

ภาคผนวก ง

---

ใบรับรองการสอบเทียบเครื่องมือ

รายการเครื่องมือที่ใช้ในการวิเคราะห์ / ทดสอบ

Sample Name	Parameter	Equipment Name	ID No.	Calibrated Date	Next Cal	Freq. Calibrate (Months)
Stack	Total Suspended Particulate	Console Control Unit	BKK_FS0518	12-Jul-22	12-Jan-23	6
Stack	Total Suspended Particulate	Console Control Unit	BKK_FS0468	12-Jul-22	12-Jan-23	6
Stack	Total Suspended Particulate	Console Control Unit	BKK_FS0556	12-Jul-22	12-Jan-23	6
Stack	Total Suspended Particulate	Console Control Unit	BKK_FS0527	12-Jul-22	12-Jan-23	6
Stack	Total Suspended Particulate	Flue gas Analyzer	RYG_FS0564	9-Dec-21	9-Dec-22	12
Stack	Total Suspended Particulate	Flue gas Analyzer	RYG_FS0565	1-Dec-21	1-Dec-22	12
Stack	Total Suspended Particulate	Flue gas Analyzer	RYG_FS0563	9-Dec-21	9-Dec-22	12
Stack	Total Suspended Particulate	Analytical Balance 4 D.	RYG_EN0003	23-Mar-22	23-Mar-23	12
Stack	Carbon Monoxide	Console Control Unit	BKK_FS0518	12-Jul-22	12-Jan-23	6
Stack	Carbon Monoxide	Console Control Unit	BKK_FS0468	12-Jul-22	12-Jan-23	6
Stack	Carbon Monoxide	Console Control Unit	BKK_FS0556	12-Jul-22	12-Jan-23	6
Stack	Carbon Monoxide	Console Control Unit	BKK_FS0527	12-Jul-22	12-Jan-23	6
Stack	Carbon Monoxide	Flue gas Analyzer	RYG_FS0564	9-Dec-21	9-Dec-22	12
Stack	Carbon Monoxide	Flue gas Analyzer	RYG_FS0565	1-Dec-21	1-Dec-22	12
Stack	Carbon Monoxide	Flue gas Analyzer	RYG_FS0563	9-Dec-21	9-Dec-22	12
Stack	Carbon Monoxide	CO Analyzer	RYG_EN0034	11-May-22	11-May-23	12
Stack	Oxides of Nitrogen	Console Control Unit	BKK_FS0518	12-Jul-22	12-Jan-23	6
Stack	Oxides of Nitrogen	Console Control Unit	BKK_FS0468	12-Jul-22	12-Jan-23	6
Stack	Oxides of Nitrogen	Console Control Unit	BKK_FS0556	12-Jul-22	12-Jan-23	6
Stack	Oxides of Nitrogen	Console Control Unit	BKK_FS0527	12-Jul-22	12-Jan-23	6
Stack	Oxides of Nitrogen	Flue gas Analyzer	RYG_FS0564	9-Dec-21	9-Dec-22	12
Stack	Oxides of Nitrogen	Flue gas Analyzer	RYG_FS0565	1-Dec-21	1-Dec-22	12
Stack	Oxides of Nitrogen	Flue gas Analyzer	RYG_FS0563	9-Dec-21	9-Dec-22	12
Stack	Oxides of Nitrogen	Vacuum Gauge	BKK_FS0516	21-Sep-21	22-Mar-23	18
Stack	Oxides of Nitrogen	Vacuum Gauge	BKK_FS0435	9-Apr-21	8-Oct-22	18
Stack	Oxides of Nitrogen	Vacuum Gauge	BKK_FS0437	21-Sep-21	22-Mar-23	18
Stack	Oxides of Nitrogen	Vacuum Gauge	RYG_FS0332	21-Sep-21	22-Mar-23	18
Stack	Oxides of Nitrogen	SPECTROPHOTOMETER	RYG_EN0179	2-Nov-21	2-Nov-22	12
Stack	n-Decane	Console Control Unit	BKK_FS0468	12-Jul-22	12-Jan-23	6
Stack	n-Decane	Console Control Unit	BKK_FS0556	12-Jul-22	12-Jan-23	6
Stack	n-Decane	Console Control Unit	BKK_FS0527	12-Jul-22	12-Jan-23	6
Stack	n-Decane	Flue gas Analyzer	RYG_FS0465	19-Jan-22	19-Jan-23	12
Stack	n-Decane	Flue gas Analyzer	RYG_FS0563	9-Dec-21	9-Dec-22	12
Stack	n-Decane	Field Rotameter	BKK_FS1004	1-Jul-22	1-Oct-22	3
Stack	n-Decane	GC-FID	BKK_EN0126	21-Oct-21	21-Apr-23	18
Stack	Aluminium	Console Control Unit	BKK_FS0468	12-Jul-22	12-Jan-23	6
Stack	Aluminium	Flue gas Analyzer	RYG_FS0465	19-Jan-22	19-Jan-23	12
Stack	Aluminium	ICP-OES	BKK_EL0037	13-Sep-21	12-Mar-23	18
Stack	Dioxin and Furan	Console Control Unit	BKK_FS0468	12-Jul-22	12-Jan-23	6
Stack	Dioxin and Furan	HRGC/MS	No. 73/2022	14-Feb-22	14-Feb-27	60
Ambient	Nitrogen Dioxide	NO <sub>2</sub> Analyzer	RYG_FS0252	1-Jul-22	1-Jan-23	6
Ambient	Nitrogen Dioxide	NO <sub>2</sub> Analyzer	BKK_FS1064	1-Jul-22	1-Jan-23	6
Ambient	Nitrogen Dioxide	NO <sub>2</sub> Analyzer	RYG_FS0455	1-Jul-22	1-Jan-23	6
Ambient	Nitrogen Dioxide	NO <sub>2</sub> Analyzer	BKK_FS0797	1-Jul-22	1-Jan-23	6
Ambient	Sulfur Dioxide	SO <sub>2</sub> Analyzer	RYG_FS0251	1-Jul-22	1-Jan-23	6
Ambient	Sulfur Dioxide	SO <sub>2</sub> Analyzer	RYG_FS0266	1-Jul-22	1-Jan-23	6
Ambient	Sulfur Dioxide	SO <sub>2</sub> Analyzer	RYG_FS0454	1-Jul-22	1-Jan-23	6
Ambient	Sulfur Dioxide	SO <sub>2</sub> Analyzer	BKK_FS0796	1-Jul-22	1-Jan-23	6
Ambient	Total Suspended Particulate	High Volume	RYG_FS0175	-	-	On site Calibration
Ambient	Total Suspended Particulate	High Volume	RYG_FS0292	-	-	On site Calibration
Ambient	Total Suspended Particulate	High Volume	RYG_FS0393	-	-	On site Calibration
Ambient	Total Suspended Particulate	High Volume	RYG_FS0291	-	-	On site Calibration
Ambient	Total Suspended Particulate	Digital Balance	RYG_EN0001	23-Mar-22	23-Mar-23	12
Ambient	Particulate Matter (PM-10)	High Volume	RYG_FS0183	-	-	On site Calibration
Ambient	Particulate Matter (PM-10)	High Volume	RYG_FS0400	-	-	On site Calibration
Ambient	Particulate Matter (PM-10)	High Volume	RYG_FS0398	-	-	On site Calibration
Ambient	Particulate Matter (PM-10)	High Volume	RYG_FS0399	-	-	On site Calibration
Ambient	Particulate Matter (PM-10)	Digital Balance	RYG_EN0001	23-Mar-22	23-Mar-23	12
Ambient	Wind Speed / Wind Direction	Wind Speed / Wind Direction	RYG_FS0085	8-Oct-21	8-Apr-23	18



right solutions.  
right partner.

รายการเครื่องมือที่ใช้ในการวิเคราะห์ / ทดสอบ

Sample Name	Parameter	Equipment Name	ID No.	Calibrated Date	Next Cal	Freq. Calibrate (Months)
Noise	Leq 24 hrs	Sound Calibrator	RYG_FS0213	26-Apr-22	26-Apr-23	12
Noise	Leq 24 hrs	Sound Level Meter	RYG_FS0024	4-Oct-21	4-Oct-22	12
Noise	Leq 24 hrs	Sound Level Meter	RYG_FS0025	21-Jan-22	21-Jan-23	12
Noise	Leq 24 hrs	Sound Level Meter	RYG_FS0026	21-Jan-22	21-Jan-23	12
Noise	Leq 24 hrs	Sound Level Meter	RYG_FS0434	21-Jan-22	21-Jan-23	12
Noise	Leq 24 hrs	Sound Level Meter	RYG_FS0431	21-Jan-22	21-Jan-23	12
Noise	Leq 8 hrs	Sound Calibrator	RYG_FS0216	9-Aug-21	9-Aug-22	12
Noise	Leq 8 hrs	Sound Level Meter	RYG_FS0031	20-Jun-22	20-Jun-23	12
Noise	Leq 8 hrs	Sound Level Meter	RYG_FS0303	11-Jul-22	11-Jul-23	12
Noise	Leq 8 hrs	Sound Level Meter	RYG_FS0304	11-Jul-22	11-Jul-23	12
Noise	Leq 8 hrs	Sound Level Meter	RYG_FS0437	6-Aug-21	6-Aug-22	12
Noise	Leq 8 hrs	Sound Level Meter	RYG_FS0438	6-Aug-21	6-Aug-22	12
Noise	Leq 8 hrs	Sound Level Meter	RYG_FS0439	6-Aug-21	6-Aug-22	12
Noise	Leq 8 hrs	Sound Level Meter	RYG_FS0492	10-Jan-22	10-Jan-23	12
Noise	Leq 8 hrs	Sound Calibrator	RYG_FS0213	26-Apr-22	26-Apr-23	12
Noise	Leq 8 hrs	Sound Level Meter	RYG_FS0302	11-Jul-22	11-Jul-23	12
Noise	Leq 8 hrs	Sound Level Meter	RYG_FS0030	21-Jan-22	21-Jan-23	12
Noise	Noise Dose, TWA	Dose Badge Reader	RYG_FS0440	7-Sep-21	7-Sep-22	12
Noise	Noise Dose, TWA	Dose Badge Reader	RYG_FS0212	1-Dec-21	1-Dec-22	12
Workplace	Chlorine	Field Rotameter	BKK_FS1039	1-Jul-22	1-Oct-22	3
Workplace	Total Dust	Field Rotameter	RYG_FS0198	1-Jul-22	1-Oct-22	3
Workplace	Total Dust	Digital Balance	RYG_EN0004	23-Mar-22	23-Mar-23	12
Workplace	Respirable Dust	Field Rotameter	RYG_FS0198	1-Jul-22	1-Oct-22	3
Workplace	Respirable Dust	Digital Balance	RYG_EN0004	23-Mar-22	23-Mar-23	12
Workplace	Hydrogen Chloride	Field Rotameter	BKK_FS1039	1-Jul-22	1-Oct-22	3
Workplace	Hydrogen Chloride	Ion Chromatography	BKK_EN0069	12-Jan-22	12-Jan-23	12
Workplace	Aluminium	Field Rotameter	RYG_FS0198	1-Jul-22	1-Oct-22	3
Workplace	Aluminium	ICP-OES	BKK_EL0037	13-Sep-21	12-Mar-23	18
Workplace	Total VOC	TVOC Analyzer	BKK_FS0819	4-Feb-22	5-Aug-23	18
Heat	Heat Stress	Heat Stress Monitor	RYG_FS0358	16-Feb-22	16-Feb-23	12
Heat	Heat Stress	Heat Stress Monitor	RYG_FS0359	24-Jan-22	24-Jan-23	12
Heat	Heat Stress	Heat Stress Monitor	RYG_FS0360	16-Feb-22	16-Feb-23	12
Rayong Lab	pH on site	pH meter	RYG_FS0420	14-Mar-22	14-Mar-23	12
Rayong Lab	BOD (5 days at 20°C)	DO meter with Sensor	RYG_EN0032	14-Feb-22	15-Aug-23	12
Rayong Lab	BOD (5 days at 20°C)	Incubator	RYG_EN0154	22-Apr-22	21-Oct-23	12
Rayong Lab	COD	Spectrophotometer	RYG_EN0037	27-Sep-22	27-Mar-24	18
Rayong Lab	Total Suspended Solids	Electronic Balance	RYG_EN0002	23-Mar-22	23-Mar-23	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	23-Mar-22	23-Mar-23	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	23-Mar-22	23-Mar-23	12
Rayong Lab	Oil & Grease	Chamber 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	Fluoride	pH ISE Meter	RYG_EN0183	17-Mar-22	17-Mar-23	12
Water Lab	Hexavalent Chromium	Spectrophotometer	BKK_EN0018	16-Sep-22	16-Sep-23	12



#### CONSOLE CONTROL UNIT CALIBRATION TEST REPORT

Calibration of Date : 12 Jul 22  
Next Cal. Date : 12 Jan 23  
Barometric Pressure (mm.Hg) : 755  
Relative Humidity (%) : 70.0  
Temperature (°C) : 30.0

#### Console Control Meter Data

Calibration No. : C-120722-BKK\_FS0518  
Dry Gas Meter No. : BKK\_FS0518  
Console Serial No. : 1504025  
Console Model No. : XC-572-V

#### Reference Dry Gas Meter Data

Serial No. : A2003240  
Model No. : DGM-SKQ5RM-QS8  
Correction Factor (Y) : 1.0160  
Next Calibration Date : 27 May 23

ΔH (mm H <sub>2</sub> O)	Θ Minutes	Reference Dry Gas Meter Calibration						Console Control : Drygas Meter						Dry Gas Meter Correction Factor	Onflow Calibration
		Wt (Liters)			T <sub>i</sub> (°C)	Wt (Liters)			T <sub>i</sub> (°C)	T <sub>a</sub> (°C)	T <sub>o</sub> (°C)	Avg T <sub>m</sub> (°C)			
		Final	Initial	Total		Final	Initial	Total							
15	12.41	150.00	0.00	150.00	31.0	153838.0	153807.0	151.00	29.0	29.0	29.0	1.0012	47.8884		
25	9.38	150.00	0.00	150.00	31.0	154002.0	153851.0	151.00	29.0	29.0	29.0	1.0052	46.8070		
35	6.63	150.00	0.00	150.00	31.0	154166.0	154015.0	151.00	29.0	29.0	29.0	0.9988	46.2985		
100	4.40	150.00	0.00	150.00	32.0	154939.0	154777.0	153.00	30.0	30.0	30.0	0.9905	44.9789		
120	4.17	150.00	0.00	150.00	32.0	154616.0	154463.0	153.00	30.0	30.0	30.0	0.9781	43.4365		
Avg													0.9915	45.4374	

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

ΔH : Orifice pressure differential that equates to 21.24 in of air @ 25°C and 760 mm of mercury, rest 100 : tolerance for individual values ± 5.08 from average.

Procedure: 40 CFR 60, APPA METH SEC 5.3 & 7

Calibrated by :   
( Mr.Tinnakorn Kulchart )  
Field Scientist (1)

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

ALS-TH-201-046 (04/03/02)



#### DIGITAL TEMPERATURE CALIBRATION DATA SHEET

Calibration Date :	12-Jul-22	Ambient Temperature (°C) :	30
Calibration sheet No. :	C-120722-BKK_FS0519	Relative Humidity (%) :	70
Digital Temperature ID	BKK_FS0519	Reference Temperature ID. :	BKK_FS1144
Console Serial No. :	1504025	Serial No. :	201090006013
Console Model :	XC-572-V	Model :	Digicon-CC-VT-MS
		Next Calibrate :	31 Jan 23

Location	Reference Temperature °C	Digital Temperature °C	Error °C	Remark
Stack	0	0	0	
	25	25	0	
	50	50	0	
	100	101	1	
	150	153	3	
	200	202	2	
	250	252	2	
Probe	300	302	2	
	500	503	3	
	1000	1004	4	
	1200	1205	5	
	100	101	1	
	125	127	2	
	150	153	3	
Oven	100	101	1	
	125	127	2	
	150	153	3	
Filter	100	101	1	
	125	127	2	
	150	153	3	
Exit	0	0	0	
	10	9	-1	
	20	19	-1	
Meter	0	0	0	
	25	24	-1	
	50	50	0	
AUX	0	0	0	
	25	25	0	
	50	50	0	

Calibrated by :   
( Mr.tinnakorn Kulchart )  
Field Scientist (1)

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



#### Pitot Tube Calibration Data

Pitot Tube Identification Number : BKK\_FS0522  
Lab test duct Number : 258-1-13-01  
Calibration Sheet No. : C-120722-BKK\_FS0522  
Calibration Date : 12 Jul 22  
Standard Pitot ID : BKK\_FS0441  
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	16.60	0.842	-
	B	12.00	16.60	-	0.842
Test 2	A	12.00	16.60	0.842	-
	B	12.00	16.60	-	0.842
Test 3	A	12.00	16.60	0.842	-
	B	12.00	16.60	-	0.842
C <sub>p</sub>				0.842	0.842

$$C_p(S) = C_{p,std} \sqrt{\frac{\Delta P(std)}{\Delta P(s)}}$$
$$\left[ \bar{C}_{p(A)} - \bar{C}_{p(B)} \right] \text{ must BE } \leq 0.01$$
$$\text{Average deviation(A or B)} = \frac{\sum [C_p(s) - C_{p(A \text{ or } B)}]}{3} \text{ must BE } \leq 0.01$$

Calibrated by :   
( Mr.Tinnakorn Kulchart )  
Field Scientist (1)

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

Form 291-046 (04/03/02)



#### Pitot Tube Calibration Data

Pitot Tube Identification Number : BKK\_FS0523  
Lab test duct Number : 258-1-13-01  
Calibration Sheet No. : C-120722-BKK\_FS0523  
Calibration Date : 12 Jul 22  
Standard Pitot ID : BKK\_FS0441  
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	16.60	0.842	-
	B	12.00	16.60	-	0.842
Test 2	A	12.00	16.60	0.842	-
	B	12.00	16.60	-	0.842
Test 3	A	12.00	16.60	0.842	-
	B	12.00	16.60	-	0.842
C <sub>p</sub>				0.842	0.842

$$C_p(S) = C_{p,std} \sqrt{\frac{\Delta P(std)}{\Delta P(s)}}$$
$$\left[ \bar{C}_{p(A)} - \bar{C}_{p(B)} \right] \text{ must BE } \leq 0.01$$
$$\text{Average deviation(A or B)} = \frac{\sum [C_p(s) - C_{p(A \text{ or } B)}]}{3} \text{ must BE } \leq 0.01$$

Calibrated by :   
( Mr.tinnakorn Kulchart )  
Field Scientist (1)

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

Form 291-046 (04/03/02)



PROBE NOZZLE DIAMETER  
CALIBRATION DATA SHEET

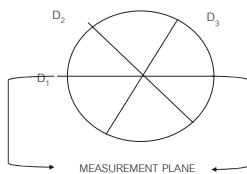
Calibration Date	12 Jul 22			Nozzle Set ID. :	BKK_FS0524
Calibration Sheet No. :	C-120722-BKK_FS0524			Vernier Caliper ID. :	BKK_FS0626
Nozzle ID #	Nozzle Diameter (cm.)			Hi - Lo	$(D_1 + D_2 + D_3) / 3$
	D <sub>1</sub>	D <sub>2</sub>	D <sub>3</sub>	$\Delta D$	
1	0.318	0.318	0.318	0.000	0.318
2	0.475	0.475	0.475	0.000	0.475
3	0.635	0.635	0.635	0.000	0.635
4	0.792	0.792	0.792	0.000	0.792
5	0.952	0.952	0.952	0.000	0.952
6	1.110	1.110	1.110	0.000	1.110
7	1.270	1.270	1.270	0.000	1.270

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.

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

D<sub>avg</sub> =  $(D_1 + D_2 + D_3) / 3$



Calibrated by :   
( Mr. Innakom Kulcha )  
Field Scientist (1)

Approved by :   
( Mr. Natthapol Jiengwareewong )  
Field Specialist(1)

Form No. QS 281-02S (13/01/03)



CONSOLE CONTROL UNIT CALIBRATION TEST REPORT

Calibration of Date : 12 Jul 22  
Barometric Pressure (mm.Hg) : 755  
Next Cal. Date : 12 Jan 23  
Relative Humidity (%) : 70.0  
Temperature (°C) : 30.0

Console Control Meter Data

Calibration No. : C-120722-BKK\_FS0468  
Dry Gas Meter No. : BKK\_FS0468  
Console Serial No. : 1302005  
Console Model No. : XC-572-V

Reference Dry Gas Meter Data

Serial No. : 1607009  
Model No. : SK25EXSR-QC8  
Correction Factor (Y) : 1.0060  
Next Calibration Date : 7 Oct 22

AH (mm.H <sub>2</sub> O)	Minutes	Reference Dry Gas Meter Calibration						Console Control : Drygas Meter						Dry Gas Meter		Orifice Calibration Factor $\Delta Wg$
		Wt (Liters)			T <sub>i</sub>	T <sub>o</sub>	Wt (Liters)			T <sub>i</sub>	T <sub>o</sub>	Avg T <sub>m</sub>	Correction Factor (Y)			
		Final	Initial	Total			Final	Initial	Total							
15	12.80	150.00	0.00	150.00	31.0	344.0	191.0	153.00	30.0	30.0	30.0	0.9816	50.7881			
25	9.60	150.00	0.00	150.00	31.0	511.4	358.0	153.40	30.0	30.0	30.0	0.9781	47.8136			
35	6.88	150.00	0.00	150.00	31.0	673.4	505.0	152.40	31.0	31.0	31.0	0.9759	45.9960			
150	4.40	150.00	0.00	150.00	32.0	842.0	689.0	153.00	31.0	31.0	31.0	0.9756	44.2547			
150	3.77	150.00	0.00	150.00	32.0	1065.5	893.0	152.40	32.0	32.0	32.0	0.9756	44.0275			
												Avg	0.9776	46.5339		

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

$\Delta Wg$  : Orifice 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  $\pm 5.08$  from average.

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

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

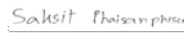
Approved by :   
( Mr. Natthapol Jiengwareewong )  
Field Specialist(1)

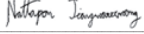
Form No. QS 281-02S (13/01/03)



DIGITAL TEMPERATURE CALIBRATION DATA SHEET

Calibration Date : 12-Jul-22		Ambient Temperature (°C) : 30		
Calibration sheet No. : C-120722-BKK_FS0469		Relative Humidity (%) : 70		
Digital Temperature ID BKK_FS0469		Reference Temperature ID BKK_FS0609		
Serial No. : 1302005		Serial No. : 7688004		
Model : XC-572-V		Model : FLUKE 714		
		Next Calibrate : 26 Jul 23		
Location	Reference Temperature °C	Digital Temperature °C	Error °C	Remark
Stack	0	0	0	
	25	24	-1	
	50	49	-1	
	100	98	-2	
	150	148	-2	
	200	197	-3	
	250	247	-3	
	300	297	-3	
	500	497	-3	
	1000	997	-3	
Probe	1200	1197	-3	
	100	99	-1	
	125	124	-1	
	150	149	-1	
	Oven	100	99	-1
125		124	-1	
150		149	-1	
Filter	100	100	0	
	125	125	0	
	150	149	-1	
Exit	0	0	0	
	10	11	1	
	20	21	1	
Meter	0	0	0	
	25	25	0	
	50	50	0	
ALUX	0	0	0	
	25	25	0	
	50	50	0	

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

Approved by :   
( Mr. Natthapol Jiengwareewong )  
Manager

Form No. 281-04S (02/05/02)



Pitot Tube Calibration Data

Pitot Tube Identification Number : BKK\_FS0472  
Calibration Date : 12 Jul 22  
Lab test duct Number : 258-1-13-01  
Standard Pitot ID : BKK\_FS0441  
Calibration Sheet No. : C-120722-BKK\_FS0472  
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	16.60	0.842	-
	B	12.00	16.60	-	0.842
Test 2	A	12.00	16.60	0.842	-
	B	12.00	16.60	-	0.842
Test 3	A	12.00	16.60	0.842	-
	B	12.00	16.60	-	0.842
$\bar{C}_p$				0.842	0.842

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

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

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

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

Approved by :   
( Mr. Natthapol Jiengwareewong )  
Field Specialist(1)

Form No. 281-04S (04/03/02)



### Pitot Tube Calibration Data

Pitot Tube Identification Number : BKK\_FS0473 Calibration Date : 12 Jul 22  
Lab test duct Number : 258-1-13-01 Standard Pitot ID : BKK\_FS0441  
Calibration Sheet No. : C-120722-BKK\_FS0473 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	16.60	0.842	-
	B	12.00	16.60	-	0.842
Test 2	A	12.00	16.60	0.842	-
	B	12.00	16.60	-	0.842
Test 3	A	12.00	16.60	0.842	-
	B	12.00	16.60	-	0.842
$\bar{C}_p$				0.842	0.842

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

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

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

Calibrated by Saksit Phaisanphisit Approved by Nattapong Jaywareewong  
( Mr.Saksit Phaisanphisit ) ( Mr.Nattapong Jaywareewong )  
Field Scientist (4) Field Specialist(1)

Form 281-046 (04/03/02)



### PROBE NOZZLE DIAMETER CALIBRATION DATA SHEET

Calibration Date 12 Jul 22 Nozzle Set ID. : BKK\_FS0474  
Calibration Sheet No. : C-120722-BKK\_FS0474 Vernier Calliper ID. : BKK\_FS0626

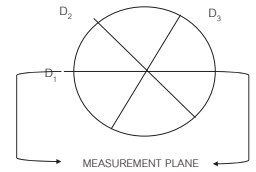
Nozzle ID #	Nozzle Diameter (cm.)			Hi - Lo $\Delta D$	$(D_1 + D_2 + D_3) / 3$ $D_{avg}$
	$D_1$	$D_2$	$D_3$		
1	0.300	0.300	0.300	0.000	0.300
2	0.450	0.450	0.450	0.000	0.450
3	0.600	0.600	0.600	0.000	0.600
4	0.780	0.780	0.780	0.000	0.780
5	0.932	0.932	0.932	0.000	0.932
6	1.094	1.094	1.094	0.000	1.094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

Where :

$D_1, D_2, D_3$  = There 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 Phaisanphisit Approved by Nattapong Jaywareewong  
( Mr.Saksit Phaisanphisit ) ( Mr.Nattapong Jaywareewong )  
Field Scientist (4) Field Specialist(1)

Form No. QS 281-025 (13/01/03)



### CONSOLE CONTROL UNIT CALIBRATION TEST REPORT

Calibration of Date : 12 Jul 22 Barometric Pressure (mm.Hg) : 755  
Next Cal. Date : 12 Jan 23 Relative Humidity (%) : 70.0  
Temperature (°C) : 30.0

Console Control Meter Data  
Calibration No. : C-120722-BKK\_FS0556 Serial No. : 1607009  
Dry Gas Meter No. : BKK\_FS0556 Model No. : SK25XSR-QC6  
Console Serial No. : 1606041 Correction Factor (Yt) : 1.0060  
Console Model No. : XC-572-V Next Calibration Date : 7 Oct 22

$\Delta H$ (mm H <sub>2</sub> O)	$\Theta$ Minutes	Reference Dry Gas Meter Calibration				Console Control : Drygas Meter						Dry Gas Meter Correction Factor (Yt)	Orifice Calibration Factor $\Delta_{avg}$
		W (Grams)		Total Tt (°C)	Tt (°C)	W (Grams)		Total Tt (°C)	Tt (°C)	To (°C)	Avg Tm (°C)		
		Final	Initial			Final	Initial						
75	12.58	150.00	0.00	150.00	26.0	1734086.8	1733938.0	147.80	26.0	26.0	26.0	1.0363	47.7721
75	9.67	150.00	0.00	150.00	26.0	1734045.0	1734086.0	147.80	26.0	26.0	26.0	1.0369	47.5461
50	6.75	150.00	0.00	150.00	26.0	1734399.2	1734253.0	146.20	26.0	26.0	26.0	1.0340	46.2542
100	4.68	150.00	0.00	150.00	26.0	1734362.5	1734417.0	146.45	26.0	26.0	26.0	1.0343	44.0771
150	3.82	150.00	0.00	150.00	26.0	1734719.9	1734824.0	145.80	26.0	26.0	26.0	1.0360	43.9035
											Avg	1.0373	45.8104

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

$\Delta_{avg}$  : Orifice pressure differential that equates to 21.24 in. of air @ 25°C and 760 mm of mercury,  $\text{mmH}_2\text{O}$  : tolerance for individual values  $\pm 5.08$  from average.

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

Calibrated by Saksit Phaisanphisit Approved by Nattapong Jaywareewong  
( Mr.Saksit Phaisanphisit ) ( Mr.Nattapong Jaywareewong )  
Field Scientist(4) Field Specialist(1)

Form 281-048 (02/05/02)



### DIGITAL TEMPERATURE CALIBRATION DATA SHEET

Calibration Date : 12-Jul-22 Ambient Temperature (°C) : 30  
Calibration sheet No. : C-120722-BKK\_FS0557 Relative Humidity (%) : 70  
Digital Temperature ID : BKK\_FS0557 Reference Temperature ID : BKK\_FS0609  
Console Serial No. : 1606041 Serial No. : 7688004  
Console Model : XC-572-V Model : FLUKE 714  
Next Calibrate : 26 Jul 23

Location	Reference Temperature °C	Digital Temperature °C	Error °C	Remark
Stack	0	1	1	
	25	26	1	
	50	51	1	
	100	102	2	
	150	153	3	
	200	202	2	
	250	251	1	
	300	302	2	
Probe	500	503	3	
	1000	1001	1	
	1200	1201	1	
	100	102	2	
Oven	125	128	3	
	150	153	3	
	100	102	2	
Filter	125	128	3	
	150	153	3	
	100	102	2	
Exit	125	128	3	
	150	153	3	
	100	102	2	
Meter	0	1	1	
	25	26	1	
	50	51	1	
AUX	0	1	1	
	25	26	1	
	50	51	1	

Calibrated by Saksit Phaisanphisit Approved by Nattapong Jaywareewong  
( Mr.Saksit Phaisanphisit ) ( Mr.Nattapong Jaywareewong )  
Field Scientist (4) Field Specialist(1)

Form 281-048 (02/05/02)



### Pitot Tube Calibration Data

Pitot Tube Identification Number : BKK\_FS0561 Calibration Date : 12 Jul 22  
Lab test duct Number : 258-1-13-01 Standard Pitot ID : BKK\_FS0441  
Calibration Sheet No. : C-120722-BKK\_FS0561 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	16.60	0.842	-
	B	12.00	16.60	-	0.842
Test 2	A	12.00	16.60	0.842	-
	B	12.00	16.60	-	0.842
Test 3	A	12.00	16.60	0.842	-
	B	12.00	16.60	-	0.842
$\bar{C}_p$				0.842	0.842

$$Cp(S) = Cp_{std} \sqrt{\frac{\Delta P(Std)}{\Delta P(s)}}$$
$$\left[ \bar{C}_p(A) - \bar{C}_p(B) \right] \text{ must BE } \leq 0.01$$
$$\text{Average deviation(A or B)} = \frac{\sum [Cp(s) - Cp(A \text{ or } B)]}{3} \text{ must BE } \leq 0.01$$

Calibrated by : Saksit Phaisanphiset Approved by : Nattapol Jiengwarewong  
( Mr.Saksit Phaisanphiset ) ( Mr.Nattapol Jiengwarewong )  
Field Scientist (4) Field Specialist(1)

Form 261-046 (04/03/02)



### Pitot Tube Calibration Data

Pitot Tube Identification Number : BKK\_FS0560 Calibration Date : 12 Jul 22  
Lab test duct Number : 258-1-13-01 Standard Pitot ID : BKK\_FS0441  
Calibration Sheet No. : C-120722-BKK\_FS0560 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	16.60	0.842	-
	B	12.00	16.60	-	0.842
Test 2	A	12.00	16.60	0.842	-
	B	12.00	16.60	-	0.842
Test 3	A	12.00	16.60	0.842	-
	B	12.00	16.60	-	0.842
$\bar{C}_p$				0.842	0.842

$$Cp(S) = Cp_{std} \sqrt{\frac{\Delta P(Std)}{\Delta P(s)}}$$
$$\left[ \bar{C}_p(A) - \bar{C}_p(B) \right] \text{ must BE } \leq 0.01$$
$$\text{Average deviation(A or B)} = \frac{\sum [Cp(s) - Cp(A \text{ or } B)]}{3} \text{ must BE } \leq 0.01$$

Calibrated by : Saksit Phaisanphiset Approved by : Nattapol Jiengwarewong  
( Mr.Saksit Phaisanphiset ) ( Mr.Nattapol Jiengwarewong )  
Field Scientist (4) Field Specialist(1)

Form 261-046 (04/03/02)



### PROBE NOZZLE DIAMETER CALIBRATION DATA SHEET

Calibration Date : 12 Jul 22 Nozzle Set ID. : BKK\_FS0562  
Calibration Sheet No. : C-120722-BKK\_FS0562 Vernier Caliper ID. : BKK\_FS0626

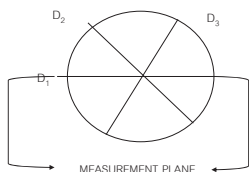
Nozzle ID #	Nozzle Diameter (cm.)			Hi - Lo $\Delta D$	$(D_1 + D_2 + D_3) / 3$ $D_{avg}$
	$D_1$	$D_2$	$D_3$		
1	0.300	0.306	0.302	0.006	0.303
2	0.480	0.475	0.480	0.005	0.478
3	0.625	0.630	0.630	0.005	0.628
4	0.755	0.750	0.765	0.015	0.757
5	0.975	0.980	0.970	0.010	0.975
6	1.095	1.090	1.095	0.005	1.093
7	1.275	1.275	1.270	0.005	1.273
8	1.610	1.610	1.610	0.000	1.610

Where :

$D_1, D_2, D_3$  = There 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 Approved by : Nattapol Jiengwarewong  
( Mr.Saksit Phaisanphiset ) ( Mr.Nattapol Jiengwarewong )  
Field Scientist (4) Field Specialist(1)

Form No. Q9 261-025 (13/01/03)



### CONSOLE CONTROL UNIT CALIBRATION TEST REPORT

Calibration of Date : 12 Jul 22 Barometric Pressure (mm.Hg) : 755  
Next Cal. Date : 12 Jan 23 Relative Humidity (%) : 70.0  
Temperature (°C) : 30.0  
Reference Dry Gas Meter Date :  
Calibration No. : C-120722-BKK\_FS0527 Serial No. : 1607009  
Dry Gas Meter No. : BKK\_FS0507 Model No. : SKCSEXR-QC6  
Serial No. : 1508053 Correction Factor (Y) : 1.0080  
Model No. : XC-572-V Next Calibration Date : 7 Oct 22

ΔH (mm.H <sub>2</sub> O)	Θ Minutes	Reference Dry Gas Meter Calibration						Console Control : Drygas Meter						Dry Gas Meter Correction Factor (Y)	Office Calibration Factor ΔH <sub>avg</sub>
		W (Liters)			T <sub>g</sub> (°C)	W (Liters)			T <sub>g</sub> (°C)	T <sub>a</sub> (°C)	Avg T <sub>g</sub> (°C)				
		Final	Initial	Total		Final	Initial	Total							
15	11.26	150.00	0.00	150.00	30.0	264368.0	264222.0	146.80	30.0	30.0	30.0	1.0278	38.1830		
25	8.63	150.00	0.00	150.00	31.0	264326.8	264380.0	146.80	31.0	31.0	31.0	1.0254	40.1496		
50	6.32	150.00	0.00	150.00	31.0	264885.2	264636.0	146.20	31.0	31.0	31.0	1.0271	41.1381		
100	4.45	150.00	0.00	150.00	31.0	264845.0	264699.0	146.00	31.0	31.0	31.0	1.0266	40.7987		
150	3.67	150.00	0.00	150.00	31.0	265059.0	264912.0	147.00	31.0	31.0	31.0	1.0118	41.6143		
Avg.												1.0252	40.5743		

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

$\Delta H_{avg}$  : Office pressure differential that equates to 21.24 in of air @ 25 °C and 760 mm of mercury, mmHGO : tolerance for individual values  $\pm 5.08$  from average.

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

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

Approved by : Nattapol Jiengwarewong  
( Mr.Nattapol Jiengwarewong )  
Field Specialist(1)

FORM NO. 7-06-014 REVISION NO.1 ISSUE DATE: 9/1/19



### DIGITAL TEMPERATURE CALIBRATION DATA SHEET

Calibration Date :	12 Jul 22	Ambient Temperature (°C) :	30
Calibration sheet No. :	C-120722-BKK_FS0528	Relative Humidity (%) :	70
Digital Temperature ID :	BKK_FS0508	Reference Temperature ID. :	BKK_FS0609
Console Serial No. :	1503017	Serial No. :	7688004
Console Model :	XC-572-V	Model :	FLUKE 714
		Next Calibrate :	26 Jul 23

Location	Reference Temperature °C	Digital Temperature °C	Error °C	Remark
Stack	0	2	2	
	25	24	-1	
	50	51	1	
	100	103	3	
	150	151	1	
	200	202	2	
	250	251	1	
	300	301	1	
	500	503	3	
	1000	1001	1	
Probe	1200	1202	2	
	100	101	1	
	125	126	1	
	150	153	3	
	100	101	1	
Oven	125	126	1	
	150	151	1	
	100	102	2	
Filter	125	125	0	
	150	152	2	
Exit	0	0	0	
	10	10	0	
	20	20	0	
Meter	0	0	0	
	25	25	0	
	50	50	0	
AUX	0	0	0	
	25	25	0	
	50	50	0	

Calibrated by

Saksit Phaisanphiset

( Mr.Saksit Phaisanphiset )  
Field Scientist (4)

Approved by

Nattapon Jangwareewong

( Mr.Nattapol Jangwareewong )  
Field Specialist(1)

Form 281-048 (02/03/02)



### Pitot Tube Calibration Data

Pitot Tube Identification Number :	BKK_FS0531	Calibration Date :	12 Jul 22
Lab test duct Number :	258-1-13-01	Standard Pitot ID :	BKK_FS0441
Calibration Sheet No. :	C-120722-BKK_FS0531	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	16.60	0.842	-
	B	12.00	16.60	-	0.842
Test 2	A	12.00	16.60	0.842	-
	B	12.00	16.60	-	0.842
Test 3	A	12.00	16.60	0.842	-
	B	12.00	16.60	-	0.842
		$\bar{C}_p$		0.842	0.842

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

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

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

Calibrated by

Saksit Phaisanphiset

( Mr.Saksit Phaisanphiset )  
Field Scientist (4)

Approved by

Nattapon Jangwareewong

( Mr.Nattapol Jangwareewong )  
Field Specialist(1)

Form 281-046 (04/03/02)



### Pitot Tube Calibration Data

Pitot Tube Identification Number :	BKK_FS0532	Calibration Date :	12 Jul 22
Lab test duct Number :	258-1-13-01	Standard Pitot ID :	BKK_FS0441
Calibration Sheet No. :	C-120722-BKK_FS0532	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	16.60	0.842	-
	B	12.00	16.60	-	0.842
Test 2	A	12.00	16.60	0.842	-
	B	12.00	16.60	-	0.842
Test 3	A	12.00	16.60	0.842	-
	B	12.00	16.60	-	0.842
		$\bar{C}_p$		0.842	0.842

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

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

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

Calibrated by

Saksit Phaisanphiset

( Mr.Saksit Phaisanphiset )  
Field Scientist (4)

Approved by

Nattapon Jangwareewong

( Mr.Nattapol Jangwareewong )  
Field Specialist(1)

Form 281-046 (04/03/02)



### PROBE NOZZLE DIAMETER CALIBRATION DATA SHEET

Calibration Date	12 Jul 22	Nozzle Set ID. :	BKK_FS0533
Calibration Sheet No. :	C-120722-BKK_FS0533	Vernier Caliper ID. :	BKK_FS0626

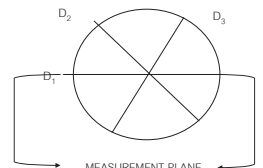
Nozzle ID #	Nozzle Diameter (mm.)			Hi - Lo ΔD	(D <sub>1</sub> + D <sub>2</sub> + D <sub>3</sub> ) / 3 D <sub>avg</sub>
	D <sub>1</sub>	D <sub>2</sub>	D <sub>3</sub>		
1	0.318	0.318	0.318	0.000	0.318
2	0.475	0.475	0.475	0.000	0.475
3	0.635	0.635	0.635	0.000	0.635
4	0.792	0.792	0.792	0.000	0.792
5	0.952	0.952	0.952	0.000	0.952
6	1.110	1.110	1.110	0.000	1.110
7	1.270	1.270	1.270	0.000	1.270

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

Nattapon Jangwareewong

( Mr.Nattapol Jangwareewong )  
Field Specialist(1)

Form No. Q6 281-025 (13/01/03)

REVIEW BY *M. Kohnen P.*  
 APPROVED BY *[Signature]*  
 NEXT CAL. DATE *9/12/22*

testo

## Calibration certificate Kalibrier-Zertifikat

4319339

Object Gegenstand: Controlunit t350  
 Manufacturer Hersteller: TESTO SE & Co. KGaA  
 Type description Typ: 0632 3511  
 Serial no. Serien Nr.: 03580182  
 Inventory no. Inventar Nr.: ---  
 Test equipment no. Prüfmittel Nr.: ---  
 Equipment no. Equipment Nr.: 14672444  
 Location Standort: ---  
 Customer Auftraggeber: ALS Laboratory Group (Thailand) Co., Ltd  
 Customer ID no. Kunden Nr.: 1031994  
 Order no. Order Nr.: 10842828 / 0520 0055  
 Date of calibration Datum der Kalibrierung: 09.12.2021  
 Date of the recommended re-calibration Datum der empfohlenen Rekalibrierung: 09.12.2022

Hereby we confirm that the performing calibration laboratory is working with a management system according to ISO 9001:2015 and ISO/IEC 17025:2018. Accreditation certificates can be found under [www.testo.de](http://www.testo.de). The measuring installations used for calibration are regularly calibrated and traceable to the national standards of the German Federal Physical Technical Institute (PTB) or other national standards. Should no national standards exist, the measuring procedure corresponds with the technical regulations and norms valid at the time of the measurement. The documents established for this procedure are available for viewing. All the necessary measured data can be found on this calibration certificate.

Hiermit bestätigen wir, dass das durchführende Kalibrierlabor ein Managementsystem nach ISO 9001:2015, sowie ISO/IEC 17025:2018 eingeführt hat. Die Urkunden finden Sie auf [www.testo.de](http://www.testo.de). Die für die Kalibrierung verwendeten Messeinrichtungen werden regelmäßig kalibriert und sind rückführbar auf die nationalen Normale der Physikalisch-Technischen Bundesanstalt (PTB) Deutschlands oder auf andere nationale Normale. Wo keine nationalen Normale existieren, entspricht das Messverfahren den derzeit gültigen technischen Regeln und Normen. Die für diesen Vorgang angefertigte Dokumentation kann eingesehen werden. Alle erforderlichen Messdaten sind in diesem Kalibrier-Zertifikat aufgeführt.

Conformity statement Konformitätsaussage  
☒ Measured value(s) within the allowable deviation<sup>1</sup>. Messwert(e) innerhalb der zulässigen Abweichung<sup>1</sup>.  
☐ Measured value(s) outside of the allowable deviation<sup>1</sup>. Messwert(e) außerhalb der zulässigen Abweichung<sup>1</sup>.

<sup>1</sup> The expanded measurement uncertainty was calculated according to EA-4-02 M:2013 with a coverage probability of approx. 95% and contains the uncertainty of the reference, the method and the uncertainty of the unit under test. The statement of conformity is based on the decision rule "Vertrauensniveau 50" (confidence level 50).  
<sup>1</sup> Die erweiterte Messunsicherheit wurde nach EA-4-02 M:2013 mit einer Überdeckungswahrscheinlichkeit von etwa 95% berechnet und enthält die Unsicherheit der Referenz, des Verfahrens sowie die Unsicherheit des Prüflings. Die Konformitätsaussage erfolgt nach der Entscheidungsregel "Vertrauensniveau 50".  
 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.  
 Dieser Kalibrierzertifikat darf nur vollständig weiterverbreitet werden. Auszüge oder Änderungen bedürfen der Genehmigung des ausstellenden Kalibrierlaboratoriums. Kalibrierzertifikate ohne Unterschrift und Stempel haben keine Gültigkeit.

Seal Stempel: Supervisor Fachverantwortlicher: *[Signature]* Martin Förderer  
 Technician: *[Signature]* Johannes Wängler

Testo Industrial Services GmbH

Gewerbestraße 3 | Tel. +49 7661 90901-8000 | www.testo.de | Page 1/3  
 79199 Kirchzarten | Fax +49 7661 90901-8010 | info@testo.de

## Calibration certificate Kalibrier-Zertifikat

4319339

### Special remarks Besondere Bemerkungen

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

# Kalibrier-Zertifikat Calibration certificate

4308414

## Messeinrichtungen Measuring equipment

Index	Reference	Traceability	Next cal.	Certificate-no.	Eq.-no.
a	Prüfgas Medium 1 Test gas medium 1	SCS-SC50026 2021-03	2024-03	4017585	12898976
b	Prüfgas Medium 3 Test gas medium 3	SCS-SC50026 2021-03	2022-03	4017588	12898982
c	Prüfgas Medium 5 Test gas medium 5	SCS-SC50026 2021-03	2022-03	4017591	12898994
d	Prüfgas Medium 8 Test gas medium 8	SCS-SC50026 2021-03	2022-10	4190481	12898987
e	Prüfgas Medium 11 Test gas medium 11	SCS-SC50026 2021-03	2022-03	4183499	14067664
f	Digistart 4420 Digistart 4420	ISO-ISO 6141 2021-07	2022-07	E166673	12966901
g	Pneumator Pneumator	ISO-ISO 6141 2021-07	2022-07	D53219	12966547

Reference certificates are available at [www.primosonline.com](http://www.primosonline.com) abrufbar Reference certificates are available at [www.primosonline.com](http://www.primosonline.com)

## Umgebungsbedingungen Ambient conditions

Temperatur Temperature (20...26) °C Feuchte Humidity (20...60) % RH

## Messverfahren Measuring procedure

Die Kalibrierung erfolgte durch Vergleichsmessung mit kalibrierten Prüfgasen, einem Temperatur- und Druckkalibrator.

The calibration was carried out by comparison measurement with calibrated test gases, a calibrator of temperature and pressure.

## Messergebnisse Measuring results

Kanal Channel ---

Einheit Unit	Bezugswert Reference value	Angezeigter Messwert Indicated measured value probe	Abweichung Deviation	Zulässige Abweichung <sup>1)</sup> Allowed deviation <sup>1)</sup>	Messunsicherheit (k=2) Measurement uncertainty (k=2)	Bewertung Evaluation
CO						
ppm	100,1 <sup>a</sup>	101	0,9	± 11	3,3	pass
ppm	401,0 <sup>b</sup>	397	-4,0	± 21	8,5	pass
ppm	700,0 <sup>c</sup>	717	17,0	± 36	14,4	pass
NO						
ppm	150,3 <sup>a</sup>	150	-0,3	± 9	4,0	pass
ppm	301 <sup>d</sup>	301	0	± 16	6,9	pass
SO2						
ppm	100,1 <sup>a</sup>	99	-1,1	± 11	3,5	pass
O2						
Vol.-%	0,0 <sup>a</sup>	0,09	0,1	± 0,21	0,027	pass
Vol.-%	2,510 <sup>b</sup>	2,58	0,070	± 0,21	0,055	pass
Vol.-%	5,000 <sup>c</sup>	5,08	0,080	± 0,21	0,102	pass
Temperatur						
°C	100,0 <sup>d</sup>	99,1	-0,9	± 1,1	0,24	pass
°C	200,0 <sup>d</sup>	200,1	0,1	± 1,1	0,24	pass
Druck						
hPa	50,0 <sup>b</sup>	50,1	0,1	± 0,9	0,52	pass
hPa	100,0 <sup>b</sup>	100,5	0,5	± 1,6	0,52	pass

<sup>a)</sup> gemäß Hersteller in accordance with the manufacturer

## Besondere Bemerkungen Special remarks

---

---

Testo Industrial Services GmbH

Gewerbestraße 3 79199 Kirchzarten Tel. +49 7661 90901-8000 Fax +49 7661 90901-8010 [www.testo.de](http://www.testo.de) [info@testo.de](mailto:info@testo.de) Seite 2/2

# Calibration certificate Kalibrier-Zertifikat

4319391

Object Gegenstand	Controlunit 1350	Measuring Box testo 350	<p>Hereby we confirm that the performing calibration laboratory is working with a management system according to ISO 9001:2015 and ISO/IEC 17025:2018. Accreditation certificates can be found under <a href="http://www.testo.de">www.testo.de</a>. The measuring installations used for calibration are regularly calibrated and traceable to the national standards of the German Federal Physical Technical Institute (PTB) or other national standards. Should no national standards exist, the measuring procedure corresponds with the technical regulations and norms valid at the time of the measurement. The documents established for this procedure are available for viewing. At the necessary measured data can be found on this calibration certificate.</p> <p>Hiermit bestätigen wir, dass das durchführende Kalibrierlabor ein Managementsystem nach ISO 9001:2015, sowie ISO/IEC 17025:2018 eingeführt hat. Die Urkunden finden Sie auf <a href="http://www.testo.de">www.testo.de</a>. Die für die Kalibrierung verwendeten Messanordnungen werden regelmäßig kalibriert und sind rückführbar auf die nationalen Normale der Physikalisch-Technischen Bundesanstalt (PTB), Deutschlands oder auf andere nationale Normale. Wo keine nationalen Normale existieren, entspricht das Messverfahren den derzeit gültigen technischen Regeln und Normen. Die für diesen Vorgang angefertigte Dokumentation kann eingesehen werden. Alle erforderlichen Messdaten sind in diesem Kalibrier-Zertifikat aufgeführt.</p>
Manufacturer Hersteller	TESTO SE & Co. KGaA	TESTO SE & Co. KGaA	
Type description Typ	0632 3511	0632 3510	
Serial no. Serien Nr.	03580098	62985047	
Inventory no. Inventar Nr.	---	---	
Test equipment no. Prüfmittel Nr.	---	---	<p>1) The expanded measurement uncertainty was calculated according to EA-4-02 M:2013 with a coverage probability of approx. 95% and contains the uncertainty of the reference, the method and the uncertainty of the unit under test. The statement of conformity is based on the decision rule "Vertrauensniveau 50" (confidence level 50).</p> <p>1) Die erweiterte Messunsicherheit wurde nach EA-4-02 M:2013 mit einer Überdeckungs Wahrscheinlichkeit von etwa 95% berechnet und enthält die Unsicherheit der Referenz, des Verfahrens sowie die Unsicherheit des Prüflings. Die Konformitätsaussage erfolgt nach der Entscheidungsregel "Vertrauensniveau 50".</p> <p>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.</p> <p>Dieses Kalibrierzertifikat darf nur vollständig wiederverbreitet werden. Auszüge oder Änderungen bedürfen der Genehmigung des ausstellenden Kalibrierlaboratoriums. Kalibrierzertifikate ohne Unterschrift und Stempel haben keine Gültigkeit.</p>
Equipment no. Equipment Nr.	14672501	14674794	
Location Standort	---	---	
Customer Auftraggeber	ALS Laboratory Group (Thailand) Co., Ltd Eastern Seaboard Industrial Estate TH-21140 A. Puaokdaeng, Rayong, Thailand		
Customer ID no. Kunden Nr.	1031994		
Order no. Auftrags Nr.	10842826 / 0520 0055		
Date of calibration Datum der Kalibrierung	09.12.2021		<p>Date of the recommended re-calibration Datum der empfohlenen Rekalibrierung 09.12.2022</p>
Date of the recommended re-calibration Datum der empfohlenen Rekalibrierung	09.12.2022		

## Conformity statement Konformitätsaussage

- ☒ Measured value(s) within the allowable deviation<sup>1)</sup>. Messwert(e) innerhalb der zulässigen Abweichung<sup>1)</sup>.  
☐ Measured value(s) outside of the allowable deviation<sup>1)</sup>. Messwert(e) außerhalb der zulässigen Abweichung<sup>1)</sup>.

1) The expanded measurement uncertainty was calculated according to EA-4-02 M:2013 with a coverage probability of approx. 95% and contains the uncertainty of the reference, the method and the uncertainty of the unit under test. The statement of conformity is based on the decision rule "Vertrauensniveau 50" (confidence level 50).

1) Die erweiterte Messunsicherheit wurde nach EA-4-02 M:2013 mit einer Überdeckungs Wahrscheinlichkeit von etwa 95% berechnet und enthält die Unsicherheit der Referenz, des Verfahrens sowie die Unsicherheit des Prüflings. Die Konformitätsaussage erfolgt nach der Entscheidungsregel "Vertrauensniveau 50".

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.

Dieses Kalibrierzertifikat darf nur vollständig wiederverbreitet werden. Auszüge oder Änderungen bedürfen der Genehmigung des ausstellenden Kalibrierlaboratoriums. Kalibrierzertifikate ohne Unterschrift und Stempel haben keine Gültigkeit.

Seal Stempel



Supervisor Fachverantwortlicher

*[Signature]*  
Martin Förderer

Technician Geprüfter

*[Signature]*  
Johannes Wängler

Testo Industrial Services GmbH

Gewerbestraße 3 79199 Kirchzarten Tel. +49 7661 90901-8000 Fax +49 7661 90901-8010 [www.testo.de](http://www.testo.de) [info@testo.de](mailto:info@testo.de) Seite 1/3

# Calibration certificate Kalibrier-Zertifikat

4319391

## Special remarks Besondere Bemerkungen

---

---

# Calibration certificate Kalibrier-Zertifikat

4319391

## Measuring equipment Messeinrichtungen

Index	Reference	Traceability	Next cal.	Certificate-no.	Eq.-no.
a	Test gas medium 1 Prüfgas Medium 1	SCS-SC50026 2021-03	2024-03	4017585	12898976
b	Test gas medium 3 Prüfgas Medium 3	SCS-SC50026 2021-03	2022-03	4017588	12898982
c	Test gas medium 5 Prüfgas Medium 5	SCS-SC50026 2021-03	2022-03	4017591	12898994
d	Test gas medium 8 Prüfgas Medium 8	SCS-SC50026 2021-03	2022-10	4220471	12898987
e	Test gas medium 11 Prüfgas Medium 11	SCS-SC50026 2021-03	2022-03	4017596	12898986
f	Test gas medium 11 Prüfgas Medium 11	ISO-ISO 6141 2021-04	2022-04	4017602	14067664
g	Digistart 4420 Digistart 4420	ISO-ISO 6141 2021-07	2022-07	E166673	12966901
h	Pneumator Pneumator	ISO-ISO 6141 2021-07	2022-07	D53219	12966547

Reference certificates are available at [www.primosonline.com](http://www.primosonline.com) Referenzzertifikate sind auf [www.primosonline.com](http://www.primosonline.com) abrufbar

## Ambient conditions Umgebungsbedingungen

Temperature Temperature (20...26) °C Humidity Feuchte (20...60) % RH

## Measuring procedure Messverfahren

The calibration was carried out by comparison measurement with calibrated test gases, a calibrator of temperature and pressure.

Die Kalibrierung erfolgte durch Vergleichsmessung mit kalibrierten Prüfgasen, einem Temperatur- und Druckkalibrator.

## Measuring results Messergebnisse

Channel Kanal ---

Unit Einheit	Reference value Bezugswert	Indicated measured value probe Angezeigter Messwert Kalibriergegenstand	Deviation Abweichung	Allowed deviation <sup>1)</sup> Zulässige Abweichung <sup>1)</sup>	Measurement uncertainty (k=2) Messunsicherheit (k=2)	Evaluation Bewertung
CO						
ppm	100,1 <sup>a</sup>	102	1,9	± 11	3,3	pass
ppm	401,0 <sup>b</sup>	401	0,0	± 21	8,5	pass
ppm	700,0 <sup>c</sup>	725	25,0	± 36	14,4	pass
NO						
ppm	150,3 <sup>a</sup>	151	0,7	± 9	4,0	pass
ppm	300 <sup>d</sup>	302	2	± 16	6,9	pass
NO2						
ppm	99,9 <sup>a</sup>	102,7	2,8	± 5,1	3,20	pass
SO2						
ppm	100,1 <sup>a</sup>	97	-3,1	± 6	3,5	pass
O2						
Vol.-%	0,0 <sup>a</sup>	0,06	0,1	± 0,21	0,027	pass
Vol.-%	2,510 <sup>b</sup>	2,58	0,050	± 0,21	0,055	pass
Vol.-%	5,000 <sup>c</sup>	5,08	0,080	± 0,21	0,102	pass
Temperatur						
°C	100,0 <sup>d</sup>	99,0	-1,0	± 1,1	0,24	pass
°C	200,0 <sup>d</sup>	199,9	-0,1	± 1,1	0,24	pass
Druck						
hPa	50,0 <sup>b</sup>	49,8	-0,2	± 0,9	0,52	pass
hPa	100,0 <sup>b</sup>	99,9	-0,1	± 1,6	0,52	pass

<sup>a)</sup> in accordance with the manufacturer gemäß Hersteller

Testo Industrial Services GmbH

Gewerbestraße 3 79199 Kirchzarten Tel. +49 7661 90901-8000 Fax +49 7661 90901-8010 [www.testo.de](http://www.testo.de) [info@testo.de](mailto:info@testo.de) Seite 2/3

Testo Industrial Services GmbH

Gewerbestraße 3 79199 Kirchzarten Tel. +49 7661 90901-8000 Fax +49 7661 90901-8010 [www.testo.de](http://www.testo.de) [info@testo.de](mailto:info@testo.de) Seite 3/3

## Certificate of Calibration

Represent to Certificate of Calibration ,PTC/07/22099

Certificate No.: PTC/07/22099 Page: 1 of 2  
Equipment: Digital Balance Condition: Normal  
Manufacturer: Sartorius Serial No: 31709552  
Model: MSJ224S-100-DU ID No: RYG\_EN0003  
Type of Balance: Single Interval



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

REVIEW BY Thanitak  
APPROVED BY D. [Signature]  
NEXT CAL DATE 09/03/2023

Environment Condition: Temperature: 23.9 °C ± 0.3 °C  
Humidity: 58.1 %RH ± 4.4 %RH  
Air density: 1.17 kg/m<sup>3</sup>

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

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

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

Date Received: March 23, 2022

Calibration Date: March 23, 2022

Issued Date: March 25, 2022

Calibration By: Mr. Rungroje Metakul



Mr. Kriangsak Kalasri  
(Mr.Kriangsak Kalasri)  
Reviewed by

Approved By: [Signature]  
(Mr. Keattisak Kertho)  
Laboratory Manager

This certificate is issued the units of measurement according to the International System of Units (SI). It provides traceability of measurement to international or national standard or other 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). The effect that the results relate only to the items calibrated.

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

PTC/MC-07-02-21 Feb 2020

Represent to Certificate of Calibration ,PTC/07/22099

Certificate No.: PTC/07/22099

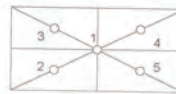
Page: 2 of 2

### Measurement Results:

Without Adjustment :

Function Calibration: Non Adjustment

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



Eccentricity test 100 (g)				
Position (g)				
1	2	3	4	5
0.0000	0.0000	-0.0001	-0.0001	0.0001
Maximum deviation: 0.0001				

Repeatability Test : Weight to be 1/2 ≤ L<sub>1</sub> ≤ Maximum capacity

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

Nominal test value (g)	Standard Deviation
200	0.00007

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

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

Note: Weight of adjust (g)

The End of Certificate

PTC/MC-07-02-2 Feb 2020

### MULTI POINT CALIBRATION REPORT

CUSTOMER NAME : ALS Laboratory Group (Thailand) Co.Ltd.

