

ภาคผนวก ง

ใบรับรองการสอบเทียบเครื่องมือ



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รายการเครื่องมือที่ใช้ในการวิเคราะห์ / ทดสอบ

Sample Name	Parameter	Equipment Name	ID No.	Calibrated Date	Next Cal	Freq. Calibrate (Months)
Stack	Aluminum	Console Control Unit	BKK_FS0468	13-Jul-23	13-Jan-24	6
Stack	Aluminum	Console Control Unit	BKK_FS0527	13-Jul-23	13-Jan-24	6
Stack	Aluminum	Flue gas Analyzer	RYG_FS0465	23-Jan-23	23-Jan-24	12
Stack	Aluminum	Flue gas Analyzer	RYG_FS0563	28-Dec-22	28-Dec-23	12
Stack	Aluminum	ICP-OES	BKK_EL0037	2-Mar-23	1-Mar-24	12
Stack	Carbon Monoxide	Console Control Unit	BKK_FS0468	13-Jul-23	13-Jan-24	6
Stack	Carbon Monoxide	Flue gas Analyzer	RYG_FS0465	23-Jan-23	23-Jan-24	12
Stack	Carbon Monoxide	CO Analyzer	RYG_E00394	21-Dec-22	21-Dec-23	12
Stack	Oxides of Nitrogen	Console Control Unit	BKK_FS0468	13-Jul-23	13-Jan-24	6
Stack	Oxides of Nitrogen	Console Control Unit	BKK_FS0527	13-Jul-23	13-Jan-24	6
Stack	Oxides of Nitrogen	Console Control Unit	RYG_FS0315	13-Jul-23	13-Jan-24	6
Stack	Oxides of Nitrogen	Flue gas Analyzer	RYG_FS0465	23-Jan-23	23-Jan-24	12
Stack	Oxides of Nitrogen	Flue gas Analyzer	RYG_FS0563	28-Dec-22	28-Dec-23	12
Stack	Oxides of Nitrogen	Flue gas Analyzer	RYG_FS0563	28-Dec-22	28-Dec-23	12
Stack	Oxides of Nitrogen	Flue gas Analyzer	RYG_FS0464	23-Jan-23	23-Jan-24	12
Stack	Oxides of Nitrogen	Vacuum Gauge	BKK_FS0483	14-Feb-23	14-Aug-24	18
Stack	Oxides of Nitrogen	Vacuum Gauge	BKK_FS0479	14-Feb-23	14-Aug-24	18
Stack	Oxides of Nitrogen	Vacuum Gauge	RYG_FS0333	30-Mar-23	30-Sep-24	18
Stack	Oxides of Nitrogen	SPECTROPHOTOMETER	RYG_E00037	27-Sep-22	27-Mar-24	18
Stack	n-Decane	Console Control Unit	BKK_FS0468	13-Jul-23	13-Jan-24	6
Stack	n-Decane	Console Control Unit	BKK_FS0527	13-Jul-23	13-Jan-24	6
Stack	n-Decane	Console Control Unit	BKK_FS0527	13-Jul-23	13-Jan-24	6
Stack	n-Decane	Flue gas Analyzer	RYG_FS0465	23-Jan-23	23-Jan-24	12
Stack	n-Decane	Flue gas Analyzer	RYG_FS0563	28-Dec-22	28-Dec-23	12
Stack	n-Decane	Flue gas Analyzer	RYG_FS0563	28-Dec-22	28-Dec-23	12
Stack	n-Decane	Field Rotameter	BKK_FS1042	1-Jul-23	1-Oct-23	3
Stack	n-Decane	GC-FID	BKK_E00126	21-Apr-23	21-Oct-24	18
Stack	Total Suspended Particulate	Console Control Unit	BKK_FS0468	13-Jul-23	13-Jan-24	6
