	0.58
	45.000	43	-4	0.70
	90.000	89	-2	0.66
5.01	135.000	134	-1	0.64
	180.000	177	-3	0.74
	225.000	229	4	0.68
	270.000	273	3	0.64
	315.000	317	2	0.74

## Remarks:

<sup>1</sup> Calibration results only count for the tested circumstances and environmental conditions during which calibration took place

<sup>2</sup> Direction of standard

<sup>3</sup> Direction of Unit Under Calibration

\*\*\*End of Certificate of Calibration\*\*\*

Remarks:  
<sup>1</sup> Inside cross-section area of the wind tunnel  
<sup>2</sup> Projected cross-section area of the tested object including mounting pipe  
<sup>3</sup> Reusability of mounting pipe  
<sup>4</sup> Ratio "a"

Jiranatee Associates Co., Ltd.  
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Accredited calibration laboratory  
 ISO/IEC 17025:2017  
 NSC-TIS-TIS 17025  
 CALIBRATION 0367

Air speed measurement laboratory  
 Calibration services department.

Certificate Number:

CL-009-06

## CERTIFICATE OF CALIBRATION

Page 1 of 2 Pages

## MEASUREMENT ITEM

MANUFACTURER

MODEL/TYPE

SERIAL NUMBER

ID NUMBER

CONDITION AS RECEIVED

CUSTOMER

RECEIVED DATE

MEASUREMENT DATE

ISSUE DATE

## ENVIRONMENTAL CONDITIONS:

Ambient condition in the laboratory are as follows:

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

## PLACE OF CALIBRATION

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

## CALIBRATION CONDITION

Wind tunnel cross-section area: 900 cm<sup>2</sup>  
 Win direction frontal area: 129 cm<sup>2</sup>  
 Diameter of mounting pipe: mm  
 Blockage ratio of test object: 0.143 %

## Preconditioning

Measurement Condition

24 hours at ambient conditions.  
 The average values during measurement are (23.8)°C, (47.3) %RH and (1014.8) hPa.

## TABULATION OF RESULTS:

The table on next page give the measurement results.

Calibrated by:

☒ Mr. Sorawit Thirakulchai  
☐ Miss Intaraporn Lertseemee

## Remarks:

<sup>1</sup> Inside cross-section area of the wind tunnel

<sup>2</sup> Projected cross-section area of the tested object including mounting pipe

<sup>3</sup> Diameter of mounting pipe

<sup>4</sup> Ratio "a"



Approved signature:

*Ms. P. Booncharon*

Mr. Parinya Booncharon  
 Calibration Department Manager

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

Jiranatee Associates Co., Ltd.  
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Accredited calibration laboratory  
 ISO/IEC 17025:2017  
 NSC-TIS-TIS 17025  
 CALIBRATION 0367

Air speed measurement laboratory  
 Calibration services department.

CHECKED BY: *Parinya P.*APPROVED BY: *Ms. P.*

DATE: 19/4/24

Certificate Number:

CL-010-06

## CERTIFICATE OF CALIBRATION

Page 1 of 2 Pages

## MEASUREMENT ITEM

MANUFACTURER

MODEL/TYPE

SERIAL NUMBER

ID NUMBER

CONDITION AS RECEIVED

CUSTOMER

RECEIVED DATE

MEASUREMENT DATE

ISSUE DATE

## ENVIRONMENTAL CONDITIONS:

Ambient condition in the laboratory are as follows:

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

## PLACE OF CALIBRATION

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

## CALIBRATION CONDITION

Wind tunnel cross-section area: 900 cm<sup>2</sup>  
 Win direction frontal area: 129 cm<sup>2</sup>  
 Diameter of mounting pipe: mm  
 Blockage ratio of test object: 0.143 %

## Preconditioning

Measurement Condition

24 hours at ambient conditions.  
 The average values during measurement are (23.5)°C, (47.4) %RH and (1015.6) hPa.

## TABULATION OF RESULTS:

The table on next page give the measurement results.

Calibrated by:

☒ Mr. Sorawit Thirakulchai  
☐ Miss Intaraporn Lertseemee

## Remarks:

<sup>1</sup> Inside cross-section area of the wind tunnel

<sup>2</sup> Projected cross-section area of the tested object including mounting pipe

<sup>3</sup> Diameter of mounting pipe

<sup>4</sup> Ratio "a"



Approved signature:

*Ms. P. Booncharon*

Mr. Parinya Booncharon  
 Calibration Department Manager

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-001-66

Page 2 of 2 Pages

MEASUREMENT RESULTS<sup>1</sup>

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.

$V_{std}$ (m/s)	Temp. wind tunnel (°C)	Temp. room (°C)	$V_{UUC}$ (m/s)	Error (m/s)	$U/(V-2)$ (m/s)
0.980	23.82	23.85	0.7	-0.3	0.16
2.021	23.90	23.85	1.9	-0.3	0.16
3.093	24.00	23.85	2.9	-0.3	0.20
4.112	23.84	23.85	3.9	-0.7	0.20
5.100	23.88	23.85	4.9	-0.2	0.24
5.98	23.94	23.85	5.8	-0.2	0.18
7.06	23.82	23.85	6.8	-0.2	0.18
8.17	23.90	23.85	8.0	-0.1	0.22
9.88	23.72	23.85	9.0	-0.1	0.21
10.69	23.46	23.85	9.9	-0.2	0.30
11.14	23.69	23.85	13.0	-0.1	0.28
12.14	23.74	23.85	12.1	-0.1	0.28
13.21	23.68	23.85	13.0	-0.2	0.21
14.28	23.70	23.85	14.3	-0.2	0.27
15.26	23.64	23.85	15.0	-0.3	0.26
16.30	23.60	23.85	16.1	-0.2	0.28

## Remark:

<sup>1</sup> Calibration results only valid for the tested circumstances and environmental conditions during of all calibration task plus.

<sup>2</sup> Velocity of standard

<sup>3</sup> 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 position of the set-up is not true to scale due to image geometry.



Page 2 of 2 Pages

MEASUREMENT RESULTS<sup>1</sup>

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 adjustment has been made. The flow speed of wind tunnel (usually 5 m/s) is kept constant while the sensor is rotated around its vertical axis. The results of calibration and associated measurement uncertainties are reported in the table below.

Air speed m/s	$\theta^{std}$ Degree (°)	$\theta^{UUC}$ Degree (°)	Error Degree (°)	$U/(V-2)$ Degree (°)
	0.000	0	0	0.58
	45.000	41	-4	0.74
	90.000	87	-3	0.88
	135.000	134	-1	0.74
5.02	180.001	181	1	0.74
	225.000	228	3	0.74
	270.001	273	3	0.74
	315.000	318	3	0.68

## Remark:

<sup>1</sup> Calibration results only valid for the tested circumstances and environmental conditions during of all calibration task plus.

<sup>2</sup> Direction of standard

<sup>3</sup> Direction of Unit Under Calibration



\*\*\*Foot of Certificate of Calibration\*\*\*

Remark:  
<sup>1</sup> Nozzle cross-section area of the wind tunnel  
<sup>2</sup> Projected cross-section area of the tested object include mounting pipe  
<sup>3</sup> Diameter of mounting pipe  
<sup>4</sup> Ratio  $\frac{V}{V-2}$

Certificate Number

CL-001-66

## CERTIFICATE OF CALIBRATION

Page 1 of 2 Pages

## MEASUREMENT ITEM

## MANUFACTURER

## MODEL/TYPE

## SERIAL NUMBER

## ID NUMBER

## CONDITION AS-RECEIVED

## CUSTOMER

## RECEIVED DATE

## MEASUREMENT DATE

## ISSUE DATE

## ENVIRONMENTAL CONDITIONS:

Ambient condition in the laboratory are as follow:

Temperature:  $23.0 \pm 0.5$  °C

Relative Humidity:  $55.0 \pm 15.0$  %RH

Atmospheric Pressure:  $1010 \pm 10$  hPa

## PLACE OF CALIBRATION

## CALIBRATION CONDITION

Wind tunnel cross-section area<sup>1</sup>

Win direction frontal area<sup>2</sup>

Diameter of mounting pipe<sup>3</sup>

Blockage ratio of test object<sup>4</sup>

Ratio  $\frac{V}{V-2}$

Preconditioning

Measurement Condition

24 hours at ambient conditions.

The average values during measurement are (23.5) °C, (48.8) %RH and (1015.8) hPa.

TABULATION OF RESULTS:

The table on next page give the measured values.

Calibrated by:

Mr. Sorawit Thachalad

Mr. Jiranatee Jiranatee

Mr. Jiranatee Jiranatee

Mr. Jiranatee Jiranatee

Mr. Jiranatee Jiranatee

Mr. Jiranatee Jiranatee

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Mr. Jiranatee Jiranatee

Mr. Jiranatee Jiranatee

## WIND DIRECTION SENSOR

## MANUFACTURER

## MODEL/TYPE

## SERIAL NUMBER

## ID NUMBER

## CONDITION AS-RECEIVED

## CUSTOMER

## RECEIVED DATE

## MEASUREMENT DATE

## ISSUE DATE

## ENVIRONMENTAL CONDITIONS:

Ambient condition in the laboratory are as follow:

Temperature:  $23.0 \pm 0.5$  °C

Relative Humidity:  $55.0 \pm 15.0$  %RH

Atmospheric Pressure:  $1010 \pm 10$  hPa

## PLACE OF CALIBRATION

## CALIBRATION CONDITION

Wind tunnel cross-section area<sup>1</sup>

Win direction frontal area<sup>2</sup>

Diameter of mounting pipe<sup>3</sup>

Blockage ratio of test object<sup>4</sup>

Ratio  $\frac{V}{V-2}$

Preconditioning

Measurement Condition

24 hours at ambient conditions.

The average values during measurement are (23.5) °C, (48.8) %RH and (1015.8) hPa.

TABULATION OF RESULTS:

The table on next page give the measured values.

Calibrated by:

Mr. Sorawit Thachalad

Mr. Jiranatee Jiranatee

Mr. Jiranatee Jiranatee

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Mr. Jiranatee Jiranatee

Certificate Number
CL-018-66

Page 2 of 2 Pages

#### MEASUREMENT RESULTS<sup>1</sup>

The cup anemometer, Unit Under Calibration (UUC) was operated at 10 m/s for 5 minutes prior to calibration being performed. The standard air velocity 0.8 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.

$V_{std}$ (m/s)	Temp. wind tunnel (°C)	Temp. room (°C)	$V_{UUC}$ (m/s)	Error (m/s)	$U$ (m/s)
0.984	24.10	24.00	0.7	-0.3	0.16
2.029	23.98	24.00	1.8	-0.3	0.16
3.044	23.96	24.00	2.9	-0.2	0.19
4.136	24.20	24.00	3.9	-0.3	0.20
5.00	23.80	24.00	4.8	-0.2	0.21
5.98	24.24	24.00	5.8	-0.2	0.17
7.05	23.90	24.00	6.9	-0.2	0.19
8.19	24.14	24.00	8.0	-0.3	0.18
9.29	23.88	24.00	9.2	-0.2	0.20
10.09	23.88	24.00	9.8	-0.4	0.17
11.19	23.74	24.00	11.0	-0.2	0.23
12.13	23.82	24.00	12.0	-0.2	0.24
13.19	23.70	24.00	13.0	-0.2	0.22
14.26	23.66	24.00	14.0	-0.3	0.28
15.24	23.66	24.00	14.8	-0.5	0.23
16.30	23.70	24.00	16.0	-0.3	0.23

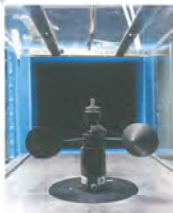
#### Remark:

<sup>1</sup> Calibration results only count for the tested circumstances and environmental conditions during which calibration took place.

<sup>2</sup> Velocity of standard

<sup>3</sup> 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.



Certificate Number
CL-018-66

Page 2 of 2 Pages

#### MEASUREMENT RESULTS<sup>1</sup>

The wind direction sensor was calibrated against standard rotary encoder by comparison method. During calibration, the measurement was carried out at 45° intervals in clockwise and counter-clockwise directions after offset adjustment has been made. The flow speed of wind tunnel (usually 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	$D'_{std}$ Degree (°)	$D'_{UUC}$ Degree (°)	Error Degree (°)	$U$ (°)
	0.000	0	0	0.53
	45.000	45	-4	0.66
	90.000	90	-3	0.71
4.99	135.000	133	-3	0.78
	180.000	180	0	0.74
	225.000	217	-2	0.68
	270.000	273	3	0.82
	315.000	318	3	0.74

#### Remark:

<sup>1</sup> Calibration results only count for the tested circumstances and environmental conditions during which calibration took place.

<sup>2</sup> Direction of standard

<sup>3</sup> Direction of Unit Under Calibration



Accredited calibration laboratory  
ISO/IEC 17025:2017  
MSC-15175 17025  
CALIBRATION 0347

Air speed measurement laboratory  
Calibration services department

Jiranatee Associates Co., Ltd.  
83/14-15, 83/15-16,  
Pattana 1, 17/1, Rd. Wattana, Bangkok,  
Bangkok 10160 (Thailand)  
Tel: +662-054-117  
Mobile: +662-054-117  
Email: jiranatee@jiranatee.com  
Web site: www.jiranatee.com

Certificate Number
CL-018-66

## CERTIFICATE OF CALIBRATION

Page 1 of 2 Pages

#### MEASUREMENT ITEM

MANUFACTURER

MODEL/TYPE

SERIAL NUMBER

ID NUMBER

CONDITION AS RECEIVED

CUSTOMER

RECEIVED DATE

MEASUREMENT DATE

ISSUE DATE

#### ENVIRONMENTAL CONDITIONS:

Ambient condition in the laboratory are as follow:

Temperature : 23.0 ± 3.0 °C

Relative Humidity : 55.0 ± 15.0 %RH

Atmospheric Pressure : 1010 ± 10 hPa

#### PLACE OF CALIBRATION

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

#### CALIBRATION CONDITION

: Wind tunnel cross-section area<sup>1</sup> : 900 cm<sup>2</sup>

Win direction frontal area<sup>2</sup> : 129 cm<sup>2</sup>

Diameter of mounting pipe<sup>3</sup> : - mm

Blockage ratio of test object<sup>4</sup> : 0.143 [-]

#### Preconditioning

: 24 hours at ambient conditions.

Measurement Condition : The average values during measurement are (23.8) °C, (50.3) %RH and (1012.3) hPa.

#### TABULATION OF RESULTS:

The table on next page give the measured values.

#### Calibrated by:

☒ Mr. Sorawat Thairatad

☐ Miss Nitayaporn Leetornsil



#### Approved signature:

*Mr. Panyapa Booncharoen*

Calibration Department Manager

#### Remark:

<sup>1</sup> Testing calibration area of the wind tunnel

<sup>2</sup> Projected cross-section area of the tested object include mounting pipe

<sup>3</sup> Diameter of mounting pipe

<sup>4</sup> Ratio  $\frac{A}{A_0}$

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

## SITHIPORN ASSOCIATES CO.,LTD. CALIBRATION LABORATORY

451-451/1 Siririnthorn Rd.,Bangbunmy, Bangplud Bangkok 10700 THAILAND.  
Tel:0-2435-0800 Fax:0-2433-1679 e-mail:cal-center@sithiporn.com http://www.sithiporn.com



Cert. No. : ACC22023

Pages : 1 of 3

## Calibration Certificate

Equipment : SOUND CALIBRATOR

Manufacturer : RION

Model : NC-74

Serial No. : 34178123

ID No. : RYG\_FS0215

Condition As Found : GOOD

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

#### Location :

Ambient Temperature : ( 23.0 ± 3 ) °C

Pressure : ( 101.3 ± 3 ) kPa

Relative Humidity : ( 50.0 ± 20 ) %

Received Date : 22 AUGUST 2022

Calibration Date : 31 AUGUST 2022

Date of Issue : 02 SEPTEMBER 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.

QT-TS12-01-01-020661



Cert. No. : ACC22023  
Job No. : VC66AC0077  
Pages : 2 of 3

Calibration Procedure : CP-AC-03

## Calibration Method :

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

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

## Condition of this result of calibration :

## 1. Reference Standard Instruments :

Instrument	Model	Serial No.	Cert. No.	Due Date
Waveform Generator	33511B	MY52302742	EF-0008-22	04-Feb-23
Digital Multimeter	33461A	MY53220104	EEL_BP_04/0265	09-Feb-23
Digital Multimeter	33461A	MY53220076	EEL_BP_03/0265	09-Feb-23
Digital Multimeter	33461A	MY60024273	EEL_BP_05/0265	09-Feb-23
Programmable Attenuator	MAT-1070	62100114	EF-0009-22	07-Feb-23
Condenser Microphone	4180	2977900	AA-1013-22	24-Feb-23
Measuring Amplifier	NA-42KAI	34560495	AA-3005-22	22-Feb-23
Audio Analyzer	AVR-3360A	V744B6069	EF-0010-22	07-Feb-23

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

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

3.1 National Institute of Metrology (Thailand).

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

QF-TS12-04-04-020664

T. Petch

Cert. No. : ACC22023  
Job No. : VC66AC0077  
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	94.04	0.04	0.14	0.40

## 2. Frequency

Specified Frequency (Hz)	Measured value (Hz)	Deviated value (%)	Uncertainty (%)	Tolerance limit (%)
1000	1001.5	0.1	0.1	1.0

## 3. Total distortion

Measured value (%)	Uncertainty (%)	Tolerance limit (%)
1.70	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. Petch

SITHIPORN ASSOCIATES CO.,LTD.  
CALIBRATION LABORATORY451-451/1 Sittithorn Rd., Bangbunru, Bangkok 10700 THAILAND.  
Tel:0-2435-8800 Fax:0-2433-1629 e-mail:cal-center@sithiporn.com http://www.sithiporn.comCert. No. : ACL23086  
Pages : 1 of 1

## Calibration Certificate

Equipment : SOUND LEVEL METER  
Manufacturer : RION  
Model : NL-42/ Microphone UC-52 / Preamplifier NH-24  
Serial No. : 01222723 / 143841 / 22770  
ID No. : RYG\_FS0022

Condition As Found : GOOD

Customer : ALS LABORATORY GROUP (THAILAND) CO., LTD.  
104 PHATTHANAKAN 40, PHATTHANAKAN ROAD,  
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 : 24 JANUARY 2023  
Calibration Date : 25-26 JANUARY 2023  
Date of Issue : 27 JANUARY 2023

Calibrated by : Nathakorn Pisutpaisan

Approved by :

T. Petch  
( 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

Cert. No. : ACL23086  
Job No. : VC66AC0031  
Pages : 2 of 1

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 SI.M'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-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

T. Petch

## Continuation of Calibration Certificate

Cert. No. : ACL23086  
Job No. : VC66AC0031  
Pages : 3 of 8

## Summary of Measurement Result :

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

QF-TS12-04-04-020664

T. Petch

## Continuation of Calibration Certificate

Cert. No. : ACL23086  
Job No. : VC66AC0031  
Pages : 5 of 8

## 4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

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

## 5. Frequency and time weightings at 1 kHz

## 5.1 Frequency weightings at 1 kHz

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

## 5.2 Time weighting at 1 kHz

Frequency Weighting	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Fast	94.0	0.0	-
Slow	94.0	0.0	±0.1
1eq	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. : ACL23086  
Job No. : VC66AC0031  
Pages : 8 of 8

## Result of calibration :

## 1. Absolute sensitivity

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

## 2. Self-generated noise

## 2.1 Normal test

Measured Value (dB)
15.1

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

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

## 3. Acoustical signal tests of frequency weightings

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

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

QF-TS12-04-04-020664

T. Petch

## Continuation of Calibration Certificate

Cert. No. : ACL23086  
Job No. : VC66AC0031  
Pages : 6 of 8

## 7. Level linearity on the reference level range

Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
137.0	137.0	0.0	±1.1
136.0	136.0	0.0	±1.1
135.0	135.0	0.0	±1.1
134.0	134.0	0.0	±1.1
133.0	133.0	0.0	±1.1
132.0	132.0	0.0	±1.1
131.0	131.0	0.0	±1.1
129.0	129.0	0.0	±1.1
124.0	124.0	0.0	±1.1
119.0	119.0	0.0	±1.1
114.0	114.0	0.0	±1.1
109.0	109.0	0.0	±1.1
104.0	104.0	0.0	±1.1
99.0	99.0	0.0	±1.1
94.0	94.0	0.0	±1.1
89.0	89.0	0.0	±1.1
84.0	84.0	0.0	±1.1
79.0	79.0	0.0	±1.1
74.0	74.0	0.0	±1.1
69.0	69.0	0.0	±1.1
64.0	64.0	0.0	±1.1
59.0	59.0	0.0	±1.1
54.0	53.9	-0.1	±1.1
49.0	49.0	0.0	±1.1
44.0	44.0	0.0	±1.1
39.0	38.9	-0.1	±1.1
34.0	33.9	-0.1	±1.1
30.0	29.9	-0.1	±1.1
29.0	28.9	-0.1	±1.1
28.0	27.9	-0.1	±1.1
27.0	26.9	-0.1	±1.1
26.0	25.9	-0.1	±1.1
25.0	24.8	-0.2	±1.1

QF-TS12-04-04-020664

T. Petch



## Continuation of Calibration Certificate

Cert. No. : ACL23086  
Job No. : VC66AC0031  
Pages : 7 of 8

## 8. Level linearity including the level range control

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

## 9. Tone burst response

Time Weighting	Tone burst duration, T <sub>b</sub> (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 <sub>peak</sub> (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.0	0.0	-
One	136.4	136.1	-0.3	±3.0

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

QF-TS12-04-04-020664

T. Petchu

## Continuation of Calibration Certificate

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

## 11. Overload indication

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

## 12. High level stability

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

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

End of Calibration Certificate

QF-TS12-04-04-020664

T. Petchu

SITHIPORN ASSOCIATES CO.,LTD.  
CALIBRATION LABORATORY451-451 / 1 Sindhorn Rd., Bangbunru, Bangplud Bangkok 10709 THAILAND  
Tel: 0-2433-8800 Fax: 0-2433-1679 e-mail: cal-center@sithiporn.com http://www.sithiporn.comCert. No. : ACL23048  
Pages : 1 of 8

## Calibration Certificate

Equipment : SOUND LEVEL METER  
Manufacturer : RION  
Model : NL-42 / Microphone UC-52 / Preamplifier NH-24  
Serial No. : 01222724 / 143842 / 22771  
ID No. : RYG\_FS0023

Condition As Found : GOOD

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

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

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

Calibrated by : Nathakorn Pisutpaisan

Approved by :

( 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 / SITHIPORN ASSOCIATES CO.,LTD.  
ASSOCIATES CALIBRATION LABORATORY

## Continuation of Calibration Certificate

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

Calibration Procedure : CP-AC-01

## Calibration Method :

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

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

## Condition of this result of calibration :

## 1. Reference Standard Instruments :

Instrument	Model	Serial No.	Cert. No.	Due Date
Waveform Generator	33210A	MY48017076	FF-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	EJ-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. Petchu



## 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

P.T.A.

## Result of calibration :

## 1. Absolute sensitivity

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

## 2. Self-generated noise

## 2.1 Normal test

Measured Value (dB)
15.4

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

Frequency Weighting	Measured value (dB)
A - weight	11.2
C - weight	17.6
Flat	23.4

## 3. Acoustical signal tests of frequency weightings

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

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)			Acceptance Limits
	Flat	C-weight	A-weight	
125	0.2	0.2	0.2	± 1.5
1000	-0.1	-0.1	-0.1	± 1.0
8000	-0.8	-0.8	-0.7	± 5.0

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P.T.A.

## 4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz

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

## 5. Frequency and time weightings at 1 kHz

## 5.1 Frequency weightings at 1 kHz

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

## 5.2 Time weighting at 1 kHz

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

## 6. Long - term stability

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

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P.T.A.

## 7. Level linearity on the reference level range

Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
137.0	137.0	0.0	± 1.1
136.0	136.0	0.0	± 1.1
135.0	135.0	0.0	± 1.1
134.0	134.0	0.0	± 1.1
133.0	133.0	0.0	± 1.1
132.0	132.0	0.0	± 1.1
131.0	131.0	0.0	± 1.1
129.0	129.0	0.0	± 1.1
124.0	124.0	0.0	± 1.1
119.0	119.0	0.0	± 1.1
114.0	114.0	0.0	± 1.1
109.0	109.0	0.0	± 1.1
104.0	104.0	0.0	± 1.1
99.0	99.0	0.0	± 1.1
94.0	94.0	0.0	± 1.1
89.0	89.0	0.0	± 1.1
84.0	84.0	0.0	± 1.1
79.0	79.0	0.0	± 1.1
74.0	74.0	0.0	± 1.1
69.0	69.0	0.0	± 1.1
64.0	64.0	0.0	± 1.1
59.0	59.0	0.0	± 1.1
54.0	53.9	-0.1	± 1.1
49.0	48.9	-0.1	± 1.1
44.0	43.9	-0.1	± 1.1
39.0	38.9	-0.1	± 1.1
34.0	33.9	-0.1	± 1.1
30.0	29.9	-0.1	± 1.1
29.0	28.8	-0.2	± 1.1
28.0	27.9	-0.1	± 1.1
27.0	26.8	-0.2	± 1.1
26.0	25.9	-0.1	± 1.1
25.0	24.8	-0.2	± 1.1

QF-TS12-04-04-020664

P.T.A.

Cert. No. : ACT23048  
Job No. : VC66AC0024  
Pages : 7 of 8

## 8. Level linearity including the level range control

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

## 9. Tone burst response

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

## 10. Peak C sound level

Number of cycle in test signal	Anticipated Value (dB)	Measured Value, L <sub>peak</sub> (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.0	0.0	-
One	136.4	135.8	-0.6	±3.0

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

QF-TS12-04-04-020664

T. Petchurani

SITHIPORN ASSOCIATES CO.,LTD.  
CALIBRATION LABORATORY451-451/1 Sirinthorn Rd., Bangbunru, Bangplud Bangkok 10700 THAILAND.  
Tel:0-2435-8800 Fax:0-2433-1629 e-mail:cal-center@sithiporn.com http://www.sithiporn.comCert. No. : ACC23005  
Pages : 1 of 3

## Calibration Certificate

Equipment : SOUND CALIBRATOR  
Manufacturer : RION  
Model : NC-75  
Serial No.: 35002736  
ID No.: RYG\_FS0496

Condition As Found : GOOD

Customer : ALS LABORATORY GROUP (THAILAND) CO., LTD.  
104 PHATTHANAKAN 40, PHATTHANAKAN ROAD,  
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 JANUARY 2023  
Calibration Date : 17 JANUARY 2023  
Date of Issue : 19 JANUARY 2023

Calibrated by : Nathakorn Pisutpaisan

Approved by :

T. Petchurani  
( Thanakul Petchurani )

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QF-TS12-04-04-020664

Cert. No. : ACT23048  
Job No. : VC66AC0024  
Pages : 8 of 8

## 11. Overload indication

Measured value (dB)		Deviated Value (dB)	Acceptance Limits (dB)
Positive one-half cycle	Negative one-half cycle		
89.6	89.7	0.1	±1.5

## 12. High level stability

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

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

End of Calibration Certificate

QF-TS12-04-04-020664

T. Petchurani

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

Calibration Procedure : CP-AC-03

## Calibration Method :

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

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

## Condition of this result of calibration :

## 1. Reference Standard Instruments :

Instrument	Model	Serial No.	Cert. No.	Due Date
Waveform Generator	33511B	MY52302742	EF-0008-22	04-Feb-23
Digital Multimeter	33461A	MY53220104	EEL_BP_04/0265	09-Feb-23
Digital Multimeter	33461A	MY53220076	EEL_BP_03/0265	09-Feb-23
Digital Multimeter	33461A	MY60024273	EEL_BP_05/0265	09-Feb-23
Programmable Attenuator	MAT-1070	62100114	EF-0009-22	07-Feb-23
Condenser Microphone	4180	2977900	AA-1013-22	24-Feb-23
Measuring Amplifier	NA-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. Petchurani



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

## Result of calibration :

## 1. Sound pressure level

Specified sound pressure level (dB)	Measured value (dB)	Deviated value (dB)	Uncertainty (dB)	Tolerance limit (dB)
94	93.98	-0.02	0.14	0.10

## 2. Frequency

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

## 3. Total distortion

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

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

End of Calibration Certificate

451-451/1 Sirthiporn Rd., Bangbunrut, Bangkok 10700 THAILAND.  
Tel: 0-2435-8800 Fax: 0-2433-1679 e-mail: cal-center@sithiporn.com http://www.sithiporn.comCert. No. : ACL22295  
Pages : 1 of 8

## Calibration Certificate

Equipment : SOUND LEVEL METER  
Manufacturer : RION  
Model : NL-42/ Microphone UC-52 / Preamplifier NH-24  
Serial No. : 00233183 / 144835 / 23230  
ID No. : RYG\_FS0024

Condition As Found : GOOD

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

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

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

Calibrated by : Nathakorn Pisutpaian

Approved by :

T. Petchum  
( Thunukul Petchumai )

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QF-TS12-04-04-020661

QF-TS12-04-04-020661

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

Calibration Procedure : CP-AC-01

## Calibration Method :

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

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

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

## Condition of this result of calibration :

## 1. Reference Standard Instruments :

Instrument	Model	Serial No.	Cert. No.	Due Date
Waveform Generator	33210A	MY48017076	EF-0007-22	04-Feb-23
Waveform Generator	33511B	MY52302742	EF-0008-22	04-Feb-23
Digital Multimeter	33461A	MY53220104	EEL-BP_04/0263	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-TS12-04-04-020661

Cert. No. : ACL22295  
Job No. : VC66AC0016  
Pages : 3 of 8

## Summary of Measurement Result :

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

QF-TS12-04-04-020661

## Continuation of Calibration Certificate

Cert. No. : ACL22295  
Job No. : VC66AC0018  
Pages : 4 of 8

## Result of calibration :

## 1. Absolute sensitivity

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

## 2. Self-generated noise

## 2.1 Normal test

Measured Value ( dB )
19.3

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

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

## 3. Acoustical signal tests of frequency weightings

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

Frequency ( Hz )	Deviation from various frequency weighting response curve (dB)			
	Flat	C-weight	A-weight	Acceptance Limits
125	-0.1	-0.1	-0.1	± 1.5
1000	-0.1	-0.1	-0.1	± 1.0
8000	0.3	0.4	0.4	±5.0

QP-1512-04-04-020664

T. Petch

## Continuation of Calibration Certificate

Cert. No. : ACL22295  
Job No. : VC66AC0018  
Pages : 5 of 8

## 4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

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

## 5. Frequency and time weightings at 1 kHz

## 5.1 Frequency weightings at 1 kHz

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

## 5.2 Time weighting at 1 kHz

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

## 6. Long-term stability

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

QP-1512-04-04-020664

T. Petch

## Continuation of Calibration Certificate

Cert. No. : ACL22295  
Job No. : VC66AC0016  
Pages : 6 of 8

## 7. Level linearity on the reference level range

Anticipated Value ( dB )	Measured Value ( dB )	Deviated Value ( dB )	Acceptance Limits ( dB )
137.0	137.0	0.0	± 1.1
136.0	136.0	0.0	± 1.1
135.0	135.0	0.0	± 1.1
134.0	134.0	0.0	± 1.1
133.0	133.0	0.0	± 1.1
132.0	132.0	0.0	± 1.1
131.0	131.0	0.0	± 1.1
129.0	129.0	0.0	± 1.1
124.0	124.0	0.0	± 1.1
119.0	119.0	0.0	± 1.1
114.0	114.0	0.0	± 1.1
109.0	109.0	0.0	± 1.1
104.0	104.0	0.0	± 1.1
99.0	99.0	0.0	± 1.1
94.0	94.0	0.0	± 1.1
89.0	89.0	0.0	± 1.1
84.0	84.0	0.0	± 1.1
79.0	79.0	0.0	± 1.1
74.0	74.0	0.0	± 1.1
69.0	69.0	0.0	± 1.1
64.0	64.0	0.0	± 1.1
59.0	59.0	0.0	± 1.1
54.0	53.9	-0.1	± 1.1
49.0	49.0	0.0	± 1.1
44.0	43.9	-0.1	± 1.1
39.0	38.9	-0.1	± 1.1
34.0	33.9	-0.1	± 1.1
30.0	29.9	-0.1	± 1.1
29.0	28.9	-0.1	± 1.1
28.0	27.9	-0.1	± 1.1
27.0	26.8	-0.2	± 1.1
26.0	25.9	-0.1	± 1.1
25.0	24.8	-0.2	± 1.1

QP-1512-04-04-020664

T. Petch

## Continuation of Calibration Certificate

Cert. No. : ACL22295  
Job No. : VC66AC0016  
Pages : 7 of 8

## 8. Level linearity including the level range control

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

## 9. Tone burst response

Time Weighting	Tone burst duration, Tb ( ms )	Cycle	Anticipated Value ( dB )	Measured Value ( dB )	Deviated Value ( dB )	Acceptance Limits ( dB )
Fast	0.25	1	108.0	107.9	-0.1	1.5 ; -5.0
	2	8	117.0	117.0	0.0	1.0 ; -2.5
	200	800	134.0	134.0	0.0	±1.0
Slow	2	8	108.0	108.0	0.0	1.5 ; -5.0
	200	800	127.6	127.6	0.0	±1.0
	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 <sub>peak</sub> ( 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	133.4	133.2	-0.2	±2.0
Negative half cycle	133.4	133.2	-0.2	±2.0

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T. Petch



Continuation of Calibration Certificate

Cert. No. : ACL22228  
Job No. : VC65AC0016  
Pages : 8 of 8

11. Overload indication

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

12. High level stability

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

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

End of Calibration Certificate

QF-TS12-04-04-020664

451-451/1 Sirinthern Rd., Bangbunru, Bangkok 10709 THAILAND.  
Tel:0-2435-8800 Fax:0-2433-1679 e-mail:cal-center@sithiporn.com http://www.sithiporn.com



Cert. No. : ACL22228  
Pages : 1 of 8

Calibration Certificate

Equipment : SOUND LEVEL METER  
Manufacturer : RION  
Model : NL-42A/ Microphone UC-52 / Preamplifier NH-24  
Serial No. : 00623389 / 198636 / 26417  
ID No. : -

Condition As Found : GOOD

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

Location : -  
Ambient Temperature : ( 23.0 ± 3 ) °C  
Pressure : ( 101.3 ± 3 ) kPa  
Relative Humidity : ( 50.0 ± 20 ) %  
Received Date : 28 SEPTEMBER 2022  
Calibration Date : 12-17 OCTOBER 2022  
Date of Issue : 18 OCTOBER 2022



Calibrated by : Nathakorn Pisutpaisan

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

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QF-TS12-04-04-020664

Continuation of Calibration Certificate

Cert. No. : ACL22228  
Job No. : VC65AC0006  
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. : ACL22228  
Job No. : VC65AC0006  
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. : ACL22228  
Job No. : VC65AC0086  
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	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 )	Deviation from various frequency weighting response curve (dB)			
	Flat	C-weight	A-weight	Acceptance Limits
125	-0.2	0.2	0.2	± 1.5
1000	0.0	0.0	0.0	± 1.0
8000	1.0	1.1	1.1	±5.0

QF-TS12-04-04-020664

T. Petch.

## Continuation of Calibration Certificate

Cert. No. : ACL22228  
Job No. : VC65AC0086  
Pages : 5 of 8

## 4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

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

## 5. Frequency and time weightings at 1 kHz

## 5.1 Frequency weightings at 1 kHz

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

## 5.2 Time weighting at 1 kHz

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

## 6. Long-term stability

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

QF-TS12-04-04-020664

T. Petch.

## Continuation of Calibration Certificate

Cert. No. : ACL22228  
Job No. : VC65AC0086  
Pages : 6 of 8

## 7. Level linearity on the reference level range

Anticipated Value ( dB )	Measured Value ( dB )	Deviated Value ( dB )	Acceptance Limits ( dB )
137.0	137.0	0.0	± 1.1
136.0	136.0	0.0	± 1.1
135.0	135.0	0.0	± 1.1
134.0	134.0	0.0	± 1.1
133.0	133.0	0.0	± 1.1
132.0	132.0	0.0	± 1.1
131.0	131.0	0.0	± 1.1
129.0	129.0	0.0	± 1.1
124.0	124.0	0.0	± 1.1
119.0	119.0	0.0	± 1.1
114.0	114.0	0.0	± 1.1
109.0	109.0	0.0	± 1.1
104.0	104.0	0.0	± 1.1
99.0	99.0	0.0	± 1.1
94.0	94.0	0.0	± 1.1
89.0	89.1	0.1	± 1.1
84.0	84.1	0.1	± 1.1
79.0	79.0	0.0	± 1.1
74.0	74.1	0.1	± 1.1
69.0	69.1	0.1	± 1.1
64.0	64.0	0.0	± 1.1
59.0	59.1	0.1	± 1.1
54.0	54.0	0.0	± 1.1
49.0	49.0	0.0	± 1.1
44.0	44.0	0.0	± 1.1
39.0	39.0	0.0	± 1.1
34.0	34.0	0.0	± 1.1
30.0	30.1	0.1	± 1.1
29.0	29.1	0.1	± 1.1
28.0	28.0	0.0	± 1.1
27.0	27.0	0.0	± 1.1
26.0	26.1	0.1	± 1.1
25.0	25.1	0.1	± 1.1

QF-TS12-04-04-020664

T. Petch.

## Continuation of Calibration Certificate

Cert. No. : ACL22228  
Job No. : VC65AC0086  
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, f <sub>peak</sub> ( dB )	Deviated Value ( dB )	Acceptance Limits ( dB )
Continuous	133.0	133.0	0.0	-
One	136.4	135.8	-0.6	±3.0

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

QF-TS12-04-04-020664

T. Petch.



## Continuation of Calibration Certificate

Cert. No. : ACL22228  
Job No. : VC65AC0086  
Pages : 8 of 8

## 11. Overload indication

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

## 12. High level stability

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

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

End of Calibration Certificate

QF-TS12-04-04-020664

## Continuation of Calibration Certificate

Cert. No. : ACL22230  
Job No. : VC65AC0086  
Pages : 2 of 8

Calibration Procedure : UP-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

451-451/1 Sirinthon Rd., Bangbunru, Bangplud Bangkok 10700 THAILAND  
Tel:0-2435-8800 Fax:0-2433-1679 e-mail:cal-center@sithiporn.com http://www.sithiporn.comCert. No. : ACL22230  
Pages : 1 of 8

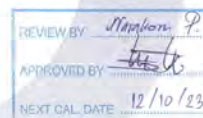
## Calibration Certificate

Equipment : SOUND LEVEL METER  
Manufacturer : RION  
Model : NL-42A/ Microphone UC-52 / Preamplifier NH-24  
Serial No. : 00623391 / 198638 / 26419  
ID No. : -

Condition As Found : GOOD

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

Location : -  
Ambient Temperature : ( 23.0 ± 3 ) °C  
Pressure : ( 101.3 ± 3 ) kPa  
Relative Humidity : ( 50.0 ± 20 ) %  
Received Date : 28 SEPTEMBER 2022  
Calibration Date : 12-17 OCTOBER 2022  
Date of Issue : 18 OCTOBER 2022



Calibrated by : Nathakorn Pisutpaisan

Approved by :

T. Petchurai  
( Thanakul Petchurai )

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

QF-TS12-04-04-020664

## Continuation of Calibration Certificate

Cert. No. : ACL22230  
Job No. : VC65AC0086  
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



Cert. No. : ACL22230  
Job No. : VC65AC0086  
Pages : 4 of 8

## Result of calibration :

## 1. Absolute sensitivity

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

## 2. Self-generated noise

## 2.1 Normal test

Measured Value ( dB )
15.7

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

Frequency Weighting	Measured value ( dB )
A - weight	12.8
C - weight	18.6
Flat	24.1

## 3. Acoustical signal tests of frequency weightings

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

Frequency ( Hz )	Deviation from various frequency weighting response curve (dB)			
	Flat	C-weight	A-weight	Acceptance Limits
125	0.0	0.1	0.1	± 1.5
1000	0.0	0.0	0.0	± 1.0
8000	0.9	0.9	1.0	±5.0

QP-TS12-04-04-020664

T. R. A.

Cert. No. : ACL22230  
Job No. : VC65AC0086  
Pages : 6 of 8

## 7. Level linearity on the reference level range

Anticipated Value ( dB )	Measured Value ( dB )	Deviated Value ( dB )	Acceptance Limits ( dB )
137.0	137.1	0.1	± 1.1
136.0	136.1	0.1	± 1.1
135.0	135.1	0.1	± 1.1
134.0	134.1	0.1	± 1.1
133.0	133.0	0.0	± 1.1
132.0	132.0	0.0	± 1.1
131.0	131.0	0.0	± 1.1
129.0	129.0	0.0	± 1.1
124.0	124.0	0.0	± 1.1
119.0	119.1	0.1	± 1.1
114.0	114.1	0.1	± 1.1
109.0	109.0	0.0	± 1.1
104.0	104.1	0.1	± 1.1
99.0	99.1	0.1	± 1.1
94.0	94.0	0.0	± 1.1
89.0	89.0	0.0	± 1.1
84.0	84.0	0.0	± 1.1
79.0	79.0	0.0	± 1.1
74.0	74.0	0.0	± 1.1
69.0	69.0	0.0	± 1.1
64.0	64.0	0.0	± 1.1
59.0	59.0	0.0	± 1.1
54.0	54.0	0.0	± 1.1
49.0	49.0	0.0	± 1.1
44.0	44.0	0.0	± 1.1
39.0	39.0	0.0	± 1.1
34.0	34.0	0.0	± 1.1
30.0	30.1	0.1	± 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	25.2	0.2	± 1.1

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T. R. A.

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Job No. : VC65AC0086  
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## 4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

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

## 5. Frequency and time weightings at 1 kHz

## 5.1 Frequency weightings at 1 kHz

Frequency Weighting	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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Job No. : VC65AC0086  
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## 8. Level linearity including the level range control

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

## 9. Tone burst response

Time Weighting	Tone burst duration, Tb ( ms )	Cycle	Anticipated Value ( dB )	Measured Value ( dB )	Deviated Value ( dB )	Acceptance Limits ( dB )
Fast	0.25	1	108.0	107.9	-0.1	1.5 ; -5.0
	2	8	117.0	116.9	-0.1	1.0 ; -2.5
	200	800	134.0	134.0	0.0	±1.0
Slow	2	8	108.0	108.0	0.0	1.5 ; -5.0
	200	800	127.6	127.6	0.0	±1.0
	0.25	1	99.0	98.8	-0.2	1.5 ; -5.0
SEL	2	8	108.0	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 <sub>peak</sub> ( dB )	Deviated Value ( dB )	Acceptance Limits ( dB )
Continuous	133.0	133.0	0.0	-
One	136.4	135.5	-0.9	±3.0

Number of cycle in test signal	Anticipated Value ( dB )	Measured Value ( dB )	Deviated Value ( dB )	Acceptance Limits ( dB )
Continuous	133.0	133.0	0.0	-
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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## 11. Overload indication

Measured value ( dB )		Deviated Value ( dB )	Acceptance Limits ( dB )
Positive one-half cycle	Negative one-half cycle		
89.6	89.7	0.1	±1.5

## 12. High level stability

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

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

End of Calibration Certificate

QF-TS12-04-04-020664

451-451/1 Sirinthorn Rd.,Bangbunrat, Bangplud Bangkok 10700 THAILAND  
Tel:0-2435-8800 Fax:0-2433-1679 e-mail:cal-center@sithiphom.com http://www.sithiphom.comCert. No. : ACL22226  
Pages : 1 of 8

## Calibration Certificate

Equipment : SOUND LEVEL METER  
Manufacturer : RION  
Model : NL-42A/ Microphone UC-52 / Preamplifier NH-24  
Serial No. : 00623387 / 198634 / 26415  
ID No. : -

Condition As Found : GOOD

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

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

Received Date : 28 SEPTEMBER 2022  
Calibration Date : 12-17 OCTOBER 2022  
Date of Issue : 18 OCTOBER 2022



Calibrated by : Nathakorn Pisutnaisan

Approved by :

T. Petchumai  
( Thanakul Petchumai )

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

QF-TS12-04-04-020664

Cert. No. : ACL22226  
Job No. : VC65AC0086  
Pages : 2 of 8

Calibration Procedure : GP-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).

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Cert. No. : ACL22226  
Job No. : VC65AC0086  
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## Summary of Measurement Result :

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

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## Continuation of Calibration Certificate

Cert. No. : ACL22226  
Job No. : VC65AC0086  
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 )
14.8

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

Frequency Weighting	Measured value ( dB )
A - weight	11.6
C - weight	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	0.2	0.1	0.2	± 1.5
1000	-0.0	0.0	0.0	± 1.0
8000	0.4	0.5	0.5	±5.0

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T. Petch

## Continuation of Calibration Certificate

Cert. No. : ACL22226  
Job No. : VC65AC0086  
Pages : 5 of 8

## 4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

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

## 5. Frequency and time weightings at 1 kHz

## 5.1 Frequency weightings at 1 kHz

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

## 5.2 Time weighting at 1 kHz

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

## 6. Long - term stability

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

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T. Petch

## Continuation of Calibration Certificate

Cert. No. : ACL22226  
Job No. : VC65AC0086  
Pages : 6 of 8

## 7. Level linearity on the reference level range

Anticipated Value ( dB )	Measured Value ( dB )	Deviated Value ( dB )	Acceptance Limits ( dB )
137.0	137.0	0.0	± 1.1
136.0	136.0	0.0	± 1.1
135.0	135.0	0.0	± 1.1
134.0	134.0	0.0	± 1.1
133.0	132.9	-0.1	± 1.1
132.0	131.9	-0.1	± 1.1
131.0	130.9	-0.1	± 1.1
129.0	129.0	0.0	± 1.1
124.0	124.0	0.0	± 1.1
119.0	119.0	0.0	± 1.1
114.0	114.0	0.0	± 1.1
109.0	109.0	0.0	± 1.1
104.0	104.0	0.0	± 1.1
99.0	99.0	0.0	± 1.1
94.0	94.0	0.0	± 1.1
89.0	89.0	0.0	± 1.1
84.0	84.0	0.0	± 1.1
79.0	79.0	0.0	± 1.1
74.0	74.0	0.0	± 1.1
69.0	69.0	0.0	± 1.1
64.0	64.0	0.0	± 1.1
59.0	59.0	0.0	± 1.1
54.0	54.0	0.0	± 1.1
49.0	49.0	0.0	± 1.1
44.0	44.0	0.0	± 1.1
39.0	39.0	0.0	± 1.1
34.0	34.0	0.0	± 1.1
30.0	30.0	0.0	± 1.1
29.0	29.0	0.0	± 1.1
28.0	28.1	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

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T. Petch

## Continuation of Calibration Certificate

Cert. No. : ACL22226  
Job No. : VC65AC0086  
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 ; -2.5
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 <sub>peak</sub> ( dB )	Deviated Value ( dB )	Acceptance Limits ( dB )
Continuous	133.0	133.0	0.0	-
One	136.4	135.8	-0.6	±3.0

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

OP-TS12-04-04-020664

T. Petch



## Customer Contact:

ALS Laboratory Group (Thailand) Co.  
 Ltd.  
 Head Office  
 104 Phatthanakan 40 Phatthanakan Rd  
 Khwaeng Phatthanakan Khet Suan  
 TAX ID : 010540004659  
 Chamattagarn.lmchom@ulsglobal.com  
 27603088

## Invoice To:

ALS Laboratory Group (Thailand) Co.  
 Ltd.  
 Head Office  
 104 Phatthanakan 40 Phatthanakan Rd  
 Khwaeng Phatthanakan Khet Suan

## SERVICE REPORT

Customer Purchase Order Number:	Customer Number:
70371013	70371013
Service Request:	Service Request Date:
Service Order:	Service Confirmation:
6006033911	8904800024

REVIEW BY: Thitima B.  
 APPROVED BY: [Signature]  
 NEXT CAL DATE: 19 Sep 2024

## Delivery Site:

ALS Laboratory Group (Thailand) Co.  
 Ltd.  
 Head Office  
 104 Phatthanakan 40 Phatthanakan Rd  
 Khwaeng Phatthanakan Khet Suan

## Location:

Room  
 Bldg  
 Lab  
 Dept

## Direct Inquiries to:

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 Sub-district, Western District, Bangkok 10110 Thailand  
 Acc. No: 012-4452-087  
 THB-King Thai Bank PCL  
 50m Square Bldg. 116/1-2 Rama 1 Rd, Pathumwan, BKK 10330  
 Thailand

ORIGINAL

Service Confirmation Number: 8904800024  
 Service Confirmation Date: 20.03.2023

## Service Information:

<b>Problem Description:</b> WU-S-00-10-5100-6001143313	
<b>Service Provided:</b> Complete DOHW 5100ICPOES Equipment ID: BKK_EL0037, oil tests passed	
<b>Service Overview Code:</b> Reason Code: Scheduled Service Diagnosis Code: Scheduled Service Resolution Code: Scheduled Service	
<b>Reported Hours:</b> 4.0	<b>Travel Hours:</b> 2.0
<b>Customer Field Service Representative Name:</b> Kanyakorn Sukphatjaroen	<b>Customer Field Service Representative Signature:</b> [Signature] <b>Date:</b> 20 Mar 2023
<b>Customer Name:</b> Thitima Boonpong	<b>Customer Signature:</b> [Signature] <b>Date:</b> 20 Mar 2023
<b>Additional Comments:</b>	

## Service Instrument:

Model Number	Model Description	Serial Number	System Handle	Parent Asset
SYS-ID-5100	ICP-OES 5100/S110 System			
G8010A	Agilent 5100 SVDV ICP-OES Spectrometer	MY16010005	ICP OES 5100	SYS-ID-5100
G8410A	SPS 4 Autosampler	AU15440764	ICP OES 5100	SYS-ID-5100

## Service Items:

Item	Service/Part #	Description	Qty	Entitlement	Service Start	Service End
1000	EDC	Enterprise Operational Qualification	1.00	Agreement Entitlement - 100 % covered	20.03.2023	20.03.2023

## Additional Information:



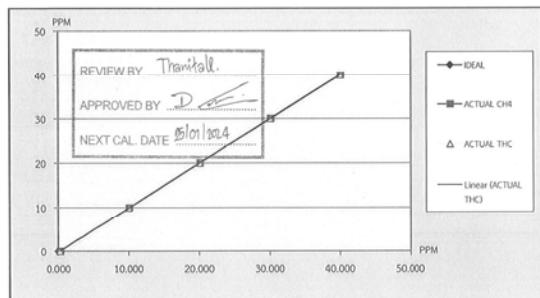
## TEST REPORT

RYG\_EN0038

CUSTOMER NAME	: ALS Laboratory Group (Thailand) Co., Ltd. (บริษัท แอลเอส กรุ๊ป (ประเทศไทย) จำกัด)		
EQUIPMENT NAME	: THC Analyzer		
MANUFACTURER	: HORIBA	MODEL	: APHA-370
SERIAL NO	: UA3NG4TH		
STANDARD GAS CONCENTRATION (PPM)	: 506.1 PPM	CYLINDER NO	: CC734373
CYLINDER PRESSURE (psig)	: 1,600 PSI	CERTIFIED DATE	: 12/05/2020
CERTIFIED BY	: AIRGAS	EXPIRED DATE	: 12/05/2028

## TEST RESULTS

POINT NO	TEST RESULTS						
	IDEAL	ACTUAL CH4	ERROR CH4	%ERROR CH4	ACTUAL THC	ERROR THC	%ERROR THC
ZERO	0.000	0.210	0.210	-	0.200	0.200	-
1	10.000	10.050	0.050	0.50	10.050	0.050	0.50
2	20.000	20.120	0.120	0.60	20.150	0.150	0.75
3	30.000	30.110	0.110	0.37	30.050	0.050	0.17
4	40.000	40.030	0.030	0.08	40.030	0.030	0.08
AVERAGE (%)				0.39			0.37



CALIBRATED BY: [Signature] DATE: 25/1/16  
 CHECKED BY: [Signature] DATE: 25/1/16  
 J NAC  
 JUKANY ASSOCIATES CO., LTD.

ผลการสอบเทียบเครื่องมือ: เจ้าหน้าที่ฝ่ายบริการลูกค้า, โทร 02-868-0812 # 15,16, E-Mail: Engineer@jranatee.com  
 วันที่ 63/14-15,67/35-36 ถนนพหลโยธิน 7,71 แขวงวัดราชบพิธ เขตพระนคร กรุงเทพฯ 10000 โทร 02-8680812-13 โทรสาร 02-868-1889



**J NAC**  
CHECK LIST

CUSTOMER NAME : ALS Laboratory Group (Thailand) Co., Ltd. (บริษัท แอลเอส แล็บราทอรี กรุ๊ป (ประเทศไทย) จำกัด)  
EQUIPMENT NAME : THC Analyzer  
MANUFACTURER : HORIBA MODEL : APHA-370 SERIAL NO. : U430GTHB

**TEST VALUES**

NO.	THC Analyzer ( APHA - 370 )	UNIT	BEFORE	AFTER
1	Signal ( CH4 )	mV	4.300	42.400
2	Signal ( THC )	mV	3.200	64.400
3	Detector	Temp °C, Standard Value : Ambient temp±(5°Cto15°C) Pressure kPa, Standard Value : (Ambient/1013x100-20)±4kPa	46.700 70.000	50.000 70.100
4	Ambient	kPa current atmospheric pressure	101.000	101.100
5	Purifier	°C, Standard Value : 390 °C to 430 °C kPa, Normal value : 8 kPa to 25 kPa	420.400 9.800	421.200 9.800
6	NMHC	°C, Standard Value : 230 °C to 260 °C	244.800	245.100
7	DC 24 V	V, Standard Value : 24 V ± 0.5 V	23.900	23.900
8	DC 5 V	V, Standard Value : 5 V ± 0.5 V	5.000	5.000
9	Bypass (Optional)	L/min, Normal value : 0.9 L/min ± 0.3 L/min	-	-
10	Over Flow (Optional)	L/min, Standard Value : 0.8 L/min or More	-	-
11	CH4 Sampling Reading	PPM	3.530	2.330
12	NMHC Sampling Reading	PPM	4.280	1.150
13	THC Sampling Reading	PPM	8.810	3.480
14	Zero Gas CH4/THC	PPM	0.21/0.20	0.00/0.00
15	Span Gas	PPM	54.87/55.78	40.03/40.03
16	Gas H2	20 PSI	20	20

Remark : Reference EX-EN-017-56, Ambient HC Monitor APHA-370 Operation Manual Page #81  
Remark : ( Ambient temperature = 5°C to 40°C )

อาการที่ตรวจพบ  
- Service Maintenance

รายละเอียดการดำเนินการ  
- ทำ Calibration Zero/Span, Multipoint

ผลการดำเนินการ  
- เครื่องมือ เครื่องมือสามารถดำเนินการตรวจวัดได้ตามปกติ

CALIBRATED BY : *Dr. J. NAC* DATE : 25/1/16  
CHECKED BY : *Dr. J. NAC* DATE : 25/1/16

J NAC  
JANAMATE ASSOCIATES CO., LTD.

ต้องการข้อมูลทางด้านเทคนิคเพิ่มเติม : เจ้าหน้าที่ฝ่ายบริการลูกค้า, โทร 02-868-0812 # 15-16, E-Mail : Engineer@janamate.com  
เลขที่ 63/14-15,67/35-36 ซอยเพชรเกษม 7/1 ถนนเพชรเกษม แขวงวัดท่าพระ เขตบางกอกใหญ่ กรุงเทพมหานคร 10600 โทร 02-868-0812-13 โทรสาร 02-868-1889

FO-EN-207 R00/01-08-13

**Sartorius (Thailand) Co., Ltd.**  
129 Rama 9 Road, Huaykwang, Huaykwang, Bangkok 10310  
Tel : 085 2043 8201-9 Fax : 085 2043 8201-7 E-mail : service.thailand@sartorius.com



# Certificate of Calibration

REVIEW BY : *Dr. J. NAC*  
APPROVED BY : *Dr. J. NAC*  
NEXT CAL DATE : 01/06/16

Model Number : MSE125P-100-DU Certificate No. : 23BCI0114  
Description : Semi-micro Balance Issued Date : Friday, March 03, 2023  
Serial Number : 0033108993 Reference No. : 204833  
ID No. : RYG\_EN0004  
Manufacturer : Sartorius Page No. : 1 of 3

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

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

Calibrated By : Mr.Chonchai Inthana  
Calibration Date : Wednesday, March 01, 2023

Calibration Procedure No. : This calibration was conducted by Using in-house calibration procedure number (WI-003)  
Based on UKAS LAB 14 : 2019

Metrological data :  
Capacity : 120 g Readability : 0.00001 g  
Reasons for calibration : ☐ New Installation ☐ Service / Repair ☒ 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 from the standard uncertainty multiplied by the coverage factor (k=2) to provide a level of confidence of approximately 95%. It is determined in accordance with the Guide to Expression of Uncertainty in Measurement (GUM). The calibration certificate documents the traceability to National Standards, which realise the unit of measurement according to the International Standard System of Units (SI). Report of Tolerance came from list of Sartorius Metrological Specifications.