EQUIPMENT NAME : CO Analyzer

MANUFACTURER : Teledyne API MODEL : T300 SERIAL NO : 1215

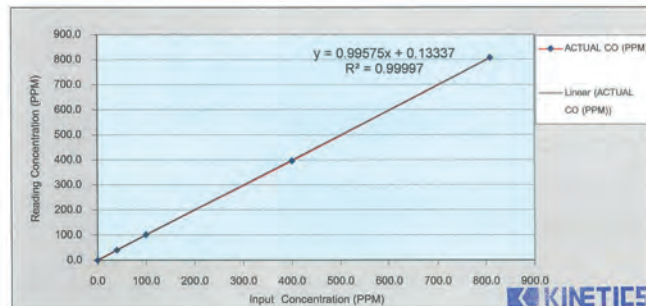
STANDARD GAS CONCENTRATION (PPM) : 4512 CYLINDER NO : CC745169

CYLINDER PRESSURE (psig) : 1900 CERTIFIED DATE : Mar 10, 2021

CERTIFIED BY : AIRGAS SPECIALTY GASES EXPIRED DATE : Mar 10, 2029

### CALIBRATION RESULTS

POINT NO	CALIBRATION RESULTS			
	IDEAL (PPM)	ACTUAL CO (PPM)	ERROR CO (PPM)	% ERROR CO
ZERO	0.000	0.004	0.004	-
1	40.000	40.531	0.531	1.328
2	100.000	101.135	1.135	1.135
3	400.300	395.446	-4.854	-1.213
4	808.900	807.019	-1.881	-0.233
AVERAGE (%)				0.977



CALIBRATED BY : คุณพรชัย มาดิวันนากัณ DATE : 11 พฤษภาคม 2565

ต้องการข้อมูลทางด้านเทคนิคเพิ่มเติม : คุณพรชัย มาดิวันนากัณ โทรศัพท์ : 02-515-8987

เลขที่ 388 ถนนวิภาวดีรังสิต แขวงจันทน์เกษม เขตจตุจักร กรุงเทพฯ 10000 โทรศัพท์ : 0-2515-8999 โทรสาร : 0-2515-8988 E-Mail : info@kinetics.co.th

บริษัท ไคเนติกส์ คอร์ปอเรชั่น จำกัด

KINETICS CORPORATION LTD.

รายงานผลการซ่อมและปรับเทียบอุปกรณ์ตรวจวัดคุณภาพอากาศ

ลูกค้า / หน่วยงาน : ALS Laboratory Group (Thailand) Co.Ltd.

วันที่ : 11 พฤษภาคม 2565

รายชื่ออุปกรณ์ / เครื่องมือ : CO Analyzer

บริษัทผู้ผลิต : Teledyne API

รุ่นของอุปกรณ์ / เครื่องมือ : T300

หมายเลขอุปกรณ์ / เครื่องมือ : 1215

TEST VALUES			
API MODEL T300		BEFORE	AFTER
1	RANGE 1 : 1000 PPM	100.0	100.0
2	STABILITY ≤ 1 PPM	0.095	0.094
3	CO MEASURE 2500 - 4900 mV	3047.2	3579.0
4	CO REFERENCE 2000 - 4800 mV	2521.8	2959.4
5	PRESEURE 25 - 35 in - Hg-A	29.7	29.5
6	SAMPLE FLOW 800 ± 10% cc/min	823	795
7	SAMPLE TEMP 48 ± 4 °C	44.7	44.8
8	BENCH TEMP 48 ± 2 °C	48.0	48.0
9	WHEEL TEMP 68 ± 2 °C	67.9	68.0
10	BOX TEMP AMBIENT ± 5 °C	34.3	35.5
11	PHT DRIVE 250 - 4750 mV	4160.7	4123.5
12	CO SLOPE 1.0 ± 0.3	0.863	0.859
13	CO OFFSET 0.0 ± 0.3	0.008	0.009
14	CO READING (AMBIENT) PPM	0.421	0.377
15	ELECTRICAL TEST 40 ± 2 PPM	39.184	39.892
16	VOLTAGE TEST +5 V +12 V +15 V -15 V	5.20 / 12.09 / 16.78 / -15.28	5.20 / 12.09 / 16.78 / -15.28
17	ZERO GAS 0.00 PPM	-0.150	0.004
18	SPAN GAS 40.0 PPM	38.903	40.081

### หมายเหตุ

- ทำการเปลี่ยน O-ring 2 ชิ้น, Spring 1 ชิ้น, Sintered Filter 1 ชิ้น



บริษัท ไคเนติกส์ คอร์ปอเรชั่น จำกัด



( คุณพรชัย มาดิวันนากัณ )

ลงนามเจ้าหน้าที่ (Signature)

ต้องการข้อมูลเพิ่มเติมทางด้านเทคนิค กรุณาติดต่อ : คุณพรชัย มาดิวันนากัณ โทรศัพท์ : 0-2515-8987

เลขที่ 388 ถนนวิภาวดีรังสิต แขวงจันทน์เกษม เขตจตุจักร กรุงเทพฯ 10000 โทรศัพท์ : 0-2515-8999 โทรสาร : 0-2515-8988 E-Mail : info@kinetics.co.th

TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)  
CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES  
534/4 PATTANAKARN ROAD SOI 18, SUANLIANG, SUANLIANG, BANGKOK 10250  
TEL. 0-2717-3000-24 FAX. 0-2719-9484

**Certificate of Calibration** Certificate No.: 21P3177  
Page: 1 of 2

Equipment: Digital Vacuum Gauge  
Manufacturer: Dwyer  
Model: DPGA-00  
Serial No.: DVG09  
ID No.: BKK\_FS0516  
Condition As-Received: Used Item  
Received Date: 15 September 2021  
Calibration Date: 21 September 2021  
Reference: 2109-0560WSC Submitted by: ALS Laboratory Group (Thailand) Co., Ltd.  
Ambient Temperature: ( 23 ± 2 ) °C  
Relative Humidity: ( 50 ± 15 ) %  
Atmospheric Pressure: 1009 mbar  
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 guidelines.

**Condition of this result of calibration**  
1. Reference standards instruments:  
Instrument Model Serial No. Certificate No. Due Date  
1) Digital Pressure Gauge 15PSDXP2 156870 21P2929 03 Sep 2022  
2. This instrument was installed in vertical orientation and lower groove of pressure sensor was used as the reference level.  
3. This result of calibration was made on requested 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: Attapol Panurach  
Issue Date: 22 September 2021  
Approved Signatory: Attapol P.  
[ ] Phalinee Prabpaipal  
[ ] Sura Suwannasri  
[x] Attapol Panurach

B 0268464

Cert.No.: 21P3177  
Page: 2 of 2

**Result of calibration:- Without adjustment**  
Function:- Vacuum Pressure Measurement  
Range: 0 inHg to -30 inHg  
Resolution: 0.01 inHg

**Increasing Pressure**

Applied Pressure (inHg)	0.000	-5.000	-10.000	-15.000	-20.000	-26.800
UUC* Indication (inHg)	0.00	-5.07	-10.16	-15.20	-20.30	-27.17
Error (inHg)	0.000	-0.070	-0.160	-0.200	-0.300	-0.370

**Decreasing Pressure**

Applied Pressure (inHg)	-26.800	-20.000	-15.000	-10.000	-5.000	0.000
UUC* Indication (inHg)	-27.17	-20.30	-15.22	-10.16	-5.07	0.00
Error (inHg)	-0.370	-0.300	-0.220	-0.160	-0.070	0.000

The uncertainty of measurement was ± 0.090 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 %.

-00-

Attapol P.  
a 1068735

TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)  
CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES  
534/4 PATTANAKARN ROAD SOI 18, SUANLIANG, SUANLIANG, BANGKOK 10250  
TEL. 0-2717-3000-24 FAX. 0-2719-9484

**Certificate of Calibration** Certificate No.: 21P1350  
Page: 1 of 2

Equipment: Digital Vacuum Gauge  
Manufacturer: Dwyer  
Model: DPGA-00  
Serial No.: DVG03  
ID No.: BKK\_FS0435  
Condition As-Received: Used Item  
Received Date: 09 April 2021  
Calibration Date: 20 April 2021  
Reference: 2104-0323WSC Submitted by: ALS Laboratory Group (Thailand) Co., Ltd.  
Ambient Temperature: ( 23 ± 2 ) °C  
Relative Humidity: ( 50 ± 15 ) %  
Atmospheric Pressure: 1010 mbar  
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 guidelines.

**Condition of this result of calibration**  
1. Reference standards instruments:  
Instrument Model Serial No. Certificate No. Due Date  
1) Pressure Calibrator PC106P 1169 MP-0113-20 14 Jul 2021  
2. This instrument was installed in vertical orientation and lower groove of pressure sensor was used as the reference level.  
3. This result of calibration was made on requested 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: Suwit Aussanee  
Issue Date: 21 April 2021  
Approved Signatory: Attapol P.  
[ ] Phalinee Prabpaipal  
[ ] Sura Suwannasri  
[x] Attapol Panurach

B 0256843

Cert.No.: 21P1350  
Page: 2 of 2

**Result of calibration:- Without adjustment**  
Function:- Vacuum Pressure Measurement  
Range: 0 inHg to -30 inHg  
Resolution: 0.01 inHg

**Increasing Pressure**

Applied Pressure (inHg)	0.000	-4.998	-9.996	-14.994	-19.992	-26.487
UUC* Indication (inHg)	0.00	-5.05	-10.10	-15.20	-20.30	-26.90
Error (inHg)	0.000	-0.052	-0.104	-0.206	-0.308	-0.413

**Decreasing Pressure**

Applied Pressure (inHg)	-26.487	-19.992	-14.994	-9.996	-4.998	0.000
UUC* Indication (inHg)	-26.90	-20.30	-15.20	-10.10	-5.05	0.00
Error (inHg)	-0.413	-0.308	-0.206	-0.104	-0.052	0.000

The uncertainty of measurement was ± 0.090 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 %.

-00-

Attapol P.  
a 1046981

TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)  
CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES  
53/44 PATTANAKARN ROAD SOI 18, SUANLIJANG, SUANLIJANG, BANGKOK 10250  
TEL. 0-2717-3000-24 FAX. 0-2719-9484

**Certificate of Calibration** Certificate No.: 21P3176  
Page: 1 of 2

Equipment: Digital Pressure Gauge  
Manufacturer: Dwyer  
Model: DPGA-00  
Serial No.: DVG04  
ID No.: BKG\_FS0437  
Condition As-Received: Used Item  
Received Date: 15 September 2021  
Calibration Date: 21 September 2021  
Reference: 2109-0560WSC Submitted by: ALS Laboratory Group (Thailand) Co., Ltd.  
Ambient Temperature: ( 23 ± 2 ) °C  
Relative Humidity: ( 50 ± 15 ) %  
Atmospheric Pressure: 1009 mbar  
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 guidelines.

**Condition of this result of calibration**  
1. Reference standards instruments:

Instrument	Model	Serial No.	Certificate No.	Due Date
1) Digital Pressure Gauge	15PSIXP21	158670	21P2929	03 Sep 2022

2. This instrument was installed in vertical orientation and lower groove of pressure sensor was used as the reference level.  
3. This result of calibration was made on requested 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: Suksan Khankaew  
Issue Date: 22 September 2021

Approved Signatory: Attapol P.  
[ ] Phalinee Prabpalpal  
[ ] Sura Suwannasri  
[x] Attapol Panurach

B 0268463

Cert.No.: 21P3176  
Page: 2 of 2

Result of calibration:- Without adjustment  
Function:- Vacuum Pressure Measurement  
Range: 0 inHg to -30 inHg  
Resolution: 0.01 inHg

**Increasing Pressure**

Applied Pressure (inHg)	0.000	-5.000	-10.000	-15.000	-20.000	-25.000
UUC* Indication (inHg)	0.00	-5.06	-10.07	-15.10	-20.13	-25.14
Error (inHg)	0.000	-0.060	-0.070	-0.100	-0.130	-0.140

**Decreasing Pressure**

Applied Pressure (inHg)	-25.000	-20.000	-15.000	-10.000	-5.000	0.000
UUC* Indication (inHg)	-26.94	-20.14	-15.10	-10.08	-5.04	0.00
Error (inHg)	-0.140	-0.140	-0.100	-0.080	-0.040	0.000

The uncertainty of measurement was ± 0.090 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 %.

-00-

Attapol P.

a 1068736

TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)  
CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES  
53/44 PATTANAKARN ROAD SOI 18, SUANLIJANG, SUANLIJANG, BANGKOK 10250  
TEL. 0-2717-3000-24 FAX. 0-2719-9484

**Certificate of Calibration** Certificate No.: 21P3175  
Page: 1 of 2

Equipment: Vacuum Gauge  
Manufacturer: QualityWell  
Model: F221AVD  
Serial No.: VG01  
ID No.: RYG\_FS0332  
Condition As-Received: Used Item  
Received Date: 15 September 2021  
Calibration Date: 21 September 2021  
Reference: 2109-0560WSC Submitted by: ALS Laboratory Group (Thailand) Co., Ltd.  
Ambient Temperature: ( 23 ± 2 ) °C  
Relative Humidity: ( 50 ± 15 ) %  
Atmospheric Pressure: 1009 mbar  
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 guidelines.

**Condition of this result of calibration**  
1. Reference standards instruments:

Instrument	Model	Serial No.	Certificate No.	Due Date
1) Digital Pressure Gauge	15PSIXP21	158670	21P2929	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 requested 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: Suksan Khankaew  
Issue Date: 22 September 2021

Approved Signatory: Attapol P.  
[ ] Phalinee Prabpalpal  
[ ] Sura Suwannasri  
[x] Attapol Panurach

B 0268462

Cert.No.: 21P3175  
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	-4.74	-9.77	-14.83	-19.74	-25.62
UUC* Indication (inHg)	0.0	-5.0	-10.0	-15.0	-20.0	-26.0
Error (inHg)	0.00	-0.26	-0.23	-0.17	-0.26	-0.38

**Decreasing Pressure**

Applied Pressure (inHg)	-25.64	-19.70	-14.76	-9.77	-4.73	0.00
UUC* Indication (inHg)	-26.0	-20.0	-15.0	-10.0	-5.0	0.0
Error (inHg)	-0.36	-0.30	-0.24	-0.23	-0.27	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 %.

-00-

Attapol P.

a 1068738



## Certificate of Calibration

Equipment: SPECTROPHOTOMETER  
Model: DR3900  
Serial No. (or ID.): 2021761 (RYG\_EN0179)  
Manufacturer: HACH  
Condition: In Condition

Certificate No.: C06210513  
Issued Date: 02 November 2021  
Job No.: KSPR2114860  
Page: 1 of 2

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

Environment Condition: Temperature 22.2 °C ± 0.6 °C  
Humidity 61.8 %RH ± 2.5 %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. Chattuphon Fothong  
Calibration Date: 02 November 2021  
The Method used: In house method, SPCG-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 Starna Scientific Limited.

The standard for Wavelength Certificate No. 87146 and 87152  
The standard for Photometric Certificate No. 87220

REVIEW BY *N. Banwit*  
APPROVED BY *D. J.*  
NEXT CAL DATE *8/1/22*

*(Mr. Chattuphon Fothong)*  
Person in charge

*(Mr. Dumrong Boonsopon)*  
Authorized signatory

*(Mr. Dumrong Boonsopon)*  
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 standard or other recognized standard laboratories.  
The measurement uncertainty stated is the expanded uncertainty which is obtained from the standard uncertainty multiplied by the coverage factor (k=2) to provide a level of confidence of approximately 95%. It is determined in accordance with the Guide to Expression of Uncertainty in Measurement (GUM).  
These results may be affected by deviations from specified conditions. The results relate only to the items tested, calibrated or sampled. The report shall not be reproduced except in full without approval of SPC-RT Co., Ltd.

บริษัท เอสพี แล็บ จำกัด  
SPC RT CO., LTD.  
สาขา 00003 1184 ซอย นวมวงศ์ 47 แขวงบางนา เขตคลองเตย กรุงเทพมหานคร 10260  
Branch 00003 1184 Soi Nwamwong 47, Bangna Subdistrict, Bangkok 10260 Thailand  
Tel: 0 2185 4333 Ext. 3330-3338 Fax: 0 2185 4424 E-mail: info@spc-rt.com Website: www.spc-rt.com

SPCC-FIA-C06-12/23 Nov 2020

Calibration Results:  
Without Adjustment

Wavelength Accuracy (nm), The spectral bandwidth of Std at 5 nm and UUC at 5 nm	Standard Wavelength	Unit Under Calibration	Correction	Uncertainty
	418.40	418	0.40	0.59
	537.00	536	1.00	0.59
	638.00	638	0.00	0.59
	747.61	748	-0.39	0.59
	807.04	807	0.04	0.59

Photometric Accuracy (Absorbance)	Wavelength	Standard absorbance	Unit Under Calibration	Correction	Uncertainty
		0.0000	0.000	0.0000	0.0045
		0.5890	0.587	0.0020	0.0045
		0.7618	0.759	0.0026	0.0045
		1.0263	1.023	0.0033	0.0045
		0.0000	0.000	0.0000	0.0045
		0.5787	0.575	0.0037	0.0045
		0.7442	0.741	0.0032	0.0045
		1.0039	1.000	0.0039	0.0045
		0.0000	0.000	0.0000	0.0045
		0.5292	0.528	0.0012	0.0045
		0.6865	0.686	0.0005	0.0045
		0.9534	0.952	0.0014	0.0045
		0.0000	0.000	0.0000	0.0045
		0.5468	0.545	0.0018	0.0045
		0.6957	0.694	0.0017	0.0045
		0.9991	0.998	0.0011	0.0045
		0.0000	0.000	0.0000	0.0045
		0.5851	0.582	0.0031	0.0045
		0.7238	0.721	0.0028	0.0045
		1.0957	1.091	0.0047	0.0045
		0.0000	0.000	0.0000	0.0045
		0.5892	0.587	0.0022	0.0045
		0.6914	0.690	0.0014	0.0045
		1.0881	1.086	0.0021	0.0045

The End of Certificate

บริษัท เอสพี แล็บ จำกัด  
SPC RT CO., LTD.  
สาขา 00003 1184 ซอย นวมวงศ์ 47 แขวงบางนา เขตคลองเตย กรุงเทพมหานคร 10260  
Branch 00003 1184 Soi Nwamwong 47, Bangna Subdistrict, Bangkok 10260 Thailand  
Tel: 0 2185 4333 Ext. 3330-3338 Fax: 0 2185 4424 E-mail: info@spc-rt.com Website: www.spc-rt.com

SPCC-FIA-C06-12/23 Nov 2020

## ใบตรวจสอบสภาพเครื่องวัดสิ่งแวดล้อม

เลขที่ใบงาน: KSPR2114860

ชนิดเครื่องมือ: SPECTROPHOTOMETER		รุ่น: DR3900	หมายเลขเครื่อง: 2021761	
ตรวจสอบ (วัน)		รายการตรวจเช็ค		หมายเหตุ
02 Nov 2021		02 Nov 2021		
ปกติ	ไม่ปกติ	ปกติ	ไม่ปกติ	
<b>General</b>				
<input checked="" type="checkbox"/>	<input type="checkbox"/>	1. ความสมบูรณ์เครื่อง	<input checked="" type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	2. ความสะอาด (ช่องใส่ตัวอย่าง, ภายใน-นอกเครื่อง)	<input checked="" type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	3. สวิทช์ ปิด - เปิด เครื่อง (On-Off Switch)	<input checked="" type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	4. ปุ่มกด (Keypad)	<input checked="" type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	5. หน้าจอ (Display, Screen Contrast)	<input checked="" type="checkbox"/>	
<b>Spectrophotometer</b>				
<input type="checkbox"/>	<input type="checkbox"/>	6. แรงดันไฟฟ้า (Battery Backup) >= 2.5 VDC	<input type="checkbox"/>	
<input type="checkbox"/>	<input type="checkbox"/>	7. ตัวหมุนเลือกความยาวคลื่น (Wavelength Control)	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	8. ความยาวคลื่น (Wavelength Check)	<input checked="" type="checkbox"/>	807 ได้ 807.3 nm
<input type="checkbox"/>	<input type="checkbox"/>	9. แหล่งกำเนิดแสง (UV < 3,000 hour)	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	10. แหล่งกำเนิดแสง (Visible < 5,000 hour)	<input checked="" type="checkbox"/>	
<input type="checkbox"/>	<input type="checkbox"/>	11. ช่องวัดหลายตัวอย่าง (Carousel Module)	<input type="checkbox"/>	
<b>pH Meter and Conductivity Meter</b>				
<input type="checkbox"/>	<input type="checkbox"/>	12. อิเล็กโทรด (Electrode and Connection Cable)	<input type="checkbox"/>	
<input type="checkbox"/>	<input type="checkbox"/>	13. ระดับสารละลายใน Electrode (Level KCl)	<input type="checkbox"/>	
<input type="checkbox"/>	<input type="checkbox"/>	14. ฝาปิดกันเปื้อน Electrode (Dust Protection Hood)	<input type="checkbox"/>	
<input type="checkbox"/>	<input type="checkbox"/>	15. ขาตั้งอิเล็กโทรด (Stand)	<input type="checkbox"/>	
<b>Turbidimeter</b>				
<input type="checkbox"/>	<input type="checkbox"/>	16. ค่าความขุ่นที่ต่ำสุด (No Sample)	<input type="checkbox"/>	
<input type="checkbox"/>	<input type="checkbox"/>	17. ระดับการล่อแสงของแสง >= 2.5 ไม่นาที 3.0)	<input type="checkbox"/>	
<b>Automatic titrator</b>				
<input type="checkbox"/>	<input type="checkbox"/>	18. สภาพ Piston Burettes	<input type="checkbox"/>	
<input type="checkbox"/>	<input type="checkbox"/>	19. Function Rinsing and Dosing	<input type="checkbox"/>	
<input type="checkbox"/>	<input type="checkbox"/>	20. ระบบท่อสายยางและอุปกรณ์ประกอบ	<input type="checkbox"/>	

เพื่อเตรียมข้อมูล:

Mr. Chattuphon Fothong  
Service Engineer

Certificate No.: G 650023  
Date of issue : 21-Jan-22

Instrument description : Flue gas Analyzer  
Instrument model : Testo 340  
Instrument serial no. : 62150585  
ID no. or control no. : RYG\_F50465  
Manufacturer : testo SE  
Probe description : -  
Probe model : -  
Probe serial : -  
Customer name : ALS LABORATORY GROUP (THAILAND) CO., LTD.  
Customer address : 104 Phattanasarak 40, Phattanasarak Road, Khwaeng Phattanasarak, Khet Suan Luang, Bangkok, 10250 Thailand

Total pages of certificate : 3 Pages  
Receiving no. : L-220082  
Receiving date : 14-Jan-22  
Parameter of calibration : Gas Calibration(Oxygen 2.501,10.00,21.00 %v/v, Carbon Monoxide 80.97,309.9,1003 ppm), Nitric Oxide 10.08,150.9,320.6 ppm, Sulphur Dioxide 50.04,100.9,601.1 ppm)

Condition of UUC. : Used  
Ambient condition : All of the Measurement were carried out the stabilized laboratory  
Temperature : 23 ± 5 °C  
Humidity : 55 ± 45 %RH  
Calibration place : 17/121 Soi Nigamwongwan 47 Yeak 48, Toongsonghong, Lakki, Bangkok 10210  
Calibration procedure no. : WI-CL-28-C

REVIEW BY *Nongluck P.*  
APPROVED BY *Nongluck P.*  
NEXT CAL DATE *14/1/22*

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

Date of calibration : 19-Jan-22

*(Mr. Nongluck Wongsettee)*  
Mr. Nongluck Wongsettee  
Calibration Technician

*(Mr. Nongluck Wongsettee)*  
Mr. Nongluck Wongsettee  
Technical Manager

Standard References (Table 1)

Standard	Certificate No.	Vendor	Due date
Oxygen ( O <sub>2</sub> ) 2.501 % Vol	2431/19	Linde	16-Jul-23
Oxygen ( O <sub>2</sub> ) 10.00 % Vol	2453/19	Linde	18-Jul-23
Oxygen ( O <sub>2</sub> ) 21.00 % Vol	2426/19	Linde	16-Jul-23
Carbon monoxide ( CO ) 89.97 ppm	2842/21	Linde	24-Jun-23
Carbon monoxide ( CO ) 309.9 ppm	2803/21	Linde	22-Jun-23
Carbon monoxide ( CO ) 1003 ppm	2829/21	Linde	23-Apr-23
Nitric Oxide ( NO ) 10.08 ppm	3241/21	Linde	25-Jul-23
Nitric Oxide ( NO ) 150.9 ppm	2857/21	Linde	27-Jun-23
Nitric Oxide ( NO ) 320.6 ppm	2944/21	Linde	2 Jul 23
Sulphur Dioxide ( SO <sub>2</sub> ) 50.04 ppm	3205/21	Linde	25-Jul-23
Sulphur Dioxide ( SO <sub>2</sub> ) 100.9 ppm	4942/20	Linde	20-Nov-22
Sulphur Dioxide ( SO <sub>2</sub> ) 601.1 ppm	3204/21	Linde	20-Jul-23

Measured room conditions

Temperature : 22.5 °C Humidity : 56.2 %RH Pressure : 1018.3 mbar

Calibration conditions

Gas Temperature : 23 °C Flow rate : 600 ml/min Gas pressure : 1021.9 mbar

Calibration Results Before Adjustment (Table 2)

Parameter of Standard	Standard Values	Mean of UUC	Error	Uncertainty (±)
O <sub>2</sub> (%Vol)	2.501	2.47	-0.031	0.20
O <sub>2</sub> (%Vol)	10.00	9.89	-0.11	0.40
O <sub>2</sub> (%Vol)	21.00	21.12	0.12	0.80
CO (ppm)	89.97	83	2.03	2.8
CO (ppm)	309.9	314	4.1	11
CO (ppm)	1003	1016	13	34
NO (ppm)	10.08	8	-2.08	3.0
NO (ppm)	150.9	162	11.1	5.0
NO (ppm)	320.6	345	24.4	10
SO <sub>2</sub> (ppm)	50.04	38	-12.04	5.0
SO <sub>2</sub> (ppm)	100.9	92	-8.9	5.0
SO <sub>2</sub> (ppm)	601.1	593	-8.1	14

FM-CL-09-C Rev.0

Page 2 of 3

Issued Date 23/02/16

ENTECH INDUSTRIAL SOLUTION CO.,LTD.

171121 Sor Ngamwongwan 47 Yrak 48, Toongsonghong, Lakki Bangkok 10210 THAILAND Tel. 0-2779-8888 Fax. 0-2779-8890 info@entech.co.th  
Tax ID : 0105538035501 www.entech.co.th

Calibration Results After Adjustment (Table 3)

Parameter of Standard	Standard Values	Mean of UUC	Error	Uncertainty (±)
O <sub>2</sub> (%Vol)	2.501	2.47	-0.031	0.20
O <sub>2</sub> (%Vol)	10.00	9.89	-0.11	0.40
O <sub>2</sub> (%Vol)	21.00	21.11	0.12	0.80
CO (ppm)	89.97	83	2.03	2.8
CO (ppm)	309.9	314	4.1	11
CO (ppm)	1003	1016	13	34
NO (ppm)	10.08	9	-1.08	3.0
NO (ppm)	150.90	150	-0.9	5.0
NO (ppm)	320.6	318	-2.6	10
SO <sub>2</sub> (ppm)	50.04	48	-2.04	5.0
SO <sub>2</sub> (ppm)	100.9	101	0.1	5.0
SO <sub>2</sub> (ppm)	601.1	604	2.9	14

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

End of Report

FM-CL-09-C Rev.0

Page 3 of 3

Issued Date 23/02/16

ENTECH INDUSTRIAL SOLUTION CO.,LTD.

171121 Sor Ngamwongwan 47 Yrak 48, Toongsonghong, Lakki Bangkok 10210 THAILAND Tel. 0-2779-8888 Fax. 0-2779-8890 info@entech.co.th  
Tax ID : 0105538035501 www.entech.co.th



ROTA METER CALIBRATION RESULT JULY 2022

Rotameter ID.	Calibration Date	Regression Result	Coefficient (R <sup>2</sup> )
BKK_FS0577	01 Jul 22	Y = 1.0202x + 0.1976	1.0000
BKK_FS0579	01 Jul 22	Y = 1.0078x + 0.4789	0.9998
BKK_FS0583	01 Jul 22	Y = 1.016x + 0.3922	1.0000
BKK_FS0584	01 Jul 22	Y = 1.0036x + 2.2262	0.9997
BKK_FS0585	01 Jul 22	Y = 1.0189x - 5.6476	0.9997
BKK_FS0586	01 Jul 22	Y = 1.0095x - 1.1524	0.9995
BKK_FS0587	01 Jul 22	Y = 1.013x - 3.6619	0.9996
BKK_FS0588	01 Jul 22	Y = 1.0154x + 4.8357	0.9999
BKK_FS0589	01 Jul 22	Y = 0.9918x + 4.8069	0.9999
BKK_FS0590	01 Jul 22	Y = 1.0038x - 0.4857	0.9996
BKK_FS0591	01 Jul 22	Y = 0.9705x - 52.174	0.9986
BKK_FS0592	01 Jul 22	Y = 0.9646x - 37.642	0.9985
BKK_FS0593	01 Jul 22	Y = 0.9767x - 58.445	0.9988
BKK_FS0594	01 Jul 22	Y = 0.9902x - 62.87	0.9999
BKK_FS0595	01 Jul 22	Y = 1.0249x - 98.162	0.9999
BKK_FS0596	01 Jul 22	Y = 0.9843x - 26.806	0.9991
BKK_FS0597	01 Jul 22	Y = 0.9802x - 61.653	0.9978
BKK_FS1004	01 Jul 22	Y = 0.9696x + 17.69	0.9990
BKK_FS1005	01 Jul 22	Y = 1.0092x + 2.4571	0.9999
BKK_FS1006	01 Jul 22	Y = 1.168x - 5.566	0.9997
BKK_FS1007	01 Jul 22	Y = 0.9917x + 1.6592	1.0000
BKK_FS1008	01 Jul 22	Y = 1.0132x + 0.7207	1.0000
BKK_FS1009	01 Jul 22	Y = 1.0132x + 1.1633	0.9960
BKK_FS1010	01 Jul 22	Y = 1.0033x + 0.5758	0.9999
BKK_FS1011	01 Jul 22	Y = 1.0234x + 0.1759	0.9996
BKK_FS1012	01 Jul 22	Y = 1.0106x - 2.0048	0.9997
BKK_FS1013	01 Jul 22	Y = 0.9677x - 35.851	0.9997
BKK_FS1014	01 Jul 22	Y = 1.0021x + 0.3148	0.9998
BKK_FS1015	01 Jul 22	Y = 0.9994x + 1.786	1.0000
BKK_FS1016	01 Jul 22	Y = 1.0105x - 80.256	0.9998
BKK_FS1017	01 Jul 22	Y = 0.9995x + 0.649	1.0000
BKK_FS1018	01 Jul 22	Y = 1.0011x + 1.1786	1.0000
BKK_FS1019	01 Jul 22	Y = 1.0023x - 68.424	0.9996
BKK_FS1020	01 Jul 22	Y = 1.0547x - 0.666	0.9998
BKK_FS1021	01 Jul 22	Y = 1.018x - 3.3286	0.9998
BKK_FS1022	01 Jul 22	Y = 0.9932x - 57.035	0.9986
BKK_FS1023	01 Jul 22	Y = 1.0094x + 0.0717	0.9999
BKK_FS1024	01 Jul 22	Y = 1.0042x + 0.4086	0.9997
BKK_FS1025	01 Jul 22	Y = 1.0132x - 88.507	0.9996



ROTA METER CALIBRATION RESULT JULY 2022

Rotameter ID.	Calibration Date	Regression Result	Coefficient (R <sup>2</sup> )
BKK_FS1026	01 Jul 22	Y = 1.0018x + 1.0776	0.9997
BKK_FS1027	01 Jul 22	Y = 1.0053x + 0.231	0.9995
BKK_FS1028	01 Jul 22	Y = 0.9792x - 60.312	0.9982
BKK_FS1029	01 Jul 22	Y = 0.9935x + 0.8234	1.0000
BKK_FS1030	01 Jul 22	Y = 1.0039x + 0.515	0.9999
BKK_FS1031	01 Jul 22	Y = 1.009x - 79.295	0.9998
BKK_FS1039	01 Jul 22	Y = 0.9879x + 7.3524	0.9996
BKK_FS1040	01 Jul 22	Y = 0.9704x + 88.336	0.9987
BKK_FS1041	01 Jul 22	Y = 1.0645x - 1.7878	0.9999
BKK_FS1042	01 Jul 22	Y = 0.9983x + 3.6262	0.9998
BKK_FS1043	01 Jul 22	Y = 1.0089x - 6.9619	1.0000
BKK_FS1044	01 Jul 22	Y = 1.0355x - 0.6214	0.9997
BKK_FS1161	01 Jul 22	Y = 1.0126x + 0.7738	0.9999
BKK_FS1162	01 Jul 22	Y = 0.9994x + 2.6357	0.9995
BKK_FS1163	01 Jul 22	Y = 0.977x - 55.03	0.9987
BKK_FS1164	01 Jul 22	Y = 0.9914x + 0.8427	0.9997
BKK_FS1165	01 Jul 22	Y = 0.9893x + 6.5919	0.9998
BKK_FS1166	01 Jul 22	Y = 1.0031x - 77.881	0.9996
BKK_FS1200	01 Jul 22	Y = 1.0313x - 0.4602	0.9995
BKK_FS1201	01 Jul 22	Y = 1.0045x + 0.15	0.9996
BKK_FS1202	01 Jul 22	Y = 0.9702x - 44.156	0.9994
RYG_FS0197	01 Jul 22	Y = 1.0039x - 0.179	0.9999
RYG_FS0198	01 Jul 22	Y = 0.9971x + 16.648	0.9999
RYG_FS0199	01 Jul 22	Y = 1.0832x - 2.6367	1.0000

Review By :

(Mr. Wichan Choonharat)

Enviro Field Services Manager

Approved By :

(Mr. Sarayuth Jittrantoni)

Assistant General Manager

## Certificate of System Qualification

GC-OQ

System ID: GC-6  
Organization Name: ALS Laboratory Group (Thailand) Co., Ltd.  
Organization Location: 104 Phattanakan 40, Phattanakan Rd., Suan Luang, Bangkok 10250  
Date: October 21, 2021 10:05:40 AM  
EQP Name: AgilentRecommended  
EQP Revision: GC.O2.50  
Overall Qualification Status: Pass

REVIEW BY: *Surabode T.*  
APPROVED BY: *Surabode T.*  
NEXT CAL DATE: 21 Apr 2023

## 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: 0.0 psi /5 minutes

Agilent Recommended:  $\geq -2.0$  and  $\leq 0.5$ 

## Overall Inlet Pressure Decay Test Status

Pass

## Inlet Pressure Accuracy

Name: 7890

Front SSL

Date: October 21, 2021 10:05:40 AM  
System ID: GC-6

Page 1 / 22

Setpoint Status: Pass

Setpoint Actual  
Inlet Pressure: 25.0 psi 24.9 psi  
Accuracy: 0.1 psi  
Agilent Recommended:  $\leq 1.2$

## 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:  $\geq -2.0$  and  $\leq 0.5$ 

## Overall Inlet Pressure Decay Test Status

Pass

## Inlet Pressure Accuracy

Name: 7890

Back SSL

Setpoint Status: Pass

Setpoint Actual  
Inlet Pressure: 25.0 psi 24.9 psi  
Accuracy: 0.1 psi  
Agilent Recommended:  $\leq 1.2$

## Overall Inlet Pressure Accuracy Test Status

Pass

## Detector Flow Accuracy

Date: October 21, 2021 10:05:40 AM  
System ID: GC-6

Page 2 / 22

Name: 7890

Front FID

Setpoint Status: Pass

Flow Type: Fuel

Setpoint: 30.0 mL/min Measured Flow: 30.5 mL/min

Accuracy: 0.5 mL/min

Agilent Recommended:  $\leq 10.0$  % 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: 394.0 mL/min

Accuracy: 6.0 mL/min

Agilent Recommended:  $\leq 10.0$  % 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: 24.2 mL/min

Accuracy: 0.8 mL/min

Agilent Recommended:  $\leq 10.0$  % 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

## Detector Flow Accuracy

Name: 7890

Back FID

Date: October 21, 2021 10:05:40 AM  
System ID: GC-6

Page 3 / 22

Setpoint Status: Pass

Flow Type: Fuel

Setpoint: 30.0 mL/min Measured Flow: 29.1 mL/min

Accuracy: 0.9 mL/min

Agilent Recommended:  $\leq 10.0$  % 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: 397.3 mL/min

Accuracy: 2.7 mL/min

Agilent Recommended:  $\leq 10.0$  % 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: 24.4 mL/min

Accuracy: 0.6 mL/min

Agilent Recommended:  $\leq 10.0$  % 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: October 21, 2021 10:05:40 AM  
System ID: GC-6

Page 4 / 22

Setpoint Status: Pass  
Zone: Oven  
Setpoint/Actual  
Temperature: 230.0 231.5 °C  
Accuracy: 1.5 °C  
Agilent Recommended:  $\geq -1.0$  % setpoint in K ( -5.0 °C )  
 $\leq 1.0$  % setpoint in K ( 5.0 °C )

Setpoint Status: Pass  
Zone: Oven  
Setpoint/Actual  
Temperature: 100.0 100.5 °C  
Accuracy: 0.5 °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: 100.0 100.4667 °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: October 21, 2021 10:05:40 AM  
System ID: GC-6

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: 12.7 pA  
ASTM Noise  
pA  
0.06  
Agilent Recommended:  $\leq 0.10$   
Status: Pass  
Drift  
pA/Hr  
0.10  
Agilent Recommended:  $\leq 2.50$   
Status: 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 µL  
Area RSD: 0.42 % Retention Time RSD: 0.16 %  
Agilent Recommended:  $\leq 3.00$   $\leq 1.00$

## Overall Injection Precision Test Status

Pass

## Signal to Noise

Date: October 21, 2021 10:05:40 AM  
System ID: GC-6

Tested Combination1 Front SSL / Front FID  
Injection Tower  
Name: 7890

Setpoint Status: Pass  
Signal to Noise: 1174661  
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 µL

## Overall Scouting Run Status

Completed

## Noise and Drift

Tested Combination2 Back SSL / Back FID  
Name: 7890

Setpoint Status: Pass  
Base Signal: 10.4 pA  
ASTM Noise  
pA  
0.05  
Agilent Recommended:  $\leq 0.10$   
Status: Pass  
Drift  
pA/Hr  
0.00  
Agilent Recommended:  $\leq 2.50$   
Status: Pass

Date: October 21, 2021 10:05:40 AM  
System ID: GC-6

## 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: 1.16 % Retention Time RSD: 0.12 %  
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: 805466  
Agilent Recommended:  $\geq 300000$

## Overall Signal to Noise Test Status

Pass

Date: October 21, 2021 10:05:40 AM  
System ID: GC-6

## Instrument Details

### Purpose

This section describes the as found system configuration

### Details

#### System

System ID	GC-6
Manufacturer	Agilent Technologies
Name	7890
Flow Data Input	Manual Data
Temperature Data Input	Manual Data or Other Data Logging

#### Tested Combination1

Injection Technique	Injection Tower
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	7893A
Model Number	G4514A
Serial Number	CN15380030
Firmware Revision	A.11.01
Vial Heater	Not installed

Date: October 21, 2021 10:05:40 AM  
System ID: GC-6

Page 9 / 22

#### Sampler 2

Manufacturer	Agilent Technologies
Type	Injection Tower
Name	7893A
Model Number	G4513A
Serial Number	CN10340103
Firmware Revision	A.10.09
Usage	Sample Injection
Location	Front
Syringe Volume (µL)	10

#### Sampler 3

Manufacturer	Agilent Technologies
Type	Injection Tower
Name	7893A
Model Number	G4513A
Serial Number	CN16280128
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	CN11461066
Firmware Revision	Version 4.27
Component ID/Asset No.	GC-6
Oven Type	Standard

Date: October 21, 2021 10:05:40 AM  
System ID: GC-6

Page 10 / 22

#### 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: October 21, 2021 10:05:40 AM  
System ID: GC-6

Page 11 / 22

## 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:	Suriya Thongkaew
Logged On User Name:	suriya.thongkaew@non.agilent.com
Signature Creation Date:	October 21, 2021
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 promises or representations as to its sufficiency for any specific regulatory program.

### Warranty

Agilent Technologies makes no warranty of any kind to this material, including but not limited to, the implied warranties or merchantability and fitness for a particular purpose. Agilent Technologies shall not be liable for errors contained herein or for incidental or consequential damages in connection with the furnishing, performance, or use of this material.

Date: October 21, 2021 10:05:40 AM  
System ID: GC-6

Page 12 / 22

User Name: suriya.thongkawe Hostname: ASBKKW7915		System ID: GC-6 Print Date: October 21, 2021 10:05:46 AM		
OQ GC ALS CN1461066 Transaction log :				
Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
October 20, 2021 12:18:50 PM	Audit	SessionCreated	Session	None
October 20, 2021 12:18:50 PM	Start	Configuration	Session	None
October 20, 2021 12:18:50 PM	Audit	Entitlement	Licensing	User is Nonpaying and does not require an unlock code
October 20, 2021 12:24:51 PM	Audit	Eng. Loaded	Session	EOP details for primary technique [GC] - File path: [ProtocolBack]\GC\Config\one02.01\GC_02.01.eop. EOP File Name: [GC_02.01.eop], EOP Name: [AgilentRecommended]
October 20, 2021 12:25:02 PM	End	Configuration	Session	None
October 20, 2021 12:25:09 PM	Start	Qualification	Session	OQ
October 20, 2021 12:25:09 PM	Start	Execution	System Inspection and Basic Safety and Operation - 7890 - Qualitative Test - No setpoints associated	None
October 20, 2021 12:30:25 PM	End	Execution	System Inspection and Basic Safety and Operation - 7890 - Qualitative Test - No setpoints associated	Run Count : 1
October 20, 2021 12:36:29 PM	Start	Execution	Inlet Pressure Decay - Front SSL - Pressure Controlled Inlet - S: 25.0 psi - L: >= -2.0 psi and <= 0.5 psi	None

Page 1 / 10

Page 1 / 10

Date: October 21, 2021 10:05:40 AM  
System ID: GC-6

Page 13 / 22

User Name: suriya.thongkawe

Hostname: ASBKKW7915

System ID: GC-6

Print Date: October 21, 2021 10:05:46 AM

OQ GC ALS CN1461066 Transaction log :

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
October 20, 2021 1:02:18 PM	End	Execution	Inlet Pressure Decay - Front SSL - Pressure Controlled Inlet - S: 25.0 psi - L: >= -2.0 psi and <= 0.5 psi	Run Count : 1
October 20, 2021 1:02:18 PM	Start	Execution	Inlet Pressure Accuracy - Front SSL - Pressure Controlled Inlet - S: 25.0 psi - L: <= 1.2 psi	None
October 20, 2021 1:02:26 PM	End	Execution	Inlet Pressure Accuracy - Front SSL - Pressure Controlled Inlet - S: 25.0 psi - L: <= 1.2 psi	Run Count : 1
October 20, 2021 1:02:29 PM	Start	Execution	Inlet Pressure Decay - Back SSL - Pressure Controlled Inlet - S: 25.0 psi - L: >= -2.0 psi and <= 0.5 psi	None
October 20, 2021 1:04:21 PM	End	Execution	Inlet Pressure Decay - Back SSL - Pressure Controlled Inlet - S: 25.0 psi - L: >= -2.0 psi and <= 0.5 psi	Run Count : 1
October 20, 2021 1:07:53 PM	Start	Execution	Inlet Pressure Accuracy - Back SSL - Pressure Controlled Inlet - S: 25.0 psi - L: <= 1.2 psi	None
October 20, 2021 1:08:11 PM	End	Execution	Inlet Pressure Accuracy - Back SSL - Pressure Controlled Inlet - S: 25.0 psi - L: <= 1.2 psi	Run Count : 1
October 20, 2021 1:08:16 PM	Start	Execution	Detector Flow Accuracy - Front FID - Type: Fuel - S: 30.0 mL/min - L: <= 10.0% setpoint	None
October 20, 2021 1:20:23 PM	Audit	Data	Detector Flow Accuracy - Front FID - Type: Fuel - S: 30.0 mL/min - L: <= 10.0% setpoint	Manual Data Entry
October 20, 2021 1:20:26 PM	End	Execution	Detector Flow Accuracy - Front FID - Type: Fuel - S: 30.0 mL/min - L: <= 10.0% setpoint	Run Count : 1

Page 2 / 10

Page 2 / 10

Date: October 21, 2021 10:05:40 AM  
System ID: GC-6

Page 14 / 22

User Name: suriya.thongkawe

Hostname: ASBKKW7915

System ID: GC-6

Print Date: October 21, 2021 10:05:46 AM

OQ GC ALS CN1461066 Transaction log :

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
October 20, 2021 1:20:29 PM	Start	Execution	Detector Flow Accuracy - Front FID - Type: Oxidizer - S: 400.0 mL/min - L: <= 10.0% setpoint	None
October 20, 2021 1:23:27 PM	Audit	Data	Detector Flow Accuracy - Front FID - Type: Oxidizer - S: 400.0 mL/min - L: <= 10.0% setpoint	Manual Data Entry
October 20, 2021 1:23:29 PM	End	Execution	Detector Flow Accuracy - Front FID - Type: Oxidizer - S: 400.0 mL/min - L: <= 10.0% setpoint	Run Count : 1
October 20, 2021 1:23:31 PM	Start	Execution	Detector Flow Accuracy - Front FID - Type: Makeup - S: 25.0 mL/min - L: <= 10.0% setpoint	None
October 20, 2021 1:27:40 PM	Audit	Data	Detector Flow Accuracy - Front FID - Type: Makeup - S: 25.0 mL/min - L: <= 10.0% setpoint	Manual Data Entry
October 20, 2021 1:27:42 PM	End	Execution	Detector Flow Accuracy - Front FID - Type: Makeup - S: 25.0 mL/min - L: <= 10.0% setpoint	Run Count : 1
October 20, 2021 1:27:46 PM	Start	Execution	Detector Flow Accuracy - Back FID - Type: Fuel - S: 30.0 mL/min - L: <= 10.0% setpoint	None
October 20, 2021 1:32:10 PM	Audit	Data	Detector Flow Accuracy - Back FID - Type: Fuel - S: 30.0 mL/min - L: <= 10.0% setpoint	Manual Data Entry
October 20, 2021 1:32:12 PM	End	Execution	Detector Flow Accuracy - Back FID - Type: Fuel - S: 30.0 mL/min - L: <= 10.0% setpoint	Run Count : 1
October 20, 2021 1:32:14 PM	Start	Execution	Detector Flow Accuracy - Back FID - Type: Oxidizer - S: 400.0 mL/min - L: <= 10.0% setpoint	None
October 20, 2021 1:34:13 PM	Audit	Data	Detector Flow Accuracy - Back FID - Type: Oxidizer - S: 400.0 mL/min - L: <= 10.0% setpoint	Manual Data Entry

Page 3 / 10

Page 3 / 10

Date: October 21, 2021 10:05:40 AM  
System ID: GC-6

Page 15 / 22

User Name: suriya.thongkawe Hostname: ASBKKW7915			System ID: GC-6 Print Date: October 21, 2021 10:05:46 AM	
OQ GC ALS CN1461066 Transaction log :				
Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
October 20, 2021 1:34:16 PM	End	Execution	Detector Flow Accuracy - Back FID - Type: Oxidizer - S: 400.0 mL/min - L: <= 10.0% setpoint	Run Count : 1
October 20, 2021 1:34:46 PM	Start	Execution	Detector Flow Accuracy - Back FID - Type: Makeup - S: 25.0 mL/min - L: <= 10.0% setpoint	None
October 20, 2021 1:36:33 PM	Audit	Data	Detector Flow Accuracy - Back FID - Type: Makeup - S: 25.0 mL/min - L: <= 10.0% setpoint	Manual Data Entry
October 20, 2021 1:36:36 PM	End	Execution	Detector Flow Accuracy - Back FID - Type: Makeup - S: 25.0 mL/min - L: <= 10.0% setpoint	Run Count : 1
October 20, 2021 1:36:38 PM	Start	Execution	GC Oven Temperature Accuracy - 7890 - Temperature (Oven - S: 230.0°C - L: >= -1.0 AND <= 1.0 % setpoint in K)	None
October 20, 2021 2:04:31 PM	Audit	Data	GC Oven Temperature Accuracy - 7890 - Temperature (Oven - S: 230.0°C - L: >= -1.0 AND <= 1.0 % setpoint in K)	Manual Data Entry
October 20, 2021 2:04:32 PM	End	Execution	GC Oven Temperature Accuracy - 7890 - Temperature (Oven - S: 230.0°C - L: >= -1.0 AND <= 1.0 % setpoint in K)	Run Count : 1
October 20, 2021 2:04:34 PM	Start	Execution	GC Oven Temperature Accuracy - 7890 - Temperature (Oven - S: 100.0°C - L: >= -1.0 AND <= 1.0 % setpoint in K)	None
October 20, 2021 2:10:47 PM	Audit	Data	GC Oven Temperature Accuracy - 7890 - Temperature (Oven - S: 100.0°C - L: >= -1.0 AND <= 1.0 % setpoint in K)	Manual Data Entry

Page 4 / 10

Page 4 / 10

Date: October 21, 2021 10:05:40 AM  
System ID: GC-6

Page 16 / 22

User Name: suriya.thongkiew  
Host Name: ASBKKW7015  
Print Date: October 21, 2021 10:05:46 AM  
System ID: GC-6

GC ALS CN11461066 Transaction log:

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
October 20, 2021 2:10:48 PM	End	Execution	GC Oven Temperature Accuracy - 7890 - Temperature Over: S: 100.0°C - L: <= 1.0 AND <= 1.0 % setpoint in K	Run Count: 1
October 20, 2021 2:10:51 PM	Start	Execution	GC Oven Temperature Stability - 7890 - Temperature Over: S: 100.0°C - L: <= 0.5°C	None
October 20, 2021 2:31:39 PM	Auto	Data	GC Oven Temperature Stability - 7890 - Temperature Over: S: 100.0°C - L: <= 0.5°C	Manual Data Entry
October 20, 2021 2:31:41 PM	End	Execution	GC Oven Temperature Stability - 7890 - Temperature Over: S: 100.0°C - L: <= 0.5°C	Run Count: 1
October 20, 2021 2:31:44 PM	Start	Execution	GC Scouting Run - Injection Tower, Front SSL, Front FID - Part of System Preparation - No limits associated	None
October 20, 2021 2:43:08 PM	Auto	AcqClosed	Session	None
October 21, 2021 9:18:09 AM	Auto	AcqRestarted	Session	None
October 21, 2021 9:19:02 AM	Auto	SessionReloaded	Session	None
October 21, 2021 9:19:06 AM	Start	Qualification	Session	OQ
October 21, 2021 9:19:09 AM	Start	Execution	GC Scouting Run - Injection Tower, Front SSL, Front FID - Part of System Preparation - No limits associated	None
October 21, 2021 9:19:41 AM	Auto	AcqClosed	Session	None

Page 5 / 18

Date: October 21, 2021 10:05:40 AM  
System ID: GC-6

Page 17 / 22

User Name: suriya.thongkiew  
Host Name: ASBKKW7015  
Print Date: October 21, 2021 10:05:46 AM  
System ID: GC-6

GC ALS CN11461066 Transaction log:

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
October 21, 2021 9:20:08 AM	Auto	AcqRestarted	Session	None
October 21, 2021 9:20:09 AM	Auto	SessionReloaded	Session	None
October 21, 2021 9:20:13 AM	Start	Qualification	Session	OQ
October 21, 2021 9:20:13 AM	Start	Execution	GC Scouting Run - Injection Tower, Front SSL, Front FID - Part of System Preparation - No limits associated	None
October 21, 2021 9:29:45 AM	Auto	Data	GC Scouting Run - Injection Tower, Front SSL, Front FID - Part of System Preparation - No limits associated	Data File Path: C:\Chem321\DATA\OQPV20\21OQPV2021_F_2021-10-20\15-45-01\SCOUT_F001.D\FID1A.ch
October 21, 2021 9:30:05 AM	End	Execution	GC Scouting Run - Injection Tower, Front SSL, Front FID - Part of System Preparation - No limits associated	Run Count: 1
October 21, 2021 9:30:08 AM	Start	Execution	Noise and DR - Front FID - Detector FID - L (Noise) <= 0.10 pA - L (DR) <= 2.50 pA/Hz	None
October 21, 2021 9:30:41 AM	Auto	Data	Noise and DR - Front FID - Detector FID - L (Noise) <= 0.10 pA - L (DR) <= 2.50 pA/Hz	Data File Path: C:\Chem321\DATA\OQPV20\21OQPV2021_F_2021-10-20\15-45-01\SCOUT_F001.D\FID1A.ch
October 21, 2021 9:31:10 AM	End	Execution	Noise and DR - Front FID - Detector FID - L (Noise) <= 0.10 pA - L (DR) <= 2.50 pA/Hz	Run Count: 1

Page 6 / 18

Date: October 21, 2021 10:05:40 AM  
System ID: GC-6

Page 18 / 22

User Name: suriya.thongkiew  
Host Name: ASBKKW7015  
Print Date: October 21, 2021 10:05:46 AM  
System ID: GC-6

GC ALS CN11461066 Transaction log:

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
October 21, 2021 9:31:42 AM	Start	Execution	Injection Precision - Injection Tower, Front SSL, Front FID - GC - L (Area) <= 3.00% - L (Ret. Time) <= 1.00%	None
October 21, 2021 9:32:55 AM	Auto	Data	Injection Precision - Injection Tower, Front SSL, Front FID - GC - L (Area) <= 3.00% - L (Ret. Time) <= 1.00%	Data File Path: C:\Chem321\DATA\OQPV20\21OQPV2021_F_2021-10-20\16-51-16\NUPREC_F002.D\FID1A.ch
October 21, 2021 9:32:58 AM	Auto	Data	Injection Precision - Injection Tower, Front SSL, Front FID - GC - L (Area) <= 3.00% - L (Ret. Time) <= 1.00%	Data File Path: C:\Chem321\DATA\OQPV20\21OQPV2021_F_2021-10-20\16-51-16\NUPREC_F003.D\FID1A.ch
October 21, 2021 9:32:58 AM	Auto	Data	Injection Precision - Injection Tower, Front SSL, Front FID - GC - L (Area) <= 3.00% - L (Ret. Time) <= 1.00%	Data File Path: C:\Chem321\DATA\OQPV20\21OQPV2021_F_2021-10-20\16-51-16\NUPREC_F004.D\FID1A.ch
October 21, 2021 9:32:58 AM	Auto	Data	Injection Precision - Injection Tower, Front SSL, Front FID - GC - L (Area) <= 3.00% - L (Ret. Time) <= 1.00%	Data File Path: C:\Chem321\DATA\OQPV20\21OQPV2021_F_2021-10-20\16-51-16\NUPREC_F005.D\FID1A.ch
October 21, 2021 9:32:58 AM	Auto	Data	Injection Precision - Injection Tower, Front SSL, Front FID - GC - L (Area) <= 3.00% - L (Ret. Time) <= 1.00%	Data File Path: C:\Chem321\DATA\OQPV20\21OQPV2021_F_2021-10-20\16-51-16\NUPREC_F007.D\FID1A.ch

Page 7 / 10

Date: October 21, 2021 10:05:40 AM  
System ID: GC-6

Page 19 / 22

User Name: suriya.thongkiew  
Host Name: ASBKKW7015  
Print Date: October 21, 2021 10:05:46 AM  
System ID: GC-6

GC ALS CN11461066 Transaction log:

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
October 21, 2021 9:33:07 AM	End	Execution	Injection Precision - Injection Tower, Front SSL, Front FID - GC - L (Area) <= 3.00% - L (Ret. Time) <= 1.00%	Run Count: 1
October 21, 2021 9:33:23 AM	Start	Execution	Signal to Noise - Injection Tower, Front SSL, Front FID - Detector FID - L: >= 300000	None
October 21, 2021 9:34:01 AM	Auto	Data	Signal to Noise - Injection Tower, Front SSL, Front FID - Detector FID - L: >= 300000	Data File Path: C:\Chem321\DATA\OQPV20\21OQPV2021_F_2021-10-20\16-51-16\SCOUTS_F001.D\FID1A.ch
October 21, 2021 9:34:15 AM	End	Execution	Signal to Noise - Injection Tower, Front SSL, Front FID - Detector FID - L: >= 300000	Run Count: 1
October 21, 2021 9:34:19 AM	Start	Execution	GC Scouting Run - Injection Tower, Back SSL, Back FID - Part of System Preparation - No limits associated	None
October 21, 2021 9:35:04 AM	Auto	Data	GC Scouting Run - Injection Tower, Back SSL, Back FID - Part of System Preparation - No limits associated	Data File Path: C:\Chem321\DATA\OQPV20\21OQPV2021_B_2021-10-20\17-13-45\SCOUTS_F001.D\FID1A.ch
October 21, 2021 9:35:27 AM	End	Execution	GC Scouting Run - Injection Tower, Back SSL, Back FID - Part of System Preparation - No limits associated	Run Count: 1
October 21, 2021 9:36:32 AM	Start	Execution	Noise and DR - Back FID - Detector FID - L (Noise) <= 0.10 pA - L (DR) <= 2.50 pA/Hz	None

Page 8 / 10

Date: October 21, 2021 10:05:40 AM  
System ID: GC-6

Page 20 / 22

User Name: surya.thongkham  
Host Name: AS8KKW7915  
Print Date: October 21, 2021 10:05:46 AM  
System ID: GC-6

## OQ GC ALS CH1461966 Transaction log

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
October 21, 2021 9:38:06 AM	Auto	Data	Noise and Drift - Back FID - Detector FID - L (Noise) <= 0.10 (pA - L (Drift)) <= 2.50 (pA/decade)	Data File Path: C:\Chem32\10DATA\OQPV20\21OQPV2021_B 2021-10-20 17-13-45\NUPREC_B001.D\FID02.ch
October 21, 2021 9:38:16 AM	End	Execution	Noise and Drift - Back FID - Detector FID - L (Noise) <= 0.10 (pA - L (Drift)) <= 2.50 (pA/decade)	Run Count: 1
October 21, 2021 9:38:20 AM	Start	Execution	Injection Precision - Injection Tower, Back SSL, Back FID - GC - L (Area) <= 3.00% - L (Ret. Time) <= 1.00%	None
October 21, 2021 9:38:57 AM	Auto	Data	Injection Precision - Injection Tower, Back SSL, Back FID - GC - L (Area) <= 3.00% - L (Ret. Time) <= 1.00%	Data File Path: C:\Chem32\10DATA\OQPV20\21OQPV2021_B 2021-10-20 17-13-45\NUPREC_B002.D\FID02.ch
October 21, 2021 9:39:07 AM	Auto	Data	Injection Precision - Injection Tower, Back SSL, Back FID - GC - L (Area) <= 3.00% - L (Ret. Time) <= 1.00%	Data File Path: C:\Chem32\10DATA\OQPV20\21OQPV2021_B 2021-10-20 17-13-45\NUPREC_B003.D\FID02.ch
October 21, 2021 9:38:57 AM	Auto	Data	Injection Precision - Injection Tower, Back SSL, Back FID - GC - L (Area) <= 3.00% - L (Ret. Time) <= 1.00%	Data File Path: C:\Chem32\10DATA\OQPV20\21OQPV2021_B 2021-10-20 17-13-45\NUPREC_B004.D\FID02.ch
October 21, 2021 9:38:57 AM	Auto	Data	Injection Precision - Injection Tower, Back SSL, Back FID - GC - L (Area) <= 3.00% - L (Ret. Time) <= 1.00%	Data File Path: C:\Chem32\10DATA\OQPV20\21OQPV2021_B 2021-10-20 17-13-45\NUPREC_B005.D\FID02.ch

Page 9 / 10

Date: October 21, 2021 10:05:40 AM  
System ID: GC-6

Page 21 / 22

User Name: surya.thongkham  
Host Name: AS8KKW7915  
Print Date: October 21, 2021 10:05:46 AM  
System ID: GC-6

## OQ GC ALS CH1461966 Transaction log

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
October 21, 2021 9:38:57 AM	Auto	Data	Injection Precision - Injection Tower, Back SSL, Back FID - GC - L (Area) <= 3.00% - L (Ret. Time) <= 1.00%	Data File Path: C:\Chem32\10DATA\OQPV20\21OQPV2021_B 2021-10-20 17-13-45\NUPREC_B006.D\FID02.ch
October 21, 2021 9:39:07 AM	Auto	Data	Injection Precision - Injection Tower, Back SSL, Back FID - GC - L (Area) <= 3.00% - L (Ret. Time) <= 1.00%	Data File Path: C:\Chem32\10DATA\OQPV20\21OQPV2021_B 2021-10-20 17-13-45\NUPREC_B007.D\FID02.ch
October 21, 2021 9:39:06 AM	End	Execution	Injection Precision - Injection Tower, Back SSL, Back FID - GC - L (Area) <= 3.00% - L (Ret. Time) <= 1.00%	Run Count: 1
October 21, 2021 9:39:11 AM	Start	Execution	Signal to Noise - Injection Tower, Back SSL, Back FID - Detector FID - L: <= 300000	None
October 21, 2021 9:39:28 AM	Auto	Data	Signal to Noise - Injection Tower, Back SSL, Back FID - Detector FID - L: <= 300000	Data File Path: C:\Chem32\10DATA\OQPV20\21OQPV2021_B 2021-10-20 17-13-45\NUPREC_B008.D\FID02.ch
October 21, 2021 9:39:39 AM	End	Execution	Signal to Noise - Injection Tower, Back SSL, Back FID - Detector FID - L: <= 300000	Run Count: 1
October 21, 2021 9:39:43 AM	End	Qualification	Session	OQ
October 21, 2021 9:39:43 AM	Start	Reporting	Session	None
October 21, 2021 10:04:15 AM	Auto	Reporting	Session	Report Generated Certificate

Page 10 / 10

Date: October 21, 2021 10:05:40 AM  
System ID: GC-6

Page 22 / 22

# Certificate of System Qualification

ES-OQ

System ID: MY16010005  
Organization Name: ALS Laboratory Group (Thailand) Co., Ltd.  
Organization Location: 104 Phatthanakan 40 Phatthanakan Rd., Bangkok 10250

Date: September 13, 2021 5:49:11 PM  
EQP Name: Agilent/Recommended  
EQP Revision: ES.02.60  
Overall Qualification Status: Pass

## Preparation

Pass

## Instrument Tests

Pass

## Autosampler Operation

Pass

REVIEW BY: Thitiya B.  
APPROVED BY: Suranta N.  
NEXT CAL. DATE: 12 Feb 23

Date: September 13, 2021 5:49:11 PM  
System ID: MY16010005

Page 1 / 5

BKK\_EL0037



EA MLA Signatory  
Český institut pro akreditaci, o.p.s.  
Obšanská 54/3, 130 00 Praha 3

issues

according to section 16 of Act No. 22/1997 Coll., on technical requirements for products, as amended

## CERTIFICATE OF ACCREDITATION

No. 73/2022

ALS Czech Republic, s.r.o.  
with registered office Na Harč 336/9, 190 00 Praha 9 - Vršovice, Company Registration No. 27407551

to the Testing Laboratory No. 1163  
ALS Czech Republic, s.r.o.