Stack	Total Suspended Particulate	Console Control Unit	BKK_FS0527	13-Jul-23	13-Jan-24	6
Stack	Total Suspended Particulate	Console Control Unit	BKK_FS0527	13-Jul-23	13-Jan-24	6
Stack	Total Suspended Particulate	Flue gas Analyzer	RYG_FS0315	13-Jul-23	13-Jan-24	6
Stack	Total Suspended Particulate	Flue gas Analyzer	RYG_FS0465	23-Jan-23	23-Jan-24	12
Stack	Total Suspended Particulate	Flue gas Analyzer	RYG_FS0563	28-Dec-22	28-Dec-23	12
Stack	Total Suspended Particulate	Flue gas Analyzer	RYG_FS0563	28-Dec-22	28-Dec-23	12
Stack	Total Suspended Particulate	Digital Balance	RYG_E00003	1-Mar-23	1-Mar-24	12
Stack	Dioxin and Furan	Console Control Unit	BKK_FS0468	13-Jul-23	13-Jan-24	6
Stack	Dioxin and Furan	Flue gas Analyzer	RYG_FS0465	23-Jan-23	23-Jan-24	12
Stack	Dioxin and Furan	HRGC/MS	No. 73/2022	14-Feb-22	14-Feb-27	60
Ambient	Total Suspended Particulate	High Volume	RYG_FS0661	-	-	On site Calibration
Ambient	Total Suspended Particulate	High Volume	RYG_FS0662	-	-	On site Calibration
Ambient	Total Suspended Particulate	High Volume	RYG_FS0173	-	-	On site Calibration
Ambient	Total Suspended Particulate	High Volume	RYG_FS0664	-	-	On site Calibration
Ambient	Total Suspended Particulate	Digital Balance	RYG_E00001	1-Mar-23	1-Mar-24	12
Ambient	Particulate Matter (PM-10)	High Volume	RYG_FS0668	-	-	On site Calibration
Ambient	Particulate Matter (PM-10)	High Volume	RYG_FS0666	-	-	On site Calibration
Ambient	Particulate Matter (PM-10)	High Volume	RYG_FS0400	-	-	On site Calibration
Ambient	Particulate Matter (PM-10)	High Volume	RYG_FS0665	-	-	On site Calibration
Ambient	Particulate Matter (PM-10)	Digital Balance	RYG_E00001	1-Mar-23	1-Mar-24	12
Ambient	Nitrogen Dioxide	NO ₂ Analyzer	RYG_FS0461	1-Jul-23	1-Jan-24	6
Ambient	Nitrogen Dioxide	NO ₂ Analyzer	RYG_FS0459	1-Jul-23	1-Jan-24	6
Ambient	Nitrogen Dioxide	NO ₂ Analyzer	RYG_FS0453	1-Jul-23	1-Jan-24	6
Ambient	Nitrogen Dioxide	NO ₂ Analyzer	RYG_FS0551	1-Jul-23	1-Jan-24	6
Ambient	Sulfur Dioxide	SO ₂ Analyzer	RYG_FS0460	2-Jul-23	2-Jan-24	6
Ambient	Sulfur Dioxide	SO ₂ Analyzer	RYG_FS0458	2-Jul-23	2-Jan-24	6
Ambient	Sulfur Dioxide	SO ₂ Analyzer	RYG_FS0452	2-Jul-23	2-Jan-24	6
Ambient	Sulfur Dioxide	SO ₂ Analyzer	RYG_FS0257	2-Jul-23	2-Jan-24	6
Ambient	Wind Speed / Wind Direction	Wind Speed / Wind Direction	BKK_FS0143	5-Jan-23	5-Jul-24	18