Traceability:

Model Number	Description	Traceability	Certificate No.	Dus Date
YCS011-522-00	Sartorius weight set 1mg - 5000g E2, YCS011-522-00	SPC-RT	C02212585	14-Sep-2023
MHB-382SD	Humidity/Barometer/Temp. Lutron MHB-382SD	DKSH	C19220444	5-Sep-2023

This certificate relate and apply this equipment only.  
The information 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

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129 Rama 9 Road, Huaykwang, Huaykwang, Bangkok 10310  
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Description : Semi-micro Balance Issued Date : Friday, March 03, 2023  
Serial Number : 0033108993 Reference No. : 204833  
ID No. : RYG\_EN0004  
Manufacturer : Sartorius 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 series is placed repeatedly on the weighing pan in the same manner. The standard deviation is used to express repeatability quantitatively.		The off-center loading error is yielded by the difference between the result of the load, i.e. 1/3 or 1/4 of maximum capacity, placed in the middle of the weighing pan and between each of four additional measurement points (positions defined according to OIML R111).	
Nominal Value : (Low Load)	5.00002 g	Nominal value :	50 g
Tolerance	0.000015 g	Tolerance	0.00015 g
Nominal Value : (High Load)	50 g		
Tolerance	0.000015 g		
Standard Deviation	0.000007		

Linearity

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

7

Tolerance 0.00004 g

Nominal Value	Conventional Mass Value	Displayed Value	Deviation	Uncertainty
(g)	(g)	(g)	(g)	(g)
0.01	0.01000	0.01000	0.00000	0.000026
0.1	0.10000	0.10000	0.00000	0.000026
1	1.00000	1.00000	0.00000	0.000026
2	2.00002	2.00002	0.00000	0.000020
5	5.00003	5.00003	-0.00001	0.000033
10	10.00002	10.00002	0.00000	0.000038
20	20.00000	20.00000	0.00000	0.000049
30	30.00002	30.00002	0.00000	0.000060
40	40.00003	40.00003	-0.00001	0.000069
50	50.00002	50.00002	-0.00001	0.000081

SOP FM 33 03 February 2022

**Sartorius (Thailand) Co., Ltd.**  
129 Rama 9 Road, Huaykwang, Huaykwang, Bangkok 10310  
Tel : 085 2043 8201-9 Fax : 085 2043 8201-7 E-mail : service.thailand@sartorius.com



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Manufacturer : Sartorius Page No. : 3 of 3

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Nominal Value : (Low Load)	100.0000 g	Nominal value :	50 g
Tolerance	0.000015 g	Tolerance	0.00015 g
Nominal Value : (High Load)	100 g		
Tolerance	0.000015 g		
Standard Deviation	0.000003		

Linearity

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

Tolerance	0.0001 g
-----------	----------

Nominal Value	Conventional Mass Value	Displayed Value	Deviation	Uncertainty
(g)	(g)	(g)	(g)	(g)
65	65.00000	65.00000	0.00000	0.000035
70	70.00000	70.00000	0.00000	0.000035
75	75.00000	75.00000	0.00000	0.000036
80	80.00000	80.00000	0.00000	0.000037
85	85.00001	85.00001	0.00000	0.000038
90	90.00001	90.00001	0.00000	0.000039
95	95.00001	95.00001	0.00000	0.000040
100	100.00000	100.00000	0.00000	0.000041
110	110.00000	110.00000	0.00000	0.000046
120	120.00000	120.00000	0.00000	0.000046

SOP FM 33 03 February 2022

## Certificate of System Qualification

GC-00

System ID: CN11481068  
Organization Name: ALS Laboratory Group (Thailand) Co., Ltd.  
Organization Location: 104 Soi 40 Phatthanakan Rd, Khwang Suan Luang, Khel Suan Luang, Bangkok 10250

Date: April 21, 2023 3:26:38 PM  
EDP Name: Agilent/Recommended  
EQP Revision: GC/02.52  
Overall Qualification Status: Pass

## CDS Logon Verification - GC

Logon: Gaenguthai Tarak

## Overall CDS Logon Verification - GC Test Status

Pass

## System Inspection and Basic Safety and Operation

Name: 7890

Setpoint Status: Pass

## Overall System Inspection and Basic Safety and Operation Test Status

Pass

## Inlet Pressure Decay

Name: 7890

Front SSL

Setpoint Status: Pass

Pressure: 25.0 psi

Pressure Change: 0.1 psi /5 minutes

Agilent Recommended: &gt;= -2.0 and &lt;= 0.5

Date: April 21, 2023 3:26:38 PM  
System ID: CN11481068

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REVIEW BY: *Jinde K.*  
APPROVED BY: *Tangthorn M.*  
NEXT CAL DATE: *11 Oct 24*

## Overall Inlet Pressure Decay Test Status

Pass

## Inlet Pressure Accuracy

Name: 7890

Front SSL

Setpoint Status: Pass

Inlet Pressure: Setpoint 25.0 psi Actual 25.2 psi

Accuracy: 0.2 psi  
Agilent Recommended: <= 1.2

## Overall Inlet Pressure Accuracy Test Status

Pass

## Inlet Pressure Decay

Name: 7890

Back SSL

Setpoint Status: Pass

Pressure: 25.0 psi

Pressure Change: 0.0 psi /5 minutes

Agilent Recommended: &gt;= -2.0 and &lt;= 0.5

## Overall Inlet Pressure Decay Test Status

Pass

## Inlet Pressure Accuracy

Name: 7890

Back SSL

Date: April 21, 2023 3:26:38 PM  
System ID: CN11481068

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## Setpoint Status: Pass

Inlet Pressure: Setpoint 25.0 psi Actual 24.8 psi

Accuracy: 0.2 psi  
Agilent Recommended: <= 1.2

## Overall Inlet Pressure Accuracy Test Status

Pass

## Detector Flow Accuracy

Name: 7890

Front FID

Setpoint Status: Pass

Flow Type: Fuel

Setpoint: 30.0 mL/min Measured Flow: 28.9 mL/min

Accuracy: 1.1 mL/min  
Agilent Recommended: <= 10.0 % setpoint ( 3.0 mL/min )

Limit is percentage of setpoint or 0.5 mL/minute, whichever is largest.

Setpoint Status: Pass

Flow Type: Oxidizer

Setpoint: 400.0 mL/min Measured Flow: 400 mL/min

Accuracy: 0.0 mL/min  
Agilent Recommended: <= 10.0 % setpoint ( 40.0 mL/min )

Limit is percentage of setpoint or 0.5 mL/minute, whichever is largest.

Setpoint Status: Pass

Flow Type: Makeup

Setpoint: 25.0 mL/min Measured Flow: 24.9 mL/min

Accuracy: 0.1 mL/min  
Agilent Recommended: <= 10.0 % setpoint ( 2.5 mL/min )

Limit is percentage of setpoint or 0.5 mL/minute, whichever is largest.

Date: April 21, 2023 3:26:38 PM  
System ID: CN11481068

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## Overall Detector Flow Accuracy Test Status

Pass

## Detector Flow Accuracy

Name: 7890

Back FID

Setpoint Status: Pass

Flow Type: Fuel

Setpoint: 30.0 mL/min Measured Flow: 30.7 mL/min

Accuracy: 0.7 mL/min  
Agilent Recommended: <= 10.0 % setpoint ( 3.0 mL/min )

Limit is percentage of setpoint or 0.5 mL/minute, whichever is largest.

Setpoint Status: Pass

Flow Type: Oxidizer

Setpoint: 400.0 mL/min Measured Flow: 399 mL/min

Accuracy: 1.0 mL/min  
Agilent Recommended: <= 10.0 % setpoint ( 40.0 mL/min )

Limit is percentage of setpoint or 0.5 mL/minute, whichever is largest.

Setpoint Status: Pass

Flow Type: Makeup

Setpoint: 25.0 mL/min Measured Flow: 24.5 mL/min

Accuracy: 0.4 mL/min  
Agilent Recommended: <= 10.0 % setpoint ( 2.5 mL/min )

Limit is percentage of setpoint or 0.5 mL/minute, whichever is largest.

## Overall Detector Flow Accuracy Test Status

Pass

## GC Oven Temperature Accuracy

Name: 7890

Date: April 21, 2023 3:26:38 PM  
System ID: CN11481068

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Setpoint Status: **Pass**  
Zone: **Oven**  
Setpoint/Actual  
Temperature: 230.0 230.6 °C  
Accuracy: 0.6 °C  
Agilent Recommended:  $\geq -1.0$  % setpoint in K ( -6.0 °C )  
 $\leq 1.0$  % setpoint in K ( 5.0 °C )

Setpoint Status: **Pass**  
Zone: **Oven**  
Setpoint/Actual  
Temperature: 100.0 100.9 °C  
Accuracy: 0.9 °C  
Agilent Recommended:  $\geq -1.0$  % setpoint in K ( -3.7 °C )  
 $\leq 1.0$  % setpoint in K ( 3.7 °C )

## Overall GC Oven Temperature Accuracy Test Status

Pass

## GC Oven Temperature Stability

Name: 7890  
Setpoint Status: **Pass**  
Setpoint/Average  
Temperature: 100.0 100.8833 °C  
Stability: 0.1 °C  
Agilent Recommended:  $\leq 0.5$

## Overall GC Oven Temperature Stability Test Status

Pass

## Scouting Run

Tested Combination1 Front SSL / Front FID  
Injection Tower  
Name: 7693A

Date: April 21, 2023 3:26:38 PM  
System ID: CN11461066

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Setpoint Status: **Completed**  
Injection Volume on Column: 1.0 uL  
Overall Scouting Run Status  
**Completed**

## Noise and Drift

Tested Combination1 Front SSL / Front FID  
Name: 7890  
Setpoint Status: **Pass**  
Base Signal: 22.7 pA  
ASTM Noise pA 0.06  
Drift pA/hr 0.05  
Agilent Recommended:  $\leq 0.10$   $\leq 2.50$   
Status: **Pass** **Pass**

## Overall Noise and Drift Test Status

Pass

## Injection Precision

Tested Combination1 Front SSL / Front FID  
Name: 7693A  
Setpoint Status: **Pass**  
Injection Volume on Column: 1.0 uL  
Area RSD: 0.32 %  
Retention Time RSD: 0.67 %  
Agilent Recommended:  $\leq 3.00$   $\leq 1.00$

## Overall Injection Precision Test Status

Pass

## Signal to Noise

Date: April 21, 2023 3:26:38 PM  
System ID: CN11461066

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Tested Combination1 Front SSL / Front FID  
Injection Tower  
Name: 7890  
Setpoint Status: **Pass**  
Signal to Noise: 721755  
Agilent Recommended:  $\geq 300000$

## Overall Signal to Noise Test Status

Pass

## Scouting Run

Tested Combination2 Back SSL / Back FID  
Injection Tower  
Name: 7693A

Setpoint Status: **Completed**  
Injection Volume on Column: 1.0 uL

## Overall Scouting Run Status

Completed

## Noise and Drift

Tested Combination2 Back SSL / Back FID  
Name: 7890  
Setpoint Status: **Pass**  
Base Signal: 22.6 pA  
ASTM Noise pA 0.07  
Drift pA/hr 0.09  
Agilent Recommended:  $\leq 0.10$   $\leq 2.50$   
Status: **Pass** **Pass**

Date: April 21, 2023 3:26:38 PM  
System ID: CN11461066

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## Overall Noise and Drift Test Status

Pass

## Injection Precision

Tested Combination2 Back SSL / Back FID  
Name: 7693A  
Setpoint Status: **Pass**  
Injection Volume on Column: 1.0 uL  
Area RSD: 1.28 %  
Retention Time RSD: 0.83 %  
Agilent Recommended:  $\leq 3.00$   $\leq 1.00$

## Overall Injection Precision Test Status

Pass

## Signal to Noise

Tested Combination2 Back SSL / Back FID  
Injection Tower  
Name: 7890  
Setpoint Status: **Pass**  
Signal to Noise: 2404366  
Agilent Recommended:  $\geq 300000$

## Overall Signal to Noise Test Status

Pass

Date: April 21, 2023 3:26:38 PM  
System ID: CN11461066

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## Instrument Details

### Purpose

This section describes the as found system configuration.

### Details

#### System

System ID	CN11461066
Manufacturer	Agilent Technologies
Name	7690
Flow Data Input	Manual Data
Temperature Data Input	Manual Data or Other Data Logging

#### Tested Combination1

Injection Technique	Injection Tower
Sampler Identifier	Sampler 2
Inlet	Front
Detector	Front
LTM Included?	No

#### Tested Combination2

Injection Technique	Injection Tower
Sampler Identifier	Sampler 3
Inlet	Back
Detector	Back
LTM Included?	No

#### Sampler 1

Manufacturer	Agilent Technologies
Type	Tray
Name	7693A
Model Number	G4514A
Serial Number	CN15380030
Firmware Revision	A.11.01
Vial Heater	Not Installed

Date: April 21, 2023 3:26:36 PM  
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#### Sampler 2

Manufacturer	Agilent Technologies
Type	Injection Tower
Name	7693A
Model Number	G4513A
Serial Number	CN16280128
Firmware Revision	A.10.09
Usage	Sample Injection
Location	Front
Syringe Volume (µL)	10

#### Sampler 3

Manufacturer	Agilent Technologies
Type	Injection Tower
Name	7693A
Model Number	G4513A
Serial Number	CN103A0103
Firmware Revision	A.10.09
Usage	Sample Injection
Location	Back
Syringe Volume (µL)	10

#### Mainframe 1

Manufacturer	Agilent Technologies
Name	7660
Model Number	G3443A
Serial Number	CN11461066
Firmware Revision	Version 4.27
Oven Type	Standard

Date: April 21, 2023 3:26:36 PM  
System ID: CN11461066

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#### Inlet 1

Manufacturer	Agilent Technologies
Name	7690
Type	SSL
Location	Front
Carrier Gas	Helium
Control Type	Electronic Pressure Control (EPC)
Purged Inlet	Yes

#### Inlet 2

Manufacturer	Agilent Technologies
Name	7690
Type	SSL
Location	Back
Carrier Gas	Helium
Control Type	Electronic Pressure Control (EPC)
Purged Inlet	Yes

#### Detector 1

Manufacturer	Agilent Technologies
Name	7690
Type	FID
Adapter	Capillary
Control Type	Electronic Pressure Control (EPC)
Location	Front
Makeup Gas	Nitrogen

#### Detector 2

Manufacturer	Agilent Technologies
Name	7690
Type	FID
Adapter	Capillary
Control Type	Electronic Pressure Control (EPC)
Location	Back
Makeup Gas	Nitrogen

Date: April 21, 2023 3:26:36 PM  
System ID: CN11461066

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## Electronic Signature

### Purpose

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

### Details

Full Name of Signer:	Saengulhal Tarak
Logged On User Name:	saengulhal.tarak@non.agilent.com
Signature Creation Date:	April 21, 2023
Reason for Signature:	Executed protocol and published this original version of document

### Regulatory Disclaimer

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

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Date: April 21, 2023 3:26:36 PM  
System ID: CN11461066

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User Name: samgupta@lanl  
Hostname: LAPTOP-CQ39KGMVSystem ID: CN11461066  
Print Date: April 21, 2023 3:26:49 PM

## GC-E\_BKK\_ENH127\_ALS Transaction log:

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
April 21, 2023 11:21:36 AM	Auth	Session Created	Session	None
April 21, 2023 11:21:36 AM	Start	Configuration	Session	None
April 21, 2023 11:21:36 AM	Auth	Endscreen	Logging	User is logging off and does not require an unlock code
April 21, 2023 11:22:04 AM	Auth	Disconnected	Session	EGP data for primary technique [24] - File path: [P:\Data\PeakData\GC\Conf\Qual\Qual02.D\GC\02-02-02.mpl], EGP File Name: [GC02.D2.mpl], EGP Name: [Agilent\Recommendations\Pressure\Pressure_02-02-02]
April 21, 2023 11:22:09 AM	End	Configuration	Session	None
April 21, 2023 11:22:14 AM	Start	Qualification	Session	QC
April 21, 2023 11:22:14 AM	Start	Execution	CDS Login Verification - QC	- Qualitative Test
April 21, 2023 11:23:14 AM	End	Execution	CDS Login Verification - QC	- Qualitative Test
April 21, 2023 11:23:15 AM	Start	Execution	System Inspection and Basic Safety and Operation - 7890 - Qualitative Test - No sample associated	None
April 21, 2023 11:23:38 AM	End	Execution	System Inspection and Basic Safety and Operation - 7890 - Qualitative Test - No sample associated	Run Count: 1
April 21, 2023 11:23:37 AM	Start	Execution	Inlet Pressure Accuracy - Front, SSU - Pressure Controlled Inlet	None - S: 25.0 psi - L: <= -2.0 psi and <= 0.5 psi

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Date: April 21, 2023 3:26:38 PM  
System ID: CN11461066

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User Name: samgupta@lanl  
Hostname: LAPTOP-CQ39KGMVSystem ID: CN11461066  
Print Date: April 21, 2023 3:26:40 PM

## GC-E\_BKK\_ENH127\_ALS Transaction log:

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
April 21, 2023 11:24:01 AM	End	Execution	Inlet Pressure Accuracy - Front, SSU - Pressure Controlled Inlet	Run Count: 1 - S: 25.0 psi - L: <= -2.0 psi and <= 0.5 psi
April 21, 2023 11:24:04 AM	Start	Execution	Inlet Pressure Accuracy - Front, SSU - Pressure Controlled Inlet	None - S: 25.0 psi - L: <= 1.2 psi
April 21, 2023 11:24:26 AM	End	Execution	Inlet Pressure Accuracy - Front, SSU - Pressure Controlled Inlet	Run Count: 1 - S: 25.0 psi - L: <= 1.2 psi
April 21, 2023 11:24:11 AM	Start	Execution	Inlet Pressure Accuracy - Back, SSU - Pressure Controlled Inlet	None - S: 25.0 psi - L: <= -2.0 psi and <= 0.5 psi
April 21, 2023 11:24:43 AM	End	Execution	Inlet Pressure Accuracy - Back, SSU - Pressure Controlled Inlet	Run Count: 1 - S: 25.0 psi - L: <= -2.0 psi and <= 0.5 psi
April 21, 2023 11:24:45 AM	Start	Execution	Inlet Pressure Accuracy - Back, SSU - Pressure Controlled Inlet	None - S: 25.0 psi - L: <= 1.2 psi
April 21, 2023 11:24:51 AM	End	Execution	Inlet Pressure Accuracy - Back, SSU - Pressure Controlled Inlet	Run Count: 1 - S: 25.0 psi - L: <= 1.2 psi
April 21, 2023 11:24:53 AM	Start	Execution	Detector Flow Accuracy - Front, FID - Type: Fuel - S: 30.0 mL/min - L: <= 10.0% response	None
April 21, 2023 11:25:00 AM	Auth	Data	Detector Flow Accuracy - Front, FID - Type: Fuel - S: 30.0 mL/min - L: <= 10.0% response	Manual Data Entry
April 21, 2023 11:25:03 AM	End	Execution	Detector Flow Accuracy - Front, FID - Type: Fuel - S: 30.0 mL/min - L: <= 10.0% response	Run Count: 1

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Date: April 21, 2023 3:26:38 PM  
System ID: CN11461066

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User Name: samgupta@lanl  
Hostname: LAPTOP-CQ39KGMVSystem ID: CN11461066  
Print Date: April 21, 2023 3:26:40 PM

## GC-E\_BKK\_ENH127\_ALS Transaction log:

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
April 21, 2023 11:25:29 AM	Start	Execution	Detector Flow Accuracy - Front, FID - Type: Outlier - S: 400.0 mL/min - L: <= 10.0% response	None
April 21, 2023 11:25:40 AM	Auth	Data	Detector Flow Accuracy - Front, FID - Type: Outlier - S: 400.0 mL/min - L: <= 10.0% response	Manual Data Entry
April 21, 2023 11:25:42 AM	End	Execution	Detector Flow Accuracy - Front, FID - Type: Outlier - S: 400.0 mL/min - L: <= 10.0% response	Run Count: 1
April 21, 2023 11:25:44 AM	Start	Execution	Detector Flow Accuracy - Front, FID - Type: Makeup - S: 25.0 mL/min - L: <= 10.0% response	None
April 21, 2023 11:26:01 AM	Auth	Data	Detector Flow Accuracy - Front, FID - Type: Makeup - S: 25.0 mL/min - L: <= 10.0% response	Manual Data Entry
April 21, 2023 11:26:04 AM	End	Execution	Detector Flow Accuracy - Front, FID - Type: Makeup - S: 25.0 mL/min - L: <= 10.0% response	Run Count: 1
April 21, 2023 11:26:25 AM	Start	Execution	Detector Flow Accuracy - Back, FID - Type: Fuel - S: 30.0 mL/min - L: <= 10.0% response	None
April 21, 2023 11:26:19 AM	Auth	Data	Detector Flow Accuracy - Back, FID - Type: Fuel - S: 30.0 mL/min - L: <= 10.0% response	Manual Data Entry
April 21, 2023 11:26:22 AM	End	Execution	Detector Flow Accuracy - Back, FID - Type: Fuel - S: 30.0 mL/min - L: <= 10.0% response	Run Count: 1
April 21, 2023 11:26:24 AM	Start	Execution	Detector Flow Accuracy - Back, FID - Type: Outlier - S: 400.0 mL/min - L: <= 10.0% response	None
April 21, 2023 11:26:38 AM	Auth	Data	Detector Flow Accuracy - Back, FID - Type: Outlier - S: 400.0 mL/min - L: <= 10.0% response	Manual Data Entry

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Date: April 21, 2023 3:26:38 PM  
System ID: CN11461066

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User Name: samgupta@lanl  
Hostname: LAPTOP-CQ39KGMVSystem ID: CN11461066  
Print Date: April 21, 2023 3:26:40 PM

## GC-E\_BKK\_ENH127\_ALS Transaction log:

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
April 21, 2023 11:26:43 AM	End	Execution	Detector Flow Accuracy - Back, FID - Type: Outlier - S: 400.0 mL/min - L: <= 10.0% response	Run Count: 1
April 21, 2023 11:26:45 AM	Start	Execution	Detector Flow Accuracy - Back, FID - Type: Makeup - S: 25.0 mL/min - L: <= 10.0% response	None
April 21, 2023 11:27:01 AM	Auth	Data	Detector Flow Accuracy - Back, FID - Type: Makeup - S: 25.0 mL/min - L: <= 10.0% response	Manual Data Entry
April 21, 2023 11:27:05 AM	End	Execution	Detector Flow Accuracy - Back, FID - Type: Makeup - S: 25.0 mL/min - L: <= 10.0% response	Run Count: 1
April 21, 2023 11:27:07 AM	Start	Execution	GC Oven Temperature Accuracy - 7890 - Temperature - Oven - S: 230.0°C - L: <= -1.0 AND <= 1.0 % response in K	None
April 21, 2023 11:27:33 AM	Auth	Data	GC Oven Temperature Accuracy - 7890 - Temperature - Oven - S: 230.0°C - L: <= -1.0 AND <= 1.0 % response in K	Manual Data Entry
April 21, 2023 11:27:36 AM	End	Execution	GC Oven Temperature Accuracy - 7890 - Temperature - Oven - S: 230.0°C - L: <= -1.0 AND <= 1.0 % response in K	Run Count: 1
April 21, 2023 11:27:37 AM	Start	Execution	GC Oven Temperature Accuracy - 7890 - Temperature - Oven - S: 100.0°C - L: <= -1.0 AND <= 1.0 % response in K	None
April 21, 2023 11:27:54 AM	Auth	Data	GC Oven Temperature Accuracy - 7890 - Temperature - Oven - S: 100.0°C - L: <= -1.0 AND <= 1.0 % response in K	Manual Data Entry

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Date: April 21, 2023 3:26:38 PM  
System ID: CN11461066

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User Name: xiangguohu@ahk  
Host Name: LAPTOP-CQ35KUMV  
System ID: CN11461056  
Print Date: April 21, 2023 3:26:43 PM

GC-E\_BKK\_ENH127\_ALS Transaction Log :

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
April 21, 2023 11:27:57 AM	End	Execution	GC Oven Temperature Accuracy - 7892 - Temperature	Run Count : 1
			Oven - S: 100.0°C - L: >= -1.0	
			AFD <= 1.0 % setpoint in K	
April 21, 2023 11:27:58 AM	Start	Execution	GC Oven Temperature Stability	None
			7892 - Temperature - Oven - S: 100.0°C - L: <= 0.5°C	
April 21, 2023 11:28:07 AM	Auto	Data	GC Oven Temperature Stability	Manual Data Entry
			7892 - Temperature - Oven - S: 100.0°C - L: <= 0.5°C	
April 21, 2023 11:28:19 AM	End	Execution	GC Oven Temperature Stability	Run Count : 1
			7892 - Temperature - Oven - S: 100.0°C - L: <= 0.5°C	
April 21, 2023 11:29:12 AM	Start	Execution	GC Scouting Run - Injection	None
			Tower, Front SSIL, Front FID - Part of System Preparation - No limits associated	
April 21, 2023 11:30:27 AM	Auto	Data	GC Scouting Run - Injection	Data File Path : C:\Users\Public\Documents\C
			Tower, Front SSIL, Front FID - Part of System Preparation - No limits associated	hemStation3\Data\CO2_GC-E_ALS_2023-04-20\CO2_GC-E_2023-2023-04-20_14-36-08F_Phd3-011F.D\FID 1A.ch
April 21, 2023 11:31:04 AM	End	Execution	GC Scouting Run - Injection	Run Count : 1
			Tower, Front SSIL, Front FID - Part of System Preparation - No limits associated	
April 21, 2023 11:31:07 AM	Start	Execution	Noise and Drift - Front FID - Detector FID - L: Noise <= 3.10 pA - L: (Drift) <= 2.50 pA/hour	None

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Date: April 21, 2023 3:26:38 PM  
System ID: CN11461056

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User Name: xiangguohu@ahk  
Host Name: LAPTOP-CQ35KUMV  
System ID: CN11461056  
Print Date: April 21, 2023 3:26:48 PM

GC-E\_BKK\_ENH127\_ALS Transaction Log :

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
April 21, 2023 11:31:43 AM	Auto	Data	Noise and Drift - Front FID - Detector FID - L: (Noise) <= 3.10 pA - L: (Drift) <= 2.50 pA/hour	Data File Path : C:\Users\Public\Documents\C
				hemStation3\Data\CO2_GC-E_ALS_2023-04-20\CO2_GC-E_2023-2023-04-20_14-36-08F_Phd3-011F.D\FID 1A.ch
April 21, 2023 11:32:00 AM	End	Execution	Noise and Drift - Front FID - Detector FID - L: (Noise) <= 3.10 pA - L: (Drift) <= 2.50 pA/hour	Run Count : 1
April 21, 2023 11:32:03 AM	Start	Execution	Injection Precision - Injection	None
			Tower, Front SSIL, Front FID - GC - L: (Area) <= 3.00% - L: (Rel. Time) <= 1.00%	
April 21, 2023 11:32:23 AM	Start	Execution	Injection Precision - Injection	None
			Tower, Front SSIL, Front FID - GC - L: (Area) <= 3.00% - L: (Rel. Time) <= 1.00%	
April 21, 2023 11:32:53 AM	Auto	Data	Injection Precision - Injection	Data File Path : C:\Users\Public\Documents\C
			Tower, Front SSIL, Front FID - GC - L: (Area) <= 3.00% - L: (Rel. Time) <= 1.00%	hemStation3\Data\CO2_GC-E_ALS_2023-04-20\CO2_GC-E_2023-2023-04-20_14-36-08F_Phd3-011F.D\FID 1A.ch
April 21, 2023 11:33:53 AM	Auto	Data	Injection Precision - Injection	Data File Path : C:\Users\Public\Documents\C
			Tower, Front SSIL, Front FID - GC - L: (Area) <= 3.00% - L: (Rel. Time) <= 1.00%	hemStation3\Data\CO2_GC-E_ALS_2023-04-20\CO2_GC-E_2023-2023-04-20_14-36-08F_Phd3-011F.D\FID 1A.ch

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Date: April 21, 2023 3:26:39 PM  
System ID: CN11461056

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User Name: xiangguohu@ahk  
Host Name: LAPTOP-CQ35KUMV  
System ID: CN11461056  
Print Date: April 21, 2023 3:26:48 PM

GC-E\_BKK\_ENH127\_ALS Transaction Log :

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
April 21, 2023 11:33:35 AM	Auto	Data	Injection Precision - Injection	Data File Path : C:\Users\Public\Documents\C
			Tower, Front SSIL, Front FID - GC - L: (Area) <= 3.00% - L: (Rel. Time) <= 1.00%	hemStation3\Data\CO2_GC-E_ALS_2023-04-20\CO2_GC-E_2023-2023-04-20_14-36-08F_Phd3-011F.D\FID 1A.ch
April 21, 2023 11:33:53 AM	Auto	Data	Injection Precision - Injection	Data File Path : C:\Users\Public\Documents\C
			Tower, Front SSIL, Front FID - GC - L: (Area) <= 3.00% - L: (Rel. Time) <= 1.00%	hemStation3\Data\CO2_GC-E_ALS_2023-04-20\CO2_GC-E_2023-2023-04-20_14-36-08F_Phd3-011F.D\FID 1A.ch
April 21, 2023 11:33:59 AM	Auto	Data	Injection Precision - Injection	Data File Path : C:\Users\Public\Documents\C
			Tower, Front SSIL, Front FID - GC - L: (Area) <= 3.00% - L: (Rel. Time) <= 1.00%	hemStation3\Data\CO2_GC-E_ALS_2023-04-20\CO2_GC-E_2023-2023-04-20_14-36-08F_Phd3-011F.D\FID 1A.ch
April 21, 2023 11:33:59 AM	Auto	Data	Injection Precision - Injection	Data File Path : C:\Users\Public\Documents\C
			Tower, Front SSIL, Front FID - GC - L: (Area) <= 3.00% - L: (Rel. Time) <= 1.00%	hemStation3\Data\CO2_GC-E_ALS_2023-04-20\CO2_GC-E_2023-2023-04-20_14-36-08F_Phd3-011F.D\FID 1A.ch
April 21, 2023 11:34:05 AM	End	Execution	Injection Precision - Injection	Run Count : 1
			Tower, Front SSIL, Front FID - GC - L: (Area) <= 3.00% - L: (Rel. Time) <= 1.00%	
April 21, 2023 11:35:04 AM	Start	Execution	Signal to Noise - Injection	None
			Tower, Front SSIL, Front FID - Detector FID - L: <= 30000	

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Date: April 21, 2023 3:26:38 PM  
System ID: CN11461056

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User Name: xiangguohu@ahk  
Host Name: LAPTOP-CQ35KUMV  
System ID: CN11461056  
Print Date: April 21, 2023 3:26:48 PM

GC-E\_BKK\_ENH127\_ALS Transaction Log :

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
April 21, 2023 11:35:29 AM	Auto	Data	Signal to Noise - Injection	Data File Path : C:\Users\Public\Documents\C
			Tower, Front SSIL, Front FID - Detector FID - L: <= 30000	hemStation3\Data\CO2_GC-E_ALS_2023-04-20\CO2_GC-E_2023-2023-04-20_14-36-08F_Phd3-011F.D\FID 1A.ch
April 21, 2023 11:36:09 AM	End	Execution	Signal to Noise - Injection	Run Count : 1
			Tower, Front SSIL, Front FID - Detector FID - L: <= 30000	
April 21, 2023 11:36:53 AM	Start	Execution	GC Scouting Run - Injection	None
			Tower, Back SSIL, Back FID - Part of System Preparation - No limits associated	
April 21, 2023 11:36:56 AM	Auto	Data	GC Scouting Run - Injection	Data File Path : C:\Users\Public\Documents\C
			Tower, Back SSIL, Back FID - Part of System Preparation - No limits associated	hemStation3\Data\CO2_GC-E_ALS_2023-04-20\CO2_GC-E_2023-2023-04-20_14-36-08F_Phd3-011F.D\FID 1A.ch
April 21, 2023 11:37:30 AM	End	Execution	GC Scouting Run - Injection	Run Count : 1
			Tower, Back SSIL, Back FID - Part of System Preparation - No limits associated	
April 21, 2023 11:37:32 AM	Start	Execution	Noise and Drift - Back FID - Detector FID - L: (Noise) <= 0.10 pA - L: (Drift) <= 2.50 pA/hour	None

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Date: April 21, 2023 3:26:38 PM  
System ID: CN11461056

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Certificate No : 73-DPM-041

Request No : Req-2023-0364

Measurement results : Barometric Pressure

Calibration Range	Barometric Pressure		
	STD Reading	UUC Reading	Correction
(hpa)	(hpa)	(hpa)	(hpa)
1012.0	1012.1	1012.0	0.1

The Uncertainty of measurement was  $\pm 1.9$  (hPa)

Calibration Procedure : In-house method CP-DPM-03 by Comparison With Standard Barometric Pressure

End of Certificate

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

FM-708-AFM-01 Rev.02 Issue date 13/02/20



Certificate of Calibration

Customer

Name : ALS Laboratory Group Thailand Co., Ltd.  
Address : 104 Soi Phatthanasak 40, Phatthanasak Road, Suan Luang,  
Bangkok 10250

Certificate No : 23-GDM-022

Request No : Req-2023-0364

Unit Under Calibration Details

Measurement Item : Gas Detection Monitor Resolution : 0.1 (CO), 1 (CO2)  
Manufacturer : TSI Sensor : -  
Model : 082 Serial Number Sensor : -  
Serial Number : P18260056 Instrument Status : Used  
ID : BKK\_FS0933

Calibration Environment and Details

Temperature : 18 °C to 28 °C  
Humidity : 35 %RH to 65 %RH  
Received Date : 08 February 2023  
Calibration Date : 28 February 2023  
Calibration By : Mr. Sittichok Jirapaksadeesakun  
Location of Calibration : LAB 5 Gas meter  
Calibration Procedure : The measurement was done in accordance with CP-GDM-01 by Direct Measurement with Standard Gas

Reference Standard	Model / Lot #	Serial Number	Traceable	Due Calibration
Carbon Monoxide (CO)	304-402048969-1	-	GASCO	1 March 2023
Carbon Dioxide (CO2)	305-401914332-1	-	GASCO	18 September 2024

Traceability : This certificate provides traceability of measurement to recognized national standard, and to the realization of the international System of Units (SI).

Note : The reported uncertainty is based on standard uncertainty multiplied by the Coverage Factor  $k=2$ , providing a level of confidence approximately 95 %.

Calibrated By :   
Calibration Engineer

Approved By :   
Mr. Pacit Mathavorn  
Calibration Engineer Supervisor  
Issue Date : 28 February 2023

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

FM-708-GDM-01 Rev.00 Issue date 01/07/19



Certificate No : 23-GDM-022

Request No : Req-2023-0364

Calibration Result : Without Adjustment

Gas Calibration

Gas Calibration	Gas Standard	Before Adjustment		After Adjustment		Uncertainty 95%
		UUC Reading	Error	UUC Reading	Error	
Carbon Dioxide (CO2) ppm	0	0	0	0	0	0.58
	1005	841	-164	1000	-3	20
Carbon Monoxide (CO)	0	0	0	0	0	0.58
	100.0	89.5	-10.5	100.1	0.1	2.09

Note

- The UUC Reading are average of 4 value.
- Correction = Gas Standard - UUC Reading

End of Certificate

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

FM-708-GDM-01 Rev.00 Issue date 01/07/19.



Certificate of Calibration

Customer

Name : ALS Laboratory Group Thailand Co., Ltd.  
Address : 104 Soi Phatthanasak 40, Phatthanasak Road, Suan Luang,  
Bangkok 10250

Certificate No : 23-TPM-118

Request No : Req-2023-0364

Page : 1/2

Unit Under Calibration Details

Calibration Parameter : Temperature  
Instrument Name : Digital Thermometer with Sensor Range Calibration : 20 °C to 50 °C  
Manufacturer : TSI Type of Sensor : RTD  
Model : 982 Sensor Diameter (mm) : 4.5  
Serial Number : P18260056 Calibration Position (mm) : 67.5  
Resolution : 0.1 °C Instrument Status : Used  
ID Number : BKK\_FS0933

Calibration Environment and Details

Temperature : 23 °C  $\pm$  3 °C  
Humidity : 55 %RH  $\pm$  15 %RH  
Received Date : 8 February 2023  
Calibrated Date : 28 February 2023  
Calibration Procedure : In-house method CP-TPM-01 by Comparison with Standard Thermometer.

Reference Standard : Digital Thermometer with Sensor, Manufacturer: GINGO/GINGO, Model: GT11/ RTD100, SN: 08000057,  
ID: 02-TPM Which was calibrated on 10 March 2022, Calibration Certificate No. : QR22-0578

Traceability : This Certificate is traceable to SI Unit through Quality Reborn Co., Ltd., NSC-ONSC Accreditation No.:  
Calibration 0292

Note

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

Approved By :   
Mr. Pacit Mathavorn  
Calibration Engineer Supervisor  
Issue Date : 28 February 2023

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

FM-708-TPM-01 Rev.04 Issue date 13/07/19



Calibration Note

UUC Adjustment: ☐ Not Adjust

Certificate No.: 71-TPM-118

Request No.: Req-2023-0364

Page: 2/2

Result of Calibration

UUC Sensor	Standard Temperature (°C)	UUC Reading (°C)	Correction (°C)	Uncertainty (°C)
SENSOR 1	20.006	20.2	-0.2	0.14
	50.006	49.8	+0.2	0.14

End of Certificate

Calibrated By:

Mr. Sirichok Jirapukdeesakin

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

FM-708-TPM-01 Rev.03 Issue date: 13/03/20

Page 1 of 2

Certificate of Calibration

Customer

Name: ALS Laboratory Group Thailand Co., Ltd.  
Address: 104 Soi Phatthanasak 40, Phatthanasak Road, Suan Luang,  
Bangkok 10250

Certificate No.: 71-RHM-079

Request No.: Req-2023-0364

Unit Under Calibration Details

Measurement item: Relative Humidity Meter  
Manufacturer: TSI  
Model: 982  
Serial Number: P1A260056  
ID: BKK\_FS0933

Resolution: 0.1 (%RH)  
Resolution: -  
Sensor Model: 982  
Sensor S/N: P1A260056  
Instrument Status: Used

Calibration Environment and Details

Temperature: 25 °C ± 5 °C  
Humidity: 55 %RH ± 20 %RH  
Received Date: 8 February 2023  
Calibration Date: 28 February 2023  
Calibration By: Mr. Sirichok Jirapukdeesakin  
Location of Calibration: LAB 2 Temperature  
Calibration Method: In-house method CP-TIM-01 by Comparison With Standard Relative Humidity Meter and Standard Thermometer with RTD Probe in Humidity / Temperature Chamber

Reference Standard

Standard Thermometer Model: GT11, S/N: 08000057, Which was calibration on 10 March 2022, Calibration of Certificate No.: QR22-0578 and Relative Humidity Meter, Model: HP23, S/N: S200886, Which was calibration on 14 March 2022, Calibration of Certificate No.: QR22-0579

Traceability

This Certificate is traceable to SI Unit through Quality Reikom Co., Ltd., NSC-ONSC Accreditation No. Calibration 0293

Note

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

Calibrated By:

Service Calibration Engineer

Approved By:

Mr. Pacit Mathavorn

Calibration Engineer Supervisor

Issue Date: 28 February 2023

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

FM-708-TIM-01 Rev.03 Issue date: 02/07/20

Page 2 of 2

Certificate No.: 23-RHM-029

Request No.: Req-2023-0364

Calibration Results: Without Adjustment

Relative Humidity Calibration

Humidity Range (%RH)	Without Adjustment (%RH)			Uncertainty (%RH)
	STD Reading (%RH)	UUC Reading (%RH)	Correction (%RH)	
35	35.72	37.6	-1.9	0.9
80	79.95	78.6	-1.35	1.9

End of Certificate

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

FM-708-TIM-01 Rev.03 Issue date: 02/07/20

CERTIFICATE OF CALIBRATION

Certificate No.: CL-046-66

Page 1 of 2

Equipment Name: Heat Stress Monitor  
Manufacturer: Delta QHM  
Model: HD32.2  
Serial No: 20032249  
ID No: RYG\_FS0524

Customer

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

Received date: 24 Feb 2023  
Calibration date: 24 Feb 2023  
Issue date: 28 Feb 2023

Reference Used During Calibration

1. Standard Temperature Probe Model: STS-100 /A500,  
Serial No.: 667682-09, Due date: 23 Mar 2023  
2. Digital Temperature Indicator Model: DT1-1000-A MH,  
II, Serial No.: B71407-00591 Due date: 22 July 2023



Calibration Condition  
Temperature: (23±3) °C  
Relative Humidity: (65±15)%

Calibration Procedure

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

Traceability

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

REVIEW BY:   
APPROVED BY:   
ISSUE DATE: 24/2/24

Calibrated by

☐ Mr. Sorawit Thairachal  
☒ Miss Jitraporn Lertsomphol



Approved Signatory:

Mr. Panyin Booncharoen  
Calibration Department Manager

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



63/14-16,07/35-36, Soi Petchkasem 7/71, Petchkasem Rd,  
Watthapra, Bangkokhyal, Bangkok 10600 Thailand.  
Tel: (66) 02-8080812#13 Fax: (66) 02-8080801 www.jiranatee.com



Certificate No. : CL 049-01  
Page 2 of 3

Result of Calibration: ☒ Without Adjustment ☐ With Adjustment

Calibration Range:  
Function: 20 ~ 40 °C

Table 1: This equipment was connected with wet bulb probe Model: HP3201.2 S/N: 21001215.  
Dimension: Diameter 14 mm, Length 170 mm.

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
60	20.065	20.2	-0.1	0.099
80	25.061	25.2	-0.1	0.099
60	30.064	30.2	-0.1	0.099
80	35.045	35.2	-0.2	0.099
60	40.045	40.2	-0.2	0.099

Table 2: This equipment was connected with temperature probe Model: TP3207.2 S/N: 21001785.  
Dimension: Diameter 14 mm, Length 150 mm.

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
70	20.064	20.1	-0.0	0.099
70	25.061	25.0	-0.1	0.099
70	30.053	29.9	-0.2	0.099
70	35.045	34.9	-0.1	0.099
70	40.045	39.8	-0.2	0.099

Table 3: This equipment was connected with Globe thermometer probe Model: TP3276.2 S/N: 21001244.  
Dimension: Diameter 8 mm, Length 170 mm.

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
110	20.065	20.0	-0.1	0.099
110	25.061	25.0	-0.1	0.099
110	30.054	30.0	-0.1	0.099
110	35.045	35.0	-0.0	0.099
110	40.045	40.0	0.0	0.099

UUC\*: Unit Under Calibration

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

★ End of Certificate ★



## CERTIFICATE OF CALIBRATION

ISSUED BY

Cirrus Research plc

DATE OF ISSUE

03 November 2022 CERTIFICATE NUMBER 102475

REVIEW BY: *Monica P*

APPROVED BY: *Steve G*

NEXT CAL DATE: 11/11/23

Page 1 of 1

Test engineer:  
Nigel Smith  
Electronically signed

*Nigel Smith*

## doseBadge Reader

Instrument

Manufacturer: Cirrus Research plc

Model Number: RC110A

Serial Number: 75996

Notes:

### Calibration Procedure

The tests were carried out in accordance with the requirements of IEC 60942:2003 where applicable.

Date of Calibration: 01 November 2022

### Functionality Results

Function	Result
Keypad	Pass
Battery Power	Pass
Display	Pass
Communication	Pass
Z way IR link	Pass
Clock	Pass

### Calibration Results

	Level (dB)	Frequency (Hz)	Distortion (% THD + Noise)
Initial	114.25	1004.0	0.26
Adjusted	114.00	1004.0	0.26
Uncertainty	± 0.11	± 0.14	± 0.10
Tolerances	± 0.60	± 2.00	± 4.00

### Environmental Conditions

Pressure: 99.05 kPa

Temperature: 22.1 °C

Humidity: 48.6 %

### Notes

This certificate provides traceability of measurement to the SI system of units and/or to units of measurement realised at the National Physical Laboratory or other recognised national metrology institutes. This certificate may not be reproduced other than in full, except with the prior written approval of the issuing laboratory. The results within this certificate relate only to the items calibrated. The reported expanded uncertainty is based on a standard uncertainty multiplied by a coverage factor k=2, providing a coverage probability of approximately 95%.



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)  
CORPORATE SERVICES & EQUIPMENT CALIBRATION AND TESTING SERVICES  
834/4 PATTANAKARN ROAD SOI 18, SIANGLIANG, SIANGLIANG BANGKOK 10250  
TEL: 0-2717-3000-27 FAX: 0-2719-9464



Cert.No.: 22CH1733  
Page.: 1 of 3

## Certificate of Calibration

Equipment: pH Meter  
Manufacturer: Mettler Toledo  
Model: SevenExcellence  
Serial No.: B834291445  
ID No.: RYG\_EN0152  
Condition As-Received: Used Item  
Received Date: 21 December 2022  
Calibration Date: 22 December 2022  
Reference: 2212-0602DSC-1  
Submitted by: ALS Laboratory Group (Thailand) Co., Ltd.  
Rayong Branch  
616/10 Moo 5 T.Maenam Khu,  
A.Pluakdaeng, Rayong 21140, Thailand

Ambient Temperature: (25 ± 2.5) °C  
Relative Humidity: (50 ± 15) %  
In-house method:  
- CP-CH5 by direct measurement with standard voltage calibrator and direct measurement with certified reference material (CRM)  
- CP-CH8 by comparison with standard thermometer

Calibrated by: Warakorn Lemgagtrakul

Approved by: *Malee Butkruea*  
Approved Signatory

(/ ) Malee Butkruea  
( ) Sathip Meangmai  
( ) Warakorn Lemgagtrakul

Issue Date: 28 December 2022

The Uncertainties are for a confidence probability of approximately 95%

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



Cert.No.: 22CH1733  
Page.: 2 of 3

### Condition of this calibration result

1. Reference Standard Instrument: -

Instrument	Serial No.	ID No.	Cert. No.	Due Date
1) Document Process Calibrator	54030049	130RC116	22E2769	24 Aug 2023
2) Ref. Standard Thermometer	4982054	110RC044	2211306	27 Oct 2023

This certification is traceable to the International System of Units maintained at:  
- Traceable to National Institute of Metrology (Thailand), NIMT

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

Buffer Solution	Manufacturer	Lot No.	Exp. date
pH 4.008	CPA chem	826588	09 July 2024
pH 6.987	CPA chem	823322	20 June 2023
pH 10.008	CPA chem	826580	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	Coverage factor
	pH	mV	mV	pH	(±mV)	k
pH Meter S/N: B834291445	4.000	177.48	177.3	4.000	0.058	2.00
	7.000	0.00	-0.1	7.000	0.058	2.00
	10.000	-177.48	-177.5	10.000	0.058	2.00





Cert.No.: ZZCH1/33  
Page: 3 of 3

#### Calibration Results

Function : pH Measurement

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

Unit Under Calibration	Standard pH Buffer Solution	Actual pH Reading	Actual mV Reading (mV)	Uncertainty of pH measurement ( $\pm$ )	Coverage factor k
pH Electrode S/N: 1475518	4.008 6.987 10.008	4.011 6.990 10.014	185.2 10.4 -166.5	0.0052 0.0088 0.0072	2.06 2.00 2.00

#### Function : Temperature Measurement

(\*) Without adjustment

This equipment was connected with Temperature Probe;

- Model : InLab Expert Pro-ISM

- Serial No. : 1475518

Dimension of probe;

- Length : 120 mm.

- Diameter : 12 mm.

- Immersion Depth : 100 mm.

Calibration Point (°C)	Standard Temperature (°C)	UUC* Reading (°C)	Error (°C)	Uncertainty of measurement ( $\pm$ °C)	Coverage factor
25.0	25.001	24.9	-0.101	0.13	2.00

Remark : - UUC\* = Unit Under Calibration

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

-o-o-

Melu

a 1141166



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



#### Certificate of Calibration

Certificate No.: 22E4008  
Page: 1 of 2

Equipment : pH Meter  
Manufacturer : Mettler Toledo  
Model : SevenExcellence  
Serial No.: B634291445  
ID No.: RYG\_EN0152

Condition As-Received: Used Item  
Received Date: 21 December 2022  
Calibration Date: 23 December 2022

Reference: 2212-0802DSC

Ambient Temperature: ( 23  $\pm$  2 ) °C

Relative Humidity: ( 50  $\pm$  10 ) %

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

616/10 Moo 5, T.Maenam Khu, A.Pluakdaeng,  
Rayong 21140, Thailand

Procedure used: Calibration were conducted using In-house calibration Procedure CPE17 According to direct measurement method with Multi-Product Calibrator.

#### Condition of this result of calibration

1.Reference standards instruments :

Instrument	Model	Serial No.	Certificate No.	Due Date
1) Multi-Product Calibrator	5500A	6315011	22E1431	05 May 2023
2.This result of calibration was made on requested at the point specified by customer.				
3.The certificate is valid only to the item calibrated on date and place of calibration.				
4.This Certification is traceable to the International System of Unit maintained at:- -National Institute of Metrology Thailand (NIMT)				

Calibrated by : Wutharaporn Wongchulkrane  
Issue Date : 26 December 2022

Approved Signatory :

Phalinee Prabpaijai  
Nuntawat Khamchai  
Pornthippa Tameyakul

D 0304803



Cert. No.: 22F4008  
Page: 2 of 2

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

Function: DC voltage measurer

Range: 2000

mV

Standard Value (mV)	UUC* Reading (mV)	Error (mV)	Uncertainty ( $\pm$ $\mu$ V)
-200.0000	-200.0	0.0	72
-150.0000	-150.0	0.0	69
-100.0000	-100.0	0.0	65
-50.0000	-50.0	0.0	62
0.0000	0.0	0.0	58
50.0000	50.0	0.0	62
100.0000	100.0	0.0	65
150.0000	150.0	0.0	69
200.0000	199.9	-0.1	72

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

\*UUC= Unit Under Calibration.

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a 1140616



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

#### Certificate of Testing

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

Equipment : DO Meter  
Manufacturer : YSI  
Model : 5000-115V  
Serial No.: 15E102796  
ID No.: RYG\_EN0032

Received Date : 11 February 2022

Test Date : 14 February 2022

Reference : 2202-0404DSC-4

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

Laboratory Condition : Temperature ( 25  $\pm$  5 ) °C  
Humidity ( 50  $\pm$  20 ) %

Test Procedure : In-house method : CP-CH9  
by Comparison Technique with Azide Modification Method

Tested by : Walailak Sirinthean

Approved by :

Saithip  
Approved Signatory

( ) Malee Dutkrua  
( ) Saithip Maengmai  
( ) Warakorn Lemagatrakul

Issue Date : 18 February 2022

REVIEW BY N.Bamrit  
APPROVED BY D. An  
NEXT CAL. DATE 15/8/23

B 0201205





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

Result : Dissolved Oxygen Meter Adjustment With Air 100 %

Dissolved Oxygen Probe No.: 15E100464

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

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

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Saitip

a 1094744



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



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

## Certificate of Calibration

Equipment : DO Meter with Sensor  
Manufacturer : YSI  
Model : 5000-115V  
Serial No. : 15E102796  
ID No. : RYG\_EN0032  
Submitted by : ALS Laboratory Group (Thailand) Co., Ltd. (Rayong Branch)  
616/10 Moo 5 T. Maenam Khu, A. Pluakdaeng,  
Rayong 21140, Thailand  
Location : TPA On Site Calibration Laboratory  
Received Order : 11 February 2022  
Calibrated Date : 21 February 2022  
Ambient Temperature : ( 26 ± 10 ) °C  
Relative Humidity : ( 50 ± 30 ) %  
AC Line Voltage : ( 220 ± 22 ) V  
Calibrated by : Kunchit Promrat  
Approved by :   
( ) Pornthipa Tameyakul  
( / ) Malee Butkruea  
( ) Suwit Imjai  
Issue Date : 21 February 2022

The Uncertainties are for a confidence probability of approximately 95%

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

A 0038008



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

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

Calibration were conducted using in-house calibration procedure GP-QT01 according to comparison with Industrial Platinum Resistance Thermometer (IPRT) into Temperature Bath.

The temperature scale used was based on ITS-90.

### Condition of this result of calibration

1. Reference standard instrument:-

Instrument	Model	Serial No.	Cert. No.	Due Date
1) Digital Thermometer	1523	2188080	21112/3	22 Nov 2022

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

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

Result of Calibration :- ( \* ) Without Adjustment

Function : Temperature measurement.

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

Calibration Point ( °C )	Immersion Depth ( mm )	Standard Temperature ( °C )	UUC* Reading ( °C )	Error ( °C )	Uncertainty ( ± °C )	Coverage Factor k
20.00	45	20.001	19.88	-0.121	0.15	2.00

UUC\* : Unit Under Calibration

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

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Malee

a 1095714



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)  
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TEL: 0-2717-3000-27 FAX: 0-2719-9484



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

## Certificate of Calibration

Equipment : Low Temp. Incubator  
Manufacturer : Memmert  
Model : IPP750  
Serial No. : V818.0084  
ID No. : RYG\_EN0154  
Submitted by : ALS Laboratory Group (Thailand) Co., Ltd.  
(Rayong Branch)  
616/10 Moo 5 T. Maenam Khu,  
A. Pluakdaeng, Rayong 21140, Thailand  
BOD Room  
Location :  
Received Order : 22 April 2022  
Calibration Date : 22 April 2022  
Ambient Temperature : ( 26 ± 10 ) °C  
Relative Humidity : ( 50 ± 30 ) %  
Calibrated by : Man Pattanapongpaiboon  
Approved by :   
( ) Pornthipa Tameyakul  
( / ) Malee Butkruea  
( ) Suwit Imjai  
Issue Date : 3 May 2022

The Uncertainties are for a confidence probability of approximately 95%

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

A 0040735



Equipment : Low Temp. Incubator  
Condition As-Received : Used Item  
Reference : 2204.01460C-1  
Cert. No.: 22TM317  
Page: 2 of 3

#### Procedure Used :-

Calibration were conducted using calibration procedure CP-0T02 according to direct measurement  
The temperature scale used was based on ITS-90.

#### Condition of this result of calibration

##### 1. Reference standard instrument:-

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

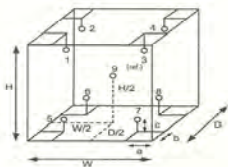
2. This certificate is valid only to the item calibrated on date and place of calibration.

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

Result of Calibration :- ( ° ) Without Adjustment

Function of UUC\* : Temperature Source

Fresh air setting : Close



#### Probe Installation Details :

#### Dimension of Chamber :

a = 10 cm D = 0.80 m  
b = 10 cm W = 1.0 m  
c = 10 cm H = 1.2 m  
Capacity = 0.75 m<sup>3</sup>

Environment during calibration		
	Beginning	Finished
Temp. ( °C )	25	25
REL.Humid. ( % )	54	58
AC Supply ( Volt )	221	223

Position :	Ref. Std. ID No.:
1	9RTD-2/1
2	9RTD-2/2
3	9RTD-2/3
4	9RTD-2/4
5	9RTD-2/5
6	9RTD-2/6
7	9RTD-2/7
8	9RTD-2/8
9 (ref.)	9RTD-2/9

a 1106485



Equipment : Low Temp. Incubator  
Condition As-Received : Used Item  
Reference : 2204.01460C-1  
Cert. No.: 22TM317  
Page: 3 of 3

#### Result of Calibration :-

( ° ) Without Adjustment

Function of UUC\* : Temperature Source

Fresh air setting : Close

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

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

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

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

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

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

UUC\* : Unit Under Calibration

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

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

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a 1106484



## Certificate of Calibration

Equipment : SPECTROPHOTOMETER  
Model : DR6000  
Serial No. (or ID.): 1627845 (RYG\_EN0037)  
Manufacturer : HACH  
Condition : In Condition

Certificate No.: C06220464  
Issued Date: 27 September 2022  
Job No.: KSPR2212224  
Page: 1 of 3

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

REVIEW BY : N.B. JET  
APPROVED BY : D.A.  
NEXT CAL. DATE : 27/13/24

Environment Condition: Temperature 23.1 °C ±  
Humidity 85.4 %RH ± 3.2 %RH

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

Calibration By: Mr. Chattaphon Foithong  
Calibration Date: 27 September 2022

The Method used: In house method, CAL-WI-24, base on ASTM E 275-08 and ASTM E 367-04

Traceability: This certificate is traceable to the CRM maintained by National Institute of Standards and Technology (NIST) through Stama Scientific Limited.