Scope of accreditation:

Chemical, radiochemical and microbiological analyses of water, extracts, liquids, soils, waste, sludge, oils, sediments, rocks, solid samples, building materials, materials for building, emissions, immissions, working environment, gases from biogas stations and landfill gases, biological materials, food, feed, cosmetics, pharmaceutical raw materials and products, lubricants, fuels, ecotoxicological testing of waste and water, sensory analyses of food; sampling of water, sediments, soils, outdoor and indoor air and working environment to the extent as specified in the appendix to this Certificate.

This Certificate of Accreditation is a proof of Accreditation issued on the basis of assessment of fulfillment of the accreditation criteria in accordance with:

ČSN EN ISO/IEC 17025:2018

In its activities performed within the scope and for the period of validity of this Certificate, the Body is entitled to refer to this Certificate, provided that the accreditation is not suspended and the Body meets the specified accreditation requirements in accordance with the relevant regulations applicable to the activity of an accredited Conformity Assessment Body.

This Certificate of Accreditation replaces, to the full extent, Certificate No.: 519/2021 of 5. 10. 2021, or any administrative acts building upon it.

The Certificate of Accreditation is valid until: 14. 2. 2027

Prague: 14. 2. 2022



Lukáš Burda  
Director of the Department  
of Testing and Calibration Laboratories  
Czech Accreditation Institute  
Public Service Company

Entity accredited according to ČSN EN ISO/IEC 17025:2018:

ALS Czech Republic, s.r.o.  
Na Harře 336/9, 190 00 Praha 9 - Vysočany

Testing laboratory Workplaces:

1	Prague	Na Harře 336/9, 190 00 Praha 9
2	Česká Lípa	Bendlova 1687/7, 470 01 Česká Lípa
3	Pardubice	V Ráji 906, 530 02 Pardubice
4	Brno	Videňská 134/102, 619 00 Brno
5	Ostrava	Vratimovská 111, 718 00 Ostrava
6	Plzeň	Lobezská 15, 30146 Plzeň
7	Lovosice	U Zřymadel 827, 410 02 Lovosice
8	Rožnov pod Radhoštěm	1. Máje 823, budova C6, 756 61 Rožnov pod Radhoštěm
9	Kroměříž	Kotojedská 2588/91, 767 01 Kroměříž
10	Prague	Na Harře 916/9a, 190 00 Praha 9
11	Prague	Kolbenova 942/38a, 190 00 Praha 9
12	Liberec	Jugoslávská 11, 460 07 Liberec

The Laboratory has a flexible scope of accreditation permitted as detailed in the Annex.  
Updated list of activities provided within the required flexible scope of accreditation is available on the laboratory website [www.alsglobal.cz](http://www.alsglobal.cz) or at the Quality Manager.  
The Laboratory provides expert opinions and interprets test results.  
The Laboratory is qualified to carry out independent sampling.

Tests:

Ordinal number <sup>1</sup>	Test procedure/method name	Test procedure/method identification <sup>2</sup>	Subject of the test
1	<b>General Chemistry</b>		
1.1 <sup>1</sup>	Determination of elements <sup>41</sup> by atomic emission spectrometry with inductively coupled plasma and stoichiometric calculations of compounds concentration from measured values <sup>51</sup> including the calculation of total mineralization and calculating the sum of Ca+Mg	CZ_SOP_D06_02_001 (US EPA 200.7, ČSN EN ISO 11885, US EPA 6010, SM 3120, ČSN 75 7358)	Water <sup>41</sup> , extracts <sup>52</sup> , liquid samples <sup>41</sup>
1.2 <sup>1</sup>	Determination of elements <sup>41</sup> by atomic emission spectrometry with inductively coupled plasma and stoichiometric calculations of compounds concentration from measured values <sup>51</sup>	CZ_SOP_D06_02_001 (US EPA 200.7, ČSN EN ISO 11885, US EPA 6010, SM 3120)	Solid samples <sup>45</sup> , building materials <sup>42</sup> , materials for building <sup>49</sup>
1.3 <sup>1</sup>	Determination of elements <sup>41</sup> by atomic emission spectrometry with inductively coupled plasma and stoichiometric calculations of compounds concentration from measured values <sup>51</sup>	CZ_SOP_D06_04_001 (US EPA 200.7, ČSN EN ISO 11885)	Food, feed <sup>43</sup>
1.4 <sup>1</sup>	Determination of elements <sup>41</sup> by atomic emission spectrometry with inductively coupled plasma and stoichiometric calculations of compounds concentration from measured values <sup>51</sup>	CZ_SOP_D06_04_001 (US EPA 200.7, ČSN EN ISO 11885)	Biological materials <sup>77</sup>

Entity accredited according to ČSN EN ISO/IEC 17025:2018:

ALS Czech Republic, s.r.o.  
Na Harře 336/9, 190 00 Praha 9 - Vysočany

Ordinal number <sup>1</sup>	Test procedure/method name	Test procedure/method identification <sup>2</sup>	Subject of the test
1.5 <sup>1</sup>	Determination of elements <sup>41</sup> by atomic emission spectrometry with inductively coupled plasma and calculation of Cr <sup>6+</sup> from measured values	CZ_SOP_D06_02_001 (US EPA 200.7, ČSN EN ISO 11885, ČSN EN 13211, ČSN EN 14385, ČSN EN 14902, IO 3.4, US EPA 29)	Emission <sup>48</sup> , imission <sup>49</sup>
1.6 <sup>1</sup>	Determination of elements <sup>41</sup> by atomic emission spectrometry with inductively coupled plasma	CZ_SOP_D06_04_001 (US EPA 200.7, ČSN EN ISO 11885, ČL/PhEur/USP)	Pharmaceutical material
1.7 <sup>1</sup>	Determination of elements <sup>41</sup> by mass spectrometry with inductively coupled plasma and stoichiometric calculations of compounds concentration from measured values <sup>51</sup> including the calculation of total mineralization and calculating the sum of Ca+Mg	CZ_SOP_D06_02_002 (US EPA 200.8, ČSN EN ISO 17294-2, US EPA 6020A, ČSN 75 7358)	Water <sup>41</sup> , extracts <sup>52</sup> , liquid samples <sup>41</sup>
1.8 <sup>1</sup>	Determination of elements <sup>42</sup> by mass spectrometry with inductively coupled plasma and stoichiometric calculations of compounds concentration from measured values	CZ_SOP_D06_02_002 (US EPA 200.8, ČSN EN ISO 17294-2, US EPA 6020A)	Solid samples <sup>45</sup> , building materials <sup>42</sup> , materials for building <sup>49</sup>
1.9 <sup>1</sup>	Determination of elements <sup>41</sup> by mass spectrometry with inductively coupled plasma and stoichiometric calculations of compounds concentration from measured values	CZ_SOP_D06_04_002 (US EPA 200.8, ČSN EN ISO 17294-2, ČSN EN 15111)	Food, feed <sup>43</sup>
1.10 <sup>1</sup>	Determination of elements <sup>41</sup> by mass spectrometry with inductively coupled plasma and stoichiometric calculations of compounds concentration from measured values	CZ_SOP_D06_04_002 (US EPA 200.8, ČSN EN ISO 17294-2)	Biological materials <sup>77</sup>
1.11 <sup>1</sup>	Determination of elements <sup>41</sup> by mass spectrometry with inductively coupled plasma and calculation of Cr <sup>6+</sup> from measured values	CZ_SOP_D06_02_002 (US EPA 200.8, ČSN EN ISO 17294-2, ČSN EN 13211, ČSN EN 14385, ČSN EN 14902, US EPA 29)	Emission <sup>48</sup> , imission <sup>49</sup>
1.12 <sup>1</sup>	Determination of elements <sup>41</sup> by mass spectrometry with inductively coupled plasma	CZ_SOP_D06_04_002 (US EPA 200.8, ČSN EN ISO 17294-2, ČSN EN 15111, ČL/PhEur/USP)	Pharmaceutical material
1.13 <sup>1</sup>	Determination of Hg by atomic absorption spectrometry	CZ_SOP_D06_02_003 (ČSN 46 5735, ČSN 75 7440)	Emission <sup>48</sup> , imission <sup>49</sup>
1.14 <sup>2</sup>	Determination of Hg by single-purpose atomic absorption spectrometer	CZ_SOP_D06_07_004 (ČSN 75 7440, ČSN 46 5735)	Water <sup>41</sup> , extracts <sup>52</sup> , liquid samples <sup>41</sup> , solid samples <sup>41</sup>
1.15 <sup>2</sup>	Determination of elements <sup>41</sup> by flame AAS method and stoichiometric calculations of compounds concentration from measured values	CZ_SOP_D06_07_005 (ČSN ISO 8288, ČSN 75 7400, ČSN EN 1233,	Water <sup>41</sup> , extracts <sup>52</sup> , liquid samples <sup>41</sup>

Entity accredited according to ČSN EN ISO/IEC 17025:2018:

ALS Czech Republic, s.r.o.  
Na Harře 336/9, 190 00 Praha 9 - Vysočany

Ordinal number <sup>1</sup>	Test procedure/method name	Test procedure/method identification <sup>2</sup>	Subject of the test
		ČSN ISO 7980, ČSN ISO 9964, Perkin-Elmer specifications)	
1.16 <sup>2</sup>	Determination of elements <sup>41</sup> by flame AAS method and stoichiometric calculations of compounds concentration from measured values	CZ_SOP_D06_07_005 (ČSN ISO 8288, ČSN 75 7400, ČSN EN 1233, ČSN ISO 7980, ČSN ISO 9964, Perkin-Elmer specifications)	Solid samples <sup>45</sup>
1.17 <sup>2</sup>	Determination of elements <sup>41</sup> by atomic emission spectrometry with inductively coupled plasma and stoichiometric calculations of compounds concentration from measured values	CZ_SOP_D06_07_006 (ČSN EN ISO 11885, AITM3-0032)	Water <sup>41</sup> , extracts <sup>52</sup> , liquid samples <sup>41</sup>
1.18 <sup>2</sup>	Determination of elements <sup>41</sup> by atomic emission spectrometry with inductively coupled plasma and stoichiometric calculations of compounds concentration from measured values	CZ_SOP_D06_07_006 (ČSN EN ISO 11885, ČSN EN 15410, ČSN EN 15411)	Solid samples <sup>45</sup> , solid recovered fuels
1.19 <sup>2</sup>	Determination of Kjeldahl nitrogen by spectrophotometry	CZ_SOP_D06_07_007.A (ČSN EN 25663, ČSN ISO 7150-1)	Water <sup>41</sup> , extracts <sup>52</sup>
1.20 <sup>2</sup>	Determination of Kjeldahl nitrogen by spectrophotometry	CZ_SOP_D06_07_007.B (ČSN EN 25663, ČSN EN 13342, ČSN ISO 7150-1)	Solid samples <sup>45</sup>
1.21 <sup>2</sup>	Determination of Cr <sup>6+</sup> by spectrophotometry with diphenylcarbazide	CZ_SOP_D06_07_008 (ČSN ISO 11083)	Water <sup>41</sup> , extracts <sup>52</sup> , absorption solutions from emission samples
1.22 <sup>2</sup>	Determination of total phosphorus and orthophosphate by spectrophotometry and calculation of P <sub>2</sub> O <sub>5</sub> from measured values	CZ_SOP_D06_07_009.A (ČSN EN ISO 6878)	Water <sup>41</sup> , extracts <sup>52</sup>
1.23 <sup>2</sup>	Determination of total phosphorus by spectrophotometry and calculation of P <sub>2</sub> O <sub>5</sub> from measured values	CZ_SOP_D06_07_009.B (ČSN EN 14672, ČSN EN ISO 6878)	Sludge, technological sludge products
1.24 1.28	Reserved		
1.29 <sup>2</sup>	Determination of nonionic surfactants (BIAS) by spectrophotometry using the HACH cuvette test	CZ_SOP_D06_07_014 (Hach Instruction)	Water <sup>41</sup> , extracts <sup>52</sup>
1.30 <sup>2</sup>	Determination of sum of sulfane and sulfide by spectrophotometry and calculation of free sulfane from measured values	CZ_SOP_D06_07_015.A (ČSN 83 0520-16:1978, ČSN 83 0530-31:1980 SM 4500-S <sup>2</sup> -D)	Water <sup>41</sup> , extracts <sup>52</sup>
1.31 <sup>2</sup>	Determination of sum of sulfane and sulfide by spectrophotometry	CZ_SOP_D06_07_015.B (ČSN 83 0520-16:1978, ČSN 83 0530-31:1980)	Solid samples <sup>45</sup> , building materials <sup>42</sup> , materials for building <sup>49</sup>
1.32 <sup>2</sup>	Determination of sum of sulfane and sulfide by spectrophotometry	CZ_SOP_D06_07_015.C (ČSN 83 0520-16:1978, ČSN 83 0530-31:1980, ČSN 83 4712 No. 3)	Absorption solutions from emission samples

Entity accredited according to ČSN EN ISO/IEC 17025:2018:

ALS Czech Republic, s.r.o.  
Na Harře 336/9, 190 00 Praha 9 - Vysočany

Ordinal number <sup>1</sup>	Test procedure/method name	Test procedure/method identification <sup>2</sup>	Subject of the test
1.33 <sup>1</sup>	Determination of sulfate by turbidimetry using discrete spectrophotometry and calculation of sulfate sulfur from measured values	CZ_SOP_D06_02_016 (US EPA 375.4, SM 4500-SO <sub>4</sub> <sup>2-</sup> )	Water <sup>41</sup> , extracts <sup>52</sup>
1.34 <sup>2</sup>	Determination of nitrite sum and sum of nitrite and nitrate nitrogen by discrete spectrophotometry and calculation of nitrites and nitrates from measured values	CZ_SOP_D06_02_019 (ČSN EN ISO 11732, ČSN EN ISO 13395, SM 4500-NO <sub>2</sub> <sup>-</sup> , SM 4500-NO <sub>3</sub> <sup>-</sup> )	Liquid samples
1.35 <sup>1</sup>	Determination of the number of asbestos and mineral fibers by SEM / EDS	CZ_SOP_D06_02_018 (ISO 14966, except chap. 5, 6.1 and 6.2, VDI 3492, except chap. 5 and 6, Decree No. 6/2003 Coll., Government Decree No. 361/2007 Coll., Annex No. 3)	Outdoor and indoor air, working environment - exposed filters
1.36 <sup>1</sup>	Determination of sum of ammonium and ammonium ions, nitrite and the sum of nitrite and nitrate ions by discrete spectrophotometry and calculation of nitrite, nitrate, ammonia, inorganic, organic, total nitrogen, free ammonia, and dissociated ammonium ions from measured values including the calculation of total mineralization	CZ_SOP_D06_02_019 (ČSN EN ISO 11732, ČSN EN ISO 13395, SM 4500-NO <sub>2</sub> <sup>-</sup> , SM 4500-NO <sub>3</sub> <sup>-</sup> )	Water <sup>41</sup> , extracts <sup>52</sup>
1.37 <sup>2</sup>	Determination of sum of ammonia and ammonium ions by spectrophotometry and calculation of ammonia nitrogen, free ammonia, and dissociated ammonium ions from measured values	CZ_SOP_D06_07_020 (ČSN ISO 7150-1, ČSN EN ISO 21877)	Water <sup>41</sup> , extracts <sup>52</sup> , liquid samples <sup>41</sup> , absorption solutions from emission samples
1.38 <sup>2</sup>	Determination of nitrite nitrogen by spectrophotometry and calculation of nitrite from measured values	CZ_SOP_D06_07_021 (ČSN EN 26777)	Water <sup>41</sup> , extracts <sup>52</sup>
1.39 <sup>1</sup>	Determination of orthophosphate by discrete spectrophotometry and calculation of orthophosphate phosphorus from measured values including the calculation of total mineralization	CZ_SOP_D06_02_022 (ČSN EN ISO 6878, SM 4500-P)	Water <sup>41</sup> , extracts <sup>52</sup>
1.40 <sup>2</sup>	Determination of chloride by potentiometric titration	CZ_SOP_D06_07_023.A (ČSN 03 8526:1989, ČSN 83 0530-20:1980, SM 4500-Cl <sup>-</sup> D)	Water <sup>41</sup> , extracts <sup>52</sup> , liquid samples <sup>41</sup>
1.41 <sup>2</sup>	Determination of chloride by potentiometric titration and calculation of NaCl from measured values	CZ_SOP_D06_07_023.B (ČSN EN 480-10)	Solid samples <sup>45</sup> , building materials <sup>42</sup> , materials for building <sup>49</sup>
1.42 <sup>1</sup>	Determination of Hg by atomic absorption spectrometry	CZ_SOP_D06_04_024 (ČSN 46 5735, ČSN 75 7440, ČL/PhEur/USP)	Food, feed <sup>43</sup> , biological materials <sup>77</sup> , Pharmaceutical materials
1.43 <sup>2</sup>	Determination of extractable organically bound halogens (EOX) by coulometry	CZ_SOP_D06_07_025.A (DIN 38409-H8, DIN 38414-S17)	Water <sup>41</sup> , extracts <sup>52</sup>

Appendix is an integral part of  
Certificate of Accreditation No: 73/2022 of 14/02/2022

Entity accredited according to ČSN EN ISO/IEC 17025:2018:

ALS Czech Republic, s.r.o.  
Na Harře 336/9, 190 00 Praha 9 - Vysočany

Ordinal number <sup>1</sup>	Test procedure/method name	Test procedure/method identification <sup>2</sup>	Subject of the test
1.44 <sup>2</sup>	Determination of extractable organically bound halogens (EOX) by coulometry	CZ_SOP_D06_07_025.B (DIN 38409-H8, DIN 38414-S17)	Solid samples <sup>85</sup>
1.45 <sup>2</sup>	Determination of adsorbable organically bound halogens (AOX) by coulometry	CZ_SOP_D06_07_026 (CSN EN 16166, DIN 38414-S18)	Solid samples <sup>85</sup>
1.46 <sup>2</sup>	Determination of total halogens (TX) by coulometry	CZ_SOP_D06_07_027 (US EPA 9076)	Solid samples <sup>85</sup> , oils, organic solvents
1.47 <sup>2</sup>	Determination of adsorbable organically bound halogens (AOX) by coulometry	CZ_SOP_D06_07_028 (CSN EN ISO 9562, TNI 757531)	Water <sup>91</sup> , extracts <sup>92</sup>
1.48 <sup>2</sup>	Determination of phenol index by spectrophotometric method after distillation	CZ_SOP_D06_07_029 (CSN ISO 6439)	Solid samples <sup>85</sup>
1.49	Reserved		
1.50 <sup>2</sup>	Determination of anionic surfactants by measurement of the methylene blue index (MBAS) by spectrophotometry	CZ_SOP_D06_07_031 (CSN EN 903, SM 5540 C)	Water <sup>91</sup> , extracts <sup>92</sup>
1.51 <sup>2</sup>	Determination of absorbance and transmittance by spectrophotometry	CZ_SOP_D06_07_032 (CSN 75 7360)	Water <sup>91</sup> , extracts <sup>92</sup>
1.52* 1.2,3,4,5,6,7, 8,9	Field measurement of turbidity ZFn by turbidimeter	CZ_SOP_D06_01_033 (CSN EN ISO 7027-1)	Water <sup>91</sup>
1.53 <sup>2</sup>	Determination of humic substances by spectrophotometry	CZ_SOP_D06_07_034 (CSN 75 7536)	Drinking, raw, surface, ground water
1.54 <sup>2</sup>	Determination of water colour by spectrophotometric method	CZ_SOP_D06_07_035 (CSN EN ISO 7887)	Water <sup>91</sup> , extracts <sup>92</sup>
1.55 <sup>2</sup>	Determination of electrical conductivity	CZ_SOP_D06_07_036 (CSN EN 27888)	Water <sup>91</sup> , extracts <sup>92</sup> , liquid samples <sup>81</sup>
1.56 <sup>2</sup>	Determination of pH electrochemically	CZ_SOP_D06_07_037 (CSN ISO 10523)	Water <sup>91</sup> , extracts <sup>92</sup> , liquid samples <sup>81</sup>
1.57 <sup>2</sup>	Biodegradation of organic compounds in aqueous medium – Static test (Zahn-Wellens method) calculated from the measured values of COD <sub>C</sub>	CZ_SOP_D06_07_038 (CSN EN ISO 9888, OECD 302B, with COD <sub>C</sub> ; determination according to CZ_SOP_D06_07_040)	Chemicals and chemical products, water <sup>91</sup> and waste leachate <sup>92</sup>
1.58	Reserved		
1.59 <sup>2</sup>	Determination of chemical oxygen demand using dichromate (COD <sub>Cr</sub> ) by titration	CZ_SOP_D06_07_040 (CSN ISO 6060)	Water <sup>91</sup> , extracts <sup>92</sup>
1.60	Reserved		
1.61 <sup>2</sup>	Determination of analytical water and gross water by gravimetry and calculation of total water from measured values	CZ_SOP_D06_07_041 (CSN 44 1377, CSN EN ISO 18134-1, CSN EN ISO 18134-2, CSN EN ISO 18134-3, ČSN P CEN/TS 15414-1, ČSN P CEN/TS 15414-2, CSN EN ISO 21660-3, CSN EN 12880, CSN EN 14346, CSN EN 15002)	Solid fossil fuels, solid biofuels, solid recovered fuels, sludge, waste
1.62 – 1.63	Reserved		

Page 5 of 45

Appendix is an integral part of  
Certificate of Accreditation No: 73/2022 of 14/02/2022

Entity accredited according to ČSN EN ISO/IEC 17025:2018:

ALS Czech Republic, s.r.o.  
Na Harře 336/9, 190 00 Praha 9 - Vysočany

Ordinal number <sup>1</sup>	Test procedure/method name	Test procedure/method identification <sup>2</sup>	Subject of the test
1.64 <sup>1</sup>	Determination of dissolved oxygen (in the laboratory) by electrochemical method with optical sensor	CZ_SOP_D06_02_043 (CSN ISO 17289)	Water <sup>91</sup>
1.65* 1.2,3,4,5,6,7, 8,9	Determination of dissolved oxygen by electrochemical method with membrane probe	CZ_SOP_D06_01_044 (CSN EN ISO 5814)	Water <sup>91</sup>
1.66 <sup>1,3</sup>	Determination of dry matter by gravimetry and calculation of moisture from measured values	CZ_SOP_D06_01_045 (CSN ISO 11465, CSN EN 12880, CSN EN 14346:2007)	Solid samples <sup>85</sup>
1.67 <sup>2</sup>	Determination of dry matter by gravimetry and calculation of moisture from measured values	CZ_SOP_D06_07_046 (CSN ISO 11465, CSN EN 12880, CSN EN 14346:2007, CSN 46 5735)	Solid samples <sup>85</sup>
1.68 <sup>2</sup>	Determination of ash by gravimetry and calculation of loss on ignition from measured values	CZ_SOP_D06_07_047.A (CSN EN 15169, CSN EN 15935, CSN EN 13039, CSN 72 0103, CSN 46 5735)	Solid samples <sup>85</sup> , silicate materials
1.69	Reserved		
1.70 <sup>2</sup>	Determination of ash by gravimetry and calculation of loss on ignition from measured values	CZ_SOP_D06_07_047.C (CSN ISO 1171, CSN EN ISO 18122, CSN EN ISO 21656, CSN EN ISO 6245)	Solid and liquid fuels
1.71 <sup>1</sup>	Qualitative determination of asbestos by SEM/EDS	CZ_SOP_D06_02_048 (ISO 22262-1, VDI 3866, Part 5, DM 06/09/94 GU n° 288 10/12/1994 All. 1 Met. B – quantitative determination)	Solid samples <sup>85</sup> (except liquid waste, biowaste) building materials <sup>89</sup> , materials for building <sup>92</sup>
1.72 <sup>1</sup>	Qualitative determination of asbestos by SEM/EDS	CZ_SOP_D06_02_049 (VDI 3866, Part 5, DM 06/09/94 GU n° 288 10/12/1994 All. 1 Met. B)	Solid samples <sup>85</sup> (except liquid waste, biowaste) building materials <sup>89</sup> , materials for building <sup>92</sup>
1.73 <sup>2</sup>	Determination of water content by Karl Fischer method	CZ_SOP_D06_07_050 (CSN ISO 760)	Liquid samples <sup>81</sup> , solid samples <sup>85</sup>
1.74	Reserved		
1.75 <sup>2</sup>	Determination of suspended solids, fixed suspended solids, total solids and fixed total solids by gravimetry and calculation of volatile suspended solids and volatile total solids from measured values	CZ_SOP_D06_07_052 (TSN 75 7350, SM 2540 B, SM 2540 D, SM 2540 E)	Water <sup>91</sup> , extracts <sup>92</sup>
1.76 <sup>2</sup>	Determination of suspended solids using glass fibre filters by gravimetry	CZ_SOP_D06_07_053 (CSN EN 872)	Water <sup>91</sup> , extracts <sup>92</sup>
1.77 <sup>2</sup>	Determination of dissolved solids (RL105) and fixed dissolved solids (RAS) using glass fibre filters by gravimetry and calculation of volatile dissolved solids from measured values	CZ_SOP_D06_07_054 (CSN 75 7346, CSN 75 7347)	Water <sup>91</sup> , extracts <sup>92</sup>

Page 6 of 45

Appendix is an integral part of  
Certificate of Accreditation No: 73/2022 of 14/02/2022

Entity accredited according to ČSN EN ISO/IEC 17025:2018:

ALS Czech Republic, s.r.o.  
Na Harře 336/9, 190 00 Praha 9 - Vysočany

Ordinal number <sup>2</sup>	Test procedure/method name	Test procedure/method identification <sup>2</sup>	Subject of the test
1.78 <sup>2</sup>	Determination of total carbon (TC) and inorganic carbon (TIC) by IR detection and calculation of total organic carbon (TOC), carbonates and organic matter from measured values	CZ_SOP_D06_07_055 (CSN EN 13137:2002, CSN EN 15936, ČSN ISO 10694)	Solid samples <sup>85</sup> , building materials <sup>82</sup> , materials for building <sup>89</sup>
1.79 <sup>1</sup>	Determination of total organic carbon (TOC), dissolved organic carbon (DOC), total inorganic carbon (TIC) and total carbon (TC) by IR detection	CZ_SOP_D06_02_056 (CSN EN 1484, SM 5310)	Water <sup>91</sup> , extracts <sup>92</sup>
1.80 <sup>1</sup>	Determination of nonpolar extractive substances by infrared spectrometry and calculation of polar extractive substances from measured values	CZ_SOP_D06_02_057 (CSN 75 7505:2006, SS 028145, STN 83 0520-27:2015, STN 83 0530-36, US EPA 418.1, SM 5520 F, DS/R 209, SFS 3010)	Water <sup>91</sup> , extracts <sup>92</sup>
1.81 <sup>1</sup>	Determination of extractive and non-polar extractive compounds by infrared spectrometry and calculation of polar extractive substances from measured values	CZ_SOP_D06_02_058 (SS 028145, TNV 75 8052, ISO/TR 11046, US EPA 418.1, SM 5520 F, DS/R 209, SFS 3010)	Solid samples <sup>85</sup>
1.82 <sup>1</sup>	Determination of extractive substances by infrared spectrometry and calculation of polar extractive substances from measured values	CZ_SOP_D06_02_059 (CSN 75 7506, SS 028145, STN 83 0520-27:2015, STN 83 0540-4, DS/R 209, SFS 3010)	Water <sup>91</sup> , extracts <sup>92</sup>
1.83 <sup>1</sup>	Determination of alpha modification of silicon dioxide in respirable dust by infrared spectrometry	CZ_SOP_D06_02_060 (NIOSH 7602)	Dust
1.84* 1.2,3,4,5,6,7, 8,9,12	Field determination of free and total chlorine and chlorine dioxide by DPD method using HACH sets and bound chlorine by calculation from measured values	CZ_SOP_D06_01_061 (HACH COMPANY methods, CSN EN ISO 7393-2)	Drinking water, warm water, raw water
1.85* 1.2,3,4,5,6,7, 8,9,12	Field measurement of temperature	ČSN 75 7342	Water <sup>91</sup>
1.86* 1.2,3,4,5,6,7,8, 9	Field measurement of electrical conductivity	CZ_SOP_D06_01_063 (CSN EN 27888)	Water <sup>91</sup>
1.87* 1.2,3,4,5,6,7, 8,9,12	Field measurement of pH electrochemically	CZ_SOP_D06_01_064 (CSN ISO 10523)	Water <sup>91</sup>

Page 7 of 45

Appendix is an integral part of  
Certificate of Accreditation No: 73/2022 of 14/02/2022

Entity accredited according to ČSN EN ISO/IEC 17025:2018:

ALS Czech Republic, s.r.o.  
Na Harře 336/9, 190 00 Praha 9 - Vysočany

Ordinal number <sup>2</sup>	Test procedure/method name	Test procedure/method identification <sup>2</sup>	Subject of the test
1.88 <sup>1</sup>	Sensory analysis of water – determination of odour and taste	CZ_SOP_D06_04_065 (TNV 75 7340:2005, CSN EN 1622, STN EN 1622)	Drinking water
1.89 <sup>2</sup>	Determination of phenols by continuous flow analysis (CFA) method spectrophotometrically	CZ_SOP_D06_07_066 (SKALAR EN ISO 14402, SKALAR Company methodology)	Water <sup>91</sup> , extracts <sup>92</sup> , absorption solution from emission sampling
1.90 <sup>2</sup>	Determination of anionic surfactants by methylene blue (MBAS) by continuous flow analysis (CFA) method spectrophotometrically	CZ_SOP_D06_07_067 (CSN EN 16265, SKALAR Company methodology, CSN EN 903)	Water <sup>91</sup> , extracts <sup>92</sup>
1.91 <sup>1</sup>	Determination of dissolved fluoride, chloride, nitrite, bromide, nitrate and sulphate by ion liquid chromatography and calculation of nitrite nitrogen and nitrate nitrogen and sulphate sulphur from measured values including the calculation of total mineralization	CZ_SOP_D06_02_068 (CSN EN ISO 10304-1)	Water <sup>91</sup> , extracts <sup>92</sup>
1.92	Reserved		
1.93 <sup>1</sup>	Determination of dry suspended solids and annealed suspend solids by gravimetry and calculation of loss of ignition of suspend solids and total solids from measured values	CZ_SOP_D06_02_070 (CSN EN 872, CSN 757350, SM 2540 D, SM 2540 E)	Water <sup>91</sup> , extracts <sup>92</sup>
1.94 <sup>1</sup>	Determination of dissolved solids (RL) and dissolved solid annealed (RAS) using glass fibre filters by gravimetry and calculation of loss on ignition of dissolved solids (RL550) from measured values	CZ_SOP_D06_02_071 (CSN 75 7346, CSN 757347, CSN EN 15216, SM 2540 C, SM 2540 E)	Water <sup>91</sup> , extracts <sup>92</sup>
1.95 <sup>1</sup>	Determination of acid neutralizing capacity (alkalinity) by potentiometric titration and calculation of the carbonate hardness and CO <sub>2</sub> forms from measured values including the calculation of total mineralization	CZ_SOP_D06_02_072 (CSN EN ISO 9963-1, CSN EN ISO 9963-2, CSN 75 7373, SM 2320)	Water <sup>91</sup> , extracts <sup>92</sup>
1.96 <sup>1</sup>	Determination of base neutralizing capacity (acidity) by potentiometric titration	CZ_SOP_D06_02_073 (CSN 75 7372)	Water <sup>91</sup> , extracts <sup>92</sup>
1.97 <sup>1</sup>	Determination of turbidity by optical turbidimeter	CZ_SOP_D06_02_074 (CSN EN ISO 7027-1)	Water <sup>91</sup> , extracts <sup>92</sup>
1.98 <sup>1</sup>	Determination of electrical conductivity by conductometer and calculation of salinity	CZ_SOP_D06_02_075 (CSN EN 27888, SM 2530 B)	Water <sup>91</sup> , extracts <sup>89</sup> , liquid samples <sup>81</sup>
1.99 <sup>1</sup>	Determination of chemical oxygen demand using dichromate (COD <sub>Cr</sub> ) by photometry	CZ_SOP_D06_02_076 (CSN ISO 15705)	Water <sup>91</sup> , extracts <sup>92</sup>
1.100	Reserved		
1.101 <sup>1</sup>	Determination of biochemical oxygen demand electrochemically after n days (BODn) by dilution method with allylthiourea addition	CZ_SOP_D06_02_077 (CSN EN ISO 5815-1)	Water <sup>91</sup> , extracts <sup>92</sup>
1.102 <sup>1</sup>	Determination of biochemical oxygen demand electrochemically after n days (BODn) by method for undiluted samples	CZ_SOP_D06_02_078 (CSN EN 1899-2, ISO 5815-2)	Water <sup>91</sup> , extracts <sup>92</sup>

Page 8 of 45

Appendix is an integral part of  
Certificate of Accreditation No: 73/2022 of 14/02/2022

Entity accredited according to ČSN EN ISO/IEC 17025:2018:

ALS Czech Republic, s.r.o.  
Na Harč 336/9, 190 00 Praha 9 - Vysočany

Ordinal number <sup>1</sup>	Test procedure/method name	Test procedure/method identification <sup>2</sup>	Subject of the test
1.103 <sup>1</sup>	Determination of colour by spectrophotometry	CZ_SOP_D06_02_079 (ČSN EN ISO 7887)	Water <sup>81</sup> , extracts <sup>82</sup>
1.104 <sup>1</sup>	Determination of total phosphorus by discrete spectrophotometry and calculation of phosphorus as P <sub>2</sub> O <sub>5</sub> and PO <sub>4</sub> <sup>3-</sup> from measured values	CZ_SOP_D06_02_080 (ČSN EN ISO 6878, ČSN EN ISO 15681-1)	Water <sup>81</sup> , extracts <sup>82</sup>
1.105 <sup>1</sup>	Determination of total nitrogen by discrete spectrophotometry after mineralization with peroxisulphate	CZ_SOP_D06_02_081 (ČSN EN ISO 11905-1)	Water <sup>81</sup> , extracts <sup>82</sup>
1.106 <sup>2</sup>	Determination of chloride in absorption solution from emission sample of inorganic compounds of chlorine by potentiometric titration and calculation of hydrogen chloride from measured values	CZ_SOP_D06_07_082 (ČSN EN 1911)	Absorption solutions from emission sampling
1.107 <sup>2</sup>	Determination of fluoride in absorption solution from emission sample of inorganic compounds of fluorine after separation by distillation by direct potentiometry and calculation of hydrogen fluoride from measured values	CZ_SOP_D06_07_083 (ČSN 83 4752-3:1989)	Absorption solutions from emission sampling
1.108	Reserved		
1.109 <sup>2</sup>	Determination of ammonia in absorption solution from emission sample by photometry after distillation	CZ_SOP_D06_07_085 (ČSN 83 4728-4)	Absorption solutions from emission sampling
1.110 <sup>1</sup>	Determination of total solids by gravimetry	CZ_SOP_D06_02_086 (ČSN 75 7346, ČSN 757347, ČSN EN 872, SM 2540 B, C, D)	Water <sup>81</sup>
1.111 <sup>2</sup>	Determination of pH, temperature and electrical conductivity in extracts prepared by a bottom-up percolation test (under specific conditions)	CZ_SOP_D06_07_087 (ČSN EN 14405, ČSN ISO 10523, ČSN 75 7342, ČSN EN 27888)	Solid samples <sup>85</sup>
1.112 <sup>1,2</sup>	Determination of pH, temperature and electrical conductivity in extracts prepared by a two-stage batch test (under specific conditions)	CZ_SOP_D06_07_088 (ČSN EN 12457-3, ČSN ISO 10523, ČSN 75 7342, ČSN EN 27888)	Solid samples <sup>85</sup>
1.113 <sup>1</sup>	Determination of total cyanide by spectrophotometry and calculation of complex-forming cyanides from measured values	CZ_SOP_D06_02_089.A (ČSN 75 7415, ČSN EN ISO 14403-2)	Water <sup>81</sup> , extracts <sup>82</sup> , absorption solutions from emission sampling
1.114 <sup>1</sup>	Determination of total cyanide by spectrophotometry and calculation of complex-forming cyanides from measured values	CZ_SOP_D06_02_089.B (ČSN 75 7415, ČSN EN ISO 17380, ČSN EN ISO 14403-2, SM 4500 CN)	Solid samples <sup>85</sup> , building materials <sup>82</sup> , materials for building <sup>89</sup>
1.115 <sup>1</sup>	Determination of easily releasable cyanide (free cyanide) and cyanide dissociated by weak acid by spectrophotometry	CZ_SOP_D06_02_090.A (ČSN ISO 6703-2, ČSN EN ISO 14403-2, SM 4500 CN)	Water <sup>81</sup> , extracts <sup>82</sup>

Page 9 of 45

Appendix is an integral part of  
Certificate of Accreditation No: 73/2022 of 14/02/2022

Entity accredited according to ČSN EN ISO/IEC 17025:2018:

ALS Czech Republic, s.r.o.  
Na Harč 336/9, 190 00 Praha 9 - Vysočany

Ordinal number <sup>1</sup>	Test procedure/method name	Test procedure/method identification <sup>2</sup>	Subject of the test
1.116 <sup>1</sup>	Determination of easily releasable cyanide (free cyanide) and cyanide dissociated by weak acid by spectrophotometry	CZ_SOP_D06_02_090.B (ČSN 75 7415, ČSN EN ISO 17380, ČSN EN ISO 14403-2, SM 4500 CN)	Solid samples <sup>85</sup> , building materials <sup>82</sup> , materials for building <sup>89</sup>
1.117 <sup>1</sup>	Determination of fluorides by electrochemical method (ISE)	CZ_SOP_D06_02_091 (ČSN ISO 10359-1)	Water <sup>81</sup> , extracts <sup>82</sup>
1.118 <sup>1</sup>	Determination of chemical oxygen demand using permanganate (COD <sub>Mn</sub> ) by titration	CZ_SOP_D06_02_092 (ČSN EN ISO 8467)	Water <sup>81</sup> , extracts <sup>82</sup>
1.119 <sup>1</sup>	Determination of bound nitrogen (TNb), following oxidation to nitrogen oxides by chemiluminescent detection	CZ_SOP_D06_02_094.A (ČSN EN 12260)	Water <sup>81</sup> , extracts <sup>82</sup>
1.120 <sup>1</sup>	Determination of bound nitrogen (TNb) following oxidation to nitrogen oxides by IR detection	CZ_SOP_D06_02_094.B (ČSN EN 12260)	Water <sup>81</sup> , extracts <sup>82</sup>
1.121 <sup>1</sup>	Qualitative determination of asbestos fibre by polarization microscope	CZ_SOP_D06_02_095 (NIOSH 9002)	Solid samples <sup>85</sup> , (except liquid waste, biowaste), building materials <sup>89</sup> , materials for building <sup>82</sup>
1.122 <sup>1</sup>	Determination of mercury by fluorescence spectrometry	CZ_SOP_D06_02_096 (US EPA 245.7, ČSN EN ISO 17852)	Water <sup>81</sup> , extracts <sup>82</sup>
1.123 <sup>1</sup>	Determination of mercury by fluorescence spectrometry	CZ_SOP_D06_02_096 (ČSN EN ISO 17852, PSA Application Note 025, ISO 16772:2004)	Solid samples <sup>85</sup> , building materials <sup>82</sup> , materials for building <sup>89</sup>
1.124	Reserved		
1.125 <sup>1</sup>	Determination of mercury by fluorescence spectrometry	CZ_SOP_D06_02_096 (ČSN EN ISO 17852, ČSN EN 13211, ČSN EN ISO 12846)	Emission <sup>86</sup> , imission <sup>89</sup>
1.126 – 1.127	Reserved		
1.128 <sup>1</sup>	Determination of dissolved bromate, chlorate and chlorite by ion liquid chromatography method and calculation of the sum of chlorate and chlorite from measured values	CZ_SOP_D06_02_098 (ČSN EN ISO 15061, ČSN EN ISO 10304-4)	Water <sup>81</sup> , extracts <sup>82</sup>
1.129 <sup>1</sup>	Determination of chloride by discrete spectrophotometry	CZ_SOP_D06_02_099 (US EPA 325.1, SM 4500-Cl)	Water <sup>81</sup> , extracts <sup>82</sup>
1.130 <sup>1</sup>	Determination of extractive substances by gravimetry	CZ_SOP_D06_02_100 (ČSN 75 7508, SM 5520B)	Water <sup>81</sup>
1.131 <sup>2</sup>	Determination of reactive and non-labile aluminium by continuous flow analysis (CFA) spectrophotometrically and calculation of labile aluminium from measured values	CZ_SOP_D06_07_101 (SKALAR Company method)	Drinking, surface water
1.132 <sup>2</sup>	Determination of total nitrogen by modified Kjeldahl method by spectrophotometry	CZ_SOP_D06_07_102 (ČSN ISO 11261)	Solid samples <sup>85</sup>

Page 10 of 45

Appendix is an integral part of  
Certificate of Accreditation No: 73/2022 of 14/02/2022

Entity accredited according to ČSN EN ISO/IEC 17025:2018:

ALS Czech Republic, s.r.o.  
Na Harč 336/9, 190 00 Praha 9 - Vysočany

Ordinal number <sup>1</sup>	Test procedure/method name	Test procedure/method identification <sup>2</sup>	Subject of the test
1.133 <sup>8</sup> 1.2.3.5.5.7, 8.9	Field measurement of oxidation-reduction potential (ORP) by potentiometry	CZ_SOP_D06_01_103 (ČSN 75 7367)	Water <sup>81</sup>
1.134 <sup>1</sup>	Determination of grease and oils by gravimetry (extraction after evaporation)	CZ_SOP_D06_02_104 (ČSN 75 7509)	Water <sup>81</sup>
1.135 <sup>1</sup>	Determination of pH by potentiometry	CZ_SOP_D06_02_105 (ČSN ISO 10523, US EPA 150.1, SM 4500-H <sup>+</sup> B)	Water <sup>81</sup> , extracts <sup>82</sup> , liquid samples <sup>81</sup>
1.136	Reserved		
1.137 <sup>2</sup>	Determination of total nitrogen by modified Kjeldahl method by spectrophotometry	CZ_SOP_D06_07_107 (ČSN EN 25663, ČSN ISO 7150-1, SFS 5505)	Water <sup>81</sup> , extracts <sup>82</sup>
1.138 <sup>1</sup>	Determination of settleable solids by volumetry	CZ_SOP_D06_02_108 (SM 2540 F)	Water <sup>81</sup> , extracts <sup>82</sup>
1.139 <sup>1</sup>	Determination of dissolved silicates by discrete photometry and calculation of H <sub>2</sub> SiO <sub>3</sub> and total mineralization from measured values	CZ_SOP_D06_02_109 (ČSN EN ISO 16264, US EPA 370.1)	Water <sup>81</sup> , extracts <sup>82</sup>
1.140 <sup>1</sup>	Determination of chlorophyll by spectrophotometry	CZ_SOP_D06_02_110 (SM 10200 H)	Surface waters <sup>87</sup>
1.141	Reserved		
1.142 <sup>2</sup>	Determination of phosphorus soluble in sodium hydrogen carbonate solution spectrophotometrically	CZ_SOP_D06_07_112 (ČSN ISO 11263)	Solid samples <sup>85</sup>
1.143 <sup>2</sup>	Determination of pH electrochemically in a suspension in water, KCl, CaCl <sub>2</sub> , BaCl <sub>2</sub>	CZ_SOP_D06_07_113 (ČSN ISO 10390, ČSN EN 12176:1999, ČSN EN 13037, ČSN EN 15933, ČSN 46 5735, ONORM L 1086-1, US EPA 9045D, US EPA 9040C)	Solid samples <sup>85</sup> , building materials <sup>82</sup> , materials for building <sup>89</sup>
1.144 <sup>2</sup>	Determination of formaldehyde by spectrophotometry	CZ_SOP_D06_07_114 (Chemical and physical methods of water analysis, SNTL Prague 1989)	Water <sup>81</sup> , extracts <sup>82</sup>
1.145	Reserved		
1.146 <sup>2</sup>	Determination of iron(II) by spectrophotometry	CZ_SOP_D06_07_116 (ČSN ISO 6332)	Water <sup>81</sup> , extracts <sup>82</sup>
1.147 <sup>2</sup>	Determination of total carbon (TC), total organic carbon (TOC) by the combustion method with IR detection and calculation of total inorganic carbon (TIC), carbonates and organic matter from measured values	CZ_SOP_D06_07_117 (Elementar Company methodology, ČSN ISO 10694, ČSN EN 13137:2002, ČSN EN 15936)	Solid samples <sup>85</sup> , building materials <sup>82</sup> , materials for building <sup>89</sup>
1.148 <sup>3</sup>	Determination of permeability by falling head	CZ_SOP_D06_07_118 (ČSN EN ISO 17892-11, chap. 5.2.2.3)	Soil
1.149 <sup>1</sup>	Determination of aggressive carbon dioxide by the Heyer's method using calculation from alkalinity	CZ_SOP_D06_02_119 (ČSN 83 0530-14:2000)	Water <sup>81</sup>

Page 11 of 45

Appendix is an integral part of  
Certificate of Accreditation No: 73/2022 of 14/02/2022

Entity accredited according to ČSN EN ISO/IEC 17025:2018:

ALS Czech Republic, s.r.o.  
Na Harč 336/9, 190 00 Praha 9 - Vysočany

Ordinal number <sup>1</sup>	Test procedure/method name	Test procedure/method identification <sup>2</sup>	Subject of the test
1.150 <sup>2</sup>	Determination of graininess of solid samples by the combined method of suspension density, sieve analyses and laser diffraction and calculation of permeability from measured values according to USBSC	CZ_SOP_D06_07_120 (ČSN EN ISO 17892-4, ČSN EN 933-1, ČSN EN 933-2, BS ISO 11277, Instructions TOM 23/1, ISO 13320)	Solid samples <sup>85</sup> (grain size lower than 63 mm)
1.151 <sup>2</sup>	Determination of total carbon, total sulfur, and hydrogen by combustion method with IR detection, determination of total nitrogen by combustion method with TCD detection and calculation of oxygen from measured values	CZ_SOP_D06_07_121.A (LECO Company methodology, ČSN ISO 29541, ČSN EN ISO 16994, ČSN EN ISO 16948, ČSN ISO 19579, ČSN EN 15408, ČSN ISO 10694, ČSN EN ISO 21663)	Solid samples <sup>85</sup> , waste, sludge, lubricants, feed <sup>83</sup> , plants, digestates, solid fossil fuels, solid biofuels, solid recovered fuels, building materials <sup>82</sup> , materials for building <sup>89</sup>
1.152 <sup>2</sup>	Determination of carbon, sulfur and hydrogen by combustion method with IR detection and determination of nitrogen by combustion method with TCD detection and calculation of oxygen from measured values	CZ_SOP_D06_07_121.B (LECO Company methodology)	Oil, liquid fuels, combustible liquid and solid wastes
1.153 <sup>1</sup>	Determination of hexavalent chromium by ion chromatography with spectrophotometric detection and calculation of trivalent chromium from measured values	CZ_SOP_D06_02_122, except chap. 10.2; 11.3.2; 11.5; 12.2.2; 15.5 (US EPA 7199, SM 3500-Cr)	Water <sup>81</sup> , extracts <sup>82</sup>
1.154 <sup>1</sup>	Determination of hexavalent chromium by ion chromatography with spectrophotometric detection and calculation of trivalent chromium from measured values	CZ_SOP_D06_02_122, except chap. 10.1; 11.3.1; 12.2.1; 15.4 (ČSN EN ISO 15192, EPA 3060A)	Solid samples <sup>85</sup>
1.155 – 1.156	Reserved		
1.157 <sup>2</sup>	Determination of gross calorific value by calorimetric method and calculation of net calorific value and emission factor from measured values	CZ_SOP_D06_07_124.A (ČSN ISO 1928, ČSN EN ISO 18125, ČSN EN ISO 21654, ČSN EN 15170, ČSN DIN 51900-1, ČSN DIN 51900-2, ČSN DIN 51900-3, ČSN P CEN/TS 16023)	Solid fossil fuels, solid biofuels, solid recovered fuels, waste, sludge, combustible building materials <sup>89</sup>
1.158 <sup>2</sup>	Determination of gross calorific value by calorimetric method and calculation of net calorific value and emission factor from measured values	CZ_SOP_D06_07_124.B (ČSN DIN 51900-1, ČSN DIN 51900-2, ČSN DIN 51900-3)	Oils, liquid fuels, combustible liquid, and solid wastes
1.159 <sup>2,1</sup>	Determination of total bromine, chlorine, fluorine, and sulphur by calculation from the measured values of bromide, chloride, fluoride and sulphate by IC method after burning the sample	CZ_SOP_D06_07_124.C (ČSN EN ISO 16994, ČSN EN 15408, ČSN EN 14582)	Solid fossil fuels, solid biofuels, solid recovered fuels, waste, sludge, combustible building materials <sup>89</sup>

Page 12 of 45

Entity accredited according to ČSN EN ISO/IEC 17025:2018:

ALS Czech Republic, s.r.o.  
Na Harře 336/9, 190 00 Praha 9 - Vysočany

Ordinal number <sup>1</sup>	Test procedure/method name	Test procedure/method identification <sup>2</sup>	Subject of the test
1.160 <sup>2,1</sup>	Determination of total bromine, chlorine, fluorine and sulphur by calculation from the measured values of bromide, chloride, fluoride and sulphate by IC method after burning the sample	CZ_SOP_D06_07_124.D (ČSN DIN 51900-1, ČSN DIN 51900-2, ČSN DIN 51900-3)	Oils, liquid fuels, combustible liquid and solid wastes
1.161 <sup>2</sup>	Determination of laboratory compacted bulk density (LCBD)	CZ_SOP_D06_07_125 (ČSN EN 13040)	Sludge, composts, soils meliorants and growth stimulants
1.162 <sup>2</sup>	Determination of electrical conductivity	CZ_SOP_D06_07_126 (ČSN EN 13038, ČSN ISO 11265, ČSN P CEN/TS 15937)	Sludge, composts, soils, soils meliorants and growth stimulants, modified bio waste
1.163 <sup>1</sup>	Determination of hexavalent chromium by ion chromatography with spectrophotometric detection and calculation of trivalent chromium from measured values	CZ_SOP_D06_02_127 (ISO 16740, EPA 425)	Emission <sup>3</sup> , imission <sup>39</sup>
1.164 <sup>1</sup>	Determination of nitrogen dioxide and sulphur dioxide in passive samplers by ion chromatography method and results recalculation to the volume of air	CZ_SOP_D06_02_128 (Materials of Institute Fondazione Salvatore Maugeri, ČSN EN ISO 10304-1, ČSN EN ISO 10304-3)	Emission <sup>39</sup> , imission <sup>39</sup>
1.165 <sup>1</sup>	Determination of sulphite by ion chromatography method	CZ_SOP_D06_02_129 (ČSN EN ISO 10304-3)	Water <sup>30,1</sup> , extracts <sup>32</sup>
1.166 <sup>2</sup>	Determination of volatile matter by gravimetry and calculation of fixed carbon from the measured values	CZ_SOP_D06_07_130 (ČSN ISO 562, ČSN ISO 5071-1, ČSN EN ISO 18123, ČSN EN ISO 22167)	Solid fossil fuels, solid biofuels, solid recovered fuels
1.167 <sup>2</sup>	Determination of sulphite after distillation by titration	CZ_SOP_D06_07_131 (M. Horáková et al.: Chemical and physical methods of water analyses)	Water <sup>30,1</sup> , extracts <sup>32</sup>
1.168 <sup>2</sup>	Determination of respiratory activity (AT <sub>a</sub> ) using respirometer	CZ_SOP_D06_07_132 (ONORM S 2027-4)	Wastes, sludge, composts, soils
1.169* 1.2.48, 7.8.9	Field determination of ozone using HACH sets	CZ_SOP_D06_01_133 (Method 8311 HACH Company, USA)	Drinking water, pool water
1.170 <sup>1</sup>	Determination of fluoride, chloride, and sulphate in absorption solution from emission sampling by ion chromatographic method and calculation of hydrogen fluoride, hydrogen chloride and sulphur dioxide from measured values	CZ_SOP_D06_02_134 (ČSN EN 1911, STN ISO 15713, ČSN EN 14791, ČSN EN ISO 10304-1)	Emission <sup>3</sup>
1.171 <sup>1</sup>	Determination of non-polar extractable compounds by UV spectrometry	CZ_SOP_D06_02_135, except chap. 10.2 (ČSN 83 0540-4:1998, STN 83 0540-4)	Water <sup>30,1</sup> , extracts <sup>32</sup>
1.172 <sup>1</sup>	Determination of non-polar extractable compounds by UV spectrometry	CZ_SOP_D06_02_135, except chap. 10.1 (ČSN 83 0540-4:1998, STN 83 0540-4)	Solid samples <sup>35</sup>

Entity accredited according to ČSN EN ISO/IEC 17025:2018:

ALS Czech Republic, s.r.o.  
Na Harře 336/9, 190 00 Praha 9 - Vysočany

Ordinal number <sup>1</sup>	Test procedure/method name	Test procedure/method identification <sup>2</sup>	Subject of the test
1.173 <sup>1</sup>	Determination of total dust concentration and respirable dust fraction by gravimetry and results recalculation to the volume of air	CZ_SOP_D06_02_136 (ČSN EN 481, ČSN EN 482, ČSN EN 689+AC, NIOSH 0500, NIOSH 0600, GR No. 361/2007 Coll.)	Working environment <sup>37</sup>
1.174 <sup>2</sup>	Determination of SiO <sub>2</sub> in silicate materials after decomposition by gravimetry	CZ_SOP_D06_07_137 (ČSN 72 0105-1)	Solid samples <sup>35</sup>
1.175 <sup>2</sup>	Determination of P <sub>2</sub> O <sub>5</sub> in silicate materials after decomposition by spectrophotometry	CZ_SOP_D06_07_138 (ČSN 72 0116-1)	Solid samples <sup>35</sup>
1.176 <sup>2</sup>	Determination of total sulfur in silicate materials after decomposition by gravimetry	CZ_SOP_D06_07_139 (ČSN 72 0118)	Solid samples <sup>35</sup>
1.177	Reserved		
1.178* 1.2.5	Analysis of CH <sub>4</sub> , CO <sub>2</sub> , O <sub>2</sub> , H <sub>2</sub> S gases by Geotech gas analyzer and calculation of N <sub>2</sub> from measured values	CZ_SOP_D06_01_141 (BIOGA5 5000 Analyzer Manual)	Gases <sup>36</sup>
1.179	Reserved		
1.180 <sup>2</sup>	Determination of total inorganic fluorine after separation by distillation by direct potentiometry	CZ_SOP_D06_07_143, except chap. 10 and 13.1 (ČSN ISO 10359-2, ČSN 83 4752-3:1989)	Water <sup>30,1</sup> , extracts <sup>32</sup> , liquid samples <sup>41</sup>
1.181 <sup>2</sup>	Determination of total inorganic fluorine after separation by distillation by direct potentiometry	CZ_SOP_D06_07_143 (ČSN ISO 10359-2, ČSN 83 4752-3:1989)	Solid samples <sup>35</sup>
1.182 <sup>2</sup>	Determination of biomass content by selective dissolution	CZ_SOP_D06_07_144 (ČSN EN 15440, Annex A)	Solid alternative fuels, solid combustible wastes
2	<b>Organic Chemistry</b>		
2.1 <sup>1</sup>	Determination of extractable compounds in the range of hydrocarbons C10 – C40, their fractions calculated from the measured values by gas chromatography method with FID detection	CZ_SOP_D06_03_150 (ČSN EN 14039, ČSN EN ISO 16703, ČSN P CEN ISO/TS 16558-2, US EPA 8015, US EPA 3550, TNRCC Method 1006)	Solid samples <sup>35</sup>
2.2 <sup>1</sup>	Determination of extractable compounds in the range of hydrocarbons C10 – C40, their fractions calculated from the measured values by gas chromatography method with FID detection	CZ_SOP_D06_03_151 (ČSN ISO 9377-2, US EPA 8015, US EPA 3510, TNRCC Method 1006)	Water <sup>30,1</sup> , extracts <sup>32</sup>
2.3 <sup>1</sup>	Determination of extractable compounds in the range of hydrocarbons C5 – C40, their fractions calculated from the measured values by gas chromatography method with FID detection	CZ_SOP_D06_03_152, except chap. 9.1 (TNRCC Method 1006, TNRCC Method 1005)	Water <sup>30,1</sup> , extracts <sup>32</sup> , liquid samples <sup>41</sup>
2.4 <sup>1</sup>	Determination of extractable compounds in the range of hydrocarbons C5 – C40, their fractions calculated from the measured values by gas chromatography method with FID detection	CZ_SOP_D06_03_152, except chap. 9.2 (TNRCC Method 1006, TNRCC Method 1005)	Solid samples <sup>35</sup>