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Sample Name	Parameter	Equipment Name	ID No.	Calibrated Date	Next Cal	Freq. Calibrate (Months)
Workplace	Chlorine	Field Rotameter	RYG_FS0198	1-Jul-23	1-Oct-23	3
Workplace	Total Dust	Field Rotameter	RYG_FS0198	1-Jul-23	1-Oct-23	3
Workplace	Digital Balance	Digital Balance	RYG_E00004	1-Mar-23	1-Mar-24	12
Workplace	Respirable Dust	Field Rotameter	RYG_FS0198	1-Jul-23	1-Oct-23	3
Workplace	Respirable Dust	Digital Balance	RYG_E00004	1-Mar-23	1-Mar-24	12
Workplace	Hydrogen Chloride	Field Rotameter	BKK_FS1042	1-Jul-23	1-Oct-23	3
Workplace	Hydrogen Chloride	Ion Chromatography	BKK_E00069	12-Jan-23	12-Jan-24	12
Workplace	Aluminum	Field Rotameter	RYG_FS0198	1-Jul-23	1-Oct-23	3
Workplace	Aluminum	ICP-OES	BKK_EL0037	2-Mar-23	1-Mar-24	12
Workplace	Total VOC	TWOC Analyzer	BKK_FS0820	2-Mar-22	31-Aug-23	18
Noise	Leq 8 hrs	Sound Calibrator	RYG_FS0496	17-Jan-23	17-Jan-24	12
Noise	Leq 8 hrs	Sound Level Meter	RYG_FS0301	18-Oct-22	18-Oct-23	12
Noise	Leq 8 hrs	Sound Level Meter	RYG_FS0387	18-Oct-22	18-Oct-23	12
Noise	Leq 8 hrs	Sound Level Meter	RYG_FS0388	18-Oct-22	18-Oct-23	12
Noise	Leq 8 hrs	Sound Level Meter	RYG_FS0433	25-Jan-23	25-Jan-24	12
Noise	Leq 8 hrs	Sound Level Meter	RYG_FS0628	26-Jan-23	26-Jan-24	12
Noise	Leq 8 hrs	Sound Level Meter	RYG_FS0629	26-Jan-23	26-Jan-24	12
Noise	Leq 8 hrs	Sound Level Meter	RYG_FS0630	26-Jan-23	26-Jan-24	12
Noise	Leq 24 hrs	Sound Calibrator	RYG_FS0496	17-Jan-23	17-Jan-24	12
Noise	Leq 24 hrs	Sound Level Meter	RYG_FS0494	13-Jan-23	13-Jan-24	12
Noise	Leq 24 hrs	Sound Level Meter	RYG_FS0614	12-Oct-22	12-Oct-23	12
Noise	Leq 24 hrs	Sound Level Meter	RYG_FS0616	12-Oct-22	12-Oct-23	12
Noise	Leq 24 hrs	Sound Level Meter	RYG_FS0617	20-Oct-22	20-Oct-23	12
Noise	Leq 24 hrs	Sound Level Meter	RYG_FS0618	20-Oct-22	20-Oct-23	12
Noise	Noise Dose, TWA	Dose Badge Reader	RYG_FS0210	22-May-23	22-May-24	12
Heat	Heat Stress	Heat Stress Monitor	RYG_FS0228	25-Aug-22	25-Aug-23	12
Heat	Heat Stress	Heat Stress Monitor	RYG_FS0230	25-Aug-22	25-Aug-23	12
Heat	Heat Stress	Heat Stress Monitor	RYG_FS0232	14-Feb-23	14-Feb-24	12
Rayong Lab	BOD	DO meter with Sensor	RYG_E00032	28-Jan-23	28-Jan-25	18
Rayong Lab	BOD	Burette	RYG_E00154	29-May-23	29-May-24	12
Rayong Lab	BOD	Burette	RYG_E00216	25-Sep-23	25-Sep-24	12
Rayong Lab	COD	Spectrophotometer	RYG_E00037	18-Sep-23	18-Mar-25	18
Rayong Lab	Fluoride	pH ISE Meter	RYG_E00152	14-Dec-23	14-Dec-24	12
Rayong Lab	Oil & Grease	Electronic Balance	RYG_E00002	1-Mar-23	1-Mar-24	12
Rayong Lab	Oil & Grease	Hot Air Oven	RYG_E00006	20-Oct-22	20-Apr-24	18
Rayong Lab	Oil & Grease	Water Bath	RYG_E00061	20-Oct-22	20-Apr-24	18
Rayong Lab	pH on site	pH meter	RYG_FS0595	3-Jul-23	3-Jul-24	12
Rayong Lab	Total Dissolved Solids 180°C	Electronic Balance	RYG_E00002	1-Mar-23	1-Mar-24	12
Rayong Lab	Total Dissolved Solids 180°C	Hot Air Oven	RYG_E00010	20-Oct-22	20-Apr-24	18
Rayong Lab	Total Dissolved Solids	Electronic Balance	RYG_E00002	1-Mar-23	1-Mar-24	12
Rayong Lab	Total Suspended Solids	Hot Air Oven	RYG_E00010	20-Oct-22	20-Apr-24	18
Water Lab	Hexavalent Chromium	Spectrophotometer	BKK_E00018	15-Sep-23	15-Sep-24	12