The standard for Wavelength Certificate No. 91418 and 91435  
The standard for Photometric Certificate No. 91441 and 101088  
The standard for Stray light Certificate No. 101041 and 101040  
The standard for Spectral resolution Certificate No. 101037

(Mr. Chattaphon Foithong)

Person in charge

(Mr. Thakerngkiet Pongrarn)

Authorized signatory

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

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

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

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CALFM-C06-13: 20 Jul 2022



Certificate No.: C06220464 Page 2 of 3

#### Calibration Results:

##### Without Adjustment

Wavelength Accuracy (nm), The spectral bandwidth of 86d at 2 nm and UUC at 2 nm

Standard Wavelength	Unit Under Calibration	Correction	Uncertainty
418.81	418.4	0.21	0.14
656.86	656.7	-0.04	0.14
657.90	656.3	-0.32	0.14
746.46	746.8	-0.32	0.14
807.03	807.4	-0.37	0.13

##### Photometric Accuracy (Absorbance)

Wavelength	Standard absorbance	Unit Under Calibration	Correction	Uncertainty
420 nm	0.0000	0.000	0.0000	0.0045
	0.5606	0.563	-0.0025	0.0045
	0.7334	0.737	-0.0036	0.0045
	1.0534	1.057	-0.0036	0.0045
440 nm	0.0000	0.000	0.0000	0.0045
	0.5503	0.553	-0.0027	0.0045
	0.7179	0.720	-0.0021	0.0045
	1.0312	1.034	-0.0028	0.0045
485 nm	0.0000	0.000	0.0000	0.0045
	0.5024	0.506	-0.0036	0.0045
	0.6693	0.672	-0.0027	0.0045
	0.9904	0.994	-0.0036	0.0045
546.1 nm	0.0000	0.000	0.0000	0.0045
	0.5168	0.519	-0.0022	0.0045
	0.6903	0.691	-0.0007	0.0045
	0.9904	0.992	-0.0016	0.0045
590 nm	0.0000	0.000	0.0000	0.0045
	0.5525	0.554	-0.0015	0.0045
	0.7175	0.718	-0.0005	0.0045
	1.0301	1.031	-0.0009	0.0045
630 nm	0.0000	0.000	0.0000	0.0045
	0.5367	0.538	-0.0013	0.0045
	0.6647	0.665	-0.0003	0.0045
	0.9823	0.983	-0.0007	0.0045

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CALFM-C06-13: 20 Jul 2022



Calibration Results:  
Without Adjustment

Photometric Accuracy (Absorbance)				
Wavelength	Standard absorbance	Unit Under Calibration	Correction	Uncertainty
235 nm	0.0000	0.000	0.0000	0.0080
	0.7423	0.744	-0.0017	0.0083
257 nm	0.0000	0.000	0.0000	0.0080
	0.8609	0.861	-0.0001	0.0084
313 nm	0.0000	0.000	0.0000	0.0080
	0.2895	0.292	-0.0025	0.0080
350 nm	0.0000	0.000	0.0000	0.0080
	0.6381	0.638	0.0001	0.0080
Stray light *				
Standard: cut-off	UUC: Wavelength (nm)	UUC: Transmission (%)	Absorbance (A)	
260.67 +/- 0.11 nm	260.7	2.1	1.678	
391.84 +/- 0.11 nm	391.9	1.7	1.770	
Spectral Resolution *				
Nominal Concentration 0.02 % v/v	Peak	Trough	Ratio	SBW
Standard Wavelength ( nm )	268.60	266.63	1.39	2.00
UUC: Wavelength (nm)	268.2	266.1		
Std Absorbance ( A )	0.4810	0.3176		
Absorbance ( A )	0.373	0.268		

\* Calibration Marked \* Not TISI Accredited \* In this Certificate have been included for completeness.

The End of Certificate

DKSH Technology Limited  
3533 หมู่ 9 ตำบลบ้านใหม่ อำเภอรามไทย กรุงเทพมหานคร 10260  
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CAL-FM-C06-13: 20 Jul 2022

## ใบตรวจสอบสภาพเครื่องวัดสิ่งแวดล้อม

เลขที่ใบงาน: K6PR2212224

ชนิดเครื่องมือ: SPECTROPHOTOMETER รุ่น: DR6000

หมายเลขเครื่อง: 1627845

ตรวจสอบ (รับ)		ตรวจสอบ (ส่ง)		หมายเหตุ
27 Sep 2022	รายการตรวจเช็ค	27 Sep 2022		
ปกติ	ไม่ปกติ	ปกติ	ไม่ปกติ	
General				
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	1. ความสมบูรณ์เครื่อง
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	2. ความสะอาด (ช่องใส่ตัวอย่าง, ภายใน-นอกเครื่อง)
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	3. สวิตช์ ปิด - เปิด เครื่อง (On-Off Switch)
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	4. ปุ่มกด (Keypad)
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	5. หน้าจอ (Display, Screen Contrast)
Spectrophotometer				
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	6. แบตเตอรี่ (Battery Backup) >= 2.5 VDC
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	7. ตัวควบคุมความยาวคลื่น (Wavelength Control)
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	8. ความยาวคลื่น (Wavelength Check)
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	9. แหล่งกำเนิดแสง (UV < 3,000 hour)
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	10. แหล่งกำเนิดแสง (Visible < 5,000 hour)
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	11. ช่องวัดหลายตัวอย่าง (Carousel Module)
pH Meter and Conductivity Meter				
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	12. อิเล็กโทรด (Electrode and Connection Cable)
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	13. ระดับสารละลายใน Electrode (Level KCl)
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	14. ฝาปิดกันละออง Electrode (Dust Protection Hood)
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	15. ขาจับอิเล็กโทรด (Stand)
Turbidimeter				
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	16. ค่าความขุ่นที่อ่าน (No Sample)
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	17. ระดับการล้างตัวกรองแสง (>= 2.5 ไม่นาน 3.0)
Automatic Dilutor				
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	18. สลัก Piston Burettes
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	19. Function Rinsing and Dosing
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	20. ระบบท่อจ่ายน้ำและอุปกรณ์ประกอบ

เพิ่มข้อมูลเข้ามา :

Mr. Chathuphon Folthong  
Service Engineer

DKSH Technology Limited  
3533 หมู่ 9 ตำบลบ้านใหม่ อำเภอรามไทย กรุงเทพมหานคร 10260  
Phone: +66 2659 7000 Email: info@dksh.com Website: www.dksh.com

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CAL-FM-R31-03: 20 Jul 2022

RYG\_EN0002

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

SARTORIUS

REVIEW BY: *Thanyal*  
APPROVED BY: *Dan*  
NEXT CAL. DATE: 01/03/24

## Certificate of Calibration

Model Number: MSE224S-100-DU Certificate No.: 23BCI0112  
Description: Analytical Balance Issued Date: Friday, March 03, 2023  
Serial Number: 0026207038 Reference No.: 204833  
ID No.: RYG\_EN0002  
Manufacturer: Sartorius Page No.: 1 of 2

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

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

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

Metrological data:  
Capacity: 220 g Readability: 0.0001 g  
Reasons for calibration:  
☒ New Installation ☐ Service / Repair ☒ Re-calibration / Maintenance ☐ Equipment Condition: ☒ Good Operation ☐ Fit

Measurement Method: UKAS Publication Ref: Lab 14  
The measurement uncertainty stated is the expanded uncertainty which is obtained from the standard uncertainty multiplied by the coverage factor (k=2) to provide a level of confidence of approximately 95%. It is determined in accordance with the Guide to Expression of Uncertainty in Measurement (GUM). The calibration certificate documents the traceability to National Standards, which realise the unit of measurement according to the International Standard System of Units (SI). Report of Tolerance came from list of Sartorius Metrological Specifications.

## Traceability:

Model Number	Description	Traceability	Certificate No.	Due Date
YCS011-522-D0	Sartorius weight set 1mg - 5000g E2 YCS011-522-D0	SPC-RT	C02212685	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 either in full or in part without 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 9 Road, Huaykwang, Huaykwang, Bangkok 10310  
Tel: +66 2643 8361-6, e-mail: service.thailand@sartorius.com

SARTORIUS

## Certificate of Calibration

Model Number: MSE224S-100-DU Certificate No.: 23BCI0112  
Description: Analytical Balance Issued Date: Friday, March 03, 2023  
Serial Number: 0026207038 Reference No.: 204833  
ID No.: RYG\_EN0002  
Manufacturer: Sartorius Page No.: 2 of 2

## Calibration Results : Without Adjustment

Repeatability			Eccentricity (Off-center loading error)		
The repeatability is the ability of a weighing instrument to display nearly identical 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 repeatability quantitatively.			The off-center loading error is yielded by the difference between the reading of the load, i.e. 1/3 or 1/4 of maximum capacity, placed in the middle of the weighing pan and between each of four additional measurement points (positions defined according to OIML R110).		
Nominal Value : (Low Load)	20.0000	199.9999	Nominal value	100	0
20 g	20.0000	200.0000	Tolerance	0.0004	g
Tolerance	0.0001 g	199.9999	Difference		
	20.0000	200.0000		1	
	20.0000	199.9999		2	-0.0001
Nominal Value : (High Load)	20.0000	199.9999		3	-0.0001
200 g	19.9999	200.0000		4	0.0001
Tolerance	0.0001 g	200.0000		5	0.0002
	20.0000	200.0000		6	-
Standard Deviation			End of Report		
0.00003 0.00005					

Linearity					
The linearity, also called linearity error, describes the deviation of the characteristic curve of a weighing instrument from the linear slope.					
Tolerance	0.0002 g				
Nominal Value (g)	Conventional Mass Value (g)	Displayed Value (g)	Deviation (g)	Uncertainty (g)	
0.01	0.0100	0.0100	0.0000	0.00014	
0.05	0.0500	0.0500	0.0000	0.00014	
0.1	0.1000	0.1000	0.0000	0.00014	
0.5	0.5000	0.5000	0.0000	0.00014	
1	1.0000	1.0000	0.0000	0.00014	
5	5.0000	5.0000	0.0000	0.00014	
10	10.0000	10.0001	0.0001	0.00014	
20	20.0000	20.0000	0.0000	0.00024	
50	50.0000	50.0000	0.0000	0.00015	
100	100.0000	99.9999	-0.0001	0.00019	
200	200.0000	200.0000	0.0000	0.00032	

SOP FM 33 03 February 2022





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TEL: 0-2715-3000-27 FAX: 0-2719-9884



Cert. No.: 22TM1517  
Page: 1 of 3

## Certificate of Calibration

Equipment : Hot Air Oven  
Manufacturer : Memmert  
Model : UFE 500  
Serial No. : G511.1572  
ID No. : RYG\_EN0010  
Submitted by : ALS Laboratory Group (Thailand) Co.,Ltd. (Rayong Branch)  
616/10 Moo 5 T. Maenam Khu,  
A. Pluakdaeng,  
Rayong 21140 Thailand  
Location : Oven Room  
Received Order : 20 October 2022  
Calibration Date : 20 October 2022  
Ambient Temperature : (26 ± 10) °C  
Relative Humidity : (50 ± 30) %  
Calibrated by : Man Pattanapongpaiboon  
Approved by :   
( ) Pornthippa Tameyakul  
(✓) Malee Butkrusa  
( ) Suwit Imjai

Issue Date : 2 November 2022

The Uncertainties are for a confidence probability of approximately 95%

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

A 0046908



Equipment : Hot Air Oven  
Condition As-Received : Used Item  
Reference : 2210-0376OC-2  
Procedure Used :-

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

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

The temperature scale used was based on ITS-90.

### Condition of this result of calibration

#### 1. Reference standard instrument:-

Instrument	Model	Serial No.	Cert. No.	Due Date
1) Data Acquisition	34972A	MY49023932	22LM97	29 Jul 2023

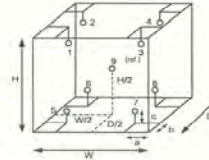
2. This certificate is valid only to the item calibrated on date and place of calibration.

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

Result of Calibration :- (°) Without Adjustment

Function of UUC\* : Temperature Source

Fresh air setting : Close



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

Ref. Std. ID No.: @ Calibration Point		
Position :	(180) °C	(104) °C
1	21-16TC-01	20-16RTD-01
2	21-16TC-02	20-16RTD-02
3	21-16TC-03	20-16RTD-03
4	21-16TC-04	20-16RTD-04
5	21-16TC-05	22-16RTD-05
6	21-16TC-06	20-16RTD-06
7	21-16TC-07	20-16RTD-07
8	21-16TC-08	22-16RTD-08
9 (ref.)	21-16TC-09	22-16RTD-09

Probe Installation Details : Dimension of Chamber :  
a = 5.0 cm D = 0.40 m  
b = 5.0 cm W = 0.56 m  
c = 5.0 cm H = 0.48 m  
Capacity = 0.11 m³

a 1132466



Equipment : Hot Air Oven  
Condition As-Received : Used Item  
Reference : 2210-0376OC-2  
Result of Calibration :- (°) Without Adjustment  
Function of UUC\* : Temperature Source  
Fresh air setting : Close

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

Calibration Point (°C)	UUC* Setting (°C)	UUC* Reading (°C)	Temperature stability (± °C)	Temperature uniformity (°C)	Overall Variation (°C)	Uncertainty (± °C)	Coverage Factor k
104.0	104.0	104.0	0.076	0.52	0.60	0.42	2
180.0	180.0	180.0	0.13	0.88	1.2	1.1	2

Calibration Point (°C)	Measured Temperature (°C)								
	Position								
	1	2	3	4	5	6	7	8	9 (ref.)
104.0	103.768	103.794	103.723	103.800	104.215	104.131	104.132	103.740	103.747
180.0	179.723	179.359	179.439	179.489	180.361	180.114	180.131	180.243	179.805

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

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

Overall Variation : The Difference of the maximum and minimum measured temperatures throughout observation.  
UUC\* : Unit Under Calibration

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

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

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a 1132465



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TEL: 0-2715-3000-27 FAX: 0-2719-9884



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

## Certificate of Calibration

Equipment : Hot Air Oven  
Manufacturer : Memmert  
Model : UM 400  
Serial No. : b495.0899  
ID No. : RYG\_EN0006  
Submitted by : ALS Laboratory Group (Thailand) Co.,Ltd. (Rayong Branch)  
616/10 Moo 5, T. Maenam Khu,  
A. Pluakdaeng,  
Rayong 21140, Thailand  
Location : Oven Room  
Received Order : 20 October 2022  
Calibration Date : 20 October 2022  
Ambient Temperature : (26 ± 10) °C  
Relative Humidity : (50 ± 30) %  
Calibrated by : Preecha Hlahib

Approved by :   
( ) Pornthippa Tameyakul  
(✓) Malee Butkrusa  
( ) Suwit Imjai

Issue Date : 2 November 2022

The Uncertainties are for a confidence probability of approximately 95%

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

A 0046905





Equipment : Hot Air Oven  
Condition As-Received : Used Item  
Reference : 2210-0376OC-1  
Procedure Used :-

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

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

The temperature scale used was based on ITS-90.

#### Condition of this result of calibration

##### 1. Reference standard instrument:-

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

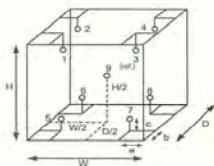
2. This certificate is valid only to the item calibrated on date and place of calibration.

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

Result of Calibration :- ( \* ) Without Adjustment

Function of UUC\* : Temperature Source

Fresh air setting : Close



#### Probe Installation Details :

#### Dimension of Chamber :

a = 5.0 cm D = 0.33 m  
b = 5.0 cm W = 0.40 m  
c = 5.0 cm H = 0.40 m  
Capacity = 0.053 m<sup>3</sup>

Environment during calibration		
	Beginning	Finished
Temp. ( °C )	28	29
REL.Humid. ( % )	43	47
AC Supply ( Volt )	220	221

Position :	Ref. Std. ID No.:
1	18-10RTD-01
2	18-10RTD-02
3	18-10RTD-03
4	18-10RTD-04
5	18-10RTD-05
6	18-10RTD-06
7	18-10RTD-07
8	18-10RTD-08
9 (ref.)	18-10RTD-09

a 1132473



Equipment : Hot Air Oven  
Condition As-Received : Used Item  
Reference : 2210-0376OC-1

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

Result of Calibration :- ( \* ) Without Adjustment

Function of UUC\* : Temperature Source

Fresh air setting : Close

Calibration Point ( °C )	UUC* Setting ( °C )	UUC* Reading ( °C )	Temperature stability ( ± °C )	Temperature uniformity ( °C )	Overall Variation ( °C )	Uncertainty ( ± °C )	Coverage Factor k
70.0	70.0	70.0	0.079	0.47	0.77	0.42	2

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

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

Temperature stability : One-half of the greatest maximum difference of measured temperature at any one sensor temperature at the reference location which are observed at the same time or at as close an observation time as possible to determine the temperature pattern or homogeneity within the chamber under steady-state conditions.

Overall Variation : The Difference of the maximum and minimum measured temperatures throughout observation UUC\* : Unit Under Calibration

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

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

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a 1132472

RYG\_EN0061



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TEL. 0-2713-3000-27 FAX. 0-2719-9484



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

## Certificate of Calibration

Equipment : Water Bath

Manufacturer : Memmert

Model : WNB22

Serial No. : L513.0648

ID No. : RYG\_EN0061

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

Location : Wet Chemistry Lab

Received Order : 20 October 2022

Calibration Date : 20 October 2022

Ambient Temperature : ( 26 ± 10 ) °C

Relative Humidity : ( 50 ± 30 ) %

Calibrated by : Preecha Hlahib

Approved by :   
Approved Signatory

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

Issue Date : 2 November 2022

The Uncertainties are for a confidence probability of approximately 95%

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A 0046906



Equipment : Water Bath  
Condition As-Received : Used Item  
Reference : 2210-0376OC-4

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

Procedure Used :-

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

The temperature scale used was based on ITS-90.

#### Condition of this result of calibration

##### 1. Reference standard instrument:-

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

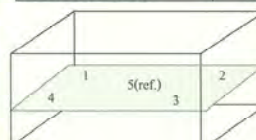
2. This certificate is valid only to the item calibrated on date and place of calibration.

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

Result of Calibration :- ( \* ) Without Adjustment

Function of UUC\* : Temperature Source

	Environmental		AC Voltage Supply
	( °C )	( %R.H. )	( Volt )
Beginning of Calibration	24	53	222
Finished of Calibration	24	50	221



Front

Position :	Ref. Std. S/N.:
1	N37P300726
2	N37P300727
3	N37P300728
4	N37P300729
5(ref.)	N37P300730

a 1132471



Equipment : Water Bath  
Condition As-Received : Used Item  
Reference : 2210-03760C-4  
Result of Calibration :- ( \* ) Without Adjustment  
Function of UUC\* : Temperature Source

Cert. No.: 22TM1494  
Page : 3 of 3

Calibration point ( °C )	UUC* Setting ( °C )	UUC* Reading ( °C )	Average* Standard Reading ( °C )				
			Position				
			1	2	3	4	5 (ref.)
85.0	85.0	85.0	84.527	84.563	84.628	84.516	84.580

Calibration point ( °C )	Uniformity ( °C )	Stability ( ± °C )	Uncertainty ( ± °C )	Coverage Factor k
85.0	0.12	0.081	0.18	2

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

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

Stability : One-half of the greatest maximum difference of measured temperature at any one probe.

UUC\* : Unit Under Calibration

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

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

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Malu

a 1132470



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## Certificate of Calibration

Certificate No.: 22T1581  
Page : 1 of 2

Equipment : Digital Thermometer With Sensor  
Manufacturer : Testo  
Model : 106  
Serial No.: 51162979/811  
ID No.: RYG\_FS0418  
Condition As-Received: Used Item  
Received Date: 28 August 2022  
Calibration Date: 31 August 2022  
Reference: 2208-0964DSC  
Ambient Temperature: ( 25 ± 3 ) °C  
Relative Humidity: ( 50 ± 20 ) %

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Procedure used: Calibration were conducted using in-house calibration procedure CP-T01 according to comparison with Industrial Platinum Resistance Thermometer (IPRT) into liquid bath temperature controller.  
The temperature scale used was based on ITS-90.

### Condition of this result of calibration

1. Reference standards (instruments) :

Instrument	Model	Serial No.	Certificate No.	Due Date
1) Digital Thermometer	1528	A7A609	2111126	14 Oct 2022
2) Industrial Platinum Resistance Thermometer	5627	824304	2111128	14 Oct 2022

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

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

REVIEW BY	Tanakit
APPROVED BY	Supt S
NEXT CAL. DATE	31/08/23

Calibrated by : Pitak Srimongkol  
Issue Date : 12 September 2022

Approved Signatory :  
[ ] Phalinee Pratsapaai  
[ ] Chatchawan Khunpluek  
[x] Wanlop Larpum

B 0296665



Cert. No.: 22T1581  
Page.: 2 of 2

Result of Calibration:- Without Adjustment  
Function: Temperature measurement  
Dimension of probe : Diameter 3 mm., Length 55 mm. Sheath material : Stainless Steel

Immersion Depth ( mm )	Standard Temperature ( °C )	UUC* Reading ( °C )	Error ( °C )	Uncertainty of Measurement ( ± °C )
50	24.9968	24.9	-0.0968	0.12
50	30.0015	29.9	-0.1015	0.12
50	39.9966	39.9	-0.0966	0.12

UUC\* : Unit Under Calibration

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

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Malu

a 1125496



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



## Certificate of Calibration

Cert.No.: 22CH1084  
Page.: 1 of 2

Equipment : pH Meter  
Manufacturer : Mettler Toledo  
Model : Seven2Go  
Serial No.: C129171492  
ID No.: RYG\_FS0549  
Condition As-Received: Used Item  
Received Date: 17 August 2022  
Calibration Date : 18 August 2022  
Reference : 2208-0823DSC-1  
Submitted by : ALS Laboratory Group (Thailand) Co.,Ltd. Rayong Branch  
618/10 Moo 5 T.Maenam Khu, A.Pluakdaeng, Rayong 21140, Thailand

Ambient Temperature : (25 ± 2.5) °C  
Relative Humidity : (50 ± 15) %  
Calibration Procedure : In - house method  
- CP-CH5 by direct measurement with standard voltage calibrator and direct measurement with certified reference material (CRM)

Calibrated by : Warakorn Lerngagrakul

Approved by :  
Approved Signatory

(x) Malee Butkruea  
( ) Saithip Meangmai  
( ) Warakorn Lerngagrakul

Issue Date : 22 August 2022

REVIEW BY	Tanakit
APPROVED BY	Supt S
NEXT CAL. DATE	18/08/23

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

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A 0044346





Cert. No.: ZZCH1084  
Page.: 2 of 2

#### Condition of this calibration result

##### 1. Reference Standard Instrument :-

Instrument	Serial No.	ID No.	Cert. No.	Due Date
1) Document Process Calibrator	54030049	130RC116	21E2682	25 Aug 2022

This certification is traceable to the International System of Unit maintained at:-  
- Traceable to National Institute of Metrology (Thailand), NIMT

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

Buffer Solution	Manufacturer	Lot No.	Exp. date
pH 4.008	CPA chem	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	pH	( $\pm$ mV)	k
pH Meter S/N: C129171492	4.00	177.48	178	4.00	0.58	2.00
	7.00	0.00	0	7.00	0.58	2.00
	10.00	-177.48	-178	10.00	0.58	2.00

Function : pH Measurement

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

Unit Under Calibration	Standard pH Buffer Solution	Actual pH Reading	Actual mV Reading (mV)	Uncertainty of pH measurement ( $\pm$ )	Coverage factor k
pH Electrode S/N: 1231783	4.008	4.01	171	0.0086	2.05
	6.985	7.00	-2	0.011	2.00
	10.008	10.00	-174	0.0092	2.00

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

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a 1121482



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55/44 PATTANAKARN ROAD, SUK 18, SIAM LUNG, SIAM LUNG BANGKOK 10250  
TEL: 0-2717-3000-27 FAX: 0-2719-9448



Cert. No.: 22LM112  
Page.: 1 of 2

## Certificate of Calibration

Equipment : pH Meter with Sensor  
Manufacturer : Mettler Toledo  
Model : Seven2Go  
Serial No. : C129171492  
ID No. : RYG\_FS0549  
Submitted by : ALS Laboratory Group (Thailand) Co., Ltd.  
(Rayong Branch)  
618/10 Moo 5 T. Maenam Khu, A. Pluakdaeng,  
Rayong 21140 Thailand  
Location : TPA On Site Calibration Laboratory  
Received Order : 17 August 2022  
Calibrated Date : 19 August 2022  
Ambient Temperature : (26  $\pm$  10) °C  
Relative Humidity : (50  $\pm$  30) %  
AC Line Voltage : (220  $\pm$  22) V  
Calibrated by : Kunchit Promprat  
Approved by :   
( ) Ponthipha Tameyakul  
( ) Malee Butkruea  
(✓) Suwit Imjai  
Issue Date : 24 August 2022

The Uncertainties are for a confidence probability of approximately 95%

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

A 0044522



Equipment : pH Meter with Sensor  
Condition As Received : Used Item  
Reference : 2208-0623DSC-3

Cert. No.: 22LM112  
Page.: 2 of 2

#### Procedure Used :-

Calibration were conducted using in-house calibration procedure CP-OT01 according to comparison with Industrial Platinum Resistance Thermometer (IPRT) into Temperature Bath.  
The temperature scale used was based on ITS-90.

#### Condition of this result of calibration

##### 1. Reference standard instrument:-

Instrument	Model	Serial No.	Cert. No.	Due Date
1) Digital Thermometer	1502A	A52847	21I1144	20 Oct 2022

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

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

Result of Calibration :- (°) Without Adjustment

Function : Temperature measurement.

This instrument was connected with temperature sensor, S/N: 1231783

Calibration Point (°C)	Immersion Depth (mm)	Standard Temperature (°C)	UUC* Reading (°C)	Error (°C)	Uncertainty ( $\pm$ °C)	Coverage Factor k
25.0	120	24.999	25.1	0.101	0.16	2.00
30.0	120	30.001	30.1	0.099	0.16	2.00
40.0	120	40.004	40.1	0.096	0.16	2.00
50.0	120	50.003	50.1	0.097	0.16	2.00

UUC\* : Unit Under Calibration

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

-000-

a 1122902

#### CONSOLE CONTROL UNIT CALIBRATION TEST REPORT

Barometric Pressure (mmHg) :  
Relative Humidity (%) :  
Temperature (°C) :

Reference Dry Gas Meter Data

Reference Dry Gas Meter ID :

Serial No. :

Correction Factor (Y) :

Next Calibration Date :

Calibration of Date : 13-Jan-23  
Next Cal. Date : 13-Jul-23

Console Control Meter Data

Calibration No. : C-130123-RYG\_FS0315

Dry Gas Meter ID : RYG\_FS0315

Serial No. : 1706001

Model No. : XC-572-V

ΔH (mm H <sub>2</sub> O)	Θ (Minutes)	Reference Dry Gas Meter Calibration				Console Control : Drygas Meter			
		Vr (liters)		Tr (°C)		Vm (liters)		Tt (°C)	
25	12.16	Final	Initial	Total	Tt	Final	Initial	Total	Tt
25	12.16	150.00	0.00	150.00	36.0	1659020.0	145.40	145.40	34.0
25	9.33	150.00	0.00	150.00	36.0	1659056.4	145.20	145.20	36.0
50	6.61	150.00	0.00	150.00	36.0	1659070.0	145.20	145.20	36.0
80	5.20	150.00	0.00	150.00	36.0	1659215.2	145.20	145.20	36.0
120	4.21	150.00	0.00	150.00	37.0	1659380.0	145.00	145.00	36.0
						1660005.0	145.00	145.00	36.0
						1660164.0	144.00	144.00	37.0
						1660200.0	144.00	144.00	37.0

Y : Ratio of reading of reference to dry gas meter : tolerance for individual values  $\pm$  0.02 from average

ΔHg : Office pressure differential that equates to 21.24 in. of air @ 25 °C and 760 mm of mercury, mmH<sub>2</sub>O, tolerance for individual values  $\pm$  6

Procedure: 40 CFR 60 APP A METH. SEC 6.3 & 7

Calibrated by : Sakit Phasamphat

(Mr. Sakit Phasamphat)

Field Scientist(4)

Approved by :

(Mr. Sakit Phasamphat)

Field Scientist



# DIGITAL TEMPERATURE CALIBRATION DATA SHEET

Calibration Date : 13/01/23		Ambient Temperature (°C) 30	
Calibration sheet No. : C-130123-RYG_FS0316		Relative Humidity (%) : 55	
Digital Temperature ID : RYG_FS0316		Reference Temperature ID : BKK_FS0609	
Console Serial No. : 1706091		Serial No. : 7688004	
Model : XC-572-V		Model : FLUKE 714	
Last Calibrate : 1/25/22			

Location	Reference Temperature °C	Digital Temperature °C	Error °C	Remark
Stick	0	1	1	
	25	26	1	
	50	51	1	
	100	101	1	
	150	151	1	
	200	201	1	
	250	251	1	
	300	301	1	
	500	501	1	
	1000	1001	1	
Probe	1200	1201	1	
	100	101	1	
	120	121	1	
	140	141	1	
Filter	100	101	1	
	120	121	1	
	140	141	1	
	Exit	0	1	1
Meier	10	11	1	
	20	21	1	
	0	1	1	
AUX	25	26	1	
	50	51	1	
	25	26	1	
50	51	1		

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

Approved by : Nattapol Jengwarewong  
 Mr. Nattapol Jengwarewong  
 Specialist (1)

FORM NO: F 06-007 REVISION NO: - ISSUE DATE: 2/5/02



# PROBE NOZZLE DIAMETER CALIBRATION DATA SHEET

Calibration Date : 13 Jan 23		Nozzle Set ID. : RYG_FS0319	
Calibration Sheet No. : C-130123-RYG_FS0319		Vernier Caliper ID.: BKK_FS1123	

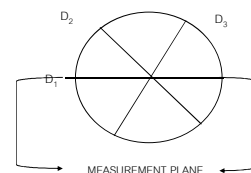
Nozzle ID #	Nozzle Diameter (cm.)			Hi - Lo ΔD	(D <sub>1</sub> + D <sub>2</sub> + D <sub>3</sub> ) / 3 D <sub>avg</sub>
	D <sub>1</sub>	D <sub>2</sub>	D <sub>3</sub>		
1	0.300	0.300	0.300	0.000	0.300
2	0.470	0.465	0.465	0.005	0.467
3	0.600	0.600	0.600	0.000	0.600
4	0.770	0.760	0.755	0.015	0.762
5	0.920	0.930	0.930	0.010	0.927
6	1.080	1.080	1.085	0.005	1.082
7	1.240	1.230	1.235	0.010	1.235
8	1.594	1.598	1.597	0.004	1.596

Where :

D<sub>1</sub>, D<sub>2</sub>, D<sub>3</sub> = There different nozzle diameters at 60 degrees to each other, each measured the nearest 0.025 mm.

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

D<sub>avg</sub> = (D<sub>1</sub> + D<sub>2</sub> + D<sub>3</sub>) / 3



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

Approved by : Nattapol Jengwarewong  
 (Mr. Nattapol Jengwarewong)  
 Field Specialist (1)

FORM NO: F 06-026 REVISION NO: - ISSUE DATE: 9/1/03



# Pitot Tube Calibration Data

Pitot Tube Identification Number : RYG\_FS0320 Calibration Date : 13 Jan 23  
 Lab test duct Number : 258-1-13-01 Standard Pitot ID : BKK\_FS0441  
 Calibration Sheet No. : C-130123-RYG\_FS0320 Cp Standard : 0.99

Type S Pitot Tube Coefficient Data					
	Type s pitot tube Leg A,B	Standard pitot tube (ΔP, mm.H <sub>2</sub> O)	Type s pitot tube (ΔP, mm.H <sub>2</sub> 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

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

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

$$\text{Average deviation(A or B)} = \frac{\sum_{i=1}^n [Cp(s) - Cp(A \text{ or } B)]}{3} \text{ must BE } \leq 0.01$$

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

Approved by : Nattapol Jengwarewong  
 (Mr. Nattapol Jengwarewong)  
 Specialist (1)

FORM NO: F 06-003 REVISION NO: 1 ISSUE DATE: 30 Jun 22



# Pitot Tube Calibration Data

Pitot Tube Identification Number : RYG\_FS0321 Calibration Date : 13 Jan 23  
 Lab test duct Number : 258-1-13-01 Standard Pitot ID : BKK\_FS0441  
 Calibration Sheet No. : C-130123-RYG\_FS0321 Cp Standard : 0.99

Type S Pitot Tube Coefficient Data					
	Type s pitot tube Leg A,B	Standard pitot tube (ΔP, mm.H <sub>2</sub> O)	Type s pitot tube (ΔP, mm.H <sub>2</sub> 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

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

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

$$\text{Average deviation(A or B)} = \frac{\sum_{i=1}^n [Cp(s) - Cp(A \text{ or } B)]}{3} \text{ must BE } \leq 0.01$$

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

Approved by : Nattapol Jengwarewong  
 (Mr. Nattapol Jengwarewong)  
 Specialist (1)

FORM NO: F 06-003 REVISION NO: 1 ISSUE DATE: 30 Jun 22



Certificate No: G 660042  
Date of issue : 24-Jun-23

Instrument description : Flue gas Analyzer  
Instrument model : Testo 350 New  
Instrument serial no. : 62087344  
ID no. or control no. : RYG\_FS0317  
Manufacturer : Testo SE & Co. KGaA  
Probe description :  
Probe model :  
Probe serial :  
Customer name : ALS LABORATORY GROUP (THAILAND) CO., LTD.  
Customer address : 101 Phutthamon Road, Phutthamon Road, Khwaeng Phutthamon,  
Khet Suan Luang, Bangkok, 10250 Thailand  
Total pages of certificate : 3 pages  
Receiving no. : L-23P167  
Receiving date : 20 Jun-23  
Parameter of calibration : Gas Calibration (Oxygen 2.498, 10.04, 21.02 %Vol, Carbon Monoxide 80.14, 309.9, 1003 ppm,  
Nitrogen Dioxide 30.34, 80.96, 202.2 ppm, Nitric Oxide 30.08, 150.9, 320.6 ppm,  
Sulphur Dioxide 50.04, 100.8, 601.1 ppm)

REVIEW BY: [Signature]  
APPROVED BY: [Signature]  
NEXT CAL. DATE: 23 Jun-24

Condition of UUC: Used  
Ambient condition : As of the Measurement were carried out the stabilized laboratory  
Temperature : 23 ± 0.5 °C  
Humidity : 55 ± 15 %RH  
Calibration place : 17/121 Soi Ngamwongwan 47 Yaek 48, Toongsonghong, Lakki, Bangkok 10210  
Calibration procedure no. : WI-CL-09-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 valid.  
This calibration certificate documents are traceability to national standards, which realize measurement according to the International System of Units (SI).  
Date of calibration : 23-Jun-23

[Signature]  
[Signature]  
Calibration Technician: Mrs. Nongluk Wongsettee  
Technical Manager



Certificate No: G 660042

Standard References (Table 1)

Standard	Certificate No.	Vendor	Due date
Oxygen ( O <sub>2</sub> ) 2.498 % Vol	4219/21	Unide	30-Sep-25
Oxygen ( O <sub>2</sub> ) 10.04 % Vol	CG-0153-21	Nimt	18-Nov-26
Oxygen ( O <sub>2</sub> ) 21.02 % Vol	CG-0041-22	Nimt	10-Feb-27
Carbon monoxide ( CO ) 80.14 ppm	CG-0040-22	Nimt	14-Feb-27
Carbon monoxide ( CO ) 309.9 ppm	2003/21	Unide	22-Jun-23
Carbon monoxide ( CO ) 1003 ppm	2583/22	Unide	09-Aug-24
Nitrogen Dioxide ( NO <sub>2</sub> ) 30.34 ppm	2703/22	Unide	22-Aug-24
Nitrogen Dioxide ( NO <sub>2</sub> ) 80.96 ppm	2041/22	Unide	26-Jun-24
Nitrogen Dioxide ( NO <sub>2</sub> ) 202.2 ppm	3239/21	Unide	20-Jul-23
Nitric Oxide ( NO ) 30.08 ppm	CG-0089-22	Nimt	13-Jun-24
Nitric Oxide ( NO ) 150.9 ppm	3857/21	Unide	29-Jun-23
Nitric Oxide ( NO ) 320.6 ppm	2944/21	Unide	02-Jul-23
Sulphur Dioxide ( SO <sub>2</sub> ) 50.04 ppm	3205/21	Unide	25-Jul-23
Sulphur Dioxide ( SO <sub>2</sub> ) 100.8 ppm	3507/22	Unide	09-Nov-24
Sulphur Dioxide ( SO <sub>2</sub> ) 601.1 ppm	3204/21	Unide	20-Jul-23

Measured room conditions

Temperature : 22.2 °C Humidity : 58.9 %RH Pressure : 1014.9 mbar

Calibration conditions

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

Calibration Results Before Adjustment (Table 2)

Parameter of Standard	Standard Values	Mean of UUC	Error	Uncertainty (k)
O <sub>2</sub> (%Vol)	2.498	2.47	-0.028	0.20
O <sub>2</sub> (%Vol)	10.04	9.95	-0.09	0.40
O <sub>2</sub> (%Vol)	21.02	21.08	0.06	0.80
CO (ppm)	80.14	80	-0.14	3.0
CO (ppm)	309.9	306	-3.9	6.0
CO (ppm)	1003	995	-8	12
NO <sub>2</sub> (ppm)	30.34	29.7	-0.64	8.0
NO <sub>2</sub> (ppm)	80.96	79.4	-1.56	8.0
NO <sub>2</sub> (ppm)	202.2	195.1	-7.1	12
NO (ppm)	30.08	30	-0.08	8.0
NO (ppm)	150.9	153	2.1	8.0
NO (ppm)	320.6	315	-5.6	12
SO <sub>2</sub> (ppm)	50.04	49	-1.04	6.0
SO <sub>2</sub> (ppm)	100.8	101	0.2	6.0
SO <sub>2</sub> (ppm)	601.1	602	1.9	12



Certificate No: G 660042

Calibration Results After Adjustment (Table 3)

Parameter of Standard	Standard Values	Mean of UUC	Error	Uncertainty (k)
O <sub>2</sub> (%Vol)	2.498	2.47	-0.028	0.20
O <sub>2</sub> (%Vol)	10.04	9.95	-0.09	0.40
O <sub>2</sub> (%Vol)	21.02	21.08	0.06	0.80
CO (ppm)	80.14	80	-0.14	3.0
CO (ppm)	309.9	306	-3.9	6.0
CO (ppm)	1003	995	-8	12
NO <sub>2</sub> (ppm)	30.34	29.7	-0.64	8.0
NO <sub>2</sub> (ppm)	80.96	81.3	0.34	8.0
NO <sub>2</sub> (ppm)	202.2	204.4	2.2	12
NO (ppm)	30.08	30	-0.08	8.0
NO (ppm)	150.9	153	2.1	8.0
NO (ppm)	320.6	315	-5.6	12
SO <sub>2</sub> (ppm)	50.04	49	-1.04	6.0
SO <sub>2</sub> (ppm)	100.8	101	0.2	6.0
SO <sub>2</sub> (ppm)	601.1	602	1.9	12

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

End of Report



DRY GAS METER CALIBRATION TEST REPORT

Calibration of Date 13-Jan-23 Barometric Pressure (mm.Hg) : 760  
Next Calibration Date 13-Jul-23 Relative Humidity (%) : 55.0  
Temperature (°C) : 30.0  
Dry Gas Meter Data Reference Dry Gas Meter Data  
Calibration sheet No.: C-130123-RYG\_FS0317 Reference Dry Gas Meter ID : BKK\_FS1122  
Dry Gas Meter ID RYG\_FS0317 Serial No. : A2003240  
Serial No. 1706003 Correction Factor (Y) : 1.0160  
Model No. XC-62-CV Next Calibration Date : 27 May 23

Reference Dry Gas Meter Calibration				Dry Gas Meter						Dry Gas Meter Correction
Vr (Liters)			Tr (°C)	Vm (Liters)			Ti (°C)	To (°C)	Avg. Tm (°C)	Factor (Y)
Final	Initial	Total		Final	Initial	Total				
30.00	0.00	30.00	27.0	30.10	0.00	30.10	27.0	27.0	27.0	1.0126
30.00	0.00	30.00	29.0	30.27	0.00	30.27	29.0	29.0	29.0	1.0069
60.00	0.00	60.00	30.0	60.11	0.00	60.11	30.0	30.0	30.0	1.0141
60.00	0.00	60.00	31.0	60.10	0.00	60.10	31.0	31.0	31.0	1.0143
90.00	0.00	90.00	31.0	89.78	0.00	89.78	31.0	31.0	31.0	1.0185
90.00	0.00	90.00	32.0	89.77	0.00	89.77	32.0	32.0	32.0	1.0186
									Avg.	1.0142

Y = Ratio of reading of reference dry gas meter to dry gas meter ; tolerance for individual  $\pm 0.05$  from average.

Calibrate by : [Signature] Approved by : [Signature]  
Mr. (Tinnakorn Kulchart) Mr. (Nathaporn Jengwareewong)  
Field Scientist (1) Specialist (1)





### DIGITAL TEMPERATURE CALIBRATION DATA SHEET

Calibration Date :	13 Jan 23	Ambient Temperature (°C) :	30
Calibration sheet No. :	C-130123-RYG_FS0317	Relative Humidity (%) :	55
Digital Temperature ID :	RYG_FS0317	Reference Temperature ID :	BKK_FS0609
Console Serial No. :		Serial No. :	7688004
Model :	XC-62-CV	Model :	FLUKE 714
		Last Calibrate :	25-Jan-23

Location	Reference Temperature °C	Digital Temperature °C	Error °C	Remark
Stick	0	0	0	
	25	25	0	
	50	50	0	
	100	100	0	
	150	150	0	
	200	200	0	
	250	250	0	
	300	301	1	
	500	501	1	
	1000	1002	2	
Probe	1200	1203	3	
	100	100	0	
	120	120	0	
	140	140	0	
Filter	100	100	0	
	120	120	0	
Exit	0	0	0	
	10	10	0	
Meter	20	20	0	
	0	0	0	
AUX	25	25	0	
	50	50	0	

Calibrated by : Approved by :

Mr. Tinnakorn Kulchart  
Field Scientist (1)

Mr. Nathapong Jengwarewong  
Specialist (1)

FORM NO. : F-06-007 REVISION NO. : ISSUE DATE: 2/5/02



### Rotameter Calibration Report

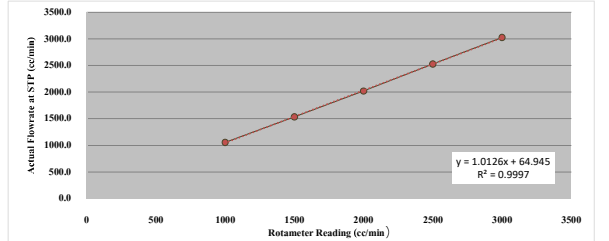
Calibration Date :	13 Jan 23	Relative Humidity (%) :	55.0
Rotameter ID :	RYG_FS0317	Barometric Pressure (mmHg) :	760
Calibration Sheet No :	C-130123-RYG_FS0317	Temperature (°C) :	30.0

### Primary Equipment Data

Brand :	Bios	Model :	Defender 520 M
Serial No. :	129958	ID :	RYG_FS0209

### Calibration Data

Rotameter Reading(cc/min)	Actual Flowrate (cc/min)				Actual Flowrate at STP (cc/min)
	1	2	3	Avg.	
1000	1084.0	1071.0	1066.0	1073.7	1055.9
1500	1557.0	1564.0	1560.0	1560.3	1534.6
2000	2055.0	2055.0	2056.0	2055.3	2021.4
2500	2571.0	2568.0	2569.0	2569.3	2526.9
3000	3075.0	3079.0	3080.0	3078.0	3027.2



Calibrated by : Approved by :

(Mr. Tinnakorn Kulchart)  
Field Scientist (1)

(Mr. Nathapong Jengwarewong)  
Field Specialist (1)

Form 281-012 (27/02/00)

RYG\_EN0003

Sartorius (Thailand) Co., Ltd.  
129 Rama 9 Road, Huaykwang, Huaykwang, Bangkok 10310  
Tel: +66 2543 8361-6, e-mail: service.thailand@sartorius.com



SARTORIUS

NSC 753-TIS 17025  
CALIBRATION 0426

REVIEW BY:

APPROVED BY:

NEXT CAL DATE: 01/03/24

## Certificate of Calibration

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

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

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

Calibrated By : Mr. Chonchai Inthana  
Calibration Date : Wednesday, March 01, 2023

Calibration Procedure No. : This calibration was conducted by Using in-house calibration procedure number (WI-003)  
Based on UKAS LAB 14 : 2019

Metrolological data :  
Capacity : 220 g Readability : 0.0001 g  
Ambients Conditions :  
Temperature : 23.0 °C ± 5.0 °C  
Humidity : 58.0 % RH ± 10.0 % RH  
Pressure : ±

Reasons for calibration  
☐ New Installation ☐ Service / Repair ☒ Re-calibration / Maintenance ☐ Equipment Condition: ☒ Good 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 realise the unit of measurement according to the International Standard System of Units (SI). Report of Tolerance came from list of Sartorius Metrological Specifications.

### Traceability:

Model Number	Description	Traceability	Certificate No.	Due Date
YCS011-522-00	Sartorius weight set 1mg - 5000g E2 YCS011-522-00	SPC-RT	C02212585	14-Sep-2023
MHB-382SD	Humidity/Barometer/Temp. Lubon MHB-382SD	DKSH	C19220444	5-Sep-2023

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

Mr. Chonchai Inthana (Technical Manager)

SARTORIUS  
NSC 753-TIS 17025

SOP FM 33 03 February 2022

Sartorius (Thailand) Co., Ltd.  
129 Rama 9 Road, Huaykwang, Huaykwang, Bangkok 10310  
Tel: +66 2543 8361-6, e-mail: service.thailand@sartorius.com

SARTORIUS

## Certificate of Calibration

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

### Calibration Results : Without Adjustment

<b>Repeatability</b> 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 series is placed repeatedly on the weighing pan in the same manner. The standard deviation is used to express repeatability quantitatively.	<b>Eccentricity (Off-center loading error)</b> The off-center loading error is yielded by the difference between the readout of the load, i.e. 1/3 or 1/4 of maximum capacity, placed in the middle of the weighing pan and between each of four additional measurement points (positions defined according to GIM, #78).
Nominal Value (Low Load) 20 g Tolerance 0.0001 g	Nominal Value (High Load) 200 g Tolerance 0.0001 g
Standard Deviation 0.00004	Standard Deviation 0.00005

Linearity					
The linearity, also called linearity error, describes the deviation of the characteristic curve of a weighing instrument from the linear slope.					
Tolerance	0.0002 g				
Nominal Value (g)	Conventional Mass Value (g)	Displayed Value (g)	Deviation (g)	Uncertainty (g)	
0.01	0.0100	0.0100	0.0000	0.00013	
0.05	0.0500	0.0500	0.0000	0.00013	
0.1	0.1000	0.1000	0.0000	0.00013	
0.5	0.5000	0.5000	0.0000	0.00014	
1	1.0000	1.0000	0.0000	0.00014	
5	5.0000	5.0000	0.0000	0.00013	
10	10.0000	10.0000	0.0000	0.00014	
20	20.0000	20.0000	0.0000	0.00024	
50	50.0000	50.0000	0.0000	0.00013	
100	100.0000	100.0000	0.0000	0.00019	
200	200.0000	200.0001	0.0001	0.00032	

End of Report

SOP FM 33 03 February 2022



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)  
CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES  
23/4 PATANAKARN ROAD NO. 18, SUANLIANG, SUANLIANG, BANGKOK 10250  
TEL. 0-2717-3000/24 FAX 0-2718-0414



## Certificate of Calibration

Certificate No.: 21P3344  
Page: 1 of 2

Equipment: Vacuum Gauge

Manufacturer: QualityWell

Model: F221AVD

Serial No.: VG02

ID No.: RYG\_FS0333

Condition As-Received: Used Item

Received Date: 01 October 2021

Calibration Date: 06 October 2021

Reference: 2110-006WSC

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

Ambient Temperature: ( 23 ± 2 ) °C

Relative Humidity: ( 50 ± 15 ) %

Atmospheric Pressure: 1008 mbar

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

Procedure used: The calibration was conducted by direct comparison method against Pressure Measuring Instruments Standard according to in-house calibration procedure CP-P06, using "DKD-R 6-1; Calibration of Pressure Gauges, Edition 03/2014." as a guideline.

### Condition of this result of calibration

#### 1. Reference standards instruments:

Instrument	Model	Serial No.	Certificate No.	Due Date
1) Digital Pressure Gauge	15PSIXP21	158670	21P2529	03 Sep 2022

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

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

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

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

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

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

- National Institute of Metrology Thailand (NIMT)



Calibrated by: Noppapat Phongam  
Issue Date: 07 October 2021

Approved Signatory: Attapol P.

[ ] Phalinee Prabpaipal  
[ ] Sura Suwannasri  
[x] Attapol Panurach

B 0270821



Cert No.: 21P3344  
Page: 2 of 2

### Result of calibration: Without adjustment

#### Function: Vacuum Pressure Measurement

Range: 0 inHg to -30 inHg  
Scale Interval: 0.5 inHg (The Fifth Estimate)

Applied Pressure (inHg)	0.00	-4.97	-9.97	-14.97	-19.99	-26.02
UUC* Indication (inHg)	0.0	-5.0	-10.0	-15.0	-20.0	-26.0
Error (inHg)	0.00	-0.03	-0.03	-0.03	-0.01	0.02

Applied Pressure (inHg)	-26.00	-19.97	-14.96	-9.98	-4.97	0.00
UUC* Indication (inHg)	-26.0	-20.0	-15.0	-10.0	-5.0	0.0
Error (inHg)	0.00	-0.03	-0.05	-0.04	-0.03	0.00

The uncertainty of measurement was ± 0.12 inHg

\* UUC = Unit Under Calibration

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

-000-

Attapol P.

1075036



## Certificate of Calibration

Equipment: SPECTROPHOTOMETER

Model: DR3900

Serial No. (or ID.): 2021781 (RYG\_EN0179)

Manufacturer: HACH

Condition: In Condition

Certificate No.: C06220465

Issued Date: 27 September 2022

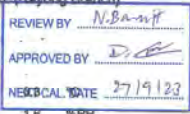
Job No.: KSPR2212225

Page: 1 of 3

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

616/10 Moo 5 T. Maenam Khu,

A. Pluakdaeng, Rayong 21140, Thailand.



Environment Condition: Temperature 22.5 °C ±  
Humidity 87.5 %RH ±

Calibration Place: ALS Laboratory Group (Thailand) Co., Ltd. (Rayong Branch) ( Wet Chemistry )

616/10 Moo 5 T. Maenam Khu,

A. Pluakdaeng, Rayong 21140, Thailand.

Calibration By: Mr. Chutaphon Fothong

Calibration Date: 27 September 2022

The Method used: In house method, CAL-WI-24, base on ASTM E 275-08 and ASTM E 387-04

Traceability: This certificate is traceable to the CRM maintained by National Institute of Standards and Technology (NIST) through Starra Scientific Limited.

The standard for Wavelength Certificate No. 91418 and 91435

The standard for Photometric Certificate No. 91441

The standard for Stray light Certificate No. 101040

(Mr. Chutaphon Fothong)  
Person in charge

(Mr. Thalergrat Pongranyam)  
Authorized signatory

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

The measurement uncertainty stated in the expanded uncertainty which is obtained from the standard uncertainty multiplied by the coverage factor k=2, to provide a level of confidence of approximately 95%, is determined in accordance with the Guide to Expression of Uncertainty in Measurement (GUM).

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

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Phone: +66 2539 7000 Email: info@calibration@dksh.com Website: www.dksh.com/calibration

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CALFA-C06-13: 20 Jul 2022



Certificate No.: C06220465 Page 2 of 3

### Calibration Results:

#### Without Adjustment

Wavelength Accuracy (nm), The spectral bandwidth of Sld at 5 nm and UUC at 5 nm

Standard Wavelength	Unit Under Calibration	Correction	Uncertainty
418.40	418	0.40	0.58
537.00	536	1.00	0.88
636.00	636	0.00	0.86
747.81	746	-0.39	0.59
807.04	807	0.04	0.66

#### Photometric Accuracy (Absorbance)

Wavelength	Standard absorbance	Unit Under Calibration	Correction	Uncertainty
420 nm	0.0000	0.000	0.0000	0.0045
	0.8605	0.862	-0.0015	0.0045
	0.7334	0.735	-0.0016	0.0045
	1.0534	1.054	-0.0006	0.0045
440 nm	0.0000	0.000	0.0000	0.0045
	0.5503	0.550	0.0003	0.0045
	0.7178	0.718	-0.0001	0.0045
	1.0312	1.031	0.0002	0.0045
465 nm	0.0000	0.000	0.0000	0.0045
	0.5024	0.505	-0.0028	0.0045
	0.6693	0.671	-0.0017	0.0045
	0.9604	0.964	-0.0036	0.0045
546.1 nm	0.0000	0.000	0.0000	0.0045
	0.5168	0.519	-0.0022	0.0045
	0.6903	0.691	-0.0007	0.0045
	0.9604	0.962	-0.0016	0.0045
590 nm	0.0000	0.000	0.0000	0.0045
	0.5526	0.553	-0.0005	0.0045
	0.7175	0.717	0.0005	0.0045
	1.0301	1.030	0.0001	0.0045
635 nm	0.0000	0.000	0.0000	0.0045
	0.5387	0.538	-0.0013	0.0045
	0.6847	0.685	-0.0003	0.0045
	0.9823	0.983	-0.0007	0.0045

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CALFA-C06-13: 20 Jul 2022



Calibration Results:  
Without Adjustment

Standard: out-off	UUC: Wavelength (nm)	UUC: Transmission (%T)	Absorbance (A)
391.94 +/- 0.11 nm	392	4.1	1.387

\* Calibration Marked \* Not TISI Accredited \* In this Certificate have been included for completeness.