Entity accredited according to ČSN EN ISO/IEC 17025:2018:

ALS Czech Republic, s.r.o.  
Na Harře 336/9, 190 00 Praha 9 - Vysočany

Ordinal number <sup>1</sup>	Test procedure/method name	Test procedure/method identification <sup>2</sup>	Subject of the test
2.5 <sup>1</sup>	Determination of volatile organic compounds <sup>39</sup> by gas chromatography method with FID and MS detection and calculation of volatile organic compounds sums from measured values and results recalculation to the volume of air	CZ_SOP_D06_03_153 (CEN/TS 13649, NIOSH <sup>11</sup> )	Solid sorbents
2.6	Reserved		
2.7 <sup>1</sup>	Determination of volatile organic compounds <sup>3</sup> by gas chromatography method with FID and MS detection and calculation of volatile organic compounds sums from measured values	CZ_SOP_D06_03_155 except chap. 10.5 and 10.6 (US EPA 624, US EPA 5021A, US EPA 8260, US EPA 8015, ČSN EN ISO 10301, MADEP 2004, rev. 1.1, ČSN ISO 11423, ČSN EN ISO 15680)	Water <sup>30,1</sup> , extracts <sup>32</sup>
2.8 <sup>1</sup>	Determination of volatile organic compounds <sup>3</sup> by gas chromatography method with FID and MS detection and calculation of volatile organic compounds sums from measured values	CZ_SOP_D06_03_155, except chap. 10.4 (US EPA 8260, US EPA 5021A, US EPA 5021, US EPA 8015, ČSN EN ISO 22155, ČSN EN ISO 15009, ČSN EN ISO 16558-1, MADEP 2004, rev. 1.1.)	Solid samples <sup>35</sup>
2.9 <sup>1</sup>	Determination of volatile organic compounds <sup>4</sup> by gas chromatography method with FID and ECD detection and calculation of volatile organic compounds sums from measured values	CZ_SOP_D06_03_156, except chap. 11.3 - 11.5 (US EPA 601, US EPA 8260, US EPA 8015, RBCA Petroleum Hydrocarbon Methods, ČSN EN ISO 11423, ČSN EN ISO 15680)	Water <sup>30,1</sup> , extracts <sup>32</sup>
2.10 <sup>1</sup>	Determination of volatile organic compounds <sup>4</sup> by gas chromatography method with FID and ECD detection and calculation of volatile organic compounds sums from measured values	CZ_SOP_D06_03_156, except chap. 11.1 and 11.2 (US EPA 8260, US EPA 8015, ČSN EN ISO 22155, ČSN EN ISO 15009, ČSN EN ISO 16558-1, RBCA Petroleum Hydrocarbon Methods)	Solid samples <sup>35</sup>
2.11 <sup>1</sup>	Determination of organic contaminants <sup>5</sup> by gas chromatography method with MS detection (SPIMFAB) and calculation of organic contaminants sums from measured values	CZ_SOP_D06_03_157, except chap. 9.2 (SPIMFAB)	Water <sup>30,1</sup> , extracts <sup>32</sup>

Entity accredited according to ČSN EN ISO/IEC 17025:2018:

ALS Czech Republic, s.r.o.  
Na Harře 336/9, 190 00 Praha 9 - Vysočany

Ordinal number <sup>1</sup>	Test procedure/method name	Test procedure/method identification <sup>2</sup>	Subject of the test
2.12 <sup>1</sup>	Determination of organic contaminants <sup>5</sup> by gas chromatography method with MS detection (SPIMFAB) and calculation of organic contaminants sums from measured values	CZ_SOP_D06_03_157, except chap. 9.1 (SPIMFAB)	Waste (solid waste, biowaste), sediments, soil, rocks
2.13 <sup>1</sup>	Determination of phenols, chlorinated phenols and cresols <sup>6</sup> by gas chromatography method with MS and ECD detection and calculation of phenols, chlorinated phenols and cresols sums from measured values	CZ_SOP_D06_03_158, except chap. 9.3 and 9.4 (US EPA 8041, US EPA 3500, ČSN EN 12673)	Water <sup>30,1</sup>
2.14 <sup>1</sup>	Determination of phenols, chlorinated phenols and cresols <sup>6</sup> by gas chromatography method with MS and ECD detection and calculation of phenols, chlorinated phenols and cresols sums from measured values	CZ_SOP_D06_03_158, except chap. 9.1, 9.2 and 9.4 (US EPA 8041, US EPA 3500, DIN ISO 14154)	Building materials <sup>42</sup> , materials for building <sup>49</sup> , waste (solid waste, biowaste), sediments, soil, rocks
2.15	Reserved		
2.16 <sup>1</sup>	Determination of phthalates <sup>7</sup> by gas chromatography method with MS detection and calculation of phthalates sums from measured values	CZ_SOP_D06_03_159, except chap. 9.2 and 9.3 (US EPA 8061A)	Water <sup>30,1</sup> , extracts <sup>32</sup>
2.17 <sup>1</sup>	Determination of phthalates <sup>7</sup> by gas chromatography method with MS detection and calculation of phthalates sums from measured values	CZ_SOP_D06_03_159, except chap. 9.1 (US EPA 8061A, CPSC-CH-C1001-09.3)	Building materials <sup>42</sup> , materials for building <sup>49</sup> , waste (solid waste, biowaste), sediments, soil, rocks
2.18 <sup>1</sup>	Determination of phenols and cresols <sup>40</sup> by gas chromatography method with MS detection and calculation of phenols and cresols sums from measured values	CZ_SOP_D06_03_160, except chap. 9.2 (US EPA 8041A, US EPA 3500)	Water <sup>30,1</sup> , extracts <sup>32</sup>
2.19 <sup>1</sup>	Determination of phenols and cresols <sup>40</sup> by gas chromatography method with MS detection and calculation of phenols and cresols sums from measured values	CZ_SOP_D06_03_160, except chap. 9.1 (US EPA 8041A, US EPA 3500)	Building materials <sup>42</sup> , materials for building <sup>49</sup> , waste (solid waste, biowaste), sediments, soil, rocks
2.20 <sup>1</sup>	Determination of semi volatile organic compounds <sup>8</sup> by gas chromatography method with MS or MS/MS detection and calculation of semi volatile organic compounds sums from measured values	CZ_SOP_D06_03_161 except chap. 10.1.3 – 10.1.5 (US EPA 8270D, US EPA 8082A, ČSN EN ISO 6468, US EPA 8000D)	Water <sup>30,1</sup> , extracts <sup>32</sup>
2.21 <sup>1</sup>	Determination of semi volatile organic compounds <sup>8</sup> by gas chromatography method with MS or MS/MS detection and calculation of semi volatile organic compounds sums from measured values	CZ_SOP_D06_03_161 except chap. 10.1.1, 10.1.2, 10.2.1, 10.2.2 (US EPA 8270D, US EPA 8082A ČSN EN 15527, ISO 18287, ISO 10382, ČSN EN 17322)	Building materials <sup>42</sup> , materials for building <sup>49</sup> , waste (solid waste, biowaste), sediments, soil, rocks

Appendix is an integral part of  
Certificate of Accreditation No: 73/2022 of 14/02/2022

Entity accredited according to ČSN EN ISO/IEC 17025:2018:

ALS Czech Republic, s.r.o.  
Na Harře 336/9, 190 00 Praha 9 - Vysočany

Ordinal number <sup>1</sup>	Test procedure/method name	Test procedure/method identification <sup>2</sup>	Subject of the test
2.22 <sup>1</sup>	Determination of polycyclic aromatic hydrocarbons <sup>10</sup> by liquid chromatography method with FLD and PDA detection and calculation of polycyclic aromatic hydrocarbons sums from measured values	CZ_SOP_D06_03_162 (US EPA 550)	Drinking, table and infant water
2.23 <sup>1</sup>	Determination of polycyclic aromatic hydrocarbons <sup>10</sup> by liquid chromatography method with detection FLD and PDA and calculation of polycyclic aromatic hydrocarbons sums from measured values	CZ_SOP_D06_03_163, except chap. 9.1.2, 9.4.2 (US EPA 610, ČSN EN ISO 17993)	Water <sup>30</sup> , extracts <sup>32</sup>
2.24 <sup>1</sup>	Determination of polycyclic aromatic hydrocarbons <sup>10</sup> by liquid chromatography method with FLD and PDA detection and calculation of polycyclic aromatic hydrocarbons sums from measured values	CZ_SOP_D06_03_163, except chap. 9.1.1., 9.4.1 (US EPA 610, US EPA 3550, ČSN EN 16181)	Solid samples <sup>85</sup>
2.25 <sup>1</sup>	Determination of glycols <sup>26</sup> by gas chromatography method with MS detection	CZ_SOP_D06_03_164	Water <sup>30</sup> , cooling liquids, anti-freeze fluid
2.26 <sup>1</sup>	Determination of polycyclic aromatic hydrocarbons <sup>10</sup> by liquid chromatography method with FLD and PDA detection and calculation of polycyclic aromatic hydrocarbons sums from measured values and results recalculation to the volume of air	CZ_SOP_D06_03_165 (ISO 11338-2)	Emission <sup>18</sup> , imission <sup>19</sup>
2.27 <sup>1</sup>	Determination of polychlorinated biphenyls <sup>39</sup> by gas chromatography method with ECD detection and calculation of polychlorinated biphenyls sums from measured values	CZ_SOP_D06_03_166 except chap. 10.1 – 10.3 (DIN 38407-3, US EPA 8082)	Water <sup>30</sup> , extracts <sup>32</sup>
2.28 <sup>1</sup>	Determination of polychlorinated biphenyls <sup>11</sup> by gas chromatography method with ECD detection and calculation of polychlorinated biphenyls sums from measured values	CZ_SOP_D06_03_166 except chap. 10.4 (US EPA 8082, ISO 10382, ČSN EN 17322)	Solid samples <sup>85</sup> , sealing materials
2.29 <sup>1</sup>	Determination of alkylphenols and alkylphenol ethoxylates <sup>9</sup> by gas chromatography method with MS or MS/MS detection and calculation of alkylphenols and alkylphenol ethoxylates sums from measured values	CZ_SOP_D06_03_167 (European Standard BT WI CSS99040)	Sediments, soils, rocks
2.30 <sup>1</sup>	Determination of polychlorinated biphenyls <sup>11</sup> - congener analyses by gas chromatography method with ECD detection and calculation of polychlorinated biphenyls sums from measured values	CZ_SOP_D06_03_168 (ČSN EN 12766-1, ČSN EN 61619)	Oil hydrocarbons, used oils, insulating liquids
2.31 <sup>1</sup>	Determination of organochlorine pesticides and other halogen compounds <sup>12</sup> by gas chromatography method with ECD detection and calculation of organochlorine pesticides and other halogen compounds sums from measured values	CZ_SOP_D06_03_169 except chap. 10.1 (ČSN EN ISO 6468, US EPA 8081, DIN 38407-3)	Water <sup>30</sup> , extracts <sup>32</sup>

Page 17 of 45

Appendix is an integral part of  
Certificate of Accreditation No: 73/2022 of 14/02/2022

Entity accredited according to ČSN EN ISO/IEC 17025:2018:

ALS Czech Republic, s.r.o.  
Na Harře 336/9, 190 00 Praha 9 - Vysočany

Ordinal number <sup>1</sup>	Test procedure/method name	Test procedure/method identification <sup>2</sup>	Subject of the test
2.32 <sup>1</sup>	Determination of organochlorine pesticides and other halogen compounds <sup>12</sup> by gas chromatography method with ECD detection and calculation of organochlorine pesticides and other halogen compounds sums from measured values	CZ_SOP_D06_03_169 except chap. 10.2 (US EPA 8081, ISO 10382)	Solid samples <sup>85</sup>
2.33 <sup>1</sup>	Determination of perchlorates by liquid chromatography with MS/MS detection	CZ_SOP_D06_03_170.A (US EPA 6850)	Drinking water
2.34 <sup>1</sup>	Determination of perchlorates by liquid chromatography with MS/MS detection	CZ_SOP_D06_03_170.B (US EPA 6850)	Sediments, sludges, soils, rocks
2.35 <sup>1</sup>	Determination of polychlorinated dibenzo-p-dioxins and dibenzofuranes <sup>13</sup> in emissions by isotope dilution method using HRGC-HRMS and calculation of TEQ parameters from measured values	CZ_SOP_D06_06_170 (US EPA 23, US EPA 23A)	Emission <sup>18</sup>
2.36 <sup>1</sup>	Determination of polychlorinated dibenzo-p-dioxins and dibenzofuranes <sup>13</sup> in immission by isotope dilution method using HRGC-HRMS and calculation of TEQ parameters from measured values	CZ_SOP_D06_06_171 (US EPA TO-9A)	Imission <sup>19</sup>
2.37 <sup>1</sup>	Determination of coplanar polychlorinated biphenyls <sup>14</sup> in stationary emission sources by isotope dilution method using HRGC-HRMS and calculation of PCB sums and TEQ parameter from measured values	CZ_SOP_D06_06_172 (JIS K 0311)	Emission <sup>18</sup> , imission <sup>19</sup>
2.38 <sup>1</sup>	Determination of polychlorinated biphenyls <sup>14</sup> by isotope dilution method using HRGC-HRMS and calculation of PCB sums and TEQ parameter from measured values	CZ_SOP_D06_06_173, except chap. 10.2.3.2-10.2.3.8, 10.2.4, 10.2.5 (US EPA 1668A, ČSN EN 16190)	Water <sup>30</sup>
2.39 <sup>1</sup>	Determination of polychlorinated biphenyls <sup>14</sup> by isotope dilution method using HRGC-HRMS and calculation of PCB sums and TEQ parameter from measured values	CZ_SOP_D06_06_173, except chap. 10.2.3.1, 10.2.3.7, 10.2.3.8, 10.2.5 (US EPA 1668A, ČSN EN 16190)	Solid samples <sup>85</sup> , building materials <sup>82</sup> , materials for building <sup>89</sup>
2.40 <sup>1</sup>	Determination of polychlorinated biphenyls <sup>14</sup> by isotope dilution method using HRGC-HRMS and calculation of PCB sums and TEQ parameter from measured values	CZ_SOP_D06_06_173, except chap. 10.2.3.1-10.2.3.7, 10.2.4 (US EPA 1668A, ČSN EN 16190)	Biological materials <sup>77</sup> , vegetable materials <sup>84</sup> , animal materials <sup>83</sup>
2.41 <sup>1</sup>	Determination of polychlorinated biphenyls <sup>14</sup> by isotope dilution method using HRGC-HRMS and calculation of PCB sums and TEQ parameter from measured values	CZ_SOP_D06_06_173, except chap. 10.2.3.1-10.2.3.6 (US EPA 1668A, ČSN EN 16190)	SPMD, food, feed <sup>83</sup> , biotic materials
2.42 <sup>1</sup>	Determination of polychlorinated dibenzo-p-dioxins and dibenzofuranes <sup>13</sup> in emission samples by isotope dilution method using HRGC-HRMS and calculation of TEQ parameters from measured values	CZ_SOP_D06_06_174 (ČSN EN 1948-2, ČSN EN 1948-3)	Emission <sup>18</sup>

Page 18 of 45

Appendix is an integral part of  
Certificate of Accreditation No: 73/2022 of 14/02/2022

Entity accredited according to ČSN EN ISO/IEC 17025:2018:

ALS Czech Republic, s.r.o.  
Na Harře 336/9, 190 00 Praha 9 - Vysočany

Ordinal number <sup>1</sup>	Test procedure/method name	Test procedure/method identification <sup>2</sup>	Subject of the test
2.43 <sup>1</sup>	Determination of tetra- to octa-chlorinated dioxins and furanes <sup>13</sup> by isotope dilution method using HRGC-HRMS and calculation of TEQ parameters from measured values	CZ_SOP_D06_06_175, except chap. 10.2.3.2 - 10.2.3.8, 10.2.4, 10.2.5 (US EPA 1613B, ČSN EN 16190)	Water <sup>30</sup>
2.44 <sup>1</sup>	Determination of tetra- to octa-chlorinated dioxins and furanes <sup>13</sup> by isotope dilution method using HRGC-HRMS and calculation of TEQ parameters from measured values	CZ_SOP_D06_06_175, except chap. 10.2.3.1, 10.2.3.7, 10.2.3.8, 10.2.5 (US EPA 1613 B, ČSN EN 16190)	Solid samples <sup>85</sup> , building materials <sup>82</sup> , materials for building <sup>89</sup>
2.45 <sup>1</sup>	Determination of tetra- to octa-chlorinated dioxins and furanes <sup>13</sup> by isotope dilution method using HRGC-HRMS and calculation of TEQ parameters from measured values	CZ_SOP_D06_06_175, except chap. 10.2.3.1 - 10.2.3.7, 10.2.4 (US EPA 1613B, ČSN EN 16190)	Biological materials <sup>77</sup> , vegetable materials <sup>84</sup> , animal materials <sup>83</sup>
2.46 <sup>1</sup>	Determination of tetra- to octa-chlorinated dioxins and furanes <sup>13</sup> by isotope dilution method using HRGC-HRMS and calculation of TEQ parameters from measured values	CZ_SOP_D06_06_175 except chap. 10.2.3.1 - 10.2.3.6 (US EPA 1613B, ČSN EN 16190)	SPMD, food, feed <sup>83</sup> , biotic materials
2.47 <sup>1</sup>	Determination of polychlorinated dibenzodioxins (PCDD) and polychlorinated dibenzofurans (PCDF) <sup>13</sup> using HRGC-HRMS and calculation of TEQ parameters from measured values	CZ_SOP_D06_06_176, except chap. 10.2.3.2 - 10.2.3.7, 10.2.4, 10.2.5 (US EPA 8290A)	Water <sup>30</sup>
2.48 <sup>1</sup>	Determination of polychlorinated dibenzodioxins (PCDD) and polychlorinated dibenzofurans (PCDF) <sup>13</sup> using HRGC-HRMS and calculation of TEQ parameters from measured values	CZ_SOP_D06_06_176, except chap. 10.2.3.1, 10.2.3.6, 10.2.5 (US EPA 8290A)	Solid samples <sup>85</sup>
2.49 <sup>1</sup>	Determination of polychlorinated dibenzodioxins (PCDD) and polychlorinated dibenzofurans (PCDF) <sup>13</sup> using HRGC-HRMS and calculation of TEQ parameters from measured values	CZ_SOP_D06_06_176, except chap. 10.2.3.1 - 10.2.3.6, 10.2.4 (US EPA 8290A)	Biological materials <sup>77</sup>
2.50 <sup>1</sup>	Determination of polychlorinated dibenzodioxins (PCDD) and polychlorinated dibenzofurans (PCDF) <sup>13</sup> using HRGC-HRMS and calculation of TEQ parameters from measured values	CZ_SOP_D06_06_176, except chap. 10.2.3.1 - 10.2.3.6 (US EPA 8290A)	Food, feed <sup>83</sup> , biotic materials
2.51 <sup>1</sup>	Determination of selected brominated flame retardants (BFR) <sup>15</sup> by isotope dilution method using HRGC-HRMS and calculation of brominated flame retardants sums from measured values	CZ_SOP_D06_06_177, except chap. 10.2.3.2 - 10.2.3.8, 10.2.4, 10.2.5 (US EPA 1614)	Water <sup>30</sup>
2.52 <sup>1</sup>	Determination of selected brominated flame retardants (BFR) <sup>15</sup> by isotope dilution method using HRGC-HRMS and calculation of brominated flame retardants sums from measured values	CZ_SOP_D06_06_177, except chap. 10.2.3.1, 10.2.3.7, 10.2.3.8, 10.2.5 (US EPA 1614, ČSN EN 16377, ČSN EN ISO 22032)	Solid samples <sup>85</sup> , building materials <sup>82</sup> , materials for building <sup>89</sup>

Page 19 of 45

Appendix is an integral part of  
Certificate of Accreditation No: 73/2022 of 14/02/2022

Entity accredited according to ČSN EN ISO/IEC 17025:2018:

ALS Czech Republic, s.r.o.  
Na Harře 336/9, 190 00 Praha 9 - Vysočany

Ordinal number <sup>1</sup>	Test procedure/method name	Test procedure/method identification <sup>2</sup>	Subject of the test
2.53 <sup>1</sup>	Determination of selected brominated flame retardants (BFR) <sup>15</sup> by isotope dilution method using HRGC-HRMS and calculation of brominated flame retardants sums from measured values	CZ_SOP_D06_06_177, except chap. 10.2.3.1 - 10.2.3.7, 10.2.4 (US EPA 1614)	Biological materials <sup>77</sup> , vegetable materials <sup>84</sup> , animal materials <sup>83</sup>
2.54 <sup>1</sup>	Determination of selected brominated flame retardants (BFR) <sup>15</sup> by isotope dilution method using HRGC-HRMS and calculation of brominated flame retardants sums from measured values	CZ_SOP_D06_06_177, except chap. 10.2.3.1 - 10.2.3.6, (US EPA 1614)	SPMD, food, feed <sup>83</sup> , biotic materials
2.55 <sup>1</sup>	Determination of alkylphenols and alkylphenol ethoxylates <sup>9</sup> by gas chromatography method with MS or MS/MS detection and calculation of alkylphenols and alkylphenol ethoxylates sums from measured values	CZ_SOP_D06_03_178 (ČSN EN ISO 18857-2)	Water <sup>30</sup> , extracts <sup>32</sup>
2.56 <sup>1</sup>	Determination of PCB <sup>14</sup> in emission samples by isotope dilution method using HRGC-HRMS and calculation of PCB sums from measured values	CZ_SOP_D06_06_179 (ČSN EN 1948-4, US EPA TO-4-A)	Emission <sup>18</sup> , imission <sup>19</sup> , working environment <sup>87</sup>
2.57 <sup>1</sup>	Determination of polycyclic aromatic hydrocarbons <sup>8</sup> by isotope dilution method using HRGC-HRMS and calculation of the sums of polycyclic aromatic hydrocarbons from the measured values	CZ_SOP_D06_06_180 except chap. 10.3.3.1 - 10.3.3.6, 10.3.3.8 - 10.3.3.10, 10.3.5 (US EPA 429, ISO 11338, US EPA 3540)	Solid samples <sup>85</sup> , building materials <sup>82</sup> , materials for building <sup>89</sup>
2.58 <sup>1</sup>	Determination of polycyclic aromatic hydrocarbons <sup>84</sup> by isotope dilution method using HRGC-HRMS and calculation of the sums of polycyclic aromatic hydrocarbons from the measured values	CZ_SOP_D06_06_180, except chap. 10.3.3.6 - 10.3.3.10, 10.3.4, 10.3.5 (US EPA 429, ISO 11338, US EPA TO-13A, ČSN EN 15549)	Emission <sup>18</sup> , imission <sup>19</sup> , working environment <sup>87</sup>
2.59 <sup>1</sup>	Determination of polycyclic aromatic hydrocarbons <sup>84</sup> by isotope dilution method using HRGC-HRMS and calculation of polyaromatic hydrocarbons sums from measured values	CZ_SOP_D06_06_180, except chap. 10.3.3.1 - 10.3.3.9, 10.3.4 (US EPA 429, STN EN 16619)	Biological materials <sup>77</sup> , vegetable materials <sup>84</sup> , animal materials <sup>83</sup>
2.60 <sup>1</sup>	Determination of polycyclic aromatic hydrocarbons <sup>84</sup> by isotope dilution method using HRGC-HRMS and calculation of polyaromatic hydrocarbons sums from measured values	CZ_SOP_D06_06_180, except chap. 10.3.3.1 - 10.3.3.8 (US EPA 429, STN EN 16619)	SPMD, food, feed <sup>83</sup> , biotic materials
2.61 <sup>1</sup>	Determination of polycyclic aromatic hydrocarbons <sup>84</sup> by isotope dilution method using HRGC-HRMS and calculation of polyaromatic hydrocarbons sums from measured values	CZ_SOP_D06_06_180, except chap. 10.3.3.1 - 10.3.3.7, 10.3.3.9, 10.3.3.10, 10.3.4, 10.3.5 (US EPA 429, ISO 11338, IP 346)	Oils

Page 20 of 45

Entity accredited according to ČSN EN ISO/IEC 17025:2018:

ALS Czech Republic, s.r.o.  
Na Harře 336/9, 190 00 Praha 9 - Vysočany

Ordinal number <sup>1</sup>	Test procedure/method name	Test procedure/method identification <sup>2</sup>	Subject of the test
2.62 <sup>1</sup>	Determination of semi-volatile organic compounds <sup>27</sup> by gas chromatography method with MS detection and calculation of semi-volatile organic compounds sums from measured values	CZ_SOP_D06_03_181 (US EPA 429, US EPA 1668, US EPA 3550)	Sediments, soils, rocks
2.63 <sup>1</sup>	Determination of acidic herbicides, drug residues and other pollutants <sup>29</sup> by liquid chromatography method with MS/MS detection and calculation of acidic herbicides, drug residues and other pollutants sums from measured values	CZ_SOP_D06_03_182.A (DIN 38407-35)	Water <sup>201</sup>
2.64 <sup>1</sup>	Determination of acidic herbicides and drug residues <sup>27</sup> by liquid chromatography method with MS/MS detection	CZ_SOP_D06_03_182.B (ČSN EN 15637, US EPA 1694)	Sediments, sludges, soils, rocks
2.65 <sup>1</sup>	Determination of pesticides, pesticide metabolites, drug residues and other pollutants <sup>30</sup> by liquid chromatography method with MS/MS detection and calculation of pesticides, pesticide metabolites, drug residues and other pollutants sums from measured values	CZ_SOP_D06_03_183.A (US EPA 535, US EPA 1694)	Water <sup>201</sup>
2.66 <sup>1</sup>	Determination of pesticides, pesticide metabolites, drug residues and other pollutants <sup>30</sup> by liquid chromatography method with MS/MS detection and calculation of pesticides, pesticide metabolites, drug residues and other pollutants sums from measured values	CZ_SOP_D06_03_183.B (ČSN EN 15637, US EPA 1694)	Sediments, sludges, soils, rocks, building materials <sup>42</sup> , materials for building <sup>49</sup>
2.67 <sup>1</sup>	Determination of pesticides, pesticide metabolites, drug residues and other pollutants <sup>32</sup> by liquid chromatography method with MS/MS detection and calculation of pesticides, pesticide metabolites, drug residues and other pollutants sums from measured values	CZ_SOP_D06_03_183.C (ČSN EN 15662)	Vegetable materials <sup>48</sup> , animal materials <sup>49</sup>
2.68 <sup>1</sup>	Determination of pesticides <sup>31</sup> by gas chromatography method with MS or MS/MS detection and calculation of pesticides sums from measured values	CZ_SOP_D06_03_184 (US EPA 8141B, US EPA 3535A, ČSN EN 12918)	Water <sup>201</sup>
2.69 <sup>1</sup>	Determination of pesticides and pesticide metabolites <sup>32</sup> by derivatization and liquid chromatography method with MS/MS detection and calculation of pesticides and pesticide metabolites sums from measured values	CZ_SOP_D06_03_185.A (ČSN ISO 21458)	Water <sup>201</sup>
2.70 <sup>1</sup>	Determination of pesticides and pesticide metabolites <sup>34</sup> by derivatization and liquid chromatography method with MS/MS detection	CZ_SOP_D06_03_185.B (Journal of Chromatography A, 1292 (2013) 132-141, EC Decision No. 2002/657/EC)	Sediments, sludges, soils, rocks
2.71 <sup>1</sup>	Determination of complexing substances <sup>33</sup> by gas chromatography method with MS detection	CZ_SOP_D06_03_186 (ČSN EN ISO 16588)	Water <sup>201</sup>
2.72 <sup>1</sup>	Determination of polycyclic aromatic hydrocarbons derivatives <sup>36</sup> by liquid chromatography method with MS detection	CZ_SOP_D06_03_187 (Journal of Chromatography A, 1133 (2006) 241-247)	Emission <sup>48</sup> , imission <sup>79</sup>

Entity accredited according to ČSN EN ISO/IEC 17025:2018:

ALS Czech Republic, s.r.o.  
Na Harře 336/9, 190 00 Praha 9 - Vysočany

Ordinal number <sup>1</sup>	Test procedure/method name	Test procedure/method identification <sup>2</sup>	Subject of the test
2.73 <sup>1</sup>	Determination of organic acids <sup>37</sup> by capillary electrophoresis method with UV detection	CZ_SOP_D06_03_188.A (Lumex Company manual, Kudrjashova, M.: Capillary electrophoretic monitoring of microbial growth: determination of organic acids, COPYRIGHT 2004 Estonian Academy Publishers, June 2004 Source Volume: 53 Source Issue: 2, ISSN: 1406-0124)	Water <sup>201</sup>
2.74 <sup>1</sup>	Determination of organic acids <sup>37</sup> by capillary electrophoresis method with UV detection	CZ_SOP_D06_03_188.B (Lumex Company manual, Kudrjashova, M.: Capillary electrophoretic monitoring of microbial growth: determination of organic acids, COPYRIGHT 2004 Estonian Academy Publishers, June 2004 Source Volume: 53 Source Issue: 2, ISSN: 1406-0124)	Feed <sup>43</sup> , composts, digestate
2.75 <sup>1</sup>	Determination of gases <sup>38</sup> by gas chromatography method with detection FID and TCD	CZ_SOP_D06_03_189 (EPA Method RSK-175)	Water <sup>201</sup> , liquid samples <sup>41</sup>
2.76 <sup>1</sup>	Low limit determination of volatile organic compounds <sup>3</sup> by gas chromatography method with MS detection and calculation of volatile organic compounds sums from measured values	CZ_SOP_D06_03_190, except chap. 12.1, 13.1.1, 13.1.2, 14.1, 16.1 (US EPA 5021, US EPA 8260)	Water <sup>201</sup>
2.77 <sup>1</sup>	Low limit determination of volatile organic compounds <sup>3</sup> by gas chromatography method with MS detection and calculation of volatile organic compounds sums from measured values	CZ_SOP_D06_03_190, except chap. 12.2, 13.2.1, 13.2.2, 14.2, 16.2 (US EPA 5021, US EPA 8260)	Solid samples <sup>45</sup>
2.78 <sup>1</sup>	Determination of chlorinated alkanes <sup>34</sup> by gas chromatography method with MS/MS detection	CZ_SOP_D06_03_192.A (ČSN EN ISO 12010)	Water <sup>201</sup>
2.79 <sup>1</sup>	Determination of chlorinated alkanes <sup>34</sup> by gas chromatography method with MS/MS detection	CZ_SOP_D06_03_192.B (ČSN EN ISO 12010, ČSN EN ISO 18635)	Building materials <sup>42</sup> , materials for building <sup>49</sup> , sediments, soils
2.80 <sup>1</sup>	Determination of aniline and aniline derivatives <sup>41</sup> by gas chromatography method with MS detection	CZ_SOP_D06_03_193 (US EPA 8270)	Sediments, sludges, soils, rocks
2.81 <sup>1</sup>	Determination of chlorinated phenols <sup>35</sup> by liquid chromatography method with MS/MS detection	CZ_SOP_D06_03_194 (2002/657/ES, 96/23/ES)	Water <sup>201</sup>
2.82 <sup>1</sup>	Determination of drug residues <sup>36</sup> by liquid chromatography with MS/MS detection and results recalculation to the volume of air	CZ_SOP_D06_03_195 (Jia Yu et al.: Biomed. Chromatogr. 2011; 25: 511-516)	Working environment <sup>41</sup>
2.83 <sup>1</sup>	Determination of epichlorohydrin by gas chromatography method with MS/MS detection	CZ_SOP_D06_03_196 (Agilent Technologies Application list 5900-6433EN)	Water <sup>201</sup>
2.84 <sup>1</sup>	Determination of perfluorinated and brominated compounds <sup>3</sup> by liquid chromatography with MS/MS detection	CZ_SOP_D06_03_197.A (US EPA 537, ČSN P CEN/TS 15968)	Water <sup>201</sup> , extracts <sup>42</sup>

Entity accredited according to ČSN EN ISO/IEC 17025:2018:

ALS Czech Republic, s.r.o.  
Na Harře 336/9, 190 00 Praha 9 - Vysočany

Ordinal number <sup>1</sup>	Test procedure/method name	Test procedure/method identification <sup>2</sup>	Subject of the test
2.85 <sup>1</sup>	Determination of per fluorinated and brominated compounds <sup>37</sup> by liquid chromatography with MS/MS detection	CZ_SOP_D06_03_197.B (DIN 38414-14)	Sediments, sludges, soils, rocks
2.86 <sup>1</sup>	Determination of volatile organic compounds <sup>39</sup> by gas chromatography method with TCD and FID detection and calculation of volatile organic compounds percentage from measured values	CZ_SOP_D06_03_198 (ČSN EN ISO 11890-2)	Organic solvents
2.87 <sup>1</sup>	Determination of fat by gravimetry	CZ_SOP_D06_06_199 (US EPA 1613)	Food, feed <sup>43</sup> , biological materials <sup>77</sup>
2.88 <sup>1</sup>	Determination of 3-chloro-1,2-propanediol by gas chromatography method with MS detection	CZ_SOP_D06_03_200 (LMBG 52.02(1))	Spices
2.89 <sup>1</sup>	Determination of drug residues and narcotic and psychotropic substances <sup>40</sup> by liquid chromatography method with MS/MS detection	CZ_SOP_D06_03_201.A (US EPA 1694)	Water <sup>201</sup>
2.90 <sup>1</sup>	Determination of organic acids <sup>42</sup> by gas chromatography method with FID detection	CZ_SOP_D06_03_202 (Determination of Volatile Fatty Acids in sewage sludge 1979 HMSO.ISBN 0-11-75462-4)	Digestates
2.91 <sup>1</sup>	Determination of polycyclic aromatic hydrocarbons <sup>44</sup> by gas chromatography with MS/MS detection, calculation of sums of polycyclic aromatic hydrocarbons from measured values and conversion of results to air volume	CZ_SOP_D06_03_203 (ISO 11338-2, ČSN EN 15549)	Emission <sup>48</sup> , imission <sup>79</sup>
3	<b>Food Organic Chemistry</b>		
3.1 <sup>1</sup>	Determination of fatty acids <sup>18</sup> by gas chromatography method with FID detection and calculation sum of SAFA, MUFA, PUFA, TFA, Omega 3, Omega 6 <sup>79</sup>	CZ_SOP_D06_04_202 (ČSN EN ISO 12966-1, ČSN EN ISO 12966-2)	Food, feed <sup>43</sup> , dietary supplements
3.2 <sup>1</sup>	Determination of cholesterol by gas chromatography method with FID detection	CZ_SOP_D06_04_205 (Prof. ing. Jiri Davidek, MD, et al, Laboratory Manual of Food Analysis, Journal of Chromatography A.; 24 (1994): 672 (1-2): 267-272)	Fatty food, non-fatty food, dietary supplements
3.3 <sup>1</sup>	Determination of retinol and alpha tocopherol by liquid chromatography method with FLD detection	CZ_SOP_D06_04_206 (ČSN EN 12823-1, ČSN EN 12822)	Fats, fatty food, non-fatty food, dietary supplements, feed <sup>43</sup> and premixes
3.4 <sup>1</sup>	Determination of vitamin C (ascorbic acid) by liquid chromatography method with PDA detection	CZ_SOP_D06_04_207 (ČSN EN 14130:2004)	Beverages, candy, non-fatty food, dietary supplements, fruit, vegetables
3.5 <sup>1</sup>	Determination of Soya protein by ELISA by commercial set	CZ_SOP_D06_04_208 (R-Biopharm Manual – Ridascree FAST Soya)	Food, swap
3.6 <sup>1</sup>	Determination of substitute sweeteners <sup>29</sup> by liquid chromatography method with PDA detection	CZ_SOP_D06_04_209 (ČSN EN 12856)	Beverages, milk products, jams, dietary supplements, fishes
3.7 <sup>1</sup>	Determination of caffeine, theobromine, and theophylline by liquid chromatography method with PDA detection	CZ_SOP_D06_04_210 (ČSN EN 12856)	Beverages, tea, coffee, cocoa, chocolate

Entity accredited according to ČSN EN ISO/IEC 17025:2018:

ALS Czech Republic, s.r.o.  
Na Harře 336/9, 190 00 Praha 9 - Vysočany

Ordinal number <sup>1</sup>	Test procedure/method name	Test procedure/method identification <sup>2</sup>	Subject of the test
3.8 <sup>1</sup>	Determination of preserving agents <sup>34</sup> in food by liquid chromatography method with PDA detection	CZ_SOP_D06_04_211 (ČSN EN 12856)	Beverages, jams, vegetable and fruit sauces and pastes, mustard, fatty and milk products, dietary supplements
3.9 <sup>1</sup>	Determination of aflatoxin B <sub>1</sub> , B <sub>2</sub> , G <sub>1</sub> and G <sub>2</sub> by liquid chromatography method with FLD detection	CZ_SOP_D06_04_212 (ČSN EN 14123)	Food with low water content, beverages, feed <sup>43</sup>
3.10 <sup>1</sup>	Determination of the content of ochratoxin A by liquid chromatography method with FLD detection	CZ_SOP_D06_04_213 (ČSN EN 15829, ČSN EN 14133, ČSN EN 14132)	Food with low water content, beverages, dietary supplements, feed <sup>43</sup>
3.11 <sup>1</sup>	Determination of zearalenone by liquid chromatography method with FLD detection	CZ_SOP_D06_04_214 (ČSN EN 15850)	Cereals, feed <sup>43</sup>
3.12 <sup>1</sup>	Determination of aflatoxin M <sub>1</sub> by liquid chromatography method with FLD detection	CZ_SOP_D06_04_215 (ČSN EN ISO 14501)	Milk, dried milk, and products from them
3.13 <sup>1</sup>	Determination of patulin by liquid chromatography method with PDA detection	CZ_SOP_D06_04_216 (ČSN EN 14177)	Food with high water content, dietary supplements, beverages
3.14 <sup>1</sup>	Determination of deoxynivalenol by liquid chromatography method with PDA detection	CZ_SOP_D06_04_217 (ČSN EN 15791, ČSN EN 15891)	Food with low water content, beverages, dietary supplements, feed <sup>43</sup>
3.15 <sup>1</sup>	Determination of vitamins B <sub>1</sub> , B <sub>2</sub> and B <sub>6</sub> by liquid chromatography method with FLD detection	CZ_SOP_D06_04_218 (ČSN EN 14122, ČSN EN 14152, ČSN EN 14663)	Fats, fatty food, non-fatty food, feed <sup>43</sup> , dietary supplements
3.16 <sup>1</sup>	Determination of folic acid by ELISA method by commercial set	CZ_SOP_D06_04_219 (R-Biopharm – Ridascree Folic Acid Manual)	Food, feed <sup>43</sup> , dietary supplements
3.17 <sup>1</sup>	Determination of biotin by ELISA method by commercial set	CZ_SOP_D06_04_220 (Demeditec Manual)	Milk, milk products, cereals and cereal products, non-alcoholic beverages, baby food, feed <sup>43</sup> , dietary supplements
3.18 <sup>1</sup>	Determination of gliadin (gluten) by sandwich enzyme immunoassay ELISA Method by commercial set	CZ_SOP_D06_04_221.A (R-Biopharm – Ridascree Gliadin Manual)	Fatty food, non-fatty food, dietary supplements, swabs
3.19 <sup>1</sup>	Determination of gliadin (gluten) by competitive immunoassay ELISA Method by commercial set	CZ_SOP_D06_04_221.B (R-Biopharm – Ridascree Gliadin Manual)	Fermented and hydrolyzed foods and beverages <sup>49</sup>
3.20 <sup>1</sup>	Determination of casein allergen by ELISA method by commercial set	CZ_SOP_D06_04_222 (Bio-Check – Casein Check Manual)	Food, dietary supplements, swabs
3.21 <sup>1</sup>	Determination of β-lactoglobulin allergen by ELISA method with a commercial kit	CZ_SOP_D06_04_223 (Bio-Check – β-lactoglobulin Check Manual)	Food, dietary supplements, swabs
3.22 <sup>1</sup>	Determination of mustard allergen by ELISA method by commercial set	CZ_SOP_D06_04_224 (Bio-Check – Mustard Check Manual)	Food, dietary supplements, swabs

Appendix is an integral part of  
Certificate of Accreditation No: 73/2022 of 14/02/2022

Entity accredited according to ČSN EN ISO/IEC 17025:2018:

ALS Czech Republic, s.r.o.  
Na Harře 336/9, 190 00 Praha 9 - Vysočany

Ordinal number <sup>1</sup>	Test procedure/method name	Test procedure/method identification <sup>2</sup>	Subject of the test
3.23 <sup>1</sup>	Determination of niacin by liquid chromatography method with PDA detection	CZ_SOP_D06_04_225 (ČSN EN 15652)	Fatty food, non-fatty food, feed <sup>83</sup> , dietary supplements
3.24 <sup>1</sup>	Determination of soya protein by ELISA method by commercial set	CZ_SOP_D06_04_226 (Biokits Neogen–Soya assay Biokits Manual)	Meat products
3.25 <sup>1</sup>	Determination of parabens contain by liquid chromatography method with PDA detection	CZ_SOP_D06_04_227 (HPLC for Food Analysis, Agilent Technologies 1996-2001)	Cosmetics
3.26 <sup>1</sup>	Determination of peanut protein allergen by ELISA method by commercial set	CZ_SOP_D06_04_228 (Bio-Check–Peanut Check Manual)	Fatty food, non-fatty food, feed <sup>83</sup> , dietary supplements
3.27 <sup>1</sup>	Determination of fat-soluble vitamins (D2 and D3) by two-dimensional liquid chromatography method with PDA detection	CZ_SOP_D06_04_229 (AN-1069 Thermo – Application list)	Fats, fatty food, non-fatty food, dietary supplements, feed <sup>83</sup> , premixes
3.28 <sup>1</sup>	Determination of Vitamin B12 by ELISA method by commercial set	CZ_SOP_D06_04_230 (R-Biopharm–Ridascreen Fast Vitamin B12 Manual)	Food, feed <sup>83</sup> , dietary supplements
3.29 <sup>1</sup>	Determination of fat-soluble vitamins (vitamins A, E) by liquid chromatography method with FLD detection	CZ_SOP_D06_04_231 (ČSN EN 128 23-1, ČSN EN 128 22)	Cosmetic masks
3.30 <sup>1</sup>	Determination of water-soluble vitamins (vitamin C) by liquid chromatography method with PDA detection	CZ_SOP_D06_04_232 (ČSN EN 14130:2004)	Cosmetic masks
3.31 <sup>1</sup>	Determination of almond allergen by ELISA method by commercial set	CZ_SOP_D06_04_233 (Bio-Check–Almonde Check Manual)	Food, dietary supplements, swabs
3.32 <sup>1</sup>	Determination of hazelnut allergen by ELISA method by commercial set	CZ_SOP_D06_04_234 (Bio-Check–Hazelnut Check Manual)	Food, dietary supplements, swabs
3.33 <sup>1</sup>	Determination of egg allergen (egg white proteins) by ELISA method by commercial set	CZ_SOP_D06_04_235 (Bio-Check–Egg Check Manual)	Food, dietary supplements, swabs
3.34 <sup>1</sup>	Determination of milk allergen (casein and $\beta$ -lactoglobulin proteins) by ELISA method by commercial set	CZ_SOP_D06_04_236 (Bio-Check–Milk Check Manual)	Food, dietary supplements, swabs
3.35 <sup>1</sup>	Determination of sesame allergen by ELISA method by commercial set	CZ_SOP_D06_04_237 (Bio-Check–Sesame Check Manual)	Food, dietary supplements, swabs
3.36 <sup>1</sup>	Determination of pantothenic acid by liquid chromatography with PDA detection	CZ_SOP_D06_04_238	Dietary supplements
4	<b>Water Microbiology</b>		
4.1 <sup>1</sup>	Enumeration of mesophilic bacteria by cultivation	ČSN 75 7841	Surface, ground, waste, pool water
4.2 <sup>1</sup>	Enumeration of psychrophilic bacteria by cultivation	ČSN 75 7842	Surface, ground, waste, pool water
4.3 <sup>1</sup>	Enumeration of intestinal enterococci by membrane filtration	ČSN EN ISO 7899-2 STN EN ISO 7899-2	Drinking, bottled, pool, raw, treated <sup>90</sup> , ground, surface, waste water
4.4 <sup>1</sup>	Enumeration of culturable microorganisms a) at 22 °C b) at 36 °C by cultivation	ČSN EN ISO 6222 STN EN ISO 6222	Drinking, bottled, natural, mineral, pool, raw, treated <sup>90</sup> , ground water

Page 25 of 45

Appendix is an integral part of  
Certificate of Accreditation No: 73/2022 of 14/02/2022

Entity accredited according to ČSN EN ISO/IEC 17025:2018:

ALS Czech Republic, s.r.o.  
Na Harře 336/9, 190 00 Praha 9 - Vysočany

Ordinal number <sup>1</sup>	Test procedure/method name	Test procedure/method identification <sup>2</sup>	Subject of the test
4.5 <sup>1</sup>	Enumeration of thermotolerant coliform bacteria and <i>Escherichia coli</i> by membrane filtration	ČSN 75 7835	Drinking, surface, ground, pool, waste water
4.6 <sup>1</sup>	Enumeration of <i>Escherichia coli</i> and coliform bacteria by membrane filtration	ČSN EN ISO 9308-1 STN EN ISO 9308-1	Drinking, pool, bottled, raw, treated <sup>90</sup> , ground water
4.7 <sup>1</sup>	Enumeration of <i>Pseudomonas aeruginosa</i> by membrane filtration	ČSN EN ISO 16266 STN EN ISO 16266	Drinking, bottled, natural mineral, pool, surface, waste water
4.8 <sup>1</sup>	Enumeration of coagulase-positive staphylococci ( <i>Staphylococcus Aureus</i> and other species) by membrane filtration	ČSN EN ISO 6888-1 ČSN EN ISO 8199	Pool, surface, waste, drinking, ground water
4.9 <sup>1</sup>	Enumeration of <i>Candida</i> yeasts by membrane filtration	CZ_SOP_D06_04_258 (Hausler, J., Microbiological Culture Methods of Quality Inspection, Volume III, 1995)	Pool, surface, waste water
4.10 <sup>1</sup>	Enumeration of <i>Clostridium perfringens</i> by membrane filtration	ČSN SOP_D06_04_259 (GR 252/2004 Coll., Annex 6, GR No. 354/2006 Coll., Annex.3)	Drinking, bottled, pool, natural mineral, raw, treated <sup>90</sup> , ground water
4.11 <sup>1</sup>	Detection of <i>Salmonella</i> by membrane filtration	ČSN ISO 19250	Drinking, surface, ground, pool, waste water
4.12 <sup>1</sup>	Determination of bioseston by microscopy	ČSN 75 7712 STN 757711	Drinking, bottled, raw, treated <sup>90</sup> , ground water
4.13 <sup>1</sup>	Determination of abioseston by microscopy	ČSN 75 7713 STN 757712	Drinking, bottled, raw, treated <sup>90</sup> , ground water
4.14 <sup>1</sup>	Detection and enumeration of <i>Legionella</i> by cultivation and membrane filtration	ČSN EN ISO 11731	Water <sup>81</sup> , treated water <sup>90</sup>
4.15 <sup>1</sup>	Detection and enumeration of <i>Legionella</i> by cultivation	ČSN EN ISO 11731	Sediments, alluvium, growths
4.16 <sup>1</sup>	Detection and enumeration of <i>Legionella</i> by cultivation	ČSN EN ISO 11731	Swabs
4.17 <sup>1</sup>	Enumeration of Coliform bacteria by membrane filtration	ČSN 75 7837	Non-disinfected water
4.18 <sup>1</sup>	Enumeration of sulphite the spores of sulfite-reducing anaerobes ( <i>Clostridium</i> ) by membrane filtration	ČSN EN 26461-2	Water <sup>81</sup>
4.19 <sup>1</sup>	Microbiological testing of water for haemodialysis. Enumeration of viable microorganisms	CZ_SOP_D06_04_266 (ČSN EN ISO 23500-3)	Dialysis water
4.20 <sup>1</sup>	Microbiological testing of dialysis fluid for haemodialysis. Enumeration of viable microorganisms	CZ_SOP_D06_04_267 (ČSN EN ISO 23500-5)	Dialysis fluid
4.21 <sup>1</sup>	Determination of the concentration of bacterial endotoxins by the LAL test: turbidimetric kinetic method	CZ_SOP_D06_04_268 (Ph. Eur. chapter 2.6.14)	Dialysis water, dialysis fluid, water purified, water highly purified, water for injection
4.22 <sup>1</sup>	Determination of the total number of microorganisms	CZ_SOP_D06_04_269 (Ph. Eur. chapter 6.3.0008, 6.3.1927, 6.3.0169)	Water purified, water highly purified, water for injection

Page 26 of 45

Appendix is an integral part of  
Certificate of Accreditation No: 73/2022 of 14/02/2022

Entity accredited according to ČSN EN ISO/IEC 17025:2018:

ALS Czech Republic, s.r.o.  
Na Harře 336/9, 190 00 Praha 9 - Vysočany

Ordinal number <sup>1</sup>	Test procedure/method name	Test procedure/method identification <sup>2</sup>	Subject of the test
4.23 <sup>1</sup>	Test for specific micro-organisms – Detection of <i>Pseudomonas Aeruginosa</i> bacteria	CZ_SOP_D06_04_270 (Ph. Eur. chapter 6.3.0008, 6.3.1927, 6.3.0169)	Water purified, water highly purified, water for injection
5	<b>Microbiology</b>		
5.1 <sup>1</sup>	Enumeration of microorganisms by cultivation	ČSN EN ISO 4833-1	Food, feed <sup>83</sup> , dietary supplements
5.2 <sup>1</sup>	Enumeration of coliform bacteria by cultivation	ČSN ISO 4832	Food, feed <sup>83</sup> , dietary supplements
5.3 <sup>1</sup>	Enumeration of enterococci by cultivation	CZ_SOP_D06_04_302 (ČSN 56 0100:1994)	Food, feed <sup>83</sup> , dietary supplements
5.4 <sup>1</sup>	Enumeration of <i>Bacillus cereus</i> by cultivation	ČSN EN ISO 7932	Food, feed <sup>83</sup> , dietary supplements
5.5 <sup>1</sup>	Enumeration of coagulase-positive staphylococci ( <i>Staphylococcus aureus</i> and other species) by cultivation	ČSN EN ISO 6888-1	Food, feed <sup>83</sup> , dietary supplements
5.6 <sup>1</sup>	Enumeration of <i>Clostridium perfringens</i> by cultivation	ČSN EN ISO 7937	Food, feed <sup>83</sup> , dietary supplements
5.7 <sup>1</sup>	Detection of <i>Salmonella</i> by cultivation	ČSN EN ISO 6579-1	Food, feed <sup>83</sup> , dietary supplements
5.8 <sup>1</sup>	Detection of <i>Salmonella</i> by cultivation	CZ_SOP_D06_04_307, except chap. 9.1.2 (ČSN EN ISO 6579, AHM No. 1/2008)	Sludge, bio waste, compost, substrates, soils
5.9 <sup>1</sup>	Detection of <i>Salmonella</i> by cultivation	CZ_SOP_D06_04_307, except chap. 9.1.1 (ČSN EN ISO 6579, AHM No. 1/2008)	Biological materials <sup>77</sup>
5.10 <sup>1</sup>	Determination of inhibiting substances by Delvostest method	CZ_SOP_D06_04_308 (O.K. Servis BioPro Manual)	Milk
5.11 <sup>1</sup>	Detection of <i>Salmonella</i> by ELISA method - commercial set Solus <i>Salmonella</i>	CZ_SOP-D06_04_309 (Solus Manual)	Food, feed <sup>83</sup> , dietary supplements
5.12 <sup>1</sup>	Enumeration of yeasts and moulds by cultivation	ČSN ISO 21527-1,2	Food, feed <sup>83</sup> , dietary supplements
5.13 <sup>1</sup>	Detection of <i>Enterobacteriaceae</i> by cultivation	ČSN ISO 21528-1	Food, feed <sup>83</sup> , dietary supplements
5.14 <sup>1</sup>	Enumeration of spore-forming microorganisms by cultivation	CZ_SOP_D06_04_312 (ČSN 56 0100:1994, Article 87)	Food, feed <sup>83</sup>
5.15 <sup>1</sup>	Detection of <i>Vibrio parahaemolyticus</i> and <i>Vibrio</i> species by cultivation	ČSN EN ISO 21872-1,2	Food, feed <sup>83</sup>
5.16 <sup>1</sup>	Enumeration of mesophilic lactic acid bacteria by cultivation	ČSN ISO 15214	Food, feed <sup>83</sup> , dietary supplements
5.17 <sup>1</sup>	Detection of <i>Shigella spp.</i> by cultivation	ČSN EN ISO 21567	Food, feed <sup>83</sup>
5.18 <sup>1</sup>	Detection of <i>Campylobacter spp.</i> by cultivation	ČSN EN ISO 10272-1	Food, feed <sup>83</sup>
5.19 <sup>1</sup>	Detection of presumptive pathogenic <i>Yersinia enterocolitica</i> by cultivation	ČSN EN ISO 10273	Food, feed <sup>83</sup>
5.20 <sup>1</sup>	Enumeration of Enterobacteriaceae by cultivation	ČSN ISO 21528-2	Food, feed <sup>83</sup> , dietary supplements
5.21 <sup>1</sup>	Enumeration of beta-glucuronidase-positive <i>Escherichia coli</i> by cultivation	ČSN ISO 16649-2	Food, feed <sup>83</sup> , dietary supplements

Page 27 of 45

Appendix is an integral part of  
Certificate of Accreditation No: 73/2022 of 14/02/2022

Entity accredited according to ČSN EN ISO/IEC 17025:2018:

ALS Czech Republic, s.r.o.  
Na Harře 336/9, 190 00 Praha 9 - Vysočany

Ordinal number <sup>1</sup>	Test procedure/method name	Test procedure/method identification <sup>2</sup>	Subject of the test
5.22 <sup>1</sup>	Detection and enumeration of <i>Listeria monocytogenes</i> by cultivation	ČSN EN ISO 11290-1 ČSN EN ISO 11290-2	Food, feed <sup>83</sup> , dietary supplements
5.23 <sup>1</sup>	Enumeration of potentially toxigenic moulds on special media by cultivation	CZ_SOP_D06_04_321 (AHM No. 1/2003)	Food, feed <sup>83</sup>
5.24 <sup>1</sup>	Enumeration of microorganisms in air by aeroscopy and sedimentation method	CZ_SOP_D06_04_322 (ČSN 56 0100:1994, Article 149, 150 AHM No. 1/2002)	Internal air environment
5.25 <sup>1</sup>	Determination of microbial contamination of areas, surface of equipment and packages using swab method	CZ_SOP_D06_04_323 (ČSN 56 0100:1994, Article 145)	Areas, surface, packaging materials, surface of food
5.26 <sup>1</sup>	Enumeration of thermotolerant coliform bacteria and <i>Escherichia coli</i> by cultivation	CZ_SOP_D06_04_324 (AHM No. 1/2008, ČSN ISO 16649-2)	Sludge, bio waste, compost, substrates, soils, sand
5.27 <sup>1</sup>	Enumeration of enterococci by cultivation	CZ_SOP_D06_04_325 (AHM No. 1/2008, ČSN EN ISO 7899-2)	Sludge, bio waste, compost, substrates, soils, sand
5.28 <sup>1</sup>	Detection of <i>Listeria</i> by ELISA method - commercial set Solus <i>Listeria</i>	CZ_SOP_D06_04_326 (Solus Manual)	Food, feed <sup>83</sup> , dietary supplements
5.29 <sup>1</sup>	Determination of the number of coagulase-positive staphylococci ( <i>Staphylococcus aureus</i> and other species) - method of detection	ČSN EN ISO 6888-3	Food, feed <sup>83</sup> , dietary supplements
5.30 <sup>1</sup>	Determination of low numbers of <i>Bacillus cereus</i> - method of detection	ČSN EN ISO 21871	Food, feed <sup>83</sup> , dietary supplements
5.31 <sup>1</sup>	Detection of <i>Cronobacter (Enterobacter) sakazakii</i> by cultivation	ČSN EN ISO 22964	Milk and milk products
5.32 <sup>1</sup>	Detection and enumeration of aerobic mesophilic bacteria by cultivation	ČSN EN ISO 21149	Cosmetics
5.33 <sup>1</sup>	Detection of <i>Pseudomonas aeruginosa</i> by cultivation	ČSN EN ISO 22717 ČSN EN ISO 18415	Cosmetics
5.34 <sup>1</sup>	Detection of <i>Staphylococcus aureus</i> by cultivation	ČSN EN ISO 22718 ČSN EN ISO 18415	Cosmetics
5.35 <sup>1</sup>	Detection of <i>Candida albicans</i> by cultivation	ČSN EN ISO 18416 ČSN EN ISO 18415	Cosmetics
5.36 <sup>1</sup>	Detection of <i>Escherichia coli</i> by cultivation	ČSN EN ISO 21150 ČSN EN ISO 18415	Cosmetics
5.37 <sup>1</sup>	Enumeration of yeast and mould by cultivation	ČSN EN ISO 16212	Cosmetics
5.38 <sup>1</sup>	Evaluation of antimicrobial protection of cosmetic product, test of conservation effectiveness	CZ_SOP_D06_04_336 (ČSN EN ISO 11930, Ph. Eur., chapter 5.1.3)	Cosmetics
5.39 <sup>1</sup>	Horizontal method for the detection and enumeration of presumptive <i>Escherichia coli</i> - Technique of most probable number	ČSN EN 7251 expect article 9.2	Food, feed <sup>83</sup>
5.40 <sup>1</sup>	Microbiological testing of non-sterile products – Determination of the number of microorganisms	CZ_SOP_D06_04_338 (Ph. Eur., chapter 2.6.12)	Pharmaceutical products, intermediates, raw materials, veterinary medicines, biopreparations, dietary supplements
5.41 <sup>1</sup>	Microbiological testing of non-sterile products – Tests for specific micro-organisms	CZ_SOP_D06_04_339 (Ph. Eur., chapter 2.6.13)	Pharmaceutical products, intermediates, raw materials.