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CONSULE CONTROL UNIT CALIBRATION TEST REPORT



Calibration of Date : 13-Jul-23
Next Cal. Date : 13-Jan-24
Barometric Pressure (mmHg) : 751
Relative Humidity (%) : 60.0
Temperature (C°) : 29.0

Reference Dry Gas Meter Data

Reference Dry Gas Meter ID : BKK_FS1122
Serial No. : A2003240
Correction Factor (Y) : 1.0160
Next Calibration Date : 25-Nov-23

ΔH (mm H ₂ O)	Θ Minutes	Reference Dry Gas Meter Calibration				Console Control ; Drygas Meter						Dry Gas Meter Correction Factor (Y)	Orifice Calibration Factor (ΔHg)
		V (Liters)		Tr (°C)	Vn (Liters)		Ti (°C)	To (°C)		Avg 1m (°C)			
		Final	Initial		Final	Initial		Final	Initial				
15	12.65	150.00	0.00	150.00	26.0	241330.0	241175.0	155.00	25.0	26.0	26.0	0.9818	48.8873
25	9.90	150.00	0.00	150.00	26.0	241498.0	241343.0	155.00	26.0	26.0	26.0	0.9808	49.9039
50	6.82	150.00	0.00	150.00	26.0	241659.0	241504.0	155.00	26.0	26.0	26.0	0.9784	47.3656
100	4.82	150.00	0.00	150.00	26.0	241820.0	241665.0	154.00	26.0	26.0	26.0	0.9800	47.3171
150	4.02	150.00	0.00	150.00	26.0	241980.0	241844.0	154.00	27.0	27.0	27.0	0.9785	49.2959
										Avg.		0.9799	48.5360

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

ΔVg : Orifice pressure differential that equates to 21.24 in of air @ 25 C and 760 mm of mercury, mmH₂O : tolerance for individual values ± 5.08 from average .

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

Calibrated by :

Saksit Praisarnphusit

(Mr. Saksit Praisarnphusit)

Field Scientist (4)

Approved by :

Nattapon Jengwareewong

(Mr. Nattapon Jengwareewong)

Field Specialist (1)

FORM NO. : F-06-025 REVISION NO. : 2 ISSUE DATE: 30 Jan 22

Pitot Tube Calibration Data

Pitot Tube Identification Number : BKK_FS0472
Lab test duct Number : 258-1-13-01
Calibration Sheet No. : C-130723-BKK_FS0472
Calibration Date : 13 Jul 23
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 ₂ O)	Type s pitot tube (ΔP, mm.H ₂ O)	Cp (s) Leg A	Cp (s) Leg B
Test 1	A	12.00	17.00	0.840	-
	B	12.00	17.00	-	0.840
Test 2	A	12.00	17.00	0.840	-
	B	12.00	17.00	-	0.840
Test 3	A	12.00	16.80	0.845	-
	B	12.00	16.80	-	0.845
			Cp	0.842	0.842

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

$$\left[Cp(A) - Cp(B) \right] must BE \leq 0.01$$

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

Calibrated by :

Saksit Praisarnphusit

(Mr. Saksit Praisarnphusit)

Field Scientist (4)

Approved by :

Nattapon Jengwareewong

(Mr. Nattapon Jengwareewong)

Specialist (1)



Pitot Tube Calibration Data

Pitot Tube Identification Number : BKK_FS0473 Calibration Date : 13 Jul 23
Lab test duct Number : 258-1-13-01 Standard Pitot ID : BKK_FS0441
Calibration Sheet No. : C-130723-BKK_FS0473 Cp Standard : 0.99