The End of Certificate

DKSH Technology Limited  
2533 ถนนสุขุมวิท แขวงคลองเตย เขตคลองเตย กรุงเทพมหานคร 10110  
Phone: +66 2559 7000 Email: info@dksh.com Website: www.dksh.com

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CALFM-C06-13: 20 Jul 2022

ใบตรวจสอบสภาพเครื่องวัดสิ่งแวดล้อม

เลขที่ใบงาน: KOPF2212225

ชนิดเครื่องมือ: SPECTROPHOTOMETER รุ่น: DR3900

หมายเลขเครื่อง: 2021761

ตรวจสอบ (รับ)	ตรวจสอบ (ส่ง)	หมายเหตุ
27 Sep 2022	27 Sep 2022	
ปกติ	ไม่ปกติ	
<b>General</b>		
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	1. ความสมบูรณ์เครื่อง
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	2. ความสะอาด (ช่องใส่ตัวอย่าง, ภายใน-นอกเครื่อง)
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	3. สวิตช์ เปิด - ปิด เครื่อง (On-Off Switch)
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	4. ปุ่มกด (Keypad)
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	5. หน้าจอ (Display, Screen Contrast)
<b>Spectrophotometer</b>		
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	6. แบตเตอรี่สำรอง (Battery Backup) >= 2.5 VDC
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	7. ตัวควบคุมความยาวคลื่น (Wavelength Control)
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	8. ความยาวคลื่น (Wavelength Check) 807 ± 607.0 nm
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	9. แหล่งกำเนิดแสง (UV < 3,000 hour)
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	10. แหล่งกำเนิดแสง (Visible < 5,000 hour)
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	11. ช่องวัดหลายตัวอย่าง (Carousel Module)
<b>pH Meter and Conductivity Meter</b>		
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	12. อิเล็กโทรด (Electrode and Connection Cable)
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	13. วัสดุสารละลาย Electrode (Level KCl)
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	14. ฝาปิดกันปลาย Electrode (Dust Protection Hood)
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	15. ขาจับอิเล็กโทรด (Stand)
<b>Turbidimeter</b>		
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	16. ค่าความขุ่นที่ต่ำสุด (No Sample)
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	17. ระยะเวลาการล้างของแสง (>= 2.5 ไม่เกิน 3.0)
<b>Automatic Dilutor</b>		
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	18. สภาวะ Piston Burettes
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	19. Function Rinsing and Dosing
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	20. ระบบท่อส่งสายยางและอุปกรณ์ประกอบ

เห็นด้วยขอแนะนำ:

Mr. Chatuphon Foithong  
Service Engineer

DKSH Technology Limited  
2533 ถนนสุขุมวิท แขวงคลองเตย เขตคลองเตย กรุงเทพมหานคร 10110  
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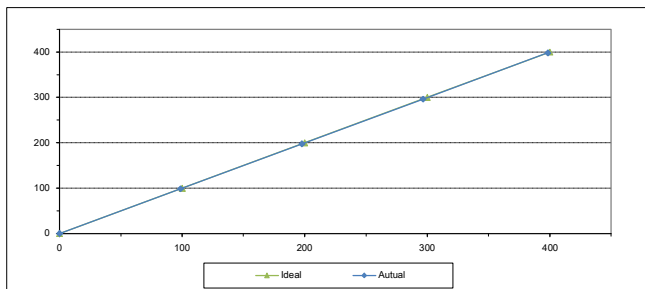
CAL-FM-R31-03: 20 Jul 2022



MULTIPOINT CALIBRATION REPORT

Calibration Date	4-Jan-23	Equipment Name	SO2 Analyzer
Manufacturer	HORIBA	Model	APSA-370
Serial No.	VABF9LSH	Equipment ID	RYG_FS0460
Calibrator Manufacturer	Teledyne API	Model	700
Serial No.	947		
Std. Gas Concentration (PPM)	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	98.70	-1.30	-1.30
2	200.00	197.80	-2.20	-1.10
3	300.00	298.50	-3.50	-1.17
4	400.00	398.30	-1.70	-0.42
AVERAGE (%)				-0.78



Calibrated By

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

Approved By

(Mr. Sarayuth Jitranont)  
Assistant General Manager

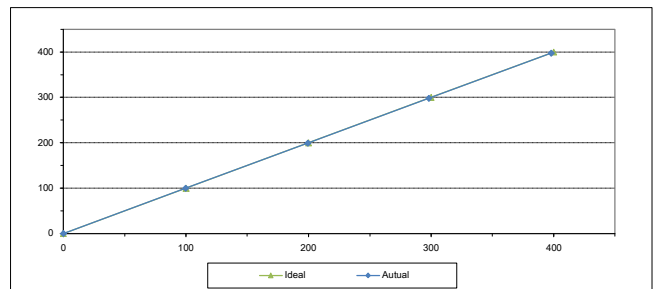
ALS Laboratory Group  
FORM NO.: F 06-056 REVISION NO.: ISSUE DATE: 02/04/12



MULTIPOINT CALIBRATION REPORT

Calibration Date	4-Jan-23	Equipment Name	SO2 Analyzer
Manufacturer	HORIBA	Model	APSA-370
Serial No.	YPRXJJ20	Equipment ID	RYG_FS0263
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	99.80	-0.20	-0.20
2	200.00	199.40	-0.60	-0.30
3	300.00	298.20	-1.80	-0.60
4	400.00	398.00	-2.00	-0.50
AVERAGE (%)				-0.30



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

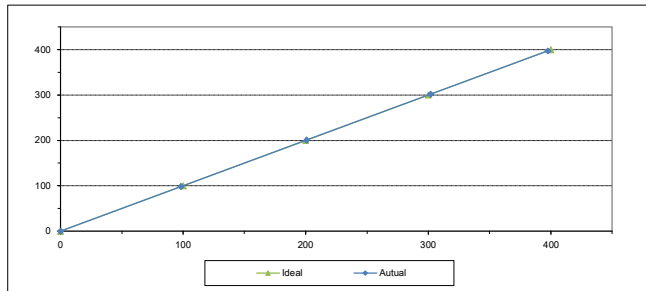




### MULTIPOINT CALIBRATION REPORT

Calibration Date 4-Jan-23 Equipment Name SO2 Analyzer  
Manufacturer HORIBA Model APSA-370  
Serial No. H0S3D9FA Equipment ID RYG\_FS0454  
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	98.30	-1.70	-1.70
2	200.00	200.80	0.80	0.40
3	300.00	301.90	1.90	0.63
4	400.00	397.50	-2.50	-0.63
AVERAGE (%)				-0.24



Calibrated By

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

Approved By

(Mr. Sarayuth Jitranont)  
Assistant General Manager

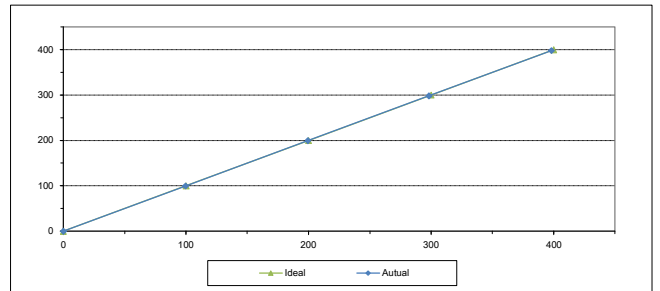
ALS Laboratory Group  
FORM NO.: F 06-056 REVISION NO.: - ISSUE DATE: 02/04/12



### MULTIPOINT CALIBRATION REPORT

Calibration Date 4-Jan-23 Equipment Name SO2 Analyzer  
Manufacturer HORIBA Model APSA-370  
Serial No. R0HWYDVW Equipment ID RYG\_FS0456  
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	99.70	-0.30	-0.30
2	200.00	199.50	-0.50	-0.25
3	300.00	298.30	-1.70	-0.57
4	400.00	398.10	-1.90	-0.47
AVERAGE (%)				-0.30



Calibrated By

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

Approved By

(Mr. Sarayuth Jitranont)  
Assistant General Manager

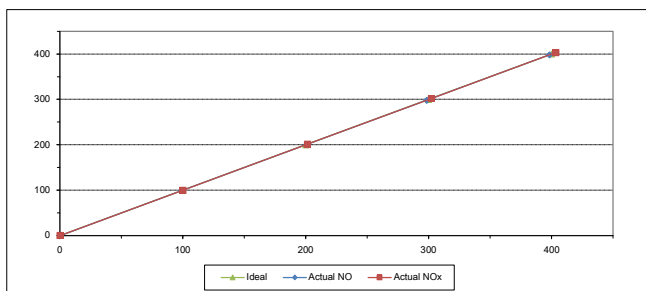
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FORM NO.: F 06-056 REVISION NO.: - ISSUE DATE: 02/04/12



### MULTIPOINT CALIBRATION REPORT

Calibration Date 5-Jan-23 Equipment Name NOx Analyzer  
Manufacturer HORIBA Model APNA-370  
Serial No. T95HWM41 Equipment ID RYG\_FS0461  
Calibrator Manufacturer Teledyne API Model 700  
Serial No. 947  
Std. Gas Concentration (PPM) 55.88 Cylinder No. GN0027222  
Cylinder Pressure (psi) 1800 Certified By Airgas Inc.  
Certified Date 9-Feb-22 Expired Date 9-Feb-30

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



Calibrated By

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

Approved By

(Mr. Sarayuth Jitranont)  
Assistant General Manager

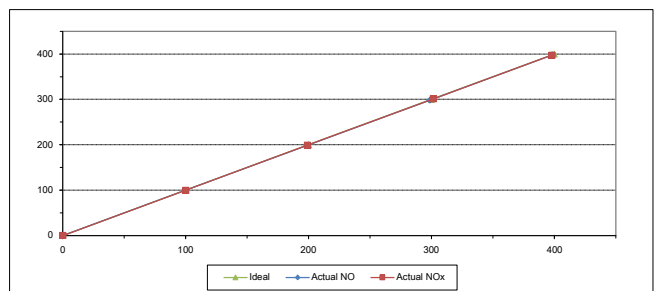
ALS Laboratory Group  
FORM NO.: F 06-056 REVISION NO.: - ISSUE DATE: 02/04/12



### MULTIPOINT CALIBRATION REPORT

Calibration Date 5-Jan-23 Equipment Name NOx Analyzer  
Manufacturer HORIBA Model APNA-370  
Serial No. 8GS14J3K Equipment ID RYG\_FS0264  
Calibrator Manufacturer Teledyne API Model 700  
Serial No. 947  
Std. Gas Concentration (PPM) 55.88 Cylinder No. GN0027222  
Cylinder Pressure (psi) 1800 Certified By Airgas Inc.  
Certified Date 9-Feb-22 Expired Date 9-Feb-30

Point	CALIBRATION RESULTS						
	Ideal	Actual NO	Error NO	%Error NO	Actual NOx	Error NOx	%Error NOx
ZERO	0.00	0.05	0.05	0.05	0.10	0.10	0.10
1	100.00	99.20	-0.80	-0.80	100.10	0.10	0.10
2	200.00	198.40	-1.60	-0.80	199.10	-0.90	-0.45
3	300.00	298.60	-1.40	-0.47	301.50	1.50	0.50
4	400.00	398.10	-1.90	-0.47	398.00	-2.00	-0.50
AVERAGE (%)				-0.50			-0.05



Calibrated By

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

Approved By

(Mr. Sarayuth Jitranont)  
Assistant General Manager

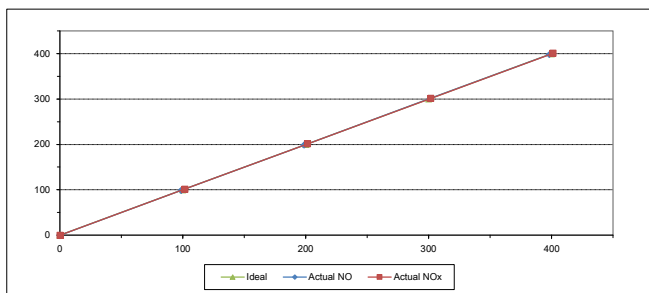
ALS Laboratory Group  
FORM NO.: F 06-056 REVISION NO.: - ISSUE DATE: 02/04/12



### MULTIPOINT CALIBRATION REPORT

Calibration Date	5-Jan-23	Equipment Name	NOx Analyzer
Manufacturer	HORIBA	Model	APNA-370
Serial No.	ALPOVOWY	Equipment ID	RYG_FS0455
Calibrator Manufacturer	Teledyne API	Model	700
Serial No.	947		
Std. Gas Concentration (PPM)	55.88	Cylinder No.	GN0027222
Cylinder Pressure (psi)	1800	Certified By	Airgas Inc.
Certified Date	9-Feb-22	Expired Date	9-Feb-30

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



Calibrated By

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

Approved By

(Mr.Sarayuth Jitranont)  
Assistant General Manager

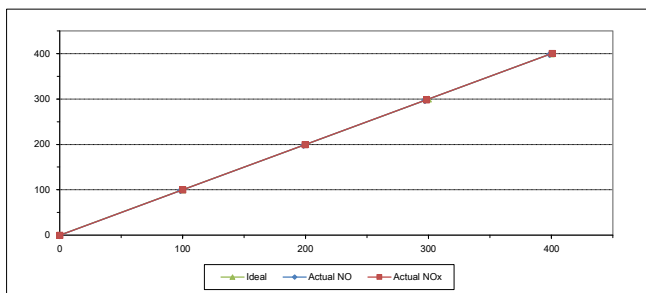
ALS Laboratory Group  
FORM NO.: F 06-056 REVISION NO.: - ISSUE DATE: 02/04/12



### MULTIPOINT CALIBRATION REPORT

Calibration Date	5-Jan-23	Equipment Name	NOx Analyzer
Manufacturer	HORIBA	Model	APNA-370
Serial No.	T2T8YRLL	Equipment ID	RYG_FS0457
Calibrator Manufacturer	Teledyne API	Model	700
Serial No.	947		
Std. Gas Concentration (PPM)	55.88	Cylinder No.	GN0027222
Cylinder Pressure (psi)	1800	Certified By	Airgas Inc.
Certified Date	9-Feb-22	Expired Date	9-Feb-30

Point	CALIBRATION RESULTS						
	Ideal	Actual NO	Error NO	%Error NO	Actual NOx	Error NOx	%Error NOx
ZERO	0.00	0.10	0.10	0.10	0.10	0.10	0.10
1	100.00	98.30	-1.70	-1.70	100.20	0.20	0.20
2	200.00	198.40	-1.60	-0.80	199.60	-0.40	-0.20
3	300.00	297.10	-2.90	-0.97	298.50	-1.50	-0.50
4	400.00	398.60	-1.40	-0.35	400.70	0.70	0.17
AVERAGE (%)				-0.74			-0.05



Calibrated By

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

Approved By

(Mr.Sarayuth Jitranont)  
Assistant General Manager

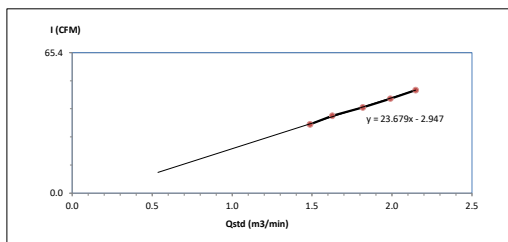
ALS Laboratory Group  
FORM NO.: F 06-056 REVISION NO.: - ISSUE DATE: 02/04/12



### High Volume Air Sampler Calibration Worksheet

Project Site:	Amata B.Grimm Power (Rayong) 3 Limited	Barometric Pressure (mm Hg):	753
Calibrate Location:	โรงหมั่นเผาถ่านหินอุตสาหกรรม	Temperature (°C):	32
Calibrate Date:	21-Mar-23	High Volume ID:	RYG_FS0190
CalibrationSheet No.:	C-210323-RYG_FS0190	High Volume Model:	G1051
Calibrator ID:	RYG_FS0205	High Volume S/N:	1625
Calibrator Model:	TE-S028A	Calibrator Slope:	0.94434
Calibrator S/N:	1166	Calibrator Intercept:	-0.01292

Test No.	Delta H <sub>2</sub> O (inch)	Q <sub>std</sub> (m <sup>3</sup> /min)	I: Chart (CFM)	Linear Regression Slope: 23.6786 Intercept: -2.9470 Correlation Coefficient: 0.9991
1	2.0	1.4864	32	
2	2.4	1.6270	36	
3	3.0	1.8175	40	
4	3.6	1.9897	44	
5	4.2	2.1481	48	



Calibrated by: (Mr.Nontachai Uppathamp)  
Field Scientist(1)

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

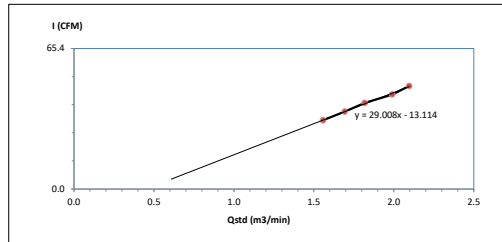
FORM NO.: F 06-074 REVISION NO.: - ISSUE DATE: 14/03/16



### High Volume Air Sampler Calibration Worksheet

Project Site:	Amata B.Grimm Power (Rayong) 3 Limited	Barometric Pressure (mm Hg):	753
Calibrate Location:	โรงหมั่นเผาถ่านหิน	Temperature (°C):	32
Calibrate Date:	21-Mar-23	High Volume ID:	RYG_FS0398
CalibrationSheet No.:	C-210323-RYG_FS0398	High Volume Model:	TE-S009X
Calibrator ID:	RYG_FS0205	High Volume S/N:	5684
Calibrator Model:	TE-S028A	Calibrator Slope:	0.94434
Calibrator S/N:	1166	Calibrator Intercept:	-0.01292

Test No.	Delta H <sub>2</sub> O (inch)	Q <sub>std</sub> (m <sup>3</sup> /min)	I: Chart (CFM)	Linear Regression Slope: 29.0079 Intercept: -13.1141 Correlation Coefficient: 0.9981
1	2.2	1.5583	32	
2	2.6	1.6929	36	
3	3.0	1.8175	40	
4	3.6	1.9897	44	
5	4.0	2.0967	48	



Calibrated by: (Mr.Nontachai Uppathamp)  
Field Scientist(1)

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

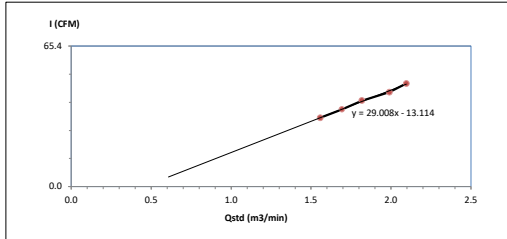
FORM NO.: F 06-074 REVISION NO.: - ISSUE DATE: 14/03/16



### High Volume Air Sampler Calibration Worksheet

Project Site : Amata B.Grimm Power (Rayong) 3 Limited  
Calibrate Location : รังนกบิน  
Calibrate Date : 21-Mar-23  
CalibrationSheet No.: C-210323-RYG\_FS0397  
Calibrator ID: RYG\_FS0205  
Calibrator Model: TE-5028A  
Calibrator S/N: 1166  
Barometric Pressure (mm Hg) : 753  
Temperature (°C) : 32  
High Volume ID : RYG\_FS0397  
High Volume Model : TE-5009X  
High Volume S/N : 5687  
Calibrator Slope : 0.94434  
Calibrator Intercept : -0.01292

Test No.	Delta H <sub>2</sub> O (inch)	Q <sub>ad</sub> (m <sup>3</sup> /min)	I: Chart (CFM)	Linear Regression
1	2.2	1.5583	32	Slope : 29.0079 Intercept : -13.1141 Correlation Coefficient : 0.9981
2	2.6	1.6929	36	
3	3.0	1.8175	40	
4	3.6	1.9897	44	
5	4.0	2.0967	48	



Calibrated by :   
( Mr.Nontchai Uppathamp )  
Field Scientist(1)

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

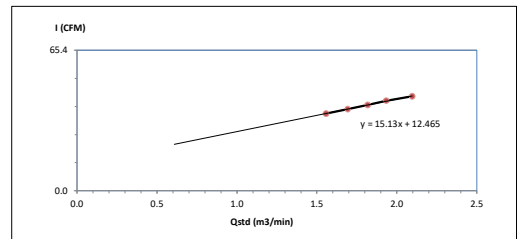
FORM NO.: F 06-074 REVISION NO.: - ISSUE DATE: 14/03/16



### High Volume Air Sampler Calibration Worksheet

Project Site : Amata B.Grimm Power (Rayong) 3 Limited  
Calibrate Location : รังนกบิน  
Calibrate Date : 21-Mar-23  
CalibrationSheet No.: C-210323-RYG\_FS0295  
Calibrator ID: RYG\_FS0205  
Calibrator Model: TE-5028A  
Calibrator S/N: 1166  
Barometric Pressure (mm Hg) : 753  
Temperature (°C) : 32  
High Volume ID : RYG\_FS0295  
High Volume Model : TE-5009X  
High Volume S/N : 5502  
Calibrator Slope : 0.94434  
Calibrator Intercept : -0.01292

Test No.	Delta H <sub>2</sub> O (inch)	Q <sub>ad</sub> (m <sup>3</sup> /min)	I: Chart (CFM)	Linear Regression
1	2.2	1.5583	36	Slope : 15.1299 Intercept : 12.4653 Correlation Coefficient : 0.9985
2	2.6	1.6929	38	
3	3.0	1.8175	40	
4	3.4	1.9341	42	
5	4.0	2.0967	44	



Calibrated by :   
( Mr.Nontchai Uppathamp )  
Field Scientist(1)

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

FORM NO.: F 06-074 REVISION NO.: - ISSUE DATE: 14/03/16

RYG\_EN0001

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



REVIEW BY :   
APPROVED BY :   
NEXT CAL DATE : 01/03/24

## Certificate of Calibration

Model Number : LA130S-F  
Description : Analytical Balance  
Serial Number : 25409664  
ID No.: RYG\_EN0001  
Manufacturer : Sartorius  
Certificate No.: 23BCI0110  
Issued Date : Friday, March 03, 2023  
Reference No.: 204833  
Page No.: 1 of 2

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

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

Calibrated By : Mr. Chonchai Inthana  
Calibration Date : Wednesday, March 01, 2023

Capacity : 160 g Readability : 0.0001 g  
Reasons for calibration : ☒ New Installation ☐ Service / Repair ☒ Re-calibration / Maintenance  
Ambient Conditions : Temperature : 24.2 °C ± 5.0 °C Humidity : 60.0 % RH ± 10.0 % RH Pressure : ±

Measurement Method : UKAS Publication Ref : Lab 14  
The measurement uncertainty stated is the expanded uncertainty which is obtained from the standard uncertainty multiplied by the coverage factor (k=2) to provide a level of confidence of approximately 95%. It is determined in accordance with the Guide to Expression of Uncertainty in Measurement (GUM). The calibration certificate documents the traceability to National Standards, which realise the unit of measurement according to the International Standard System of Units (SI). Report of Tolerance came from list of Sartorius Metrological Specifications.

#### Traceability:

Model Number	Description	Traceability	Certificate No.	Due Date
YC5011-522-00	Sartorius weight set 1mg - 5000g E2, YC5011-522-00	SPC-RT	C02212565	14-Sep-2023
MHB-382SD	Humidity/Barometer/Temp. Lutron MHB-382SD	DKSH	C19220444	5-Sep-2023

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

Mr. Chonchai Inthana (Technical Manager)



Sartorius (Thailand) Co., Ltd.

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



## Certificate of Calibration

Model Number : LA130S-F  
Description : Analytical Balance  
Serial Number : 25409664  
ID No.: RYG\_EN0001  
Manufacturer : Sartorius  
Certificate No.: 23BCI0110  
Issued Date : Friday, March 03, 2023  
Reference No.: 204833  
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 repeatability quantitatively.	The off-center loading error is yielded by the difference between the readout of the load, i.e. 1/3 or 1/4 of maximum capacity, placed in the middle of the weighing pan and between each of four additional measurement points (positions defined according to OIML R113).
Nominal Value : (Low Load) 10 g Tolerance 0.0001 g Nominal Value : (High Load) 100 g Tolerance 0.0001 g Standard Deviation 0.00009 0.00006	Nominal value : 50 g Tolerance 0.0004 g Difference 1 - 2 0.0001 3 -0.0001 4 0.0001 5 0.0000 6 -

Linearity
The linearity, also called linearity error, describes the deviation of the characteristic curve of a weighing instrument from its linear slope.
Tolerance 0.0002 g
Nominal Value (g) 0.01 0.05 0.1 0.5 1 2 5 10 20 100
Conventional Mass Value (g) 0.0100 0.0500 0.1000 0.5000 1.0000 2.0000 5.0000 10.0000 20.0000 100.0000
Displayed Value (g) 0.0100 0.0500 0.1000 0.5000 1.0000 2.0000 5.0000 10.0001 20.0001 100.0002
Deviation (g) 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0001 0.0001 0.0002
Uncertainty (g) 0.0002 0.0002 0.0002 0.0002 0.0002 0.0002 0.0002 0.0001 0.0001 0.0002

End of Report



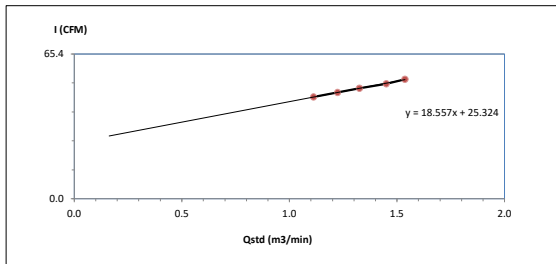


### High Volume Air Sampler Calibration Worksheet

Project Site : Amata B.Grimm Power (Rayong) 3 Limited  
Calibrate Location : โรงหมักผลิตเชื้อเพลิงชีวภาพ  
Calibrate Date : 21-Mar-23  
CalibrationSheet No.: C-210323-RYG\_FS0182  
Calibrator ID: RYG\_FS0205  
Calibrator Model : TE-5028A  
Calibrator S/N : 1166

Barometric Pressure (mm Hg) : 753  
Temperature ( °C ) : 32  
High Volume ID : RYG\_FS0182  
High Volume Model : TE-5170D  
High Volume S/N : 5335  
Calibrator Slope : 1.50765  
Calibrator Intercept : -0.02043

Test No.	Delta H <sub>2</sub> O (inch)	Q <sub>asd</sub> (m <sup>3</sup> /min)	I: Chart (CFM)	Linear Regression
1	2.8	1.1124	46	Slope : 18.5566 Intercept : 25.3237 Correlation Coefficient : 0.9989
2	3.4	1.2238	48	
3	4.0	1.3256	50	
4	4.8	1.4502	52	
5	5.4	1.5369	54	



Calibrated by :   
( Mr.Nontachai Uppathamp )  
Field Scientist(1)

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

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

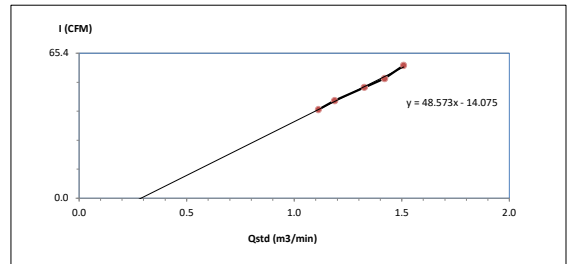


### High Volume Air Sampler Calibration Worksheet

Project Site : Amata B.Grimm Power (Rayong) 3 Limited  
Calibrate Location : โรงหมักข้าวโพด  
Calibrate Date : 21-Mar-23  
CalibrationSheet No.: C-210323-RYG\_FS0291  
Calibrator ID: RYG\_FS0205  
Calibrator Model : TE-5028A  
Calibrator S/N : 1166

Barometric Pressure (mm Hg) : 753  
Temperature ( °C ) : 32  
High Volume ID : RYG\_FS0291  
High Volume Model : TE-5170D  
High Volume S/N : 5333  
Calibrator Slope : 1.50765  
Calibrator Intercept : -0.02043

Test No.	Delta H <sub>2</sub> O (inch)	Q <sub>asd</sub> (m <sup>3</sup> /min)	I: Chart (CFM)	Linear Regression
1	2.8	1.1124	40	Slope : 48.5726 Intercept : -14.0745 Correlation Coefficient : 0.9966
2	3.2	1.1878	44	
3	4.0	1.3256	50	
4	4.6	1.4201	54	
5	5.2	1.5086	60	



Calibrated by :   
( Mr.Nontachai Uppathamp )  
Field Scientist(1)

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

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

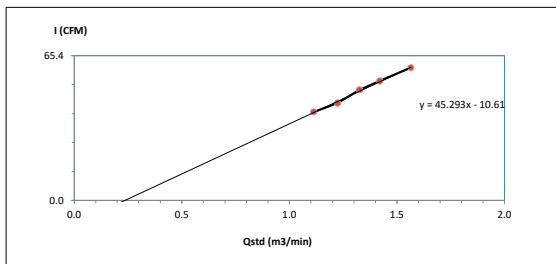


### High Volume Air Sampler Calibration Worksheet

Project Site : Amata B.Grimm Power (Rayong) 3 Limited  
Calibrate Location : โรงหมักข้าว  
Calibrate Date : 21-Mar-23  
CalibrationSheet No.: C-210323-RYG\_FS0176  
Calibrator ID: RYG\_FS0205  
Calibrator Model : TE-5028A  
Calibrator S/N : 1166

Barometric Pressure (mm Hg) : 753  
Temperature ( °C ) : 32  
High Volume ID : RYG\_FS0176  
High Volume Model : TE-5170D  
High Volume S/N : 4802  
Calibrator Slope : 1.50765  
Calibrator Intercept : -0.02043

Test No.	Delta H <sub>2</sub> O (inch)	Q <sub>asd</sub> (m <sup>3</sup> /min)	I: Chart (CFM)	Linear Regression
1	2.8	1.1124	40	Slope : 45.2930 Intercept : -10.6096 Correlation Coefficient : 0.9976
2	3.4	1.2238	44	
3	4.0	1.3256	50	
4	4.6	1.4201	54	
5	5.6	1.5648	60	



Calibrated by :   
( Mr.Nontachai Uppathamp )  
Field Scientist(1)

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

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

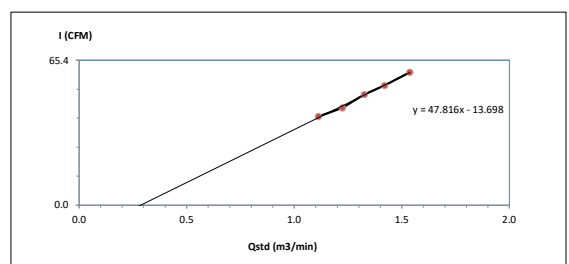


### High Volume Air Sampler Calibration Worksheet

Project Site : Amata B.Grimm Power (Rayong) 3 Limited  
Calibrate Location : ศูนย์พัฒนาเด็กเล็กองค์การบริหารส่วนตำบลบางยางพร  
Calibrate Date : 21-Mar-23  
CalibrationSheet No.: C-210323-RYG\_FS0181  
Calibrator ID: RYG\_FS0205  
Calibrator Model : TE-5028A  
Calibrator S/N : 1166

Barometric Pressure (mm Hg) : 753  
Temperature ( °C ) : 32  
High Volume ID : RYG\_FS0181  
High Volume Model : TE-5170D  
High Volume S/N : 5334  
Calibrator Slope : 1.50765  
Calibrator Intercept : -0.02043

Test No.	Delta H <sub>2</sub> O (inch)	Q <sub>asd</sub> (m <sup>3</sup> /min)	I: Chart (CFM)	Linear Regression
1	2.8	1.1124	40	Slope : 47.8162 Intercept : -13.6976 Correlation Coefficient : 0.9978
2	3.4	1.2238	44	
3	4.0	1.3256	50	
4	4.6	1.4201	54	
5	5.4	1.5369	60	



Calibrated by :   
( Mr.Nontachai Uppathamp )  
Field Scientist(1)

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

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

# ANALYSIS OF RESULTS

The cup anemometer, Unit Under Calibration (UUC) was checked at 10 m/s for 5 minutes prior to calibration being performed. The standard air velocity 5.5 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 sensor which was installed 40 mm and 500 mm respectively away from wind tunnel nozzle. UUC was installed at center of the test section. The calibration was carried out under both rising and falling air velocity in the range of 1 m/s to 16 m/s at calibration interval of 1 m/s. The results of calibration and associated measurement uncertainties are reported in the table below.

$V_{std}$ (m/s)	Temp. wind tunnel (°C)	Temp. room (°C)	$V_{UUC}$ (m/s)	Error (m/s)	$U$ (k=2) (m/s)
0.981	23.56	23.45	0.8	-0.2	0.15
2.039	23.40	23.45	1.9	-0.2	0.16
3.049	23.50	23.45	2.9	-0.3	0.17
4.129	23.50	23.45	3.9	-0.3	0.20
5.61	23.50	23.45	4.8	-0.2	0.21
5.97	23.54	23.45	5.7	0.3	0.17
7.05	23.43	23.45	6.8	-0.3	0.18
8.18	23.50	23.45	7.9	-0.3	0.18
9.10	23.34	23.45	8.8	-0.3	0.18
10.10	23.40	23.45	9.7	-0.4	0.18
11.14	23.40	23.45	10.8	-0.4	0.20
12.13	23.32	23.45	11.8	-0.4	0.20
13.20	23.10	23.45	12.9	-0.3	0.20
14.25	23.36	23.45	13.9	-0.4	0.22
15.24	23.22	23.45	14.8	-0.4	0.21
16.30	23.40	23.45	15.9	-0.5	0.22

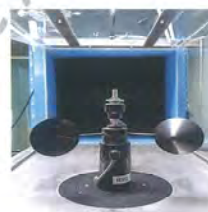
## Remarks:

<sup>1</sup> Calibration results only count for the tested circumstances and environmental conditions during which calibration took place.

<sup>2</sup> Velocity of standard

<sup>3</sup> Velocity of Unit Under Calibration

## PHOTO OF CALIBRATION SET-UP



Calibration setup of the cup anemometer calibration in the wind tunnel of Jiranatee Associates Co., Ltd. The cup anemometer chosen 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\*\*\*

## MEASUREMENT ITEM MANUFACTURER MODEL/TYPE

## SERIAL NUMBER

## ID NUMBER

## CONDITION AS RECEIVED

## CUSTOMER

## RECEIVED DATE

## MEASUREMENT DATE

## ISSUE DATE

## 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

## CALIBRATION CONDITIONS

## Preconditioning

## Measurement Condition

## TABULATION OF RESULTS:

The table on next page give the measured values.

## Calibrated by:

☒ Mr. Soravit Thachalad  
☐ Miss Jitratana Jiratanachol

## Approved signatory:

Mr. Parinya Booncharoen  
Calibration Department Manager

## Remarks:

<sup>1</sup> Nozzle cross-section area of the wind tunnel  
<sup>2</sup> Projected cross-section area of the tested object include mounting pipe  
<sup>3</sup> Diameter of mounting pipe  
<sup>4</sup> Ratio  $V_{std}$

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-009-06

# MEASUREMENT RESULTS

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

Air speed m/s	$D'_{std}$ Degree (°)	$D'_{UUC}$ Degree (°)	Error Degree (°)	$U$ (k=2) Degree (°)
	0.000	0	0	0.58
	42.000	44	-3	0.70
	80.000	80	-3	0.66
	123.000	134	-11	0.71
	180.000	177	-3	0.74
	225.000	229	-4	0.56
	270.000	273	-3	0.68
	315.000	317	-2	0.74

## Remarks:

<sup>1</sup> Calibration results only count for the tested circumstances and environmental conditions during which calibration took place.

<sup>2</sup> Direction of standard

<sup>3</sup> Direction of Unit Under Calibration

\*\*\*End of Certificate of Calibration\*\*\*

## MEASUREMENT ITEM MANUFACTURER MODEL/TYPE

## SERIAL NUMBER

## ID NUMBER

## CONDITION AS RECEIVED

## CUSTOMER

## RECEIVED DATE

## MEASUREMENT DATE

## ISSUE DATE

## 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

## CALIBRATION CONDITION

## Preconditioning

## Measurement Condition

## TABULATION OF RESULTS:

The table on next page give the measured values.

## Calibrated by:

☒ Mr. Soravit Thachalad  
☐ Miss Jitratana Jiratanachol

## Approved signatory:

Mr. Parinya Booncharoen  
Calibration Department Manager

## Remarks:

<sup>1</sup> Nozzle cross-section area of the wind tunnel  
<sup>2</sup> Projected cross-section area of the tested object include mounting pipe  
<sup>3</sup> Diameter of mounting pipe  
<sup>4</sup> Ratio  $V_{std}$

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



JIRANATEE ASSOCIATES CO., LTD.

Jirantee Associates Co., Ltd.  
63/14-15, 67/10-30  
Petchkasem 7, 7/1, Rd. Watthana, Bangkok 10150 (Thailand)  
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Mobile: +6620594533  
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Web site: www.jiranatee.com

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

Air speed measurement laboratory  
Calibration services department

VIEW BY: Naratong P.  
APPROVED BY: 47 JV  
19/1/24

Certificate Number

CL-010-68

## CERTIFICATE OF CALIBRATION

Page 1 of 2 Pages

### MEASUREMENT ITEM MANUFACTURER MODEL/TYPE

Wind Direction Sensor  
Novelme  
Sensor: WS-82F  
Data logger: Z00-WS-250L

### SERIAL NUMBER

1 Sensor: -

### ID NUMBER

Data logger: A886

### CONDITION AS RECEIVED

RYD, F50087

### 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

16 Jan 2023

### MEASUREMENT DATE

19 Jan 2023

### ISSUE DATE

20 Jan 2023

### ENVIRONMENTAL CONDITIONS:

Ambient condition in the laboratory are as follow:

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

### PLACE OF CALIBRATION

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

### CALIBRATION CONDITION

Wind tunnel cross-section area: 900 cm<sup>2</sup>  
Win direction frontal area: 129 cm<sup>2</sup>  
Diameter of mounting pipe: 10 mm  
Blockage ratio of test object: 0.143

### Preconditioning

24 hours at ambient conditions.

### Measurement Condition

The average values during measurement are (23.5) °C, (57.4) %RH and (1015.6) hPa

### TABULATION OF RESULTS:

The table on next page give the measured values.

### Calibrated by:

☒ Mr. Sorawit Thirakulchai  
☐ Miss Jitratana Lertkarnphol

### Remarks:

- 1. Notice 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 "to"

Approved signature:

Mr. Parinya Booncharoen  
Calibration Department Manager

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

Page 2 of 2 Pages

### MEASUREMENT RESULTS<sup>1</sup>

The wind direction sensor was calibrated against standard rotary encoder by comparison method. During calibration, the measurement was carried out at 45° intervals in clockwise and counter-clockwise directions after offset adjustment has been made. The flow speed of wind tunnel usually 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 <sub>ref</sub>	D <sub>me</sub>	Error	U (k=2)
m/s	Degree (°)	Degree (°)	Degree (°)	Degree (°)
0.000	0	0	0	0.58
45.000	45	48	-2	0.74
90.000	90	86	-2	0.74
135.000	135	131	-2	0.74
180.000	180	179	-1	0.74
225.000	225	225	0	0.68
270.000	270	273	3	0.58
315.000	315	319	4	0.74

### Remarks:

<sup>1</sup> Calibration results only count for the tested circumstances and environmental conditions during which calibration took place

<sup>2</sup> Direction of standard

<sup>3</sup> Direction of Unit Under Calibration

\*\*\*End of Certificate of Calibration\*\*\*



JIRANATEE ASSOCIATES CO., LTD.

Jirantee Associates Co., Ltd.  
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Accredited calibration laboratory  
ISO/IEC 17025:2017  
NSC-TIS-TIS 17025  
CALIBRATION 0367

Air speed measurement laboratory  
Calibration services department

Certificate Number

CL-010-68

## CERTIFICATE OF CALIBRATION

Page 1 of 2 Pages

### MEASUREMENT ITEM MANUFACTURER MODEL/TYPE

Cup anemometer  
Novelme  
Sensor: WS-82F  
Data logger: Z00-WS-250L

### SERIAL NUMBER

1 Sensor: -

### ID NUMBER

Data logger: A886

### CONDITION AS RECEIVED

RYD, F50087

### 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

16 Jan 2023

### MEASUREMENT DATE

18 Jan 2023

### ISSUE DATE

20 Jan 2023

### ENVIRONMENTAL CONDITIONS:

Ambient condition in the laboratory are as follow:

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

### PLACE OF CALIBRATION

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

### CALIBRATION CONDITIONS

Wind tunnel cross-section area: 900 cm<sup>2</sup>  
Win direction frontal area: 100 cm<sup>2</sup>  
Diameter of mounting pipe: 10 mm  
Blockage ratio of test object: 0.111

### Preconditioning

24 hours at ambient conditions.

### Measurement Condition

The average values during measurement are (23.6) °C, (55.3) %RH and (1013.5) hPa

### TABULATION OF RESULTS:

The table on next page give the measured values.

### Calibrated by:

☒ Mr. Sorawit Thirakulchai  
☐ Miss Jitratana Lertkarnphol

### Remarks:

- 1. Notice cross-section area of the wind tunnel
- 2. Projected cross-section area of one tested object include mounting pipe
- 3. Diameter of mounting pipe
- 4. Ratio "to"

Approved signature:

Mr. Parinya Booncharoen  
Calibration Department Manager

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-010-68

Page 2 of 2 Pages

### MEASUREMENT RESULTS<sup>1</sup>

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

U <sub>ref</sub>	Temp. wind tunnel	Temp. room	U <sub>me</sub>	Error	U (k=2)
(m/s)	(°C)	(°C)	(m/s)	(m/s)	(m/s)
0.995	23.68	23.60	0.8	-0.2	0.15
2.002	23.64	23.60	1.8	-0.2	0.14
3.004	23.68	23.60	2.9	-0.1	0.19
4.018	23.60	23.60	3.9	-0.2	0.20
5.03	23.50	23.60	4.9	-0.1	0.20
5.98	23.50	23.60	5.9	-0.1	0.18
7.05	23.35	23.60	7.0	0.1	0.18
8.18	23.54	23.60	8.0	-0.2	0.20
9.30	23.80	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	11.1	-0.1	0.22
12.12	23.40	23.60	11.9	-0.2	0.21
13.19	23.10	23.60	13.0	-0.2	0.26
14.15	23.46	23.60	14.0	-0.2	0.31
15.16	23.10	23.60	15.0	-0.2	0.23
16.31	23.25	23.50	16.2	-0.1	0.25

### Remarks:

<sup>1</sup> Calibration results only count for the tested circumstances and environmental conditions during which calibration took place

<sup>2</sup> Velocity of standard

<sup>3</sup> 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\*\*\*



## MEASUREMENT RESULTS<sup>1</sup>

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 pressure 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)	$V_{UUC}$ (m/s)	Error (m/s)	$U(R=2)$ (m/s)
0.989	23.83	23.85	0.7	-0.3	0.16
3.033	23.90	23.85	1.3	-0.3	0.19
3.954	24.00	23.85	2.9	-0.2	0.20
5.112	23.84	23.85	3.9	-0.3	0.20
5.100	23.88	23.85	4.9	-0.1	0.20
5.98	23.94	23.85	5.8	-0.2	0.18
7.66	23.82	23.85	8.8	-0.2	0.19
8.17	23.80	23.85	9.0	-0.1	0.22
9.08	23.72	23.85	9.0	-0.1	0.21
10.09	23.86	23.85	9.9	-0.2	0.20
11.14	23.60	23.85	11.0	-0.1	0.28
12.14	23.74	23.85	12.4	0.1	0.28
13.21	23.68	23.85	13.0	-0.2	0.23
14.28	23.70	23.85	14.3	-0.2	0.27
15.26	23.64	23.85	15.0	-0.3	0.26
16.30	23.60	23.85	16.1	-0.2	0.28

### Remarks:

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

<sup>2</sup> Velocity of standard.

<sup>3</sup> Velocity of Unit Under Calibration.

### PHOTO OF CALIBRATION SET-UP



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

\*\*\*End of Certificate of Calibration\*\*\*  
JIRANATEE ASSOCIATES CO., LTD.

## MEASUREMENT ITEM

### MANUFACTURER

### MODEL/TYPE

### SERIAL NUMBER

### ID NUMBER

### CONDITION AS-RECEIVED

### CUSTOMER

### RECEIVED DATE

### MEASUREMENT DATE

### ISSUE DATE

### ENVIRONMENTAL CONDITIONS:

### Ambient condition in the laboratory are as follow:

### Temperature

### Relative Humidity

### Atmospheric Pressure

### PLACE OF CALIBRATION

### CALIBRATION CONDITIONS

### Preconditioning

### Measurement Condition

### TABULATION OF RESULTS:

### The table on next page give the measured values.

### Calibrated by:

### Calibration Department Manager

### Remarks:

### <sup>1</sup> Velocity of standard

### <sup>2</sup> Velocity of Unit Under Calibration

### <sup>3</sup> Position of the set-up is not true to scale due to image geometry

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JIRANATEE ASSOCIATES CO., LTD.

Jiranatee Associates Co., Ltd.  
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Accredited calibration laboratory  
ISO/IEC 17025:2017  
NSC-TS-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

1. Cup anemometer  
2. Navline  
3. Sensor: WS-02F  
4. Data logger: 200-WS-2518

### SERIAL NUMBER

1. Sensor: -  
2. Data logger: AS375

### ID NUMBER

1. RYE\_T20413

### CONDITION AS RECEIVED

### CUSTOMER

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

### RECEIVED DATE

1. 27 Jan 2023

### MEASUREMENT DATE

1. 10 Feb 2023

### ISSUE DATE

1. 10 Feb 2023

### ENVIRONMENTAL CONDITIONS:

Ambient condition in the laboratory are as follow:

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

### PLACE OF CALIBRATION

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

### CALIBRATION CONDITIONS

1. Wind tunnel cross-section area: 900 cm<sup>2</sup>  
2. Win direction frontal area: 100 cm<sup>2</sup>  
3. Diameter of mounting pipe: mm  
4. Blockage ratio of test object: 0.111 [-]

### Preconditioning

### Measurement Condition

1. 24 hours at ambient conditions.  
2. The average values during measurement are (24.0) °C, (45.7) %RH and (1015.0) hPa.

### TABULATION OF RESULTS:

The table on next page give the measured values.

### Calibrated by:

1. Mr. Sorawat Thachalad  
2. Miss Jiragarn Uertthasiphol



### Approved signatory:

Mr. Parinya Booncharoen  
Calibration Department Manager

### Remarks:

1. Supply 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: 1 to

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Page 2 of 2 Pages

### MEASUREMENT RESULTS<sup>1</sup>

The cup anemometer, Unit Under Calibration (UUC) was exercise at 10 m/s for 5 minutes prior to calibration being performed. The standard air velocity 0.5 m/s to 5 m/s was calculated by a standard air velocity transducer and above 5 m/s to 30 m/s was calculated by a pitot tube with precision differential pressure meter which was installed 40 mm and 300 mm respectively away from wind tunnel nozzle, UUC was installed at center of the test section. The calibration was carried out under both rising and falling air velocity in the range of 1 m/s to 15 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)	$V_{UUC}$ (m/s)	Error (m/s)	$U$ (m/s) (m/s)
0.384	24.10	24.00	0.7	-0.3	0.16
2.029	23.98	24.00	1.8	-0.3	0.16
3.044	23.96	24.00	2.9	-0.2	0.19
4.135	24.20	24.00	3.9	-0.9	0.20
5.00	23.90	24.00	4.9	-0.2	0.21
5.98	24.24	24.00	5.9	-0.7	0.17
7.06	23.90	24.00	6.9	-0.2	0.19
8.19	24.14	24.00	8.0	-0.7	0.19
9.09	23.88	24.00	8.9	-0.2	0.20
10.09	23.88	24.00	9.8	-0.4	0.18
11.16	23.74	24.00	11.0	-0.2	0.23
12.13	23.82	24.00	12.0	-0.2	0.24
13.19	23.70	24.00	13.0	-0.2	0.22
14.26	23.66	24.00	14.0	-0.3	0.28
15.24	23.69	24.00	14.9	-0.8	0.23
16.30	23.70	24.00	16.0	-0.3	0.23

### Remark:

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

2. Velocity of standard

3. Velocity at test 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 missing geometry.



\*\*\*End of Certificate of Calibration\*\*\*



JIRANATEE ASSOCIATES CO., LTD.

Jiranatee Associates Co., Ltd.  
63/14-15, 63/15-16  
Petchkasem 57/1, Rd. Northside, Bangkok  
Bangkok 10500 (Thailand)  
Tel: +66(0)2083812  
Mobile: +66(0)2099453  
E-mail: jnc-calibration@jiranatee.com  
Web site: www.jiranatee.com

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

Air speed measurement laboratory  
Calibration services department

Certificate Number

CL-018-66

## CERTIFICATE OF CALIBRATION

Page 1 of 2 Pages

### MEASUREMENT ITEM MANUFACTURER MODEL/TYPE

1. Wind Direction Sensor  
2. Navline  
3. Sensor: WS-02F  
4. Data logger: 200-WS-2518

### SERIAL NUMBER

1. Sensor: -  
2. Data logger: AS375

### ID NUMBER

1. RYE\_T20413

### CONDITION AS RECEIVED

### CUSTOMER

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

### RECEIVED DATE

1. 17 Jan 2023

### MEASUREMENT DATE

1. 10 Feb 2023

### ISSUE DATE

1. 10 Feb 2023

### ENVIRONMENTAL CONDITIONS:

Ambient condition in the laboratory are as follow:

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

### PLACE OF CALIBRATION

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

### CALIBRATION CONDITION

1. Wind tunnel cross-section area: 900 cm<sup>2</sup>  
2. Win direction frontal area: 125 cm<sup>2</sup>  
3. Diameter of mounting pipe: mm  
4. Blockage ratio of test object: 0.143 [-]

### Preconditioning

### Measurement Condition

1. 24 hours at ambient conditions.  
2. The average values during measurement are (23.8) °C, (50.2) %RH and (1012.2) hPa.

### TABULATION OF RESULTS:

The table on next page give the measured values.

### Calibrated by:

1. Mr. Sorawat Thachalad  
2. Miss Jiragarn Uertthasiphol



### Approved signatory:

Mr. Parinya Booncharoen  
Calibration Department Manager

### Remarks:

1. Supply 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: 1 to

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Certificate Number

CL-020-66

Page 2 of 2 Pages

### MEASUREMENT RESULTS<sup>1</sup>

The wind direction sensor was calibrated against standard rotary encoder by comparison method. During calibration, the measurement was carried out at 45° intervals in clockwise and counter-clockwise directions after offset adjustment has been made. The flow speed of wind tunnel (usually 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	$\theta'_{ref}$ Degree [°]	$\theta'_{UUC}$ Degree [°]	Error Degree [°]	$U$ (Degree [°]) Degree [°]
4.99	0.000	0	0	0.58
	45.000	41	-4	0.56
	90.000	87	-3	0.71
	135.000	133	-2	0.19
	180.000	180	0	0.74
	225.000	227	-2	0.69
	270.000	273	3	0.68
	315.000	319	3	0.74

### Remark:

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\*\*\*



# SITHIPORN ASSOCIATES CO.,LTD. CALIBRATION LABORATORY

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



Cert. No. : ACC22023  
Pages : 1 of 3

## Calibration Certificate

**Equipment :** SOUND CALIBRATOR  
**Manufacturer :** RION  
**Model :** NC-74  
**Serial No.:** 34178123  
**ID No.:** RYG\_FS0215

**Condition As Found :** GOOD

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

**Location :** -  
**Ambient Temperature :** ( 23.0 ± 3 ) °C  
**Pressure :** ( 101.3 ± 3 ) kPa  
**Relative Humidity :** ( 50.0 ± 20 ) %  
**Received Date :** 22 AUGUST 2022  
**Calibration Date :** 31 AUGUST 2022  
**Date of Issue :** 02 SEPTEMBER 2022

REVIEW BY: *Nathakorn P.*  
APPROVED BY: *T. Petchurai*  
NEXT CAL. DATE: 31/8/23

Calibrated by : Nathakorn 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. : ACC22023  
Job No. : VC66AC0077  
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	33511H	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. : ACC22023  
Job No. : VC66AC0077  
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	94.04	0.04	0.14	0.40

### 2. Frequency

Specified Frequency (Hz)	Measured value (Hz)	Deviated value (%)	Uncertainty (%)	Tolerance limit (%)
1000	1001.5	0.1	0.1	1.0

### 3. Total distortion

Measured value (%)	Uncertainty (%)	Tolerance limit (%)
1.70	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.,Bangbunmy, Bangplud Bangkok 10700 THAILAND.  
Tel:0-2435-8800 Fax:0-2435-1679 e-mail:cali-center@sithiporn.com http://www.sithiporn.com



Cert. No. : ACL23086  
Pages : 1 of 3

## Calibration Certificate

**Equipment :** SOUND LEVEL METER  
**Manufacturer :** RION  
**Model :** NL-42/ Microphone UC-52 / Preamplifier NH-24  
**Serial No.:** 01222723 / 143841 / 22770  
**ID No.:** RYG\_FS0022

**Condition As Found :** GOOD

**Customer :** ALS LABORATORY GROUP (THAILAND) CO., LTD.  
104 PHATTHANAKAN 40, PHATTHANAKAN ROAD,  
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 :** 24 JANUARY 2023  
**Calibration Date :** 25-26 JANUARY 2023  
**Date of Issue :** 27 JANUARY 2023

REVIEW BY: *Nathakorn P.*  
APPROVED BY: *T. Petchurai*  
NEXT CAL. DATE: 29/1/24

Calibrated by : Nathakorn Pisutpaisan

Approved by :

*T. Petchurai*  
( Thanakul Petchurai )

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

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## Continuation of Calibration Certificate

Cert. No. : ACL23086  
Job No. : VC66AC0031  
Pages : 3 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

7. Petch

## Continuation of Calibration Certificate

Cert. No. : ACL23086  
Job No. : VC66AC0031  
Pages : 3 of 8

## Summary of Measurement Result :

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

QF-TS12-04-04-020664

7. Petch

## Continuation of Calibration Certificate

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

## Result of calibration :

## 1. Absolute sensitivity

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

## 2. Self-generated noise

## 2.1 Normal test

Measured Value (dB)
15.1

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

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

## 3. Acoustical signal tests of frequency weightings

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

Frequency (Hz)	Flat	C-weight	A-weight	Acceptance Limits
125	0.5	0.5	0.6	± 1.5
1000	0.0	-0.1	-0.1	± 1.0
8000	-0.1	0.0	0.0	± 5.0

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7. Petch

## Continuation of Calibration Certificate

Cert. No. : ACL23086  
Job No. : VC66AC0031  
Pages : 5 of 8

## 4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

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

## 5. Frequency and time weightings at 1 kHz

## 5.1 Frequency weightings at 1 kHz

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

## 5.2 Time weighting at 1 kHz

Frequency Weighting	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Fast	94.0	0.0	-
Slow	94.0	0.0	± 0.1
1eq	94.0	0.0	± 0.1

## 6. Long-term stability

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

QF-TS12-04-04-020664

7. Petch

## Continuation of Calibration Certificate

Cert. No. : ACL23086  
Job No. : VC66AC0031  
Pages : 6 of 8

## 7. Level linearity on the reference level range

Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
137.0	137.0	0.0	±1.1
136.0	136.0	0.0	±1.1
135.0	135.0	0.0	±1.1
134.0	134.0	0.0	±1.1
133.0	133.0	0.0	±1.1
132.0	132.0	0.0	±1.1
131.0	131.0	0.0	±1.1
129.0	129.0	0.0	±1.1
124.0	124.0	0.0	±1.1
119.0	119.0	0.0	±1.1
114.0	114.0	0.0	±1.1
109.0	109.0	0.0	±1.1
104.0	104.0	0.0	±1.1
99.0	99.0	0.0	±1.1
94.0	94.0	0.0	±1.1
89.0	89.0	0.0	±1.1
84.0	84.0	0.0	±1.1
79.0	79.0	0.0	±1.1
74.0	74.0	0.0	±1.1
69.0	69.0	0.0	±1.1
64.0	64.0	0.0	±1.1
59.0	59.0	0.0	±1.1
54.0	53.9	-0.1	±1.1
49.0	49.0	0.0	±1.1
44.0	44.0	0.0	±1.1
39.0	38.9	-0.1	±1.1
34.0	33.9	-0.1	±1.1
30.0	29.9	-0.1	±1.1
29.0	28.9	-0.1	±1.1
28.0	27.9	-0.1	±1.1
27.0	26.9	-0.1	±1.1
26.0	25.9	-0.1	±1.1
25.0	24.8	-0.2	±1.1

QF-TS12-04-04-020664

T. Petchu

## Continuation of Calibration Certificate

Cert. No. : ACL23086  
Job No. : VC66AC0031  
Pages : 7 of 8

## 8. Level linearity including the level range control

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

## 9. Tone burst response

Time Weighting	Tone burst duration, T <sub>b</sub> (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 <sub>peak</sub> (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.0	0.0	-
One	136.4	136.1	-0.3	±3.0

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

QF-TS12-04-04-020664

T. Petchu

## Continuation of Calibration Certificate

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

## 11. Overload indication

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

## 12. High level stability

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

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

End of Calibration Certificate

QF-TS12-04-04-020664

T. Petchu

451-451/1 Silinthon Rd., Bangbunru, Bangkok 10700 THAILAND  
Tel: 0-2435-8800 Fax: 0-2435-1679 e-mail: cal-center@sithiporn.com http://www.sithiporn.comCert. No. : ACT.23048  
Pages : 1 of 8

## Calibration Certificate

Equipment : SOUND LEVEL METER  
Manufacturer : RION  
Model : NL-42/ Microphone UC-52 / Preamplifier NH-24  
Serial No. : 01222724 / 143842 / 22771  
ID No. : RYG\_FS0023

Condition As Found : GOOD

Customer : ALS LABORATORY GROUP (THAILAND) CO., LTD.  
104 PHATTHANAKAN 40, PHATTHANAKAN ROAD,  
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 JANUARY 2023  
Calibration Date : 13-18 JANUARY 2023  
Date of Issue : 19 JANUARY 2023

Calibrated by : Nathakorn Pisutpaisan

Approved by :

T. Petchu  
( Thanakul Petchu )

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## Continuation of Calibration Certificate

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

Calibration Procedure : CP-AC-01

## Calibration Method :

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

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

## Condition of this result of calibration :

1. Reference Standard Instruments :

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

QP-TS12-04-04-020664

## Continuation of Calibration Certificate

Cert. No. : ACL23048  
Job No. : VC66AC0024  
Pages : 3 of 8

## Summary of Measurement Result :

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

QP-TS12-04-04-020664

## Continuation of Calibration Certificate

Cert. No. : ACL23048  
Job No. : VC66AC0024  
Pages : 4 of 8

## Result of calibration :

## 1. Absolute sensitivity

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

## 2. Self-generated noise

## 2.1 Normal test

Measured Value ( dB )
15.4

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

Frequency Weighting	Measured value ( dB )
A - weight	11.2
C - weight	17.6
Flat	23.4

## 3. Acoustical signal tests of frequency weightings

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

Frequency ( Hz )	Deviation from various frequency weighting response curve (dB)			
	Flat	C-weight	A-weight	Acceptance Limits
125	0.2	0.2	0.2	± 1.5
1000	-0.1	-0.1	-0.1	± 1.0
8000	-0.8	-0.8	-0.7	± 5.0

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## Continuation of Calibration Certificate

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

## 4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

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

## 5. Frequency and time weightings at 1 kHz

## 5.1 Frequency weightings at 1 kHz

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

## 5.2 Time weighting at 1 kHz

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

## 6. Long - term stability

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

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Cert. No. : ACL23048  
Job No. : VC66AC0024  
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## 7. Level linearity on the reference level range

Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
137.0	137.0	0.0	±1.1
136.0	136.0	0.0	±1.1
135.0	135.0	0.0	±1.1
134.0	134.0	0.0	±1.1
133.0	133.0	0.0	±1.1
132.0	132.0	0.0	±1.1
131.0	131.0	0.0	±1.1
129.0	129.0	0.0	±1.1
124.0	124.0	0.0	±1.1
119.0	119.0	0.0	±1.1
114.0	114.0	0.0	±1.1
109.0	109.0	0.0	±1.1
104.0	104.0	0.0	±1.1
99.0	99.0	0.0	±1.1
94.0	94.0	0.0	±1.1
89.0	89.0	0.0	±1.1
84.0	84.0	0.0	±1.1
79.0	79.0	0.0	±1.1
74.0	74.0	0.0	±1.1
69.0	69.0	0.0	±1.1
64.0	64.0	0.0	±1.1
59.0	59.0	0.0	±1.1
54.0	53.9	-0.1	±1.1
49.0	48.9	-0.1	±1.1
44.0	43.9	-0.1	±1.1
39.0	38.9	-0.1	±1.1
34.0	33.9	-0.1	±1.1
30.0	29.9	-0.1	±1.1
29.0	28.8	-0.2	±1.1
26.0	27.9	0.1	±1.1
27.0	26.8	-0.2	±1.1
26.0	25.9	-0.1	±1.1
25.0	24.8	-0.2	±1.1

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T. Petchurui

Cert. No. : ACL23048  
Job No. : VC66AC0024  
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## 8. Level linearity including the level range control

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

## 9. Tone burst response

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

## 10. Peak C sound level

Number of cycle in test signal	Anticipated Value (dB)	Measured Value, L <sub>peak</sub> (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.0	0.0	-
One	136.4	135.8	-0.6	±3.0

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

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T. Petchurui

Cert. No. : ACL23048  
Job No. : VC66AC0024  
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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. Petchurui

451-451/1 Sirinthorn Rd., Bangbunru, Bangplud Bangkok 10700 THAILAND.  
Tel: 0-2435-8800 Fax: 0-2433-1679 e-mail: cal-center@sithiporn.com http://www.sithiporn.comCert. No. : ACC23005  
Pages : 1 of 3

## Calibration Certificate

Equipment : SOUND CALIBRATOR  
Manufacturer : RION  
Model : NC-75  
Serial No. : 35002736  
ID No. : RYG\_FS0496

Condition As Found : GOOD

Customer : ALS LABORATORY GROUP (THAILAND) CO., LTD.  
104 PHATTHANAKAN 40, PHATTHANAKAN ROAD,  
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 JANUARY 2023  
Calibration Date : 17 JANUARY 2023  
Date of Issue : 19 JANUARY 2023

Calibrated by : Nathakorn Pisuipaisan

Approved by :

T. Petchurui  
( Thanukul Petchurui )

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. : ACC23005  
Job No. : VC66AC0024  
Pages : 2 of 4

Calibration Procedure : CP-AC-03

Calibration Method :

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

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

Condition of this result of calibration :

1. Reference Standard Instruments :

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

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

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

3.1 National Institute of Metrology (Thailand).

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

QF-TS12-04-04-020604

T. Petchur

SITHIPORN ASSOCIATES CO.,LTD.  
CALIBRATION LABORATORY

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



Cert. No. : ACL22295  
Pages : 1 of 8

Calibration Certificate

Equipment : SOUND LEVEL METER  
Manufacturer : RION  
Model : NL-42/ Microphone UC-52 / Preamplifier NH-24  
Serial No. : 00233183 / 144835 / 23230  
ID No. : RYG\_FS0024

Condition As Found : GOOD

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

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

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

Calibrated by : Nathakorn Pisutpaisan

Approved by :

T. Petchur  
( Thumakul Petchur )

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

QF-TS12-04-04-020604

Continuation of Calibration Certificate

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

Result of calibration :

1. Sound pressure level

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

2. Frequency

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

3. Total distortion

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

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

End of Calibration Certificate

QF-TS12-04-04-020604

T. Petchur

Continuation of Calibration Certificate

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

Calibration Procedure : CP-AC-01

Calibration Method :

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

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

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

Condition of this result of calibration :

1. Reference Standard Instruments :

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

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

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

3.1 National Institute of Metrology (Thailand).

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

QF-TS12-04-04-020604

T. Petchur



## Continuation of Calibration Certificate

Cert. No. : ACL22295  
Job No. : YC66AC0016  
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

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## Continuation of Calibration Certificate

Cert. No. : ACL22295  
Job No. : YC66AC0016  
Pages : 5 of 8

## 4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz

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

## 5. Frequency and time weightings at 1 kHz

## 5.1 Frequency weightings at 1 kHz

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

## 5.2 Time weighting at 1 kHz

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

## 6. Long - term stability

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

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## Continuation of Calibration Certificate

Cert. No. : ACL22295  
Job No. : YC66AC0016  
Pages : 4 of 8

## Result of calibration :

## 1. Absolute sensitivity

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

## 2. Self-generated noise

## 2.1 Normal test

Measured Value (dB)
19.3

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

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

## 3. Acoustical signal tests of frequency weightings

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

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)			
	Flat	C-weight	A-weight	Acceptance Limits
125	-0.1	-0.1	-0.1	± 1.5
1000	-0.1	-0.1	-0.1	± 1.0
8000	0.3	0.4	0.4	±5.0

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## Continuation of Calibration Certificate

Cert. No. : ACL22295  
Job No. : YC66AC0016  
Pages : 6 of 8

## 7. Level linearity on the reference level range

Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
137.0	137.0	0.0	± 1.1
136.0	136.0	0.0	± 1.1
135.0	135.0	0.0	± 1.1
134.0	134.0	0.0	± 1.1
133.0	133.0	0.0	± 1.1
132.0	132.0	0.0	± 1.1
131.0	131.0	0.0	± 1.1
129.0	129.0	0.0	± 1.1
124.0	124.0	0.0	± 1.1
119.0	119.0	0.0	± 1.1
114.0	114.0	0.0	± 1.1
109.0	109.0	0.0	± 1.1
104.0	104.0	0.0	± 1.1
99.0	99.0	0.0	± 1.1
94.0	94.0	0.0	± 1.1
89.0	89.0	0.0	± 1.1
84.0	84.0	0.0	± 1.1
79.0	79.0	0.0	± 1.1
74.0	74.0	0.0	± 1.1
69.0	69.0	0.0	± 1.1
64.0	64.0	0.0	± 1.1
59.0	59.0	0.0	± 1.1
54.0	53.9	-0.1	± 1.1
49.0	49.0	0.0	± 1.1
44.0	43.9	-0.1	± 1.1
39.0	38.9	-0.1	± 1.1
34.0	33.9	-0.1	± 1.1
30.0	29.9	-0.1	± 1.1
29.0	28.9	-0.1	± 1.1
28.0	27.9	-0.1	± 1.1
27.0	26.8	-0.2	± 1.1
26.0	25.9	-0.1	± 1.1
25.0	24.8	-0.2	± 1.1

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Continuation of Calibration Certificate

Cert. No. : ACL22195  
Job No. : VC66AC0016  
Pages : 7 of 8

8. Level linearity including the level range control

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

9. Tone burst response

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

10. Peak C sound level

Number of cycle in test signal	Anticipated Value (dB)	Measured Value, L <sub>peak</sub> (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	138.1	135.2	-0.2	±2.0

QF-TS12-04-04-020664

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Cert. No. : ACL22228  
Pages : 1 of 1

Calibration Certificate

Equipment : SOUND LEVEL METER  
Manufacturer : RION  
Model : NL-42A/ Microphone UC-52 / Preamplifier NH-24  
Serial No. : 00623389 / 198636 / 26417  
ID No. : -

Condition As Found : GOOD

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

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

Received Date : 28 SEPTEMBER 2022  
Calibration Date : 12-17 OCTOBER 2022  
Date of Issue : 18 OCTOBER 2022

Calibrated by : Nathakorn Pisutpaisan

Approved by :

*T. Petchurani*  
( Thumakul Petchurani )

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QF-TS12-04-04-020664

Continuation of Calibration Certificate

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

11. Overload indication

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

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

Continuation of Calibration Certificate

Cert. No. : ACL22228  
Job No. : VC65AC0086  
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. : ACL22228  
Job No. : VC65AC0086  
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. Pich.