Page 28 of 45

Appendix is an integral part of  
Certificate of Accreditation No: 73/2022 of 14/02/2022

Entity accredited according to ČSN EN ISO/IEC 17025:2018:

ALS Czech Republic, s.r.o.  
Na Harře 336/9, 190 00 Praha 9 - Vysočany

Ordinal number <sup>1</sup>	Test procedure/method name	Test procedure/method identification <sup>2</sup>	Subject of the test
			veterinary medicines, biopreparations, dietary supplements
6	<b>Ecotoxicology</b>		
6.1 <sup>2</sup>	Determination of the acute lethal toxicity of substance to a freshwater fish	CZ_SOP_D06_07_350 (ČSN EN ISO 7346-1, ČSN EN ISO 7346-2, STN 83 8303)	Surface, ground and waste water <sup>4</sup> , extracts of waste, solutions and extracts of chemical substances and agents
6.2 <sup>2</sup>	Determination of the inhibition of the mobility of <i>Daphnia magna</i> Straus - Acute toxicity test	CZ_SOP_D06_07_351 (ČSN EN ISO 6341, STN 83 8303)	Surface, ground and waste water <sup>4</sup> , extracts of waste, solutions and extracts of chemical substances and agents
6.3 <sup>2</sup>	Freshwater algal growth inhibition test	CZ_SOP_D06_07_352 (ČSN EN ISO 8692, STN 83 8303)	Surface, ground and waste water <sup>4</sup> , extracts of waste, solutions and extracts of chemical substances and agents
6.4 <sup>2</sup>	Toxicity test on seeds of white mustard ( <i>Sinapis alba</i> )	CZ_SOP_D06_07_353 (Ministry of Environment Bulletin, Volume XVII, Part 4/2007, p. 13-14; Waste Department Guidance for the determination of waste ecotoxicity, Annex 1 "Test on the seeds of white mustard ( <i>Sinapis alba</i> )", STN 83 8303)	Surface, ground and waste water <sup>4</sup> , extracts of waste, solutions and extracts of chemical substances and agents
6.5 <sup>2</sup>	Determination of the inhibitory effect of water samples on the light emission of <i>Vibrio fischeri</i>	CZ_SOP_D06_07_354 (ČSN EN ISO 11348-2)	Surface, ground and waste water <sup>4</sup> , extracts <sup>82</sup> , percolation water, saline, and brackish water
6.6 <sup>2</sup>	<i>Folsomia candida</i> reproduction test – determination of the inhibition.	CZ_SOP_D06_07_355 (ČSN EN ISO 11267)	Waste, soils, sediments
6.7 <sup>2</sup>	<i>Enchytraeus crypticus</i> reproduction test – determination of inhibition	CZ_SOP_D06_07_356 (ČSN EN ISO 16387)	Waste, soils, sediments
6.8 <sup>2</sup>	<i>Lactuca sativa</i> – determination of inhibition of root growth	CZ_SOP_D06_07_357 (ČSN EN ISO 11269-1)	Waste, soils, sediments
6.9 <sup>2</sup>	Determination of nitrification activity and its inhibition	CZ_SOP_D06_07_358 (ČSN ISO 15685)	Waste, soils, sediments
6.10 <sup>2</sup>	Determination of the inhibition of the growth, germination, and germination index (phytotoxicity) of Garden Cress ( <i>Lepidium sativum</i> ) - Acute toxicity test	CZ_SOP_D06_07_359 (F. Zucconi et al.: Biological evaluation of compost maturity. BioCycle, 22(2), 1981, pages 27–29.)	Surface, ground and waste water <sup>4</sup> , extracts of waste and composts, solutions and extracts of chemical substances and agents
6.11 <sup>2</sup>	Determination of the inhibition of the growth of Lesser Duckweed ( <i>Lemna minor</i> ) - Acute toxicity test	CZ_SOP_D06_07_1350 (ČSN EN ISO 20079)	Surface, ground and waste water <sup>4</sup> , extracts of waste and composts, solutions and extracts of chemical substances and agents

Page 29 of 45

Appendix is an integral part of  
Certificate of Accreditation No: 73/2022 of 14/02/2022

Entity accredited according to ČSN EN ISO/IEC 17025:2018:

ALS Czech Republic, s.r.o.  
Na Harře 336/9, 190 00 Praha 9 - Vysočany

Ordinal number <sup>1</sup>	Test procedure/method name	Test procedure/method identification <sup>2</sup>	Subject of the test
7	<b>Radiology</b>		
7.1 <sup>2</sup>	Determination of gross alpha activity by measuring evaporated residue in a mixture with ZnS(Ag) scintillator	ČSN 75 7611, chap. 4	Water <sup>91</sup> , extracts <sup>92</sup>
7.2 <sup>2</sup>	Determination of gross alpha activity by measuring incinerated evaporated residue by means of proportional detector	ČSN 75 7611, chap. 5	Water <sup>91</sup> , extracts <sup>92</sup>
7.3 <sup>2</sup>	Determination of gross beta activity by measuring evaporated residue by means of proportional detector and calculation of gross beta activity corrected for potassium 40 from measured values	CZ_SOP_D06_07_361 (ČSN 75 7612, ČSN EN ISO 9697, SÚJB Recommendation „Measurement and assessment of the content of natural radionuclides in drinking water from public sources and bottled water“, DR-RO-5.1 (Rev. 0.0), Prague 2017)	Water <sup>91</sup> , extracts <sup>92</sup>
7.4 <sup>2</sup>	Determination of radium 226 after concentration by scintillation emanometry	ČSN 75 7622	Water <sup>91</sup> , extracts <sup>92</sup>
7.5 <sup>2</sup>	Determination of radon 222 by scintillation emanometry after its transportation into scintillation chamber using vacuum	CZ_SOP_D06_07_363.A (ČSN 75 7624, chap. 5)	Water <sup>91</sup> , extracts <sup>92</sup>
7.6 <sup>2</sup>	Determination of radon 222 by scintillation gamma-spectrometry with a well type NaI(Tl) crystal	CZ_SOP_D06_07_363.B (ČSN 75 7624, chap. 6)	Water <sup>91</sup> , extracts <sup>92</sup>
7.7 <sup>2</sup>	Determination of radon 222 by liquid scintillation counting method (LSC)	CZ_SOP_D06_7_363.C (ČSN 75 7625)	Water <sup>91</sup>
7.8 <sup>2</sup>	Determination of uranium by spectrophotometry after separation on silica gel and calculation of <sup>238</sup> U from measured values	CZ_SOP_D06_07_364 (ČSN 75 7614)	Water <sup>91</sup> , extracts <sup>92</sup>
7.9 <sup>2</sup>	Determination of tritium volume activity by liquid scintillation counting method (LSC)	CZ_SOP_D06_07_365 (ČSN EN ISO 9698)	Water <sup>91</sup> , extracts <sup>92</sup>
7.10 <sup>2</sup>	Determination of polonium 210 after its concentration by sorption on ZnS(Ag) by the measurement of emitted scintillations	ČSN 75 7626	Water <sup>91</sup> , extracts <sup>92</sup>
7.11 <sup>2</sup>	Determination of polonium 210 after total decomposition and after its concentration by sorption on ZnS(Ag) by the measurement of emitted scintillations	CZ_SOP_D06_07_366 (ČSN 75 7626)	Soils, sludge, sediments, filters
7.12 <sup>2</sup>	Non-destructive determination of radionuclides <sup>93</sup> by high resolution gamma-spectrometry and calculation of the mass activity index I (ACI) from the measured volumetric activities of individual radionuclides	CZ_SOP_D06_07_367 (ČSN EN ISO 10703, SÚJB Recommendation “Measurement and evaluation of natural radionuclides in building materials”, DR-RO-5.2 (Rev. 0.0), Prague 2017)	Solid samples with granularity up to 4 mm, food, water <sup>91</sup> , liquid samples <sup>91</sup>
7.13 <sup>2</sup>	Determination of gross alpha mass activity by direct measurement of the sample by means of alpha radiation analyser	CZ_SOP_D06_07_368 (ČSN 75 7611, ISO 9696)	Solid samples <sup>93</sup> pulverized for grain size below 100 µm, liquid samples <sup>91</sup> with boiling point above 100 °C

Page 30 of 45

Appendix is an integral part of  
Certificate of Accreditation No: 73/2022 of 14/02/2022

Entity accredited according to ČSN EN ISO/IEC 17025:2018:

ALS Czech Republic, s.r.o.  
Na Harře 336/9, 190 00 Praha 9 - Vysočany

Ordinal number <sup>1</sup>	Test procedure/method name	Test procedure/method identification <sup>2</sup>	Subject of the test
7.14 <sup>2</sup>	Determination of gross beta mass activity by direct measurement of the sample by means of beta radiation analyser	CZ_SOP_D06_07_369 (ČSN 75 7612, ČSN EN ISO 9697)	Solid samples <sup>85</sup> pulverized for grain size below 100 µm, liquid samples <sup>91</sup> with boiling point above 100 °C
7.15 <sup>2</sup>	Determination of lead 210 after its sorption on ZnS-colloid by beta radiation analyzer	CZ_SOP_D06_07_370 (ČSN 75 7627)	Water <sup>91</sup> , extracts <sup>92</sup> (with low content of suspended solids or filtrated through 0.45 µm filter)
7.16 <sup>2</sup>	Determination of gross alpha activity by co-precipitation method by measurement of filtrated precipitate by means of proportional detector	CZ_SOP_D06_07_371 (ČSN 75 7610)	Water <sup>91</sup> , extracts <sup>92</sup>
7.17 <sup>2</sup>	Calculation of Indicative Dose (ID) <sup>90</sup> from the measured values of volume activities of individual radionuclides	CZ_SOP_D06_07_372 (SÚJB Recommendation „Measurement and assessment of the content of natural radionuclides in drinking water from public sources and bottled water“, DR-RO-5.1 (Rev. 0.0), Prague 2017, Council Directive 2013/51/EURATOM of 22. 10. 2013.)	Water <sup>91</sup>
7.18 <sup>2</sup>	Determination of strontium 90 by proportional detector after separation	CZ_SOP_D06_07_373 (ASTM D5811-00)	Water <sup>91</sup>
7.19 <sup>2</sup>	Determination of strontium 90 by proportional detector after separation	CZ_SOP_D06_07_373 (ASTM D5811-00, ASTM C1507-20)	Soils, sludge, sediments
7.20 <sup>2</sup>	Determination of strontium 90 by proportional detector after separation	CZ_SOP_D06_07_373 (ASTM D5811-00, ASTM C1507-20)	Biological materials <sup>97</sup> , food, feed <sup>93</sup>
7.21 <sup>2</sup>	Determination of carbon 14 by liquid scintillation method after separation	CZ_SOP_D06_07_374 (ČSN EN ISO 13162, ČSN EN 16640, US EPA 520/5-84-006)	Water <sup>91</sup> , soils, sludge, sediments, bioindicators <sup>99</sup> , food
7.22 <sup>2</sup>	Determination of total volume alpha and beta activities by liquid scintillation counting method (LSC)	CZ_SOP_D06_07_375 (ČSN EN ISO 11704, ASTM D7283-17)	Non salted water
7.23 <sup>2</sup>	Determination of radium 226 and 228 by liquid scintillation measurement method (LSC)	CZ_SOP_D06_07_376 (ČSN EN ISO 22908)	Water <sup>91</sup>
8	<b>Tribology</b>		
8.1 <sup>11</sup>	Determination of kinematic viscosity by viscometer and viscosity index by calculation	CZ_SOP_D06_05_400 (ČSN EN ISO 3104, ČSN ISO 2909, ASTM D7279, ASTM D7042)	Liquid fuels, lubricating oils
8.2 <sup>11</sup>	Determination of flash point - Pensky-Martens closed cup method by flash point analyser	CZ_SOP_D06_05_401 (ČSN EN ISO 2719, ASTM D93)	Diesel, light fuel oils

Page 31 of 45

Appendix is an integral part of  
Certificate of Accreditation No: 73/2022 of 14/02/2022

Entity accredited according to ČSN EN ISO/IEC 17025:2018:

ALS Czech Republic, s.r.o.  
Na Harře 336/9, 190 00 Praha 9 - Vysočany

Ordinal number <sup>1</sup>	Test procedure/method name	Test procedure/method identification <sup>2</sup>	Subject of the test
8.3 <sup>11</sup>	Determination of liquid cleanliness code by particle counter	CZ_SOP_D06_05_402 (User Manual for Lase Net Fines-C use and maintenance, ČSN ISO 4406)	Liquid fuels, lubricating oils
8.4 <sup>11</sup>	Determination of base number by potentiometric titration	CZ_SOP_D06_05_403 (ČSN ISO 3771)	Lubricating oils, additives to lubricants
8.5 <sup>11</sup>	Determination of neutralization number by potentiometric titration	CZ_SOP_D06_05_404 (ČSN ISO 6619)	Lubricating oils, additives to lubricants
8.6 <sup>11</sup>	Determination of water content by coulometric method	CZ_SOP_D06_05_405 (ASTM D6304)	Liquid fuels, lubricating oils
8.7 <sup>11</sup>	Determination of flash point and burning point in open cup according to Cleveland by flash point analyser	CZ_SOP_D06_05_406 (ASTM D92)	Liquid fuels, lubricating oils
8.8 <sup>11</sup>	Determination of Cold Filter Plugging Point (CFPP) by the method of gradual cooling	ČSN EN 116, ASTM D6371)	Diesel, light fuel oils
9	<b>General Food Chemistry</b>		
9.1 <sup>1</sup>	Determination of organic acids <sup>98</sup> content by capillary isotachopheresis method	CZ_SOP_D06_04_450 (Recman - Laboratory technique – Application sheets No. 35, 39, 70)	Food, feed <sup>93</sup>
9.2 <sup>1</sup>	Gravimetric determination of fat	CZ_SOP_D06_04_451 (ČSN ISO 1443, ČSN ISO 1444, ČSN 46 7092-7)	Food, feed <sup>93</sup>
9.3 <sup>1</sup>	Gravimetric determination of dry matter and calculation of moisture from measured value	CZ_SOP_D06_04_452 (Journal of AOAC International vol 88, No1, 2005; Journal of AOAC International vol 86, No6, 2003)	Food, feed <sup>93</sup> , dietary supplements
9.4 <sup>1</sup>	Determination of nitrate and nitrite by capillary isotachopheresis	CZ_SOP_D06_04_453 (ITP: Application sheet No. 33 VILLA LABECO s.r.o.)	Food, feed <sup>93</sup>
9.5 <sup>1</sup>	Determination of phosphates by capillary isotachopheresis	CZ_SOP_D06_04_454 (ITP: Application sheet No. 35 VILLA LABECO s.r.o.)	Food, feed <sup>93</sup>
9.6 <sup>1</sup>	Gravimetric determination of water extract content	ČSN 58 0113, Article 38	Coffee
9.7 <sup>1</sup>	Determination of acid value and acidity by titration	CZ_SOP_D06_04_456 (ČSN EN ISO 660)	Animal and vegetable fats and oils
9.8 <sup>1</sup>	Determination of polyols <sup>92</sup> by ion chromatographic method with EC detection	CZ_SOP_D06_04_457 (ČSN EN 15086, DIONEX Technical Note 20)	Food, feed <sup>93</sup> , dietary supplements
9.9 <sup>1</sup>	Gravimetric determination of ash	CZ_SOP_D06_04_458 (ČSN 56 0116-4)	Food, feed <sup>93</sup>
9.10 <sup>1</sup>	Determination of crude fibre by oxidation hydrolysis method	CZ_SOP_D06_04_459 (ČSN ISO 5498, ČSN EN ISO 6865)	Feed <sup>93</sup>
9.11 <sup>1</sup>	Determination of pH by potentiometry	CZ_SOP_D06_04_460 (ČSN ISO 2917, ČSN ISO 1842)	Food, feed <sup>93</sup>
9.12 <sup>1</sup>	Determination of sand by gravimetry	CZ_SOP_D06_04_461 (ČSN 56 0246-12)	Food, feed <sup>93</sup>

Page 32 of 45

**Appendix is an integral part of  
Certificate of Accreditation No: 73/2022 of 14/02/2022**

**Entity accredited according to ČSN EN ISO/IEC 17025:2018:**

**ALS Czech Republic, s.r.o.**  
Na Harře 336/9, 190 00 Praha 9 - Vysočany

Ordinal number <sup>1</sup>	Test procedure/method name	Test procedure/method identification <sup>2</sup>	Subject of the test
9.13 <sup>1</sup>	Determination of relative density of liquids by pycnometer	CZ_SOP_D06_04_462 (ČSN EN 1131)	Low viscosity liquids
9.14 <sup>1</sup>	Titrimetric determination of acidity	CZ_SOP_D06_04_463 (ČSN ISO 750, ČSN 56 0116, ČSN 57 0530, ČSN EN 12147, ČSN 56 0246-13)	Fruit juices, fruit and vegetable products, mayonnaise, water-soluble food, dairy products, bakery products
9.15 <sup>1</sup>	Determination of moisture content – distillation method	CZ_SOP_D06_04_464 (ČSN ISO 939)	Spices, mixed condiments
9.16 <sup>1</sup>	Determination of dietary fibre enzymatically by commercial set Megazyme	CZ_SOP_D06_04_465 (AOAC Method 985.29)	Food, dietary supplements
9.17 <sup>1</sup>	Determination of starch content by polarimetry	CZ_SOP_D06_04_466 (ČSN 46 7092-21)	Cereals, baking products, cereal feeds <sup>83</sup>
9.18 <sup>1</sup>	Determination of chloride by coulometric titration	CZ_SOP_D06_04_467 (O.K. SERVIS company Chloride Analyser manual)	Food, feed <sup>81</sup> , dietary supplements
9.19 <sup>1</sup>	Determination of reducing sugars and total sugars after iodometric inversion and calculation of non-reducing sugars from measured values	CZ_SOP_D06_04_468 (ČSN 56 0146)	Food, feed <sup>81</sup> , dietary supplements
9.20 <sup>1</sup>	Determination of alkalinity of water-soluble ash by titration	ČSN ISO 1578	Tea
9.21 <sup>1</sup>	Gravimetric determination of total ash	ČSN ISO 1575	Tea
9.22 <sup>1</sup>	Gravimetric determination of water-soluble and water-insoluble ash	ČSN ISO 1576	Tea
9.23 <sup>1</sup>	Gravimetric determination of acid-insoluble ash	ČSN ISO 1577	Tea
9.24 <sup>1</sup>	Gravimetric determination of water extract	ČSN ISO 9768	Tea
9.25 <sup>1</sup>	Gravimetric determination of loss in mass at 103°C	ČSN ISO 1573	Tea
9.26 <sup>1</sup>	Determination of total nitrogen by Dumas method by analyser and protein calculation from measured values	CZ_SOP_D06_04_475 (ČSN EN ISO 14891, ČSN EN ISO 16634-1, ČSN EN ISO 16634-2)	Food, feed <sup>81</sup> , dietary supplements
9.27 <sup>1</sup>	Volumetric determination of volatile oils (essential oils) by distillation with steam	ČSN EN ISO 6571	Spices, spicing agents, herbs
9.28 <sup>1</sup>	Determination of the weight of consumer packaging of food and animal feeding stuff products by gravimetry	CZ_SOP_D06_04_477 (ČSN 560305, ČSN 570146-3, ČSN 580170-3)	Food, feed <sup>81</sup> , dietary supplements
9.29 <sup>1</sup>	Determination of the meat content in meat products and products containing meat by calculation from measured values <sup>83</sup>	CZ_SOP_D06_04_478 (Commission Directive No. 2001/101/EC, Commission Regulation No. 2004/2002/EC, Commission Regulation No. 2429/86/EEC, Decree 330/2009 Coll.)	Meat products
9.30 <sup>1</sup>	Determination of carbohydrates and energy values by calculation from measured values <sup>84</sup>	CZ_SOP_D06_04_479 (Regulation (EU) 1169/2011, Decree 330/2009 Coll.)	Food, raw materials for production of food, dietary supplements

Page 33 of 45

**Appendix is an integral part of  
Certificate of Accreditation No: 73/2022 of 14/02/2022**

**Entity accredited according to ČSN EN ISO/IEC 17025:2018:**

**ALS Czech Republic, s.r.o.**  
Na Harře 336/9, 190 00 Praha 9 - Vysočany

Ordinal number <sup>1</sup>	Test procedure/method name	Test procedure/method identification <sup>2</sup>	Subject of the test
9.31 <sup>1</sup>	Determination of non-protein content substances by calculation <sup>85</sup>	ČSN 46 7092-24	Feed <sup>83</sup>
9.32 <sup>1</sup>	Determination of 4-hydroxyproline by spectrophotometry and calculation of collagen from measured values	CZ_SOP_D06_04_481 (ISO 3496)	Meat products
9.33 <sup>1</sup>	Determination of fat content by NMR method	CZ_SOP_D06_04_482 (Journal of AOAC International vol 88, No. 1, 2005, Journal of AOAC International vol 86, No. 6, 2003)	Selected food <sup>85</sup> and raw materials for production of food, feed <sup>85</sup> , dietary supplements
9.34 <sup>1</sup>	Volumetric determination of peroxide value	CZ_SOP_D06_04_483 (ČSN EN ISO 3960)	Fats and vegetable oils
9.35 <sup>1</sup>	Determination of water activity by capacitive sensor method	ČSN ISO 21807	Food, raw materials for production of food, dietary supplements
9.36 <sup>1</sup>	Determination of net muscle protein by calculation from the content of collagen and protein	CZ_SOP_D06_04_485 (Decree No. 69/2016 Coll.)	Meat, meat products
9.37 <sup>1</sup>	Identification of synthetic dyes <sup>87</sup> by thin-layer chromatography method	CZ_SOP_D06_04_486 (Davidek J., Laboratory Manual of Food Analysis, 1981)	Food
9.38 <sup>1</sup>	Determination of piperine content by spectrophotometry	ČSN ISO 5564	Black pepper and white pepper, whole or ground
9.39 <sup>1</sup>	Determination of starch in meat products by titration	CZ_SOP_D06_04_488 (BS 4401 Part 12:1979 Determination of Starch Content of Meat Products)	Meat products
9.40 <sup>1</sup>	Determination of total sulphur dioxide after distillation by titration	CZ_SOP_D06_04_489 (Prof. Ing. J. Davidek, DrSc. et al.: Laboratory Manual of Food Analysis, SNTL 1981)	Food and raw materials for food production, dietary supplements
9.41 <sup>1</sup>	Determination of total sulphur dioxide after distillation by ITP	CZ_SOP_D06_04_489 (Prof. Ing. J. Davidek, DrSc. et al.: Laboratory Manual of Food Analysis, SNTL 1981, Application sheet No. 33 Villa Labeco)	Food and raw materials for food production, dietary supplements
9.42 <sup>10</sup>	Sensory testing – description test	CZ_SOP_D06_04_490 (ČSN ISO 6658, ČSN EN ISO 8589, ČSN EN ISO 13299, ČSN ISO 13300-1.2)	Food, cosmetics, packaging materials for food, consumer goods
9.43 <sup>10</sup>	Sensory testing – comparison to standard	CZ_SOP_D06_04_491 (ČSN ISO 6658, ČSN EN ISO 8589, ČSN EN ISO 13299, ČSN ISO 13300-1.2)	Food, cosmetics, packaging materials for food, consumer goods
9.44 <sup>10</sup>	Assessment of characteristics of food	CZ_SOP_D06_04_492 (ČSN EN ISO 8589, ČSN EN ISO 13299, ČSN ISO 13300-1.2)	Food
9.45 <sup>1</sup>	Determination of density by density meter	CZ_SOP_D06_04_493 (ČSN 57 0530)	Milk and milk products

Page 34 of 45

**Appendix is an integral part of  
Certificate of Accreditation No: 73/2022 of 14/02/2022**

**Entity accredited according to ČSN EN ISO/IEC 17025:2018:**

**ALS Czech Republic, s.r.o.**  
Na Harře 336/9, 190 00 Praha 9 - Vysočany

Ordinal number <sup>1</sup>	Test procedure/method name	Test procedure/method identification <sup>2</sup>	Subject of the test
9.46 <sup>1</sup>	Determination of sugars <sup>89</sup> by ion chromatography method with EC detection	CZ_SOP_D06_04_494 (ČSN EN 12630)	Food, feed <sup>81</sup> , dietary supplements
9.47 <sup>1</sup>	Determination of ethanol after distillation by gravimetry	CZ_SOP_D06_04_495 (ČSN 56 0186-5, ČSN 56 0210, ČSN 56 0216)	Alcoholic beverages

Annex:  
Flexible scope of accreditation

Ordinal numbers of tests	
1.1 – 1.12; 1.15 – 1.18; 1.41; 1.44; 1.48; 1.51; 1.67 – 1.68; 1.70; 1.84; 1.91; 1.113 – 1.116; 1.128; 1.131 – 1.132; 1.138; 1.140; 1.146; 1.151 – 1.152; 1.157; 1.159; 1.163 – 1.165; 1.178; 1.181	
2.1 – 2.14; 2.16 – 2.34; 2.38 – 2.41; 2.43 – 2.46; 2.51 – 2.55; 2.57 – 2.86; 2.88 – 2.91	
3.1 – 3.22; 3.24 – 3.36	
6.1 – 6.11	
7.3; 7.12; 7.17	
9.1; 9.8; 9.37; 9.46	

The Laboratory is allowed to modify the test methods listed in the Annex within the specified scope of accreditation provided the measuring principle is observed. The flexible approach to the scope of accreditation cannot be applied to the tests not included in the Annex.

**Sampling:**

Ordinal number <sup>1</sup>	Sampling procedure name	Sampling procedure identification <sup>2</sup>	Subject of sampling
1 <sup>1,2,3,4,5,6,7,8,9</sup>	Sampling of grab sample of surface water manually	CZ_SOP_D06_01_V01 (ČSN EN ISO 5667-1, ČSN EN ISO 5667-3, ČSN ISO 5667-4, ČSN EN ISO 5667-6, ČSN EN ISO 5667-14)	Surface water
2 <sup>1,2,3,4,5,6,7,8,9</sup>	Sampling of grab sample of waste water manually	CZ_SOP_D06_01_V02 (ČSN EN ISO 5667-1, ČSN EN ISO 5667-3, ČSN ISO 5667-10, ČSN EN ISO 5667-14)	Waste water <sup>84</sup>
3 <sup>1,2,3,4,5,6,7,8,9,12</sup>	Sampling of drinking water and hot drinking water manually	CZ_SOP_D06_01_V03 (ČSN EN ISO 5667-1, ČSN EN ISO 5667-3, ČSN ISO 5667-5, ČSN EN ISO 5667-14, ČSN EN ISO 5667-21, ČSN EN ISO 19458, Decree 252/2004 Coll., Decree of SÚJB No. 307/2002 Coll.)	Drinking water, hot water

Page 35 of 45

**Appendix is an integral part of  
Certificate of Accreditation No: 73/2022 of 14/02/2022**

**Entity accredited according to ČSN EN ISO/IEC 17025:2018:**

**ALS Czech Republic, s.r.o.**  
Na Harře 336/9, 190 00 Praha 9 - Vysočany

Ordinal number <sup>1</sup>	Sampling procedure name	Sampling procedure identification <sup>2</sup>	Subject of sampling
4 <sup>1,2,3,4,5,6,7,8,9</sup>	Sampling of mixed sample of waste water manually and using an automatic sampler	CZ_SOP_D06_01_V04 (ČSN EN ISO 5667-1, ČSN EN ISO 5667-3, ČSN ISO 5667-10, ČSN EN ISO 5667-14)	Waste water <sup>84</sup>
5 <sup>1,2,3,4,5,7,8,9</sup>	Sampling of treated water manually	CZ_SOP_D06_01_V05 (ČSN EN ISO 5667-1, ČSN EN ISO 5667-3, ČSN ISO 5667-5, ČSN ISO 5667-14)	Treated water <sup>90</sup>
6 <sup>1,2,3,4,5,6,7,8,9</sup>	Sampling of water from artificial bathing site manually	CZ_SOP_D06_01_V06 (ČSN EN ISO 5667-1, ČSN EN ISO 5667-3, ČSN ISO 5667-5, ČSN EN ISO 5667-6, ČSN EN ISO 5667-14, ČSN EN ISO 19458, ČSN EN 15288-2, Decree No. 238/2011 Coll.)	Pool water and filling water of artificial bathing sites
7 <sup>1,2,3,4,5,6,7,8,9</sup>	Sampling of grab sample of ground water manually and using pumps	CZ_SOP_D06_01_V07 (ČSN EN ISO 5667-1, ČSN EN ISO 5667-3, ČSN ISO 5667-11, ČSN EN ISO 5667-14)	Ground water from boreholes and wells
8 <sup>1,2,4,5,6,7,8,9</sup>	Sampling of surface swab manually	CZ_SOP_D06_01_V08 (ČSN 56 0100:1994, ČSN EN ISO 18593, Decree No. 289/2007 Coll., ČSN EN ISO 5667-1, ČSN EN ISO 5667-3, ČSN EN ISO 5667-14)	Contaminated surfaces
9 <sup>1,2,4,5,6,7,8,9</sup>	Sampling of sludge from sewage and treatment plants manually	CZ_SOP_D06_01_V09 (ČSN EN ISO 5667-1, ČSN EN ISO 5667-3, ČSN EN ISO 5667-13, ČSN EN ISO 5667-14, ČSN EN ISO 5667-15, ČSN EN ISO 19458)	Sludge from water treatment plants, sludge dumps
10 <sup>1,2,3,4,5,6,7,8,9</sup>	Sampling of bottom sediments manually	CZ_SOP_D06_01_V10 (ČSN EN ISO 5667-1, ČSN EN ISO 5667-3, ČSN ISO 5667-12, ČSN EN ISO 5667-14, ČSN EN ISO 5667-15, ČSN ISO 5667-17)	Bottom sediments from streams and reservoirs
11 <sup>1,2,3,4,5,6,7,8,9</sup>	Sampling of soils manually	CZ_SOP_D06_01_V11 (ČSN EN ISO 5667-1, ČSN EN ISO 5667-3, ČSN EN ISO 5667-13, ČSN EN ISO 5667-14)	Soils

Page 36 of 45

**Appendix is an integral part of**  
**Certificate of Accreditation No: 73/2022 of 14/02/2022**

Entity accredited according to ČSN EN ISO/IEC 17025:2018:

**ALS Czech Republic, s.r.o.**  
Na Harfě 336/9, 190 00 Praha 9 - Vysočany

Ordinal number <sup>1</sup>	Sampling procedure name	Sampling procedure identification <sup>2</sup>	Subject of sampling
		ČSN EN ISO 5667-15, TNI CEN/TR 15310-1, TNI CEN/TR 15310-2, TNI CEN/TR 15310-3, TNI CEN/TR 15310-4, TNI CEN/TR 15310-5, ČSN 015110, ČSN 015111, ČSN EN 14899, ČSN EN ISO 19458	
12) <sup>2,3,4,5,6,7,8,9</sup>	Sampling of waste manually	CZ_SOP_D06_01_V12 (ČSN EN ISO 5667-1, ČSN EN ISO 5667-3, ČSN EN ISO 5667-13, ČSN EN ISO 5667-14, ČSN EN ISO 5667-15, TNI CEN/TR 15310-1, TNI CEN/TR 15310-2, TNI CEN/TR 15310-3, TNI CEN/TR 15310-4, TNI CEN/TR 15310-5, ČSN 015110, ČSN 015111, ČSN 015112, ČSN EN 14899, ČSN EN ISO 19458, ČSN EN ISO 3170, Methodological Guide of ME for Waste Sampling 2008, 101s)	Waste
13) <sup>1,2,4,5,6,7</sup>	Air sampling by personal pump	CZ_SOP_D06_01_V13 (ČSN EN 481, ČSN EN 482, ČSN EN 689+AC, GR No. 361/2007 Coll.)	Working environment <sup>47</sup>
14	Reserved		
15) <sup>1,2,7</sup>	Gas sampling for the determination of ammonia	CZ_SOP_D06_01_V15 (ČSN 834728)	Gases <sup>48</sup>
16) <sup>1</sup>	Stationary air sampling for the determination of the number of asbestos and mineral fibers	CZ_SOP_D06_01_V16 (ISO 14966, chap. 5; VDI 3492, chap. 5 and 6, ČSN EN 16000-7; ČSN EN 482, GR No. 361/2007, Coll. Annex No. 3)	Outdoor and indoor air, working environment <sup>47</sup>
17) <sup>1</sup>	Sampling for the asbestos determination	CZ_SOP_D06_01_V17 (VDI 3866, part 1)	Building materials <sup>42</sup> , materials for building <sup>49</sup>

Appendix is an integral part of  
Certificate of Accreditation No: 73/2022 of 14/02/2022

Entity accredited according to ČSN EN ISO/IEC 17025:2018:

**ALS Czech Republic, s.r.o.**  
Na Harfě 336/9, 190 00 Praha 9 - Vysočany

### Used abbreviations

AHEM	Acta hygienica, epidemiologica et microbiologica
AIMM	Airbus methods
BDE	Brominated diethylethers
BFR	Brominated flame retardants
ACI	Activity Concentration Index
CFA	Continuous Flow Analyser
CFPP	Cold Filter Plugging Point
ČL	Czech Pharmacopoeia
DIN	Deutscher Institut fuer Normung
DM 06/09/94 GU n° 288 10/12/1994	Decree of 06/09/1994 (Decreto Ministeriale 6 settembre 1994), published in Bulletin No. 288
All. I Met. B.	10/12/1994
EC	Electrochemical detection
ECD	Electron Capture Detector
FID	Flame Ionization Detector
FLD	Fluorescence Detector
GR	Government Regulation
HRGC/HRMS	High Resolution Gas Chromatography/High Resolution Mass Spectrometry
I	Mass activity index
ID	Indicative dose
IP	International Petroleum test method
IR	Infrared Region Detector
ISE	Ion Selective Electrode
ISO	International Organization for Standardisation
ITP	Isotachophoresis
LDN	Labor Diagnostika Nord GmbH & Co.KG
LSC	Liquid Scintillation Counting method for the determination of alpha- or beta- radiation emitting radionuclides
MS	Mass Detector
MUFA	Monounsaturated Fatty Acids
NEN	Nederlands Normalisatie-Instituut
NIOSH	National Institute for Occupation Safety and Health
NIOSH <sup>1)</sup>	Methods used for CZ_SOP_D06_03_153 - NIOSH 1400, NIOSH 1450, NIOSH 1457, NIOSH 1500, NIOSH 1501, NIOSH 1003, NIOSH 1005, NIOSH 1007, NIOSH 1022, NIOSH 1602, NIOSH 1609
PBB	Polybrominated biphenyls
PhEur	European Pharmacopoeia
PDA	Photo-Diode-Array detector
PUFA	Polysaturated Fatty Acids
RI	Refractometric Detector
SAFA	Saturated Fatty Acids
SEM/EDS	Scanning Electron Microscope / Energy Dispersive Spectrometer
SFS	The Finish Standard Association

**Appendix is an integral part of**  
**Certificate of Accreditation No: 73/2022 of 14/02/2022**

Entity accredited according to ČSN EN ISO/IEC 17025:2018:

**ALS Czech Republic, s.r.o.**  
Na Harfě 336/9, 190 00 Praha 9 - Vysočany

SM	Standard Methods – Standard US methods for the analysis of drinking and waste water prepared and issued by American Public Health Association, American Water Works Association and Water Environmental Federation, 21 <sup>st</sup> edition
SOP	Standard operating procedure
SPIMFAB	SPI MILJÖSANERINGSFOND AB – method of Swedish Petroleum Institute
SPMD	Semi-Permeable Membrane Device
SS	Svensk Standard – Swedish standard
STN	Slovak Technical Standard
SÚJB	State Office for Nuclear Safety
Suma Ca+Mg	Water hardness
TCD	Thermal Conductivity Detector
TEQ	Toxic Equivalent
TFA	Trans Fatty Acids
TNV	Branch Technical Standard of Water Management
USBSC	Empirical formula for permeability of mixed materials, coefficient of permeability was extracted from <u>geology</u> analysis
US EPA	U.S. Environmental Protection Agency
USP	US Pharmacopoeia
UV	Ultraviolet Detector

**Explanatory notes:**

[illegible]

Appendix is an integral part of  
Certificate of Accreditation No: 73/2022 of 14/02/2022

Entity accredited according to ČSN EN ISO/IEC 17025:2018:

**ALS Czech Republic, s.r.o.**  
Na Harfě 336/9, 190 00 Praha 9 - Vysočany

[illegible]



Entity accredited according to ČSN EN ISO/IEC 17025:2018:

ALS Czech Republic, s.r.o.  
Na Harře 336/9, 190 00 Praha 9 - Vysočany

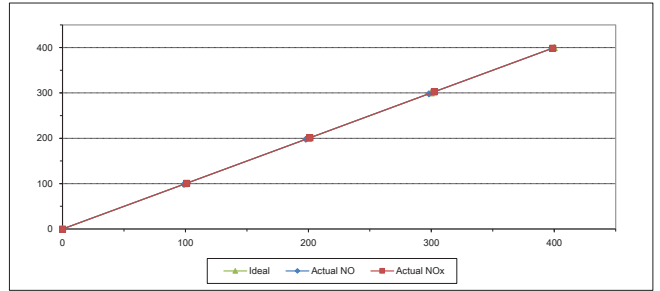
- <sup>78</sup> Bioindicators - freshwater and sea water plankton  
<sup>79</sup> Biological materials - blood, tissues, mother's milk, urine, sweat  
<sup>79</sup> Emissions - filters, liquid and solid sorbents, condensates, fly ash  
<sup>79</sup> Immissions - filters, solid sorbents  
<sup>80</sup> Fermented and hydrolysed food and beverages - e.g., beer, starch and starch products, soy sauces, malt extracts, yeast doughs  
<sup>81</sup> Liquid samples - industrial liquids, technical liquids, technological baths  
<sup>81</sup> Building materials - building materials (demolished material, recycled, disposed building materials)  
<sup>81</sup> Feed - products for animal nutrition, PET Food  
<sup>81</sup> Waste water - water from waste water treatment plants, grease or oil separators, sewage, cooling, technological, rinsing, industrial  
<sup>81</sup> Solid samples - waste (solid, liquid, biowaste), sediments, sludge, technological sludge products, soils, rocks, coal  
<sup>81</sup> Gases - gases from biogas plants, landfill gases  
<sup>81</sup> Working environment - filters, solid sorbents, tubes  
<sup>81</sup> Plant materials - green plants (root, flower, green parts), pollen  
<sup>81</sup> Material for building - new or unused building materials and raw materials for their production  
<sup>81</sup> Treated waters - dialysis water, aqua purificata, process, industrial, boiler and cooling water, irrigation water, water supplied by pipeline or taken from various reservoirs  
<sup>81</sup> Water - drinking, bottled, natural, mineral, pool, hot, bathing, raw, underground, surface, waste, sea water  
<sup>81</sup> Extracts - Aqueous extracts of soils, sediments, and waste according to valid legislation. Extracts are usually prepared according to standards ČSN EN 12457-2, ČSN EN 12457-3, ČSN EN 12457-4, ČSN EN 14405, US EPA 1311, US EPA 1312, DIN 38414 S4, ÖNORM S2072. The extract preparation method is always indicated in the test report.  
<sup>81</sup> Animal materials - insects  
<sup>81</sup> Contaminated surfaces - food industry premises, walls after fires, walls of technological operations  
<sup>81</sup> Selected foods - food, raw materials for food production, dietary supplements, and feed except for samples of listed matrices with a moisture content higher than 95%, unprocessed cereals and condensed milk  
<sup>81</sup> SPMD extracts - SPMD from surface water, ground water and immission



## MULTIPOINT CALIBRATION REPORT

Calibration Date	1-Jul-22	Equipment Name	NOx Analyzer
Manufacturer	Teledyne API	Model	T200
Serial No.	2198	Equipment ID	RYG_FS0252
Calibrator Manufacturer	Teledyne API	Model	700
Serial No.	947		
Std. Gas Concentration (PPM)	55.88	Cylinder No.	GN0027222
Cylinder Pressure (psi)	1800	Certified By	Airgas Inc.
Certified Date	9-Feb-22	Expired Date	9-Feb-30

Point	CALIBRATION RESULTS						
	Ideal	Actual NO	Error NO	%Error NO	Actual NOx	Error NOx	%Error NOx
ZERO	0.00	0.10	0.10	0.10	0.10	0.10	0.10
1	100.00	98.80	-1.20	-1.20	101.00	1.00	1.00
2	200.00	198.00	-2.00	-1.00	201.30	1.30	0.65
3	300.00	298.10	-1.90	-0.63	302.30	2.30	0.77
4	400.00	398.20	-1.80	-0.45	398.80	-1.20	-0.30
AVERAGE (%)				-0.64			0.44



Calibrated By

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

Approved By

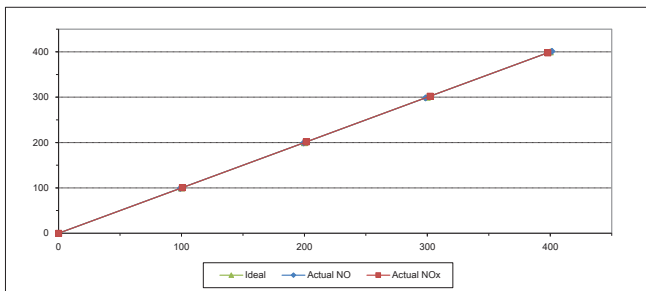
(Mr. Sarayuth Jitranont)  
Assistant General Manager



## MULTIPOINT CALIBRATION REPORT

Calibration Date	1-Jul-22	Equipment Name	NOx Analyzer
Manufacturer	HORIBA	Model	APNA-370
Serial No.	148EH0E0	Equipment ID	BKK_FS1064
Calibrator Manufacturer	Teledyne API	Model	700
Serial No.	947		
Std. Gas Concentration (PPM)	55.88	Cylinder No.	GN0027222
Cylinder Pressure (psi)	1800	Certified By	Airgas Inc.
Certified Date	9-Feb-22	Expired Date	9-Feb-30

Point	CALIBRATION RESULTS						
	Ideal	Actual NO	Error NO	%Error NO	Actual NOx	Error NOx	%Error NOx
ZERO	0.00	0.10	0.10	0.10	0.10	0.10	0.10
1	100.00	99.00	-1.00	-1.00	100.70	0.70	0.70
2	200.00	199.40	-0.60	-0.30	201.50	1.50	0.75
3	300.00	298.60	-1.40	-0.47	302.30	2.30	0.77
4	400.00	401.40	1.40	0.35	398.00	-2.00	-0.50
AVERAGE (%)				-0.26			0.36



Calibrated By

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

Approved By

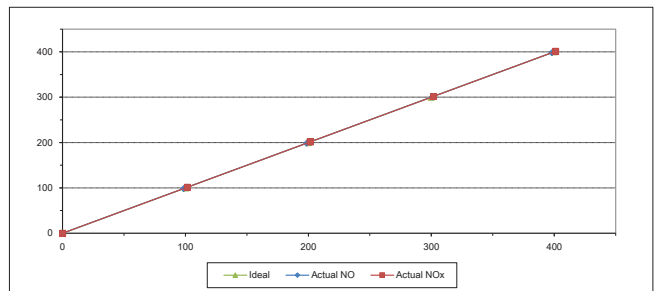
(Mr. Sarayuth Jitranont)  
Assistant General Manager



## MULTIPOINT CALIBRATION REPORT

Calibration Date	1-Jul-22	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

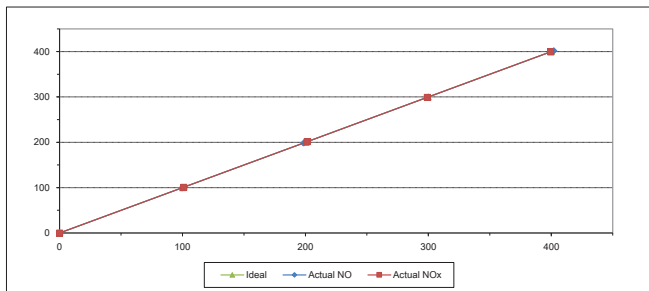
(Mr. Sarayuth Jitranont)  
Assistant General Manager



### MULTIPOINT CALIBRATION REPORT

Calibration Date	1-Jul-22	Equipment Name	NOx Analyzer
Manufacturer	HORIBA	Model	APNA-370
Serial No.	H73KYD1M	Equipment ID	BKK_FS0797
Calibrator Manufacturer	Teledyne API	Model	700
Serial No.	947		
Std. Gas Concentration (PPM)	55.88	Cylinder No.	GN0027222
Cylinder Pressure (psi)	1800	Certified By	Airgas Inc.
Certified Date	9-Feb-22	Expired Date	9-Feb-30

Point	CALIBRATION RESULTS						
	Ideal	Actual NO	Error NO	%Error NO	Actual NOx	Error NOx	%Error NOx
ZERO	0.00	0.10	0.10	0.10	0.10	0.10	0.10
1	100.00	99.70	-0.30	-0.30	101.00	1.00	1.00
2	200.00	198.60	-1.40	-0.70	201.30	1.30	0.65
3	300.00	299.00	-1.00	-0.33	299.20	-0.80	-0.27
4	400.00	402.10	2.10	0.53	399.50	-0.50	-0.13
AVERAGE (%)				-0.14			0.27



Calibrated By

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

Approved By

(Mr. Sarayuth Jitranont)  
Assistant General Manager

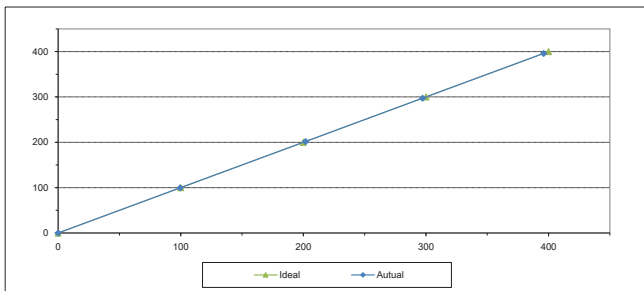
ALS Laboratory Group  
FORM NO.: F 06-056 REVISION NO.: - ISSUE DATE: 02/04/12



### MULTIPOINT CALIBRATION REPORT

Calibration Date	1-Jul-22	Equipment Name	SO2 Analyzer
Manufacturer	Teledyne API	Model	T100
Serial No.	1773	Equipment ID	RYG_FS0251
Calibrator Manufacturer	Teledyne API	Model	700
Serial No.	947		
Std. Gas Concentration (PPM)	56.3	Cylinder No.	GN0027222
Cylinder Pressure (psi)	1800	Certified By	Airgas Inc.
Certified Date	9-Feb-22	Expired Date	9-Feb-30

Point	CALIBRATION RESULTS			
	Ideal	Actual	Error	%Error
ZERO	0.00	0.10	0.10	0.10
1	100.00	99.60	-0.40	-0.40
2	200.00	201.80	1.80	0.90
3	300.00	297.20	-2.80	-0.93
4	400.00	396.00	-4.00	-1.00
AVERAGE (%)				-0.27



Calibrated By

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

Approved By

(Mr. Sarayuth Jitranont)  
Assistant General Manager

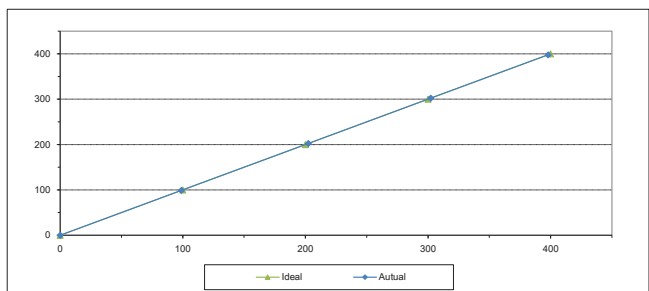
ALS Laboratory Group  
FORM NO.: F 06-056 REVISION NO.: - ISSUE DATE: 02/04/12



### MULTIPOINT CALIBRATION REPORT

Calibration Date	1-Jul-22	Equipment Name	SO2 Analyzer
Manufacturer	HORIBA	Model	APSA-370
Serial No.	NM3M2D5M	Equipment ID	RYG_FS0266
Calibrator Manufacturer	Teledyne API	Model	700
Serial No.	947		
Std. Gas Concentration (PPM)	56.3	Cylinder No.	GN0027222
Cylinder Pressure (psi)	1800	Certified By	Airgas Inc.
Certified Date	9-Feb-22	Expired Date	9-Feb-30

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



Calibrated By

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

Approved By

(Mr. Sarayuth Jitranont)  
Assistant General Manager

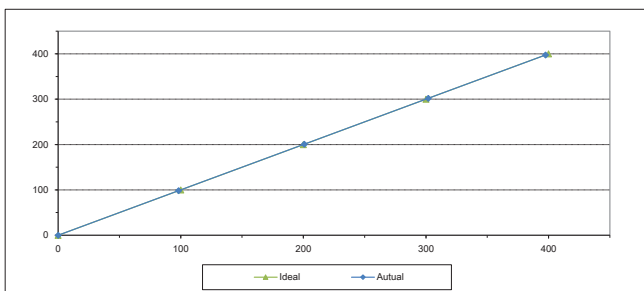
ALS Laboratory Group  
FORM NO.: F 06-056 REVISION NO.: - ISSUE DATE: 02/04/12



### MULTIPOINT CALIBRATION REPORT

Calibration Date	1-Jul-22	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	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

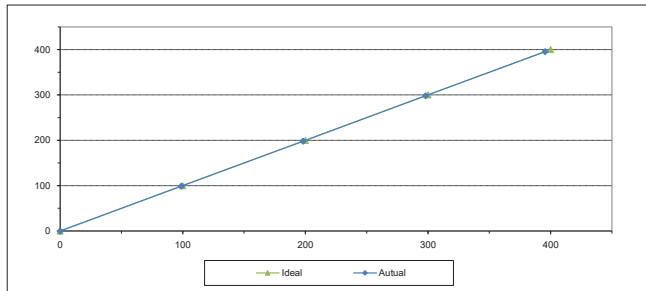
ALS Laboratory Group  
FORM NO.: F 06-056 REVISION NO.: - ISSUE DATE: 02/04/12



### MULTIPOINT CALIBRATION REPORT

Calibration Date	1-Jul-22	Equipment Name	SO2 Analyzer
Manufacturer	HORIBA	Model	APSA-370
Serial No.	G2CH436B	Equipment ID	BKK_FS0796
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	0.05	0.05	0.05
1	100.00	98.91	-1.09	-1.09
2	200.00	198.10	-1.90	-0.95
3	300.00	298.10	-1.90	-0.63
4	400.00	395.60	-4.40	-1.10
AVERAGE (%)				-0.74



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

Approved By  
  
(Mr. Sareyuth Jitranont)  
Assistant General Manager

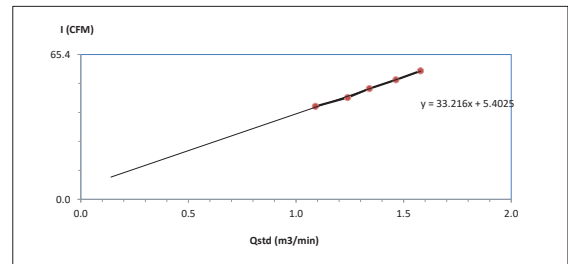
ALS Laboratory Group  
FORM NO.: F 06-056 REVISION NO.: - ISSUE DATE: 02/04/12



### High Volume Air Sampler Calibration Worksheet

Project Site :	UACJ (Thailand) Co., Ltd.	Barometric Pressure (mm Hg) :	755
Calibrate Location :	บ้านกล้วย (Ban Phusai)	Temperature (°C) :	29
Calibrate Date :	1-Aug-22	High Volume ID :	RYG_FS0175
CalibrationSheet No.:	C-010822-RYG_FS0175	High Volume Model :	TE-5170D
Calibrator ID:	RYG_FS0205	High Volume S/N :	4801
Calibrator Model :	TE-5028A	Calibrator Slope :	1.53016
Calibrator S/N :	1166	Calibrator Intercept :	-0.0468

Test No.	Delta H <sub>2</sub> O (inch)	Q <sub>std</sub> (m <sup>3</sup> /min)	I : Chart (CFM)	Linear Regression
1	2.6	1.0901	42	Slope : 33.2160 Intercept : 5.4025 Correlation Coefficient : 0.9983
2	3.4	1.2399	46	
3	4.0	1.3409	50	
4	4.8	1.4644	54	
5	5.6	1.5780	58	



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

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

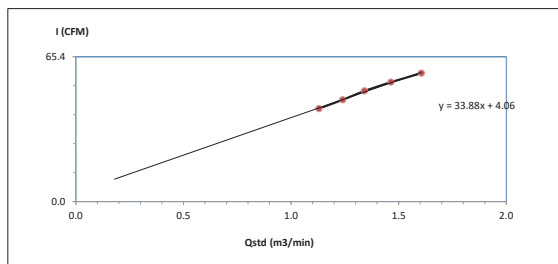
FORM NO.: F 06-073 REVISION NO.: - ISSUE DATE: 14/03/16



### High Volume Air Sampler Calibration Worksheet

Project Site :	UACJ (Thailand) Co., Ltd.	Barometric Pressure (mm Hg) :	755
Calibrate Location :	บ้านกล้วย (Ban Huay Kai Nhow)	Temperature (°C) :	29
Calibrate Date :	1-Aug-22	High Volume ID :	RYG_FS0292
CalibrationSheet No.:	C-010822-RYG_FS0292	High Volume Model :	TE-5170D
Calibrator ID:	RYG_FS0205	High Volume S/N :	5497
Calibrator Model :	TE-5028A	Calibrator Slope :	1.53016
Calibrator S/N :	1166	Calibrator Intercept :	-0.0468

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	1.1295	42	Slope : 33.8803 Intercept : 4.0600 Correlation Coefficient : 0.9979
2	3.4	1.2399	46	
3	4.0	1.3409	50	
4	4.8	1.4644	54	
5	5.8	1.6051	58	



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

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

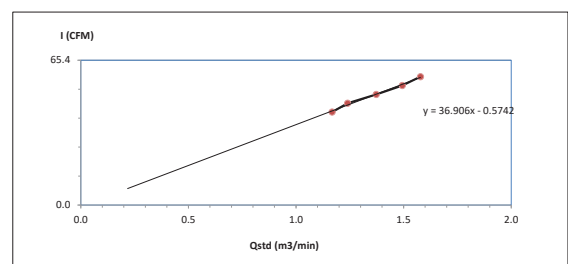
FORM NO.: F 06-073 REVISION NO.: - ISSUE DATE: 14/03/16



### High Volume Air Sampler Calibration Worksheet

Project Site :	UACJ (Thailand) Co., Ltd.	Barometric Pressure (mm Hg) :	755
Calibrate Location :	บ้านวังช้าง (Ban Wang Tan Mhon)	Temperature (°C) :	29
Calibrate Date :	1-Aug-22	High Volume ID :	RYG_FS0393
CalibrationSheet No.:	C-010822-RYG_FS0393	High Volume Model :	TE-5170D
Calibrator ID:	RYG_FS0205	High Volume S/N :	5682
Calibrator Model :	TE-5028A	Calibrator Slope :	1.53016
Calibrator S/N :	1166	Calibrator Intercept :	-0.0468

Test No.	Delta H <sub>2</sub> O (inch)	Q <sub>std</sub> (m <sup>3</sup> /min)	I : Chart (CFM)	Linear Regression
1	3.0	1.1675	42	Slope : 36.9056 Intercept : -0.5742 Correlation Coefficient : 0.9958
2	3.4	1.2399	46	
3	4.2	1.3728	50	
4	5.0	1.4936	54	
5	5.6	1.5780	58	



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

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

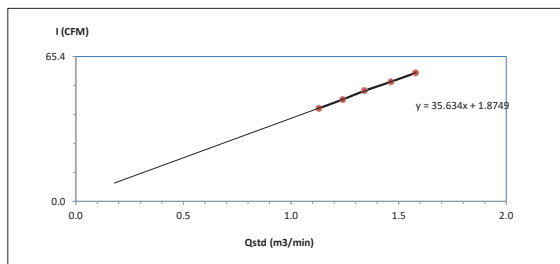
FORM NO.: F 06-073 REVISION NO.: - ISSUE DATE: 14/03/16



## High Volume Air Sampler Calibration Worksheet

Project Site :	UACJ (Thailand) Co., Ltd.	Barometric Pressure (mm Hg) :	755
Calibrate Location :	บ้านบางนา (Ban Bang Na)	Temperature (°C) :	29
Calibrate Date :	1-Aug-22	High Volume ID :	RYG_FS0291
Calibration Sheet No.:	C-010822-RYG_FS0291	High Volume Model :	TE-5170D
Calibrator ID :	RYG_FS0205	High Volume S/N :	5333
Calibrator Model :	TE-5028A	Calibrator Slope :	1.53016
Calibrator S/N :	1166	Calibrator Intercept :	-0.0468

Test No.	Delta H <sub>2</sub> O (inch)	Q <sub>std</sub> (m <sup>3</sup> /min)	I : Chart (CFM)	Linear Regression
1	2.8	1.1295	42	Slope : 35.6343 Intercept : 1.8749 Correlation Coefficient : 0.9995
2	3.4	1.2399	46	
3	4.0	1.3409	50	
4	4.8	1.4644	54	
5	5.6	1.5780	58	



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

Approved by N. Noppong Juntaruphan  
( Mr. Noppong Juntaruphan )  
Enviro Field Coordinator Scientist (3)

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



PENTA CALIBRATION CO., LTD.  
66/124 The Connect 33 Village Kanchanaphisek Road  
Dokmai Prawat Bangkok 10250  
Tel: +66 (0) 2069-9773  
www.pentalcal.com

## Certificate of Calibration

Represent to Certificate of Calibration ,PTC/07/22102

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

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

Environment Condition: Temperature 23.9 °C ± 0.3 °C  
Humidity 58.1 %RH ± 4.4 %RH  
Air density 1.17 kg/m<sup>3</sup>

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

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

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

Date Received: March 23, 2022

Calibration Date: March 23, 2022

Issued Date: March 25, 2022

Calibration By: Mr. Rungroj Metakul

REVIEW BY Thantol  
APPROVED BY P. Juntaruphan  
NEXT CAL. DATE 23/03/23



Reviewed by Mr. Kriangsak Kalasri  
( Mr. Kriangsak Kalasri )  
Reviewed by

Approved By Mr. Keattisak Kerdio  
( Mr. Keattisak Kerdio )  
Laboratory Manager

This certificate is issued the units of measurement according to the International System of Units (SI). It provides traceability of measurement to international or national standard or other 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 the Expression of Uncertainty in Measurement (GUM). The effect that the results relate only to the items calibrated.