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

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

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

$$\text{Average deviation(A or B)} = \frac{\sum_{i=1}^n [C_p(s) - C_p(A \text{ or } B)]}{3} \text{ must BE } \leq 0.01$$

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

Approved by : Nattapon Jengwareewong
(Mr.Nattapol Jengwareewong)
Specialist (1)

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



DIGITAL TEMPERATURE CALIBRATION DATA SHEET

Calibration Date :	13 Jul 23	Ambient Temperature (°C)	29
Calibration sheet No. :	C-130723-BKK_FS0469	Relative Humidity (%) :	60
Digital Temperature ID :	BKK_FS0469	Reference Temperature ID	BKK_FS1144
Serial No. :	1302005	Serial No. :	20109006013
Model :	XC-572-V	Model :	Digicon-CC-VT-MS
		Next Calibrate :	14 Aug 24

Location	Reference Temperature °C	Digital Temperature °C	Error °C	MPE	Pass / Fail
Stack	0	0	0	±3	Pass
	25	24	-1	±3	Pass
	50	49	-1	±3	Pass
	100	101	1	±3	Pass
	150	150	0	±3	Pass
	200	200	0	±3	Pass
	250	250	0	±3	Pass
	300	300	0	±3	Pass
Probe	500	501	1	±3	Pass
	100	101	1	±3	Pass
	120	120	0	±3	Pass
	140	140	0	±3	Pass
Oven	100	101	-	±3	-
	120	121	-	±3	-
	140	141	-	±3	-
	100	102	2	±3	Pass
Filter	120	121	1	±3	Pass
	140	141	1	±3	Pass
Exit	0	0	0	±3	Pass
	10	9	-1	±3	Pass
	20	19	-1	±3	Pass
Meter	0	-1	-1	±3	Pass
	25	24	-1	±3	Pass
	50	48	-2	±3	Pass
AUX	0	0	0	±3	Pass
	25	24	-1	±3	Pass
	50	49	-1	±3	Pass

MPE : (Maximum permissible error of measurement) ค่าความผิดพลาดสูงสุดของการวัดที่อนุญาต

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

Approved by : Nattapon Jengwareewong
(Mr.Nattapol Jengwareewong)
Specialist (1)

FORM NO.: F 06-027 REVISION NO.: 2 ISSUE DATE: 16/2/23

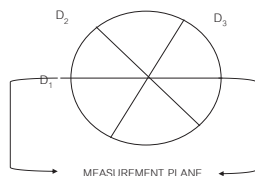


PROBE NOZZLE DIAMETER CALIBRATION DATA SHEET

Calibration Date :	13 Jul 23	Nozzle Set ID. :	BKK_FS0474
Calibration Sheet No. :	C-130723-BKK_FS0474	Vernier Caliper ID. :	BKK_FS1123

Nozzle ID #	Nozzle Diameter (cm.)			Hi - Lo ΔD	(D ₁ + D ₂ + D ₃) / 3 D _{avg}
	D ₁	D ₂	D ₃		
1	0.300	0.299	0.300	0.001	0.300
2	0.450	0.450	0.450	0.000	0.450
3	0.599	0.602	0.601	0.003	0.601
4	0.763	0.769	0.770	0.007	0.767
5	0.931	0.932	0.932	0.001	0.932
6	1.090	1.092	1.092	0.002	1.091
7	1.264	1.263	1.264	0.001	1.264
8	1.599	1.600	1.599	0.001	1.599

Where :
D₁, D₂, D₃ = 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_{avg} = (D₁ + D₂ + D₃) / 3



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

Approved by : Nattapon Jengwareewong
(Mr.Nattapol Jengwareewong)
Field Specialist (1)

FORM NO.: F 06-026 REVISION NO.: 1 ISSUE DATE: 16 Jan 22



CONSOLE CONTROL UNIT CALIBRATION TEST REPORT

Calibration of Date : 13-Jul-23 Barometric Pressure (mmHg) : 751
Next Cal. Date : 13-Jan-24 Relative Humidity (%) : 60.0
Temperature (°C) : 29.0
Reference Dry Gas Meter Data
Reference Dry Gas Meter ID : BKK_FS1122
Serial No. : A2003240
Correction Factor (Y) : 1.0160
Next Calibration Date : 25-Nov-23