## Continuation of Calibration Certificate

Cert. No. : ACL22228  
Job No. : VC65AC0086  
Pages : 5 of 8

## 4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

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

## 5. Frequency and time weightings at 1 kHz

5.1 Frequency weightings at 1 kHz

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

5.2 Time weighting at 1 kHz

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

## 6. Long - term stability

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

QF-TS12-04-04-020664

T. Pich.

## Continuation of Calibration Certificate

Cert. No. : ACL22228  
Job No. : VC65AC0086  
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	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)	Deviation from various frequency weighting response curve (dB)			
	Flat	C-weight	A-weight	Acceptance Limits
125	0.2	0.2	0.2	±1.5
1000	0.0	0.0	0.0	±1.0
8000	1.0	1.1	1.1	±5.0

QF-TS12-04-04-020664

T. Pich.

## Continuation of Calibration Certificate

Cert. No. : ACL22228  
Job No. : VC65AC0086  
Pages : 6 of 8

## 7. Level linearity on the reference level range

Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
137.0	137.0	0.0	±1.1
136.0	136.0	0.0	±1.1
135.0	135.0	0.0	±1.1
134.0	134.0	0.0	±1.1
133.0	133.0	0.0	±1.1
132.0	132.0	0.0	±1.1
131.0	131.0	0.0	±1.1
129.0	129.0	0.0	±1.1
124.0	124.0	0.0	±1.1
119.0	119.0	0.0	±1.1
114.0	114.0	0.0	±1.1
109.0	109.0	0.0	±1.1
104.0	104.0	0.0	±1.1
99.0	99.0	0.0	±1.1
94.0	94.0	0.0	±1.1
89.0	89.1	0.1	±1.1
84.0	84.1	0.1	±1.1
79.0	79.0	0.0	±1.1
74.0	74.1	0.1	±1.1
69.0	69.1	0.1	±1.1
64.0	64.0	0.0	±1.1
59.0	59.1	0.1	±1.1
54.0	54.0	0.0	±1.1
49.0	49.0	0.0	±1.1
44.0	44.0	0.0	±1.1
39.0	39.0	0.0	±1.1
34.0	34.0	0.0	±1.1
30.0	30.1	0.1	±1.1
29.0	29.1	0.1	±1.1
28.0	28.0	0.0	±1.1
27.0	27.0	0.0	±1.1
26.0	26.1	0.1	±1.1
25.0	25.1	0.1	±1.1

QF-TS12-04-04-020664

T. Pich.



Continuation of Calibration Certificate

Cert. No. : ACL22228  
Job No. : VC65AC0086  
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 <sub>b</sub> (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 <sub>peak</sub> (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.0	0.0	-
One	136.4	135.8	-0.6	±3.0

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

QF-TS12-04-04-020664

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. : ACL22230  
Pages : 1 of 8

Calibration Certificate

Equipment : SOUND LEVEL METER  
Manufacturer : RION  
Model : NL-42A/ Microphone UC-52 / Preamplifier NH-24  
Serial No. : 00623391 / 198638 / 26419  
ID No. : -

Condition As Found : GOOD

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

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

Received Date : 28 SEPTEMBER 2022  
Calibration Date : 12-17 OCTOBER 2022  
Date of Issue : 18 OCTOBER 2022

Calibrated by : Nathakorn Pisutpaisan

Approved by :

( Thanakul Petchurai )

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

QF-TS12-04-04-020664

Continuation of Calibration Certificate

Cert. No. : ACL22228  
Job No. : VC65AC0086  
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
89.5	89.6		

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

SITHIPORN SITHIPORN ASSOCIATES CO.,LTD.  
CALIBRATION LABORATORY

Continuation of Calibration Certificate

Cert. No. : ACL22230  
Job No. : VC65AC0086  
Pages : 2 of 8

Calibration Procedure : CP(AC-0)

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



Cert. No. : ACL22230  
Job No. : VC65AC0086  
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. P. A.

Cert. No. : ACL22230  
Job No. : VC65AC0086  
Pages : 5 of 8

## 4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

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

## 5. Frequency and time weightings at 1 kHz

## 5.1 Frequency weightings at 1 kHz

Frequency Weighting	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. P. A.

Cert. No. : ACL22230  
Job No. : VC65AC0086  
Pages : 4 of 8

## Result of calibration :

## 1. Absolute sensitivity

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

## 2. Self-generated noise

## 2.1 Normal test

Measured Value (dB)
15.7

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

Frequency Weighting	Measured value (dB)
A - weight	12.8
C - weight	18.6
Flat	24.1

## 3. Acoustical signal tests of frequency weightings

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

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)			
	Flat	C-weight	A-weight	Acceptance Limits
125	0.0	0.1	0.1	± 1.5
1000	0.0	0.0	0.0	± 1.0
8000	0.9	0.9	1.0	±5.0

QF-TS12-04-04-020664

T. P. A.

Cert. No. : ACL22230  
Job No. : VC65AC0086  
Pages : 6 of 8

## 7. Level linearity on the reference level range

Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
137.0	137.1	0.1	± 1.1
136.0	136.1	0.1	± 1.1
135.0	135.1	0.1	± 1.1
134.0	134.1	0.1	± 1.1
133.0	133.0	0.0	± 1.1
132.0	132.0	0.0	± 1.1
131.0	131.0	0.0	± 1.1
129.0	129.0	0.0	± 1.1
124.0	124.0	0.0	± 1.1
119.0	119.1	0.1	± 1.1
114.0	114.1	0.1	± 1.1
109.0	109.0	0.0	± 1.1
104.0	104.1	0.1	± 1.1
99.0	99.1	0.1	± 1.1
94.0	94.0	0.0	± 1.1
89.0	89.0	0.0	± 1.1
84.0	84.0	0.0	± 1.1
79.0	79.0	0.0	± 1.1
74.0	74.0	0.0	± 1.1
69.0	69.0	0.0	± 1.1
64.0	64.0	0.0	± 1.1
59.0	59.0	0.0	± 1.1
54.0	54.0	0.0	± 1.1
49.0	49.0	0.0	± 1.1
44.0	44.0	0.0	± 1.1
39.0	39.0	0.0	± 1.1
34.0	34.0	0.0	± 1.1
30.0	30.1	0.1	± 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	25.2	0.2	± 1.1

QF-TS12-04-04-020664

T. P. A.

Cert. No. : ACL22230  
Job No. : VC65AC0086  
Pages : 7 of 8

## 8. Level linearity including the level range control

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

## 9. Tone burst response

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

## 10. Peak C sound level

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

Number of cycle in test signal	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.0	0.0	-
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

SITHIPORN ASSOCIATES CO.,LTD.  
CALIBRATION LABORATORY451-451/1 Sirinthorn Rd.,Bangbunmi, Bangkok 10700 THAILAND  
Tel:0-2435-8800 Fax:0-2433-1679 e-mail:cal-center@sithiporn.com http://www.sithiporn.comCert. No. : ACL22226  
Pages : 1 of 8

## Calibration Certificate

Equipment : SOUND LEVEL METER  
Manufacturer : KION  
Model : NL-42A/ Microphone UC-52 / Pre-amplifier NI-24  
Serial No. : 00623387 / 198634 / 26415  
ID No. : -

Condition As Found : GOOD

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

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

Received Date : 28 SEPTEMBER 2022  
Calibration Date : 12-17 OCTOBER 2022  
Date of Issue : 18 OCTOBER 2022

Calibrated by : Nathakorn Pisutpaisan

Approved by :

T. Petohun  
( Thanakul Potohun )

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

Cert. No. : ACL22230  
Job No. : VC65AC0086  
Pages : 8 of 8

## 11. Overload indication

Measured value (dB)		Deviated Value (dB)	Acceptance Limits (dB)
Positive one-half cycle	Negative one-half cycle		
89.6	89.7	0.1	±1.5

## 12. High level stability

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

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

End of Calibration Certificate

QF-TS12-04-04-020664

SITHIPORN SITHIPORN ASSOCIATES CO.,LTD.  
ASSOCIATES CALIBRATION LABORATORYCert. No. : ACL22226  
Job No. : VC65AC0086  
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	EP-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



## 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

## 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)
14.8

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

Frequency Weighting	Measured value (dB)
A - weight	11.6
C - weight	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	0.2	0.1	0.2	± 1.5
1000	0.0	0.0	0.0	± 1.0
8000	0.4	0.5	0.5	± 5.0

## 4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

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

## 7. Level linearity on the reference level range

Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
137.0	137.0	0.0	± 1.1
136.0	136.0	0.0	± 1.1
135.0	135.0	0.0	± 1.1
134.0	134.0	0.0	± 1.1
133.0	132.9	-0.1	± 1.1
132.0	131.9	-0.1	± 1.1
131.0	130.9	-0.1	± 1.1
129.0	129.0	0.0	± 1.1
124.0	124.0	0.0	± 1.1
119.0	119.0	0.0	± 1.1
114.0	114.0	0.0	± 1.1
109.0	109.0	0.0	± 1.1
104.0	104.0	0.0	± 1.1
99.0	99.0	0.0	± 1.1
94.0	94.0	0.0	± 1.1
89.0	89.0	0.0	± 1.1
84.0	84.0	0.0	± 1.1
79.0	79.0	0.0	± 1.1
74.0	74.0	0.0	± 1.1
69.0	69.0	0.0	± 1.1
64.0	64.0	0.0	± 1.1
59.0	59.0	0.0	± 1.1
54.0	54.0	0.0	± 1.1
49.0	49.0	0.0	± 1.1
44.0	44.0	0.0	± 1.1
39.0	39.0	0.0	± 1.1
34.0	34.0	0.0	± 1.1
30.0	30.0	0.0	± 1.1
29.0	29.0	0.0	± 1.1
28.0	28.1	0.1	± 1.1
27.0	27.1	0.1	± 1.1
26.0	26.1	0.1	± 1.1
25.0	25.1	0.1	± 1.1

Continuation of Calibration Certificate

Cert. No. : ACL22226  
Job No. : VC65AC0086  
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 <sub>b</sub> (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 <sub>peak</sub> (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.0	0.0	-
One	136.4	135.8	-0.6	±3.0

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

01-TS13-04-04-020661

T. Bhih

Continuation of Calibration Certificate

Cert. No. : ACL22226  
Job No. : VC65AC0086  
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

01-TS13-04-04-020661

T. Bhih



ROTA METER CALIBRATION RESULT APRIL 2023

Rotameter ID.	Calibration Date	Regression Result	Coefficient (R <sup>2</sup> )
BKK_FS0577	03 Apr 23	$Y = 1.0246x - 1.1844$	0.9982
BKK_FS0579	03 Apr 23	$Y = 1.0313x - 0.8177$	0.9999
BKK_FS0583	03 Apr 23	$Y = 1.0023x - 0.0969$	0.9995
BKK_FS0584	03 Apr 23	$Y = 1.0025x + 2.25$	0.9999
BKK_FS0585	03 Apr 23	$Y = 0.9881x + 5.4452$	0.9993
BKK_FS0586	03 Apr 23	$Y = 0.9915x + 4.7452$	1.0000
BKK_FS0588	03 Apr 23	$Y = 1.0067x + 0.6738$	0.9998
BKK_FS0589	03 Apr 23	$Y = 0.9823x + 0.3286$	0.9936
BKK_FS0590	03 Apr 23	$Y = 0.9961x + 2.8786$	0.9999
BKK_FS0591	03 Apr 23	$Y = 0.9985x + 4.579$	1.0000
BKK_FS0592	03 Apr 23	$Y = 0.9975x + 3.6419$	1.0000
BKK_FS0593	03 Apr 23	$Y = 0.9966x + 16.005$	1.0000
BKK_FS0595	03 Apr 23	$Y = 0.9957x + 5.1368$	0.9999
BKK_FS0596	03 Apr 23	$Y = 1.017x - 14.044$	0.9967
BKK_FS0597	03 Apr 23	$Y = 1.0063x - 10.787$	1.0000
BKK_FS1004	01 Apr 23	$Y = 0.9943x + 7.1533$	0.9996
BKK_FS1005	01 Apr 23	$Y = 1.0035x + 3.1167$	0.9998
BKK_FS1006	01 Apr 23	$Y = 1.0273x - 0.4922$	0.9998
BKK_FS1007	03 Apr 23	$Y = 1.0452x - 1.5374$	0.9998
BKK_FS1009	03 Apr 23	$Y = 1.0351x - 1.3224$	0.9999
BKK_FS1010	03 Apr 23	$Y = 1.0108x - 0.0888$	1.0000
BKK_FS1011	03 Apr 23	$Y = 1.2946x - 6.6325$	0.9861
BKK_FS1012	03 Apr 23	$Y = 1.0976x - 27.969$	0.9996
BKK_FS1013	03 Apr 23	$Y = 1.0821x - 200.52$	0.9998
BKK_FS1017	03 Apr 23	$Y = 1.0333x + 7.0584$	0.9694
BKK_FS1018	03 Apr 23	$Y = 0.9551x - 18.832$	0.9997
BKK_FS1019	03 Apr 23	$Y = 1.0649x - 156.67$	0.9976
BKK_FS1020	03 Apr 23	$Y = 0.9911x + 0.0364$	0.9994
BKK_FS1021	03 Apr 23	$Y = 0.979x + 8.2333$	0.9992
BKK_FS1022	03 Apr 23	$Y = 0.9988x - 2.4905$	0.9997
BKK_FS1023	03 Apr 23	$Y = 1.0245x - 1.3878$	0.9996
BKK_FS1024	03 Apr 23	$Y = 0.7414x + 47.3$	0.9923
BKK_FS1025	03 Apr 23	$Y = 0.9997x + 5.4438$	1.0000
BKK_FS1026	03 Apr 23	$Y = 1.0172x - 0.9531$	1.0000
BKK_FS1027	03 Apr 23	$Y = 0.7331x + 49.317$	0.9921
BKK_FS1028	03 Apr 23	$Y = 0.9995x + 0.2124$	1.0000
BKK_FS1039	01 Apr 23	$Y = 1.025x - 3.795$	0.9994
BKK_FS1040	01 Apr 23	$Y = 1.0035x - 2.4295$	0.9998



ROTA METER CALIBRATION RESULT APRIL 2023

Rotameter ID.	Calibration Date	Regression Result	Coefficient (R <sup>2</sup> )
BKK_FS1041	01 Apr 23	$Y = 1.0329x - 0.6769$	0.9999
BKK_FS1042	01 Apr 23	$Y = 1.0144x + 1.94$	0.9997
BKK_FS1043	01 Apr 23	$Y = 1.0038x - 1.539$	0.9999
BKK_FS1044	01 Apr 23	$Y = 1.0273x - 1.6922$	0.9998
BKK_FS1164	03 Apr 23	$Y = 0.9913x + 0.8537$	0.9997
BKK_FS1165	03 Apr 23	$Y = 1.0005x + 2.0857$	1.0000
BKK_FS1166	03 Apr 23	$Y = 1.0842x - 169.6$	0.9987
BKK_FS1200	03 Apr 23	$Y = 0.9452x + 5.2959$	0.9981
BKK_FS1201	03 Apr 23	$Y = 1.0045x - 1.8786$	1.0000
BKK_FS1202	03 Apr 23	$Y = 0.9768x + 26.572$	0.9973
RYG_FS0197	01 Apr 23	$Y = 1.0042x + 15.442$	0.9999
RYG_FS0198	01 Apr 23	$Y = 1.0081x - 13.26$	0.9999
RYG_FS0199	01 Apr 23	$Y = 1.0255x - 1.2364$	0.9999

Review By :   
(Mr. Wichan Choonharat)  
Enviro Field Services Manager

Approved By :   
(Mr. Sarayuth Jitranont)  
Assistant General Manager





## Certificate of Calibration

ICS-2100: Anion (ID#659)

This certificate is to verify that instrument below are calibrated  
by Archimica Lab Co., Ltd.

ICS-2100 S/N: 15010977

A5-HV S/N: 5450A36659

For

ALS Laboratory Group (Thailand) Co., Ltd.

Operator Signature: Mr. Nudonai Laekhwan Date: Jan 12, 2023

(Mr. Nudonai Laekhwan)

Application Chemist

Service Confirmation Number: 9904900024  
Service Confirmation Date: 20.03.2023

## Service Instrument:

Model Number	Model Description	Serial Number	System Handle	Parent Asset
SYS-ID-5100	ICP-OES 5100/5110 System			
G8010A	Agilent 5100 SVDV ICP-OES Spectrometer	MY16010085	ICP OES 5100	SYS-ID-5100
G8410A	SPS 4 Autosampler	AU15440754	ICP OES 5100	SYS-ID-5100

## Service Items:

Item	Service/Part #	Description	Qty	Entitlement	Service Start	Service End
1000	EOI	Enterprise Operational Qualification	1.00	Agreement Entitlement - 100 % covered	20.03.2023	20.03.2023

## Additional Information:

## Agilent Technologies

Agilent Technologies (Thailand) Limited  
U CHAI LIAO BLDG. 22/F UNIT A.5  
999 RAMA 4 ROAD, SILOM, BANGNAK  
Bangkok 10500 Thailand  
Tel: +662 637 6363  
Fax: +662 637 6334  
Email: ccc-smt@agilent.com  
Website: www.agilent.com/thai

## Customer Contact:

ALS Laboratory Group (Thailand) Co. Ltd.  
Head Office:  
104 Phatthanakan 40 Phatthanakan Rd.  
Khwaeng Phatthanakan Khet Suan  
TAX ID: 0105640004859  
Chanattagarn.lnchom@alsglobal.com  
27603058

## Invoice To:

ALS Laboratory Group (Thailand) Co. Ltd.  
Head Office:  
104 Phatthanakan 40 Phatthanakan Rd.  
Khwaeng Phatthanakan Khet Suan

## Delivery Site:

ALS Laboratory Group (Thailand) Co. Ltd.  
Head Office:  
104 Phatthanakan 40 Phatthanakan Rd.  
Khwaeng Phatthanakan Khet Suan

Location:  
Room  
Bldg  
Lab  
Dept

## SERVICE REPORT

Customer Purchase Order Number:	Customer Number:
70371013	70371013
Service Request:	Service Request Date:
Service Order:	Service Confirmation:
6066033911	9904900024

REVIEW BY: Thitima B.  
APPROVED BY: Samet M.  
NEXT CAL. DATE: 19 Sep 2024

## Direct Inquiries to:

Contact Name: Customer Contact Center  
Contact E-mail: ccc-smt@agilent.com  
Contact Telephone: +662 637 6363  
Contact Fax: +662 632 4334

## Agilent Technologies (Thailand) Limited, Head Office

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Fax: No. 917-4952-587  
THB Kung Thai Bank PCL  
Ratch Square Bldg. 416/1-2 Rama 1 Rd., Pathumwan, BKK 10330 Thailand

ORIGINAL

## Service Information:

**Problem Description:**  
WU-S-00-ID-5100-6001143313

**Service Provided:**  
Complete DOHW 5100ICPOES  
Equipment ID: BKK\_EL0037, all tests passed

**Service Overview Code:**  
Reason Code: Scheduled Service  
Diagnosis Code: Scheduled Service  
Resolution Code: Scheduled Service

<b>Reported Hours:</b> 4.0	<b>Travel Hours:</b> 2.0
<b>Customer Field Service Representative Name:</b> Kanyakorn Sukpathajareern	<b>Customer Field Service Representative Signature:</b> <u>[Signature]</u>
<b>Customer Name:</b> Thitima Buanyong	<b>Customer Signature:</b> <u>Thitima B.</u>

**Additional Comments:**

RYG\_EN0038

TEST REPORT

CUSTOMER NAME : ALS Laboratory Group (Thailand) Co., Ltd. (บริษัท แอลเอส แลบบอราทอรี กรุ๊ป (ประเทศไทย) จำกัด)

EQUIPMENT NAME : THC Analyzer

MANUFACTURER : HORIBA MODEL : APHA-370 SERIAL NO : UA3NG4TH

STANDARD GAS CONCENTRATION (PPM) : 506.1 PPM CYLINDER NO : CC734373

CYLINDER PRESSURE (psig) : 1,600 PSI CERTIFIED DATE : 12/05/2020

CERTIFIED BY : AIRGAS EXPIRED DATE : 12/05/2028

TEST RESULTS

POINT NO	IDEAL	ACTUAL CH4	ERROR CH4	%ERROR CH4	ACTUAL THC	ERROR THC	%ERROR THC
ZERO	0.000	0.210	0.210	-	0.200	0.200	-
1	10.000	10.050	0.050	0.50	10.050	0.050	0.50
2	20.000	20.120	0.120	0.60	20.150	0.150	0.75
3	30.000	30.110	0.110	0.37	30.050	0.050	0.17
4	40.000	40.030	0.030	0.08	40.030	0.030	0.08
AVERAGE (%)				0.39			0.37

REVIEW BY: *Theritoll*

APPROVED BY: *D. [Signature]*

NEXT CAL DATE: 01/01/2024

CALIBRATED BY: *TA [Signature]* DATE: 25/1/16

CHECKED BY: *TA [Signature]* DATE: 25/1/16

UKANATE ASSOCIATES CO., LTD.

ต้องการข้อมูลภาษาอังกฤษเพิ่มเติม: เจ้าหน้าที่ฝ่ายบริการลูกค้า, โทร 02-868-0812 # 15-16, E-Mail: Engineer@jranatee.com

เลขที่ 63/14-15.67/35-36 ซอยถนนพหลโยธิน 7,7/1 แขวงวัดท่าพระ เขตบางกอกใหญ่ กรุงเทพมหานคร 10600 โทร 02-8680812-13 โทรสาร 02-868-1889

RYG\_EN0038

CHECK LIST

CUSTOMER NAME : ALS Laboratory Group (Thailand) Co., Ltd. (บริษัท แอลเอส แลบบอราทอรี กรุ๊ป (ประเทศไทย) จำกัด)

EQUIPMENT NAME : THC Analyzer

MANUFACTURER : HORIBA MODEL : APHA-370 SERIAL NO : UA30GTHB

TEST VALUES

NO.	THC Analyzer ( APHA - 370 )	UNIT	BEFORE	AFTER
1	Signal ( CH4 )	mV	4.300	42.400
2	Signal ( THC )	mV	3.200	64.400
3	Detector	Temp °C , Standard Value : Ambient temp±(5°Cto15°C)	46.700	50.000
4	Ambient	Pressure kPa , Standard Value : (Ambient/1013x100-20)±4kPa	70.000	70.100
5	Purifier	kPa current atmospheric pressure	101.000	101.100
6	NMHC	°C , Standard Value : 390 °C to 430 °C	420.400	421.200
7	DC 24 V	kPa , Normal value : 8 kPa to 25 kPa	9.800	9.800
8	DC 5 V	V , Standard Value : 24 V ± 0.5 V	23.900	23.900
9	Bypass (Optional)	V , Standard Value : 5 V ± 0.5 V	5.000	5.000
10	Over Flow (Optional)	L/min, Normal value : 0.9 L/min ± 0.3 L/min	-	-
11	CH4 Sampling Reading	L/min, Standard Value : 0.8 L/min or More	-	-
12	NMHC Sampling Reading	PPM	3.530	2.330
13	THC Sampling Reading	PPM	4.280	1.150
14	Zero Gas CH4/THC	PPM	8.810	3.480
15	Span Gas	PPM	0.21/0.20	0.00/0.00
G	Gas H2	PPM	54.87/55.78	40.03/40.03
	Gas H2	20 PSI	20	20

Remark: Reference EX-EN-017-56 , Ambient HC Monitor APHA-370 Operation Manual Page #81

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

จากการตรวจพบ

- Service Maintenance

รายละเอียดการดำเนินการ

- ทำ Calibration Zero/Span, Multipoint

ผลการดำเนินการ

- เครื่องมือ เครื่องมือสามารถดำเนินการตรวจวัดได้ตามปกติ

CALIBRATED BY: *TA [Signature]* DATE: 25/1/16

CHECKED BY: *TA [Signature]* DATE: 25/1/16

UKANATE ASSOCIATES CO., LTD.

ต้องการข้อมูลภาษาอังกฤษเพิ่มเติม: เจ้าหน้าที่ฝ่ายบริการลูกค้า, โทร 02-868-0812 # 15-16, E-Mail: Engineer@jranatee.com

เลขที่ 63/14-15.67/35-36 ซอยถนนพหลโยธิน 7,7/1 แขวงวัดท่าพระ เขตบางกอกใหญ่ กรุงเทพมหานคร 10600 โทร 02-8680812-13 โทรสาร 02-868-1889

FO-EN-206 R01/22-10-14

FO-EN-207 R00/01-08-13

RYG\_EN0004

Sartorius (Thailand) Co., Ltd.

129 Rama 9 Road, Huaykwang, Huaykwang, Bangkok 10310

Tel: +66 2543 8361-6, e-mail: service.thailand@sartorius.com

Certificate of Calibration

Model Number: MSE125P-100-DU

Description: Semi-micro Balance

Serial Number: 0033108993

ID No.: RYG\_EN0004

Manufacturer: Sartorius

Certificate No.: 23BCI0114

Issued Date: Friday, March 03, 2023

Reference No.: 204833

Page No.: 1 of 3

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

618/10 Moo 5 T. Maenam Khu, A. Pluak Daeng, Rayong 21140, Thailand.

Calibrated Place: ALS Laboratory Group (Thailand) Co., Ltd. (Balance Room)

618/10 Moo 5 T. Maenam Khu, A. Pluak Daeng, Rayong 21140, Thailand.

Calibrated By: Mr Chonchai Inthana

Calibration Date: Wednesday, March 01, 2023

Calibration Procedure No.: This calibration was conducted by Using in-house calibration procedure number (WI-003)

Based on UKAS LAB 14 : 2019

Ambients Conditions:

Temperature: 24.0 °C ± 5.0 °C

Humidity: 63.0 % RH ± 10.0 % RH

Pressure: ±

Reasons for calibration

☐ New Installation ☐ Service / Repair ☒ Recalibration 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 realise the unit of measurement according to the International Standard System of Units (SI). Report of Tolerance came from list of Sartorius Metrological Specifications.

Traceability:

Model Number	Description	Traceability	Certificate No.	Due Date
VCS011-572-00	Balance weight set 1mg - 5000g E2 VCS011-572-00	SPC-RT	C02212565	14-Sep-2023
MHB-382SD	Humidity/Barometer/Temp Lubon MHB-382SD	DKSH	C19220444	5-Sep-2023

This certificate relates and apply this equipment only.

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Mr. Chonchai Inthana (Technical Manager)

SARTORIUS

SOP FM 33 03 February 2022

Sartorius (Thailand) Co., Ltd.

129 Rama 9 Road, Huaykwang, Huaykwang, Bangkok 10310

Tel: +66 2543 8361-6, e-mail: service.thailand@sartorius.com

Certificate of Calibration

Model Number: MSE125P-100-DU

Description: Semi-micro Balance

Serial Number: 0033108993

ID No.: RYG\_EN0004

Manufacturer: Sartorius

Certificate No.: 23BCI0114

Issued Date: Friday, March 03, 2023

Reference No.: 204833

Page No.: 2 of 3

Calibration Results : Without Adjustment

Repeatability

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 series is placed repeatedly on the weighing pan in the same manner. The standard deviation is used to express repeatability quantitatively.

Nominal Value (Low Load)	5.00002	30.00002
5 g	5.00002	30.00002
Tolerance	0.000015 g	0.000015 g
Nominal Value (High Load)	50.00002	50.00002
50 g	50.00002	50.00002
Tolerance	0.000015 g	0.000015 g
Standard Deviation	0.000007	0.000009

Eccentricity (Off-center loading error)

The off-center loading error is yielded by the difference between the readout of the load, i.e. 1/3 or 1/4 of maximum capacity, placed in the middle of the weighing pan and between each of four additional measurement points (position defined according to OIML R111).

Nominal value	50 g
Tolerance	0.00015 g
Difference	1 -0.00001 2 -0.00001 3 0.00000 4 0.00002 5 0.00002 6 -

Linearity

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

Tolerance	0.00004 g			
Nominal Value (g)	Conventional Mass Value (g)	Displayed Value (g)	Deviation (g)	Uncertainty (g)
0.01	0.01000	0.01000	0.00000	0.000026
0.1	0.10000	0.10000	0.00000	0.000026
1	1.00000	1.00000	0.00000	0.000026
2	2.00000	2.00000	0.00000	0.000030
5	5.00000	5.00000	-0.00001	0.000033
10	10.00000	10.00000	0.00000	0.000038
20	20.00000	20.00000	0.00000	0.000048
30	30.00000	30.00000	0.00000	0.000049
40	40.00000	40.00000	-0.00001	0.000062
50	50.00000	50.00000	-0.00001	0.000061

SOP FM 33 03 February 2022



# Certificate of Calibration

Model Number : MSE125P-100-DU  
Description : Semi-micro Balance  
Serial Number : 0033108993  
ID No. : RYG\_EN0004  
Manufacturer : Sartorius  
Certificate No. : 23BCI0114  
Issued Date : Friday, March 03, 2023  
Reference No. : 204833  
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 results 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 caused by the difference between the readout of the load, i.e. 1/3 or 1/4 of maximum capacity, placed in the middle of the weighing pan and between each of four additional measurement points (positions defined according to OIML R76).	
Nominal Value : (Low Load)	100.0000	Nominal value :	50 g
Tolerance	100.0000	Tolerance	0.00015 g
0.000015 g	100.0000		
Nominal Value : (High Load)	100.0000		
100 g	100.0000		
Tolerance	100.0000		
0.000015 g	100.0000		
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	0.0001 g			
Nominal Value	Conventional Mass Value	Displayed Value	Deviation	Uncertainty
(g)	(g)	(g)	(g)	(g)
65	65.0000	65.0000	0.0000	0.00015
70	70.0000	70.0000	0.0000	0.00015
75	75.0000	75.0000	0.0000	0.00015
80	80.0000	80.0000	0.0000	0.00015
85	85.0000	85.0000	0.0000	0.00015
90	90.0000	90.0000	0.0000	0.00015
95	95.0000	95.0000	0.0000	0.00015
100	100.0000	100.0000	0.0000	0.00015
110	110.0000	110.0000	0.0000	0.00015
120	120.0000	120.0000	0.0000	0.00015
End of Report				

GDP FM 33 03 February 2022

## Certificate of System Qualification

GC-02

System ID : CN11461066  
Organization Name : ALS Laboratory Group (Thailand) Co., Ltd.  
Organization Location : 104 Soi 40 Phatthanakan Rd, Khwang Suan Luang, Khet Suan Luang, Bangkok 10250

Date : April 21, 2023 3:26:38 PM  
EQP Name : Agilent/Recommended  
EQP Revision : GC.02.52  
Overall Qualification Status : Pass

### CDS Logon Verification - GC

Logon : Saenguthai Tanak

### Overall CDS Logon Verification - GC Test Status

Pass

### System Inspection and Basic Safety and Operation

Name : 7890

Setpoint Status : Pass

### Overall System Inspection and Basic Safety and Operation Test Status

Pass

### Inlet Pressure Decay

Name : 7890

Front : SSL

Setpoint Status : Pass

Pressure : 25.0 psi

Pressure Change : -0.1 psi / 5 minutes

Agilent Recommended : >= -2.0 and <= 0.5

Date : April 21, 2023 3:26:38 PM

System ID : CN11461066

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### Overall Inlet Pressure Decay Test Status

Pass

### Inlet Pressure Accuracy

Name : 7890

Front : SSL

### Setpoint Status : Pass

Setpoint : 25.0 psi

Actual : 25.2 psi

Accuracy : 0.2 psi

Agilent Recommended : <= 1.2

### Overall Inlet Pressure Accuracy Test Status

Pass

### Inlet Pressure Decay

Name : 7890

Back : SSL

### Setpoint Status : Pass

Pressure : 25.0 psi

Pressure Change : 0.0 psi / 5 minutes

Agilent Recommended : >= -2.0 and <= 0.5

### Overall Inlet Pressure Decay Test Status

Pass

### Inlet Pressure Accuracy

Name : 7890

Back : SSL

Date : April 21, 2023 3:26:38 PM

System ID : CN11461066

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### Setpoint Status : Pass

Setpoint : 25.0 psi

Actual : 24.8 psi

Accuracy : 0.2 psi

Agilent Recommended : <= 1.2

### Overall Inlet Pressure Accuracy Test Status

Pass

### Detector Flow Accuracy

Name : 7890

Front : FID

### Setpoint Status : Pass

Flow Type : Fuel

Setpoint : 30.0 mL/min

Measured Flow : 28.9 mL/min

Accuracy : 1.1 mL/min

Agilent Recommended : <= 10.0 % setpoint

Limit is percentage of setpoint or 0.5 mL/minute, whichever is largest.

### Setpoint Status : Pass

Flow Type : Oxidizer

Setpoint : 400.0 mL/min

Measured Flow : 400 mL/min

Accuracy : 0.0 mL/min

Agilent Recommended : <= 10.0 % setpoint

Limit is percentage of setpoint or 0.5 mL/minute, whichever is largest.

### Setpoint Status : Pass

Flow Type : Makeup

Setpoint : 25.0 mL/min

Measured Flow : 24.9 mL/min

Accuracy : 0.1 mL/min

Agilent Recommended : <= 10.0 % setpoint

Limit is percentage of setpoint or 0.5 mL/minute, whichever is largest.

Date : April 21, 2023 3:26:38 PM

System ID : CN11461066

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## Overall Detector Flow Accuracy Test Status

Pass

## Detector Flow Accuracy

Name:

7890

Back

FID

## Setpoint Status:

Pass

Flow Type:

Fuel

Setpoint:

30.0

mL/min

Measured Flow:

30.7

mL/min

Accuracy:

0.7

mL/min

Agilent Recommended:

&lt;=

10.0

% setpoint

( 3.0

mL/min )

Limit is percentage of setpoint or 0.5 mL/minute, whichever is largest.

## Setpoint Status:

Pass

Flow Type:

Oxidizer

Setpoint:

400.0

mL/min

Measured Flow:

399

mL/min

Accuracy:

1.0

mL/min

Agilent Recommended:

&lt;=

10.0

% setpoint

( 40.0

mL/min )

Limit is percentage of setpoint or 0.5 mL/minute, whichever is largest.

## Setpoint Status:

Pass

Flow Type:

Makeup

Setpoint:

25.0

mL/min

Measured Flow:

24.6

mL/min

Accuracy:

0.4

mL/min

Agilent Recommended:

&lt;=

10.0

% setpoint

( 2.5

mL/min )

Limit is percentage of setpoint or 0.5 mL/minute, whichever is largest.

## Overall Detector Flow Accuracy Test Status

Pass

## GC Oven Temperature Accuracy

Name:

7890

Date: April 21, 2023 3:26:38 PM  
System ID: CN11461066

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## Setpoint Status:

Pass

Zone:

Oven

Temperature:

230.0

°C

Accuracy:

0.8

°C

Agilent Recommended:

&gt;=

-1.0

% setpoint in K

( -5.0

°C )

&lt;=

1.0

% setpoint in K

( 5.0

°C )

## Setpoint Status:

Pass

Zone:

Oven

Temperature:

100.0

°C

Accuracy:

0.9

°C

Agilent Recommended:

&gt;=

-1.0

% setpoint in K

( -3.7

°C )

&lt;=

1.0

% setpoint in K

( 3.7

°C )

## Overall GC Oven Temperature Accuracy Test Status

Pass

## GC Oven Temperature Stability

Name:

7890

## Setpoint Status:

Pass

Temperature:

100.0

°C

Stability:

0.1

°C

Agilent Recommended:

&lt;=

0.5

## Overall GC Oven Temperature Stability Test Status

Pass

## Scouting Run

Tested Combination1

Front

SSL

/ Front

FID

Injection Tower

Name:

7893A

Date: April 21, 2023 3:26:38 PM  
System ID: CN11461066

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## Setpoint Status:

Completed

Injection Volume on Column:

1.0

µL

## Overall Scouting Run Status

Completed

## Noise and Drift

Tested Combination1

Front

SSL

/ Front

FID

Name:

7890

## Setpoint Status:

Pass

Base Signal:

22.7

pA

ASTM Noise

pA

Drift

pA/hr

0.06

0.05

Agilent Recommended:

&lt;=

0.10

&lt;=

2.50

Status:

Pass

Pass

## Overall Noise and Drift Test Status

Pass

## Injection Precision

Tested Combination1

Front

SSL

/ Front

FID

Name:

7893A

## Setpoint Status:

Pass

Injection Volume on Column:

1.0

µL

Area RSD:

0.32

%

Retention Time RSD:

0.67

%

Agilent Recommended:

&lt;=

3.00

&lt;=

1.00

## Overall Injection Precision Test Status

Pass

## Signal to Noise

Date: April 21, 2023 3:26:38 PM  
System ID: CN11461066

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Tested Combination1

Front

SSL

/ Front

FID

Injection Tower

Name:

7890

## Setpoint Status:

Pass

Signal to Noise:

721755

Agilent Recommended:

&gt;=

300000

## Overall Signal to Noise Test Status

Pass

## Scouting Run

Tested Combination2

Back

SSL

/ Back

FID

Injection Tower

Name:

7893A

## Setpoint Status:

Completed

Injection Volume on Column:

1.0

µL

## Overall Scouting Run Status

Completed

## Noise and Drift

Tested Combination2

Back

SSL

/ Back

FID

Name:

7890

## Setpoint Status:

Pass

Base Signal:

22.6

pA

ASTM Noise

pA

Drift

pA/hr

0.07

0.09

Agilent Recommended:

&lt;=

0.10

&lt;=

2.50

Status:

Pass

Pass

Date: April 21, 2023 3:26:38 PM  
System ID: CN11461066

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## Overall Noise and Drift Test Status

Pass

## Injection Precision

Tested Combination2

Back SSL / Back FID

Name: 7693A

## Setpoint Status:

Pass

Injection Volume on Column:

1.0 µL

Area RSD:

1.28 %

Retention Time RSD:

0.83 %

Agilent Recommended:

&lt;= 3.00

&lt;= 1.00

## Overall Injection Precision Test Status

Pass

## Signal to Noise

Tested Combination2

Back SSL / Back FID

Name: Injection Tower 7890

## Setpoint Status:

Pass

Signal to Noise:

2404396

Agilent Recommended:

&gt;= 300000

## Overall Signal to Noise Test Status

Pass

Date: April 21, 2023 3:28:38 PM  
System ID: CN11451066

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## Instrument Details

## Purpose

This section describes the as found system configuration.

## Details

## System

System ID	CN11451066
Manufacturer	Agilent Technologies
Name	7690
Flow Data Input	Manual Data
Temperature Data Input	Manual Data or Other Data Logging

## Tested Combination 1

Injection Technique	Injection Tower
Sampler Identifier	Sampler 2
Inlet	Front
Detector	Front
LTM Included?	No

## Tested Combination 2

Injection Technique	Injection Tower
Sampler Identifier	Sampler 3
Inlet	Back
Detector	Back
LTM Included?	No

## Sampler 1

Manufacturer	Agilent Technologies
Type	Tray
Name	7693A
Model Number	G4514A
Serial Number	CN15380030
Firmware Revision	A.11.01
Vali Heater	Not Installed

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System ID: CN11451066

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## Sampler 2

Manufacturer	Agilent Technologies
Type	Injection Tower
Name	7693A
Model Number	G4513A
Serial Number	CN16250128
Firmware Revision	A.10.09
Usage	Sample Injection
Location	Front
Syringe Volume (µL)	10

## Sampler 3

Manufacturer	Agilent Technologies
Type	Injection Tower
Name	7693A
Model Number	G4513A
Serial Number	CN10340103
Firmware Revision	A.10.09
Usage	Sample Injection
Location	Back
Syringe Volume (µL)	10

## Mainframe 1

Manufacturer	Agilent Technologies
Name	7890
Model Number	G3440A
Serial Number	CN11451066
Firmware Revision	Version 4.2T
Oven Type	Standard

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System ID: CN11451066

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## Inlet 1

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

## Inlet 2

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

## Detector 1

Manufacturer	Agilent Technologies
Name	7890
Type	FID
Adapter	Capillary
Control Type	Electronic Pressure Control (EPC)
Location	Front
Makeup Gas	Nitrogen

## Detector 2

Manufacturer	Agilent Technologies
Name	7890
Type	FID
Adapter	Capillary
Control Type	Electronic Pressure Control (EPC)
Location	Back
Makeup Gas	Nitrogen

Date: April 21, 2023 3:28:38 PM  
System ID: CN11451066

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## Electronic Signature

## Purpose

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## Details

Full Name of Signer: Saenguthai Tarak  
Logged On User Name: saenguthai.tarak@non.agilent.com  
Signature Creation Date: April 21, 2023  
Reason for Signature: Executed protocol and published this original version of document.

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System ID: CN11461068

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User Name: saenguthai.tarak  
Host Name: LAPTOP-CG38KQWY

System ID: CN11461068  
Print Date: April 21, 2023 3:26:48 PM

## GC-A\_BKK\_ENR127\_ALS Transaction log:

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
April 21, 2023 11:21:36 AM	Auth	Session Created	Session	None
April 21, 2023 11:21:36 AM	Start	Configuration	Session	None
April 21, 2023 11:21:36 AM	Auth	Encounter	Unlocking	User is Nonpaying and does not require an unlock code
April 21, 2023 11:22:04 AM	Auth	Execute/End	Session	EDP details for primary technique [5d] - File path: [ProtocolPath\GC\Conquest\run\GC_SPC_G2_52.mq], EDP File Name: [GC_G2_52.mq], EDP Name: [AgilentRecommended], Product Revision: [GC_G2_52]
April 21, 2023 11:22:06 AM	End	Configuration	Session	None
April 21, 2023 11:22:34 AM	Start	Qualification	Session	QC
April 21, 2023 11:22:14 AM	Start	Execution	CD8 Login Verification - QC	None
April 21, 2023 11:23:14 AM	End	Execution	CD8 Login Verification - QC	Run Count: 1
April 21, 2023 11:23:16 AM	Start	Execution	System Inspection and Basic Safety and Operation - T890 - Qualitative Test - No supports associated	None
April 21, 2023 11:23:36 AM	End	Execution	System Inspection and Basic Safety and Operation - T890 - Qualitative Test - No supports associated	Run Count: 1
April 21, 2023 11:23:37 AM	Start	Execution	Initial Pressure Drift - Inlet	None

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Date: April 21, 2023 3:26:38 PM  
System ID: CN11461068

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User Name: saenguthai.tarak  
Host Name: LAPTOP-CG38KQWY

System ID: CN11461068  
Print Date: April 21, 2023 3:26:48 PM

## GC-E\_BKK\_ENR127\_ALS Transaction log:

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
April 21, 2023 11:24:01 AM	End	Execution	Inlet Pressure Drift - Front	Run Count: 1
April 21, 2023 11:24:04 AM	Start	Execution	SSC - Pressure Controlled Inlet	None
April 21, 2023 11:24:09 AM	End	Execution	Inlet Pressure Accuracy - Front	Run Count: 1
April 21, 2023 11:24:11 AM	Start	Execution	SSC - Pressure Controlled Inlet	None
April 21, 2023 11:24:43 AM	End	Execution	Inlet Pressure Drift - Back	Run Count: 1
April 21, 2023 11:24:45 AM	Start	Execution	SSC - Pressure Controlled Inlet	None
April 21, 2023 11:24:51 AM	End	Execution	Inlet Pressure Accuracy - Back	Run Count: 1
April 21, 2023 11:24:53 AM	Start	Execution	Detect Flow Accuracy - Front	None
April 21, 2023 11:25:20 AM	Auth	Data	Detect Flow Accuracy - Front	Manual Data Entry
April 21, 2023 11:25:25 AM	End	Execution	Detect Flow Accuracy - Front	Run Count: 1

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Date: April 21, 2023 3:26:38 PM  
System ID: CN11461068

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User Name: saenguthai.tarak  
Host Name: LAPTOP-CG38KQWY

System ID: CN11461068  
Print Date: April 21, 2023 3:26:48 PM

## GC-E\_BKK\_ENR127\_ALS Transaction log:

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
April 21, 2023 11:25:28 AM	Start	Execution	Detect Flow Accuracy - Front	None
April 21, 2023 11:25:49 AM	Auth	Data	Detect Flow Accuracy - Front	Manual Data Entry
April 21, 2023 11:25:42 AM	End	Execution	Detect Flow Accuracy - Front	Run Count: 1
April 21, 2023 11:25:44 AM	Start	Execution	Detect Flow Accuracy - Front	None
April 21, 2023 11:26:01 AM	Auth	Data	Detect Flow Accuracy - Front	Manual Data Entry
April 21, 2023 11:26:04 AM	End	Execution	Detect Flow Accuracy - Front	Run Count: 1
April 21, 2023 11:26:05 AM	Start	Execution	Detect Flow Accuracy - Back	None
April 21, 2023 11:26:19 AM	Auth	Data	Detect Flow Accuracy - Back	Manual Data Entry
April 21, 2023 11:26:22 AM	End	Execution	Detect Flow Accuracy - Back	Run Count: 1
April 21, 2023 11:26:24 AM	Start	Execution	Detect Flow Accuracy - Back	None
April 21, 2023 11:26:38 AM	Auth	Data	Detect Flow Accuracy - Back	Manual Data Entry

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Date: April 21, 2023 3:26:38 PM  
System ID: CN11461068

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User Name: saangul@lab.lan  
Host Name: LAPTOP-CQ35K0M9VSystem ID: CN1461066  
Print Date: April 21, 2023 3:26:46 PM

## GC-6\_BHX\_ENH127\_ALS Transaction log:

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
April 21, 2023 11:26:43 AM	End	Execution	Detector Flow Accuracy - Back PID - Type: On/Off - S: 400.0 mL/min - L: <= 10.0% sequent	Run Count: 1
April 21, 2023 11:26:45 AM	Start	Execution	Detector Flow Accuracy - Back PID - Type: Makeup - S: 25.0 mL/min - L: <= 10.0% sequent	None
April 21, 2023 11:27:31 AM	Auto	Data	Detector Flow Accuracy - Back PID - Type: Makeup - S: 25.0 mL/min - L: <= 10.0% sequent	Manual Data Entry
April 21, 2023 11:27:05 AM	End	Execution	Detector Flow Accuracy - Back PID - Type: Makeup - S: 25.0 mL/min - L: <= 10.0% sequent	Run Count: 1
April 21, 2023 11:27:07 AM	Start	Execution	GC Oven Temperature Accuracy - 7890 - Temperature: Oven - S: 200.0°C - L: <= -1.0 AND <= 1.0 % sequent in K	None
April 21, 2023 11:27:33 AM	Auto	Data	GC Oven Temperature Accuracy - 7890 - Temperature: Oven - S: 200.0°C - L: <= -1.0 AND <= 1.0 % sequent in K	Manual Data Entry
April 21, 2023 11:27:35 AM	End	Execution	GC Oven Temperature Accuracy - 7890 - Temperature: Oven - S: 200.0°C - L: <= -1.0 AND <= 1.0 % sequent in K	Run Count: 1
April 21, 2023 11:27:37 AM	Start	Execution	GC Oven Temperature Accuracy - 7890 - Temperature: Oven - S: 100.0°C - L: <= -1.0 AND <= 1.0 % sequent in K	None
April 21, 2023 11:27:54 AM	Auto	Data	GC Oven Temperature Accuracy - 7890 - Temperature: Oven - S: 100.0°C - L: <= -1.0 AND <= 1.0 % sequent in K	Manual Data Entry

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Date: April 21, 2023 3:26:38 PM  
System ID: CN1461066

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User Name: saangul@lab.lan  
Host Name: LAPTOP-CQ35K0M9VSystem ID: CN1461066  
Print Date: April 21, 2023 3:26:46 PM

## GC-6\_BHX\_ENH127\_ALS Transaction log:

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
April 21, 2023 11:27:57 AM	End	Execution	GC Oven Temperature Accuracy - 7890 - Temperature: Oven - S: 100.0°C - L: <= -1.0 AND <= 1.0 % sequent in K	Run Count: 1
April 21, 2023 11:27:59 AM	Start	Execution	GC Oven Temperature Stability - 7890 - Temperature: Oven - S: 100.0°C - L: <= 0.5°C	None
April 21, 2023 11:28:07 AM	Auto	Data	GC Oven Temperature Stability - 7890 - Temperature: Oven - S: 100.0°C - L: <= 0.5°C	Manual Data Entry
April 21, 2023 11:28:10 AM	End	Execution	GC Oven Temperature Stability - 7890 - Temperature: Oven - S: 100.0°C - L: <= 0.5°C	Run Count: 1
April 21, 2023 11:28:12 AM	Start	Execution	GC Splitting Run - Injection Tower, Front SSL, Front PID - Part of System Preparation - No Inerts associated	None
April 21, 2023 11:30:27 AM	Auto	Data	GC Splitting Run - Injection Tower, Front SSL, Front PID - Part of System Preparation - No Inerts associated	Data File Path: C:\Users\Public\Documents\GC-6_BHX_2023-04-20\GC-6_2023-04-20\GC-6_2023-04-20_14-35-09F_S01.D\FID1A.D
April 21, 2023 11:31:04 AM	End	Execution	GC Splitting Run - Injection Tower, Front SSL, Front PID - Part of System Preparation - No Inerts associated	Run Count: 1
April 21, 2023 11:31:07 AM	Start	Execution	None and Split - Front PID - Detector PID - L (Area) <= 3.00% - L (Rel. Time) <= 2.5% without	None

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Date: April 21, 2023 3:26:38 PM  
System ID: CN1461066

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User Name: saangul@lab.lan  
Host Name: LAPTOP-CQ35K0M9VSystem ID: CN1461066  
Print Date: April 21, 2023 3:26:46 PM

## GC-6\_BHX\_ENH127\_ALS Transaction log:

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
April 21, 2023 11:31:43 AM	Auto	Data	None and Split - Front PID - Detector PID - L (Area) <= 3.00% - L (Rel. Time) <= 2.5% without	Data File Path: C:\Users\Public\Documents\GC-6_BHX_2023-04-20\GC-6_2023-04-20\GC-6_2023-04-20_14-35-09F_S01.D\FID1A.D
April 21, 2023 11:32:09 AM	End	Execution	None and Split - Front PID - Detector PID - L (Area) <= 3.00% - L (Rel. Time) <= 2.5% without	Run Count: 1
April 21, 2023 11:32:03 AM	Start	Execution	Injection Precision - Injection Tower, Front SSL, Front PID - GC - L (Area) <= 3.00% - L (Rel. Time) <= 1.00%	None
April 21, 2023 11:32:20 AM	Start	Execution	Injection Precision - Injection Tower, Front SSL, Front PID - GC - L (Area) <= 3.00% - L (Rel. Time) <= 1.00%	None
April 21, 2023 11:32:55 AM	Auto	Data	Injection Precision - Injection Tower, Front SSL, Front PID - GC - L (Area) <= 3.00% - L (Rel. Time) <= 1.00%	Data File Path: C:\Users\Public\Documents\GC-6_BHX_2023-04-20\GC-6_2023-04-20_14-35-09F_S01.D\FID1A.D
April 21, 2023 11:33:55 AM	Auto	Data	Injection Precision - Injection Tower, Front SSL, Front PID - GC - L (Area) <= 3.00% - L (Rel. Time) <= 1.00%	Data File Path: C:\Users\Public\Documents\GC-6_BHX_2023-04-20\GC-6_2023-04-20_14-35-09F_S01.D\FID1A.D