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

PTC-FMC-07-02-2 Feb 2020



PENTA CALIBRATION CO., LTD.  
66/124 The Connect 33 Village Kanchanaphisek Road  
Dokmai Prawat Bangkok 10250  
Tel: +66 (0) 2069-9773  
www.pentalcal.com

Represent to Certificate of Calibration ,PTC/07/22102

Certificate No.: PTC/07/22102

Page: 2 of 2

### Measurement Results:

Without Adjustment :

Function Calibration: Non Adjustment

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



Eccentricity test 50 (g)				
Position (g)				
1	2	3	4	5
0.0000	0.0000	-0.0001	0.0000	0.0001
Maximum deviation: 0.0001				

Repeatability Test : Weight to be 1/2 ≤ L<sub>1</sub> ≤ Maximum capacity

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

Nominal test value (g)	Standard Deviation
100	0.00009

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

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

Note: Weight of adjust (g)

The End of Certificate

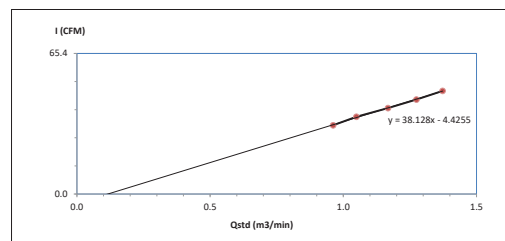
PTC-FMC-07-02-2 Feb 2020



## High Volume Air Sampler Calibration Worksheet

Project Site :	UACJ (Thailand) Co., Ltd.	Barometric Pressure (mm Hg) :	755
Calibrate Location :	บ้านบางนา (Ban Bang Na)	Temperature (°C) :	29
Calibrate Date :	1-Aug-22	High Volume ID :	RYG_FS0183
Calibration Sheet No.:	C-010822-RYG_FS0183	High Volume Model :	TE-5009X
Calibrator ID :	RYG_FS0205	High Volume S/N :	4791
Calibrator Model :	TE-5028A	Calibrator Slope :	1.53016
Calibrator S/N :	1166	Calibrator Intercept :	-0.0468

Test No.	Delta H <sub>2</sub> O (inch)	Q <sub>std</sub> (m <sup>3</sup> /min)	I : Chart (CFM)	Linear Regression
1	2.0	0.9619	32	Slope : 38.1278 Intercept : -4.4255 Correlation Coefficient : 0.9991
2	2.4	1.0492	36	
3	3.0	1.1675	40	
4	3.6	1.2748	44	
5	4.2	1.3728	48	



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

Approved by N. Noppong Juntaruphan  
( Mr. Noppong Juntaruphan )  
Enviro Field Coordinator Scientist (3)

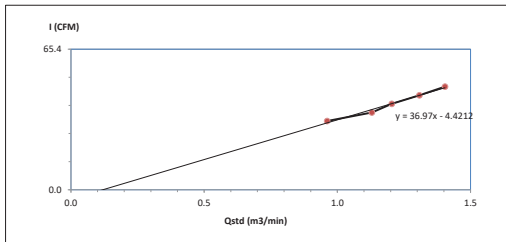
FORM NO.: F 06-074 REVISION NO.: - ISSUE DATE: 14/03/16



### High Volume Air Sampler Calibration Worksheet

Project Site : UACJ (Thailand) Co., Ltd.  
Calibrate Location : บ้านห้วยไคร้ (Ban Huay Kai Nhow)  
Calibrate Date : 1-Aug-22  
CalibrationSheet No.: C-010822-RYG\_FS0400  
Calibrator ID: RYG\_FS0205  
Calibrator Model: TE-5028A  
Calibrator S/N: 1166  
Barometric Pressure (mm Hg) : 755  
Temperature ( °C ) : 29  
High Volume ID : RYG\_FS0400  
High Volume Model : TE-5009X  
High Volume S/N : 5691  
Calibrator Slope : 1.53016  
Calibrator Intercept : -0.0468

Test No.	Delta H <sub>2</sub> O (inch)	Q <sub>std</sub> (m <sup>3</sup> /min)	I : Chart (CFM)	Linear Regression
1	2.0	0.9619	32	Slope : 36.9697 Intercept : -4.4212 Correlation Coefficient : 0.9912
2	2.8	1.1295	36	
3	3.2	1.2043	40	
4	3.8	1.3081	44	
5	4.4	1.4040	48	



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

Approved by : *N. Noppung*  
(Mr. Noppung Juntarupan)  
Enviro Field Coordinator Scientist (3)

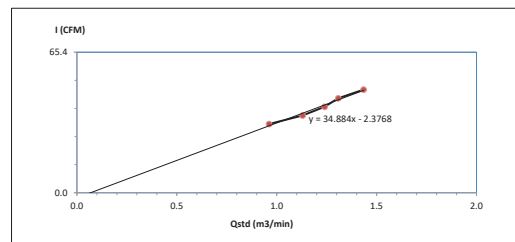
FORM NO.: F 06-074 REVISION NO.: - ISSUE DATE: 14/03/16



### High Volume Air Sampler Calibration Worksheet

Project Site : UACJ (Thailand) Co., Ltd.  
Calibrate Location : บ้านวังแตงโม (Ban Wang Tan Mhon)  
Calibrate Date : 1-Aug-22  
CalibrationSheet No.: C-010822-RYG\_FS0398  
Calibrator ID: RYG\_FS0205  
Calibrator Model: TE-5028A  
Calibrator S/N: 1166  
Barometric Pressure (mm Hg) : 755  
Temperature ( °C ) : 29  
High Volume ID : RYG\_FS0398  
High Volume Model : TE-5009X  
High Volume S/N : 5684  
Calibrator Slope : 1.53016  
Calibrator Intercept : -0.0468

Test No.	Delta H <sub>2</sub> O (inch)	Q <sub>std</sub> (m <sup>3</sup> /min)	I : Chart (CFM)	Linear Regression
1	2.0	0.9619	32	Slope : 34.8843 Intercept : -2.3768 Correlation Coefficient : 0.9901
2	2.8	1.1295	36	
3	3.4	1.2399	40	
4	3.8	1.3081	44	
5	4.6	1.4345	48	



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

Approved by : *N. Noppung*  
(Mr. Noppung Juntarupan)  
Enviro Field Coordinator Scientist (3)

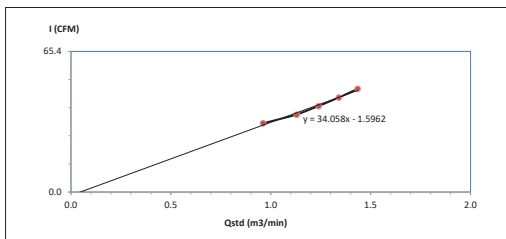
FORM NO.: F 06-074 REVISION NO.: - ISSUE DATE: 14/03/16



### High Volume Air Sampler Calibration Worksheet

Project Site : UACJ (Thailand) Co., Ltd.  
Calibrate Location : บ้านแม่งาย (Ban Map Yang Porn)  
Calibrate Date : 1-Aug-22  
CalibrationSheet No.: C-010822-RYG\_FS0399  
Calibrator ID: RYG\_FS0205  
Calibrator Model: TE-5028A  
Calibrator S/N: 1166  
Barometric Pressure (mm Hg) : 755  
Temperature ( °C ) : 29  
High Volume ID : RYG\_FS0399  
High Volume Model : TE-5009X  
High Volume S/N : 5683  
Calibrator Slope : 1.53016  
Calibrator Intercept : -0.0468

Test No.	Delta H <sub>2</sub> O (inch)	Q <sub>std</sub> (m <sup>3</sup> /min)	I : Chart (CFM)	Linear Regression
1	2.0	0.9619	32	Slope : 34.0580 Intercept : -1.5962 Correlation Coefficient : 0.9924
2	2.8	1.1295	36	
3	3.4	1.2399	40	
4	4.0	1.3409	44	
5	4.6	1.4345	48	



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

Approved by : *N. Noppung*  
(Mr. Noppung Juntarupan)  
Enviro Field Coordinator Scientist (3)

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



63/14-16,67/35-36, Soi Petchkasem 7,7/1, Petchkasem Rd,  
Walthapra, Bangkokkayai, Bangkok 10600 Thailand.  
Tel.: (66) 02-8680812#13 Fax.: (66) 02-8680860 www.jiranatee.com

### CERTIFICATE OF CALIBRATION

Certificate No: WB-01102021  
Page 1 of 2 pages

Measurement Item : Cup anemometer with data logger.  
Manufacturer : Data logger: Novatynx  
Cup anemometer: Novatynx  
Model/Type : Data logger: 200-WS-25DL  
Cup anemometer: WS-02P  
Serial Number : Data logger: A4955  
Cup anemometer: -  
ID No : Data logger: RYG\_FS0055  
Cup anemometer: -

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

Test Conditions : Wind tunnel cross test section area 900 cm<sup>2</sup>  
Anemometer frontal area 100 cm<sup>2</sup>  
Diameter of mounting pipe - mm  
Blockage ratio of test object 0.111 [-]

Test Conditions : Air temperature 24.0 ±0.8 °C  
Air pressure 1008.1 ±0.4 hPa  
Relative air humidity 58.1 ±3.6 %RH

Calibration Procedure : Calibration was carried out base on:  
IEC 61400-12-1 (2011) 2005 Power Performance Measurements of Electricity Producing Wind Turbines  
MIDASNET Anemometer Calibration Procedure - Version 2: 2009.

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

Measurement Date : Oct 08, 2021.  
Issued Date : Oct 11, 2021.

Calibrated by : ☒ Mr. Sornrat Thachad  
☐ Miss Orathai Wivachwattana



Approved Signatory : *N. Noppung*  
Mr. Panyas Boonchiratan  
Technics Support  
and Calibration Manager

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

Continuation of Certificate of Calibration Number

Certificate No: WS-01102021  
Page 2 of 2 Pages

Result of calibration: ☒ Without adjustment ☐ With adjustment.

Calibration in the range of 1 - 16 m/s at a calibration interval of 1 m/s.  
The results of calibration and associated measurement uncertainties are reported in the table below:

V <sub>ref</sub> Reading m/s	V <sub>meas</sub> Reading m/s	Error (m/s)	Uncertainty (%)
2.049	1.9	-0.1	2.7
4.103	4.0	-0.1	1.3
6.01	6.0	0.0	1.1
8.01	8.0	0.0	0.99
9.99	10.0	0.0	1.0
11.99	12.1	0.1	0.64
13.98	14.1	0.1	0.55
16.02	16.2	0.2	0.40
16.03	16.2	0.2	0.78
12.99	13.1	0.1	0.61
11.00	11.0	0.0	1.1
9.00	9.0	0.0	0.75
7.02	7.0	0.0	0.84
5.147	5.0	-0.1	0.98
2.974	2.9	-0.1	1.7
1.013	0.9	-0.1	4.5

UUC: Unit Under Calibration

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

Appendix 1: Instrumentations

NO	Sensor	Manufacturer	Model/Type	Calibration Date	Certificate Report Number	Range
1	Pilot static	TESTO INC	06352148	Aug 07, 2021	MY-0034-21	5 - 30 m/s
2	Precision Differential Pressure Meter	Zuglax	DPW500	Aug 07, 2021	MY-0034-21	5 - 30 m/s
3	Air velocity transducer (hot wire)	TSI INC	8455-12	Aug 08, 2021	MY-0035-21	0 - 5 m/s
4	Temperature	Zuglax	DSH-T14P	March 30, 2021	CL-027-64	-30 - 70°C
5	Relative humidity	Zuglax	DSH-T14P	March 30, 2021	RH-03032021	0 - 100 %RH
6	Atmospheric pressure	Zuglax	DSH-T14P	March 30, 2021	BP-01032021	500 - 1100 mPa
7	Wind sensor	CSSOM	MP3300			0 - 30 m/s

\*\*\*End of certificate of calibration\*\*\*



**CERTIFICATE OF CALIBRATION**

Certificate No: WD-01102021  
Page 1 of 2 pages

Measurement Item : Wind direction sensor with data logger.

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

Model/Type : Data logger: 200-WS-25DL  
Wind direction sensor: WS-02P

Serial Number : Data logger: A4985  
Wind direction sensor: -

ID No : Data logger: PRO\_FS0085  
Wind direction sensor: -

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

Environmental Condition:

The measurement was carried out in an ambient temperature of (23±3) °C and relative humidity of (40±10) %.

Measurement Method:

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

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

Traceability:

The measurement results are traceable to the International system of units (SI) through Certificate No: CG54-07-0045, Certificate No: KWS64/0025.

Measurement Date : Oct 08, 2021.  
Issued Date : Oct 11, 2021.

Performed by  
☒ Mr. Soravit Thachaiad  
☐ Miss Chaital Wivattayalai



Approved Signatory:

Mr. Parinya Booncharoen  
Technical Support  
and Calibration Manager

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

Continuation of Certificate of Calibration Number

Certificate No: WD-01102021  
Page 2 of 2 pages

Result of calibration: ☐ Without adjustment ☒ With adjustment.

Calibration in the range of 0 - 360 ° at a calibration interval of 45°.  
The results of calibration and associated measurement uncertainties are reported in table below:

NO	Turning Direction	Nominal Angle (°)	Standard Reading (°)	UUC* Reading (°)	Error (°)	Uncertainty (°)
1	Clockwise	0/360	360	359	-1	3.0
2		45	45	42	-3	3.0
3		90	90	88	-2	3.0
4		135	135	135	0	3.0
5		180	180	182	2	3.0
6		225	225	228	3	3.0
7		270	270	273	3	3.0
8		315	315	318	3	3.0
9	Counter Clockwise	0/360	360	359	-1	3.0
10		45	45	42	-3	3.0
11		90	90	88	-2	3.0
12		135	135	135	0	3.0
13		180	180	182	2	3.0
14		225	225	228	3	3.0
15		270	270	273	3	3.0
16		315	315	318	3	3.0

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

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



**SITHIPORN ASSOCIATES CO.,LTD.**  
**CALIBRATION LABORATORY**

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



Cert. No. : ACC22013  
Pages : 1 of 3

**Calibration Certificate**

Equipment : SOUND CALIBRATOR  
Manufacturer : RION  
Model : NC-74  
Serial No.: 34178121  
ID No.: RYG\_FS0213

Condition As Found : GOOD

Customer : ALS LABORATORY GROUP (THAILAND) CO., LTD.  
104 PHATTHANAKAN 40, PHATTHANAKAN ROAD,  
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 APRIL 2022  
Calibration Date : 26 APRIL 2022  
Date of Issue : 29 APRIL 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.

Continuation of Calibration Certificate

Cert. No. : ACC22013  
Job No. : VC65AC0054  
Pages : 2 of 3

Calibration Procedure : CP-AC-03

Calibration Method :

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

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

Condition of this result of calibration :

1. Reference Standard Instruments :

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. Petchurai

Continuation of Calibration Certificate

Cert. No. : ACC22013  
Job No. : VC65AC0054  
Pages : 3 of 3

Result of calibration :

1. Sound pressure level

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

2. Frequency

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

3. Total distortion

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

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

End of Calibration Certificate

QF-TS12-04-04-020664

T. Petchurai

SITHIPORN ASSOCIATES CO.,LTD.  
CALIBRATION LABORATORY

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



Cert. No. : ACL21117  
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 : 21 SEPTEMBER 2021  
Calibration Date : 04-06 OCTOBER 2021  
Date of Issue : 11 OCTOBER 2021

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. : ACL21117  
Job No. : VC64AC0070  
Pages : 2 of 8

Calibration Procedure : CP-AC-01

Calibration Method :

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

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

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

Condition of this result of calibration :

1. Reference Standard Instruments :

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

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

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

3.1 National Institute of Metrology (Thailand).

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

QF-TS12-04-04-020664

T. Petchurai

## Continuation of Calibration Certificate

Cert. No. : ACL21117  
Job No. : VC64AC0070  
Pages : 3 of 8

## Summary of Measurement Result :

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

QF-TS12-04-04-020664

## Continuation of Calibration Certificate

Cert. No. : ACL21117  
Job No. : VC64AC0070  
Pages : 4 of 8

## Result of calibration :

## 1. Absolute sensitivity

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

## 2. Self-generated noise

## 2.1 Normal test

Measured Value (dB)
22.9

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

Frequency Weighting	Measured value (dB)
A - weight	13.8
C - weight	19.7
Flat	25.4

## 3. Acoustical signal tests of frequency weightings

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

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)			
	Flat	C-weight	A-weight	Acceptance Limits
125	-0.1	-0.1	-0.1	± 1.5
1000	0.0	-0.1	0.0	± 1.0
8000	0.3	0.4	0.4	±5.0

QF-TS12-04-04-020664

## Continuation of Calibration Certificate

Cert. No. : ACL21117  
Job No. : VC64AC0070  
Pages : 5 of 8

## 4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

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

## 5. Frequency and time weightings at 1 kHz

## 5.1 Frequency weightings at 1 kHz

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

## 5.2 Time weighting at 1 kHz

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

## 6. Long - term stability

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

QF-TS12-04-04-020664

## Continuation of Calibration Certificate

Cert. No. : ACL21117  
Job No. : VC64AC0070  
Pages : 6 of 8

## 7. Level linearity on the reference level range

Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
137.0	137.0	0.0	± 1.1
136.0	136.0	0.0	± 1.1
135.0	135.0	0.0	± 1.1
134.0	134.0	0.0	± 1.1
133.0	133.0	0.0	± 1.1
132.0	132.0	0.0	± 1.1
131.0	131.0	0.0	± 1.1
129.0	129.0	0.0	± 1.1
124.0	124.0	0.0	± 1.1
119.0	119.0	0.0	± 1.1
114.0	114.0	0.0	± 1.1
109.0	109.0	0.0	± 1.1
104.0	104.0	0.0	± 1.1
99.0	99.0	0.0	± 1.1
94.0	94.0	0.0	± 1.1
89.0	89.0	0.0	± 1.1
84.0	84.0	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	29.1	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

## Continuation of Calibration Certificate

Cert. No. : ACL21117  
Job No. : VC64AC0070  
Pages : 7 of 8

## 8. Level linearity including the level range control

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

## 9. Tone burst response

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

## 10. Peak C sound level

Number of cycle in test signal	Anticipated Value (dB)	Measured Value, Lepeak (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.0	0.0	-
One	136.4	136.2	-0.2	±3.0

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

QF-TS12-04-04-020664

T. Petchur

## Continuation of Calibration Certificate

Cert. No. : ACL21117  
Job No. : VC64AC0070  
Pages : 8 of 8

## 11. Overload indication

Measured value (dB)		Deviated Value (dB)	Acceptance Limits (dB)
Positive one-half cycle	Negative one-half cycle		
89.6	89.5	-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. Petchur

SITHIPORN ASSOCIATES CO.,LTD.  
CALIBRATION LABORATORY451-451/1 Srinthorn Rd., Bangbunru, Bangplud Bangkok 10700 THAILAND.  
Tel.0-2433-8800 Fax.0-2433-1679 e-mail:cal-center@sithiphorn.com http://www.sithiphorn.comCert. No. : ACL22054  
Pages : 1 of 8

## Calibration Certificate

Equipment : SOUND LEVEL METER  
Manufacturer : RION  
Model : NL-42/ Microphone UC-52 / Preamplifier NH-24  
Serial No. : 00233184 / 144837 / 23232  
ID No. : RYG\_FS0025

Condition As Found : GOOD

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

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

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

Calibrated by : Nathakorn Pisutpaisan

Approved by :

( Thanakul Petchur )

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

QF-TS12-04-04-020664

## Continuation of Calibration Certificate

Cert. No. : ACL22054  
Job No. : VC65AC0043  
Pages : 2 of 8

Calibration Procedure : CP-AC-01

## Calibration Method :

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

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

## Condition of this result of calibration :

## 1. Reference Standard Instruments :

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

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

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

3.1 National Institute of Metrology (Thailand).

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

QF-TS12-04-04-020664

T. Petchur

Cert. No. : ACL22054  
Job No. : VC65AC0043  
Pages : 3 of 8

## Summary of Measurement Result :

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

QP-TS12-04-04-020664

T. P. A. L.

Cert. No. : ACL22054  
Job No. : VC65AC0043  
Pages : 4 of 8

## Result of calibration :

## 1. Absolute sensitivity

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

## 2. Self-generated noise

## 2.1 Normal test

Measured Value ( dB )
14.2

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

Frequency Weighting	Measured value ( dB )
A - weight	10.8
C - weight	17.0
Flat	22.8

## 3. Acoustical signal tests of frequency weightings

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

Frequency ( Hz )	Deviation from various frequency weighting response curve (dB)			
	Flat	C-weight	A-weight	Acceptance Limits
125	0.2	0.2	0.2	± 1.5
1000	0.0	0.0	0.0	± 1.0
8000	-0.9	-0.8	-0.8	±5.0

QP-TS12-04-04-020664

T. P. A. L.

Cert. No. : ACL22054  
Job No. : VC65AC0043  
Pages : 5 of 8

## 4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

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

QP-TS12-04-04-020664

T. P. A. L.

Cert. No. : ACL22054  
Job No. : VC65AC0043  
Pages : 6 of 8

## 7. Level linearity on the reference level range

Anticipated Value ( dB )	Measured Value ( dB )	Deviated Value ( dB )	Acceptance Limits ( dB )
137.0	137.0	0.0	± 1.1
136.0	136.0	0.0	± 1.1
135.0	135.0	0.0	± 1.1
134.0	134.0	0.0	± 1.1
133.0	133.0	0.0	± 1.1
132.0	131.9	-0.1	± 1.1
131.0	130.9	-0.1	± 1.1
129.0	129.0	0.0	± 1.1
124.0	124.0	0.0	± 1.1
119.0	119.0	0.0	± 1.1
114.0	114.0	0.0	± 1.1
109.0	109.0	0.0	± 1.1
104.0	104.0	0.0	± 1.1
99.0	99.0	0.0	± 1.1
94.0	94.0	0.0	± 1.1
89.0	89.0	0.0	± 1.1
84.0	84.0	0.0	± 1.1
79.0	79.0	0.0	± 1.1
74.0	74.0	0.0	± 1.1
69.0	69.0	0.0	± 1.1
64.0	64.0	0.0	± 1.1
59.0	59.0	0.0	± 1.1
54.0	54.0	0.0	± 1.1
49.0	49.0	0.0	± 1.1
44.0	44.0	0.0	± 1.1
39.0	39.0	0.0	± 1.1
34.0	34.0	0.0	± 1.1
30.0	30.0	0.0	± 1.1
29.0	29.0	0.0	± 1.1
28.0	28.0	0.0	± 1.1
27.0	27.1	0.1	± 1.1
26.0	26.1	0.1	± 1.1
25.0	25.1	0.1	± 1.1

QP-TS12-04-04-020664

T. P. A. L.

Continuation of Calibration Certificate

Cert. No. : ACL22054  
Job No. : VC65AC0043  
Pages : 7 of 8

8. Level linearity including the level range control

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

9. Tone burst response

Time Weighting	Tone burst duration, 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	136.4	0.0	±3.0

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

QF-TS12-04-04-020664

Continuation of Calibration Certificate

Cert. No. : ACL22054  
Job No. : VC65AC0043  
Pages : 8 of 8

11. Overload indication

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

12. High level stability

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

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

End of Calibration Certificate

QF-TS12-04-04-020664

SITHIPORN ASSOCIATES CO.,LTD.  
CALIBRATION LABORATORY

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



Cert. No. : ACL22059  
Pages : 1 of 8

Calibration Certificate

Equipment : SOUND LEVEL METER  
Manufacturer : RION  
Model : NL-42 / Microphone UC-52 / Preamplifier NH-24  
Serial No.: 00734220 / 145272 / 34370  
ID No.: RYG\_FS0026

Condition As Found : GOOD

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

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

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

Calibrated by : Nathakorn Pisutpaisan

Approved by :

( Thanakul Petchurai )

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

QF-TS12-04-04-020664

Continuation of Calibration Certificate

Cert. No. : ACL22059  
Job No. : VC65AC0043  
Pages : 2 of 8

Calibration Procedure : CP-AC-01

Calibration Method :

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

Condition of this result of calibration :

1. Reference Standard Instruments :

Instrument	Model	Serial No.	Cert. No.	Due Date
Waveform Generator	33210A	MY48017076	EF-0012-21	10-Feb-22
Waveform Generator	33511B	MY52302742	EF-0011-21	10-Feb-22
Digital Multimeter	33461A	MY53220104	EEL-BP_05/0264	10-Feb-22
Digital Multimeter	33461A	MY53220076	EEL-BP_03/0264	08-Feb-22
Digital Multimeter	34461A	MY60024273	1-15180725251-1	15-Sep-22
Programmable Attenuator	MAT-1070	62100114	1500-07774E	08-Mar-22
Condenser Microphone	4180	2977900	AA-1008-21	05-Feb-22
Measuring Amplifier	NA-42KA1	34560495	AA-3003-21	16-Feb-22

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

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

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

QF-TS12-04-04-020664

Cert. No. : ACL22059  
Job No. : VC65AC0043  
Pages : 3 of 8

## Summary of Measurement Result :

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

QF-TS12-04-04-020664

T. R. L.

Cert. No. : ACL22059  
Job No. : VC65AC0043  
Pages : 4 of 8

## Result of calibration :

## 1. Absolute sensitivity

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

## 2. Self-generated noise

## 2.1 Normal test

Measured Value (dB)
14.6

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

Frequency Weighting	Measured value (dB)
A - weight	11.6
C - weight	17.8
Flat	23.7

## 3. Acoustical signal tests of frequency weightings

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

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)			
	Flat	C-weight	A-weight	Acceptance Limits
125	0.3	0.3	0.3	± 1.5
1000	0.0	0.0	0.0	± 1.0
8000	-1.6	-1.5	-1.5	±5.0

QF-TS12-04-04-020664

T. R. L.

Cert. No. : ACL22059  
Job No. : VC65AC0043  
Pages : 5 of 8

## 4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

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

## 5. Frequency and time weightings at 1 kHz

## 5.1 Frequency weightings at 1 kHz

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

## 5.2 Time weighting at 1 kHz

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

## 6. Long - term stability

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

QF-TS12-04-04-020664

T. R. L.

Cert. No. : ACL22059  
Job No. : VC65AC0043  
Pages : 6 of 8

## 7. Level linearity on the reference level range

Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
137.0	137.0	0.0	± 1.1
136.0	136.0	0.0	± 1.1
135.0	135.0	0.0	± 1.1
134.0	134.0	0.0	± 1.1
133.0	133.0	0.0	± 1.1
132.0	132.0	0.0	± 1.1
131.0	131.0	0.0	± 1.1
129.0	129.0	0.0	± 1.1
124.0	124.0	0.0	± 1.1
119.0	119.0	0.0	± 1.1
114.0	114.0	0.0	± 1.1
109.0	109.0	0.0	± 1.1
104.0	104.0	0.0	± 1.1
99.0	99.0	0.0	± 1.1
94.0	94.0	0.0	± 1.1
89.0	89.0	0.0	± 1.1
84.0	84.0	0.0	± 1.1
79.0	79.0	0.0	± 1.1
74.0	74.0	0.0	± 1.1
69.0	69.0	0.0	± 1.1
64.0	64.0	0.0	± 1.1
59.0	59.0	0.0	± 1.1
54.0	54.0	0.0	± 1.1
49.0	49.0	0.0	± 1.1
44.0	44.0	0.0	± 1.1
39.0	38.9	-0.1	± 1.1
34.0	33.9	-0.1	± 1.1
30.0	30.0	0.0	± 1.1
29.0	29.0	0.0	± 1.1
28.0	28.0	0.0	± 1.1
27.0	27.0	0.0	± 1.1
26.0	26.1	0.1	± 1.1
25.0	25.0	0.0	± 1.1

QF-TS12-04-04-020664

T. R. L.

Cert. No. : ACL22059  
Job No. : VC65AC0043  
Pages : 7 of 8

8. Level linearity including the level range control

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

9. Tone burst response

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

Cert. No. : ACL22059  
Job No. : VC65AC0043  
Pages : 8 of 8

11. Overload indication

Measured value (dB)		Deviated Value (dB)	Acceptance Limits (dB)
Positive one-half cycle	Negative one-half cycle		
89.6	89.7	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. Petchur

SITHIPORN ASSOCIATES CO.,LTD.  
CALIBRATION LABORATORY

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.com



Cert. No. : ACL22057  
Pages : 1 of 8

Calibration Certificate

Equipment : SOUND LEVEL METER  
Manufacturer : RION  
Model : NL-42/ Microphone U/C-52 / Preamplifier NH-24  
Serial No. : 00296517 / 179120 / 87527  
ID No. : RYG- FS0434

Condition As Found : GOOD

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

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

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

Calibrated by : Nathakorn Pisutpaisan

Approved by :

T. Petchur  
( Thanakul Petchur )

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

QF-TS12-04-04-020664

Cert. No. : ACL22057  
Job No. : VC65AC0043  
Pages : 2 of 8

Calibration Procedure : CP-AC-01

Calibration Method :

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

Condition of this result of calibration :

1. Reference Standard Instruments :

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

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

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

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

QF-TS12-04-04-020664

T. Petchur

## Continuation of Calibration Certificate

Cert. No. : ACL22057  
Job No. : VC65AC0043  
Pages : 3 of 8

## Summary of Measurement Result :

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

QF-TS12-04-04-020664

7. Petch

## Continuation of Calibration Certificate

Cert. No. : ACL22057  
Job No. : VC65AC0043  
Pages : 4 of 8

## Result of calibration :

## 1. Absolute sensitivity

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

## 2. Self-generated noise

## 2.1 Normal test

Measured Value ( dB )
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	11.6
C - weight	17.7
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	0.1	0.1	0.1	± 1.5
1000	0.0	0.0	0.0	± 1.0
8000	0.6	0.7	0.7	± 5.0

QF-TS12-04-04-020664

7. Petch

## Continuation of Calibration Certificate

Cert. No. : ACL22057  
Job No. : VC65AC0043  
Pages : 5 of 8

## 4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

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

## 5. Frequency and time weightings at 1 kHz

## 5.1 Frequency weightings at 1 kHz

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

## 5.2 Time weighting at 1 kHz

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

## 6. Long - term stability

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

QF-TS12-04-04-020664

7. Petch

## Continuation of Calibration Certificate

Cert. No. : ACL22057  
Job No. : VC65AC0043  
Pages : 6 of 8

## 7. Level linearity on the reference level range

Anticipated Value ( dB )	Measured Value ( dB )	Deviated Value ( dB )	Acceptance Limits ( dB )
137.0	137.0	0.0	± 1.1
136.0	136.0	0.0	± 1.1
135.0	135.0	0.0	± 1.1
134.0	134.0	0.0	± 1.1
133.0	133.0	0.0	± 1.1
132.0	132.0	0.0	± 1.1
131.0	131.0	0.0	± 1.1
129.0	129.0	0.0	± 1.1
124.0	124.0	0.0	± 1.1
119.0	119.0	0.0	± 1.1
114.0	114.0	0.0	± 1.1
109.0	109.0	0.0	± 1.1
104.0	104.1	0.1	± 1.1
99.0	99.0	0.0	± 1.1
94.0	94.0	0.0	± 1.1
89.0	89.0	0.0	± 1.1
84.0	84.0	0.0	± 1.1
79.0	79.0	0.0	± 1.1
74.0	74.0	0.0	± 1.1
69.0	69.0	0.0	± 1.1
64.0	64.0	0.0	± 1.1
59.0	59.0	0.0	± 1.1
54.0	54.0	0.0	± 1.1
49.0	49.0	0.0	± 1.1
44.0	44.0	0.0	± 1.1
39.0	39.0	0.0	± 1.1
34.0	34.0	0.0	± 1.1
30.0	30.0	0.0	± 1.1
29.0	29.0	0.0	± 1.1
28.0	28.0	0.0	± 1.1
27.0	27.1	0.1	± 1.1
26.0	26.1	0.1	± 1.1
25.0	25.1	0.1	± 1.1

QF-TS12-04-04-020664

7. Petch

Continuation of Calibration Certificate

Cert. No. : ACL22057  
Job No. : VC65AC0043  
Pages : 7 of 8

8. Level linearity including the level range control

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

9. Tone burst response

Time Weighting	Tone burst duration, Tb (ms)	Cycle	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Fast	0.25	1	108.0	108.0	0.0	1.5 ; -5.0
	2	8	117.0	117.0	0.0	1.0 ; -2.5
	200	800	134.0	134.1	0.1	±1.0
Slow	2	8	108.0	108.0	0.0	1.5 ; -5.0
	200	800	127.6	127.6	0.0	±1.0
	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	136.3	-0.1	±3.0

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

QF-TS12-04-04-020664

T. Petchur

Continuation of Calibration Certificate

Cert. No. : ACL22057  
Job No. : VC65AC0043  
Pages : 8 of 8

11. Overload indication

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

12. High level stability

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

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

End of Calibration Certificate

QF-TS12-04-04-020664

T. Petchur

SITHIPORN ASSOCIATES CO.,LTD.  
CALIBRATION LABORATORY

451-451/11 Sirinthorn Rd.,Bangbunru, Bangplud Bangkok 10700 THAILAND.  
Tel:0-2435-8800 Fax:0-2433-1679 e-mail:cal-center@sithiporn.com http://www.sithiporn.com



Cert. No. : ACL22058  
Pages : 1 of 8

Calibration Certificate

Equipment : SOUND LEVEL METER  
Manufacturer : RION  
Model : NL-42/ Microphone UC-52 / Preamplifier NH-24  
Serial No.: 00296518 / 179118 / 87525  
ID No.: RYG\_FS0431

Condition As Found : GOOD

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

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

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

Calibrated by : Nathakorn Pisutpaisan

Approved by :

T. Petchur  
( Thanakul Petchur )

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

QF-TS12-04-04-020664

Continuation of Calibration Certificate

Cert. No. : ACL22058  
Job No. : VC65AC0043  
Pages : 2 of 8

Calibration Procedure : CP-AC-01

Calibration Method :

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

Condition of this result of calibration :

1. Reference Standard Instruments :

Instrument	Model	Serial No.	Cert. No.	Due Date
Waveform Generator	33210A	MY48017076	EF-0012-21	10-Feb-22
Waveform Generator	33511B	MY52302742	EF-0011-21	10-Feb-22
Digital Multimeter	33461A	MY53220104	EEL_BP_05/0264	10-Feb-22
Digital Multimeter	33461A	MY53220076	EEL_BP_03/0264	08-Feb-22
Digital Multimeter	34461A	MY60024273	1-15180725251-1	15-Sep-22
Programmable Attenuator	MAT-1070	62100114	1500-07774E	08-Mar-22
Condenser Microphone	4180	2977900	AA-1008-21	05-Feb-22
Measuring Amplifier	NA-42KA1	34560495	AA-3003-21	16-Feb-22

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

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

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

QF-TS12-04-04-020664

T. Petchur

Continuation of Calibration Certificate

Cert. No. : ACL22058  
Job No. : VC65AC0043  
Pages : 3 of 8

Summary of Measurement Result :

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

QF-TS12-04-04-020664

7 P.11

Continuation of Calibration Certificate

Cert. No. : ACL22058  
Job No. : VC65AC0043  
Pages : 4 of 8

Result of calibration :

1. Absolute sensitivity

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

2. Self-generated noise

2.1 Normal test

Measured Value (dB)
14.6

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

Frequency Weighting	Measured value (dB)
A - weight	11.6
C - weight	17.6
Flat	23.2

3. Acoustical signal tests of frequency weightings

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

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)			Acceptance Limits
	Flat	C-weight	A-weight	
125	0.1	0.1	0.1	± 1.5
1000	0.0	0.0	0.0	± 1.0
8000	0.8	0.9	0.9	±5.0

QF-TS12-04-04-020664

7 P.11

Continuation of Calibration Certificate

Cert. No. : ACL22058  
Job No. : VC65AC0043  
Pages : 5 of 8

4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

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

5. Frequency and time weightings at 1 kHz

5.1 Frequency weightings at 1 kHz

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

5.2 Time weighting at 1 kHz

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

6. Long - term stability

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

QF-TS12-04-04-020664

7 P.11

Continuation of Calibration Certificate

Cert. No. : ACL22058  
Job No. : VC65AC0043  
Pages : 6 of 8

7. Level linearity on the reference level range

Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
137.0	137.0	0.0	± 1.1
136.0	136.1	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	99.0	0.0	± 1.1
94.0	94.0	0.0	± 1.1
89.0	89.0	0.0	± 1.1
84.0	84.0	0.0	± 1.1
79.0	79.0	0.0	± 1.1
74.0	74.0	0.0	± 1.1
69.0	69.0	0.0	± 1.1
64.0	64.0	0.0	± 1.1
59.0	59.0	0.0	± 1.1
54.0	54.0	0.0	± 1.1
49.0	49.0	0.0	± 1.1
44.0	44.0	0.0	± 1.1
39.0	39.0	0.0	± 1.1
34.0	34.0	0.0	± 1.1
30.0	30.0	0.0	± 1.1
29.0	29.0	0.0	± 1.1
28.0	28.0	0.0	± 1.1
27.0	27.1	0.1	± 1.1
26.0	26.1	0.1	± 1.1
25.0	25.1	0.1	± 1.1

QF-TS12-04-04-020664

7 P.11

Cert. No. : ACL22058  
Job No. : VC65AC0043  
Pages : 7 of 8

8. Level linearity including the level range control

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

9. Tone burst response

Time Weighting	Tone burst duration, Tb (ms)	Cycle	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Fast	0.25	1	108.0	107.9	-0.1	1.5 ; -5.0
	2	8	117.0	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	98.9	-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	135.1	-0.3	±2.0
Negative half cycle	135.4	135.1	-0.3	±2.0

QF-TS12-04-04-020664

Cert. No. : ACL22058  
Job No. : VC65AC0043  
Pages : 8 of 8

11. Overload indication

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

SITHIPORN ASSOCIATES CO.,LTD.  
CALIBRATION LABORATORY

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



Cert. No. : ACC21010  
Pages : 1 of 3

Calibration Certificate

Equipment : SOUND CALIBRATOR  
Manufacturer : RION  
Model : NC-74  
Serial No. : 34178124  
ID No. : RYG\_FS0216

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 : 05 AUGUST 2021  
Calibration Date : 09 AUGUST 2021  
Date of Issue : 11 AUGUST 2021

Calibrated by : Nathakorn Pisutpaisan

Approved by :

( Thanakul Peichurai )

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

QF-TS12-04-04-020664

SITHIPORN ASSOCIATES CO.,LTD.  
CALIBRATION LABORATORY

Cert. No. : ACC21010  
Job No. : VC64AC0058  
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-0011-21	10-Feb-22
Digital Multimeter	33461A	MY53220104	EEL.BP. 05/0264	10-Feb-22
Digital Multimeter	8846A	1997025	EEL.BP. 06/0264	05-Feb-22
Digital Multimeter	33461A	MY53220116	EEL.BP. 04/0264	10-Feb-22
Programmable Attenuator	MAT-1070	62100114	1500-07774E	08-Mar-22
Condenser Microphone	4180	2977900	AA-1008-21	05-Feb-22
Measuring Amplifier	NA-42KAI	34560495	AA-3003-21	16-Feb-22
Audio Analyzer	AVR-3360A	V744B6069	EF-0010-21	10-Feb-22

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

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

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

QF-TS12-04-04-020664

Cert. No. : ACC21010  
Job No. : VC64AC0058  
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	94.16	0.16	0.23	0.40

## 2. Frequency

Specified Frequency (Hz)	Measured value (Hz)	Deviated value (%)	Uncertainty (%)	Tolerance limit (%)
1000	1001.3	0.1	0.1	1.0

## 3. Total distortion

Measured value (%)	Uncertainty (%)	Tolerance limit (%)
1.88	0.10	3.0

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

End of Calibration Certificate

QF-TS12-04-04-020664

451-451/1 Sirdinthorn Rd, Bangbunru, Bangplud Bangkok 10700 THAILAND.  
Tel: 0-2435-8800 Fax: 0-2433-1679 e-mail: cal-center@sithiphorn.com http://www.sithiphorn.comCert. No. : ACL22154  
Pages : 1 of 8

## Calibration Certificate

Equipment : SOUND LEVEL METER  
Manufacturer : RION  
Model : NL-42/ Microphone UC-52 / Preamplifier NH-24  
Serial No. : 00734218 / 146937 / 34368  
ID No. : RYG\_FS0031

Condition As Found : GOOD

Customer : ALS LABORATORY GROUP (THAILAND) CO., LTD.  
104 PHATTHANAKAN 40, PHATTHANAKAN ROAD,  
KHWAENG PHATTHANAKAN, KHET SUAN LUANG,  
BANGKOK, 10250 THAILAND.Location :  
Ambient Temperature : ( 23.0  $\pm$  3 ) °C  
Pressure : ( 101.3  $\pm$  3 ) kPa  
Relative Humidity : ( 50.0  $\pm$  20 ) %Received Date : 17 JUNE 2022  
Calibration Date : 20-22 JUNE 2022  
Date of Issue : 27 JUNE 2022REVIEW BY : *Nathakorn P.*  
APPROVED BY : *T. Petchur*  
NEXT CAL DATE : 20/6/23

Calibrated by : Nathakorn Pisutpaisan

Approved by :

*T. Petchur*  
( Thanakul Petchurai )

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

QF-TS12-04-04-020664

Cert. No. : ACL22154  
Job No. : VC65AC0068  
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

Cert. No. : ACL22154  
Job No. : VC65AC0068  
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. : ACL22154  
Job No. : VC65AC0068  
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 )
20.1

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

Frequency Weighting	Measured value ( dB )
A - weight	11.6
C - weight	17.4
Flat	23.1

## 3. Acoustical signal tests of frequency weightings

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

Frequency ( Hz )	Deviation from various frequency weighting response curve (dB)			
	Flat	C-weight	A-weight	Acceptance Limits
125	0.5	0.5	0.5	± 1.5
1000	0.1	0.1	0.1	± 1.0
8000	-1.5	-1.5	-1.4	±5.0

QF-TS12-04-04-020664

T. B. B. B.

## Continuation of Calibration Certificate

Cert. No. : ACL22154  
Job No. : VC65AC0068  
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	-0.1	±1.5
500	0.0	0.0	-0.1	±1.5
1000	0.0	0.0	0.0	±1.0
2000	0.0	0.0	0.0	±2.0
4000	0.0	0.0	0.0	±3.0
8000	0.0	0.1	0.1	±5.0

## 5. Frequency and time weightings at 1 kHz

## 5.1 Frequency weightings at 1 kHz

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

## 5.2 Time weighting at 1 kHz

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

## 6. Long - term stability

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

QF-TS12-04-04-020664

T. B. B. B.

## Continuation of Calibration Certificate

Cert. No. : ACL22154  
Job No. : VC65AC0068  
Pages : 6 of 8

## 7. Level linearity on the reference level range

Anticipated Value ( dB )	Measured Value ( dB )	Deviated Value ( dB )	Acceptance Limits ( dB )
137.0	137.0	0.0	± 1.1
136.0	136.0	0.0	± 1.1
135.0	135.0	0.0	± 1.1
134.0	134.0	0.0	± 1.1
133.0	132.9	-0.1	± 1.1
132.0	131.9	-0.1	± 1.1
131.0	130.9	-0.1	± 1.1
129.0	128.9	-0.1	± 1.1
124.0	123.9	-0.1	± 1.1
119.0	119.0	0.0	± 1.1
114.0	114.0	0.0	± 1.1
109.0	109.0	0.0	± 1.1
104.0	104.0	0.0	± 1.1
99.0	99.0	0.0	± 1.1
94.0	94.0	0.0	± 1.1
89.0	89.0	0.0	± 1.1
84.0	84.0	0.0	± 1.1
79.0	79.0	0.0	± 1.1
74.0	74.0	0.0	± 1.1
69.0	69.0	0.0	± 1.1
64.0	64.0	0.0	± 1.1
59.0	59.0	0.0	± 1.1
54.0	54.0	0.0	± 1.1
49.0	49.0	0.0	± 1.1
44.0	44.0	0.0	± 1.1
39.0	39.0	0.0	± 1.1
34.0	34.0	0.0	± 1.1
30.0	29.9	-0.1	± 1.1
29.0	29.0	0.0	± 1.1
28.0	28.0	0.0	± 1.1
27.0	27.0	0.0	± 1.1
26.0	25.9	-0.1	± 1.1
25.0	24.9	-0.1	± 1.1

QF-TS12-04-04-020664

T. B. B. B.

## Continuation of Calibration Certificate

Cert. No. : ACL22154  
Job No. : VC65AC0068  
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>cpk</sub> ( dB )	Deviated Value ( dB )	Acceptance Limits ( dB )
Continuous	133.0	133.0	0.0	-
One	136.4	135.7	-0.7	±3.0

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

QF-TS12-04-04-020664

T. B. B. B.

Cert. No. : ACL22154  
Job No. : VC65AC0068  
Pages : 8 of 8

## 11. Overload indication

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

## 12. High level stability

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

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

End of Calibration Certificate

QF-TS12-04-04-020664

T. Petchur

451-451/1 Sirinthorn Rd., Bangbunru, Bangplud Bangkok 10700 THAILAND.  
Tel:0-2435-8800 Fax:0-2433-1679 e-mail:cal-center@sithiphorn.com http://www.sithiphorn.comCert. No. : ACL22159  
Pages : 1 of 8

## Calibration Certificate

Equipment : SOUND LEVEL METER  
Manufacturer : RION  
Model : NL-42/ Microphone UC-52 / Preamplifier NH-24  
Serial No.: 00472130 / 157774 / 72464  
ID No.: RYG\_FS0303

Condition As Found : GOOD

Customer : ALS LABORATORY GROUP (THAILAND) CO., LTD.  
104 PHATTHANAKAN 40, PHATTHANAKAN ROAD,  
KHWAENG PHATTHANAKAN, KHET SUAN LUANG,  
BANGKOK, 10250 THAILAND.Location : -  
Ambient Temperature : ( 23.0 ± 3 ) °C  
Pressure : ( 101.3 ± 3 ) kPa  
Relative Humidity : ( 50.0 ± 20 ) %Received Date : 06 JULY 2022  
Calibration Date : 11-18 JULY 2022  
Date of Issue : 19 JULY 2022

Calibrated by : Nathakorn Pisutpaisan

Approved by :

T. Petchur  
( Thanakul 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

Cert. No. : ACL22159  
Job No. : VC65AC0069  
Pages : 2 of 8

Calibration Procedure : CP-AC-01

## Calibration Method :

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

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

## Condition of this result of calibration :

## 1. Reference Standard Instruments :

Instrument	Model	Serial No.	Cert. No.	Due Date
Waveform Generator	33210A	MY48017076	EF-0007-22	04-Feb-23
Waveform Generator	33511B	MY52302742	EF-0008-22	04-Feb-23
Digital Multimeter	33461A	MY53220104	EEL_BP_04/0265	09-Feb-23
Digital Multimeter	33461A	MY53220076	EEL_BP_03/0265	09-Feb-23
Digital Multimeter	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

T. Petchur

Cert. No. : ACL22159  
Job No. : VC65AC0069  
Pages : 3 of 8

## Summary of Measurement Result :

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

QF-TS12-04-04-020664

T. Petchur

## Continuation of Calibration Certificate

Cert. No. : ACL22159  
Job No. : VC65AC0069  
Pages : 4 of 8

## Result of calibration :

## 1. Absolute sensitivity

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

## 2. Self-generated noise

## 2.1 Normal test

Measured Value ( dB )
23.4

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

Frequency Weighting	Measured value ( dB )
A - weight	15.4
C - weight	21.0
Flat	26.9

## 3. Acoustical signal tests of frequency weightings

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

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

QF-TS12-04-04-020664

P.T.A.

## Continuation of Calibration Certificate

Cert. No. : ACL22159  
Job No. : VC65AC0069  
Pages : 5 of 8

## 4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz

Frequency ( Hz )	Deviation from various frequency weighting response curve (dB)			
	Flat	C-weight	A-weight	Acceptance Limits
63	-0.1	-0.2	-0.1	±2.0
125	-0.1	0.0	-0.1	±1.5
250	0.0	0.0	-0.1	±1.5
500	0.0	0.0	-0.1	±1.5
1000	0.0	0.0	0.0	±1.0
2000	0.0	0.0	0.0	±2.0
4000	0.0	0.0	0.0	±3.0
8000	0.0	0.0	0.0	±5.0

## 5. Frequency and time weightings at 1 kHz

## 5.1 Frequency weightings at 1 kHz

Frequency Weighting	Measured Value ( dB )	Deviated Value ( dB )	Acceptance Limits ( dB )
A - weight	94.0	0.0	-
C - weight	94.0	0.0	± 0.2
Flat	93.9	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	93.9	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	93.9	94.0	0.1	± 0.3

QF-TS12-04-04-020664

P.T.A.

## Continuation of Calibration Certificate

Cert. No. : ACL22159  
Job No. : VC65AC0069  
Pages : 6 of 8

## 7. Level linearity on the reference level range

Anticipated Value ( dB )	Measured Value ( dB )	Deviated Value ( dB )	Acceptance Limits
137.0	137.1	0.1	± 1.1
136.0	136.1	0.1	± 1.1
135.0	135.1	0.1	± 1.1
134.0	134.1	0.1	± 1.1
133.0	133.0	0.0	± 1.1
132.0	132.0	0.0	± 1.1
131.0	131.0	0.0	± 1.1
129.0	129.1	0.1	± 1.1
124.0	124.0	0.0	± 1.1
119.0	119.1	0.1	± 1.1
114.0	114.1	0.1	± 1.1
109.0	109.1	0.1	± 1.1
104.0	104.1	0.1	± 1.1
99.0	99.1	0.1	± 1.1
94.0	94.0	0.0	± 1.1
89.0	89.0	0.0	± 1.1
84.0	84.0	0.0	± 1.1
79.0	79.0	0.0	± 1.1
74.0	74.0	0.0	± 1.1
69.0	69.0	0.0	± 1.1
64.0	64.0	0.0	± 1.1
59.0	59.0	0.0	± 1.1
54.0	54.0	0.0	± 1.1
49.0	49.0	0.0	± 1.1
44.0	44.0	0.0	± 1.1
39.0	39.0	0.0	± 1.1
34.0	34.0	0.0	± 1.1
30.0	30.0	0.0	± 1.1
29.0	29.0	0.0	± 1.1
28.0	28.0	0.0	± 1.1
27.0	26.9	-0.1	± 1.1
26.0	26.0	0.0	± 1.1
25.0	25.0	0.0	± 1.1

QF-TS12-04-04-020664

P.T.A.

## Continuation of Calibration Certificate

Cert. No. : ACL22159  
Job No. : VC65AC0069  
Pages : 7 of 8

## 8. Level linearity including the level range control

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

## 9. Tone burst response

Time Weighting	Tone burst duration, 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	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	135.6	-0.8	±3.0

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

QF-TS12-04-04-020664

P.T.A.

## Continuation of Calibration Certificate

Cert. No. : ACL22159  
Job No. : VC65AC0069  
Pages : 8 of 8

## 11. Overload indication

Measured value ( dB )		Deviated Value	Acceptance Limits
Positive one-half cycle	Negative one-half cycle	( dB )	( dB )
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 Sirinthorn Rd., Bangbunru, Bangplud Bangkok 10700 THAILAND.  
Tel:0-2435-8800 Fax:0-2433-1679 e-mail:cal-center@sithiphorn.com http://www.sithiphorn.comCert. No. : ACL22160  
Pages : 1 of 8

## Calibration Certificate

Equipment : SOUND LEVEL METER  
Manufacturer : RION  
Model : NL-42/ Microphone UC-52 / Preamplifier NH-24  
Serial No.: 00472132 / 169445 / 72466  
ID No.: RYG\_FS0304

Condition As Found : GOOD

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

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

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



Calibrated by : Nathakorn Pisutpaisan

Approved by :

T. Petchum  
( Thanakul Petchumai )

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

QF-TS12-04-04-020664

## Continuation of Calibration Certificate

Cert. No. : ACL22160  
Job No. : VC65AC0069  
Pages : 2 of 8

Calibration Procedure : CP-AC-01

## Calibration Method :

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

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

## Condition of this result of calibration :

## 1. Reference Standard Instruments :

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

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

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

3.1 National Institute of Metrology (Thailand).

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

QF-TS12-04-04-020664

## Continuation of Calibration Certificate

Cert. No. : ACL22160  
Job No. : VC65AC0069  
Pages : 3 of 8

## Summary of Measurement Result :

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

QF-TS12-04-04-020664

## Continuation of Calibration Certificate

Cert. No. : ACL22160  
Job No. : VC65AC0069  
Pages : 4 of 8

## Result of calibration :

## 1. Absolute sensitivity

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

## 2. Self-generated noise

## 2.1 Normal test

Measured Value ( dB )
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	16.3
Flat	22.1

## 3. Acoustical signal tests of frequency weightings

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

Frequency ( Hz )	Deviation from various frequency weighting response curve (dB)			
	Flat	C-weight	A-weight	Acceptance Limits
125	0.2	0.2	0.2	± 1.5
1000	-0.1	-0.1	-0.1	± 1.0
8000	-1.1	-1.1	-1.1	±5.0

QF-TS12-04-04-020664

T P.T.A.

## Continuation of Calibration Certificate

Cert. No. : ACL22160  
Job No. : VC65AC0069  
Pages : 5 of 8

## 4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

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

## 5. Frequency and time weightings at 1 kHz

## 5.1 Frequency weightings at 1 kHz

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

## 5.2 Time weighting at 1 kHz

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

## 6. Long - term stability

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

QF-TS12-04-04-020664

T P.T.A.

## Continuation of Calibration Certificate

Cert. No. : ACL22160  
Job No. : VC65AC0069  
Pages : 6 of 8

## 7. Level linearity on the reference level range

Anticipated Value ( dB )	Measured Value ( dB )	Deviated Value ( dB )	Acceptance Limits ( dB )
137.0	137.0	0.0	± 1.1
136.0	136.0	0.0	± 1.1
135.0	135.0	0.0	± 1.1
134.0	134.0	0.0	± 1.1
133.0	133.0	0.0	± 1.1
132.0	132.0	0.0	± 1.1
131.0	131.0	0.0	± 1.1
129.0	129.0	0.0	± 1.1
124.0	124.0	0.0	± 1.1
119.0	119.0	0.0	± 1.1
114.0	114.0	0.0	± 1.1
109.0	109.0	0.0	± 1.1
104.0	104.1	0.1	± 1.1
99.0	99.0	0.0	± 1.1
94.0	94.0	0.0	± 1.1
89.0	89.0	0.0	± 1.1
84.0	84.0	0.0	± 1.1
79.0	79.0	0.0	± 1.1
74.0	74.0	0.0	± 1.1
69.0	69.0	0.0	± 1.1
64.0	64.0	0.0	± 1.1
59.0	59.0	0.0	± 1.1
54.0	54.0	0.0	± 1.1
49.0	49.0	0.0	± 1.1
44.0	44.0	0.0	± 1.1
39.0	39.0	0.0	± 1.1
34.0	34.0	0.0	± 1.1
30.0	30.0	0.0	± 1.1
29.0	29.0	0.0	± 1.1
28.0	28.0	0.0	± 1.1
27.0	27.0	0.0	± 1.1
26.0	26.0	0.0	± 1.1
25.0	25.0	0.0	± 1.1

QF-TS12-04-04-020664

T P.T.A.

## Continuation of Calibration Certificate

Cert. No. : ACL22160  
Job No. : VC65AC0069  
Pages : 7 of 8

## 8. Level linearity including the level range control

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

## 9. Tone burst response

Time Weighting	Tone burst duration, Tb ( ms )	Cycle	Anticipated Value ( dB )	Measured Value ( dB )	Deviated Value ( dB )	Acceptance Limits ( dB )
Fast	0.25	1	108.0	108.0	0.0	1.5 ; -5.0
	2	8	117.0	117.0	0.0	1.0 ; -2.5
	200	800	134.0	134.1	0.1	±1.0
Slow	2	8	108.0	108.0	0.0	1.5 ; -5.0
	200	800	127.6	127.6	0.0	±1.0
	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, Lepeak ( dB )	Deviated Value ( dB )	Acceptance Limits ( dB )
Continuous	133.0	133.0	0.0	-
One	136.4	135.3	-1.1	±3.0

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

QF-TS12-04-04-020664

T P.T.A.

Continuation of Calibration Certificate

Cert. No. : ACL22160  
Job No. : VC65AC0069  
Pages : 8 of 8

11. Overload indication

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

12. High level stability

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

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

End of Calibration Certificate

QF-TS12-04-04-020664

T. Petchur

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



Cert. No. : ACL21078  
Pages : 1 of 8

Calibration Certificate

Equipment : SOUND LEVEL METER  
Manufacturer : RION  
Model : NL-42/ Microphone UC-52 / Preamplifier NH-24  
Serial No.: 00597167 / 157778 / 34375  
ID No.: RYG\_FS0437

Condition As Found : GOOD

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

Location : -  
Ambient Temperature : ( 23.0 ± 3 ) °C  
Pressure : ( 101.3 ± 3 ) kPa  
Relative Humidity : ( 50.0 ± 20 ) %  
Received Date : 05 AUGUST 2021  
Calibration Date : 06 - 10 AUGUST 2021  
Date of Issue : 11 AUGUST 2021

REVIEW BY : *Pranokorn P.*  
APPROVED BY : *T. Petchur*  
NEXT CAL. DATE : 6/5/22

Calibrated by : Nathakorn Pisutpaisan

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

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

QF-TS12-04-04-020664

Continuation of Calibration Certificate

Cert. No. : ACL21078  
Job No. : VC64AC0058  
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-0012-21	10-Feb-22
Waveform Generator	33511B	MY52302742	EF-0011-21	10-Feb-22
Digital Multimeter	33461A	MY53220104	EEL-BP_05/0264	10-Feb-22
Digital Multimeter	8846A	1997025	EEL-BP_06/0264	05-Feb-22
Digital Multimeter	33461A	MY53220116	EEL-BP_04/0264	10-Feb-22
Programmable Attenuator	MAT-1070	62100114	1500-07774E	08-Mar-22
Condenser Microphone	4180	2977900	AA-1008-21	05-Feb-22
Measuring Amplifier	NA-42KA1	34560495	AA-3003-21	16-Feb-22

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

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

3.1 National Institute of Metrology (Thailand).

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

QF-TS12-04-04-020664

T. Petchur

Continuation of Calibration Certificate

Cert. No. : ACL21078  
Job No. : VC64AC0058  
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. Petchur

Cert. No. : ACL21078  
Job No. : VC64AC0058  
Pages : 4 of 8

## Result of calibration :

## 1. Absolute sensitivity

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

## 2. Self-generated noise

## 2.1 Normal test

Measured Value ( dB )
16.5

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

Frequency Weighting	Measured value ( dB )
A - weight	12.0
C - weight	18.6
Flat	24.5

## 3. Acoustical signal tests of frequency weightings

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

Frequency ( Hz )	Deviation from various frequency weighting response curve (dB)			
	Flat	C-weight	A-weight	Acceptance Limits
125	0.5	0.6	0.6	± 1.5
1000	-0.1	-0.1	0.0	± 1.0
8000	-1.6	-1.6	-1.6	±5.0

QF-TS12-04-04-020664

T. P. L.

Cert. No. : ACL21078  
Job No. : VC64AC0058  
Pages : 5 of 8

## 4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

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

Cert. No. : ACL21078  
Job No. : VC64AC0058  
Pages : 6 of 8

## 7. Level linearity on the reference level range

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

QF-TS12-04-04-020664

T. P. L.

Cert. No. : ACL21078  
Job No. : VC64AC0058  
Pages : 7 of 8

## 8. Level linearity including the level range control

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

## 9. Tone burst response

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

## 10. Peak C sound level

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

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

QF-TS12-04-04-020664

T. P. L.

Continuation of Calibration Certificate

Cert. No. : ACL21078  
Job No. : VC64AC0058  
Pages : 8 of 8

11. Overload indication

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

12. High level stability

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

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

End of Calibration Certificate

QF-TS12-04-04-020664

T. P.T.A.

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



Cert. No. : ACL21079  
Pages : 1 of 8

Calibration Certificate

Equipment : SOUND LEVEL METER  
Manufacturer : RION  
Model : NL-42/ Microphone UC-52 / Preamplifier NH-24  
Serial No.: 00597168 / 180412 / 88182  
ID No.: RYG\_FS0438

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 : 05 AUGUST 2021  
Calibration Date : 06-10 AUGUST 2021  
Date of Issue : 11 AUGUST 2021

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

T. P.T.A.

Continuation of Calibration Certificate

Cert. No. : ACL21079  
Job No. : VC64AC0058  
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-0012-21	10-Feb-22
Waveform Generator	33511B	MY52302742	EF-0011-21	10-Feb-22
Digital Multimeter	33461A	MY53220104	EEL-BP_05/0264	10-Feb-22
Digital Multimeter	8846A	1997025	EEL-BP_06/0264	05-Feb-22
Digital Multimeter	33461A	MY53220116	EEL-BP_04/0264	10-Feb-22
Programmable Attenuator	MAT-1070	62100114	1500-07774E	08-Mar-22
Condenser Microphone	4180	2977900	AA-1008-21	05-Feb-22
Measuring Amplifier	NA-42KA1	34560495	AA-3003-21	16-Feb-22

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

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

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

QF-TS12-04-04-020664

T. P.T.A.

Continuation of Calibration Certificate

Cert. No. : ACL21079  
Job No. : VC64AC0058  
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.T.A.

Cert. No. : ACL21079  
Job No. : VC64AC0058  
Pages : 4 of 8

## Result of calibration :

## 1. Absolute sensitivity

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

## 2. Self-generated noise

## 2.1 Normal test

Measured Value ( dB )
14.8

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

Frequency Weighting	Measured value ( dB )
A - weight	11.6
C - weight	17.8
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	0.2	0.3	± 1.5
1000	-0.1	-0.1	-0.1	± 1.0
8000	0.6	0.7	0.7	±5.0

QF-TS12-04-04-020664

P.T.A.