ΔH (mm H ₂ O)	Θ Minutes	Reference Dry Gas Meter Calibration				Console Control Dry Gas Meter						Dry Gas Meter Correction Factor (Y)	Orifice Calibration Factor (ΔH)
		Vr (liters)		Tr (°C)	Vm (liters)		Ti (°C)		To (°C)	Avg.Tm (°C)			
		Final	Initial		Total	Initial	Total	Initial			Total		
15	11.77	150.00	0.00	150.00	26.0	490392.0	490235.0	27.0	27.0	27.0	27.0	1.0357	42.1811
25	9.13	150.00	0.00	150.00	26.0	490671.0	490524.0	27.0	27.0	27.0	27.0	1.0377	42.3015
50	6.45	150.00	0.00	150.00	26.0	490690.0	490693.0	29.0	29.0	28.0	28.0	1.0386	42.0841
100	4.52	150.00	0.00	150.00	26.0	490990.0	490843.0	29.0	29.0	28.0	28.0	1.0386	41.3338
150	3.72	150.00	0.00	150.00	26.0	491477.0	491000.0	29.0	29.0	29.0	29.0	1.0320	41.8897
Avg.										1.0061	41.9515		

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 : tolerance for individual values ± 5.0% from average .

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

Calibrated by : Saksit Phaisanphiset
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Field Scientist (4)

Approved by : Nattapon Jengwareewong
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Field Specialist (1)

FORM NO.: F 06-024 REVISION NO.: 2 ISSUE DATE: 30 Jan 22



Pitot Tube Calibration Data

Pitot Tube Identification Number : BKK_FS0531 Calibration Date : 13 Jul 23
Lab test duct Number : 258-1-13-01 Standard Pitot ID : BKK_FS0441
Calibration Sheet No. : C-130723-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 ₂ O)	Type s pitot tube (ΔP , mm.H ₂ O)	Cp (s) Leg A	Cp (s) Leg B
Test 1	A	12.00	17.00	0.840	-
	B	12.00	17.00	-	0.840
Test 2	A	12.00	17.00	0.840	-
	B	12.00	17.00	-	0.840
Test 3	A	12.00	16.80	0.845	-
	B	12.00	16.80	-	0.845
\bar{C}_p				0.842	0.842

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

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

$$\text{Average deviation(A or B)} = \frac{\sum_{i=1}^n [Cp(s) - Cp(A \text{ or } B)]}{3} \text{ must BE } \leq 0.01$$

Calibrated by : Saksit Phaisanphiset

(Mr. Saksit Phaisanphiset)
Field Scientist (4)

Approved by : Nattapol Jiengwareewong

(Mr.Nattapol Jiengwareewong)
Specialist (1)

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



Pitot Tube Calibration Data

Pitot Tube Identification Number : BKK_FS0532 Calibration Date : 13 Jul 23
Lab test duct Number : 258-1-13-01 Standard Pitot ID : BKK_FS0441
Calibration Sheet No. : C-130723-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 ₂ O)	Type s pitot tube (ΔP , mm.H ₂ O)	Cp (s) Leg A	Cp (s) Leg B
Test 1	A	12.00	17.00	0.840	-
	B	12.00	17.00	-	0.840
Test 2	A	12.00	17.00	0.840	-
	B	12.00	17.00	-	0.840
Test 3	A	12.00	16.80	0.845	-
	B	12.00	16.80	-	0.845
\bar{C}_p				0.842	0.842

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

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

$$\text{Average deviation(A or B)} = \frac{\sum_{i=1}^n [Cp(s) - Cp(A \text{ or } B)]}{3} \text{ must BE } \leq 0.01$$

Calibrated by : Saksit Phaisanphiset

(Mr. Saksit Phaisanphiset)
Field Scientist (4)

Approved by : Nattapol Jiengwareewong

(Mr.Nattapol Jiengwareewong)
Specialist (1)