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Date: April 21, 2023 3:26:38 PM  
System ID: CN1461066

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User Name: saangul@lab.lan  
Host Name: LAPTOP-CQ35K0M9VSystem ID: CN1461066  
Print Date: April 21, 2023 3:26:46 PM

## GC-6\_BHX\_ENH127\_ALS Transaction log:

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
April 21, 2023 11:33:55 AM	Auto	Data	Injection Precision - Injection Tower, Front SSL, Front PID - GC - L (Area) <= 3.00% - L (Rel. Time) <= 1.00%	Data File Path: C:\Users\Public\Documents\GC-6_BHX_2023-04-20\GC-6_2023-04-20_14-35-09F_S01.D\FID1A.D
April 21, 2023 11:33:55 AM	Auto	Data	Injection Precision - Injection Tower, Front SSL, Front PID - GC - L (Area) <= 3.00% - L (Rel. Time) <= 1.00%	Data File Path: C:\Users\Public\Documents\GC-6_BHX_2023-04-20\GC-6_2023-04-20_14-35-09F_S01.D\FID1A.D
April 21, 2023 11:33:59 AM	Auto	Data	Injection Precision - Injection Tower, Front SSL, Front PID - GC - L (Area) <= 3.00% - L (Rel. Time) <= 1.00%	Data File Path: C:\Users\Public\Documents\GC-6_BHX_2023-04-20\GC-6_2023-04-20_14-35-09F_S01.D\FID1A.D
April 21, 2023 11:35:04 AM	Start	Execution	Injection Precision - Injection Tower, Front SSL, Front PID - GC - L (Area) <= 3.00% - L (Rel. Time) <= 1.00%	Run Count: 1

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Date: April 21, 2023 3:26:38 PM  
System ID: CN1461066

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User Name: xanigulm@labk  
Hostname: LAPTOP-CQ39KQWV  
System ID: CN11461086  
Print Date: April 21, 2023 3:26:48 PM

GC-4\_BKK\_EN0127\_ALS Transaction log:

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
April 21, 2023 11:06:28 AM	Auto	Data	Signal to Noise - Injection Tower, Front SGL, Back FID - Detector FID - L (→ 300000)	Data File Path: C:\Users\Public\Documents\GC-4_BKK_EN0127_ALS_2023-04-20\GC-4_2023-04-20 14-36-08B_N_Scan.D\FID\LA.ch
April 21, 2023 11:20:00 AM	End	Execution	Signal to Noise - Injection Tower, Front SGL, Back FID - Detector FID - L (→ 300000)	Run Count: 1
April 21, 2023 11:56:05 AM	Start	Execution	GC Sampling Run - Injection Tower, Back SGL, Back FID - Part of System Preparation - No Inlets Associated	None
April 21, 2023 11:56:28 AM	Auto	Data	GC Sampling Run - Injection Tower, Back SGL, Back FID - Part of System Preparation - No Inlets Associated	Data File Path: C:\Users\Public\Documents\GC-4_BKK_EN0127_ALS_2023-04-20\GC-4_2023-04-20 14-36-08B_Scan.D\FID\LA.ch
April 21, 2023 11:57:30 AM	End	Execution	GC Sampling Run - Injection Tower, Back SGL, Back FID - Part of System Preparation - No Inlets Associated	Run Count: 1
April 21, 2023 11:57:32 AM	Start	Execution	Noise and Drift - Back FID - Detector FID - L (Drift) <= 0.10 µA - L (Drift) <= 2.50 µA/min	None

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Date: April 21, 2023 3:26:38 PM  
System ID: CN11461086

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User Name: xanigulm@labk  
Hostname: LAPTOP-CQ39KQWV  
System ID: CN11461086  
Print Date: April 21, 2023 3:26:49 PM

GC-4\_BKK\_EN0127\_ALS Transaction log:

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
April 21, 2023 11:58:09 AM	Auto	Data	Noise and Drift - Back FID - Detector FID - L (Noise) <= 0.10 µA - L (Drift) <= 2.50 µA/min	Data File Path: C:\Users\Public\Documents\GC-4_BKK_EN0127_ALS_2023-04-20 14-36-08B_Scan.D\FID\LA.ch
April 21, 2023 11:58:23 AM	End	Execution	Noise and Drift - Back FID - Detector FID - L (Noise) <= 0.10 µA - L (Drift) <= 2.50 µA/min	Run Count: 1
April 21, 2023 11:58:32 AM	Start	Execution	Injection Precision - Injection Tower, Back SGL, Back FID - GC - L (Area) <= 3.00% - L (Rel. Time) <= 1.00%	None
April 21, 2023 11:58:51 AM	Start	Execution	Injection Precision - Injection Tower, Back SGL, Back FID - GC - L (Area) <= 3.00% - L (Rel. Time) <= 1.00%	None
April 21, 2023 11:58:17 AM	Auto	Data	Injection Precision - Injection Tower, Back SGL, Back FID - GC - L (Area) <= 3.00% - L (Rel. Time) <= 1.00%	Data File Path: C:\Users\Public\Documents\GC-4_BKK_EN0127_ALS_2023-04-20 14-36-08B_Scan.D\FID\LA.ch
April 21, 2023 11:58:17 AM	Auto	Data	Injection Precision - Injection Tower, Back SGL, Back FID - GC - L (Area) <= 3.00% - L (Rel. Time) <= 1.00%	Data File Path: C:\Users\Public\Documents\GC-4_BKK_EN0127_ALS_2023-04-20 14-36-08B_Scan.D\FID\LA.ch

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Date: April 21, 2023 3:26:38 PM  
System ID: CN11461086

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User Name: xanigulm@labk  
Hostname: LAPTOP-CQ39KQWV  
System ID: CN11461086  
Print Date: April 21, 2023 3:26:49 PM

GC-4\_BKK\_EN0127\_ALS Transaction log:

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
April 21, 2023 11:40:17 AM	Auto	Data	Injection Precision - Injection Tower, Back SGL, Back FID - GC - L (Area) <= 3.00% - L (Rel. Time) <= 1.00%	Data File Path: C:\Users\Public\Documents\GC-4_BKK_EN0127_ALS_2023-04-20 14-36-08B_Scan.D\FID\LA.ch
April 21, 2023 11:40:17 AM	Auto	Data	Injection Precision - Injection Tower, Back SGL, Back FID - GC - L (Area) <= 3.00% - L (Rel. Time) <= 1.00%	Data File Path: C:\Users\Public\Documents\GC-4_BKK_EN0127_ALS_2023-04-20 14-36-08B_Scan.D\FID\LA.ch
April 21, 2023 11:42:21 AM	Auto	Data	Injection Precision - Injection Tower, Back SGL, Back FID - GC - L (Area) <= 3.00% - L (Rel. Time) <= 1.00%	Data File Path: C:\Users\Public\Documents\GC-4_BKK_EN0127_ALS_2023-04-20 14-36-08B_Scan.D\FID\LA.ch
April 21, 2023 11:40:21 AM	Auto	Data	Injection Precision - Injection Tower, Back SGL, Back FID - GC - L (Area) <= 3.00% - L (Rel. Time) <= 1.00%	Data File Path: C:\Users\Public\Documents\GC-4_BKK_EN0127_ALS_2023-04-20 14-36-08B_Scan.D\FID\LA.ch
April 21, 2023 11:41:29 AM	End	Execution	Injection Precision - Injection Tower, Back SGL, Back FID - GC - L (Area) <= 3.00% - L (Rel. Time) <= 1.00%	Run Count: 1
April 21, 2023 11:41:33 AM	Start	Execution	Signal to Noise - Injection Tower, Back SGL, Back FID - Detector FID - L (→ 300000)	None

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Date: April 21, 2023 3:26:38 PM  
System ID: CN11461086

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User Name: xanigulm@labk  
Hostname: LAPTOP-CQ39KQWV  
System ID: CN11461086  
Print Date: April 21, 2023 3:26:49 PM

GC-4\_BKK\_EN0127\_ALS Transaction log:

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
April 21, 2023 11:42:23 AM	Auto	Data	Signal to Noise - Injection Tower, Back SGL, Back FID - Detector FID - L (→ 300000)	Data File Path: C:\Users\Public\Documents\GC-4_BKK_EN0127_ALS_2023-04-20 14-36-08B_Scan.D\FID\LA.ch
April 21, 2023 11:42:30 AM	End	Execution	Signal to Noise - Injection Tower, Back SGL, Back FID - Detector FID - L (→ 300000)	Run Count: 1
April 21, 2023 11:42:53 AM	End	Qualification	Session	OK
April 21, 2023 11:42:53 AM	Start	Reporting	Session	None
April 21, 2023 12:07:47 PM	Auto	Acquisition	Session	None
April 21, 2023 3:16:10 PM	Auto	Acquisition	Session	None
April 21, 2023 3:16:10 PM	Auto	Acquisition	Session	None
April 21, 2023 3:18:31 PM	Start	Qualification	Session	OK
April 21, 2023 3:20:09 PM	Auto	Acquisition	Session	None
April 21, 2023 3:21:00 PM	Auto	Acquisition	Session	None
April 21, 2023 3:21:07 PM	Start	Qualification	Session	OK
April 21, 2023 3:25:45 PM	Auto	Reporting	Session	Report Generated: Complete

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Date: April 21, 2023 3:26:38 PM  
System ID: CN11461086

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### Certificate of Calibration

Customer : ALS Laboratory Group Thailand Co., Ltd.  
Name : 104 Soi Phatthanakan 40, Phatthanakan Road, Suan Luang, Bangkok 10250  
Address :

Certificate No : 23-AVM-022  
Request No : Req-2023-0364

#### Unit Under Calibration Details

Measurement Item : Air Velocity Monitor  
Manufacturer : TSI  
Model : 7575-X-NB  
Serial Number : 7575X1825018  
ID : BKK\_FS0933  
Resolution : 0.01 (m/s)  
Probe Model : 962  
Probe S/N : P18260056  
Instrument Status : Used

#### Calibration Environment and Details

Temperature : 23 °C ± 2 °C  
Humidity : 55 %RH ± 20 %RH  
Barometric Pressure : 1013 hPa ± 10 hPa  
Received Date : 8 February 2023  
Calibrated Date : 28 February 2023  
Calibration By : Mr. Sirichok Jirapukdeesakun  
Location of Calibration : LAB 4 Air Velocity




Calibration Procedure : In-house method CP-ANM-01 based on Comparison technique with Standard Anemometer in Wind Tunnel.

Reference Standard : Manufacturer: TSI Model: 9565-P, S/N: 014940793 Which was calibrated on 4 January 2023, Calibration Certificate No.: 551220084744088

Traceability : This Certificate is traceable to SI Unit through National Institute of Metrology (Thailand) and Microprecision, ANAB Accreditation No. Calibration AC-1969-20

Note : The reported uncertainty is based on standard uncertainty multiplied by the Coverage Factor k=2, providing a level of confidence approximately 95 %.

Calibrated By :   
Service Calibration Engineer

Approved By :   
Mr. Pacit Mathavorn  
Calibration Engineer Supervisor  
Issue Date : 28 February 2023

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

FM-708-ANM-01 Rev.00 Issue date 01/07/19

Certificate No : 23-AVM-022  
Request No : Req-2023-0364

Calibration Results : Without Adjustment

#### Air Velocity Calibration

Calibration Point	Without Adjustment			Adjustment			Uncertainty
	STD Reading	UUC Reading	Error	STD Reading	UUC Reading	Error	
(m/s)	(m/s)	(m/s)	(m/s)	(m/s)	(m/s)	(m/s)	(m/s)
* 0	0.00	0.00	0.00	-	-	-	0.0082
0.5	0.50	0.52	+0.02	-	-	-	0.015
1.0	1.00	1.03	+0.03	-	-	-	0.019
3.0	3.00	3.01	+0.01	-	-	-	0.038
10.0	10.00	10.06	+0.06	-	-	-	0.072
40.0	40.01	39.83	-0.18	-	-	-	0.45

\* Indicates non accredited

End of Certificate

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

FM-708-ANM-01 Rev.00 Issue date 01/07/19

### Certificate of Calibration

Customer : ALS Laboratory Group Thailand Co., Ltd.  
Name : 104 Soi Phatthanakan 40, Phatthanakan Road, Suan Luang,  
Address : Bangkok 10250

Certificate No : 23-TPM-117  
Request No : Req-2023-0364  
Page : 1/2

#### Unit Under Calibration Details

Calibration Parameter : Temperature  
Instrument Name : Digital Thermometer with Sensor  
Manufacturer : TSI  
Model : 7575-X-NB  
Serial Number : 7575X1825018  
Resolution : 0.1 °C  
ID Number : BKK\_FS0933  
Range Calibration : 20 °C to 50 °C  
Type of Sensor : RTD  
Sensor Diameter (mm) : 4.5  
Calibration Position (mm) : 67.5  
Instrument Status : Used

#### Calibration Environment and Details

Temperature : 23 °C ± 3 °C  
Humidity : 55 %RH ± 15 %RH  
Received Date : 8 February 2023  
Calibrated Date : 28 February 2023


Calibration Procedure : In-house method CP-TPM-01 by Comparison with Standard Thermometer.

Reference Standard : Digital Thermometer with Sensor, Manufacturer: GINGO/INGO, Model: GT11/ RTD100, SN: 08000057, ID: 02-TPM Which was calibrated on 10 March 2022, Calibration Certificate No.: QR22-0578

Traceability : This Certificate is traceable to SI Unit through Quality Reborn Co., Ltd., NISC-ONSC Accreditation No.: Calibration 0292

#### Note

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

Approved By :   
Mr. Pacit Mathavorn  
Calibration Engineer Supervisor  
Issue Date : 28 February 2023

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

FM-708-TPM-01 Rev.01 Issue date 13/07/20

Calibration Note : UUC Adjustment : Not Adjust  
Certificate No : 23-TPM-117  
Request No : Req-2023-0364  
Page : 2/2

#### Result of Calibration :

UUC Sensor	Standard Temperature (°C)	UUC Reading (°C)	Correction (°C)	Uncertainty (°C)
SENSOR 1	20.00	20.2	-0.2	0.14
	50.00	49.8	+0.2	0.14

End of Certificate

Calibrated By :   
Mr. Sirichok Jirapukdeesakun

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

FM-708-TPM-01 Rev.01 Issue date 13/07/20





### Certificate of Calibration

#### Customer

Name : ALS Laboratory Group Thailand Co., Ltd.  
Address : 104 Soi Phatthamakan 40, Phatthamakan Road, Sam Luang, Bangkok 10250

Certificate No : 23-DPM-041

Request No : Req-2023-0364

#### Unit Under Calibration Details

Calibration Parameter : Barometric Pressure  
Instrument Name : Barometer Gauge  
Manufacturer : TSI  
Model : 7575-X-NB  
Serial Number : 7575X1825018  
ID : BKK\_FS0933

Calibration Result : Without Adjustment  
Instrument Status : Used

#### Calibration Environment and Details

Temperature : 23 °C ± 3 °C  
Humidity : 55 %RH ± 15 %RH  
Barometric Pressure : 1010 hPa ± 10 hPa  
Received Date : 8 February 2023  
Calibration Date : 28 February 2023  
Calibration By : Mr. Sirichok Jirapukdeesakun  
Location of Calibration : LAB 4 Air Velocity

Calibration Procedure : In-house method CP-AFM-02 based on Comparison technique

Reference Standard	Model	Serial Number	Traceable	Due Calibration
Barometric Pressure	Digi Mano	29598	PCAL	21 September 2023
Thermo Hygrometer	SD700	Q597547	NIMT	24 August 2023

Traceability : This certificate provide traceability of measurement to recognized national standard, and to the realization of the International System of Units (SI). National Institute of Metrology (NIST)

Note : The reported uncertainty is based on standard uncertainty multiplied by the Coverage Factor k=2, providing a level of confidence approximately 95 %.

Calibrated By :   
Service Calibration Engineer

Approved By :   
Mr. Pait Mathavorn  
Calibration Engineer Supervisor  
Issue Date : 28 February 2023



Certificate No : 23-DPM-041

Request No : Req-2023-0364

#### Measurement results : Barometric Pressure

Calibration Range	Barometric Pressure		
	STD Reading	UUC Reading	Correction
(hPa)	(hPa)	(hPa)	(hPa)
1012.0	1012.1	1012.0	0.1

The Uncertainty of measurement was ± 1.9 (hPa)

Calibration Procedure : In-house method CP-DPM-03 by Comparison With Standard Barometric Pressure

End of Certificate



### Certificate of Calibration

#### Customer

Name : ALS Laboratory Group Thailand Co., Ltd.  
Address : 104 Soi Phatthamakan 40, Phatthamakan Road, Sam Luang, Bangkok 10250

Certificate No : 23-GDM-022

Request No : Req-2023-0364

#### Unit Under Calibration Details

Measurement Item : Gas Detection Monitor  
Manufacturer : TSI  
Model : 982  
Serial Number : P18260056  
ID : BKK\_FS0933

Resolution : 0.1 (CO), 1 (CO2)  
Sensor : -  
Serial Number Sensor : -  
Instrument Status : Used

#### Calibration Environment and Details

Temperature : 18 °C to 28 °C  
Humidity : 35 %RH to 65 %RH  
Received Date : 08 February 2023  
Calibration Date : 28 February 2023  
Calibration By : Mr. Sirichok Jirapukdeesakun  
Location of Calibration : LAB 5 Gas meter  
Calibration Procedure : The measurement was done in accordance with CP-GDM-01 by Direct Measurement with Standard Gas

Reference Standard	Model / Lot #	Serial Number	Traceable	Due Calibration
Carbon Monoxide (CO)	304-402048999-1	-	GASCO	1 March 2023
Carbon Dioxide (CO2)	305-401914332-1	-	GASCO	18 September 2024

Traceability : This certificate provides traceability of measurement to recognized national standard, and to the realization of the international System of Units (SI).

Note : The reported uncertainty is based on standard uncertainty multiplied by the Coverage Factor k=2, providing a level of confidence approximately 95 %.

Calibrated By :   
Calibration Engineer

Approved By :   
Mr. Pait Mathavorn  
Calibration Engineer Supervisor  
Issue Date : 28 February 2023



Certificate No : 23-GDM-022

Calibration Result : Without Adjustment

Request No : Req-2023-0364

#### Gas Calibration

Gas Calibration	Gas Standard	Before Adjustment		After Adjustment		Uncertainty 95%
		UUC Reading	Error	UUC Reading	Error	
Carbon Dioxide (CO2) ppm	0	0	0	0	0	0.58
	1005	841	-164	1000	-3	20
Carbon Monoxide (CO)	0	0	0	0	0	0.58
	100.0	89.5	-10.6	100.1	0.1	2.09

#### Note

- The UUC Reading are average of 4 value.  
- Correction = Gas Standard - UUC Reading

End of Certificate

### Certificate of Calibration

**Customer:** Certificate No : 23-TPM-118  
Name : ALS Laboratory Group Thailand Co., Ltd. Request No : Req-2023-0364  
Address : 104 Soi Phatthanasak 40, Phatthanasak Road, Suan Luang, Bangkok 10250 Page : 1/2

#### Unit Under Calibration Details

Calibration Parameter : Temperature  
Instrument Name : Digital Thermometer with Sensor Range Calibration : 20 °C to 50 °C  
Manufacturer : TSI Type of Sensor : RTD  
Model : 982 Sensor Diameter (mm) : 4.5  
Serial Number : P18260056 Calibration Position (mm) : 67.5  
Resolution : 0.1 °C Instrument Status : Used  
ID Number : BKK\_FS0933

#### Calibration Environment and Details


Temperature : 23 °C ± 3 °C  
Humidity : 55 %RH ± 15 %RH  
Received Date : 8 February 2023  
Calibrated Date : 28 February 2023  
Calibration Procedure : In-house method CP-TPM-01 by Comparison with Standard Thermometer.

**Reference Standard :** Digital Thermometer with Sensor, Manufacturer: GINGO/GINGO, Model: GT11/ RTD100, SN: 08000057,  
ID: 02-TPM Which was calibrated on 10 March 2022, Calibration Certificate No. : QR22-0578

**Traceability :** This Certificate is traceable to SI Unit through Quality Reborn Co., Ltd., NSC-ONSC Accreditation No. Calibration 0292

#### Note

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

Approved By :   
Mr. Paet Mathavorn  
Calibration Engineer Supervisor  
Issue Date : 28 February 2023

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the Innovative Instrument Co., Ltd.  
IIM-T80-TPM-01 Rev.01 Issue date 13/03/20

**Calibration Note** Certificate No : 23-TPM-118  
UUC Adjustment : Not Adjust Request No : Req-2023-0364  
Page : 2/2

#### Result of Calibration :

UUC Sensor	Standard Temperature (°C)	UUC Reading (°C)	Correction (°C)	Uncertainty (°C)
SENSOR 1	20.006	20.2	-0.2	0.14
	50.006	49.8	+0.2	0.14

#### End of Certificate

Calibrated By :   
Mr. Sittichok Jirapukdeesakin

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the Innovative Instrument Co., Ltd.  
IIM-T80-TPM-01 Rev.01 Issue date 13/03/20

### Certificate of Calibration

**Customer:** Certificate No : 23-RHIM-029  
Name : ALS Laboratory Group Thailand Co., Ltd. Request No : Req-2023-0364  
Address : 104 Soi Phatthanasak 40, Phatthanasak Road, Suan Luang, Bangkok 10250

#### Unit Under Calibration Details

Measurement Item : Relative Humidity Meter Resolution : 0.1 (%RH)  
Manufacturer : TSI Resolution : -  
Model : 982 Sensor Model : 982  
Serial Number : P18260056 Sensor S/N : P18260056  
ID : BKK\_FS0933 Instrument Status : Used

#### Calibration Environment and Details

Temperature : 25 °C ± 5 °C  
Humidity : 55 %RH ± 20 %RH  
Received Date : 8 February 2023  
Calibration Date : 28 February 2023  
Calibration By : Mr. Sittichok Jirapukdeesakin  
Location of Calibration : LAB 2 Temperature  
Calibration Method : In-house method CP-RHM-01 by Comparison With Standard Relative Humidity Meter and Standard Thermometer with RTD Probe in Humidity / Temperature Chamber

#### Reference Standard

Standard Thermometer Model: GT11, S/N: 08000057, Which was calibration on 10 March 2022, Calibration of Certificate No. : QR22-0578 and  
Relative Humidity Meter, Model: HP23, S/N: 520086, Which was calibration on 14 March 2022, Calibration of Certificate No. : QR22-0579


#### Traceability

This Certificate is traceable to SI Unit through Quality Reborn Co., Ltd., NSC-ONSC Accreditation No. Calibration 0293

#### Note

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

Calibrated By :   
Service Calibration Engineer

Approved By :   
Mr. Paet Mathavorn  
Calibration Engineer Supervisor  
Issue Date : 28 February 2023

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the Innovative Instrument Co., Ltd.  
IIM-T80-T80M-01 Rev.01 Issue date 01/07/20

Certificate No : 23-RHIM-029  
Request No : Req-2023-0364

**Calibration Results :** Without Adjustment  
**Relative Humidity Calibration**

Humidity Range (%RH)	Without Adjustment (%RH)			Uncertainty (%RH)
	STD Reading (%RH)	UUC Reading (%RH)	Correction (%RH)	
35	35.72	37.6	-1.9	0.9
80	79.95	78.6	-1.35	1.9

#### End of Certificate

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the Innovative Instrument Co., Ltd.  
IIM-T80-T80M-01 Rev.01 Issue date 01/07/20



## CERTIFICATE OF CALIBRATION

Certificate No.: CL-046-66  
Page 2 of 2

Equipment Name: Heat Stress Monitor  
Manufacturer: Delta OHM  
Model: HD32.2  
Serial No: 20032249  
ID No: RYG\_F50524

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

Received date: 21 Feb 2023  
Calibration date: 24 Feb 2023  
Issue date: 28 Feb 2023

Reference Used During Calibration  
1. Standard Temperature Probe Model: STS-100 A500,  
Serial No.: 657682-09, Due date: 23 Mar 2023  
2. Digital Temperature Indicator Model: DTI-1000-A MK  
II, Serial No.: 671407-00591 Due date: 22 July 2023

Calibration Condition  
Temperature: (23±3) °C  
Relative Humidity: (65±15)%

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

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



Calibrated by  
Mr. Sorawit Thachalad  
Mr. Misa Jitprom Lertsomphol



Approved Signatory:  
Mr. Parinya Booncharoen  
Calibration Department Manager

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

Certificate No.: CL-046-66  
Page 2 of 3

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

Table 1: This equipment was connected with wet bulb probe Model: HP3201.2 S/N: 21001215.  
Dimension: Diameter 14 mm, Length 170 mm.

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
60	20.065	20.2	0.1	0.099
60	25.061	25.2	0.1	0.099
60	30.054	30.2	0.1	0.099
60	35.045	35.2	0.2	0.099
60	40.045	40.2	0.2	0.099

Table 2: This equipment was connected with temperature probe Model: TP3207.2 S/N: 21001785.  
Dimension: Diameter 14 mm, Length 150 mm.

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
70	20.064	20.1	0.0	0.099
70	25.061	25.0	-0.1	0.099
70	30.053	29.9	-0.2	0.099
70	35.045	34.8	-0.1	0.099
70	40.045	39.8	-0.2	0.099

Table 3: This equipment was connected with Globe thermometer probe Model: TP3276.2 S/N: 21001244.  
Dimension: Diameter 8 mm, Length 170 mm.

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
110	20.065	20.0	-0.1	0.099
110	25.061	25.0	-0.1	0.099
110	30.054	30.0	-0.1	0.099
110	35.045	35.0	0.0	0.099
110	40.045	40.0	0.0	0.099

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

★ End of Certificate ★



## CERTIFICATE OF CALIBRATION

ISSUED BY: Cirrus Research plc  
DATE OF ISSUE: 03 November 2022 CERTIFICATE NUMBER: 162475

Cirrus Research plc  
Acoustic House  
Bridlington Road  
Hummerby  
YO14 0PH  
United Kingdom

REVIEW BY: *Mr. Parinya Booncharoen*  
APPROVED BY: *Mr. Parinya Booncharoen*  
NEXT CAL. DATE: 1/11/23

Page 1 of 1

Test engineer:  
Nigel Smith  
Electronically signed:

### doseBadge Reader

#### Instrument

Manufacturer: Cirrus Research plc  
Model Number: RC110A  
Serial Number: 75996  
Notes:

#### Calibration Procedure

The tests were carried out in accordance with the requirements of IEC 60942:2003 where applicable.

Date of Calibration: 01 November 2022

#### Functionality Results

Function	Result
Keypad	Pass
Battery Power	Pass
Display	Pass
Communication	Pass
2 way IR link	Pass
Clock	Pass

#### Calibration Results

	Level (dB)	Frequency (Hz)	Distortion (% THD + Noise)
Initial	114.25	1004.0	0.26
Adjusted	114.00	1004.0	0.26
Uncertainty	± 0.11	± 0.14	± 0.10
Tolerances	± 0.60	± 2.00	± 4.00

#### Environmental Conditions

Pressure: 99.05 kPa  
Temperature: 22.1 °C  
Humidity: 40.0 %

#### Notes

This certificate provides traceability of measurement to the SI system of units and/or to units of measurement realized at the National Physical Laboratory or other recognised national metrology institutes. This certificate may not be reproduced in other than in full, except with the prior written approval of the issuing laboratory. The results within this certificate relate only to the items calibrated. The reported expanded uncertainty is based on a standard uncertainty multiplied by a coverage factor k=2, providing a coverage probability of approximately 95%.



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)  
CORPORATE SERVICES & EQUIPMENT CALIBRATION AND TESTING SERVICES  
534/9 PATTANAKARN ROAD 5TH FL. SUKUM VIANG, SUKUM VIANG BANGKOK 10250  
TEL: 0-2717-9000-27 FAX: 0-2719-9888



Cert.No.: 22CH1733  
Page: 1 of 3

## Certificate of Calibration

Equipment: pH Meter  
Manufacturer: Mettler Toledo  
Model: SevenExcellence  
Serial No.: B834291445  
ID No.: RYG\_EN0152  
Condition As-Received: Used Item  
Received Date: 21 December 2022  
Calibration Date: 22 December 2022  
Reference: 2212-0602DSC-1  
Submitted by: ALS Laboratory Group (Thailand) Co., Ltd.  
Rayong Branch  
616/10 Moo 5 T.Maenam Khu,  
A.Pluakdaeng, Rayong 21140, Thailand

Ambient Temperature: (25 ± 2.5) °C  
Relative Humidity: (50 ± 15) %  
Calibration Procedure:  
In-house method:  
- CP-CH5 by direct measurement with standard voltage calibrator and direct measurement with certified reference material (CRM)  
- CP-CH8 by comparison with standard thermometer

Calibrated by: Warakorn Lemagatrakul

Approved by: *Malee Butkruea*  
Approved Signatory

( ) Malee Butkruea  
( ) Sathip Meangmai  
( ) Warakorn Lemagatrakul

Issue Date: 26 December 2022

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

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





Cert.No.: 22CH1733  
Page.: 2 of 3

#### Condition of this calibration result

##### 1. Reference Standard Instrument :-

Instrument	Serial No.	ID No.	Cert. No.	Due Date
1) Document Process Calibrator	54030049	130RC116	22E2769	24 Aug 2023
2) Ref. Standard Thermometer	4982054	110RC044	221306	27 Oct 2023

This certification is traceable to the International System of Unit maintained at:-  
- Traceable to National Institute of Metrology (Thailand), NIMT

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

Buffer Solution	Manufacturer	Lot No.	Exp. date
pH 4.008	CPA chem	826588	09 July 2024
pH 6.987	CPA chem	823322	20 June 2023
pH 10.008	CPA chem	826590	06 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 ( $\pm$ mV)	Coverage factor k
	pH	mV	mV	mV	pH		
pH Meter S/N.: B834291445	4.000	177.48	177.3	4.000	0.058	2.00	2.00
	7.000	0.00	-0.1	7.000	0.058	2.00	2.00
	10.000	-177.48	-177.5	10.000	0.058	2.00	2.00

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Cert.No.: 22CH1/33  
Page.: 3 of 3

#### Calibration Results

##### Function : pH Measurement

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

Unit Under Calibration	Standard pH Buffer Solution	Actual pH Reading	Actual mV Reading (mV)	Uncertainty of pH measurement ( $\pm$ )	Coverage factor k
pH Electrode S/N.: 1475518	4.008	4.011	185.2	0.0052	2.06
	6.987	6.990	10.4	0.0088	2.00
	10.008	10.014	-166.5	0.0072	2.00

#### Function : Temperature Measurement

##### (\*) Without adjustment

This equipment was connected with Temperature Probe;

- Model :	InLab Expert Pro-ISM
- Serial No. :	1475518
- Dimension of probe;	
- Length :	120 mm.
- Diameter :	12 mm.
- Immersion Depth :	100 mm.

Calibration Point (°C)	Standard Temperature (°C)	UUC* Reading (°C)	Error (°C)	Uncertainty of measurement ( $\pm$ °C)	Coverage factor k
25.0	25.001	24.9	-0.101	0.13	2.00

Remark : - UUC\* = Unit Under Calibration

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

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TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)  
CORPORATE SERVICES & EQUIPMENT CALIBRATION AND TESTING SERVICES  
5344 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG, BANGKOK 10250  
TEL. 0-2717-3000-24 FAX. 0-2719-9489



## Certificate of Calibration

Certificate No.: 22E1008  
Page: 1 of 2

Equipment : pH Meter  
Manufacturer : Mettler Toledo  
Model : SevenExcellence  
Serial No.: B834291445  
ID No.: RYG\_EN0152  
Condition As-Received: Used Item  
Received Date: 21 December 2022  
Calibration Date: 23 December 2022

Reference: 2212-0602DSC  
Ambient Temperature: ( 23  $\pm$  2 ) °C  
Relative Humidity: ( 50  $\pm$  10 ) %

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

Procedure used: Calibration were conducted using In-house calibration Procedure CPE17 According to direct measurement method with Multi-Product Calibrator.

#### Condition of this result of calibration

##### 1. Reference standards instruments :

Instrument	Model	Serial No.	Certificate No.	Due Date
1) Multi-Product Calibrator	5500A	8315011	22E1431	05 May 2023

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

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

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

Calibrated by : Wutthanasorn Wongchulakarn  
Issue Date : 26 December 2022

Approved Signatory :  
[ ] Phalinee Prabpaijai  
[ ] Nuntawat Khanchai  
[ ] Ponthippa Tameyakul

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Cert. No.: 22F4068  
Page.: 2 of 2

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

Function: DC voltage measurement	Standard Value	Range: 2000	UUC* Reading	Error	Uncertainty
	( mV )		( mV )	( mV )	( $\pm$ $\mu$ V )
	-200.0000		-200.0	0.0	72
	-150.0000		-150.0	0.0	69
	-100.0000		-100.0	0.0	65
	-50.0000		-50.0	0.0	62
	0.0000		0.0	0.0	58
	50.0000		50.0	0.0	62
	100.0000		100.0	0.0	65
	150.0000		150.0	0.0	69
	200.0000		199.9	-0.1	72

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

\*UUC= Unit Under Calibration.

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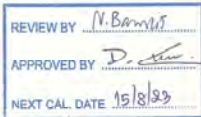
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Cert.No.: 22TW34  
Page.: 1 of 2

## Certificate of Testing

Equipment : DO Meter  
Manufacturer : YSI  
Model : 5000-115V  
Serial No. : 15E102796  
ID No. : RYG\_EN0032  
Received Date : 11 February 2022  
Test Date : 14 February 2022  
Reference : 2202-0404DSC-4  
Submitted by : ALS Laboratory Group (Thailand) Co.,Ltd.  
(Rayong Branch)  
616/10 Moo 5 T.Maenam Khu, A.Pluakdaeng,  
Rayong 21140, Thailand  
Laboratory Condition : Temperature ( 25 ± 5 ) °C  
Humidity ( 50 ± 20 ) %  
Test Procedure : In - house method : CP-CH9  
by Comparison Technique with Azide Modification Method  
Tested by : Walalak Sirithean  
Approved by : Saithip  
Approved Signatory  
( ) Malee Butkruea  
(✓) Saithip Meangmai  
( ) Warakorn Lemgagatrakul  
Issue Date : 18 February 2022



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

Result : Dissolved Oxygen Meter Adjustment With Air 100 %

Dissolved Oxygen Probe No.: 15E100464

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

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

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Saithip

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

## Certificate of Calibration

Equipment : DO Meter with Sensor  
Manufacturer : YSI  
Model : 5000-115V  
Serial No. : 15E102796  
ID No. : RYG\_EN0032  
Submitted by : ALS Laboratory Group (Thailand) Co.,Ltd. (Rayong Branch)  
616/10 Moo 5 T.Maenam Khu, A.Pluakdaeng,  
Rayong 21140, Thailand  
Location : TPA On Site Calibration Laboratory  
Received Order : 11 February 2022  
Calibrated Date : 21 February 2022  
Ambient Temperature : ( 26 ± 10 ) °C  
Relative Humidity : ( 50 ± 30 ) %  
AC Line Voltage : ( 220 ± 22 ) V  
Calibrated by : Kunchit Promrat  
Approved by : Malee  
Approved Signatory  
( ) Pornthipha Tameyakul  
(✓) Malee Butkruea  
( ) Suwit Imjai  
Issue Date : 21 February 2022



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

Cert. No.: 22LM12  
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 | 1523  | 2188080    | 21112/3   | 22 Nov 2022 |
2. This certificate is valid only to the item calibrated on date and place of calibration.  
3. This certification is traceable to the International System of Unit.

Result of Calibration : ( \* ) Without Adjustment

Function : Temperature measurement

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

Calibration Point ( °C )	Immersion Depth ( mm )	Standard Temperature ( °C )	UUC* Reading ( °C )	Error ( °C )	Uncertainty ( ± °C )	Coverage Factor k
20.00	45	20.001	19.88	-0.121	0.15	2.00

UUC\* : Unit Under Calibration

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

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Malee

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The Uncertainties are for a confidence probability of approximately 95%

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A 0038008





## Certificate of Calibration

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

Equipment : Low Temp. Incubator  
Manufacturer : Memmert  
Model : IPP750  
Serial No. : V818.0084  
ID No. : RYG\_EN0154  
Submitted by : ALS Laboratory Group (Thailand) Co., Ltd.  
(Rayong Branch)  
616/10 Moo 5 T.Maenam Khu,  
A.Pluakdaeng, Rayong 21140, Thailand  
BOD Room  
Location :  
Received Order : 22 April 2022  
Calibration Date : 22 April 2022  
Ambient Temperature :  $(26 \pm 10) ^\circ\text{C}$   
Relative Humidity :  $(50 \pm 30) \%$   
Calibrated by : Man Pattanapongpailoon  
Approved by :  
( ) Pornthippa Tameyakul  
( ) Malee Butkruea  
( ) Suwit Imjai

Issue Date : 3 May 2022  
The Uncertainties are for a confidence probability of approximately 95%

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

A 0040735



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

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

### Procedure Used :-

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

### Condition of this result of calibration

#### 1. Reference standard instrument:-

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

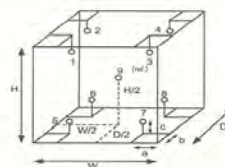
2. This certificate is valid only to the item calibrated on date and place of calibration.

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

Result of Calibration :- ( ) Without Adjustment

Function of UUC\* : Temperature Source

Fresh air setting : Close



### Probe Installation Details :

Dimension of Chamber :	Value
a = 10 cm	D = 0.80 m
b = 10 cm	W = 1.0 m
c = 10 cm	H = 1.2 m
	Capacity = 0.75 m <sup>3</sup>

Environment during calibration		
	Beginning	Finished
Temp. ( °C )	25	25
REL.Humid. ( % )	54	58
AC Supply ( Volt )	221	223

Position :	Ref. Std. ID No.:
1	9RTD-2/1
2	9RTD-2/2
3	9RTD-2/3
4	9RTD-2/4
5	9RTD-2/5
6	9RTD-2/6
7	9RTD-2/7
8	9RTD-2/8
9 (ref.)	9RTD-2/9

a 1106485



Equipment : Low Temp. Incubator  
Condition As-Received : Used Item  
Reference : 2204-0146OC-1  
Result of Calibration :- ( ) Without Adjustment  
Function of UUC\* : Temperature Source  
Fresh air setting : Close

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

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

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

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

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

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

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

UUC\* : Unit Under Calibration

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

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

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## Certificate of Calibration

Equipment : SPECTROPHOTOMETER  
Model : DR6000  
Serial No. (or ID): 1627845 (RYG\_EN0037)  
Manufacturer : HACH  
Condition : In Condition

Certificate No.: C06220464  
Issued Date : 27 September 2022  
Job No.: KSPR2212224  
Page: 1 of 3

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

Environment Condition : Temperature 23.1 °C ± 3.2 °C  
Humidity 65.4 %RH ± 3.2 %RH

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

Calibration By : Mr. Chattaphon Folthong  
Calibration Date : 27 September 2022

The Method used : In house method, CAL-WI-24, base on ASTM E 275-08 and ASTM E 367-04

Traceability : This certificate is traceable to the CRM maintained by National Institute of Standards and Technology (NIST) through Starna Scientific Limited.

The standard for Wavelength Certificate No. 91418 and 91435  
The standard for Photometric Certificate No. 91441 and 101088  
The standard for Stray light Certificate No. 101041 and 101040  
The standard for Spectral resolution Certificate No. 101037

(Mr. Chattaphon Folthong)  
Person in charge

(Mr. Thakerngkiet Pongrarn)  
Authorized signatory

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

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

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

DKSH Technology Limited  
3533 Moo 10/10, Bangna-Phra Pradaeng Road, Bangna, Phra Pradaeng, Bangkok 10260  
Phone: +66 2559 7500 Email: info.calibration@dksh.com Website: www.dksh.com/calibration-thailand

Delivering Growth - In Asia and Beyond.

CAL-006-13: 20 Jul 2022



Calibration Results:  
Without Adjustment

Wavelength Accuracy (nm), The spectral bandwidth of Std at 2 nm and UUG at 2 nm				
Standard Wavelength	Unit Under Calibration	Correction	Uncertainty	
418.81	418.4	0.21	0.14	
636.66	636.7	-0.04	0.14	
637.98	638.3	-0.32	0.14	
748.48	748.8	-0.32	0.14	
807.03	807.4	-0.37	0.13	
Photometric Accuracy (Absorbance)				
Wavelength	Standard absorbance	Unit Under Calibration	Correction	Uncertainty
420 nm	0.0000	0.000	0.0000	0.0045
	0.5605	0.563	-0.0025	0.0045
	0.7334	0.737	-0.0036	0.0045
	1.0534	1.057	-0.0036	0.0045
440 nm	0.0000	0.000	0.0000	0.0045
	0.5503	0.553	-0.0027	0.0045
	0.7179	0.720	-0.0021	0.0045
	1.0312	1.034	-0.0028	0.0045
465 nm	0.0000	0.000	0.0000	0.0045
	0.5024	0.506	-0.0036	0.0045
	0.5693	0.572	-0.0027	0.0045
	0.9504	0.954	-0.0036	0.0045
546.1 nm	0.0000	0.000	0.0000	0.0045
	0.5166	0.519	-0.0022	0.0045
	0.6903	0.691	-0.0007	0.0045
	0.9904	0.992	-0.0016	0.0045
590 nm	0.0000	0.000	0.0000	0.0045
	0.5525	0.554	-0.0015	0.0045
	0.7175	0.718	-0.0005	0.0045
	1.0301	1.031	-0.0009	0.0045
635 nm	0.0000	0.000	0.0000	0.0045
	0.5367	0.538	-0.0013	0.0045
	0.8647	0.865	-0.0003	0.0045
	0.9823	0.983	-0.0007	0.0045

DKSH Technology Limited  
2533 ถนนสุขุมวิท แขวงคลองเตย เขตคลองเตย กรุงเทพมหานคร 10110  
2533 Sukhumvit Road, Bangkok, Thailand 10110  
Phone: +66 2537 7000 Email: info@dksh.com Website: www.dksh.com

Delivering Growth - In Asia and Beyond.

CALFM-C06-13: 20 Jul 2022

Calibration Results:  
Without Adjustment

Photometric Accuracy (Absorbance)				
Wavelength	Standard absorbance	Unit Under Calibration	Correction	Uncertainty
235 nm	0.0000	0.000	0.0000	0.0080
	0.7423	0.744	-0.0017	0.0083
267 nm	0.0000	0.000	0.0000	0.0080
	0.8609	0.861	-0.0001	0.0084
313 nm	0.0000	0.000	0.0000	0.0080
	0.2895	0.292	-0.0025	0.0080
350 nm	0.0000	0.000	0.0000	0.0080
	0.6381	0.638	0.0001	0.0080
Stray light *				
Standard: cut-off	UUC: Wavelength (nm)	UUC: Transmission (%)	Absorbance (A)	
260.67 +/- 0.11 nm	260.7	2.1	1.678	
391.84 +/- 0.11 nm	391.9	1.7	1.770	
Spectral Resolution *				
Nominal Concentration 0.02 % v/v	Peak	Trough	Ratio	SBW
Standard Wavelength ( nm )	268.60	266.63	1.39	2.00
UUC: Wavelength (nm)	268.2	266.1		
Std Absorbance ( A )	0.4810	0.3178		
Absorbance ( A )	0.373	0.268		

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

The End of Certificate

DKSH Technology Limited  
2533 ถนนสุขุมวิท แขวงคลองเตย เขตคลองเตย กรุงเทพมหานคร 10110  
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Phone: +66 2537 7000 Email: info@dksh.com Website: www.dksh.com

Delivering Growth - In Asia and Beyond.

CALFM-C06-13: 20 Jul 2022

ใบตรวจสอบสภาพเครื่องวัดสิ่งแวดล้อม

เลขที่ใบงาน: KSPF2212224

ชนิดเครื่องมือ: SPECTROPHOTOMETER รุ่น: DR6000 หมายเลขเครื่อง: 1627845

ตรวจสอบ (รับ)		รายการตรวจเช็ค		ตรวจสอบ (ส่ง)		หมายเหตุ
27 Sep 2022				27 Sep 2022		
ปกติ	ไม่ปกติ			ปกติ	ไม่ปกติ	
General						
<input checked="" type="checkbox"/>	<input type="checkbox"/>	1.	ความสมบูรณ์เครื่อง	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	2.	ความสะอาด ( ช่องใส่ตัวอย่าง, ภายใน-นอกเครื่อง)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	3.	สวิตช์ ปิด – เปิด เครื่อง (On-Off Switch)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	4.	ปุ่มกด (Keypad)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	5.	หน้าจอ (Display, Screen Contrast)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
Spectrophotometer						
<input checked="" type="checkbox"/>	<input type="checkbox"/>	6.	แรงดันไฟฟ้า (Battery Backup) >= 2.5 VDC	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	7.	ตัวคูณเลือกความยาวคลื่น (Wavelength Control)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	8.	ความยาวคลื่น (Wavelength Check)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	856.1 nm ถึง 856.1 nm
<input checked="" type="checkbox"/>	<input type="checkbox"/>	9.	แหล่งกำเนิดแสง (UV < 3,000 hour)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	10.	แหล่งกำเนิดแสง (Visible < 5,000 hour)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	11.	ช่องใส่หลอดตัวอย่าง (Carousel Module)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
pH Meter and Conductivity Meter						
<input checked="" type="checkbox"/>	<input type="checkbox"/>	12.	ขั้วไฟฟ้า ( Electrode and Connection Cable )	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	13.	ระดับสารละลายใน Electrode (Level KCl )	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	14.	ฝาปิดกันลม Electrode (Dust Protection Hood)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	15.	ขาจับขั้วไฟฟ้า (Stand)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
Turbidimeter						
<input checked="" type="checkbox"/>	<input type="checkbox"/>	16.	ค่าความขุ่นที่ต่ำสุด (No Sample)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	17.	ระดับการส่องสว่างของแสง (>= 2.5 ไม่นเกิน 3.0)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
Automatic titrator						
<input checked="" type="checkbox"/>	<input type="checkbox"/>	18.	เข็ม Piston Burettes	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	19.	Function Rinsing and Dosing	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	20.	ระบบท่อสายยางและอุปกรณ์ประกอบ	<input checked="" type="checkbox"/>	<input type="checkbox"/>	

เซ็นเซอร์อุณหภูมิ:

Mr. Chaituphon Polthong  
Service Engineer

DKSH Technology Limited  
2533 ถนนสุขุมวิท แขวงคลองเตย เขตคลองเตย กรุงเทพมหานคร 10110  
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Phone: +66 2537 7000 Email: info@dksh.com Website: www.dksh.com

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CAL-FM-R31-03: 26 Jul 2022

RYG\_EN0002

Sartorius (Thailand) Co., Ltd.  
129 Rama 9 Road, Huaykwang, Huaykwang, Bangkok 10310  
Tel: +66 2543 9361-6, e-mail: service.thailand@sartorius.com



# Certificate of Calibration

Model Number: MSE224S-100-DU Certificate No.: 23BC10112  
Description: Analytical Balance Issued Date: Friday, March 03, 2023  
Serial Number: 0026207038 Reference No.: 204833  
ID No.: RYG\_EN0002  
Manufacturer: Sartorius Page No.: 1 of 2

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

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

Calibrated By: Mr Chonchai Inthana  
Calibration Date: Wednesday, March 01, 2023

Metrological data:  
Capacity: 220 g Readability: 0.0001 g  
Reasons for calibration:  
☒ New Installation ☐ Service / Repair ☒ Re-calibration / Maintenance

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 - 500g E2 YCS011-522-00	SPC-RT	C02212565	14-Sep-2023
MHB-382SD	Humidity/Barometer/Temp. Lutron MHB-382SD	DKSH	C19220444	5-Sep-2023

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



# Certificate of Calibration

Model Number : MSE224S-100-DU  
Description : Analytical Balance  
Serial Number : 0026207038  
ID No. : RYG\_EN0002  
Manufacturer : Sartorius  
Certificate No. : 23BC0112  
Issued Date : Friday, March 03, 2023  
Reference No. : 204833  
Page No. : 2 of 2

## Calibration Results : Without Adjustment

Repeatability			Eccentricity (Off-center loading error)		
The repeatability is the ability of a weighing instrument to display nearly identical results under constant test conditions when the same load within a measurement series is placed repeatedly on the weighing pan in the same manner. The standard deviation is used to express repeatability quantitatively.			The off-center loading error is given by the difference between the readout of the load, i.e. 1/3 or 1/4 of maximum capacity, placed in the middle of the weighing pan and between each of four additional measurement points (positions defined according to OIML R111).		
Nominal Value : (Low Load)	20.0000	199.9999	Nominal value :	100	0
20 g	20.0000	200.0000	Tolerance	0.0004	g
Tolerance	0.0001	g			
	20.0000	199.9999			
	20.0000	200.0000			
Nominal Value : (High Load)	20.0000	199.9999			
200 g	19.9999	200.0000			
Tolerance	0.0001	g			
	20.0000	200.0000			
	20.0000	199.9999			
	20.0000	200.0000			
Standard Deviation	0.00003	0.00005			

Linearity				
The linearity, also called linearity error, describes the deviation of the characteristic curve of a weighing instrument from the linear slope.				
Tolerance	0.0002 g			
Nominal Value	Conventional Mass Value	Displayed Value	Deviation	Uncertainty
(g)	(g)	(g)	(g)	(g)
0.01	0.0100	0.0100	0.0000	0.00014
0.05	0.0500	0.0500	0.0000	0.00014
0.1	0.1000	0.1000	0.0000	0.00014
0.5	0.5000	0.5000	0.0000	0.00014
1	1.0000	1.0000	0.0000	0.00014
5	5.0000	5.0000	0.0000	0.00014
10	10.0000	10.0001	0.0001	0.00014
20	20.0000	20.0000	0.0000	0.00028
50	50.0000	50.0000	0.0000	0.00035
100	100.0000	99.9999	-0.0001	0.00019
200	200.0000	200.0000	0.0000	0.00032

End of Report.

SOP FM 35 03 February 2022

RYG\_EN0010



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)  
CORPORATE SERVICES 3, EQUIPMENT CALIBRATION AND TESTING SERVICES  
514/ PATTANAKARN ROAD 501 18, SUANLUANG, SUANLUANG BANGKOK 10250  
TEL: 0-2717-3009-27 FAX: 0-2719-0484



Cert. No.: 22TM1517  
Page : 1 of 3

## Certificate of Calibration

Equipment : Hot Air Oven  
Manufacturer : Memmert  
Model : UFE 500  
Serial No. : G511.1572  
ID No. : RYG\_EN0010  
Submitted by : ALS Laboratory Group (Thailand) Co., Ltd. (Rayong Branch)  
616/10 Moo 5 T. Maenam Khu.  
A. Pluakdaeng,  
Rayong 21140 Thailand  
Location : Oven Room  
Received Order : 20 October 2022  
Calibration Date : 20 October 2022  
Ambient Temperature : ( 26 ± 10 ) °C  
Relative Humidity : ( 50 ± 30 ) %  
Calibrated by : Man Pattanapongpaiboon

Approved by :  
( ) Pornthipha Tameyakul  
( ) Malee Butkruea  
( ) Suwit Imjai

Issue Date : 2 November 2022

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

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

A 0046908

Equipment : Hot Air Oven  
Condition As-Received : Used Item  
Reference : 2210-0376OC-2  
Cert. No.: 22TM1517  
Page : 2 of 3

Procedure Used :-  
Calibration were conducted using calibration procedure CP-OT02 according to direct measurement method with Data Acquisition which connected with Resistance Temperature Detector ( RTD ) and Thermocouple Type T.  
The temperature scale used was based on ITS-90.

Condition of this result of calibration  
1. Reference standard instrument:-  
Instrument Model Serial No. Cert. No. Due Date  
1 ) Data Acquisition 34972A MY49023932 22LM97 29 Jul 2023  
2. This certificate is valid only to the item calibrated on date and place of calibration.  
3. This certification is traceable to the International System of Unit.

Result of Calibration :- ( \* ) Without Adjustment  
Function of UUC\* : Temperature Source  
Fresh air setting : Close

Environment during calibration

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

Ref. Std. ID No.: @ Calibration Point

Position :	( 180 ) °C	( 104 ) °C
1	21-16TC-01	20-16RTD-01
2	21-16TC-02	20-16RTD-02
3	21-16TC-03	20-16RTD-03
4	21-16TC-04	20-16RTD-04
5	21-16TC-05	22-16RTD-05
6	21-16TC-06	20-16RTD-06
7	21-16TC-07	20-16RTD-07
8	21-16TC-08	22-16RTD-08
9 (ref.)	21-16TC-09	22-16RTD-09

Probe Installation Details : Dimension of Chamber :  
a = 5.0 cm D = 0.40 m  
b = 5.0 cm W = 0.56 m  
c = 5.0 cm H = 0.48 m  
Capacity = 0.11 m³

Equipment : Hot Air Oven  
Condition As-Received : Used Item  
Reference : 2210-0376OC-2  
Cert. No.: 22TM1517  
Page : 3 of 3

Result of Calibration :- ( \* ) Without Adjustment  
Function of UUC\* : Temperature Source  
Fresh air setting : Close

Calibration Point ( °C )	UUC* Setting ( °C )	UUC* Reading ( °C )	Temperature stability ( ± °C )	Temperature uniformity ( °C )	Overall Variation ( °C )	Uncertainty ( ± °C )	Coverage Factor k
104.0	104.0	104.0	0.076	0.52	0.60	0.42	2
180.0	180.0	180.0	0.13	0.88	1.2	1.1	2

Measured Temperature ( °C )

Calibration Point ( °C )	Position								
	1	2	3	4	5	6	7	8	9 (ref.)
104.0	103.768	103.734	103.723	103.800	104.215	104.131	104.132	103.740	103.747
180.0	179.723	179.359	179.439	179.489	180.361	180.114	180.131	180.243	179.805

Average\* : The average of 30 values in each position.  
Temperature stability : One-half of the greatest maximum difference of measured temperature at any one sensor.  
Temperature uniformity : The maximum difference of measured temperatures at any sensors and the measured temperature at the reference location which are observed at the same time or at as close an observation time as possible to determine the temperature pattern or homogeneity within the chamber under steady-state conditions.  
Overall Variation : The Difference of the maximum and minimum measured temperatures throughout observation UUC\* : Unit Under Calibration  
Note : The reported uncertainty of measurement was included stability and excluded uniformity .  
The reported uncertainty of measurement was based on a standard uncertainty multiplied by a coverage factor k, providing a level of confidence of approximately 95 %.





TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)  
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TEL. 0-2717-3000-27 FAX. 0-2719-5484



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

## Certificate of Calibration

Equipment : Hot Air Oven  
Manufacturer : Memmert  
Model : UM 400  
Serial No. : b495.0899  
ID No. : RYG\_EN0006  
Submitted by : ALS Laboratory Group (Thailand) Co., Ltd. (Rayong Branch)  
616/10 Moo 5, T. Maenam Khu,  
A. Pluakdaeng,  
Rayong 21140, Thailand  
Location : Oven Room  
Received Order : 20 October 2022  
Calibration Date : 20 October 2022  
Ambient Temperature :  $(26 \pm 10) ^\circ\text{C}$   
Relative Humidity :  $(50 \pm 30) \%$   
Calibrated by : Preecha Hlahib  
Approved by :   
( ) Pornthippa Tameyakul  
(x) Malee Butkruea  
( ) Suwit Imjai

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

Issue Date : 2 November 2022

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

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

A 0046905



Equipment : Hot Air Oven  
Condition As-Received : Used Item  
Reference : 2210-0376OC-1  
Procedure Used :-

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

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

The temperature scale used was based on ITS-90.

### Condition of this result of calibration

#### 1. Reference standard instrument:-

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

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

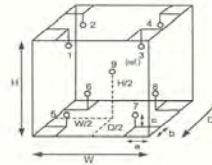
3. This certification is traceable to the International System of Unit.