Cert. No. : ACL21079  
Job No. : VC64AC0058  
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	-0.2	-0.2	-0.1	±2.0
125	-0.1	-0.1	-0.1	±1.5
250	-0.1	-0.1	-0.1	±1.5
500	-0.1	0.0	-0.1	±1.5
1000	0.0	0.0	0.0	±1.0
2000	0.0	0.0	0.0	±2.0
4000	0.0	0.0	0.0	±3.0
8000	0.0	0.0	0.0	±5.0

## 5. Frequency and time weightings at 1 kHz

## 5.1 Frequency weightings at 1 kHz

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

## 5.2 Time weighting at 1 kHz

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

## 6. Long - term stability

Frequency Weighting	SLM Display at initial ( dB )	SLM Display at final ( dB )	Deviated Value ( dB )	Acceptance Limits ( dB )
A - weight	93.9	94.0	0.1	± 0.3

QF-TS12-04-04-020664

P.T.A.

Cert. No. : ACL21079  
Job No. : VC64AC0058  
Pages : 6 of 8

## 7. Level linearity on the reference level range

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

QF-TS12-04-04-020664

P.T.A.

Cert. No. : ACL21079  
Job No. : VC64AC0058  
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	136.2	-0.2	±3.0

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

QF-TS12-04-04-020664

P.T.A.

Continuation of Calibration Certificate

Cert. No. : ACL21079  
Job No. : VC64AC0058  
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	SLM Display at initial ( dB )	SLM Display at final ( dB )	Deviated Value ( dB )	Acceptance Limits ( dB )
Weighting				
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., Bangbunru, Bangkok 10700 THAILAND.  
Tel: 0-2435-8800 Fax: 0-2433-1679 e-mail: cal-center@sithiporn.com http://www.sithiporn.com



Cert. No. : ACL21080  
Pages : 1 of 8

Calibration Certificate

Equipment : SOUND LEVEL METER  
Manufacturer : RION  
Model : NL-42/ Microphone UC-52 / Preamplifier NH-24  
Serial No.: 00597169 / 180411 / 88181  
ID No.: RYG\_FS0439

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 : 05 AUGUST 2021  
Calibration Date : 06-10 AUGUST 2021  
Date of Issue : 11 AUGUST 2021



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. : ACL21080  
Job No. : VC64AC0058  
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-0012-21	10-Feb-22
Waveform Generator	33511B	MY52302742	EF-0011-21	10-Feb-22
Digital Multimeter	33461A	MY53220104	EEL-BP_05/0264	10-Feb-22
Digital Multimeter	8846A	1997025	EEL-BP_06/0264	05-Feb-22
Digital Multimeter	33461A	MY53220116	EEL-BP_04/0264	10-Feb-22
Programmable Attenuator	MAT-1070	62100114	1500-07774E	08-Mar-22
Condenser Microphone	4180	2977900	AA-1008-21	05-Feb-22
Measuring Amplifier	NA-42KAI	34560495	AA-3003-21	16-Feb-22

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

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

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

QF-TS12-04-04-020664

Continuation of Calibration Certificate

Cert. No. : ACL21080  
Job No. : VC64AC0058  
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. : ACL21080  
Job No. : VC64AC0058  
Pages : 4 of 8

## Result of calibration :

## 1. Absolute sensitivity

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

## 2. Self-generated noise

## 2.1 Normal test

Measured Value ( dB )
14.4

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

Frequency Weighting	Measured value ( dB )
A - weight	11.6
C - weight	17.5
Flat	23.0

## 3. Acoustical signal tests of frequency weightings

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

Frequency ( Hz )	Deviation from various frequency weighting response curve (dB)			
	Flat	C-weight	A-weight	Acceptance Limits
125	0.2	0.3	0.3	± 1.5
1000	0.0	0.0	0.1	± 1.0
8000	1.3	1.4	1.4	±5.0

QF-TS12-04-04-020664

T. Bhan.

## Continuation of Calibration Certificate

Cert. No. : ACL21080  
Job No. : VC64AC0058  
Pages : 5 of 8

## 4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

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

## 5. Frequency and time weightings at 1 kHz

## 5.1 Frequency weightings at 1 kHz

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

## 5.2 Time weighting at 1 kHz

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

## 6. Long - term stability

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

QF-TS12-04-04-020664

T. Bhan.

## Continuation of Calibration Certificate

Cert. No. : ACL21080  
Job No. : VC64AC0058  
Pages : 6 of 8

## 7. Level linearity on the reference level range

Anticipated Value ( dB )	Measured Value ( dB )	Deviated Value ( dB )	Acceptance Limits ( dB )
137.0	137.0	0.0	± 1.1
136.0	136.0	0.0	± 1.1
135.0	135.0	0.0	± 1.1
134.0	134.0	0.0	± 1.1
133.0	133.0	0.0	± 1.1
132.0	132.0	0.0	± 1.1
131.0	131.0	0.0	± 1.1
129.0	129.0	0.0	± 1.1
124.0	124.0	0.0	± 1.1
119.0	119.0	0.0	± 1.1
114.0	114.0	0.0	± 1.1
109.0	109.0	0.0	± 1.1
104.0	104.0	0.0	± 1.1
99.0	99.0	0.0	± 1.1
94.0	94.0	0.0	± 1.1
89.0	89.0	0.0	± 1.1
84.0	84.0	0.0	± 1.1
79.0	79.0	0.0	± 1.1
74.0	74.0	0.0	± 1.1
69.0	69.0	0.0	± 1.1
64.0	64.0	0.0	± 1.1
59.0	59.0	0.0	± 1.1
54.0	54.0	0.0	± 1.1
49.0	49.0	0.0	± 1.1
44.0	44.0	0.0	± 1.1
39.0	39.0	0.0	± 1.1
34.0	33.9	-0.1	± 1.1
30.0	29.9	-0.1	± 1.1
29.0	28.9	-0.1	± 1.1
28.0	27.9	-0.1	± 1.1
27.0	26.9	-0.1	± 1.1
26.0	25.8	-0.2	± 1.1
25.0	24.9	-0.1	± 1.1

QF-TS12-04-04-020664

T. Bhan.

## Continuation of Calibration Certificate

Cert. No. : ACL21080  
Job No. : VC64AC0058  
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	135.3	-1.1	±3.0

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

QF-TS12-04-04-020664

T. Bhan.

## Continuation of Calibration Certificate

Cert. No. : ACL21080  
Job No. : VC64AC0058  
Pages : 8 of 8

## 11. Overload indication

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

## 12. High level stability

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

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

End of Calibration Certificate

QF-TS12-04-04-020664

451-451/1 Srinthorn Rd, Bangbunru, Bangplud Bangkok 10700 THAILAND.  
Tel.0-2435-8800 Fax.0-2433-1679 e-mail:cal-center@sithiporn.com http://www.sithiporn.comCert. No. : ACL22026  
Pages : 1 of 8

## Calibration Certificate

Equipment : SOUND LEVEL METER  
Manufacturer : RION  
Model : NL-42/ Microphone UC-52 / Preamplifier NH-24  
Serial No. : 00900071 / 188464 / 01733  
ID No. : RYG\_FS0492

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 : 05 JANUARY 2022  
Calibration Date : 10-12 JANUARY 2022  
Date of Issue : 13 JANUARY 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. : ACL22026  
Job No. : VC65AC0040  
Pages : 2 of 8

Calibration Procedure : CP-AC-01

## Calibration Method :

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

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

## Condition of this result of calibration :

## 1. Reference Standard Instruments :

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

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

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

3.1 National Institute of Metrology (Thailand).

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

QF-TS12-04-04-020664

## Continuation of Calibration Certificate

Cert. No. : ACL22026  
Job No. : VC65AC0040  
Pages : 3 of 8

## Summary of Measurement Result :

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

QF-TS12-04-04-020664

## Continuation of Calibration Certificate

Cert. No. : ACL22026  
Job No. : VC65AC0040  
Pages : 4 of 8

## Result of calibration :

## 1. Absolute sensitivity

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

## 2. Self-generated noise

## 2.1 Normal test

Measured Value ( dB )
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	17.8
Flat	23.6

## 3. Acoustical signal tests of frequency weightings

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

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

QF-TS12-04-04-020664

T. Rth.

## Continuation of Calibration Certificate

Cert. No. : ACL22026  
Job No. : VC65AC0040  
Pages : 5 of 8

## 4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

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

## 5. Frequency and time weightings at 1 kHz

## 5.1 Frequency weightings at 1 kHz

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

## 5.2 Time weighting at 1 kHz

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

## 6. Long - term stability

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

QF-TS12-04-04-020664

T. Rth.

## Continuation of Calibration Certificate

Cert. No. : ACL22026  
Job No. : VC65AC0040  
Pages : 6 of 8

## 7. Level linearity on the reference level range

Anticipated Value ( dB )	Measured Value ( dB )	Deviated Value ( dB )	Acceptance Limits ( dB )
137.0	137.0	0.0	± 1.1
136.0	136.0	0.0	± 1.1
135.0	135.0	0.0	± 1.1
134.0	134.0	0.0	± 1.1
133.0	133.0	0.0	± 1.1
132.0	132.0	0.0	± 1.1
131.0	131.0	0.0	± 1.1
129.0	129.0	0.0	± 1.1
124.0	124.0	0.0	± 1.1
119.0	119.0	0.0	± 1.1
114.0	114.0	0.0	± 1.1
109.0	109.0	0.0	± 1.1
104.0	104.0	0.0	± 1.1
99.0	99.0	0.0	± 1.1
94.0	94.0	0.0	± 1.1
89.0	89.0	0.0	± 1.1
84.0	84.0	0.0	± 1.1
79.0	79.0	0.0	± 1.1
74.0	74.0	0.0	± 1.1
69.0	69.0	0.0	± 1.1
64.0	64.0	0.0	± 1.1
59.0	59.0	0.0	± 1.1
54.0	54.0	0.0	± 1.1
49.0	49.0	0.0	± 1.1
44.0	44.0	0.0	± 1.1
39.0	38.9	-0.1	± 1.1
34.0	33.9	-0.1	± 1.1
30.0	29.9	-0.1	± 1.1
29.0	28.9	-0.1	± 1.1
28.0	27.9	-0.1	± 1.1
27.0	26.8	-0.2	± 1.1
26.0	25.9	-0.1	± 1.1
25.0	24.9	-0.1	± 1.1

QF-TS12-04-04-020664

T. Rth.

## Continuation of Calibration Certificate

Cert. No. : ACL22026  
Job No. : VC65AC0040  
Pages : 7 of 8

## 8. Level linearity including the level range control

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

## 9. Tone burst response

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

## 10. Peak C sound level

Number of cycle in test signal	Anticipated Value ( dB )	Measured Value, L <sub>peak</sub> ( dB )	Deviated Value ( dB )	Acceptance Limits ( dB )
Continuous	133.0	133.0	0.0	-
One	136.4	136.2	-0.2	±3.0

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

QF-TS12-04-04-020664

T. Rth.

Continuation of Calibration Certificate

Cert. No. : ACL22026  
Job No. : VC65AC0040  
Pages : 8 of 8

11. Overload indication

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



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

Cert. No. : ACL22158  
Pages : 1 of 8

Calibration Certificate

Equipment : SOUND LEVEL METER  
Manufacturer : RION  
Model : NL-42/ Microphone UC-52 / Preamplifier NH-24  
Serial No. : 00472127 / 169440 / 72461  
ID No. : RYG\_FS0302

Condition As Found : GOOD

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

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

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



Calibrated by : Nathakorn Pisutpaisan

Approved by : T. Petchur  
( Thanakul Petchur )

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. : ACL22158  
Job No. : VC65AC0069  
Pages : 2 of 8

Calibration Procedure : CP-AC-01

Calibration Method :

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

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

Condition of this result of calibration :

1. Reference Standard Instruments :

Instrument	Model	Serial No.	Cert. No.	Due Date
Waveform Generator	33210A	MY48017076	EF-0007-22	04-Feb-23
Waveform Generator	33511B	MY52302742	EF-0008-22	04-Feb-23
Digital Multimeter	33461A	MY53220104	EEL_BP_04/0265	09-Feb-23
Digital Multimeter	33461A	MY53220076	EEL_BP_03/0265	09-Feb-23
Digital Multimeter	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

T. Petchur

Continuation of Calibration Certificate

Cert. No. : ACL22158  
Job No. : VC65AC0069  
Pages : 3 of 8

Summary of Measurement Result :

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

QF-TS12-04-04-020664

T. Petchur

## Continuation of Calibration Certificate

Cert. No. : ACL22158  
Job No. : VC65AC0069  
Pages : 4 of 8

## Result of calibration :

## 1. Absolute sensitivity

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

## 2. Self-generated noise

## 2.1 Normal test

Measured Value ( dB )
17.3

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

Frequency Weighting	Measured value ( dB )
A - weight	12.0
C - weight	18.1
Flat	23.9

## 3. Acoustical signal tests of frequency weightings

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

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

QF-TS12-04-04-020664

T. B. L.

## Continuation of Calibration Certificate

Cert. No. : ACL22158  
Job No. : VC65AC0069  
Pages : 5 of 8

## 4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

Frequency ( Hz )	Deviation from various frequency weighting response curve (dB)			
	Flat	C-weight	A-weight	Acceptance Limits
63	0.0	-0.1	-0.1	±2.0
125	0.0	0.1	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	SIM Display at initial ( dB )	SIM 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. B. L.

## Continuation of Calibration Certificate

Cert. No. : ACL22158  
Job No. : VC65AC0069  
Pages : 6 of 8

## 7. Level linearity on the reference level range

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

QF-TS12-04-04-020664

T. B. L.

## Continuation of Calibration Certificate

Cert. No. : ACL22158  
Job No. : VC65AC0069  
Pages : 7 of 8

## 8. Level linearity including the level range control

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

## 9. Tone burst response

Time Weighting	Tone burst duration, 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	136.0	-0.4	±3.0

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

QF-TS12-04-04-020664

T. B. L.

## Continuation of Calibration Certificate

Cert. No. : ACL22158  
Job No. : VC65AC0069  
Pages : 8 of 8

## 11. Overload indication

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

## 12. High level stability

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

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

End of Calibration Certificate

QF-TS12-04-04-020664

T. Petchur

451-451/1 Siinthorn 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. : ACL22060  
Pages : 1 of 8

## Calibration Certificate

Equipment : SOUND LEVEL METER  
Manufacturer : RION  
Model : NL-42/ Microphone UC-52 / Preamplifier NH-24  
Serial No. : 00734225 / 169439 / 72460  
ID No. : RYG\_FS0030

Condition As Found : GOOD

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

Location :  
Ambient Temperature : ( 23.0 ± 3 ) °C  
Pressure : ( 101.3 ± 3 ) kPa  
Relative Humidity : ( 50.0 ± 20 ) %  
Received Date : 14 JANUARY 2022  
Calibration Date : 21-24 JANUARY 2022  
Date of Issue : 25 JANUARY 2022



Calibrated by : Nathakorn Pisutpaisan

Approved by :

T. Petchur  
( Thanakul Petchurai )

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

QF-TS12-04-04-020664

## Continuation of Calibration Certificate

Cert. No. : ACL22060  
Job No. : VC65AC0043  
Pages : 2 of 8

Calibration Procedure : CP-AC-01

## Calibration Method :

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

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

## Condition of this result of calibration :

## 1. Reference Standard Instruments :

Instrument	Model	Serial No.	Cert. No.	Due Date
Waveform Generator	33210A	MY48017076	EF-0012-21	10-Feb-22
Waveform Generator	33511B	MY52302742	EF-0011-21	10-Feb-22
Digital Multimeter	33461A	MY53220104	EEL_BP_05/0264	10-Feb-22
Digital Multimeter	33461A	MY53220076	EEL_BP_03/0264	08-Feb-22
Digital Multimeter	34461A	MY60024273	1-15180725251-1	15-Sep-22
Programmable Attenuator	MAT-1070	62100114	1500-07774E	08-Mar-22
Condenser Microphone	4180	2977900	AA-1008-21	05-Feb-22
Measuring Amplifier	NA-42KAI	34560495	AA-3003-21	16-Feb-22

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

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

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

QF-TS12-04-04-020664

T. Petchur

## Continuation of Calibration Certificate

Cert. No. : ACL22060  
Job No. : VC65AC0043  
Pages : 3 of 8

## Summary of Measurement Result :

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

QF-TS12-04-04-020664

T. Petchur

## Continuation of Calibration Certificate

Cert. No. : ACL22060  
Job No. : VC65AC0043  
Pages : 4 of 8

## Result of calibration :

## 1. Absolute sensitivity

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

## 2. Self-generated noise

## 2.1 Normal test

Measured Value ( dB )
14.2

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

Frequency Weighting	Measured value ( dB )
A - weight	10.8
C - weight	17.2
Flat	23.0

## 3. Acoustical signal tests of frequency weightings

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

Frequency ( Hz )	Deviation from various frequency weighting response curve (dB)			
	Flat	C-weight	A-weight	Acceptance Limits
125	0.4	0.5	0.5	±1.5
1000	-0.1	-0.1	-0.1	±1.0
8000	-1.6	-1.5	-1.5	±5.0

QF-TS12-04-04-020664

T. P. P. P.

## Continuation of Calibration Certificate

Cert. No. : ACL22060  
Job No. : VC65AC0043  
Pages : 5 of 8

## 4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

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

## 5. Frequency and time weightings at 1 kHz

## 5.1 Frequency weightings at 1 kHz

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

## 5.2 Time weighting at 1 kHz

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

## 6. Long - term stability

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

QF-TS12-04-04-020664

T. P. P. P.

## Continuation of Calibration Certificate

Cert. No. : ACL22060  
Job No. : VC65AC0043  
Pages : 6 of 8

## 7. Level linearity on the reference level range

Anticipated Value ( dB )	Measured Value ( dB )	Deviated Value ( dB )	Acceptance Limits ( dB )
137.0	137.0	0.0	±1.1
136.0	136.0	0.0	±1.1
135.0	135.0	0.0	±1.1
134.0	134.0	0.0	±1.1
133.0	132.9	-0.1	±1.1
132.0	131.9	-0.1	±1.1
131.0	130.9	-0.1	±1.1
129.0	129.0	0.0	±1.1
124.0	124.0	0.0	±1.1
119.0	119.0	0.0	±1.1
114.0	114.0	0.0	±1.1
109.0	109.0	0.0	±1.1
104.0	104.0	0.0	±1.1
99.0	99.0	0.0	±1.1
94.0	94.0	0.0	±1.1
89.0	89.0	0.0	±1.1
84.0	84.0	0.0	±1.1
79.0	79.0	0.0	±1.1
74.0	74.0	0.0	±1.1
69.0	69.0	0.0	±1.1
64.0	64.0	0.0	±1.1
59.0	59.0	0.0	±1.1
54.0	54.0	0.0	±1.1
49.0	49.0	0.0	±1.1
44.0	44.0	0.0	±1.1
39.0	39.0	0.0	±1.1
34.0	34.0	0.0	±1.1
30.0	30.0	0.0	±1.1
29.0	29.0	0.0	±1.1
28.0	28.0	0.0	±1.1
27.0	27.0	0.0	±1.1
26.0	26.1	0.1	±1.1
25.0	25.1	0.1	±1.1

QF-TS12-04-04-020664

T. P. P. P.

## Continuation of Calibration Certificate

Cert. No. : ACL22060  
Job No. : VC65AC0043  
Pages : 7 of 8

## 8. Level linearity including the level range control

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

## 9. Tone burst response

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

## 10. Peak C sound level

Number of cycle in test signal	Anticipated Value ( dB )	Measured Value, Lepeak ( dB )	Deviated Value ( dB )	Acceptance Limits ( dB )
Continuous	133.0	133.0	0.0	-
One	136.4	135.8	-0.6	±3.0

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

QF-TS12-04-04-020664

T. P. P. P.

Continuation of Calibration Certificate

Cert. No. : ACL22060  
Job No. : VC65AC0043  
Pages : 8 of 8

11. Overload indication

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

12. High level stability

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

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

End of Calibration Certificate

QF-TS12-04-04-020664

**CERTIFICATE OF CALIBRATION**

ISSUED BY: **Cirrus Research plc**  
DATE OF ISSUE: **07/09/21** CERTIFICATE NUMBER: **162335**

REVIEW BY: *Monika P.*  
APPROVED BY: *7/12/21*  
NEXT CAL DATE: *7/19/22*

**Cirrus Research plc**  
Acoustic House  
Bridlington Road  
Hunmanby  
North Yorkshire  
YO14 0PH  
United Kingdom

Page 1 of 1  
Test engineer:  
Nigel Smith  
Electronically signed:  
*Nigel Smith*

**doseBadge Reader**

**Instrument**

Manufacturer: Cirrus Research plc Serial Number: 89107  
Model Number: RC:110A Notes:

**Calibration Procedure**

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

Date of Calibration: 07 September 2021

**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	113.90	1000.2	0.20
Adjusted	114.00	1000.2	0.20
Uncertainty	± 0.11	± 0.14	± 0.10
Tolerances	± 0.60	± 2.00	± 4.00

**Environmental Conditions**

Pressure: 101.40 kPa  
Temperature: 22.4 °C  
Humidity: 60.2 %

**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%.

**CERTIFICATE OF CALIBRATION**

ISSUED BY: **Cirrus Research plc**  
DATE OF ISSUE: **02/12/21** CERTIFICATE NUMBER: **166913**

**Cirrus Research plc**  
Acoustic House  
Bridlington Road  
Hunmanby  
North Yorkshire  
YO14 0PH  
United Kingdom

Page 1 of 1

Test engineer:  
Rebecca Thomas  
Electronically signed:  
*Rebecca Thomas*

**doseBadge Reader**

**Instrument**

Manufacturer: Cirrus Research plc Serial Number: 76062  
Model Number: RC:110A Notes:

**Calibration Procedure**

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

Date of Calibration: 01 December 2021

**Functionality Results**

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

REVIEW BY: *Monika P.*  
APPROVED BY: *1/12/22*  
NEXT CAL DATE: *1/12/22*

**Calibration Results**

	Level (dB)	Frequency (Hz)	Distortion (% THD + Noise)
Initial	114.20	1000.9	0.35
Adjusted	113.99	1000.9	0.34
Uncertainty	± 0.11	± 0.14	± 0.10
Tolerances	± 0.60	± 2.00	± 4.00

**Environmental Conditions**

Pressure: 98.75 kPa  
Temperature: 22.4 °C  
Humidity: 43.9 %

**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%.



**PENTA CALIBRATION CO., LTD.**  
66/124 The Connect 33 Village Kanchanaphisek Road  
Dokmai Pravek Bangkok 10250  
Tel: +66 (0) 2059-9773  
www.pentalab.com

RYG\_EN0004

**Certificate of Calibration**

Represent to Certificate of Calibration ,PTC/07/22104

Certificate No.: PTC/07/22104 Page: 1 of 3  
Equipment: Digital Balance Condition: Normal  
Manufacturer: Sartorius Serial No: 33108993  
Model: MSE125P-100-DU ID No: RYG\_EN0004  
Type of Balance: Single interval

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

Environment Condition: Temperature 23.9 °C ± 0.3 °C  
Humidity 58.1 %RH ± 4.4 %RH  
Air density 1.17 kg/m<sup>3</sup>

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

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

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

Date Received: March 23, 2022

Calibration Date: March 23, 2022

Issued Date: March 25, 2022

Calibration By: Mr. Rungroj Metakul

REVIEW BY: *Thavitall*  
APPROVED BY: *1/12/22*  
NEXT CAL DATE: *03/06/23*



*Mr. Kiangsak Kalasin*  
( Mr.Kiangsak Kalasin )  
Reviewed by

Approved By: *Mr. Keattisak Kerdto*  
( Mr. Keattisak Kerdto )  
Laboratory Manager

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

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

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

Represent to Certificate of Calibration ,PTC/07/22104

Certificate No.: PTC/07/22104

Page: 2 of 3

**Measurement Results:**

Without Adjustment :

Function Calibration: Non Adjustment

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

Eccentricity test		50 (g)				
		Position (g)				
1	2	3	4	5		
0.00000	-0.00004	-0.00001	0.00000	0.00001		
Maximum deviation:					0.00004	

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

Determination of the standard deviation of weighing balance., Readability 0.00001 (g)

Nominal test value (g)	Standard Deviation
50	0.000007

Error of indication : from nominal value., Readability 0.00001 (g)

Nominal Value (g)	Conventional Mass (g)	Indication (g)	Correction of Balance (g)	Uncertainty (g)	k
0	0.000000	0.00000	0.00000	0.000020	2.65
0.01	0.010001	0.01000	0.00000	0.000022	2.17
0.05	0.050002	0.04999	0.00001	0.000022	2.17
0.1	0.099999	0.09999	0.00001	0.000022	2.17
0.5	0.500001	0.50001	-0.00001	0.000022	2.17
1	1.000004	0.99999	0.00001	0.000022	2.14
2	1.999999	1.99999	0.00001	0.000022	2.14
5	5.000015	4.99999	0.00002	0.000023	2.14
10	10.000004	10.00000	0.00000	0.000024	2.10
20	20.000029	20.00000	0.00003	0.000032	2.00
50	50.000043	49.99999	0.00005	0.000069	2.00

Note: Weight of adjust (g)

Represent to Certificate of Calibration ,PTC/07/22104

Certificate No.: PTC/07/22104

Page: 3 of 3

**Measurement Results:**

Without Adjustment :

Function Calibration: Non Adjustment

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

Eccentricity test		50	(g)	
		Position (g)		
1	2	3	4	5
0.0000	0.0000	0.0000	0.0000	0.0000
Maximum deviation:		0.0000		

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

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

Nominal test value (g)	Standard Deviation
100	0.00000

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

Nominal Value (g)	Conventional Mass (g)	Indication (g)	Correction of Balance (g)	Uncertainty (g)	k
65	65.00006	65.00000	0.0001	0.00013	2.00
70	70.00007	70.00000	0.0001	0.00013	2.00
75	75.00009	75.00000	0.0001	0.00014	2.00
80	80.00008	80.00000	0.0001	0.00014	2.00
85	85.00009	85.00000	0.0001	0.00015	2.00
90	90.00010	90.00000	0.0001	0.00015	2.00
95	95.00012	95.00000	0.0001	0.00016	2.00
100	100.00004	100.00000	0.0000	0.00014	2.00
110	110.00004	110.00000	0.0000	0.00015	2.00
120	120.00007	120.00000	0.0001	0.00016	2.00

Note: Weight of adjust (g)

The End of Certificate

PTC-PNC/07-02-2 Feb 2020

PTC-PNC/07-02-2 Feb 2020



**บริษัท เอกเสคคิวทิฟ เทรดดิ้ง จำกัด (สาขาสหกรณ์)**  
48/194-5 ซอยประติมากรรม 19 ถนนประดิษฐ์มนูธรรม แขวงลาดพร้าว เขตลาดพร้าว กรุงเทพฯ 10230  
TEL (662) 515-0145-50 FAX (662) 515-0144 www.etithai.com E-mail : info@etithai.com

**ใบรายงานผลการปรับเทียบ**

ชื่อผู้ขอรับบริการ : บริษัท เอกเสคคิวทิฟ เทรดดิ้ง จำกัด (ประเทศไทย) จำกัด.  
ที่อยู่ : 104 ซ.พัฒนาการ 40 ถ.พัฒนาการ แขวงสวนหลวง เขตสวนหลวง กรุงเทพมหานคร 10250.  
ปรับเทียบที่ : บริษัท เอกเสคคิวทิฟ เทรดดิ้ง จำกัด  
ที่อยู่ : 48/194-5 ซอย ประติมากรรม 19 ถนนประดิษฐ์มนูธรรม แขวงเขตลาดพร้าว กรุงเทพฯ 10230

รายละเอียดเครื่องมือที่ทำการปรับเทียบ : สภาวะแวดล้อม :  
เครื่องมือ : เครื่องสุญญากาศไอโซเทอปรอสแตติก : อุณหภูมิ :  $(25 \pm 3) ^\circ\text{C}$   
ผลิตภัณฑ์ : RAE Systems : ความชื้นสัมพัทธ์ :  $(36 \pm 15) \%$   
รุ่น : MiniRAE3000 : ความดันบรรยากาศ : 760 มิลลิเมตรปรอท  
หมายเลขเครื่อง : 592-906493  
ID : BKK\_FS0819

วันที่ปรับเทียบมาตรฐาน : 4 กุมภาพันธ์ 2565  
วิธีการปรับเทียบมาตรฐาน : ปรับเทียบโดยใช้ Standard Reference Gas Hydrogen GASCO  
- Isobutylene Standard Gas 100 ppm; Lot number: 304-402089381-L

**ผลการปรับเทียบมาตรฐาน**

Sensor Type	Reference Concentration	Before Cal.	After Cal.	Error Reading	Result
PID	0.0 ppm (Air Zero)	0.0 ppm	0.0 ppm	0.0 ppm	Pass
PID	100 ppm (Isobutylene)	54.1 ppm	100.0 ppm	0.0 ppm	Pass

Flow Rate of Pump : 490 cc/min.

Accuracy :  $\pm 2 \%$  at calibration point

ผู้ปรับเทียบ : (นายสุรินทร์ สายเนตร) Service Engineer  
ผู้ตรวจสอบ : (นายสุชาติ วงศ์ทองสังข์) Service Engineer Manager



บริษัท เอกเสคคิวทีฟ เทรดดิ้ง จำกัด (สำนักงานใหญ่)  
48/194-5 ซอยประติมากรรม 19 ถนนประติมากรรม แขวงลาดพร้าว เขตลาดพร้าว กรุงเทพฯ 10230  
TEL (662) 515-0145-50 FAX (662) 515-0144 www.etthai.com E-mail: info@etthai.com

No. RA 013/22

### Certificate of Calibration

**Customer** : ALS Laboratory Group (Thailand) Co., Ltd.  
**Address** : 104 Phatthanakan 40, Phatthanakan Rd., Khwaeng Suan Luang, Khet Suan Luang Bangkok 10250 TH.  
**Calibration location** : Executive Trading Limited.  
**Address** : 48/194-5 Soi Praditmanutham 19, Pradit Manutham Road, Latphrao, Bangkok 10230  
**Tools** :  
Instrument : Gas Detector  
Product : RAE Systems  
Model Name : MiniRAE3000  
Serial Number : 592-906493  
ID : BKK\_FS0819  
**Environmental Condition** :  
Temperature : (25 ± 3) °C  
Relative Humidity : (36 ± 15) %  
Pressure : 760 mmHg  
**Date of Calibration** : February 4, 2022  
**Calibration Method** : This instrument has been calibrated using calibration gases. Test and calibration data is On file with Executive trading limited.  
**Reference Standard** : Isobutylene Standard Gas 100 ppm; Lot number: 304-402089381-1.

### Test Result

Sensor Type	Reference Concentration	Before Cal.	After Cal.	Error Reading	Result
PID	0.0 ppm (Air Zero)	0.0 ppm	0.0 ppm	0.0 ppm	Pass
PID	100 ppm (Isobutylene)	54.1 ppm	100.0 ppm	0.0 ppm	Pass

Flow Rate of Pump : 490 cc/min.

Accuracy : ± 2 % at calibration point

Calibrated By : Surin S  
(Mr. Surin Sainate)  
Service Engineer

Approved By : Suttiwong  
(Mr. Suttiwong Kongthongsang.)  
Service Engineer Manager

The results relate only to the items tested or calibrated.

Advertising the Report/Certificate and publicity of the results except in full are prohibited unless written permission is obtained from the company.

EXECUTIVE TRADING LIMITED 48/194-5 SOI PRADITMANUTHAM 19, PRADITMANUTHAM ROAD, LATPHRAO, BANGKOK 10230



บริษัท เอกเสคคิวทีฟ เทรดดิ้ง จำกัด (สำนักงานใหญ่)  
48/194-5 ซอยประติมากรรม 19 ถนนประติมากรรม แขวงลาดพร้าว เขตลาดพร้าว กรุงเทพฯ 10230  
TEL (662) 515-0145-50 FAX (662) 515-0144 www.etthai.com E-mail: info@etthai.com

ที่ RA 013/22

### ใบรายงานการตรวจเช็คเครื่องตรวจวัดก๊าซ รุ่น MiniRAE3000

หมายเลขเครื่อง : 592-906493

วันที่ตรวจเช็ค : 4 กุมภาพันธ์ 2565

ลำดับที่	รายละเอียดการตรวจสอบ	RAW COUNT		สรุป	หมายเหตุ
		REF.	REAL		
1.	PID RAW COUNT				
	Ch.H	10000-62500	39643	■ YES □ NO	
	Ch.L	<62500	29542	■ YES □ NO	
2.	Lamp	>40	45	■ YES □ NO	
1.	Motor Pump	Check flow rate		■ YES □ NO	490 cc/min.
2.	Buzzer	-		■ YES □ NO	-
3.	Li-ion Battery	-		■ YES □ NO	-
4.	Key Pad			■ YES □ NO	-
	Y/+	-		■ YES □ NO	-
	N/-	-		■ YES □ NO	-
	MODE	-		■ YES □ NO	-
5.	LCD Display	-		■ YES □ NO	-
6.	THP sensor	-		■ YES □ NO	-
7.	Light Sensor	-		■ YES □ NO	-
8.	Pocket Clip	-		□ YES □ NO	-
9.	PC Port	-		■ YES □ NO	-
10.	Slim Rubber Boot	-		■ YES □ NO	เปลี่ยนใหม่

ผู้ตรวจเช็ค : Suttiwong  
(นายสุทินกร สายเนตร)  
Service Engineer

ผลการสอบเทียบเป็นที่ยอมรับ ครอบคลุมตัวชี้วัดตามข้อกำหนดการปฏิบัติงาน

การนำรายงานผลการตรวจเช็คไปโฆษณาและประชาสัมพันธ์โดยไม่ได้รับอนุญาตจากบริษัทฯ ถือเป็นความผิดตามกฎหมายว่าด้วยการคุ้มครองข้อมูลส่วนบุคคล

EXECUTIVE TRADING LIMITED 48/194-5 SOI PRADITMANUTHAM 19, PRADITMANUTHAM ROAD, LATPHRAO, BANGKOK 10230



GASCO AFFILIATES, LLC,

320 Scarlet Blvd.  
Didsmar, FL 34677  
(800) 810-0051  
Fax: (888) 755-8920  
www.gascogas.com

### CERTIFICATE OF ANALYSIS

Date: May 14, 2021  
Order Number: 56376  
Lot Number: 304-402089381-1

Customer: R.C Systems Co Inc  
Use Before: 05/14/2025

Component	Requested Concentration	Analytical Result (+/- 2%)
Isobutylene	100 PPM	101.2 PPM
Air	Balance	Balance

Cylinder Size: 3.70 Cu. Ft.  
Contents: 105 Liter

Valve: 5/8"-18 UNF  
Pressure: 1200 psig

Product composition verified by direct comparison to calibration standards traceable to N.I.S.T. weights and/or N.I.S.T. Gas Mixtures reference materials.

Analyst

R.C. Systems  
R.C. Systems

Honeywell Analytics - Singapore Office  
17 Changi Business Park Central 1  
Singapore 486073  
Cert Ref: 00317



Honeywell  
THE POWER OF CONNECTED

Gas Detection

### CERTIFICATE OF Attendance

It is hereby certified that

**Mr Suttiwong Kongthongsang**  
**(Executive Trading Limited)**

has attended the

**RAE Products & Maintenance Training Course**

Conducted by

**RAE Systems BY HONEYWELL**

on **31<sup>st</sup> July to 2<sup>nd</sup> August 2018**

Conducted by : Desmond Tan  
Service Engineer/Technical Trainer  
Date of Issue : 2<sup>nd</sup> August 2018  
Valid for 2 years from date of issue

## CERTIFICATE OF CALIBRATION

Certificate No.: CL-02165  
Page 1 of 2

Equipment Name: Heat Stress Monitor with Sensor  
Manufacturer: DeltaOHM  
Model: HD32.2  
Serial No: 18018313  
ID No: RYG\_FS0358

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

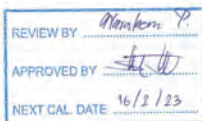
Received date: 10 JAN 2022  
Calibration date: 16 FEB 2022  
Issue date: 17 FEB 2022

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

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

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

Traceability  
The measurement results are traceable to the  
international system of units (SI) through National  
Institute of Metrology Thailand (NIMT) Certificate  
number: TT-0036-21, Certificate number: ER-0032-  
21



Calibrated by  
Mr. Sorawit Thachalad  
Miss Orathai Wiwatwitaya



Approved Signatory: Mr. Parinya Booncharoen  
Calibration Department Manager

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

Certificate No.: CL-02165  
Page 2 of 2

Result of Calibration: ☒ Without Adjustment ☐ With Adjustment

Calibration Range: 20 - 40 °C

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

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
30	20.046	20.1	0.1	0.099
30	25.050	25.1	0.1	0.099
30	30.036	30.1	0.1	0.099
30	35.027	35.1	0.1	0.099
30	40.024	40.0	0.0	0.099

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

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
70	20.049	20.0	0.0	0.099
70	24.993	25.1	0.1	0.099
70	29.932	29.9	0.0	0.099
70	34.848	34.4	-0.1	0.099
70	39.819	39.6	-0.2	0.099

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

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
110	20.045	20.1	0.1	0.099
110	25.050	25.1	0.1	0.099
110	30.037	30.1	0.1	0.099
110	35.026	35.1	0.1	0.099
110	40.023	40.1	0.1	0.099

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



## CERTIFICATE OF CALIBRATION

Certificate No.: CL-005-65  
Page 1 of 2

Equipment Name: Heat Stress Monitor with Sensor  
Manufacturer: DeltaOHM  
Model: HD32.2  
Serial No: 18018314  
ID No: RYG\_FS0359

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

Received date: 12 JAN 2022  
Calibration date: 24 JAN 2022  
Issue date: 25 JAN 2022

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

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

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

Traceability  
The measurement results are traceable to the  
international system of units (SI) through National  
Institute of Metrology Thailand (NIMT) Certificate  
number: TT-0036-21, Certificate number: ER-0032-  
21



Calibrated by  
Mr. Sorawit Thachalad  
Miss Orathai Wiwatwitaya



Approved Signatory: Mr. Parinya Booncharoen  
Calibration Department Manager

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

Certificate No.: CL-005-65  
Page 2 of 2

Result of Calibration: ☒ Without Adjustment ☐ With Adjustment

Calibration Range: 20 - 40 °C

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

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
30	20.050	20.0	0.0	0.099
30	25.039	25.0	0.0	0.099
30	30.030	30.0	0.0	0.099
30	35.025	34.9	-0.1	0.099
30	40.019	39.9	-0.1	0.099

Table 2: This equipment was connected with temperature probe Model: TP3207.2 S/N: 18021282.  
Dimension: Diameter 14 mm. Length 150 mm.

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
70	20.049	20.1	0.1	0.099
70	24.966	24.8	-0.2	0.099
70	29.925	29.7	-0.2	0.099
70	34.889	34.6	-0.4	0.099
70	39.850	39.4	-0.6	0.099

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

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
110	20.050	20.0	0.0	0.099
110	25.039	25.0	0.0	0.099
110	30.030	30.0	0.0	0.099
110	35.025	35.1	0.1	0.099
110	40.019	40.1	0.1	0.099

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

★ End of Certificate ★



## CERTIFICATE OF CALIBRATION

Certificate No.: CL-022-65  
Page 1 of 2

Equipment Name: Heat Stress Monitor with Sensor  
Manufacturer: DeltaOHM  
Model: HD32.2  
Serial No: 18018316  
ID No: RYG\_FS0360

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

Received date: 10 JAN 2022  
Calibration date: 16 FEB 2022  
Issue date: 17 FEB 2022

### Reference Used During Calibration

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

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

### Calibration Procedure

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

### Traceability

The measurement results are traceable to the  
international system of units (SI) through National  
Institute of Metrology Thailand (NIMT) Certificate  
number: TT-0036-21, Certificate number: ER-0032-  
21

REVIEW BY: *Handon P.*  
APPROVED BY: *[Signature]*  
NEXT CAL DATE: 16/2/23

Calibrated by:  
[X] Mr. Sorawit Thachetad  
[X] Miss Orathai Wiewattayaya



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

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

Certificate No.: CL-022-65  
Page 2 of 2

Result of Calibration: ☒ Without Adjustment ☐ With Adjustment

Calibration Range: 20 ~ 40 °C

### Function:

Table 1: This equipment was connected with wet bulb probe Model: HP3201.2 S/N: 18021471.  
Dimension: Diameter 14 mm, Length 170 mm.

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
30	20.054	20.0	-0.1	0.099
30	25.043	25.0	0.0	0.099
30	30.038	30.0	0.0	0.099
30	35.029	35.0	0.0	0.099
30	40.027	40.0	0.0	0.099

Table 2: This equipment was connected with temperature probe Model: TP3207.2 S/N: 18021266.  
Dimension: Diameter 14 mm, Length 150 mm.

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
70	20.049	20.1	0.1	0.099
70	25.002	25.0	0.0	0.099
70	29.926	29.8	-0.1	0.099
70	34.878	34.6	-0.3	0.099
70	39.855	39.5	-0.4	0.099

Table 3: This equipment was connected with Globe thermometer probe Model: TP3276.2 S/N: 18020502.  
Dimension: Diameter 8 mm, Length 170 mm.

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
110	20.054	20.1	0.0	0.099
110	25.042	25.1	0.1	0.099
110	30.036	30.1	0.1	0.099
110	35.030	35.1	0.1	0.099
110	40.027	40.1	0.1	0.099

UUC\*: Unit Under Calibration

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



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)  
CORPORATE SERVICES & EQUIPMENT CALIBRATION AND TESTING SERVICES  
131/4 PATTANAKARN ROAD 561 B. SUANLIANG, SUANLUANG BANGKOK 10250  
TEL: 0-2717-3000-27 FAX: 0-2719-4084

Cert.No.: ZZQH377  
Page: 1 of 2

## Certificate of Calibration

Equipment: pH Meter  
Manufacturer: Mettler Toledo  
Model: Seven2Go  
Serial No.: B5312563/1  
ID No.: RYG\_FS0420  
Condition As-Received:  
Received Date: 11 March 2022  
Calibration Date: 14 March 2022  
Reference: 2203-04950SC-1  
Submitted by: ALS Laboratory Group (Thailand) Co.,Ltd. Rayong Branch  
610/10 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: Worakorn Lomgagtrakul  
Approved by: *[Signature]*  
Approved Signatory  
Issue Date: 17 March 2022

The Uncertainties are for a confidence probability of approximately 95%  
This certificate may not be reproduced other than in full, except with the prior written  
Approval of the head of Corporate Services & Equipment Calibration and Testing Services

A 0039308

Cert. No.: ZZCH1577  
Page: 2 of 2

## Condition of this calibration result

1. Reference Standard Instrument: -  
Instrument Serial No. ID No. Cert. No. Due Date  
(J) Document Process Calibrator 64030049 130RC116 21E2682 30 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	766820	23 Sep 2023
pH 6.863	CPA chem	766822	04 Sep 2022
pH 10.015	CPA chem	766824	04 Sep 2022

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

## Calibration Results

Function: mV Measurement  
Performing standard curve by Fluke at pH (4,7,10)

Unit Under Calibration	Nominal Value	Standard Voltage Input	Actual Reading	Uncertainty of Measurement (mV)	Coverage factor k	
	pH	mV	mV	pH		
pH Meter	4.00	177.48	177	4.00	0.58	2.00
S/N: B5312563/1	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 (pH)	Coverage factor k
pH Electrode	4.008	4.01	181	0.0079	2.00
S/N: 1311407	6.863	6.88	7	0.0093	2.00
	10.015	10.01	-171	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%.

-060-

1100595



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



Cert. No.: 22LM41  
Page.: 1 of 2

## Certificate of Calibration

Equipment : pH Meter with Sensor  
Manufacturer : Mettler Toledo  
Model : Seven2Go  
Serial No. : B531258371  
ID No. : KYG-JS0420  
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 March 2022  
Calibrated Date : 15 March 2022  
Ambient Temperature : ( 26 ± 10 ) °C  
Relative Humidity : ( 50 ± 30 ) %  
AC Line Voltage : ( 220 ± 22 ) V  
Calibrated by : Malee Butkruea  
Approved by :   
( ) Pornthippa Tanmyakul  
(✓) Suwit Injai  
Issue Date : 17 March 2022

The Uncertainties are for a confidence probability of approximately 95%

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

A 0039307



Equipment : pH Meter with Sensor  
Condition As-Received : Used Item  
Reference : 2203-0495DSC-2

Cert. No.: 22LM41  
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	1023	2100000	2111273	22 Nov 2022

2) This certificate is valid only for 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, Q/N.: 1311407

Calibration Point ( °C )	Immersion Depth ( mm )	Standard Temperature ( °C )	UUC* Reading ( °C )	Error ( °C )	Uncertainty ( ± °C )	Coverage Factor #
25.0	100	25.009	25.4	0.391	0.16	2.00
30.0	100	30.008	30.5	0.492	0.16	2.00
40.0	100	39.997	40.6	0.603	0.16	2.00
50.0	100	49.997	50.6	0.603	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 %.

-oOo-

a 1100597



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

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

## Certificate of Testing

Equipment : DO Meter  
Manufacturer : YSI  
Model : 5000-115V  
Serial No. : 15E102796  
ID No. : RYG\_EN0032  
Received Date : 11 February 2022  
Test Date : 14 February 2022  
Reference : 2202-0404DSC-4  
Submitted by : ALS Laboratory Group (Thailand) Co., Ltd.  
(Rayong Branch)  
616/10 Moo 5 T. Maenam Khu. A. Pluakdaeng,  
Rayong 21140, Thailand  
Laboratory Condition : Temperature ( 25 ± 5 ) °C  
Humidity ( 50 ± 20 ) %  
Test Procedure : In - house method : CP-CH9  
by Comparison Technique with Azide Modification Method  
Tested by : Walalak Sirinthean  
Approved by :   
( ) Malee Butkruea  
(✓) Saithip Meangmal  
( ) Warakorn Lemgagtrakul

Issue Date : 18 February 2022

B 0281285



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

-oOo-

Saithip

a 1094744



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 :   
( ) Pornthippa Tameyakul  
(✓) Malee Butkruea  
( ) Suwit Imjai  
Issue Date : 21 February 2022

The Uncertainties are for a confidence probability of approximately 95%

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

A 0038008



Equipment : DO Meter with Sensor  
Condition As-Received : Used Item  
Reference : 2202-0404DSC-5  
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	2111273	22 Nov 2022
2. This certificate is valid only to the item calibrated on date and place of calibration.				
3. This certification is traceable to the International System of Unit.				

Result of Calibration :- ( \* ) Without Adjustment

Function : Temperature measurement.

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

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 %.

-000-

a 1095714



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 Pattanapongpalboon  
Approved by :   
( ) Pornthippa Tameyakul  
(✓) Malee Butkruea  
( ) Suwit Imjai  
Issue Date : 3 May 2022

REVIEW BY   
APPROVED BY   
NEXT CAL. DATE 23/10/23

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  
Procedure Used :-

Cert. No.: 22TM317  
Page: 2 of 3

Calibration were conducted using calibration procedure CP-OT02 according to direct measurement  
The temperature scale used was based on ITS-90.

### Condition of this result of calibration

#### 1. Reference standard instrument:-

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

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

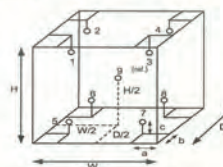
3. This certification is traceable to the International System of Unit.

Result of Calibration :- ( \* ) Without Adjustment

Function of UUC\* : Temperature Source

Fresh air setting : Close

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



Probe Installation Details :  
a = 10 cm  
b = 10 cm  
c = 10 cm  
Dimension of Chamber :  
D = 0.60 m  
W = 1.0 m  
H = 1.2 m  
Capacity = 0.75 m<sup>3</sup>

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

Calibration Point (°C)	Measured Temperature (°C)								
	Position								
20.0	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 %.

-000-

1105484

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 ±  
Humidity 65.4 %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 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. 91416 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

Person in charge (Mr. Chattaphon Foithong)  
Authorized signatory (Mr. Thalekngkiet Pongngam)

Delivering Growth - In Asia and Beyond.

Certificate No.: C06220464 Page 2 of 3

Calibration Results:  
Without Adjustment

Wavelength Accuracy (nm), The spectral bandwidth of 81d at 2 nm and UUC at 2 nm

Standard Wavelength	Unit Under Calibration	Correction	Uncertainty
418.61	418.4	0.21	0.14
536.66	536.7	-0.04	0.14
637.98	638.3	-0.32	0.14
748.46	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
	0.6693	0.672	-0.0027	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
	0.8903	0.891	-0.0007	0.0045
	0.9604	0.962	-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
	0.6847	0.685	-0.0003	0.0045
	0.9823	0.983	-0.0007	0.0045

Delivering Growth - In Asia and Beyond.

Certificate No.: C06220464 Page 3 of 3

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 (%T)	Absorbance (A)
260.67 +/- 0.11 nm	260.7	2.1	1.678
391.94 +/- 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	2.60
UUC: Wavelength (nm)	268.2	266.1		
Std Absorbance (A)	0.4610	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

Delivering Growth - In Asia and Beyond.

## ใบตรวจสอบสภาพเครื่องวัดสิ่งแวดล้อม



เลขที่ใบงาน: KSPR2212224

ชนิดเครื่องมือ: SPECTROPHOTOMETER รุ่น: DR6000

หมายเลขเครื่อง: 1627845

ตรวจสอบ (รับ)	ตรวจสอบ (ส่ง)	หมายเหตุ
27 Sep 2022	27 Sep 2022	
ปกติ	ปกติ	
<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. แบตเตอรี่ (Battery Backup) $\geq 2.5$ 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) 656.1 นาโนเมตร 656.1 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)
<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. ระดับสารละลายใน Electrode (Level KCl)
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	14. ฝาปิดกันเปื้อน Electrode (Dust Protection Hood)
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	15. ขาตั้งอิเล็กโทรด (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. ระดับการล้างตัวอย่าง (≥ 2.5 ไมล์ 3.0)
<b>Automatic Dilutor</b>		
<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

เซ็นเซอร์/ซ่อมแซม:

Mr. Chattuphon Folthong  
Service Engineer

บริษัท เทคโนโลยี จำกัด  
2533 ถนนสุขุมวิท แขวงคลองเตย เขตคลองเตย กรุงเทพมหานคร 10260  
Phone: +66 (0) 2069-9773 Email: info@pentacal.com Website: www.pentacal.com

Delivering Growth - In Asia and Beyond.

CAL-FM-R31-03: 20 Jul 2022



PENTA CALIBRATION CO., LTD.  
66/124 The Connect 33 Village Kanchanaphisek Road  
Dokmai Prawe Bangkok 10250  
Tel: +66 (0) 2069-9773  
www.pentacal.com

## Certificate of Calibration

Represent to Certificate of Calibration PTC/07/22103

Certificate No.: PTC/07/22103 Page: 1 of 2  
Equipment: Digital Balance Condition: Normal  
Manufacturer: Sartorius Serial No: 26207038  
Model: MSE224S-100-DU ID No: RYG\_EN0002  
Type of Balance: Single interval

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

Environment Condition: Temperature 23.9 °C ± 0.3 °C  
Humidity 58.1 %RH ± 4.4 %RH  
Air density 1.17 kg/m<sup>3</sup>

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

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

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

Date Received: March 23, 2022  
Calibration Date: March 23, 2022  
Issued Date: March 25, 2022  
Calibration By: Mr. Rungroje Metakul

REVIEW BY: Tranittal  
APPROVED BY: Penta  
NEXT CAL. DATE: 03/03/23



Mr. Kiangsak Kalasri  
Reviewed by

Approved By: Mr. Keattisak Kerdt  
Laboratory Manager

This certificate is issued the units of measurement according to the International System of Units (SI). It provides traceability of measurement to international or national standard or other 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 the Expression of Uncertainty in Measurement (GUM). The effect that the results relate only to the items calibrated.

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

PTC-FMC-07-02: 3 Feb 2020



PENTA CALIBRATION CO., LTD.

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

Represent to Certificate of Calibration PTC/07/22103

Certificate No.: PTC/07/22103 Page: 2 of 2

## Measurement Results:

Without Adjustment:

Function Calibration: Non Adjustment

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

Figure 1 shows the eccentricity test setup and results. (a) A rectangular plate with a central hole and five points labeled 1 to 5. (b) A circular plate with a central hole and five points labeled 1 to 5. (c) A table showing the eccentricity test results for the rectangular plate.

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

Repeatability Test: Weight to be 1/2 ≤ L<sub>1</sub> ≤ Maximum capacity

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

Nominal test value (g)	Standard Deviation
200	0.00003

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

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

Note: Weight of adjust (g)

The End of Certificate

PTC-FMC-07-02: 3 Feb 2020



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)  
CORPORATE SERVICES & EQUIPMENT CALIBRATION AND TESTING SERVICES  
3344 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG BANGKOK 10259  
TEL: 0-2717-3009-27 FAX: 0-2715-9484



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

## Certificate of Calibration

Equipment: Hot Air Oven

Manufacturer: Memmert

Model: UFE 500

Serial No.: G511.1572

ID No.: RYG\_EN0010

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

Location: Oven Room

Received Order: 20 October 2022

Calibration Date: 20 October 2022

Ambient Temperature: (26 ± 10) °C

Relative Humidity: (50 ± 30) %

Calibrated by: Man Pattanapongpaiboon

Approved by: Man  
Approved Signatory

( ) 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 & 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

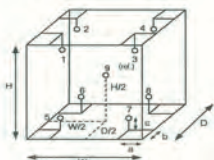
2. This certificate is valid only to the item calibrated on date and place of calibration.

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



**Probe Installation Details :**  
a = 5.0 cm  
b = 5.0 cm  
c = 5.0 cm

**Dimension of Chamber :**  
D = 0.40 m  
W = 0.56 m  
H = 0.48 m  
Capacity = 0.11 m<sup>3</sup>

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

a 1132466



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	179.605

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

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

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

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

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

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

-000-

a 1132465

RYG\_EN0006



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)  
CORPORATE SERVICES & EQUIPMENT CALIBRATION AND TESTING SERVICES  
534/4 PATTANAKARN ROAD 509 18, SUANLUANG, SUANLUANG BANGKOK 10250  
TEL. 0-2717-3000-27 FAX. 0-2716-9484



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

**Certificate of Calibration**

**Equipment :** Hot Air Oven

**Manufacturer :** Memmert

**Model :** UM 400

**Serial No. :** b495.0699

**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 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 & Equipment Calibration and Testing Services.

A 0046905



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

Cert. No.: 22TM1492  
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 ).

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

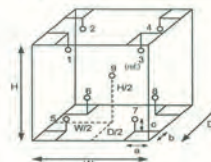
2. This certificate is valid only to the item calibrated on date and place of calibration.

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 :**  
a = 5.0 cm  
b = 5.0 cm  
c = 5.0 cm

**Dimension of Chamber :**  
D = 0.33 m  
W = 0.40 m  
H = 0.40 m  
Capacity = 0.053 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  
**Result of Calibration :-** ( \* ) Without Adjustment  
**Function of UUC\* :** Temperature Source  
**Fresh air setting :** Close

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

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

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

**Average\* :** The average of 30 values in each position.  
**Temperature stability :** One-half of the greatest maximum difference of measured temperature at any one sensor.  
**Temperature uniformity :** The maximum difference of measured temperatures at any sensors and the measured temperature at the reference location which are observed at the same time or at as close an observation time as possible to determine the temperature pattern or homogeneity within the chamber under steady-state conditions.  
**Overall Variation :** The Difference of the maximum and minimum measured temperatures throughout observation.  
**UUC\* :** Unit Under Calibration  
**Note :** The reported uncertainty of measurement was included stability and excluded uniformity.

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

-000-

Mali.


a 1132472

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

**ISO-MRA** **NAC**  
 NAC-TSI-701723  
 CALIBRATION 0000

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 Hiahib  
**Approved by :**   
 Approved Signatory  
 ( ) Pornthippa Tameyakul  
 ( / ) Malee Butkruea  
 ( ) Suwit Imjai  
**Issue Date :** 2 November 2022

The Uncertainties are for a confidence probability of approximately 95 %

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

A 0046906

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

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

Front

Mali.

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 %.

-000-

Mali.

a 1132470



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

## Certificate of Calibration

Equipment : pH Meter  
Manufacturer : Mettler Toledo  
Model : Seven Compact S220  
Serial No. : C104059460  
ID No. : RYG\_EN0183  
Condition As-Received: Used Item  
Received Date : 16 March 2022  
Calibration Date : 17 March 2022  
Reference : 2203-0611DSC-4  
Submitted by : ALS Laboratory Group (Thailand) Co., Ltd.  
Rayong Branch  
616/10 Moo 5 T.Maenam Khu.  
A.Pluakdaeng, Rayong 21140, Thailand  
Ambient Temperature : (25 ± 2.5) °C  
Relative Humidity : (50 ± 15) %  
Calibration Procedure :  
In-house method :  
- CP-CH5 by direct measurement with standard voltage calibrator and direct measurement with certified reference material (CRM)  
- CP-CH8 by comparison with standard thermometer

Calibrated by : Warakorn Lemgagrakul

Approved by :   
Approved Signatory

(✓) Malee Butkruea  
( ) Salthip Meangmai  
( ) Warakorn Lemgagrakul

Issue Date : 22 March 2022

The Uncertainties are for a confidence probability of approximately 95%

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

A 0037307



Cert.No.: 22CH405  
Page.: 2 of 3

### Condition of this calibration result

1. Reference Standard Instrument : -

Instrument	Serial No.	ID No.	Cert. No.	Due Date
1) Document Process Calibrator	54030049	130RC116	21E2682	25 Aug 2022
2) Ref. Standard Thermometer	4982054	110RC044	2111201	26 Oct 2022

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

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

Buffer Solution	Manufacturer	Lot No.	Exp. date
pH 4.008	CPA chem	789995	01 Jan 2024
pH 6.982	CPA chem	761017	02 Aug 2022
pH 10.015	CPA chem	766824	04 Sep 2022

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

### Calibration Results

Function : mV Measurement

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

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

a 1100955



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

### Calibration Results

Function : pH Measurement

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

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

### Function : Temperature Measurement

(\*) Without adjustment

This equipment was connected with Temperature Probe;

- Model : InLab Expert Pro-ISM

- Serial No. : 1453404

- Dimension of probe;

- Length : 120 mm.

- Diameter : 12 mm.

- Immersion Depth : 100 mm.

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

Remark : - UUC\* = Unit Under Calibration

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

-000-

a 1100954



## Certificate of Calibration

Certificate No.: 22E986  
Page : 1 of 2

Equipment : pH Meter  
Manufacturer : Mettler Toledo  
Model : SevenCompact S220  
Serial No. : C104059460  
ID No. : RYG\_EN0183  
Condition As-Received: Used Item  
Received Date : 16 March 2022  
Calibration Date : 21 March 2022

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

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

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

### Condition of this result of calibration

1. Reference standards instruments :

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

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

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

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

REVIEW BY   
APPROVED BY   
NEXT CAL. DATE 21/3/23

Calibrated by : Pongsagorn Boonyasom  
Issue Date : 22 March 2022

Approved Signatory :   
(✓) Phalinee Prapapal  
( ) Nuntawat Khaimchai  
( ) Pornthippa Tameyakul

B 0284414



Cert. No.: 22E986  
Page: 2 of 2

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

Function:	DC voltage measurement	Range:	2000	mV
Standard Value	UUC* Reading	Error	Uncertainty	
(mV)	(mV)	(mV)	(±µV)	
-200.0000	-200.0	0.0	72	
-150.0000	-150.0	0.0	69	
-100.0000	-100.0	0.0	65	
-50.0000	-50.0	0.0	62	
0.0000	0.0	0.0	58	
50.0000	50.0	0.0	62	
100.0000	100.0	0.0	65	
150.0000	150.0	0.0	69	
200.0000	200.0	0.0	72	

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

\*UUC= Unit Under Calibration.