Result of Calibration :- ( \* ) Without Adjustment

Function of UUC\* : Temperature Source

Fresh air setting : Close

Environment during calibration		
	Beginning	Finished
Temp. ( °C )	28	29
REL.Humid. ( % )	43	47
AC Supply ( Volt )	220	221



Probe Installation Details :  
a = 5.0 cm  
b = 5.0 cm  
c = 5.0 cm  
Dimension of Chamber :  
D = 0.33 m  
W = 0.40 m  
H = 0.40 m  
Capacity = 0.063 m<sup>3</sup>

Position :	Ref. Std. ID No.:
1	18-10RTD-01
2	18-10RTD-02
3	18-10RTD-03
4	18-10RTD-04
5	18-10RTD-05
6	18-10RTD-06
7	18-10RTD-07
8	18-10RTD-08
9 (ref.)	18-10RTD-09

a 1132473



Equipment : Hot Air Oven  
Condition As-Received : Used Item  
Reference : 2210-0376OC-1  
Result of Calibration :- ( \* ) Without Adjustment  
Function of UUC\* : Temperature Source  
Fresh air setting : Close

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

Calibration Point ( °C )	UUC* Setting ( °C )	UUC* Reading ( °C )	Temperature stability ( ± °C )	Temperature uniformity ( °C )	Overall Variation ( °C )	Uncertainty ( ± °C )	Coverage Factor k
70.0	70.0	70.0	0.079	0.47	0.77	0.42	2

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

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

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

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

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

UUC\* : Unit Under Calibration

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

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

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a 1132472



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TEL. 0-2717-3000-27 FAX. 0-2719-5484



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

## Certificate of Calibration

Equipment : Water Bath  
Manufacturer : Memmert  
Model : WNB22  
Serial No. : L513.0648  
ID No. : RYG\_EN0061  
Submitted by : ALS Laboratory Group (Thailand) Co., Ltd. (Rayong Branch)  
616/10 Moo 5, T. Maenam Khu,  
A. Pluakdaeng,  
Rayong 21140, Thailand  
Location : Wet Chemistry Lab  
Received Order : 20 October 2022  
Calibration Date : 20 October 2022  
Ambient Temperature :  $(26 \pm 10) ^\circ\text{C}$   
Relative Humidity :  $(50 \pm 30) \%$   
Calibrated by : Preecha Hlahib  
Approved by :   
( ) Pornthippa Tameyakul  
(x) Malee Butkruea  
( ) Suwit Imjai

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

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

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

A 0046906





Equipment : Water Bath  
Condition As-Received : Used Item  
Reference : 2210-0376OC-4  
Procedure Used :-

Cert. No.: 22TM1491

Page : 2 of 3

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

The temperature scale used was based on ITS-90.

#### Condition of this result of calibration

1. Reference standard instrument:-

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

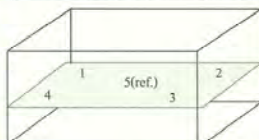
2. This certificate is valid only to the item calibrated on date and place of calibration.

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

Result of Calibration :- ( \* ) Without Adjustment

Function of UUC\* : Temperature Source

	Environmental		AC Voltage Supply
	( °C )	( %R.H. )	( Volt )
Beginning of Calibration	24	53	222
Finished of Calibration	24	50	221



Front

Position :	Ref. Std. S/N:
1	N37P300726
2	N37P300727
3	N37P300728
4	N37P300729
5(ref.)	N37P300730

Mlu

a 1132471



Equipment : Water Bath  
Condition As-Received : Used Item  
Reference : 2210-0376OC-4  
Result of Calibration :- ( \* ) Without Adjustment  
Function of UUC\* : Temperature Source

Cert. No.: 22TM1491

Page : 3 of 3

Calibration point ( °C )	UUC* Setting ( °C )	UUC* Reading ( °C )	Average* Standard Reading ( °C )				
			Position				
			1	2	3	4	5 (ref.)
85.0	85.0	85.0	84.527	84.563	84.628	84.516	84.580

Calibration point ( °C )	Uniformity ( °C )	Stability ( ± °C )	Uncertainty ( ± °C )	Coverage Factor k
85.0	0.12	0.081	0.18	2

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

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

Stability : One-half of the greatest maximum difference of measured temperature at any one probe.

UUC\* : Unit Under Calibration

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

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

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Mlu

a 1132470



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534/4 PATTANAKARN ROAD SOI 18, SUANLIANG, SUANLIANG, BANGKOK 10250  
TEL: 0-2317-3009-24 FAX: 0-27194981



### Certificate of Calibration

Certificate No.: 22T1591

Page : 1 of 2

Equipment : Digital Thermometer With Sensor  
Manufacturer : Testo  
Model : 106  
Serial No.: 51162979/811  
ID No.: RYG\_FS0418  
Condition As-Received: Used Item  
Received Date: 26 August 2022  
Calibration Date: 31 August 2022  
Reference: 2208-0964DSC  
Ambient Temperature: ( 25 ± 3 ) °C  
Relative Humidity: ( 50 ± 20 ) %

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

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

Procedure used: Calibration were conducted using in-house calibration procedure CP-T01 according to comparison with Industrial Platinum Resistance Thermometer (IPRT) into liquid bath temperature controller. The temperature scale used was based on ITS-90.

#### Condition of this result of calibration

1. Reference standards instruments :

Instrument	Model	Serial No.	Certificate No.	Due Date
1) Digital Thermometer	1529	A7A058	2111126	14 Oct 2022
2) Industrial Platinum Resistance Thermometer	5097	B24304	2111126	14 Oct 2022

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

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

-National Institute of Metrology Thailand (NIMT)

REVIEW BY *Tanont*  
APPROVED BY *Supt S*  
NEXT CAL. DATE *31/08/25*

Calibrated by : Pitak Grimgoloi  
Issue Date : 12 September 2022

Approved Signatory :  
[ ] Phalinee Prabosai  
[ ] Chatchawan Khungluk  
[x] Wanlop Larpkum

B 0296665



Cert. No.: 22T1591

Page: 2 of 2

Result of Calibration:- Without Adjustment  
Function: Temperature measurement  
Dimension of probe : Diameter 3 mm, Length 55 mm. Sheath material : Stainless Steel

Immersion Depth ( mm )	Standard Temperature ( °C )	UUC* Reading ( °C )	Error ( °C )	Uncertainty of Measurement ( ± °C )
50	24.9968	24.9	-0.0968	0.12
50	30.0015	29.9	-0.1015	0.12
50	39.9966	39.9	-0.0966	0.12

UUC\* : Unit Under Calibration

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

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a 1125496



Cert.No.: Z2CH1084  
Page.: 1 of 2

## Certificate of Calibration

Equipment : pH Meter  
Manufacturer : Mettler Toledo  
Model : Seven2Go  
Serial No. : C129171492  
ID No. : RYG\_FS0549  
Condition As-Received: Used Item  
Received Date : 17 August 2022  
Calibration Date : 18 August 2022  
Reference : 2208-0623DSC-1  
Submitted by : ALS Laboratory Group (Thailand) Co.,Ltd. Rayong Branch  
616/10 Moo 5 T. Maenam Khu,  
A. Pluakdaeng, Rayong 21140, Thailand  
Ambient Temperature : (25 ± 2.5) °C  
Relative Humidity : (50 ± 15) %  
Calibration Procedure : In - house method :  
- CP-CH5 by direct measurement with standard  
voltage calibrator and direct measurement  
with certified reference material (CRM)  
Calibrated by : Warakorn Lemgagrakul  
Approved by :   
( ) Malee Bulkruea  
( ) Sathip Meangmai  
( ) Warakorn Lemgagrakul  
Issue Date : 22 August 2022

The Uncertainties are for a confidence probability of approximately 95%

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

A 0044346



Cert. No.: Z2CH1084  
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	130RC110	21E2682	25 Aug 2022

This certification is traceable to the International System of Unit maintained at:-  
Traceable to National Institute of Metrology (Thailand), NIMT

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

Buffer Solution	Manufacturer	Lot No.	Exp. date
pH 4.008	CPA chem	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 (±mV)	Coverage factor k
	pH	mV	mV	pH		
pH Meter S/N.: C129171492	4.00	177.48	178	4.00	0.58	2.00
	7.00	0.00	0	7.00	0.58	2.00
	10.00	-177.48	-178	10.00	0.58	2.00

#### Function : pH Measurement

#### Performing three buffers standard curve by using buffer nominal pH (4.7,10)

Unit Under Calibration	Standard pH Buffer Solution	Actual pH Reading	Actual mV Reading (mV)	Uncertainty of pH measurement (±)	Coverage factor k
pH Electrode S/N.: 1231783	4.008	4.01	171	0.0086	2.05
	6.985	7.00	-2	0.011	2.00
	10.008	10.00	-174	0.0092	2.00

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

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a 1121482



Cert. No.: 22LM112  
Page.: 1 of 2

## Certificate of Calibration

Equipment : pH Meter with Sensor  
Manufacturer : Mettler Toledo  
Model : Seven2Go  
Serial No. : C129171492  
ID No. : RYG\_FS0549  
Submitted by : ALS Laboratory Group (Thailand) Co.,Ltd.  
(Rayong Branch)  
616/10 Moo 5 T. Maenam Khu, A. Pluakdaeng,  
Rayong 21140 Thailand  
Location : TPA On Site Calibration Laboratory  
Received Order : 17 August 2022  
Calibrated Date : 19 August 2022  
Ambient Temperature : (26 ± 10) °C  
Relative Humidity : (50 ± 30) %  
AC Line Voltage : (220 ± 22) V  
Calibrated by : Kunchit Promprat  
Approved by :   
( ) Pomsitippa Tameyakul  
( ) Malee Bulkruea  
( ) Suwit Imjai  
Issue Date : 24 August 2022

The Uncertainties are for a confidence probability of approximately 95%

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

A 0044522



Equipment : pH Meter with Sensor  
Condition As-Received : Used Item  
Reference : 2208-0623DSC-3  
Procedure Used :-

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

The temperature scale used was based on ITS-90.

### Condition of this result of calibration

#### 1. Reference standard instrument:-

Instrument	Model	Serial No.	Cert. No.	Due Date
1) Digital Thermometer	1502A	A52847	211144	20 Oct 2022

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

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

#### Result of Calibration :- (\*) Without Adjustment

Function : Temperature measurement.

This instrument was connected with temperature sensor, S/N.: 1231783

Calibration Point (°C)	Immersion Depth (mm)	Standard Temperature (°C)	UUC* Reading (°C)	Error (°C)	Uncertainty (± °C)	Coverage Factor k
25.0	120	24.999	25.1	0.101	0.16	2.00
30.0	120	30.001	30.1	0.099	0.16	2.00
40.0	120	40.004	40.1	0.096	0.16	2.00
50.0	120	50.003	50.1	0.097	0.16	2.00

UUC\* : Unit Under Calibration

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

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a 1122902



## ภาคผนวก จ

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สำเนาหนังสือใบอนุญาตขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์เอกชน

ที่ อก ๐๓๑๐(๑)/ ๑๐๖๙



กรมโรงงานอุตสาหกรรม  
ถนนพระรามที่ ๖ เขตราชเทวี  
กรุงเทพมหานคร ๑๐๔๐๐

๒๘ มกราคม ๒๕๖๕

เรื่อง ต่ออายุหนังสือรับขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์เอกชน

เรียน กรรมการผู้จัดการ บริษัท เอแอลเอส แลบบอราทอรี กรุ๊ป (ประเทศไทย) จำกัด

อ้างถึง คำขอขึ้นทะเบียน/ต่ออายุ/เปลี่ยนแปลงบุคลากร และชนิดสารมลพิษของห้องปฏิบัติการวิเคราะห์เอกชน  
ลงวันที่ ๓๐ กรกฎาคม ๒๕๖๓

- สิ่งที่ส่งมาด้วย ๑. รายชื่อผู้ควบคุมดูแลห้องปฏิบัติการวิเคราะห์ จำนวน ๑ แผ่น  
๒. รายชื่อเจ้าหน้าที่ประจำห้องปฏิบัติการวิเคราะห์ จำนวน ๕ แผ่น  
๓. ขอบข่ายสารมลพิษที่ได้รับขึ้นทะเบียนจากกรมโรงงานอุตสาหกรรม จำนวน ๓๑ แผ่น

ตามหนังสือที่อ้างถึง บริษัท เอแอลเอส แลบบอราทอรี กรุ๊ป (ประเทศไทย) จำกัด ขอต่ออายุ  
หนังสือรับขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์เอกชน เลขทะเบียน ว-๒๐๔ สถานที่ตั้งเลขที่ ๑๐๔  
ซอยพัฒนาการ ๔๐ ถนนพัฒนาการ แขวงพัฒนาการ เขตสวนหลวง กรุงเทพมหานคร  
ต่อกรมโรงงานอุตสาหกรรม นั้น

กรมโรงงานอุตสาหกรรมพิจารณาแล้ว ให้บริษัท เอแอลเอส แลบบอราทอรี กรุ๊ป (ประเทศไทย)  
จำกัด ต่ออายุหนังสือรับขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์เอกชน โดยมีองค์ประกอบดังนี้

- ก. ผู้ควบคุมดูแลห้องปฏิบัติการวิเคราะห์ จำนวน ๖ ราย ตามสิ่งที่ส่งมาด้วย ๑  
ข. เจ้าหน้าที่ประจำห้องปฏิบัติการวิเคราะห์ จำนวน ๑๖๒ ราย ตามสิ่งที่ส่งมาด้วย ๒  
ค. ขอบข่ายสารมลพิษที่ได้รับขึ้นทะเบียนให้วิเคราะห์ในน้ำเสีย จำนวน ๕๙ รายการ น้ำใต้ดิน  
จำนวน ๑๒๖ รายการ อากาศเสีย ๑๖ รายการ สิ่งปฏิกูลหรือวัสดุที่ไม่ใช้แล้ว จำนวน ๓๕ รายการ และดิน  
จำนวน ๑๒๕ รายการ รวมทั้งสิ้นจำนวน ๓๖๑ รายการ ตามสิ่งที่ส่งมาด้วย ๓

หนังสือฉบับนี้จะหมดอายุในวันที่ ๒ กันยายน ๒๕๖๖ หากประสงค์จะต่ออายุหนังสือ  
รับขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์เอกชน ให้ยื่นคำขอต่ออายุพร้อมเอกสารประกอบคำขอ  
ต่อกรมโรงงานอุตสาหกรรม ภายใน ๓๐ วัน ก่อนวันสิ้นอายุของหนังสือรับขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์  
เอกชน ซึ่งคำขอต่ออายุดังกล่าวขอรับได้ที่กรมโรงงานอุตสาหกรรม

จึงเรียนมาเพื่อทราบ

ขอแสดงความนับถือ

(นายศิริระ จันทรเจต)

นักวิทยาศาสตร์ชำนาญการพิเศษ รักษาการแทน  
ผู้อำนวยการกองวิจัยและเตือนภัยมลพิษโรงงาน  
ปฏิบัติราชการแทนอธิบดีกรมโรงงานอุตสาหกรรม

กองวิจัยและเตือนภัยมลพิษโรงงาน

กลุ่มมาตรฐานวิธีการวิเคราะห์ทดสอบมลพิษและทะเบียนห้องปฏิบัติการ

โทร. ๐ ๒๒๐๒ ๔๑๔๖ ๐ ๒๒๐๒ ๔๐๐๒

โทรสาร ๐ ๒๓๕๔ ๓๒๐๘ ๐ ๒๓๕๔ ๓๔๑๕



เอกสารแนบท้ายหนังสือรับต่ออายุขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์เอกชน

บริษัท เอแอลเอส แลบบอราทอรี กรุ๊ป (ประเทศไทย) จำกัด

เลขทะเบียน ว-๒๐๔

ที่ อก ๐๓๑๐(๑)/

ลงวันที่ ๒๘ มกราคม ๒๕๖๕

ก. ผู้ควบคุมดูแลห้องปฏิบัติการวิเคราะห์ จำนวน ๖ ราย

๑) นางสาวยุพาพร จันทร์เปล่ง

ทะเบียนเลขที่ ว-๒๐๔-ค-๔๗๐๐

๒) นางสาวชัชชัย โกมารกุล ณ นคร

ทะเบียนเลขที่ ว-๒๐๔-ค-๔๗๐๑

๓) นายศรายุทธ จิตรานนท์

ทะเบียนเลขที่ ว-๒๐๔-ค-๔๗๐๒

๔) นางสาวกนกกร เอนก

ทะเบียนเลขที่ ว-๒๐๔-ค-๖๑๑๑

๕) นายสุริยา สอนแก้ว

ทะเบียนเลขที่ ว-๒๐๔-ค-๖๑๑๒

๖) นายวิชาญ ชูณหะวัณ

ทะเบียนเลขที่ ว-๒๐๔-ค-๖๑๑๓



(นายศิริระ จันทร์เจิด)

นักวิทยาศาสตร์ชำนาญการพิเศษ รักษาการแทน

ผู้อำนวยการกองวิจัยและเตือนภัยมลพิษโรงงาน

ปฏิบัติราชการแทนอธิบดีกรมโรงงานอุตสาหกรรม

เอกสารแนบท้ายหนังสือรับต่ออายุขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์เอกชน

บริษัท เอแอลเอส แลบบอราทอรี กรุ๊ป (ประเทศไทย) จำกัด

เลขทะเบียน ว-๒๐๔

ที่ อก ๐๓๑๐(๑)/ ๑๐๖๙

ลงวันที่ ๒๘ มกราคม ๒๕๖๕

ข. เจ้าหน้าที่ประจำห้องปฏิบัติการวิเคราะห์ จำนวน ๑๖๒ ราย

๑) นางสาวจินดา ไชจุลธรรม	ทะเบียนเลขที่ ว-๒๐๔-จ-๔๗๐๘
๒) นางสาวสาวิตรี น้อยเสงี่ยม	ทะเบียนเลขที่ ว-๒๐๔-จ-๔๗๐๙
๓) นางสาวชนัญญาญจน์ อัมขม	ทะเบียนเลขที่ ว-๒๐๔-จ-๔๗๑๐
๔) นางสาวนรินทร์ สายเส็ง	ทะเบียนเลขที่ ว-๒๐๔-จ-๔๗๑๕
๕) นางสาวนันทวดี สมบูรณ์	ทะเบียนเลขที่ ว-๒๐๔-จ-๔๗๑๖
๖) นางสาวศรัณยา เฉลิมธำรงค์	ทะเบียนเลขที่ ว-๒๐๔-จ-๔๗๑๗
๗) นางสาวสรารักษ์ มงคลจิรวุฒิ	ทะเบียนเลขที่ ว-๒๐๔-จ-๔๗๑๙
๘) นางสาวศิริลักษณ์ พึ่งแพง	ทะเบียนเลขที่ ว-๒๐๔-จ-๔๗๒๐
๙) นายณพพงศ์ จันทรพันธุ์	ทะเบียนเลขที่ ว-๒๐๔-จ-๕๔๐๘
๑๐) นายนรเศรษฐ์ โกมาลย์	ทะเบียนเลขที่ ว-๒๐๔-จ-๕๔๑๑
๑๑) นายธันวา จรียา	ทะเบียนเลขที่ ว-๒๐๔-จ-๕๔๑๔
๑๒) นางสาวเกศรินทร์ แก้วมัน	ทะเบียนเลขที่ ว-๒๐๔-จ-๕๔๑๖
๑๓) นางสาวสุวิมล ชัยเรืองวุฒิ	ทะเบียนเลขที่ ว-๒๐๔-จ-๕๔๑๗
๑๔) นางสาวสุชาดา ธรรมถาวร	ทะเบียนเลขที่ ว-๒๐๔-จ-๕๔๒๑
๑๕) นางสาวเบมิกา ชัยเดชธนกุล	ทะเบียนเลขที่ ว-๒๐๔-จ-๕๔๒๓
๑๖) นางสาวศศิธร หมูสวัสดิ์	ทะเบียนเลขที่ ว-๒๐๔-จ-๕๔๒๔
๑๗) นางสาวเสาวลักษณ์ ภู่นภาอำพร	ทะเบียนเลขที่ ว-๒๐๔-จ-๕๔๒๕
๑๘) นายอภิสิทธิ์ สิงหา	ทะเบียนเลขที่ ว-๒๐๔-จ-๕๔๒๖
๑๙) นายศักดิ์สิทธิ์ ไพศาลพิสุทธ์	ทะเบียนเลขที่ ว-๒๐๔-จ-๕๔๒๗
๒๐) ว่าที่ร้อยตรีหญิง พรรณิภา ขำเจริญ	ทะเบียนเลขที่ ว-๒๐๔-จ-๕๔๒๘
๒๑) นางจิตดา คำภูแก้ว	ทะเบียนเลขที่ ว-๒๐๔-จ-๕๔๓๑
๒๒) นางสาวอรรพรรณ รักยง	ทะเบียนเลขที่ ว-๒๐๔-จ-๖๑๑๕
๒๓) นางสาวนพรัตน์ แยมกรานต์	ทะเบียนเลขที่ ว-๒๐๔-จ-๖๑๑๙
๒๔) นายจุลเดช วารินทร์	ทะเบียนเลขที่ ว-๒๐๔-จ-๖๑๒๐
๒๕) นางสาวดาญรัตน์ ร้องคำ	ทะเบียนเลขที่ ว-๒๐๔-จ-๖๑๒๑
๒๖) นายนคร สุขเจริญ	ทะเบียนเลขที่ ว-๒๐๔-จ-๖๑๒๒
๒๗) นายบัญชา นามเขตต์	ทะเบียนเลขที่ ว-๒๐๔-จ-๖๑๒๓
๒๘) นายพรมมี ศรีปัตเนตร	ทะเบียนเลขที่ ว-๒๐๔-จ-๖๑๒๕
๒๙) นายอุทิศ อุ่นสิม	ทะเบียนเลขที่ ว-๒๐๔-จ-๖๑๒๖
๓๐) ว่าที่ร้อยตรี เฉลิมเกียรติ อมรศรีเสริม	ทะเบียนเลขที่ ว-๒๐๔-จ-๖๑๒๘
๓๑) นางสาววริยา สร้างนา	ทะเบียนเลขที่ ว-๒๐๔-จ-๖๑๒๙
๓๒) นายอนุพงศ์ รัตนศรีประเสริฐ	ทะเบียนเลขที่ ว-๒๐๔-จ-๖๑๓๐
๓๓) นางสาวจุฑารัตน์ โอนสันเทียะ	ทะเบียนเลขที่ ว-๒๐๔-จ-๖๑๔๒
๓๔) นางสาวจรรววรรณ พิมพ์อริกฤติยา	ทะเบียนเลขที่ ว-๒๐๔-จ-๗๐๗๖

(นายศิระ จันทรเจ็ด)

๓๕) นางสาวปรารค์ทิพย์...

นักวิทยาศาสตร์ชำนาญการพิเศษ รักษาการแทน

ผู้อำนวยการกองวิจัยและเตือนภัยมลพิษโรงงาน

สำนักงานสิ่งแวดล้อมและเฝ้าระวังมลพิษทางอากาศ



๓๕) นางสาวปรางค์ทิพย์ กิจไพศาลศักดิ์	ทะเบียนเลขที่ ว-๒๐๔-จ-๗๐๗๙
๓๖) นางสาวเดือนใจ ทางกลาง	ทะเบียนเลขที่ ว-๒๐๔-จ-๗๐๘๐
๓๗) นางสาวจิราพร ศิริเวช	ทะเบียนเลขที่ ว-๒๐๔-จ-๗๐๘๑
๓๘) นายวรกร ผุ้รักษ์	ทะเบียนเลขที่ ว-๒๐๔-จ-๗๐๘๒
๓๙) นายทอง วิริยะสทกิจ	ทะเบียนเลขที่ ว-๒๐๔-จ-๗๐๘๓
๔๐) นายธนิต เจนจบ	ทะเบียนเลขที่ ว-๒๐๔-จ-๗๐๘๔
๔๑) นายคณิศร ขำเพชร	ทะเบียนเลขที่ ว-๒๐๔-จ-๗๐๘๕
๔๒) นายอรรคพล นิยมวิทยาพันธ์	ทะเบียนเลขที่ ว-๒๐๔-จ-๗๐๘๖
๔๓) นายภูวิช พรหมสะอาด	ทะเบียนเลขที่ ว-๒๐๔-จ-๗๐๘๗
๔๔) นายธนเดช โภคาพิพัฒน์	ทะเบียนเลขที่ ว-๒๐๔-จ-๗๐๘๘
๔๕) นายชวฤทธิ์ วงษ์จันทร์	ทะเบียนเลขที่ ว-๒๐๔-จ-๗๐๘๙
๔๖) นายอาทิตย์ ศรีแสน	ทะเบียนเลขที่ ว-๒๐๔-จ-๗๐๙๐
๔๗) นายเจษฎินทร์ คงศักดิ์ไทย	ทะเบียนเลขที่ ว-๒๐๔-จ-๗๐๙๑
๔๘) นายจรัส บุญยั้ง	ทะเบียนเลขที่ ว-๒๐๔-จ-๗๐๙๒
๔๙) นายธนาณัติ เอนก	ทะเบียนเลขที่ ว-๒๐๔-จ-๗๐๙๓
๕๐) นายอภิวัฒน์ ทุมหนู	ทะเบียนเลขที่ ว-๒๐๔-จ-๗๐๙๔
๕๑) นางสาวสุภาขวัญ มาก	ทะเบียนเลขที่ ว-๒๐๔-จ-๗๐๙๕
๕๒) นางสาวทัตพร ขวาลสมบูรณ์	ทะเบียนเลขที่ ว-๒๐๔-จ-๗๑๐๐
๕๓) นางสาวธิดิมา บุญเพ็ง	ทะเบียนเลขที่ ว-๒๐๔-จ-๗๑๐๑
๕๔) นางสาวกนกอร เข้มเพ็ชร	ทะเบียนเลขที่ ว-๒๐๔-จ-๗๑๐๒
๕๕) นางสาวพัชรียา หงษ์สมดี	ทะเบียนเลขที่ ว-๒๐๔-จ-๗๑๐๓
๕๖) นางสาวภาวนิดา สุรวงศ์ตระกูล	ทะเบียนเลขที่ ว-๒๐๔-จ-๗๑๐๔
๕๗) นางสาวภาณุมาศ นามวัฒน์	ทะเบียนเลขที่ ว-๒๐๔-จ-๗๑๐๕
๕๘) นางสาวอุไรรัตน์ ทิงสร้างแป้น	ทะเบียนเลขที่ ว-๒๐๔-จ-๗๑๐๖
๕๙) นายธีรวัฒน์ ปวงสุข	ทะเบียนเลขที่ ว-๒๐๔-จ-๗๑๐๗
๖๐) นายอิทธิพล ยะโส	ทะเบียนเลขที่ ว-๒๐๔-จ-๗๑๐๘
๖๑) นายประพจน์ วรรณชูชัย	ทะเบียนเลขที่ ว-๒๐๔-จ-๗๑๐๙
๖๒) นายชยธร พวงทิพย์	ทะเบียนเลขที่ ว-๒๐๔-จ-๗๑๑๐
๖๓) นางสาวกนกวรรณ จันทบาล	ทะเบียนเลขที่ ว-๒๐๔-จ-๗๑๑๑
๖๔) นางสาวเกษร หลักบุญ	ทะเบียนเลขที่ ว-๒๐๔-จ-๗๑๑๒
๖๕) นายสิทธิโชค ธงเงิน	ทะเบียนเลขที่ ว-๒๐๔-จ-๗๑๑๓
๖๖) นางศิลปวรรณ ใจบุญ	ทะเบียนเลขที่ ว-๒๐๔-จ-๗๕๐๕
๖๗) นางสาวพรรณธิดา พุ่มคง	ทะเบียนเลขที่ ว-๒๐๔-จ-๗๕๐๘
๖๘) นางสาวศรณีย์ ยิ่งดี	ทะเบียนเลขที่ ว-๒๐๔-จ-๗๕๐๙
๖๙) นายนวกัทร ศรีวิริยะ	ทะเบียนเลขที่ ว-๒๐๔-จ-๗๕๑๐
๗๐) นายสุวิชา ทองอ่อน	ทะเบียนเลขที่ ว-๒๐๔-จ-๗๕๑๑
๗๑) นายวิญญู บุญตะนัย	ทะเบียนเลขที่ ว-๒๐๔-จ-๗๕๑๓

(นายศิริระ จันทรเจ็ด)

นักวิทยาศาสตร์ชำนาญการพิเศษ รักษาการแทน

ผู้อำนวยการกองวิจัยและเตือนภัยมลพิษโรงงาน

บริษัท ปูนซิเมนต์ไทย จำกัด (มหาชน)

๗๒) นายสมบูรณ์...

[illegible]

(นายศิระ จันทรเจ็ด)

**นักวิทยาศาสตร์ชำนาญการพิเศษ รักษาราชการแทน**

ผู้อำนวยการกองวิจัยและเตือนภัยมลพิษโรงงาน

ปณิธิราชมารทพาลกิจเด็กมรโงรงามมดตามมด

๑๐๙) นายนนทชัย...

๑๐๙) นายพนนพชัย อุปถัมภ์	ทะเบียนเลขที่ ว-๒๐๔-จ-๘๕๙๔
๑๑๐) นายณัฐพล คุณสุทธิ	ทะเบียนเลขที่ ว-๒๐๔-จ-๘๕๙๕
๑๑๑) นายณันทวัฒน์ สาริน	ทะเบียนเลขที่ ว-๒๐๔-จ-๘๕๙๖
๑๑๒) นายปิยะนัฐ พลมะศรี	ทะเบียนเลขที่ ว-๒๐๔-จ-๘๕๙๗
๑๑๓) นายพงศ์สิริ โสมเขียว	ทะเบียนเลขที่ ว-๒๐๔-จ-๘๕๙๘
๑๑๔) นายพีรพัฒน์ กำคำ	ทะเบียนเลขที่ ว-๒๐๔-จ-๘๕๙๙
๑๑๕) นายภาณุพงศ์ มานิตย์	ทะเบียนเลขที่ ว-๒๐๔-จ-๘๖๐๐
๑๑๖) นายมงคล ผลาทิพย์	ทะเบียนเลขที่ ว-๒๐๔-จ-๘๖๐๑
๑๑๗) นายมนุรินทร์ พูลศิริ	ทะเบียนเลขที่ ว-๒๐๔-จ-๘๖๐๒
๑๑๘) นายสิรินันท์ ทองอ้น	ทะเบียนเลขที่ ว-๒๐๔-จ-๘๖๐๓
๑๑๙) นายอเนชา ทันสมัย	ทะเบียนเลขที่ ว-๒๐๔-จ-๘๖๐๔
๑๒๐) นายอดิศักดิ์ ผมไผ	ทะเบียนเลขที่ ว-๒๐๔-จ-๘๖๐๕
๑๒๑) นายอนันตชัย วิสุม	ทะเบียนเลขที่ ว-๒๐๔-จ-๘๖๐๖
๑๒๒) นายณัฐดนัย เจือละออง	ทะเบียนเลขที่ ว-๒๐๔-จ-๘๖๐๗
๑๒๓) นายวรวิธ คีนิก	ทะเบียนเลขที่ ว-๒๐๔-จ-๘๖๐๘
๑๒๔) นายแสงตะวัน นະตะສັດ	ทะเบียนเลขที่ ว-๒๐๔-จ-๘๖๐๙
๑๒๕) นายยุทธพงศ์ รัตนะ	ทะเบียนเลขที่ ว-๒๐๔-จ-๘๖๑๐
๑๒๖) นายชัยวุฒิ ไชยชนะนิจ	ทะเบียนเลขที่ ว-๒๐๔-จ-๘๖๑๑
๑๒๗) นายวิศรุต ศรีธรรมมา	ทะเบียนเลขที่ ว-๒๐๔-จ-๘๖๑๒
๑๒๘) นายพนนทกร เผือกผ่อง	ทะเบียนเลขที่ ว-๒๐๔-จ-๘๖๑๓
๑๒๙) นายกำชัย สุทธะ	ทะเบียนเลขที่ ว-๒๐๔-จ-๘๖๑๔
๑๓๐) นางสาวณัฐภรณ์ รักทะเล	ทะเบียนเลขที่ ว-๒๐๔-จ-๙๒๑๙
๑๓๑) นางสาวประภาภรณ์ บุตรพรม	ทะเบียนเลขที่ ว-๒๐๔-จ-๙๒๒๐
๑๓๒) นางสาวนิลาวัลย์ นามพรม	ทะเบียนเลขที่ ว-๒๐๔-จ-๙๒๒๑
๑๓๓) นางสาวพัชรินทร์ แสนสร้อย	ทะเบียนเลขที่ ว-๒๐๔-จ-๙๒๒๒
๑๓๔) นายไพโรจน์ เปี่ยมพิมาย	ทะเบียนเลขที่ ว-๒๐๔-จ-๙๒๒๓
๑๓๕) นางสาวศุภมาศ ทองมาก	ทะเบียนเลขที่ ว-๒๐๔-จ-๙๒๒๔
๑๓๖) นางสาวลลิตา จิตรสว่าง	ทะเบียนเลขที่ ว-๒๐๔-จ-๙๒๒๕
๑๓๗) นางสาวชไมพร เสิกภูเขียว	ทะเบียนเลขที่ ว-๒๐๔-จ-๙๒๒๖
๑๓๘) นางสาวกฤติมาพร คำมีแก่น	ทะเบียนเลขที่ ว-๒๐๔-จ-๙๒๒๗
๑๓๙) นางสาวสกลรัตน์ ภาควุฒิ	ทะเบียนเลขที่ ว-๒๐๔-จ-๙๒๒๘
๑๔๐) นางสาวกาญจนา คงคุณ	ทะเบียนเลขที่ ว-๒๐๔-จ-๙๒๒๙
๑๔๑) นางสาวไพรินทร์ ศรีรูปี	ทะเบียนเลขที่ ว-๒๐๔-จ-๙๒๓๐
๑๔๒) นางสาวทิพนันดา ฝูญปัญญา	ทะเบียนเลขที่ ว-๒๐๔-จ-๙๒๓๑
๑๔๓) นางสาวสาธิตา ปานทอง	ทะเบียนเลขที่ ว-๒๐๔-จ-๙๒๓๒
๑๔๔) นางสาวอริสา ทองนวล	ทะเบียนเลขที่ ว-๒๐๔-จ-๙๒๓๓
๑๔๕) นางสาวอริยา คำคลอง	ทะเบียนเลขที่ ว-๒๐๔-จ-๙๒๓๔

(นายศิริ จันทรเจ็ด)

นักวิทยาศาสตร์ชำนาญการพิเศษ รักษาการแทน

ผู้อำนวยการกองวิจัยและเตือนภัยมลพิษโรงงาน

๑๔๖) นางสาวบุษดาภรณ์...



๑๔๖) นางสาวชุตติภรณ์ สุนทรสนาน	ทะเบียนเลขที่ ว-๒๐๔-จ-๙๒๓๕
๑๔๗) นางสาวสุภารัตน์ นนทประสาท	ทะเบียนเลขที่ ว-๒๐๔-จ-๙๒๓๖
๑๔๘) นางสาวรัชนิกร เนียมกลาง	ทะเบียนเลขที่ ว-๒๐๔-จ-๙๒๓๗
๑๔๙) นางสาวกัญญารัตน์ ศรีนิลทา	ทะเบียนเลขที่ ว-๒๐๔-จ-๙๒๓๘
๑๕๐) นางสาวอัญชลี คำจันทร์	ทะเบียนเลขที่ ว-๒๐๔-จ-๙๒๓๙
๑๕๑) นายบุญฤทธิ์ เอี่ยมเทศ	ทะเบียนเลขที่ ว-๒๐๔-จ-๙๒๔๐
๑๕๒) นายศิริวัฒน์ พานิชย์	ทะเบียนเลขที่ ว-๒๐๔-จ-๙๒๔๑
๑๕๓) นางสาวศุภรดา ปันมยุรา	ทะเบียนเลขที่ ว-๒๐๔-จ-๙๒๔๒
๑๕๔) นางสาวพาฤดี คุณน่าน	ทะเบียนเลขที่ ว-๒๐๔-จ-๙๒๔๓
๑๕๕) นางสาวจิราเจต พองดา	ทะเบียนเลขที่ ว-๒๐๔-จ-๙๒๔๔
๑๕๖) นางสาวกนกภรณ์ อุระ	ทะเบียนเลขที่ ว-๒๐๔-จ-๙๒๔๕
๑๕๗) นางสาวอารยา มีชัย	ทะเบียนเลขที่ ว-๒๐๔-จ-๙๒๔๖
๑๕๘) นางสาวจิตสุภา ประเทืองสุข	ทะเบียนเลขที่ ว-๒๐๔-จ-๙๒๔๗
๑๕๙) นางสาวอริสา วิริยขันติธรรม	ทะเบียนเลขที่ ว-๒๐๔-จ-๙๒๔๘
๑๖๐) นางสาววิษุตา นาคผจญ	ทะเบียนเลขที่ ว-๒๐๔-จ-๙๒๔๙
๑๖๑) นางสาวพนิดา ยอดอินทร์	ทะเบียนเลขที่ ว-๒๐๔-จ-๙๒๕๐
๑๖๒) นางสาวนันทิยา จันทะสุน	ทะเบียนเลขที่ ว-๒๐๔-จ-๙๒๕๑



(นายศิริระ จันทรเจิด)

นักวิทยาศาสตร์ชำนาญการพิเศษ รักษาการแทน

ผู้อำนวยการกองวิจัยและเตือนภัยมลพิษโรงงาน

ปฏิบัติราชการแทนอธิบดีกรมโรงงานอุตสาหกรรม

เอกสารแนบท้ายหนังสือรับต่ออายุขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์เอกชน

บริษัท เอแอลเอส แลบบอราทอรี กรุ๊ป (ประเทศไทย) จำกัด

เลขทะเบียน ว-๒๐๔

ที่ อก ๐๓๑๐(๑)/ ๑๐๖๕

ลงวันที่ ๒๘ มกราคม ๒๕๖๕

ขอขยายสารมลพิษที่ได้รับขึ้นทะเบียนจากกรมโรงงานอุตสาหกรรม จำนวน ๓๖๑ รายการ

น้ำเสีย จำนวน 59 รายการ

ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
1	Aldicarb	High-Performance Liquid Chromatographic Method <sup>[4]</sup>
2	Aldicarb Sulfone	High-Performance Liquid Chromatographic Method <sup>[4]</sup>
3	Aldicarb Sulfoxide	High-Performance Liquid Chromatographic Method <sup>[4]</sup>
4	Aldrin	Liquid-Liquid Extraction, Gas Chromatographic Method <sup>[4]</sup>
5	Arsenic	1) Digestion, Inductively Coupled Plasma Method <sup>[4]</sup> 2) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method <sup>[4]</sup>
6	Barium	1) Digestion, Inductively Coupled Plasma Method <sup>[4]</sup> 2) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method <sup>[4]</sup>
7	$\alpha$ -BHC	Liquid-Liquid Extraction, Gas Chromatographic Method <sup>[4]</sup>
8	$\beta$ -BHC	Liquid-Liquid Extraction, Gas Chromatographic Method <sup>[4]</sup>
9	$\delta$ -BHC	Liquid-Liquid Extraction, Gas Chromatographic Method <sup>[4]</sup>
10	$\gamma$ -BHC	Liquid-Liquid Extraction, Gas Chromatographic Method <sup>[4]</sup>
11	Biochemical Oxygen Demand	1) 5-Day BOD Test, Azide Modification Method <sup>[4]</sup> 2) 5-Day BOD Test, Membrane Electrode Method <sup>[4]</sup>
12	Carbaryl	High-Performance Liquid Chromatographic Method <sup>[4]</sup>
13	Carbofuran	High-Performance Liquid Chromatographic Method <sup>[4]</sup>
14	Cadmium	1) Digestion, Inductively Coupled Plasma Method <sup>[4]</sup> 2) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method <sup>[4]</sup>
15	Chemical Oxygen Demand	1) Closed Reflux, Colorimetric Method <sup>[4]</sup> 2) Closed Reflux, Titrimetric Method <sup>[4]</sup>
16	Chlordane	Liquid-Liquid Extraction, Gas Chromatographic Method <sup>[4]</sup>
17	Chromium	1) Digestion, Inductively Coupled Plasma Method <sup>[4]</sup> 2) Digestion, Inductively Coupled Plasma/Mass Spectrometric Method <sup>[4]</sup>
18	Color	ADMI Weighted-Ordinate Spectrophotometric Method

(นางริกาญจน์ จันทรกุลวิไล)

ผู้อำนวยการกลุ่มมาตรฐานวิธีการวิเคราะห์ทดสอบมลพิษ

และทะเบียนห้องปฏิบัติการ

19 Copper...

ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
19	Copper	1) Digestion, Inductively Coupled Plasma Method <sup>[4]</sup> 2) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method <sup>[4]</sup>
20	Cyanide	Distillation, Colorimetric Method <sup>[4]</sup>
21	2,4'-DDD	Liquid-Liquid Extraction, Gas Chromatographic Method <sup>[4]</sup>
22	4,4'-DDD	Liquid-Liquid Extraction, Gas Chromatographic Method <sup>[4]</sup>
23	2,4'-DDE	Liquid-Liquid Extraction, Gas Chromatographic Method <sup>[4]</sup>
24	4,4'-DDE	Liquid-Liquid Extraction, Gas Chromatographic Method <sup>[4]</sup>
25	2,4'-DDT	Liquid-Liquid Extraction, Gas Chromatographic Method <sup>[4]</sup>
26	4,4'-DDT	Liquid-Liquid Extraction, Gas Chromatographic Method <sup>[4]</sup>
27	Dieldrin	Liquid-Liquid Extraction, Gas Chromatographic Method <sup>[4]</sup>
28	Endosulfan Sulfate	Liquid-Liquid Extraction, Gas Chromatographic Method <sup>[4]</sup>
29	Endosulfan I	Liquid-Liquid Extraction, Gas Chromatographic Method <sup>[4]</sup>
30	Endosulfan II	Liquid-Liquid Extraction, Gas Chromatographic Method <sup>[4]</sup>
31	Endrin	Liquid-Liquid Extraction, Gas Chromatographic Method <sup>[4]</sup>
32	Endrin Aldehyde	Liquid-Liquid Extraction, Gas Chromatographic Method <sup>[4]</sup>
33	Formaldehyde	Distillation, Colorimetric Method <sup>[3]</sup>
34	Free Chlorine	1) DPD Ferrous Titrimetric Method <sup>[4]</sup> 2) Iodometric Method <sup>[4]</sup>
35	Heptachlor	Liquid-Liquid Extraction, Gas Chromatographic Method <sup>[4]</sup>
36	Heptachlor epoxide	Liquid-Liquid Extraction, Gas Chromatographic Method <sup>[4]</sup>
37	Hexavalent Chromium	Filtration, Colorimetric Method <sup>[4]</sup>
38	3-Hydroxycarbofuran	High-Performance Liquid Chromatographic Method <sup>[4]</sup>
39	Lead	1) Digestion, Inductively Coupled Plasma Method <sup>[4]</sup> 2) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method <sup>[4]</sup>
40	Manganese	1) Digestion, Inductively Coupled Plasma Method <sup>[4]</sup> 2) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method <sup>[4]</sup>
41	Mercury	1) Digestion, Cold-Vapor Atomic Absorption Spectrometric Method <sup>[4]</sup> 2) Digestion, Inductively Coupled Plasma/Mass spectrometric Method <sup>[4]</sup>
42	Methiocarb	High-Performance Liquid Chromatographic Method <sup>[4]</sup>
43	Methoxychlor	Liquid-Liquid Extraction, Gas Chromatographic Method <sup>[4]</sup>

วิมล

44 Methomyl...

(นางริกาญจน์ อัครสกุลวิไล)

ผู้อำนวยการกลุ่มมาตรฐานวิธีการวิเคราะห์ทดสอบมลพิษ

กรมส่งเสริมการค้าระหว่างประเทศ



ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
44	Methomyl	High-Performance Liquid Chromatographic Method <sup>[4]</sup>
45	Nickel	1) Digestion, Inductively Coupled Plasma Method <sup>[4]</sup> 2) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method <sup>[4]</sup>
46	Oil & Grease	1) Liquid-Liquid, Partition-Gravimetric Method <sup>[4]</sup> 2) Soxhlet Extraction Method <sup>[4]</sup>
47	Oxamyl	High-Performance Liquid Chromatographic Method <sup>[4]</sup>
48	Propoxur	High-Performance Liquid Chromatographic Method <sup>[4]</sup>
49	pH	Electrometric Method <sup>[4]</sup>
50	Phenols	1) Distillation, Chloroform Extraction Method <sup>[4]</sup> 2) Distillation, Direct Photometric Method <sup>[4]</sup>
51	Selenium	1) Digestion, Inductively Coupled Plasma Method <sup>[4]</sup> 2) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method <sup>[4]</sup>
52	Sulfide	Iodometric Method <sup>[4]</sup>
53	Temperature	Laboratory and Field Methods <sup>[4]</sup>
54	Total Dissolved Solids	Dried at 180 °C <sup>[4]</sup>
55	Total Kjeldahl Nitrogen	Semi-Micro Kjeldahl Method <sup>[4]</sup>
56	Total Suspended Solids	Dried at 103-105 °C <sup>[4]</sup>
57	Toxaphene	Liquid-Liquid Extraction, Gas Chromatographic Method <sup>[4]</sup>
58	Trivalent Chromium	1) Digestion, Inductively Coupled Plasma Method; Colorimetric Method; Calculation <sup>[4]</sup> 2) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method; Colorimetric Method; Calculation <sup>[4]</sup>
59	Zinc	1) Digestion, Inductively Coupled Plasma Method <sup>[4]</sup> 2) Digestion, Inductively Coupled Plasma/Mass Spectrometric Method <sup>[4]</sup>

น้ำใต้ดิน จำนวน 126 รายการ

ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
1	Acenaphthene	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>[4]</sup>
2	Acetone	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>[4]</sup>

*วิภา*

3 Aldrin...

(นางริภาญจน์ ฉัตรสกุลวิไล)

ผู้อำนวยการกลุ่มมาตรฐานวิธีการวิเคราะห์ทดสอบมลพิษ  
และทะเบียนห้องปฏิบัติการ

ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
3	Aldrin	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>[4]</sup>
4	Anthracene	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>[4]</sup>
5	Antimony	1) Digestion, Inductively Coupled Plasma Method <sup>[4]</sup> 2) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method <sup>[4]</sup>
6	Arsenic	1) Digestion, Inductively Coupled Plasma Method <sup>[4]</sup> 2) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method <sup>[4]</sup>
7	Atrazine	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>[4]</sup>
8	Barium	1) Digestion, Inductively Coupled Plasma Method <sup>[4]</sup> 2) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method <sup>[4]</sup>
9	Benz(a)anthracene	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>[4]</sup>
10	Benzene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>[4]</sup>
11	Benzo(b)fluoranthene	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>[4]</sup>
12	Benzo(k)fluoranthene	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>[4]</sup>
13	Benzoic Acid	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>[4]</sup>
14	Benzo(a)pyrene	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>[4]</sup>
15	Benzo[g,h,i]perylene	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>[4]</sup>
16	Beryllium	1) Digestion, Inductively Coupled Plasma Method <sup>[4]</sup> 2) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method <sup>[4]</sup>
17	Bis(2-chloroethyl)ether	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>[4]</sup>

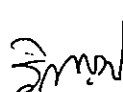
วิธีทาง)

18 Bis(2-ethylhexyl)phthalate...

(นางริกาญจน์ ฉัตรสกุลวิไล)

ผู้อำนวยการกลุ่มมาตรฐานวิธีการวิเคราะห์ทดสอบมลพิษ  
และทะเบียนห้องปฏิบัติการ

ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
18	Bis(2-ethylhexyl)phthalate	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>[4]</sup>
19	Bromodichloromethane	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>[4]</sup>
20	Bromoform	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>[4]</sup>
21	Butanol	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>[4]</sup>
		Equilibrium Headspace, Gas Chromatographic/ Mass Spectrometric Method <sup>[4]</sup>
22	Butyl Benzyl Phthalate	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>[4]</sup>
23	Cadmium	1) Digestion, Inductively Coupled Plasma Method <sup>[4]</sup> 2) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method <sup>[4]</sup>
24	Carbazole	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>[4]</sup>
25	Carbon Disulfide	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>[4]</sup>
26	Carbon tetrachloride	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>[4]</sup>
27	Chlordane	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>[4]</sup>
28	p-Chloroaniline	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>[4]</sup>
29	Chlorobenzene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>[4]</sup>
30	Chlorodibromomethane	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>[4]</sup>
31	Chloroform	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>[4]</sup>
32	2-Chlorophenol	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>[4]</sup>
33	Chromium	1) Digestion, Inductively Coupled Plasma Method <sup>[4]</sup> 2) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method <sup>[4]</sup>



34 Chromium (III)...

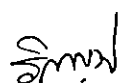
(นางริกาญจน์ จิตรสกุลไธ)

ผู้อำนวยการกลุ่มมาตรฐานวิธีการวิเคราะห์ทดสอบมลพิษ





ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
51	cis-1,2-Dichloroethylene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>[4]</sup>
52	trans-1,2-Dichloroethylene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>[4]</sup>
53	2,4-Dichlorophenol	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>[4]</sup>
54	1,2-Dichloropropane	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>[4]</sup>
55	1,3-Dichloropropane	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>[4]</sup>
56	1,3-Dichloropropene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>[4]</sup>
57	Dieldrin	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>[4]</sup>
58	Diethyl Phthalate	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>[4]</sup>
59	2,4-Dimethylphenol	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>[4]</sup>
60	2,4-Dinitrophenol	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>[4]</sup>
61	2,4-Dinitrotoluene	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>[4]</sup>
62	2,6-Dinitrotoluene	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>[4]</sup>
63	Di-n-Octyl Phthalate	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>[4]</sup>
64	Endosulfan	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>[4]</sup>
65	Endrin	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>[4]</sup>
66	Ethylbenzene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>[4]</sup>
67	Fluoranthene	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>[4]</sup>



(นางริกาญจน์ ฉัตรสกุลวิไล)

ผู้อำนวยการกลุ่มมาตรฐานวิธีการวิเคราะห์ทดสอบมลพิษ  
และทะเบียนห้องปฏิบัติการ

68 Fluorene...

ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
68	Fluorene	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>[4]</sup>
69	Heptachlor	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>[4]</sup>
70	Heptachlor epoxide	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>[4]</sup>
71	Hexachlorobenzene	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>[4]</sup>
72	Hexachloro-1,3-butadiene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>[4]</sup>
73	n-Hexane	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>[4]</sup>
74	$\alpha$ -HCH	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>[4]</sup>
75	$\beta$ -HCH	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>[4]</sup>
76	$\gamma$ -HCH	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>[4]</sup>
77	Hexachlorocyclopentadiene	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>[4]</sup>
78	Hexachloroethane	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>[4]</sup>
79	Indeno(1,2,3-cd)pyrene	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>[4]</sup>
80	Isophorone	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>[4]</sup>
81	Lead	1) Digestion, Inductively Coupled Plasma Method <sup>[4]</sup> 2) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method <sup>[4]</sup>
82	Manganese	1) Digestion, Inductively Coupled Plasma Method <sup>[4]</sup> 2) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method <sup>[4]</sup>
83	Mercury	1) Cold Vapor Atomic Absorption Spectrometric Method <sup>[4]</sup> 2) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method <sup>[4]</sup>

ร.พ.ว.

84 Methanol...

(นางริกาญจน์ ฉัตรสกุลวิไล)

ผู้อำนวยการกลุ่มมาตรฐานวิธีการวิเคราะห์ทดสอบมลพิษ

แบบฟอร์มแจ้งผลการวิเคราะห์



ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
84	Methanol	1) Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>[4]</sup> 2) Equilibrium Headspace, Gas Chromatographic/ Mass Spectrometric Method <sup>[4]</sup>
85	Methoxychlor	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>[4]</sup>
86	Methyl Bromide	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>[4]</sup>
87	Methylene Chloride	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>[4]</sup>
88	2-Methylphenol	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>[4]</sup>
89	2-Methylnaphthalene	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>[4]</sup>
90	Methyl tert-Butyl Ether	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>[4]</sup>
91	Naphthalene	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>[4]</sup>
92	Nickel	1) Digestion, Inductively Coupled Plasma Method <sup>[4]</sup> 2) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method <sup>[4]</sup>
93	Nitrobenzene	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>[4]</sup>
94	N-Nitrosodiphenylamine	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>[4]</sup>
95	N-Nitrosodi-n-Propylamine	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>[4]</sup>
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 <sup>[4]</sup>

วิมล

97 Pentachlorophenol...

(นางริกาญจน์ ฉัตรสกุลวิไล)

ผู้อำนวยการกลุ่มมาตรฐานวิธีการวิเคราะห์ทดสอบมลพิษ

และทะเบียนห้องปฏิบัติการ

ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
97	Pentachlorophenol	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>[4]</sup>
98	pH	Electrometric Method <sup>[4]</sup>
99	Phenanthrene	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>[4]</sup>
100	Phenol	1) Distillation, Direct Photometric Method <sup>[4]</sup> 2) Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>[4]</sup>
101	Pyrene	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>[4]</sup>
102	Selenium	1) Digestion, Inductively Coupled Plasma Method <sup>[4]</sup> 2) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method <sup>[4]</sup>
103	Silver	1) Digestion, Inductively Coupled Plasma Method <sup>[4]</sup> 2) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method <sup>[4]</sup>
104	Styrene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>[4]</sup>
105	1,1,2,2-Tetrachloroethane	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>[4]</sup>
106	Tetrachloroethylene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>[4]</sup>
107	Toluene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>[4]</sup>
108	Toxaphene	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>[4]</sup>
109	TPH (C <sub>5</sub> -C <sub>9</sub> )	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>[13,24]</sup>
110	TPH (C <sub>8</sub> -C <sub>16</sub> )	Solvent Extraction, Gas Chromatographic Method <sup>[9,21]</sup>
111	TPH (C <sub>16</sub> -C <sub>35</sub> )	Solvent Extraction, Gas Chromatographic Method <sup>[9,21]</sup>
112	1,2,4-Trichlorobenzene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>[4]</sup>
113	1,1,1-Trichloroethane	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>[4]</sup>

วิมล

114 1,1,2-Trichloroethane...

ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
114	1,1,2-Trichloroethane	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>[4]</sup>
115	Trichloroethylene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>[4]</sup>
116	2,4,5-Trichlorophenol	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>[4]</sup>
117	2,4,6-Trichlorophenol	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>[4]</sup>
118	1,3,5-Trimethylbenzene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>[4]</sup>
119	Vanadium	1) Digestion, Inductively Coupled Plasma Method <sup>[4]</sup> 2) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method <sup>[4]</sup>
120	Vinyl Acetate	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>[4]</sup>
121	Vinyl Chloride	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>[4]</sup>
122	m-Xylene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>[4]</sup>
123	o-Xylene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>[4]</sup>
124	p-Xylene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>[4]</sup>
125	Xylene (Total)	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>[4]</sup>
126	Zinc	1) Digestion, Inductively Coupled Plasma Method <sup>[4]</sup> 2) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method <sup>[4]</sup>

**อากาศเสีย (ปล่อยระบาย) จำนวน 16 รายการ**

ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
1	Antimony	Isokinetic, Digestion, Inductively Coupled Plasma Method <sup>[5]</sup>
2	Arsenic	Isokinetic, Digestion, Inductively Coupled Plasma Method <sup>[5]</sup>

*วิฑูรย์*

3 Carbon Monoxide...

(นางริกาญจน์ ฉัตรสกุลวิไล)

ผู้อำนวยการกลุ่มมาตรฐานวิธีการวิเคราะห์ทดสอบมลพิษ

และหน่วยงานที่เกี่ยวข้อง



ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
3	Carbon Monoxide	1) Sampling Bag Non-Dispersive Infrared Method <sup>[5]</sup> 2) Non-Dispersive Infrared Method <sup>[5]</sup> 3) Instrumental Analyzer Method <sup>[5]</sup>
4	Chlorine	1) Absorption Sampling, Ion Chromatographic Method <sup>[5]</sup> 2) Isokinetic Sampling, Ion Chromatographic Method <sup>[5]</sup>
5	Copper	Isokinetic, Digestion, Inductively Coupled Plasma Method <sup>[5]</sup>
6	Dioxins	Isokinetic Sampling, Analysis by ISO/IEC 17025 Accredited Laboratory or Analysis by Department of Industrial Works Registered Laboratory (Dioxins/Furans Analysis Approved) <sup>[5]</sup>
7	Hydrogen Chloride	1) Absorption Sampling, Ion Chromatographic Method <sup>[5]</sup> 2) Isokinetic Sampling, Ion Chromatographic Method <sup>[5]</sup>
8	Hydrogen Sulfide	Absorption Sampling, Iodometric Method <sup>[5]</sup>
9	Lead	Isokinetic, Digestion, Inductively Coupled Plasma Method <sup>[5]</sup>
10	Mercury	1) Isokinetic Sampling, Digestion, Cold-Vapor Atomic Absorption Spectrometric Method <sup>[5]</sup> 2) Isokinetic, Digestion, Inductively Coupled Plasma Method <sup>[5]</sup>
11	Opacity	Ringelmann's Method <sup>[2]</sup>
12	Oxides of Nitrogen	1) Absorption Sampling, Phenoldisulfonic Acid Method <sup>[5]</sup> 2) Chemiluminescence Method <sup>[5]</sup> 3) Instrumental Analyzer Method <sup>[5]</sup>
13	Sulfur Dioxide	1) Absorption Sampling, Barium-Thorin Titrimetric Method <sup>[5]</sup> 2) UV Fluorescence Method <sup>[5]</sup> 3) Instrumental Analyzer Method <sup>[5]</sup>
14	Sulfuric Acid	Isokinetic Sampling, Barium-Thorin Titrimetric Method <sup>[5]</sup>
15	Total Suspended Particulate	Isokinetic Sampling, Gravimetric Method <sup>[5]</sup>
16	Xylene	Adsorption Sampling, Gas Chromatographic Method <sup>[5]</sup>

วิมล

สิ่งปลูก...

(นางริกาญจน์ ฉัตรสกุลวิไล)

ผู้อำนวยการกลุ่มมาตรฐานวิชาการวิเคราะห์ทดสอบมลพิษ

กรมควบคุมมลพิษ

สิ่งปฏิกูลหรือวัสดุที่ไม่ใช้แล้ว จำนวน 35 รายการ

ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
1	Aldrin	1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>[1,9,25]</sup> 2) Soxhlet Extraction, Gas Chromatographic Method <sup>[10,22]</sup> 3) Automated Soxhlet Extraction, Gas Chromatographic Method <sup>[22,31]</sup>
2	Antimony	1) Waste Extraction, Digestion, Inductively Coupled Plasma Method <sup>[1,6,15]</sup> 2) Waste Extraction, Digestion, Inductively Coupled Plasma/Mass Spectrometric Method <sup>[1,6,16]</sup> 3) Digestion, Inductively Coupled Plasma Method <sup>[7,15]</sup> 4) Digestion, Inductively Coupled Plasma/Mass Spectrometric Method <sup>[7,16]</sup>
3	Arsenic	1) Waste Extraction, Digestion, Inductively Coupled Plasma Method <sup>[1,6,15]</sup> 2) Waste Extraction, Digestion, Inductively Coupled Plasma/Mass Spectrometric Method <sup>[1,6,16]</sup> 3) Digestion, Inductively Coupled Plasma Method <sup>[7,15]</sup> 4) Digestion, Inductively Coupled Plasma/Mass Spectrometric Method <sup>[7,16]</sup>
4	Barium	1) Waste Extraction, Digestion, Inductively Coupled Plasma Method <sup>[1,6,15]</sup> 2) Waste Extraction, Digestion, Inductively Coupled Plasma/Mass Spectrometric Method <sup>[1,6,16]</sup> 3) Digestion, Inductively Coupled Plasma Method <sup>[7,15]</sup> 4) Digestion, Inductively Coupled Plasma/Mass Spectrometric Method <sup>[7,16]</sup>
5	Beryllium	1) Waste Extraction, Digestion, Inductively Coupled Plasma Method <sup>[1,6,15]</sup> 2) Waste Extraction, Digestion, Inductively Coupled Plasma/Mass Spectrometric Method <sup>[1,6,16]</sup> 3) Digestion, Inductively Coupled Plasma Method <sup>[7,15]</sup> 4) Digestion, Inductively Coupled Plasma/Mass Spectrometric Method <sup>[7,16]</sup>



6 Cadmium...

(นางริกาญจน์ จิตรสกุลใจ)

ผู้อำนวยการกลุ่มมาตรฐานวิธีการวิเคราะห์ทดสอบมลพิษ

และทะเบียนห้องปฏิบัติการ

ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
6	Cadmium	1) Waste Extraction, Digestion, Inductively Coupled Plasma Method <sup>[1,6,15]</sup> 2) Waste Extraction, Digestion, Inductively Coupled Plasma/Mass Spectrometric Method <sup>[1,6,16]</sup> 3) Digestion, Inductively Coupled Plasma Method <sup>[7,15]</sup> 4) Digestion, Inductively Coupled Plasma/Mass Spectrometric Method <sup>[7,16]</sup>
7	Chlordane	1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>[1,19,25]</sup> 2) Soxhlet Extraction, Gas Chromatographic Method <sup>[10,22]</sup> 3) Automated Soxhlet Extraction, Gas Chromatographic Method <sup>[22,31]</sup>
8	Chromium	1) Waste Extraction, Digestion, Inductively Coupled Plasma Method <sup>[1,6,15]</sup> 2) Waste Extraction, Digestion, Inductively Coupled Plasma/Mass Spectrometric Method <sup>[1,6,16]</sup> 3) Digestion, Inductively Coupled Plasma Method <sup>[7,15]</sup> 4) Digestion, Inductively Coupled Plasma/Mass Spectrometric Method <sup>[7,16]</sup>
9	Chromium (III)	1) Waste Extraction, Digestion, Inductively Coupled Plasma Method; Waste Extraction, Colorimetric Method; Calculation Method <sup>[1,6,15,17]</sup> 2) Waste Extraction, Digestion, Inductively Coupled Plasma/Mass Spectrometric Method; Waste Extraction, Colorimetric Method; Calculation Method <sup>[1,6,16,17]</sup> 3) Digestion, Inductively Coupled Plasma Method; Alkaline Digestion, Colorimetric Method; Calculation Method <sup>[7,8,15,17]</sup> 4) Digestion, Inductively Coupled Plasma/Mass Spectrometric Method; Alkaline Digestion, Colorimetric Method; Calculation Method <sup>[7,8, 16,17]</sup>
10	Chromium (VI)	1) Waste Extraction, Colorimetric Method <sup>[1,6,17]</sup> 2) Alkaline Digestion, Colorimetric Method <sup>[8,17]</sup>



(นางริกาญจน์ จิตรสกุลวิไล)

11 Cobalt...

ผู้อำนวยการกลุ่มมาตรฐานวิธีการวิเคราะห์ทดสอบมลพิษ

.....เรียน...../.....



ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
11	Cobalt	1) Waste Extraction, Digestion, Inductively Coupled Plasma Method <sup>[1,6,15]</sup> 2) Waste Extraction, Digestion, Inductively Coupled Plasma/Mass Spectrometric Method <sup>[1,6,16]</sup> 3) Digestion, Inductively Coupled Plasma Method <sup>[7,15]</sup> 4) Digestion, Inductively Coupled Plasma/Mass Spectrometric Method <sup>[7,16]</sup>
12	Copper	1) Waste Extraction, Digestion, Inductively Coupled Plasma Method <sup>[1,6,15]</sup> 2) Waste Extraction, Digestion, Inductively Coupled Plasma/Mass Spectrometric Method <sup>[1,6,16]</sup> 3) Digestion, Inductively Coupled Plasma Method <sup>[7,15]</sup> 4) Digestion, Inductively Coupled Plasma/Mass Spectrometric Method <sup>[7,16]</sup>
13	2,4-D	1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>[1,9,25]</sup> 2) Soxhlet Extraction, Gas Chromatographic Method <sup>[10,22]</sup> 3) Automated Soxhlet Extraction, Gas Chromatographic Method <sup>[22,31]</sup>
14	DDD	1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>[1,9,25]</sup> 2) Soxhlet Extraction, Gas Chromatographic Method <sup>[10,22]</sup> 3) Automated Soxhlet Extraction, Gas Chromatographic Method <sup>[22,31]</sup>
15	DDE	1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>[1,9,25]</sup> 2) Soxhlet Extraction, Gas Chromatographic Method <sup>[10,22]</sup> 3) Automated Soxhlet Extraction, Gas Chromatographic Method <sup>[22,31]</sup>
16	DDT	1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>[1,9,25]</sup>

จิราภรณ์

2) Soxhlet...

(นางริกาญจน์ จัตรสกุลวิไล)

ผู้อำนวยการกลุ่มมาตรฐานวิธีการวิเคราะห์ทดสอบมลพิษ

และทะเบียนห้องปฏิบัติการ

ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
17	Dieldrin	2) Soxhlet Extraction, Gas Chromatographic Method <sup>[10,22]</sup> 3) Automated Soxhlet Extraction, Gas Chromatographic Method <sup>[22,31]</sup> 1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>[1,9,25]</sup>
18	Endrin	2) Soxhlet Extraction, Gas Chromatographic Method <sup>[10,22]</sup> 3) Automated Soxhlet Extraction, Gas Chromatographic Method <sup>[22,31]</sup> 1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>[1,9,25]</sup>
19	Heptachlor	2) Soxhlet Extraction, Gas Chromatographic Method <sup>[10,22]</sup> 3) Automated Soxhlet Extraction, Gas Chromatographic Method <sup>[22,31]</sup> 1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>[1,9,25]</sup>
20	Lead	2) Soxhlet Extraction, Gas Chromatographic Method <sup>[10,22]</sup> 3) Automated Soxhlet Extraction, Gas Chromatographic Method <sup>[22,31]</sup> 1) Waste Extraction, Digestion, Inductively Coupled Plasma Method <sup>[1,6,15]</sup> 2) Waste Extraction, Digestion, Inductively Coupled Plasma/Mass Spectrometric Method <sup>[1,6,16]</sup>
21	Lindane	3) Digestion, Inductively Coupled Plasma Method <sup>[7,15]</sup> 4) Digestion, Inductively Coupled Plasma/Mass Spectrometric Method <sup>[7,16]</sup> 1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>[1,9,25]</sup> 2) Soxhlet Extraction, Gas Chromatographic Method <sup>[10,22]</sup>
22	Mercury	3) Automated Soxhlet Extraction, Gas Chromatographic Method <sup>[22,31]</sup> 1) Waste Extraction, Digestion, Cold-Vapor Atomic Absorption Spectrometric Method <sup>[1,6,18]</sup>

วิมล

2) Waste Extraction...

(นางริกาญจน์ ฉัตรสกุลวิไล)

ผู้อำนวยการกลุ่มมาตรฐานวิธีการวิเคราะห์ทดสอบมลพิษ

ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
23	Methoxychlor	2) Waste Extraction, Thermal Decomposition Amalgamation and Atomic Absorption Spectrometric Method <sup>[1,6,19]</sup> 3) Waste Extraction, Digestion, Cold-Vapor Atomic Fluorescence Spectrometric Method <sup>[1,6,20]</sup> 4) Digestion, Cold-Vapor Atomic Absorption Spectrometric Method <sup>[18]</sup> 5) Thermal Decomposition Amalgamation and Atomic Absorption Spectrometric Method <sup>[19]</sup> 6) Digestion, Cold-Vapor Atomic Fluorescence Spectrometric Method <sup>[20]</sup>
24	Mirex	1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>[1,9,25]</sup> 2) Soxhlet Extraction, Gas Chromatographic Method <sup>[10,22]</sup> 3) Automated Soxhlet Extraction, Gas Chromatographic Method <sup>[22,31]</sup>
25	Molybdenum	1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>[1,9,25]</sup> 2) Soxhlet Extraction, Gas Chromatographic Method <sup>[10,22]</sup> 3) Automated Soxhlet Extraction, Gas Chromatographic Method <sup>[22,31]</sup>
26	Nickel	1) Waste Extraction, Digestion, Inductively Coupled Plasma Method <sup>[1,6,15]</sup> 2) Waste Extraction, Digestion, Inductively Coupled Plasma/Mass Spectrometric Method <sup>[1,6,16]</sup> 3) Digestion, Inductively Coupled Plasma Method <sup>[7,15]</sup> 4) Digestion, Inductively Coupled Plasma/Mass Spectrometric Method <sup>[7,16]</sup>
		1) Waste Extraction, Digestion, Inductively Coupled Plasma Method <sup>[1,6,15]</sup> 2) Waste Extraction, Digestion, Inductively Coupled Plasma/Mass Spectrometric Method <sup>[1,6,16]</sup> 3) Digestion, Inductively Coupled Plasma Method <sup>[7,15]</sup> 4) Digestion, Inductively Coupled Plasma/Mass Spectrometric Method <sup>[7,16]</sup>

วิภากร

27 Polychlorinated...

(นางริภาญจน์ ฉัตรสกุลวิไล)

ผู้อำนวยการกลุ่มมาตรฐานวิธีการวิเคราะห์ทดสอบมลพิษ



ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
27	<p>Polychlorinated biphenyls (PCBs)</p> <ul style="list-style-type: none"> <li>- Aroclor 1016</li> <li>- Aroclor 1221</li> <li>- Aroclor 1232</li> <li>- Aroclor 1242</li> <li>- Aroclor 1248</li> <li>- Aroclor 1254</li> <li>- Aroclor 1260</li> <li>- 2-Chlorobiphenyl</li> <li>- 2,3-Dichlorobiphenyl</li> <li>- 2,2',5-Trichlorobiphenyl</li> <li>- 2,4',5-Trichlorobiphenyl</li> <li>- 2,2',3,5'-Tetrachlorobiphenyl</li> <li>- 2,2',5,5'-Tetrachlorobiphenyl</li> <li>- 2,3',4,4'-Tetrachlorobiphenyl</li> <li>- 2,2',3,4,5'-Pentachlorobiphenyl</li> <li>- 2,2',4,5,5'-Pentachlorobiphenyl</li> <li>- 2,3,3',4',6-Pentachlorobiphenyl</li> <li>- 2,2',3,4,4',5'-Hexachlorobiphenyl</li> <li>- 2,2',3,4,5,5'-Hexachlorobiphenyl</li> <li>- 2,2',3,5,5',6-Hexachlorobiphenyl</li> <li>- 2,2',4,4',5,5'-Hexachlorobiphenyl</li> <li>- 2,2',3,3',4,4',5-Heptachlorobiphenyl</li> <li>- 2,2',3,4,4',5,5'-Heptachlorobiphenyl</li> <li>- 2,2',3,4,4',5',6-Heptachlorobiphenyl</li> <li>- 2,2',3,4',5,5',6-Heptachlorobiphenyl</li> <li>- 2,2',3,3',4,4',5,5',6-Nonachlorobiphenyl</li> </ul>	<p>1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic Method<sup>[1,9,23]</sup></p> <p>2) Soxhlet Extraction, Gas Chromatographic Method<sup>[10,23]</sup></p> <p>3) Automated Soxhlet Extraction, Gas Chromatographic Method<sup>[22,31]</sup></p>

วิมล

(นางริกาญจน์ ฉัตรสกุลวิไล)

ผู้อำนวยการกลุ่มมาตรฐานวิธีการวิเคราะห์ทดสอบมลพิษ

28 Pentachlorophenol...

ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
28	Pentachlorophenol	1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>[1,9,25]</sup> 2) Soxhlet Extraction, Gas Chromatographic Method <sup>[10,22]</sup> 3) Automated Soxhlet Extraction, Gas Chromatographic Method <sup>[22,31]</sup>
29	pH	Electrometric Method <sup>[29,30]</sup>
30	Selenium	1) Waste Extraction, Digestion, Inductively Coupled Plasma Method <sup>[1,6,15]</sup> 2) Waste Extraction, Digestion, Inductively Coupled Plasma/Mass Spectrometric Method <sup>[1,6,16]</sup> 3) Digestion, Inductively Coupled Plasma Method <sup>[7,15]</sup> 4) Digestion, Inductively Coupled Plasma/Mass Spectrometric Method <sup>[7,16]</sup>
31	Silver	1) Waste Extraction, Digestion, Inductively Coupled Plasma Method <sup>[1,6,15]</sup> 2) Waste Extraction, Digestion, Inductively Coupled Plasma/Mass Spectrometric Method <sup>[1,6,16]</sup>
32	Thallium	1) Waste Extraction, Digestion, Inductively Coupled Plasma Method <sup>[1,6,15]</sup> 2) Waste Extraction, Digestion, Inductively Coupled Plasma/Mass Spectrometric Method <sup>[1,6,16]</sup> 3) Digestion, Inductively Coupled Plasma Method <sup>[7,15]</sup> 4) Digestion, Inductively Coupled Plasma/Mass Spectrometric Method <sup>[7,16]</sup>
33	Toxaphene	1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>[1,9,25]</sup> 2) Soxhlet Extraction, Gas Chromatographic Method <sup>[10,22]</sup> 3) Automated Soxhlet Extraction, Gas Chromatographic Method <sup>[22,31]</sup>
34	Vanadium	1) Waste Extraction, Digestion, Inductively Coupled Plasma Method <sup>[1,6,15]</sup> 2) Waste Extraction, Digestion, Inductively Coupled Plasma/Mass Spectrometric Method <sup>[1,6,16]</sup> 3) Digestion, Inductively Coupled Plasma Method <sup>[7,15]</sup>

วิมล

(นางริกาญจน์ ฉัตรสกุลวิไล)

ผู้อำนวยการกลุ่มมาตรฐานวิชาการวิเคราะห์ทดสอบมลพิษ

4) Digestion...

ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
35	Zinc	4) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method <sup>[7,16]</sup> 1) Waste Extraction, Digestion, Inductively Coupled Plasma Method <sup>[1,6,15]</sup> 2) Waste Extraction, Digestion, Inductively Coupled Plasma/Mass Spectrometric Method <sup>[1,6,16]</sup> 3) Digestion, Inductively Coupled Plasma Method <sup>[7,15]</sup> 4) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method <sup>[7,16]</sup>

ดิน จำนวน 125 รายการ

ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
1	Acenaphthene	Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>[25,31]</sup>
2	Acetone	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>[14,24]</sup>
3	Aldrin	1) Soxhlet Extraction, Gas Chromatographic Method <sup>[10,22]</sup> 2) Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>[25,31]</sup>
4	Anthracene	Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>[25,31]</sup>
5	Antimony	1) Digestion, Inductively Coupled Plasma Method <sup>[7,15]</sup> 2) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method <sup>[7,16]</sup>
6	Arsenic	1) Digestion, Inductively Coupled Plasma Method <sup>[7,15]</sup> 2) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method <sup>[7,16]</sup>
7	Atrazine	1) Soxhlet Extraction, Gas Chromatographic Method <sup>[10,22]</sup> 2) Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>[25,31]</sup>
8	Barium	1) Digestion, Inductively Coupled Plasma Method <sup>[7,15]</sup> 2) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method <sup>[7,16]</sup>

วิมล

(นางริกาณจน์ ฉัตรสกุลวิไล)

ผู้อำนวยการกลุ่มมาตรฐานวิธีการวิเคราะห์ทดสอบมลพิษ

9 Benz(a)anthracene...



ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
9	Benz(a)anthracene	Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>[25,31]</sup>
10	Benzene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>[14,24]</sup>
11	Benzo(b)fluoranthene	Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>[25,31]</sup>
12	Benzo(k)fluoranthene	Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>[25,31]</sup>
13	Benzoic acid	Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>[25,31]</sup>
14	Benzo(a)pyrene	Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>[25,31]</sup>
15	Benzo(g,h,i)perylene	Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>[25,31]</sup>
16	Beryllium	1) Digestion, Inductively Coupled Plasma Method <sup>[7,15]</sup> 2) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method <sup>[7,16]</sup>
17	Bis(2-chloroethyl)ether	Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>[25,31]</sup>
18	Bis(2-ethylhexyl)phthalate	Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>[25,31]</sup>
19	Bromodichloromethane	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>[14,24]</sup>
20	Bromoform	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>[14,24]</sup>
21	Butanol	Equilibrium Headspace, Gas Chromatographic/ Mass Spectrometric Method <sup>[12,24]</sup>
22	Butyl Benzyl Phthalate	Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>[25,31]</sup>
23	Cadmium	1) Digestion, Inductively Coupled Plasma Method <sup>[7,15]</sup> 2) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method <sup>[7,16]</sup>
24	Carbazole	Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>[25,31]</sup>
25	Carbon Disulfide	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>[14,24]</sup>

วิกรม

26 Carbon tetrachloride...

(นางริกาญจน์ ฉัตรสกุลวิไล)

ผู้อำนวยการกลุ่มมาตรฐานวิธีการวิเคราะห์ทดสอบมลพิษ

ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
26	Carbon tetrachloride	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>[14,24]</sup>
27	Chlordane	1) Soxhlet Extraction, Gas Chromatographic Method <sup>[10,22]</sup> 2) Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>[25,31]</sup>
28	p-Chloroaniline	Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>[25,31]</sup>
29	Chlorobenzene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>[14,24]</sup>
30	Chlorodibromomethane	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>[14,24]</sup>
31	Chloroform	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>[14,24]</sup>
32	2-Chlorophenol	Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>[25,31]</sup>
33	Chromium	1) Digestion, Inductively Coupled Plasma Method <sup>[7,15]</sup> 2) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method <sup>[7,16]</sup>
34	Chromium (III)	1) Digestion, Inductively Coupled Plasma Method; Alkaline Digestion, Colorimetric Method; Calculation Method <sup>[7,8,15,17]</sup> 2) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method; Alkaline Digestion, Colorimetric Method; Calculation Method <sup>[7,8,16,17]</sup>
35	Chromium (VI)	Alkaline Digestion, Colorimetric Method <sup>[8,17]</sup>
36	Chrysene	Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>[25,31]</sup>
37	Cyanide	Extraction, Distillation, Colorimetric Method <sup>[26,27,28]</sup>
38	2,4-D	1) Soxhlet Extraction, Gas Chromatographic Method <sup>[10,22]</sup> 2) Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>[25,31]</sup>
39	DDD	1) Soxhlet Extraction, Gas Chromatographic Method <sup>[10,22]</sup> 2) Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>[25,31]</sup>

ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
40	DDE	1) Soxhlet Extraction, Gas Chromatographic Method <sup>[10,22]</sup> 2) Automated Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>[25,31]</sup>
41	DDT	1) Soxhlet Extraction, Gas Chromatographic Method <sup>[10,22]</sup> 2) Automated Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>[25,31]</sup>
42	Dibenz(a,h)anthracene	Automated Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>[25,31]</sup>
43	Di-n-Butyl Phthalate	Automated Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>[25,31]</sup>
44	1,2-Dichlorobenzene	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method <sup>[14,24]</sup>
45	1,3-Dichlorobenzene	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method <sup>[14,24]</sup>
46	1,4-Dichlorobenzene	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method <sup>[14,24]</sup>
47	3,3-Dichlorobenzidine	Automated Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>[25,31]</sup>
48	1,1-Dichloroethane	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method <sup>[14,24]</sup>
49	1,2-Dichloroethane	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method <sup>[14,24]</sup>
50	1,1-Dichloroethylene	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method <sup>[14,24]</sup>
51	cis-1,2-Dichloroethylene	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method <sup>[14,24]</sup>
52	trans-1,2-Dichloroethylene	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method <sup>[14,24]</sup>
53	2,4-Dichlorophenol	Automated Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>[25,31]</sup>
54	1,2-Dichloropropane	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method <sup>[14,24]</sup>
55	1,3-Dichloropropane	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method <sup>[14,24]</sup>
56	1,3-Dichloropropene	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method <sup>[14,24]</sup>

วิภาณี

(นางริกาญจน์ ฉัตรสกุลวิไล)

57 Dieldrin...



ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
57	Dieldrin	1) Soxhlet Extraction, Gas Chromatographic Method <sup>[10,22]</sup> 2) Automated Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>[25,31]</sup>
58	Diethyl Phthalate	Automated Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>[25,31]</sup>
59	2,4-Dimethylphenol	Automated Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>[25,31]</sup>
60	2,4-Dinitrophenol	Automated Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>[25,31]</sup>
61	2,4-Dinitrotoluene	Automated Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>[25,31]</sup>
62	2,6-Dinitrotoluene	Automated Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>[25,31]</sup>
63	Di-n-Octyl Phthalate	Automated Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>[25,31]</sup>
64	Endosulfan	1) Soxhlet Extraction, Gas Chromatographic Method <sup>[10,22]</sup> 2) Automated Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>[25,31]</sup>
65	Endrin	1) Soxhlet Extraction, Gas Chromatographic Method <sup>[10,22]</sup> 2) Automated Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>[25,31]</sup>
66	Ethylbenzene	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method <sup>[14,24]</sup>
67	Fluoranthene	Automated Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>[25,31]</sup>
68	Fluorene	Automated Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>[25,31]</sup>
69	Heptachlor	1) Soxhlet Extraction, Gas Chromatographic Method <sup>[10,22]</sup> 2) Automated Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>[25,31]</sup>
70	Heptachlor Epoxide	1) Soxhlet Extraction, Gas Chromatographic Method <sup>[10,22]</sup> 2) Automated Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>[25,31]</sup>

ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
71	Hexachlorobenzene	1) Soxhlet Extraction, Gas Chromatographic Method <sup>[10,22]</sup> 2) Automated Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>[25,31]</sup>
72	Hexachloro-1,3-butadiene	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method <sup>[14,24]</sup>
73	n-Hexane	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method <sup>[14,24]</sup>
74	$\alpha$ -HCH	1) Soxhlet Extraction, Gas Chromatographic Method <sup>[10,22]</sup> 2) Automated Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>[25,31]</sup>
75	$\beta$ -HCH	1) Soxhlet Extraction, Gas Chromatographic Method <sup>[10,22]</sup> 2) Automated Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>[25,31]</sup>
76	$\gamma$ -HCH	1) Soxhlet Extraction, Gas Chromatographic Method <sup>[10,22]</sup> 2) Automated Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>[25,31]</sup>
77	Hexachlorocyclopentadiene	Automated Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>[25,31]</sup>
78	Hexachloroethane	Automated Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>[25,31]</sup>
79	Indeno(1,2,3-cd)pyrene	Automated Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>[25,31]</sup>
80	Isophorone	Automated Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>[25,31]</sup>
81	Lead	1) Digestion, Inductively Coupled Plasma Method <sup>[7,15]</sup> 2) Digestion, Inductively Coupled Plasma/Mass Spectrometric Method <sup>[7,16]</sup>
82	Manganese	1) Digestion, Inductively Coupled Plasma Method <sup>[7,15]</sup> 2) Digestion, Inductively Coupled Plasma/Mass Spectrometric Method <sup>[7,16]</sup>
83	Mercury	1) Digestion, Cold-Vapor Atomic Absorption Spectrometric Method <sup>[18]</sup>

วิมล

(นางริกาญจน์ ฉัตรสกุลวิไล)

ผู้อำนวยการกลุ่มมาตรฐานวิธีการวิเคราะห์ทดสอบมลพิษ

และหน่วยงานบังคับปฏิบัติการ

2) Thermal...

ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
84	Methanol	2) Thermal Decomposition, Amalgamation, and Atomic Absorption Spectrophotometry <sup>[19]</sup> 3) Digestion, Cold-Vapor Atomic Fluorescence Spectrometric Method <sup>[20]</sup> Equilibrium Headspace, Gas Chromatographic/Mass Spectrometric Method <sup>[12,24]</sup>
85	Methoxychlor	1) Soxhlet Extraction, Gas Chromatographic Method <sup>[10,22]</sup> 2) Automated Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>[25,31]</sup>
86	Methyl Bromide	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method <sup>[14,24]</sup>
87	Methylene Chloride	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method <sup>[14,24]</sup>
88	2-methylphenol	Automated Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>[25,31]</sup>
89	2-Methylnaphthalene	Automated Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>[25,31]</sup>
90	Methyl tert-Butyl Ether	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method <sup>[14,24]</sup>
91	Naphthalene	Automated Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>[25,31]</sup>
92	Nickel	1) Digestion, Inductively Coupled Plasma Method <sup>[7,15]</sup> 2) Digestion, Inductively Coupled Plasma/Mass Spectrometric Method <sup>[7,16]</sup>
93	Nitrobenzene	Automated Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>[25,31]</sup>
94	N-Nitrosodiphenylamine	Automated Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>[25,31]</sup>
95	N-Nitrosodi-n-propylamine	Automated Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>[25,31]</sup>
96	Polychlorinated biphenyls (PCBs) - Aroclor 1016 - Aroclor 1221 - Aroclor 1232	1) Soxhlet Extraction, Gas Chromatographic Method <sup>[10,23]</sup> 2) Automated Soxhlet Extraction, Gas Chromatographic Method <sup>[23,32]</sup>

วิฑูรย์

(นางริกาญจน์ ฉัตรสกุลวิไล)

- Aroclor 1242...



ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
	<ul style="list-style-type: none"> <li>- Aroclor 1242</li> <li>- Aroclor 1248</li> <li>- Aroclor 1254</li> <li>- Aroclor 1260</li> <li>- 2-Chlorobiphenyl</li> <li>- 2,2',3,5'-Tetrachlorobiphenyl</li> <li>- 2,2',5,5'-Tetrachlorobiphenyl</li> <li>- 2,3',4,4'-Tetrachlorobiphenyl</li> <li>- 2,2',3,4,5'-Pentachlorobiphenyl</li> <li>- 2,2',4,5,5'-Pentachlorobiphenyl</li> <li>- 2,3,3',4',6-Pentachlorobiphenyl</li> <li>- 2,2',3,4,4',5'-Hexachlorobiphenyl</li> <li>- 2,2',3,4,5,5'-Hexachlorobiphenyl</li> <li>- 2,2',3,5,5',6-Hexachlorobiphenyl</li> <li>- 2,2',4,4',5,5'-Hexachlorobiphenyl</li> <li>- 2,2',3,3',4,4',5-Heptachlorobiphenyl</li> <li>- 2,2',3,4,4',5,5'-Heptachlorobiphenyl</li> <li>- 2,2',3,4,4',5',6-Heptachlorobiphenyl</li> <li>- 2,2',3,4',5,5',6-Heptachlorobiphenyl</li> <li>- 2,2',3,3',4,4',5,5',6-Nonachlorobiphenyl</li> </ul>	
97	Pentachlorophenol	Automated Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>[25,31]</sup>
98	Phenanthrene	Automated Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>[25,31]</sup>
99	Phenol	Automated Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>[25,31]</sup>
100	Pyrene	Automated Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>[25,31]</sup>

ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
101	Selenium	1) Digestion, Inductively Coupled Plasma Method <sup>[7,15]</sup> 2) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method <sup>[7,16]</sup>
102	Silver	1) Digestion, Inductively Coupled Plasma Method <sup>[7,15]</sup> 2) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method <sup>[7,16]</sup>
103	Styrene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>[14,24]</sup>
104	1,1,2,2-Tetrachloroethane	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>[14,24]</sup>
105	Tetrachloroethylene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>[14,24]</sup>
106	Toluene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>[14,24]</sup>
107	Toxaphene	1) Soxhlet Extraction, Gas Chromatographic Method <sup>[10,22]</sup> 2) Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>[25,31]</sup>
108	TPH (C <sub>5</sub> -C <sub>8</sub> )	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>[14,24]</sup>
109	TPH (C <sub>8</sub> - C <sub>16</sub> )	1) Solvent Extraction, Gas Chromatographic Method <sup>[11,21]</sup> 2) Automated Soxhlet Extraction, Gas Chromatographic Method <sup>[21,31]</sup>
110	TPH (C <sub>16</sub> - C <sub>35</sub> )	1) Solvent Extraction, Gas Chromatographic Method <sup>[11,21]</sup> 2) Automated Soxhlet Extraction, Gas Chromatographic Method <sup>[21,31]</sup>
111	1,2,4-Trichlorobenzene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>[14,24]</sup>
112	1,1,1-Trichloroethane	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>[14,24]</sup>
113	1,1,2-Trichloroethane	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>[14,24]</sup>
114	Trichloroethylene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>[14,24]</sup>
115	2,4,5-Trichlorophenol	Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>[25,31]</sup>

วิมล

116 2,4,6-Trichlorophenol...

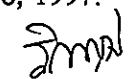
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ผู้อำนวยการกลุ่มมาตรฐานวิธีการวิเคราะห์ทดสอบมลพิษ

ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
116	2,4,6-Trichlorophenol	Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>[25,31]</sup>
117	1,3,5-Trimethylbenzene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>[14,24]</sup>
118	Vanadium	1) Digestion, Inductively Coupled Plasma Method <sup>[7,15]</sup> 2) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method <sup>[7,16]</sup>
119	Vinyl Acetate	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>[14,24]</sup>
120	Vinyl Chloride	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>[14,24]</sup>
121	m-Xylene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>[14,24]</sup>
122	o-Xylene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>[14,24]</sup>
123	p-Xylene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>[14,24]</sup>
124	Xylene (Total)	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>[14,24]</sup>
125	Zinc	1) Digestion, Inductively Coupled Plasma Method <sup>[7,15]</sup> 2) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method <sup>[7,16]</sup>

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(นางริกาญจน์ ฉัตรสกุลไธ)

ผู้อำนวยการกลุ่มมาตรฐานวิธีการวิเคราะห์ทดสอบมลพิษ  
และทะเบียนห้องปฏิบัติการ



ที่ อก ๐๓๑๐(๑)/ ๕ ๓ ๗ ๙

กรมโรงงานอุตสาหกรรม  
ถนนพระรามที่ ๖ แขวงทุ่งพญาไท  
เขตราชเทวี กรุงเทพฯ ๑๐๔๐๐

๐ ๙ มีนาคม ๒๕๖๖

เรื่อง เปลี่ยนแปลงบุคลากรของห้องปฏิบัติการวิเคราะห์

เรียน กรรมการผู้จัดการ บริษัท เอแอลเอส แลบบอราทอรี กรุ๊ป (ประเทศไทย) จำกัด

อ้างถึง คำขอขึ้นทะเบียน/ต่ออายุ/เปลี่ยนแปลงบุคลากร และชนิดสารมลพิษของห้องปฏิบัติการวิเคราะห์เอกชน  
ลงวันที่ ๔ กุมภาพันธ์ ๒๕๖๖

ตามหนังสือที่อ้างถึง บริษัท เอแอลเอส แลบบอราทอรี กรุ๊ป (ประเทศไทย) จำกัด ห้องปฏิบัติการวิเคราะห์เอกชน เลขทะเบียน ว-๒๐๔ สถานที่ตั้งเลขที่ ๑๐๔ ซอยพัฒนาการ ๔๐ ถนนพัฒนาการ แขวงพัฒนาการ เขตสวนหลวง กรุงเทพมหานคร ขอเปลี่ยนแปลงบุคลากรของห้องปฏิบัติการวิเคราะห์ ความละเอียดแจ้งแล้ว นั้น

กรมโรงงานอุตสาหกรรมพิจารณาแล้ว มีความเห็นดังนี้

๑. ให้ยกเลิกเจ้าหน้าที่ประจำห้องปฏิบัติการวิเคราะห์ จำนวน ๑๙ ราย

- |                                 |                            |
|---------------------------------|----------------------------|
| ๑) นายนคร สุขเจริญ              | ทะเบียนเลขที่ ว-๒๐๔-จ-๖๑๒๒ |
| ๒) นายบัญชา นามเขตต์            | ทะเบียนเลขที่ ว-๒๐๔-จ-๖๑๒๓ |
| ๓) นายอรรคพล นิยมวิทย์พาณ       | ทะเบียนเลขที่ ว-๒๐๔-จ-๗๐๘๗ |
| ๔) นางสาวพัชรียา หงษ์สมดี       | ทะเบียนเลขที่ ว-๒๐๔-จ-๗๑๐๓ |
| ๕) นางสาวภาณิดา สุรวงศ์ตระกูล   | ทะเบียนเลขที่ ว-๒๐๔-จ-๗๑๐๔ |
| ๖) นางสาวศรณีย์ ยิ่งดี          | ทะเบียนเลขที่ ว-๒๐๔-จ-๗๕๐๙ |
| ๗) นายสมโภช วันสา               | ทะเบียนเลขที่ ว-๒๐๔-จ-๗๕๑๙ |
| ๘) นายณัฐนันท์ ปานประเสริฐ      | ทะเบียนเลขที่ ว-๒๐๔-จ-๗๘๑๙ |
| ๙) ว่าที่ร้อยตรีภาณุพงศ์ แสนศรี | ทะเบียนเลขที่ ว-๒๐๔-จ-๗๘๓๖ |
| ๑๐) นายมนินทร์ พูลศิริ          | ทะเบียนเลขที่ ว-๒๐๔-จ-๘๖๐๒ |
| ๑๑) นายณัฐดนัย เจือละออง        | ทะเบียนเลขที่ ว-๒๐๔-จ-๘๖๐๗ |
| ๑๒) นางสาวกาญจนา คงคุณ          | ทะเบียนเลขที่ ว-๒๐๔-จ-๙๒๒๙ |
| ๑๓) นางสาวรัชนิกร เนียมกลาง     | ทะเบียนเลขที่ ว-๒๐๔-จ-๙๒๓๗ |
| ๑๔) นางสาวกัญญารัตน์ ศรีนิลทา   | ทะเบียนเลขที่ ว-๒๐๔-จ-๙๒๓๘ |
| ๑๕) นายศิริวัฒน์ พานิชย์        | ทะเบียนเลขที่ ว-๒๐๔-จ-๙๒๔๑ |
| ๑๖) นางสาวกนกภรณ์ อูระ          | ทะเบียนเลขที่ ว-๒๐๔-จ-๙๒๔๕ |
| ๑๗) นางสาวจิตสุภา ประเทืองสุข   | ทะเบียนเลขที่ ว-๒๐๔-จ-๙๒๔๗ |
| ๑๘) นางสาวอริสา วิริยขันติธรรม  | ทะเบียนเลขที่ ว-๒๐๔-จ-๙๒๔๘ |
| ๑๙) นางสาวพนิดา ยอดอินทร์       | ทะเบียนเลขที่ ว-๒๐๔-จ-๙๒๕๐ |

๒. ให้เพิ่มเจ้าหน้าที่...



๒. ให้เพิ่มเจ้าหน้าที่ประจำห้องปฏิบัติการวิเคราะห์ จำนวน ๕ ราย

- |                                 |                            |
|---------------------------------|----------------------------|
| ๑) นายกาจบัณฑิต กิตติสุขภวณิชย์ | ทะเบียนเลขที่ ว-๒๐๔-จ-๐๐๐๑ |
| ๒) นายภัทรพล สว่างใจธรรม์       | ทะเบียนเลขที่ ว-๒๐๔-จ-๐๐๐๒ |
| ๓) นายนราธิป เทือกชัยคำ         | ทะเบียนเลขที่ ว-๒๐๔-จ-๐๐๐๓ |
| ๔) นายศิริโชค พงษ์ประสม         | ทะเบียนเลขที่ ว-๒๐๔-จ-๐๐๐๔ |
| ๕) นายณัฐวุฒิ ดั่งแพง           | ทะเบียนเลขที่ ว-๒๐๔-จ-๐๐๐๕ |

อนึ่ง หนังสือฉบับนี้จะหมดอายุพร้อมหนังสือต่ออายุรับขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์เอกชน ที่ อก ๐๓๑๐(๑)/๑๐๖๔ ลงวันที่ ๒๘ มกราคม ๒๕๖๔ คือในวันที่ ๒ กันยายน ๒๕๖๖ ทั้งนี้ สามารถยื่นคำขอผ่านระบบอิเล็กทรอนิกส์ได้ที่หน้าเว็บไซต์กรมโรงงานอุตสาหกรรม ตาม QR Code ทำหนังสือฉบับนี้

จึงเรียนมาเพื่อทราบ

ขอแสดงความนับถือ



(นางริกาญจน์ นัตรสกุลวิไล)

นักวิทยาศาสตร์ชำนาญการพิเศษ รักษาการแทน

ผู้อำนวยการกองวิจัยและเตือนภัยมลพิษโรงงาน

ปฏิบัติราชการแทนอธิบดีกรมโรงงานอุตสาหกรรม

กองวิจัยและเตือนภัยมลพิษโรงงาน

กลุ่มมาตรฐานวิธีการวิเคราะห์ทดสอบมลพิษและทะเบียนห้องปฏิบัติการ

โทร. ๐ ๒๔๓๐ ๖๓๑๒ ต่อ ๒๑๐๓-๕

โทรสาร ๐ ๒๔๓๐ ๖๓๑๒ ต่อ ๒๑๔๙

ไปรษณีย์อิเล็กทรอนิกส์ saraban@diw.mail.go.th



ที่ อก ๐๓๑๐(๑)/ ๖ ๑ ๒ ๕



กรมโรงงานอุตสาหกรรม  
ถนนพระรามที่ ๖ แขวงทุ่งพญาไท  
เขตราชเทวี กรุงเทพฯ ๑๐๔๐๐

๒ ๓ มีนาคม ๒๕๖๖

เรื่อง เปลี่ยนแปลงบุคลากรของห้องปฏิบัติการวิเคราะห์

เรียน กรรมการผู้จัดการ บริษัท เอแอลเอส แลบบอราทอรี กรุ๊ป (ประเทศไทย) จำกัด

อ้างถึง คำขอขึ้นทะเบียน/ต่ออายุ/เปลี่ยนแปลงบุคลากร และชนิดสารมลพิษของห้องปฏิบัติการวิเคราะห์เอกชน  
ลงวันที่ ๑๐ มีนาคม ๒๕๖๖

ตามหนังสือที่อ้างถึง บริษัท เอแอลเอส แลบบอราทอรี กรุ๊ป (ประเทศไทย) จำกัด  
ห้องปฏิบัติการวิเคราะห์เอกชน เลขทะเบียน ว-๒๐๔ สถานที่ตั้งเลขที่ ๑๐๔ ซอยพัฒนาการ ๔๐  
ถนนพัฒนาการ แขวงพัฒนาการ เขตสวนหลวง กรุงเทพมหานคร ขอเปลี่ยนแปลงบุคลากรของห้องปฏิบัติการ  
วิเคราะห์ ความละเอียดแจ้งแล้ว นั้น

กรมโรงงานอุตสาหกรรมพิจารณาแล้ว ให้เปลี่ยนแปลงชื่อเจ้าหน้าที่ประจำห้องปฏิบัติการ  
วิเคราะห์ จากเดิม นางสาวสรารค์มี มงคลจิรวุฒิ ทะเบียนเลขที่ ว-๒๐๔-จ-๔๗๑๙ เป็น นางสาวธัญญธร มงคลจิรวุฒิ  
ทะเบียนเลขที่ ว-๒๐๔-จ-๔๗๑๙

ทั้งนี้ หากท่านมีความประสงค์จะยื่นคำขอใดๆ สามารถยื่นคำขอผ่านระบบอิเล็กทรอนิกส์  
ได้ที่หน้าเว็บไซต์กรมโรงงานอุตสาหกรรม ตาม QR Code ท้ายหนังสือฉบับนี้

จึงเรียนมาเพื่อทราบ

ขอแสดงความนับถือ

-(นายประสม ดำรงพงษ์)

ผู้อำนวยการกองวิจัยและเตือนภัยมลพิษโรงงาน  
ปฏิบัติราชการแทนอธิบดีกรมโรงงานอุตสาหกรรม

กองวิจัยและเตือนภัยมลพิษโรงงาน

กลุ่มมาตรฐานวิธีการวิเคราะห์ทดสอบมลพิษและทะเบียนห้องปฏิบัติการ

โทร. ๐ ๒๔๓๐ ๖๓๑๒ ต่อ ๒๑๐๓-๕

โทรสาร ๐ ๒๔๓๐ ๖๓๑๒ ต่อ ๒๑๙๙

ไปรษณีย์อิเล็กทรอนิกส์ saraban@diw.mail.go.th



ยื่นคำขอผ่านระบบอิเล็กทรอนิกส์



“อุตสาหกรรมก้าวไกล ประเทศไทยก้าวหน้า ร่วมกันพัฒนา อุตสาหกรรมสีเขียว”







ที่ อก ๐๓๑๐(๓)/ ๖๔๗๐

กรมโรงงานอุตสาหกรรม  
ถนนพระรามที่ ๖ แขวงทุ่งพญาไท  
เขตราชเทวี กรุงเทพฯ ๑๐๔๐๐

๒๘ มิถุนายน ๒๕๖๕

เรื่อง ขันทะเบียนห้องปฏิบัติการวิเคราะห์เอกชน

เรียน กรรมการผู้จัดการ บริษัท เอแอลเอส แลборาทอรี กรุ๊ป (ประเทศไทย) จำกัด

อ้างถึง คำขอขึ้นทะเบียน/ต่ออายุ/เปลี่ยนแปลงบุคลากร และชนิดสารมลพิษของห้องปฏิบัติการวิเคราะห์เอกชน  
ลงวันที่ ๒๙ เมษายน ๒๕๖๔

สิ่งที่ส่งมาด้วย เอกสารแนบท้ายหนังสือรับขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์เอกชน

บริษัท เอแอลเอส แลборาทอรี กรุ๊ป (ประเทศไทย) จำกัด จำนวน ๒ แผ่น

ตามหนังสือที่อ้างถึง บริษัท เอแอลเอส แลборาทอรี กรุ๊ป (ประเทศไทย) จำกัด ขอขึ้นทะเบียน  
ห้องปฏิบัติการวิเคราะห์เอกชน พร้อมรายชื่อผู้ควบคุมดูแลห้องปฏิบัติการวิเคราะห์ เจ้าหน้าที่ประจำ  
ห้องปฏิบัติการวิเคราะห์ และรายการสารมลพิษที่จะทำการวิเคราะห์ ต่อกรมโรงงานอุตสาหกรรม นั้น

กรมโรงงานอุตสาหกรรมพิจารณาแล้ว ให้บริษัท เอแอลเอส แลборาทอรี กรุ๊ป  
(ประเทศไทย) จำกัด ขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์เอกชน มีเลขทะเบียน ว-๓๒๓ สถานที่ตั้งเลขที่  
๖๑๖/๑๐ หมู่ที่ ๕ ตำบลแม่น้ำคู้ อำเภอลวกแดง จังหวัดระยอง โดยมีองค์ประกอบดังนี้

ก. ผู้ควบคุมดูแลห้องปฏิบัติการวิเคราะห์

- |                          |               |              |
|--------------------------|---------------|--------------|
| ๑) นายเดช ช้างชน         | ทะเบียนเลขที่ | ว-๓๒๓-ค-๙๔๔๒ |
| ๒) นางวิลาวัลย์ บริรักษ์ | ทะเบียนเลขที่ | ว-๓๒๓-ค-๙๔๔๓ |
| ๓) นายสุพจน์ สลามเต๊ะ    | ทะเบียนเลขที่ | ว-๓๒๓-ค-๙๔๔๔ |

ข. เจ้าหน้าที่ประจำห้องปฏิบัติการวิเคราะห์

- |                                 |               |              |
|---------------------------------|---------------|--------------|
| ๑) นางสาวนฤมล บรรจงกิจ          | ทะเบียนเลขที่ | ว-๓๒๓-จ-๙๔๔๕ |
| ๒) นางพจนา สีดา                 | ทะเบียนเลขที่ | ว-๓๒๓-จ-๙๔๔๖ |
| ๓) นางสาวธนิดา กุลสุริวงศ์      | ทะเบียนเลขที่ | ว-๓๒๓-จ-๙๔๔๗ |
| ๔) นายพิทยา ทองแดง              | ทะเบียนเลขที่ | ว-๓๒๓-จ-๙๔๔๘ |
| ๕) นางชลธิชา สุนงข              | ทะเบียนเลขที่ | ว-๓๒๓-จ-๙๔๔๙ |
| ๖) ว่าที่ ร.ต.รณชัย ม่วงมา      | ทะเบียนเลขที่ | ว-๓๒๓-จ-๙๔๕๐ |
| ๗) นายวรารุณ พับพา              | ทะเบียนเลขที่ | ว-๓๒๓-จ-๙๔๕๑ |
| ๘) นายศักดิ์รินทร์ จรัสกาย      | ทะเบียนเลขที่ | ว-๓๒๓-จ-๙๔๕๒ |
| ๙) นายสุรศักดิ์ สาชิน           | ทะเบียนเลขที่ | ว-๓๒๓-จ-๙๔๕๓ |
| ๑๐) นางสาวเพชรคุณ ภาภูตานนท์    | ทะเบียนเลขที่ | ว-๓๒๓-จ-๙๔๕๔ |
| ๑๑) นายสถาพร ถาแก้ว             | ทะเบียนเลขที่ | ว-๓๒๓-จ-๙๔๕๕ |
| ๑๒) นายสุทธิดำรงค์ โชคปิตินันท์ | ทะเบียนเลขที่ | ว-๓๒๓-จ-๙๔๕๖ |



๑๓) นายวัลลภ หันไชยเนาว์	ทะเบียนเลขที่	ว-๓๒๓-จ-๙๔๕๗
๑๔) นางสาววนาลี เจริญตระกูล	ทะเบียนเลขที่	ว-๓๒๓-จ-๙๔๕๘
๑๕) นางสาวนิตา ผดุงจิตต์	ทะเบียนเลขที่	ว-๓๒๓-จ-๙๔๕๙
๑๖) นายธนะสิทธิ์ วงศ์ษาไชย	ทะเบียนเลขที่	ว-๓๒๓-จ-๙๔๖๐
๑๗) นายชัยนุสรณ์ เลิศนันทกุลชัย	ทะเบียนเลขที่	ว-๓๒๓-จ-๙๔๖๑
๑๘) นายสัจจา เพ็ชรแสง	ทะเบียนเลขที่	ว-๓๒๓-จ-๙๔๖๒
๑๙) นายกันตภณ มณีสัมพันธ์	ทะเบียนเลขที่	ว-๓๒๓-จ-๙๔๖๓
๒๐) นางสาวจันทนีย์ โกเมนชนะ	ทะเบียนเลขที่	ว-๓๒๓-จ-๙๔๖๔
๒๑) นายธารินทร์ อ็อกจินดา	ทะเบียนเลขที่	ว-๓๒๓-จ-๙๔๖๕
๒๒) นายศุภณัฐ พิสัยพันธ์	ทะเบียนเลขที่	ว-๓๒๓-จ-๙๔๖๖
๒๓) นายศุภชัย วงศ์สุริย์ฉาย	ทะเบียนเลขที่	ว-๓๒๓-จ-๙๔๖๗
๒๔) นายปฐมพงศ์ กรสวัสดิ์	ทะเบียนเลขที่	ว-๓๒๓-จ-๙๔๖๘
๒๕) นายไสว ตันโพธิ์	ทะเบียนเลขที่	ว-๓๒๓-จ-๙๔๖๙
๒๖) นางสาวกิตติยา สัญญาอริยาภรณ์	ทะเบียนเลขที่	ว-๓๒๓-จ-๙๔๗๐
๒๗) นางสาวเจษฎาพร ศรีบุญเรือง	ทะเบียนเลขที่	ว-๓๒๓-จ-๙๔๗๑
๒๘) นางสาวมธุรินทร์ สิงห์เงา	ทะเบียนเลขที่	ว-๓๒๓-จ-๙๔๗๒
๒๙) นางสาวธิดารัตน์ ศิริมังคะโร	ทะเบียนเลขที่	ว-๓๒๓-จ-๙๔๗๓
๓๐) นายพิพัฒน์ นิภัทร์เศรษฐ์	ทะเบียนเลขที่	ว-๓๒๓-จ-๙๔๗๔
๓๑) นายศิริวิทย์ เรืองสม	ทะเบียนเลขที่	ว-๓๒๓-จ-๙๔๗๕
๓๒) นายปารามศ สัตยาคุณ	ทะเบียนเลขที่	ว-๓๒๓-จ-๙๔๗๖
๓๓) นายนฤนาท ธรรมสโร	ทะเบียนเลขที่	ว-๓๒๓-จ-๙๔๗๗
๓๔) นางสาวศุภรัตน์ โสจันทร์	ทะเบียนเลขที่	ว-๓๒๓-จ-๙๔๗๘
๓๕) นายพชรกร อินทรเสนา	ทะเบียนเลขที่	ว-๓๒๓-จ-๙๔๗๙
๓๖) นายทิวากร เชื้อมาก	ทะเบียนเลขที่	ว-๓๒๓-จ-๙๔๘๐
๓๗) นายอนุรักษ์ ทองขจรศักดิ์	ทะเบียนเลขที่	ว-๓๒๓-จ-๙๔๘๑
๓๘) นายอภิชาติ วิชาศ	ทะเบียนเลขที่	ว-๓๒๓-จ-๙๔๘๒
๓๙) นายจรัสระวี ศรีรักษา	ทะเบียนเลขที่	ว-๓๒๓-จ-๙๔๘๓
๔๐) นายประสานมิตร เชื้อนเพชร	ทะเบียนเลขที่	ว-๓๒๓-จ-๙๔๘๔
๔๑) นายภาณุวัฒน์ วังบง	ทะเบียนเลขที่	ว-๓๒๓-จ-๙๔๘๕
๔๒) นายสันติ ชัยชนะ	ทะเบียนเลขที่	ว-๓๒๓-จ-๙๔๘๖
๔๓) นายสิทธิชัย แก้วเกตุ	ทะเบียนเลขที่	ว-๓๒๓-จ-๙๔๘๗
๔๔) นายทินกร กุลชาติ	ทะเบียนเลขที่	ว-๓๒๓-จ-๙๔๘๘

ค. ขอบข่ายสารมลพิษที่ได้รับขึ้นทะเบียนให้วิเคราะห์ในน้ำเสีย จำนวน ๑๔ รายการ  
อากาศเสีย (ปล่องระบาย) จำนวน ๗ รายการ และน้ำใต้ดิน จำนวน ๓ รายการ รวมทั้งสิ้นจำนวน ๒๔ รายการ  
ตามสิ่งที่ส่งมาด้วย

หนังสือฉบับนี้มีอายุ ๓ ปี นับจากวันที่กรมโรงงานอุตสาหกรรมออกหนังสือ หากประสงค์จะต่ออายุหนังสือรับขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์เอกชน ให้ยื่นคำขอต่ออายุพร้อมเอกสารประกอบคำขอต่อกรมโรงงานอุตสาหกรรมภายใน ๓๐ วัน ก่อนวันสิ้นอายุของหนังสือรับขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์เอกชน ซึ่งคำขอต่ออายุดังกล่าวขอรับได้ที่กรมโรงงานอุตสาหกรรม

จึงเรียนมาเพื่อทราบ

ขอแสดงความนับถือ



(นางจินดา เตชะศรีนทร์)

ผู้อำนวยการกองวิจัยและเตือนภัยมลพิษโรงงาน  
ปฏิบัติราชการแทนอธิบดีกรมโรงงานอุตสาหกรรม

๒๘ มิ.ย. ๒๕๖๔

กองวิจัยและเตือนภัยมลพิษโรงงาน

ศูนย์วิจัยและเตือนภัยมลพิษโรงงานภาคตะวันออก

โทร. ๐ ๓๘๐๕ ๗๒๖๑-๓

ไปรษณีย์อิเล็กทรอนิกส์ [eirw@diw.mail.go.th](mailto:eirw@diw.mail.go.th)



เอกสารแนบท้ายหนังสือรับขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์เอกชน

บริษัท เอแอลเอส แลบบอราทอรี กรุ๊ป (ประเทศไทย) จำกัด เลขทะเบียน ว-๓๒๓

ที่ ออก ๐๓๑๐(๓)/

๖๔๗๐

ลงวันที่

๒๘

มิถุนายน

๒๕๖๔

ขอขยาสารมลพิษที่ได้รับขึ้นทะเบียนจากกรมโรงงานอุตสาหกรรม จำนวน ๒๔ รายการ  
น้ำเสีย จำนวน 14 รายการ

ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
1	Biochemical Oxygen Demand	1) 5-Day BOD Test, Membrane Electrode Method <sup>[2]</sup> 2) 5-Day BOD Test, Azide Modification Method <sup>[2]</sup>
2	Chemical Oxygen Demand	1) Open Reflux, Titrimetric Method <sup>[2]</sup> 2) Closed Reflux, Colorimetric Method <sup>[2]</sup> 3) Closed Reflux, Titrimetric Method <sup>[2]</sup>
3	Color	ADMI Weighted – Ordinate Spectrophotometric Method <sup>[2]</sup>
4	Cyanide	Distillation, Colorimetric Method <sup>[2]</sup>
5	Formaldehyde	Distillation, Colorimetric Method <sup>[1]</sup>
6	Free Chlorine	DPD-Ferrous Titrimetric Method <sup>[2]</sup>
7	Oil and Grease	Liquid-Liquid Partition-Gravimetric Method <sup>[2]</sup>
8	pH	Electrometric Method <sup>[2]</sup>
9	Phenols	1) Distillation, Chloroform Extraction Method <sup>[2]</sup> 2) Distillation, Direct Photometric Method <sup>[2]</sup>
10	Sulfide	ZnS Precipitation, Iodometric Method <sup>[2]</sup>
11	Temperature	Laboratory and Field Method <sup>[2]</sup>
12	Total Dissolved Solids	Dried at 180 °C <sup>[2]</sup>
13	Total Kjeldahl Nitrogen	Semi-Micro Kjeldahl Method <sup>[2]</sup>
14	Total Suspended Solids	Dried at 103-105 °C <sup>[2]</sup>

อากาศเสีย (ปล่อยระบาย) จำนวน 7 รายการ

ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
1	Carbon Monoxide	1) Sampling Bag, Non-Dispersive Infrared Method <sup>[5]</sup> 2) Instrumental Analyzer Method <sup>[8]</sup>
2	Hydrogen Sulfide	Absorption Sampling, Iodometric Method <sup>[5]</sup>
3	Opacity	Ringelmann's Method <sup>[3,4]</sup>
4	Oxide of Nitrogen	1) Absorption Sampling, Phenoldisulfonic Acid Method <sup>[6]</sup> 2) Instrumental Analyzer Method <sup>[9]</sup>
5	Sulfur Dioxide	1) Absorption Sampling, Barium-Thorin Titrimetric Method <sup>[5]</sup> 2) Instrumental Analyzer Method <sup>[10]</sup>

วิภา สัมฤทธิ์ผล

(นางสาววิชุดา สัมฤทธิ์ผล)

ผู้อำนวยการ

ศูนย์วิจัยและเตือนภัยมลพิษโรงงานภาคตะวันออก

Sulfuric Acid...



ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
6	Sulfuric Acid	Isokinetic Sampling, Barium – Thorin Titrimetric Method <sup>[6]</sup>
7	Total Suspended Particulate	Isokinetic Sampling, Gravimetric Method <sup>[7]</sup>

น้ำใต้ดิน จำนวน 3 รายการ

ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
1	Cyanide	Distillation, Colorimetric Method <sup>[2]</sup>
2	pH	Electrometric Method <sup>[2]</sup>
3	Phenols	Distillation, Direct Photometric Method <sup>[2]</sup>

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วิภา สัมฤทธิ์ผล

(นางสาววิชุดา สัมฤทธิ์ผล)

ผู้อำนวยการ

ศูนย์วิจัยและเตือนภัยมลพิษโรงงานภาคตะวันออก

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