-000-

a 1101070



Bara Scientific Co., Ltd.  
968 U Chu Liang Building Floor 7 Rama4 Road  
Siam Bangkok Bangkok Thailand 10500  
Tel : 02-6324300 Fax : 02-6375496-7  
www.barascientific.com



## Certificate of Calibration

Number of Page(s) 1 of 3

Certificate No. BSCC-UV-307/22  
Equipment UV/Vis Spectrophotometer  
Model UV-1800  
Manufacturer Shimadzu  
Serial No. A11454908533CD  
ID No. BOK\_EN0018  
Date of receipt 16 September 2022  
Date of calibration 16 September 2022  
Date of issue 23 September 2022

REVIEW BY *Suluk P.*  
APPROVED BY *K. A.*  
NEXT CAL. DATE *16/9/23*

Customer name ALS Laboratory Group (Thailand) Co., Ltd.  
Address 104 Soi Phatthanakan 40, Phatthanakan Road, Phatthanakan, Suan Luang, Bangkok 10250

Temperature (22.1-23.3) °C (On site)  
Humidity (58.8-63.2) %RH (On site)

Equipment condition Good Operation

Calibration Location Organic Prep

Calibration Procedure In-house method WI-UV-702-01 based on ASTM E275-01

Traceability Wavelength Accuracy is traceable to certificate No. 95917 and 95918  
Photometric Accuracy is traceable to certificate No. 95924 and 95937  
Stray Light is traceable to certificate No. 95908  
The above certificate are traceable to SI unit through Starna Scientific Ltd.  
(UKAS accredited calibration laboratory NO. 0659)

Calibrated by Mr. Waruth Janphung

Approved by

*Suluk P.*  
Mr. Kanchit Choothep  
Technical Manager

The above results are valid exclusively for the calibrated item(s) as mention in this report / certificate.  
Advertising this report / Certificate and publicity of the results are prohibited and also shall not be reproduced  
except in full, without written approval of the Bara Scientific Co., Ltd.

FM-UV-708-02 Rev.01 (23/01/63)



Bara Scientific Co., Ltd.  
968 U Chu Liang Building Floor 7 Rama4 Road  
Siam Bangkok Bangkok Thailand 10500  
Tel : 02-6324300 Fax : 02-6375496-7  
www.barascientific.com



## Certificate of Calibration

Certificate No. BSCC-UV-307/22 Number of Page(s) 2 of 3

Calibration Results:

1. Wavelength Accuracy

Certified Wavelength (nm)	UUC (nm)	Error (nm)	Uncertainty (±nm)
241.70	241.65	-0.05	0.18
334.02	333.92	-0.10	0.18
418.53	418.46	-0.07	0.18
572.99	572.96	-0.03	0.18
879.41	879.17	-0.24	0.18

2. Photometric Accuracy (UV)

Wavelength (nm)	Certified Absorbance (A)	UUC (A)	Error (A)	Uncertainty (±A)
235	0.0000	0.0000	0.0000	0.0075
	0.7467	0.7461	-0.0006	0.0075
257	0.0000	0.0000	0.0000	0.0075
	0.8662	0.8647	-0.0015	0.0075
313	0.0000	0.0000	0.0000	0.0075
	0.2904	0.2911	0.0007	0.0075
350	0.0000	0.0000	0.0000	0.0075
	0.6429	0.6426	-0.0003	0.0075

\*CNR = Customer not request

The above results are valid exclusively for the calibrated item(s) as mention in this report / certificate.  
Advertising this report / Certificate and publicity of the results are prohibited and also shall not be reproduced  
except in full, without written approval of the Bara Scientific Co., Ltd.

FM-UV-708-02 Rev.01 (23/01/63)



Bara Scientific Co., Ltd.  
968 U Chu Liang Building Floor 7 Rama4 Road  
Siam Bangkok Bangkok Thailand 10500  
Tel : 02-6324300 Fax : 02-6375496-7  
www.barascientific.com



## Certificate of Calibration

Certificate No. BSCC-UV-307/22 Number of Page(s) 3 of 3

Calibration Results:

3. Photometric Accuracy (Visible)

Wavelength (nm)	Certified Absorbance (A)	UUC (A)	Error (A)	Uncertainty (±A)
420.0	0.0000	0.0000	0.0000	0.0042
	0.5783	0.5777	-0.0006	0.0042
	0.7628	0.7635	0.0007	0.0046
	1.0206	1.0230	0.0024	0.0042
440.0	0.0000	0.0000	0.0000	0.0042
	0.5621	0.5618	-0.0003	0.0042
	0.7455	0.7460	0.0005	0.0048
	0.9685	1.0005	0.0020	0.0042
465.0	0.0000	0.0000	0.0000	0.0042
	0.5227	0.5219	-0.0008	0.0042
	0.6880	0.6884	0.0004	0.0051
	0.9487	0.9503	0.0016	0.0042
545.1	0.0000	0.0000	0.0000	0.0042
	0.5207	0.5199	-0.0008	0.0042
	0.6973	0.6971	-0.0002	0.0049
	0.9959	0.9964	0.0005	0.0042
590.0	0.0000	0.0000	0.0000	0.0042
	0.5544	0.5534	-0.0010	0.0042
	0.7233	0.7242	0.0009	0.0050
	1.0942	1.0943	0.0001	0.0042
635.0	0.0000	0.0000	0.0000	0.0042
	0.5616	0.5606	-0.0010	0.0042
	0.6927	0.6921	-0.0006	0.0053
	1.0881	1.0885	0.0004	0.0042

\*CNR = Customer not request

4. Stray Light\*

Standard cut-off wavelength (nm)	Unit Under Calibration(UUC) Wavelength (nm)	Transmission (%T)	Absorbance (A)
200.85±0.11nm	200.30	0.9505	2.0229

The Stray light transmission reference is less than 1.0%T and Stray light absorbance reference is greater than 2.00A  
\*Stray Light not NSC-ONSC Accredited.

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

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

The above results are valid exclusively for the calibrated item(s) as mention in this report / certificate.  
Advertising this report / Certificate and publicity of the results are prohibited and also shall not be reproduced  
except in full, without written approval of the Bara Scientific Co., Ltd.

FM-UV-708-02 Rev.01 (23/01/63)

ภาคผนวก จ

---

สำเนาหนังสืออนุญาตขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์เอกชน





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>(4)</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  
(นางรักกัญจน์ อัครสกุลวิไล)  
ผู้อำนวยการศูนย์มาตรฐานวิธีการวิเคราะห์ของมลพิษ  
กรมควบคุมมลพิษ

44 Methomyl...

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>

วิมล  
(นางรักกัญจน์ อัครสกุลวิไล)  
ผู้อำนวยการศูนย์มาตรฐานวิธีการวิเคราะห์ของมลพิษ  
กรมควบคุมมลพิษ

3 Aldrin...

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>

วิมล  
(นางรักกัญจน์ อัครสกุลวิไล)  
ผู้อำนวยการศูนย์มาตรฐานวิธีการวิเคราะห์ของมลพิษ  
กรมควบคุมมลพิษ


18 Bis(2-ethylhexyl)phthalate...

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>
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>

วิมล  
(นางรักกัญจน์ อัครสกุลวิไล)  
ผู้อำนวยการศูนย์มาตรฐานวิธีการวิเคราะห์ของมลพิษ  
กรมควบคุมมลพิษ


34 Chromium (III)...

ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
34	Chromium (III)	1) Digestion, Inductively Coupled Plasma Method; Colorimetric Method; Calculation <sup>(4)</sup> 2) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method; Colorimetric Method; Calculation <sup>(8)</sup>
35	Chromium (VI)	Colorimetric Method <sup>(4)</sup>
36	Chrysene	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
37	Cyanide	Distillation, Colorimetric Method <sup>(4)</sup>
38	2,4-D	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
39	DDD	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
40	DDE	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
41	DDT	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
42	Dibenz(a,h)anthracene	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
43	Di-n-Butyl Phthalate	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
44	1,2-Dichlorobenzene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
45	1,3-Dichlorobenzene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
46	1,4-Dichlorobenzene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
47	3,3-Dichlorobenzidine	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
48	1,1-Dichloroethane	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
49	1,2-Dichloroethane	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
50	1,1-Dichloroethylene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>

  
 (นางธิภาญจน์ ชิตตรกุลชัย)  
 ผู้อำนวยการศูนย์มาตรฐานวิธีการวิเคราะห์สิ่งแวดล้อมพิษ  
 กรมควบคุมมลพิษ (ป.อ.ส.อ.)


51 cis-1,2-Dichloroethylene...

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>

  
 (นางธิภาญจน์ ชิตตรกุลชัย)  
 ผู้อำนวยการศูนย์มาตรฐานวิธีการวิเคราะห์สิ่งแวดล้อมพิษ  
 กรมควบคุมมลพิษ (ป.อ.ส.อ.)


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	α-HCH	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
75	β-HCH	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
76	γ-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>

  
 (นางธิภาญจน์ ชิตตรกุลชัย)  
 ผู้อำนวยการศูนย์มาตรฐานวิธีการวิเคราะห์สิ่งแวดล้อมพิษ  
 กรมควบคุมมลพิษ (ป.อ.ส.อ.)

84 Methanol...

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>

  
 (นางธิภาญจน์ ชิตตรกุลชัย)  
 ผู้อำนวยการศูนย์มาตรฐานวิธีการวิเคราะห์สิ่งแวดล้อมพิษ  
 กรมควบคุมมลพิษ (ป.อ.ส.อ.)

97 Pentachlorophenol...

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>8</sub> -C <sub>6</sub> )	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(1,3,20)</sup>
110	TPH (C <sub>8</sub> -C <sub>12</sub> )	Solvent Extraction, Gas Chromatographic Method <sup>(9,21)</sup>
111	TPH (C <sub>13</sub> -C <sub>33</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>



114 1,1,2-Trichloroethane...

(นางธิภาญจน์ นัตถกุลวิไล)  
ผู้อำนวยการศูนย์มาตรฐานวิธีการวิเคราะห์มลพิษ  
และประเมินผลกระทบสิ่งแวดล้อม

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>

ภาคเคมี (ต่อเนื่องจาก) จำนวน 16 รายการ

ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
1	Antimony	Isokinetic, Digestion, Inductively Coupled Plasma Method <sup>(4)</sup>
2	Arsenic	Isokinetic, Digestion, Inductively Coupled Plasma Method <sup>(4)</sup>



3 Carbon Monoxide...

(นางธิภาญจน์ นัตถกุลวิไล)  
ผู้อำนวยการศูนย์มาตรฐานวิธีการวิเคราะห์มลพิษ  
และประเมินผลกระทบสิ่งแวดล้อม

ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
3	Carbon Monoxide	1) Sampling Bag Non-Dispersive Infrared Method <sup>(4)</sup> 2) Non-Dispersive Infrared Method <sup>(4)</sup> 3) Instrumental Analyzer Method <sup>(4)</sup>
4	Chlorine	1) Absorption Sampling, Ion Chromatographic Method <sup>(4)</sup> 2) Isokinetic Sampling, Ion Chromatographic Method <sup>(4)</sup>
5	Copper	Isokinetic, Digestion, Inductively Coupled Plasma Method <sup>(4)</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>(4)</sup>
7	Hydrogen Chloride	1) Absorption Sampling, Ion Chromatographic Method <sup>(4)</sup> 2) Isokinetic Sampling, Ion Chromatographic Method <sup>(4)</sup>
8	Hydrogen Sulfide	Absorption Sampling, Iodometric Method <sup>(4)</sup>
9	Lead	Isokinetic, Digestion, Inductively Coupled Plasma Method <sup>(4)</sup>
10	Mercury	1) Isokinetic Sampling, Digestion, Cold-Vapor Atomic Absorption Spectrometric Method <sup>(4)</sup> 2) Isokinetic, Digestion, Inductively Coupled Plasma Method <sup>(4)</sup>
11	Opacity	Ringelmann's Method <sup>(2)</sup>
12	Oxides of Nitrogen	1) Absorption Sampling, Phenoldisulfonic Acid Method <sup>(4)</sup> 2) Chemiluminescence Method <sup>(4)</sup> 3) Instrumental Analyzer Method <sup>(4)</sup>
13	Sulfur Dioxide	1) Absorption Sampling, Barium-Thorin Titrimetric Method <sup>(4)</sup> 2) UV Fluorescence Method <sup>(4)</sup> 3) Instrumental Analyzer Method <sup>(4)</sup>
14	Sulfuric Acid	Isokinetic Sampling, Barium-Thorin Titrimetric Method <sup>(4)</sup>
15	Total Suspended Particulate	Isokinetic Sampling, Gravimetric Method <sup>(4)</sup>
16	Xylene	Absorption Sampling, Gas Chromatographic Method <sup>(4)</sup>



สิ่งมีชีวิต...

(นางธิภาญจน์ นัตถกุลวิไล)  
ผู้อำนวยการศูนย์มาตรฐานวิธีการวิเคราะห์มลพิษ  
และประเมินผลกระทบสิ่งแวดล้อม

สิ่งมีชีวิตหรือวัตถุที่ไม่ใช่แล้ว จำนวน 35 รายการ

ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
1	Aldrin	1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(1,3,20)</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>(1,6,13)</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>(1,6,13)</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>(1,6,13)</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>(1,6,13)</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...

(นางธิภาญจน์ นัตถกุลวิไล)  
ผู้อำนวยการศูนย์มาตรฐานวิธีการวิเคราะห์มลพิษ  
และประเมินผลกระทบสิ่งแวดล้อม

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>(1,9,20)</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>(1,6,13,17)</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>(7,8,13,17)</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>

วิมล  
(นางสาวอุษณีย์ อัครสกุลวิไล)  
ผู้อำนวยการศูนย์มาตรฐานวิธีการวิเคราะห์สิ่งแวดล้อมพิษ  
กรมส่งเสริมการค้าระหว่างประเทศ  
กระทรวงพาณิชย์

11 Cobalt...

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>(1,9,20)</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>(1,9,20)</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>(1,9,20)</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>(1,9,20)</sup>

วิมล  
(นางสาวอุษณีย์ อัครสกุลวิไล)  
ผู้อำนวยการศูนย์มาตรฐานวิธีการวิเคราะห์สิ่งแวดล้อมพิษ  
กรมส่งเสริมการค้าระหว่างประเทศ  
กระทรวงพาณิชย์

2) Soxhlet...

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>(1,9,20)</sup> 2) Soxhlet Extraction, Gas Chromatographic Method <sup>(10,22)</sup> 3) Automated Soxhlet Extraction, Gas Chromatographic Method <sup>(22,31)</sup>
18	Endrin	1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(1,9,20)</sup> 2) Soxhlet Extraction, Gas Chromatographic Method <sup>(10,22)</sup> 3) Automated Soxhlet Extraction, Gas Chromatographic Method <sup>(22,31)</sup>
19	Heptachlor	1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(1,9,20)</sup> 2) Soxhlet Extraction, Gas Chromatographic Method <sup>(10,22)</sup> 3) Automated Soxhlet Extraction, Gas Chromatographic Method <sup>(22,31)</sup>
20	Lead	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>
21	Lindane	1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(1,9,20)</sup> 2) Soxhlet Extraction, Gas Chromatographic Method <sup>(10,22)</sup> 3) Automated Soxhlet Extraction, Gas Chromatographic Method <sup>(22,31)</sup>
22	Mercury	1) Waste Extraction, Digestion, Cold-Vapor Atomic Absorption Spectrometric Method <sup>(1,6,18)</sup>

วิมล  
(นางสาวอุษณีย์ อัครสกุลวิไล)  
ผู้อำนวยการศูนย์มาตรฐานวิธีการวิเคราะห์สิ่งแวดล้อมพิษ  
กรมส่งเสริมการค้าระหว่างประเทศ  
กระทรวงพาณิชย์

2) Waste Extraction...

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>(1,8)</sup> 5) Thermal Decomposition Amalgamation and Atomic Absorption Spectrometric Method <sup>(9)</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>(1,9,20)</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, 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>
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>

วิมล  
(นางสาวอุษณีย์ อัครสกุลวิไล)  
ผู้อำนวยการศูนย์มาตรฐานวิธีการวิเคราะห์สิ่งแวดล้อมพิษ  
กรมส่งเสริมการค้าระหว่างประเทศ  
กระทรวงพาณิชย์

27 Polychlorinated...

ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
27	Polychlorinated biphenyls (PCBs) - Aroclor 1016 - Aroclor 1221 - Aroclor 1232 - Aroclor 1242 - Aroclor 1248 - Aroclor 1254 - Aroclor 1260 - 2-Chlorobiphenyl - 2,3-Dichlorobiphenyl - 2,2',5-Trichlorobiphenyl - 2,4',5-Trichlorobiphenyl - 2,2',3,5'-Tetrachlorobiphenyl - 2,2',5,5'-Tetrachlorobiphenyl - 2,3',4,4'-Tetrachlorobiphenyl - 2,2',3,4,5'-Pentachlorobiphenyl - 2,2',4,5,5'-Pentachlorobiphenyl - 2,3,3',4',6-Pentachlorobiphenyl - 2,2',3,4,4',5'-Hexachlorobiphenyl - 2,2',3,4,5,5'-Hexachlorobiphenyl - 2,2',3,5,5',6-Hexachlorobiphenyl - 2,2',4,4',5,5'-Hexachlorobiphenyl - 2,2',3,3',4,4',5-Heptachlorobiphenyl - 2,2',3,4,4',5,5'-Heptachlorobiphenyl - 2,2',3,4,4',5,6-Heptachlorobiphenyl - 2,2',3,4',5,5',6-Heptachlorobiphenyl - 2,2',3,3',4,4',5,6-Heptachlorobiphenyl - 2,2',3,3',4,4',5,5',6-Nonachlorobiphenyl	1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic Method <sup>(1,6,23)</sup> 2) Soxhlet Extraction, Gas Chromatographic Method <sup>(10,23)</sup> 3) Automated Soxhlet Extraction, Gas Chromatographic Method <sup>(22,31)</sup>

28 Pentachlorophenol...

(นางวิภาดา ชัยพรกุลกิจ)

ผู้อำนวยการศูนย์มาตรฐานวิธีการวิเคราะห์สิ่งแวดล้อม

ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
28	Pentachlorophenol	1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(1,9,23)</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>(27,36)</sup>
30	Selenium	1) Waste Extraction, Digestion, Inductively Coupled Plasma Method <sup>(1,4,13)</sup> 2) Waste Extraction, Digestion, Inductively Coupled Plasma/Mass Spectrometric Method <sup>(1,6,16)</sup> 3) Digestion, Inductively Coupled Plasma Method <sup>(7,13)</sup> 4) Digestion, Inductively Coupled Plasma/Mass Spectrometric Method <sup>(7,16)</sup>
31	Silver	1) Waste Extraction, Digestion, Inductively Coupled Plasma Method <sup>(1,4,13)</sup> 2) Waste Extraction, Digestion, Inductively Coupled Plasma/Mass Spectrometric Method <sup>(1,4,16)</sup>
32	Thallium	1) Waste Extraction, Digestion, Inductively Coupled Plasma Method <sup>(1,4,13)</sup> 2) Waste Extraction, Digestion, Inductively Coupled Plasma/Mass Spectrometric Method <sup>(1,4,16)</sup> 3) Digestion, Inductively Coupled Plasma Method <sup>(7,13)</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>(1,9,23)</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>(1,4,13)</sup> 2) Waste Extraction, Digestion, Inductively Coupled Plasma/Mass Spectrometric Method <sup>(1,6,16)</sup> 3) Digestion, Inductively Coupled Plasma Method <sup>(7,13)</sup>

4) Digestion...

(นางวิภาดา ชัยพรกุลกิจ)

ผู้อำนวยการศูนย์มาตรฐานวิธีการวิเคราะห์สิ่งแวดล้อม

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>(1,6,13)</sup> 2) Waste Extraction, Digestion, Inductively Coupled Plasma/Mass Spectrometric Method <sup>(1,4,16)</sup> 3) Digestion, Inductively Coupled Plasma Method <sup>(7,13)</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>(13,20)</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>(7,13)</sup> 2) Digestion, Inductively Coupled Plasma/Mass Spectrometric Method <sup>(7,16)</sup>
6	Arsenic	1) Digestion, Inductively Coupled Plasma Method <sup>(7,13)</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>(7,13)</sup> 2) Digestion, Inductively Coupled Plasma/Mass Spectrometric Method <sup>(7,16)</sup>

9 Benz(a)anthracene...

(นางวิภาดา ชัยพรกุลกิจ)

ผู้อำนวยการศูนย์มาตรฐานวิธีการวิเคราะห์สิ่งแวดล้อม

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>(14,20)</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	Benzolc 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>(7,13)</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>(14,20)</sup>
20	Bromoform	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method <sup>(14,20)</sup>
21	Butanol	Equilibrium Headspace, Gas Chromatographic/Mass Spectrometric Method <sup>(12,20)</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>(7,13)</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>(14,20)</sup>

26 Carbon tetrachloride...

(นางวิภาดา ชัยพรกุลกิจ)

ผู้อำนวยการศูนย์มาตรฐานวิธีการวิเคราะห์สิ่งแวดล้อม

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/ Mass Spectrometric 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>(7,15,17)</sup> 2) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method; Alkaline Digestion, Colorimetric Method; Calculation Method <sup>(7,16,17)</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>(25,28)</sup>
38	2,4-D	1) Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(10,22)</sup> 2) Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(25,31)</sup>
39	DDO	1) Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(10,22)</sup> 2) Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(25,31)</sup>

วิทย์  
(นางวิภาดา ชัยยศกุลวิไล)  
ผู้อำนวยการศูนย์การวิเคราะห์ทางพิษวิทยา

40 DDE...

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>

วิทย์  
(นางวิภาดา ชัยยศกุลวิไล)  
ผู้อำนวยการศูนย์การวิเคราะห์ทางพิษวิทยา

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>

วิทย์  
(นางวิภาดา ชัยยศกุลวิไล)  
ผู้อำนวยการศูนย์การวิเคราะห์ทางพิษวิทยา

71 Hexachlorobenzene...

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	α-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	β-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	γ-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>

วิทย์  
(นางวิภาดา ชัยยศกุลวิไล)  
ผู้อำนวยการศูนย์การวิเคราะห์ทางพิษวิทยา

2) Thermal...

ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
84	Methanol	2) Thermal Decomposition, Amalgamation, and Atomic Absorption Spectrophotometry <sup>(19)</sup>
85	Methoxychlor	3) Digestion, Cold-Vapor Atomic Fluorescence Spectrometric Method <sup>(20)</sup>
86	Methyl Bromide	Equilibrium Headspace, Gas Chromatographic/Mass Spectrometric Method <sup>(12,24)</sup>
87	Methylene Chloride	1) Soxhlet Extraction, Gas Chromatographic Method <sup>(25,22)</sup>
88	2-methylphenol	2) Automated Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(25,31)</sup>
89	2-Methylnaphthalene	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method <sup>(14,24)</sup>
90	Methyl tert-Butyl Ether	Automated Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(25,31)</sup>
91	Naphthalene	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method <sup>(14,24)</sup>
92	Nickel	Automated Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(25,31)</sup>
93	Nitrobenzene	1) Digestion, Inductively Coupled Plasma Method <sup>(7,13)</sup>
94	N-Nitrosodiphenylamine	2) Digestion, Inductively Coupled Plasma/Mass Spectrometric Method <sup>(7,14)</sup>
95	N-Nitrosodipropylamine	Automated Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(25,31)</sup>
96	Polychlorinated biphenyls (PCBs)	Automated Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(25,31)</sup>
	- Aroclor 1016	1) Soxhlet Extraction, Gas Chromatographic Method <sup>(10,22)</sup>
	- Aroclor 1221	2) Automated Soxhlet Extraction, Gas Chromatographic Method <sup>(25,31)</sup>
	- Aroclor 1232	

สำนักงานสิ่งแวดล้อมแห่งชาติ  
(นางวิภาดา ชัยกุลกิจ)

- Aroclor 1242...

ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
	- Aroclor 1242	
	- Aroclor 1248	
	- Aroclor 1254	
	- Aroclor 1260	
	- 2-Chlorobiphenyl	
	- 2,2',3,5'-Tetrachlorobiphenyl	
	- 2,2',5,5'-Tetrachlorobiphenyl	
	- 2,3',4,4'-Tetrachlorobiphenyl	
	- 2,2',3,4,5'-Pentachlorobiphenyl	
	- 2,2',4,5,5'-Pentachlorobiphenyl	
	- 2,3,3',4,6'-Pentachlorobiphenyl	
	- 2,2',3,4,4',5'-Hexachlorobiphenyl	
	- 2,2',3,4,5,5'-Hexachlorobiphenyl	
	- 2,2',3,5,5',6'-Hexachlorobiphenyl	
	- 2,2',4,4',5,5'-Hexachlorobiphenyl	
	- Hexachlorobiphenyl	
	- 2,2',4,4',5,5'-Hexachlorobiphenyl	
	- 2,2',3,3',4,4',5'-Heptachlorobiphenyl	
	- 2,2',3,4,4',5,5'-Heptachlorobiphenyl	
	- 2,2',3,4,4',5,6'-Heptachlorobiphenyl	
	- 2,2',3,4,4',5,6'-Heptachlorobiphenyl	
	- 2,2',3,3',4,4',5,6'-Nonachlorobiphenyl	
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>

สำนักงานสิ่งแวดล้อมแห่งชาติ  
(นางวิภาดา ชัยกุลกิจ)

101 Selenium...

ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
101	Selenium	1) Digestion, Inductively Coupled Plasma Method <sup>(7,15)</sup>
102	Silver	2) Digestion, Inductively Coupled Plasma/Mass Spectrometric Method <sup>(7,14)</sup>
103	Styrene	1) Digestion, Inductively Coupled Plasma Method <sup>(7,15)</sup>
104	1,1,2,2-Tetrachloroethane	2) Digestion, Inductively Coupled Plasma/Mass Spectrometric Method <sup>(7,16)</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	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method <sup>(14,24)</sup>
108	TPH (C <sub>9</sub> -C <sub>9</sub> )	1) Soxhlet Extraction, Gas Chromatographic Method <sup>(10,22)</sup>
109	TPH (C <sub>9</sub> -C <sub>16</sub> )	2) Automated Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(25,31)</sup>
110	TPH (C <sub>16</sub> -C <sub>32</sub> )	1) Solvent Extraction, Gas Chromatographic Method <sup>(11,21)</sup>
111	1,2,4-Trichlorobenzene	2) Automated Soxhlet Extraction, Gas Chromatographic Method <sup>(25,31)</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>

สำนักงานสิ่งแวดล้อมแห่งชาติ  
(นางวิภาดา ชัยกุลกิจ)

116 2,4,6-Trichlorophenol...


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>
119	Vinyl Acetate	2) Digestion, Inductively Coupled Plasma/Mass Spectrometric Method <sup>(7,16)</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>(7,12)</sup>
		2) Digestion, Inductively Coupled Plasma/Mass Spectrometric Method <sup>(7,14)</sup>

## เอกสารอ้างอิง

- กระทรวงอุตสาหกรรม. ประกาศกระทรวงอุตสาหกรรม, พ.ศ. 2548. เรื่อง การกำจัดสิ่งปฏิกูลหรือวัสดุที่ไม่ใช้แล้ว.ราชกิจจานุเบกษา. 25 มกราคม 2549. เล่มที่ 123 ตอนพิเศษ 11ง.
- กระทรวงอุตสาหกรรม. ประกาศกระทรวงอุตสาหกรรม, พ.ศ. 2549. เรื่อง กำหนดค่าปริมาณแอมโมเนียที่เจือปนในอากาศที่ระบายออกจากปล่องของหน่วยโรงสีข้าวที่ใช้กลั่นเป็นเชื้อเพลิง.ราชกิจจานุเบกษา. 4 ธันวาคม 2549. เล่มที่ 123 ตอนพิเศษ 125ง.
- สมาคมวิศวกรสิ่งแวดล้อมแห่งประเทศไทย. คู่มือวิเคราะห์น้ำเสีย. พิมพ์ครั้งที่ 4. กรุงเทพฯ: เรืองวัฒนาพรปรีช, 2547.
- APHA, AWWA, WEF. Standard Methods for the Examination of Water and Wastewater. 23<sup>rd</sup> ed. Washington, DC: APHA, 2017.
- United States Environmental Protection Agency. Standards of Performance for New Stationary Sources. 40 CFR 60. Appendix A, 2019.
- United States Environmental Protection Agency. Test Methods for Evaluation Solid Waste Physical/Chemical Methods. SW-846, 1997.
- United States...


สำนักงานสิ่งแวดล้อมแห่งชาติ  
(นางวิภาดา ชัยกุลกิจ)

7. United States Environmental Protection Agency. Test Methods for Evaluation Solid Waste Physical/Chemical Methods. Acid Digestion of Sludges and Sediments and Soils. SW-846 Method 3050B, 1996.
8. United States Environmental Protection Agency. Test Methods for Evaluation Solid Waste Physical/Chemical Methods. Alkaline Digestion for Hexavalent Chromium. SW-846 Method 3060A, 1996.
9. United States Environmental Protection Agency. Test Methods for Evaluation Solid Waste Physical/Chemical Methods. Separatory Funnel Liquid-Liquid Extraction. SW-846 Method 3510C, 1996.
10. United States Environmental Protection Agency. Test Methods for Evaluation Solid Waste Physical/Chemical Methods. Soxhlet Extraction. SW-846 Method 3540C, 1996.
11. United States Environmental Protection Agency. Test Methods for Evaluation Solid Waste Physical/Chemical Methods. Microscale Solvent Extraction (MSE). SW-846 Method 3570, 2002.
12. United States Environmental Protection Agency. Test Methods for Evaluation Solid Waste Physical/Chemical Methods. Volatile Organic Compounds (VOCs) in Various Sample Matrices Using Equilibrium Headspace Analysis. SW-846 Method 5021A, 2014.
13. United States Environmental Protection Agency. Test Methods for Evaluation Solid Waste Physical/Chemical Methods. Purge-and-Trap for Aqueous Samples. SW-846 Method 5030B, 1996.
14. United States Environmental Protection Agency. Test Methods for Evaluation Solid Waste Physical/Chemical Methods. Closed-System Purge-and-Trap and Extraction for Volatile Organics in Soil and Waste Samples. SW-846 Method 5035, 1996.
15. United States Environmental Protection Agency. Test Methods for Evaluation Solid Waste Physical/Chemical Methods. Inductively Coupled Plasma- Atomic Emission Spectrometry. SW-846 Method 6010B, 1996.
16. United States Environmental Protection Agency. Test Methods for Evaluation Solid Waste Physical/Chemical Methods. Inductively Coupled Plasma-Mass Spectrometry. SW-846 Method 6020A, 2007.
17. United States Environmental Protection Agency. Test Methods for Evaluation Solid Waste Physical/Chemical Methods. Chromium, Hexavalent (Colorimetric). SW-846 Method 7196A, 1992.
18. United States Environmental Protection Agency. Test Methods for Evaluation Solid Waste Physical/Chemical Methods. Mercury in Solid or Semisolid Waste (Manual Cold-Vapor Technique). SW-846 Method 7471B, 2007.
19. United States Environmental Protection Agency. Test Methods for Evaluation Solid Waste Physical/Chemical Methods. Mercury in Solids and Solutions by Thermal Decomposition, Amalgamation, and Atomic Absorption Spectrophotometry. SW-846 Method 7473, 2007.

  
(นางริกาญจน์ นัครสกุลวิไล)  
ผู้อำนวยการศูนย์มาตรฐานวิธีการวิเคราะห์ของมลพิษ  
(ประเทศไทย) สำนักงาน

20. United States

20. United States Environmental Protection Agency. Test Methods for Evaluation Solid Waste Physical/Chemical Methods. Mercury in Sediment and Tissue Sample by Atomic Fluorescence Spectrometry. SW-846 Method 7474, 2007.
21. United States Environmental Protection Agency. Test Methods for Evaluation Solid Waste Physical/Chemical Methods. Nonhalogenated Organics Using GC/FID. SW-846 Method 8015B, 1996.
22. United States Environmental Protection Agency. Test Methods for Evaluation Solid Waste Physical/Chemical Methods. Organochlorine Pesticides by Gas Chromatography. SW-846 Method 8081B, 2007.
23. United States Environmental Protection Agency. Test Methods for Evaluation Solid Waste Physical/Chemical Methods. Polychlorinated Biphenyls (PCBs) by Gas Chromatography. SW-846 Method 8082, 1996.
24. United States Environmental Protection Agency. Test Methods for Evaluation Solid Waste Physical/Chemical Methods. Volatile Organic Compounds by Gas Chromatography/Mass Spectrometry (GC/MS). SW-846 Method 8260D, 2018.
25. United States Environmental Protection Agency. Test Methods for Evaluation Solid Waste Physical/Chemical Methods. Semivolatile Organic Compounds by Gas Chromatography/Mass Spectrometry (GC/MS). SW-846 Method 8270E, 2018.
26. United States Environmental Protection Agency. Test Methods for Evaluation Solid Waste Physical/Chemical Methods. Total and Amenable Cyanide: Distillation SW-846 Method 9010B, 1996.
27. United States Environmental Protection Agency. Test Methods for Evaluation Solid Waste Physical/Chemical Methods. Cyanide Extraction Procedure for Solids and Oil. SW-846 Method 9013A, 1996.
28. United States Environmental Protection Agency. Test Methods for Evaluation Solid Waste Physical/Chemical Methods. Cyanide in Waters and Extracts Using Titrimetric and Manual Spectrophotometric Procedures. SW-846 Method 9014, 2014.
29. United States Environmental Protection Agency. Test Methods for Evaluation Solid Waste Physical/Chemical Methods. pH Electrometric Measurement. SW-846 Method 9040C, 2004.
30. United States Environmental Protection Agency. Test Methods for Evaluation Solid Waste Physical/Chemical Methods. Soil and Waste pH. SW-846 Method 9045D, 2004.
31. United States Environmental Protection Agency. Test Methods for Evaluation Solid Waste Physical/Chemical Methods. Automated Soxhlet Extraction. SW-846 Method 3541, 1994.

  
(นางริกาญจน์ นัครสกุลวิไล)  
ผู้อำนวยการศูนย์มาตรฐานวิธีการวิเคราะห์ของมลพิษ  
(ประเทศไทย) สำนักงาน

กลุ่มมาตรฐานวิธีการวิเคราะห์ทดสอบมลพิษและทะเบียนห้องปฏิบัติการ การวิจัยและเตือนภัยมลพิษโรงงาน กรมโรงงานอุตสาหกรรม โทร. ๐ ๒๒๐๓ ๔๐๐๒, ๔๐๐๓



ที่ ๒๓ ๐๓๓๐(๑)/ ๕๓๗ ๕

กรมโรงงานอุตสาหกรรม  
ถนนพระรามที่ ๖ แขวงทุ่งพญาไท  
เขตราชเทวี กรุงเทพฯ ๑๐๕๐๐

๐ ๕ มีนาคม ๒๕๖๖

เรื่อง เปลี่ยนแปลงบุคลากรของห้องปฏิบัติการวิเคราะห์

เรียน กรรมการผู้จัดการ บริษัท เอแอลเอส แลบบอราทอรี กรุ๊ป (ประเทศไทย) จำกัด

อ้างถึง คำขอขึ้นทะเบียน/ต่ออายุ/เปลี่ยนแปลงบุคลากร และขอพิจารณาผลของห้องปฏิบัติการวิเคราะห์เอกชน  
ลงวันที่ ๔ กุมภาพันธ์ ๒๕๖๖

ตามที่หนังสือที่อ้างถึง บริษัท เอแอลเอส แลบบอราทอรี กรุ๊ป (ประเทศไทย) จำกัด ห้องปฏิบัติการ  
วิเคราะห์เอกชน เลขทะเบียน ๖-๒๐๔-๕๓๗๕ สถานที่ตั้งเลขที่ ๑๐๔ ซอยพัฒนาการ ๔๐ ถนนพัฒนาการ แขวงพัฒนาการ  
เขตสามพร้าว กรุงเทพมหานคร ขอเปลี่ยนแปลงบุคลากรของห้องปฏิบัติการวิเคราะห์ ความละเอียดแจ้งแล้ว นั้น

กรมโรงงานอุตสาหกรรมพิจารณาแล้ว มีความเห็นดังนี้

๑. ให้ออกเลือกเจ้าหน้าที่ประจำห้องปฏิบัติการวิเคราะห์ จำนวน ๑๕ ราย

- ๑) นายนคร สุขเจริญ ทะเบียนเลขที่ ๖-๒๐๔-๕๓๗๕
- ๒) นายบัญชา นามขัตต์ ทะเบียนเลขที่ ๖-๒๐๔-๕๓๗๕
- ๓) นายอรุณพล นิยมวิทย์ ทะเบียนเลขที่ ๖-๒๐๔-๕๓๗๕
- ๔) นางสาวพัชรียา พงษ์สมบัติ ทะเบียนเลขที่ ๖-๒๐๔-๕๓๗๕
- ๕) นางสาวภาณิดา สุวรรณตระกูล ทะเบียนเลขที่ ๖-๒๐๔-๕๓๗๕
- ๖) นางสาวกรรณิณี อึ้งดี ทะเบียนเลขที่ ๖-๒๐๔-๕๓๗๕
- ๗) นายสมโภช วัธสา ทะเบียนเลขที่ ๖-๒๐๔-๕๓๗๕
- ๘) นายณัฐนันท์ ปานประเสริฐ ทะเบียนเลขที่ ๖-๒๐๔-๕๓๗๕
- ๙) ว่าที่ร้อยตรีภาณุพงศ์ แสนศิริ ทะเบียนเลขที่ ๖-๒๐๔-๕๓๗๕
- ๑๐) นายณัฐนันท์ พุดศิริ ทะเบียนเลขที่ ๖-๒๐๔-๕๓๗๕
- ๑๑) นายณัฐนันท์ เขื่อนทอง ทะเบียนเลขที่ ๖-๒๐๔-๕๓๗๕
- ๑๒) นางสาวกาญจนา คงสุข ทะเบียนเลขที่ ๖-๒๐๔-๕๓๗๕
- ๑๓) นางสาววันฉัตร นิยมกลาง ทะเบียนเลขที่ ๖-๒๐๔-๕๓๗๕
- ๑๔) นางสาวกัญญารัตน์ ศรีนิลสา ทะเบียนเลขที่ ๖-๒๐๔-๕๓๗๕
- ๑๕) นายศิริวัฒน์ พาณิชย ทะเบียนเลขที่ ๖-๒๐๔-๕๓๗๕
- ๑๖) นางสาวกนกภรณ์ อูระ ทะเบียนเลขที่ ๖-๒๐๔-๕๓๗๕
- ๑๗) นางสาวจิตติภา ปะเทืองสุข ทะเบียนเลขที่ ๖-๒๐๔-๕๓๗๕
- ๑๘) นางสาวอริสา วิริยะดิษฐ์ ทะเบียนเลขที่ ๖-๒๐๔-๕๓๗๕
- ๑๙) นางสาวภาณิดา ยอดอินทร์ ทะเบียนเลขที่ ๖-๒๐๔-๕๓๗๕

๒. ให้เพิ่มเจ้าหน้าที่...

๒. ให้เพิ่มเจ้าหน้าที่ประจำห้องปฏิบัติการวิเคราะห์ จำนวน ๕ ราย
- ๑) นายกฤษณ์พิศ กิตติคุณาภิรักษ์ ทะเบียนเลขที่ ๖-๒๐๔-๕๓๗๕
- ๒) นายภัทรพล สว่างใจธรรม ทะเบียนเลขที่ ๖-๒๐๔-๕๓๗๕
- ๓) นายณัฐนันท์ เพ็ญชัยคำ ทะเบียนเลขที่ ๖-๒๐๔-๕๓๗๕
- ๔) นายศิริโชค พงษ์ประสม ทะเบียนเลขที่ ๖-๒๐๔-๕๓๗๕
- ๕) นายณัฐนันท์ คังแพง ทะเบียนเลขที่ ๖-๒๐๔-๕๓๗๕

อนึ่ง หนังสือฉบับนี้จะส่งต่อมายังห้องปฏิบัติการวิเคราะห์เอกชน  
ที่ ๒๓ ๐๓๓๐(๑)/๒๐๖๔ ลงวันที่ ๒๘ มกราคม ๒๕๖๕ คือในวันที่ ๒ กันยายน ๒๕๖๖ ทั้งนี้ สามารถยื่นคำขอ  
ผ่านระบบอิเล็กทรอนิกส์ได้ที่หน้าเว็บไซต์กรมโรงงานอุตสาหกรรม ตาม QR Code ที่แนบหนังสือฉบับนี้

จึงเรียนมาเพื่อทราบ

ขอแสดงความนับถือ



(นางริกาญจน์ นัครสกุลวิไล)

อธิบดีกรมมาตรฐานวิธีการวิเคราะห์ของมลพิษ  
ผู้อำนวยการศูนย์มาตรฐานวิธีการวิเคราะห์ของมลพิษ  
ผู้อำนวยการศูนย์มาตรฐานวิธีการวิเคราะห์ของมลพิษ  
ผู้อำนวยการศูนย์มาตรฐานวิธีการวิเคราะห์ของมลพิษ

กองวิจัยและเตือนภัยมลพิษโรงงาน  
กลุ่มมาตรฐานวิธีการวิเคราะห์ทดสอบมลพิษและทะเบียนห้องปฏิบัติการ  
โทร. ๐ ๒๒๐๓ ๔๐๐๒ ต่อ ๒๒๐๓-๕  
โทรสาร ๐ ๒๒๐๓ ๔๐๐๒ ต่อ ๒๒๐๓-๕  
ไปรษณีย์อิเล็กทรอนิกส์ sarabangudw@mail.go.th



“อุตสาหกรรมสีเขียว ประเทศไทยก้าวหน้า”



ที่ อก ๐๓๓๐(๑)/ ๖๑๒๕



กรมโรงงานอุตสาหกรรม  
ถนนพระรามที่ ๖ แขวงทุ่งพญาไท  
เขตราชเทวี กรุงเทพฯ ๑๐๕๐๐

๒๓ มีนาคม ๒๕๖๖

เรื่อง เปลี่ยนแปลงบุคลากรของห้องปฏิบัติการวิเคราะห์

เรียน กรรมการผู้จัดการ บริษัท เอนเทล แลบบอราทอรี กรุ๊ป (ประเทศไทย) จำกัด

อ้างถึง คำขอขึ้นทะเบียน/ต่ออายุ/เปลี่ยนแปลงบุคลากร และขอคืนสมรรถนะของห้องปฏิบัติการวิเคราะห์เอกชน  
ลงวันที่ ๑๐ มีนาคม ๒๕๖๖

ตามหนังสือที่อ้างถึง บริษัท เอนเทล แลบบอราทอรี กรุ๊ป (ประเทศไทย) จำกัด  
ห้องปฏิบัติการวิเคราะห์เอกชน เลขทะเบียน ๖-๒๐๔ สถานที่ตั้งเลขที่ ๑๐๔ ซอยพัฒนาการ ๔๐  
ถนนพัฒนาการ แขวงพัฒนาการ เขตสวนหลวง กรุงเทพมหานคร ขอเปลี่ยนแปลงบุคลากรของห้องปฏิบัติการ  
วิเคราะห์ ความละเอียดแจ้งแล้ว นั้น

กรมโรงงานอุตสาหกรรมพิจารณาแล้ว ให้เปลี่ยนแปลงชื่อเจ้าหน้าที่ประจำห้องปฏิบัติการ  
วิเคราะห์ จากเดิม นางสาวศิริณี มงคลจิ๋วดี ทะเบียนเลขที่ ๖-๒๐๔-๖-๔๕๖๑๑ เป็น นางสาวสิริคุณ มงคลจิ๋วดี  
ทะเบียนเลขที่ ๖-๒๐๔-๖-๔๕๖๑๑

ทั้งนี้ หากท่านมีความประสงค์จะยื่นคำขอใดๆ สามารถยื่นคำขอผ่านระบบอิเล็กทรอนิกส์  
ได้ที่หน้าเว็บไซต์กรมโรงงานอุตสาหกรรม ตาม QR Code ที่ท้ายหนังสือฉบับนี้

จึงเรียนมาเพื่อทราบ

ขอแสดงความนับถือ

สุวิทย์ อภัย

(นายประพนธ์ คำทรง)  
ผู้อำนวยการกองวิจัยและเตือนภัยมลพิษโรงงาน  
ปฏิตรากรรมและนิติกรมโรงงานอุตสาหกรรม

กองวิจัยและเตือนภัยมลพิษโรงงาน

กลุ่มมาตรฐานวิธีการวิเคราะห์ทดสอบมลพิษและทะเบียนห้องปฏิบัติการ

โทร. ๐ ๒๕๓๐ ๖๓๒๒ ต่อ ๒๑๐๓๔

โทรสาร ๐ ๒๕๓๐ ๖๓๒๒ ต่อ ๒๑๐๓๔

ไปรษณีย์อิเล็กทรอนิกส์ saraban@dlw.moi.go.th



ยื่นคำขอผ่านระบบอิเล็กทรอนิกส์



"อุตสาหกรรมก้าวไกล ปะเทศไทยก้าวหน้า ร่วมกันพัฒนา จุลสาหกรรมเป็นไทย"



ที่ อก ๐๓๓๐(๑)/ ๖๔๗๐



กรมโรงงานอุตสาหกรรม  
ถนนพระรามที่ ๖ แขวงทุ่งพญาไท  
เขตราชเทวี กรุงเทพฯ ๑๐๕๐๐

๒๔ มิถุนายน ๒๕๖๕

เรื่อง ขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์เอกชน

เรียน กรรมการผู้จัดการ บริษัท เอนเทล แลบบอราทอรี กรุ๊ป (ประเทศไทย) จำกัด

อ้างถึง คำขอขึ้นทะเบียน/ต่ออายุ/เปลี่ยนแปลงบุคลากร และขอคืนสมรรถนะของห้องปฏิบัติการวิเคราะห์เอกชน  
ลงวันที่ ๒๙ เมษายน ๒๕๖๔

สิ่งที่ส่งมาด้วย เอกสารแนบท้ายหนังสือรับขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์เอกชน  
บริษัท เอนเทล แลบบอราทอรี กรุ๊ป (ประเทศไทย) จำกัด จำนวน ๒ แผ่น

ตามหนังสือที่อ้างถึง บริษัท เอนเทล แลบบอราทอรี กรุ๊ป (ประเทศไทย) จำกัด ขอขึ้นทะเบียน  
ห้องปฏิบัติการวิเคราะห์เอกชน พร้อมรายชื่อผู้ควบคุมดูแลห้องปฏิบัติการวิเคราะห์ เจ้าหน้าที่ประจำ  
ห้องปฏิบัติการวิเคราะห์ และรายการสมรรถนะที่จะทำการวิเคราะห์ ต่อกรมโรงงานอุตสาหกรรม นั้น

กรมโรงงานอุตสาหกรรมพิจารณาแล้ว ให้บริษัท เอนเทล แลบบอราทอรี กรุ๊ป  
(ประเทศไทย) จำกัด ขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์เอกชน มีเลขทะเบียน ๖-๒๐๔ สถานที่ตั้งเลขที่  
๖๒๖/๑๐ หมู่ที่ ๕ ตำบลแม่ไม้ อำเภอลำปาง จังหวัดลำปาง โดยมีองค์ประกอบดังนี้

ก. ผู้ควบคุมดูแลห้องปฏิบัติการวิเคราะห์

๑) นายเดช ช้างชน ทะเบียนเลขที่ ๖-๒๐๔-๖-๔๕๖๑๑

๒) นางวิลาวัลย์ บริรักษ์ ทะเบียนเลขที่ ๖-๒๐๔-๖-๔๕๖๑๑

๓) นายสุพรรณ สลมนะ ทะเบียนเลขที่ ๖-๒๐๔-๖-๔๕๖๑๑

ข. เจ้าหน้าที่ประจำห้องปฏิบัติการวิเคราะห์

๑) นางสาวณัฐพร บรรจงกิจ ทะเบียนเลขที่ ๖-๒๐๔-๖-๔๕๖๑๑

๒) นางพจนา สีดา ทะเบียนเลขที่ ๖-๒๐๔-๖-๔๕๖๑๑

๓) นางสาวอนิศา กุลสุวังสี ทะเบียนเลขที่ ๖-๒๐๔-๖-๔๕๖๑๑

๔) นายพิทยา ทองแดง ทะเบียนเลขที่ ๖-๒๐๔-๖-๔๕๖๑๑

๕) นางชัชชยา สุนทรภะ ทะเบียนเลขที่ ๖-๒๐๔-๖-๔๕๖๑๑

๖) ว่าที่ ร.ต.ณชัย ม่วงมา ทะเบียนเลขที่ ๖-๒๐๔-๖-๔๕๖๑๑

๗) นายวราวุฒิ หับพา ทะเบียนเลขที่ ๖-๒๐๔-๖-๔๕๖๑๑

๘) นายศักดิ์รินทร์ จรัสสาย ทะเบียนเลขที่ ๖-๒๐๔-๖-๔๕๖๑๑

๙) นายสุรศักดิ์ สาขิน ทะเบียนเลขที่ ๖-๒๐๔-๖-๔๕๖๑๑

๑๐) นางสาวเพชรคุณ ภวภูตานนท์ ทะเบียนเลขที่ ๖-๒๐๔-๖-๔๕๖๑๑

๑๑) นายสุภากร อามแก้ว ทะเบียนเลขที่ ๖-๒๐๔-๖-๔๕๖๑๑

๑๒) นายสุทธิศักดิ์ โชคอินันท์ ทะเบียนเลขที่ ๖-๒๐๔-๖-๔๕๖๑๑

๑๓) นายวิมล...

-๒-

๑๓) นายวิมล หันไชยเนาว์

๑๔) นางสาววนิดา เจริญตระกูล

๑๕) นางสาววนิดา ผดุงจิตต์

๑๖) นายธนสิทธิ์ วงศ์ไชย

๑๗) นายชัยสุนทร เลิศนันทกุลชัย

๑๘) นายสุจิตา เพ็ชรแสง

๑๙) นายกันตภณ มณีสัมพันธ์

๒๐) นางสาวจินตนิยา โกมลชนะ

๒๑) นายธวัชพร อธิกุลจินดา

๒๒) นายคุณนัฐ พิสมัยพันธ์

๒๓) นายศุภชัย วงศ์ศรีชัย

๒๔) นายปฐมพงศ์ กรสวัสดิ์

๒๕) นายสิริวัฒน์ ดันโพธิ์

๒๖) นางสาวกิตติยา สันติยาภิรมย์

๒๗) นางสาวเจษฎาพร ศรีบุญเรือง

๒๘) นางสาวณัฐพร สิงห์ใจ

๒๙) นางสาวศิริรัตน์ ศิริมงคล

๓๐) นายพิพัฒน์ นิพัทธ์เศรษฐ์

๓๑) นายศิริวิทย์ เรืองสม

๓๒) นายปารเมศ สัตยาคุณ

๓๓) นายณัฐภา ธรรมะโร

๓๔) นางสาวศุภรัตน์ โสจันทร์

๓๕) นายพชรกร อินทรเสนา

๓๖) นายทิวากร เชื้อมาก

๓๗) นายอนุรักษ์ ทองขจรศักดิ์

๓๘) นายอริชชาติ วิลาศ

๓๙) นายจรัสศรี ศรีรักษา

๔๐) นายประสาธมิตร เชื้อนเพชร

๔๑) นายภาณุวัฒน์ วังบง

๔๒) นายสันติ ชัยชนะ

๔๓) นายสิทธิชัย แก้วมาก

๔๔) นายทินกร กุลชาติ

ทะเบียนเลขที่ ๖-๒๐๔-๖-๔๕๖๑๑

ทะเบียนเลขที่ ๖-๒๐๔-๖-๔๕๖๑๑

ทะเบียนเลขที่ ๖-๒๐๔-๖-๔๕๖๑๑

ทะเบียนเลขที่ ๖-๒๐๔-๖-๔๕๖๑๑

ทะเบียนเลขที่ ๖-๒๐๔-๖-๔๕๖๑๑

ทะเบียนเลขที่ ๖-๒๐๔-๖-๔๕๖๑๑

ทะเบียนเลขที่ ๖-๒๐๔-๖-๔๕๖๑๑

ทะเบียนเลขที่ ๖-๒๐๔-๖-๔๕๖๑๑

ทะเบียนเลขที่ ๖-๒๐๔-๖-๔๕๖๑๑

ทะเบียนเลขที่ ๖-๒๐๔-๖-๔๕๖๑๑

ทะเบียนเลขที่ ๖-๒๐๔-๖-๔๕๖๑๑

ทะเบียนเลขที่ ๖-๒๐๔-๖-๔๕๖๑๑

ทะเบียนเลขที่ ๖-๒๐๔-๖-๔๕๖๑๑

ทะเบียนเลขที่ ๖-๒๐๔-๖-๔๕๖๑๑

ทะเบียนเลขที่ ๖-๒๐๔-๖-๔๕๖๑๑

ทะเบียนเลขที่ ๖-๒๐๔-๖-๔๕๖๑๑

ทะเบียนเลขที่ ๖-๒๐๔-๖-๔๕๖๑๑

ทะเบียนเลขที่ ๖-๒๐๔-๖-๔๕๖๑๑

ทะเบียนเลขที่ ๖-๒๐๔-๖-๔๕๖๑๑

ทะเบียนเลขที่ ๖-๒๐๔-๖-๔๕๖๑๑

ทะเบียนเลขที่ ๖-๒๐๔-๖-๔๕๖๑๑

ทะเบียนเลขที่ ๖-๒๐๔-๖-๔๕๖๑๑

ทะเบียนเลขที่ ๖-๒๐๔-๖-๔๕๖๑๑

ทะเบียนเลขที่ ๖-๒๐๔-๖-๔๕๖๑๑

ทะเบียนเลขที่ ๖-๒๐๔-๖-๔๕๖๑๑

ทะเบียนเลขที่ ๖-๒๐๔-๖-๔๕๖๑๑

ทะเบียนเลขที่ ๖-๒๐๔-๖-๔๕๖๑๑

ทะเบียนเลขที่ ๖-๒๐๔-๖-๔๕๖๑๑

ทะเบียนเลขที่ ๖-๒๐๔-๖-๔๕๖๑๑

ทะเบียนเลขที่ ๖-๒๐๔-๖-๔๕๖๑๑

ทะเบียนเลขที่ ๖-๒๐๔-๖-๔๕๖๑๑

ทะเบียนเลขที่ ๖-๒๐๔-๖-๔๕๖๑๑

ค. ขอขยายสมรรถนะที่ได้รับขึ้นทะเบียนให้วิเคราะห์ในน้ำเสีย จำนวน ๑๔ รายการ  
อากาศเสีย (ปล่องระบาย) จำนวน ๗ รายการ และน้ำใต้ดิน จำนวน ๓ รายการ รวมทั้งสิ้นจำนวน ๒๔ รายการ  
ตามสิ่งที่ส่งมาด้วย

ขอแสดงความนับถือ

สุวิทย์ อภัย  
(นางจินดา เศรษฐินันท์)  
ผู้อำนวยการกองวิจัยและเตือนภัยมลพิษโรงงาน  
ปฏิตรากรรมและนิติกรมโรงงานอุตสาหกรรม

๒๔ มิ.ย. ๒๕๖๕

กองวิจัยและเตือนภัยมลพิษโรงงาน

ศูนย์วิจัยและเตือนภัยมลพิษโรงงานภาคตะวันออก

โทร. ๐ ๒๕๐๕ ๗๒๖๑-๓

ไปรษณีย์อิเล็กทรอนิกส์ elnw@dlw.moi.go.th

เอกสารแนบท้ายหนังสือรับขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์เอกชน

บริษัท เอแอลเอส แล็บอราทอรี กรุ๊ป (ประเทศไทย) จำกัด เลขทะเบียน 7-๓๒๓๓

ที่ อก ๐๓๑๐(๓)/ ๖๔๗๐

ลงวันที่ ๒๔ มิถุนายน ๒๕๖๔

ขอข่ายสารมลพิษที่ได้รับขึ้นทะเบียนจากกรมโรงงานอุตสาหกรรม 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>[2]</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 (ปล่องระบาย) จำนวน 7 รายการ

ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
1	Carbon Monoxide	1) Sampling Bag, Non-Dispersive Infrared Method <sup>[3]</sup> 2) Instrumental Analyzer Method <sup>[6]</sup>
2	Hydrogen Sulfide	Absorption Sampling, Iodometric Method <sup>[2]</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>

วิศกร สันฤทธิ์

(นางสาววิชุดา สันฤทธิ์ผล)

ผู้อำนวยการ

ศูนย์วิจัยและเตือนภัยมลพิษโรงงานภาคตะวันออก

Sulfuric Acid...

ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
6	Sulfuric Acid	Isokinetic Sampling, Barium – Thorin Titrimetric Method <sup>[8]</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>

เอกสารอ้างอิง

1. ธงชัย พรหมสวัสดิ์ และวิบูลย์ลักษณ์ วิสุทธิศักดิ์, บรรณาธิการ. (2547) คู่มือวิเคราะห์น้ำเสีย. พิมพ์ครั้งที่ 4. กรุงเทพฯ: สมาคมวิศวกรรมสิ่งแวดล้อมแห่งประเทศไทย.
2. APHA, AWWA, WEF. Standard Methods for the Examination of Water and Wastewater. 23<sup>rd</sup> ed. Washington, DC.: APHA, 2017
3. กระทรวงอุตสาหกรรม. ประกาศกระทรวงอุตสาหกรรม, พ.ศ. 2549. เรื่อง กำหนดค่าปริมาณเขม่าควันที่เจือปนในอากาศที่ระบายออกจากปล่องของหม้อน้ำโรตารีที่ใช้แก๊สเป็นเชื้อเพลิง.
4. ราชกิจจานุเบกษา. 4 ธันวาคม 2549. เล่มที่ 123 ตอนพิเศษ 125ง.
4. กระทรวงอุตสาหกรรม. ประกาศกระทรวงอุตสาหกรรม, พ.ศ. 2549. เรื่อง กำหนดค่าปริมาณเขม่าควันที่เจือปนในอากาศที่ระบายออกจากปล่องของหม้อน้ำของโรงงาน.
- 4 ธันวาคม 2549. เล่มที่ 123 ตอนพิเศษ 125ง.
5. United States Environmental Protection. Standards of Performance for New Stationary Sources. 40 CFR 60. Appendix A, 2017.
6. United States Environmental Protection. Standards of Performance for New Stationary Sources. 40 CFR 60. Appendix A, 2019.
7. United States Environmental Protection. Standards of Performance for New Stationary Sources. 40 CFR 60. Appendix A, 2020.
8. United States Environmental Protection Agency. Determination of Carbon Monoxide Emissions from Stationary Sources; Instrumental Analyzer Procedure. 40 CFR 60. Appendix A Method 10, 2017.
9. United States Environmental Protection Agency. Determination of Oxide of Nitrogen Emissions from Stationary Sources; Instrumental Analyzer Procedure. 40 CFR 60. Appendix A Method 7E, 2019.
10. United States Environmental Protection Agency. Determination of Sulfur Dioxide Emissions from Stationary Sources; Instrumental Analyzer Procedure. 40 CFR 60. Appendix A Method 6C, 2017.

วิศกร สันฤทธิ์

(นางสาววิชุดา สันฤทธิ์ผล)

ผู้อำนวยการ

ศูนย์วิจัยและเตือนภัยมลพิษโรงงานภาคตะวันออก

ศูนย์วิจัยและเตือนภัยมลพิษโรงงานภาคตะวันออก กองวิจัยและเตือนภัยมลพิษโรงงาน กรมโรงงานอุตสาหกรรม โทร ๐ ๒๕๐๔ ๙๖๖๑-๑๑