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



DIGITAL TEMPERATURE CALIBRATION DATA SHEET

Calibration Date : 13 Jul 23	Ambient Temperature (°C) 29
Calibration sheet No. : C-130723-BKK_FS0527	Relative Humidity (%) : 60
Digital Temperature ID : BKK_FS0527	Reference Temperature ID BKK_FS1144
Serial No. : 201090006013	Model : Digicon-CC-VT-MS
Model : XC-572-V	Next Calibrate : 14 Aug 24

Location	Reference Temperature °C	Digital Temperature °C	Error °C	MPE	Pass / Fail
Stack	0	0	0	±3	Pass
	25	25	0	±3	Pass
	50	50	0	±3	Pass
	100	100	0	±3	Pass
	150	150	0	±3	Pass
	200	200	0	±3	Pass
	250	250	0	±3	Pass
	300	300	0	±3	Pass
Probe	500	501	1	±3	Pass
	100	101	1	±3	Pass
	120	121	1	±3	Pass
	140	141	1	±3	Pass
Oven	100	101	-	±3	-
	120	121	-	±3	-
	140	142	-	±3	-
Filter	100	102	2	±3	Pass
	120	121	1	±3	Pass
	140	141	1	±3	Pass
Exit	0	1	1	±3	Pass
	10	9	-1	±3	Pass
	20	20	0	±3	Pass
Meter	0	-1	-1	±3	Pass
	25	24	-1	±3	Pass
	50	48	-2	±3	Pass
AUX	0	-1	-1	±3	Pass
	25	25	0	±3	Pass
	50	50	0	±3	Pass

MPE : (Maximum permissible error of measurement) ค่าความผิดพลาดสูงสุดของการวัดข้อนี้

Calibrated by : Saksit Phaisanphiset

Mr. Saksit Phaisanphiset
Field Scientist (4)

Approved by : Nattapol Jiengwareewong

(Mr.Nattapol Jiengwareewong)
Specialist (1)

FORM NO.: F 06-027 REVISION NO.: 2 ISSUE DATE: 16/2/23



PROBE NOZZLE DIAMETER CALIBRATION DATA SHEET

Calibration Date : 13 Jul 23	Nozzle Set ID. : BKK_FS0533
Calibration Sheet No. : C-130723-BKK_FS0533	Vernier Caliper ID. : BKK_FS1123

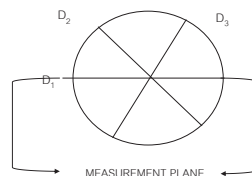
Nozzle ID #	Nozzle Diameter (cm.)			Hi - Lo ΔD	$(D_1 + D_2 + D_3) / 3$ D_{avg}
	D_1	D_2	D_3		
1	0.316	0.318	0.316	0.002	0.317
2	0.480	0.475	0.474	0.006	0.476
3	0.635	0.635	0.635	0.000	0.635
4	0.791	0.792	0.791	0.001	0.791
5	0.950	0.952	0.951	0.002	0.951
6	1.088	1.080	1.089	0.009	1.086
7	1.270	1.270	1.270	0.000	1.270
8	1.598	1.600	1.598	0.002	1.599

Where :

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



Calibrated by : Saksit Phaisanphiset

(Mr. Saksit Phaisanphiset)
Field Scientist (4)

Approved by : Nattapol Jiengwareewong

(Mr.Nattapol Jiengwareewong)
Field Specialist (1)

FORM NO.: F 06-028 REVISION NO.: 1 ISSUE DATE: 30 Jun 22

Certificate No: G 660041
Date of issue : 24-Jan-23

Instrument description : Flue gas Analyzer
Instrument model : Testo 340
Instrument serial no. : 62150585
ID no. or control no. : RYG_F50465
Manufacturer : Testo SE & Co. KGaA
Probe description :
Probe model :
Probe serial :
Customer name : ALS LABORATORY GROUP (THAILAND) CO.,LTD.
Customer address : 104 Phatthanakan 40, Phatthanakan Road, Khwaeng Phatthanakan, Khet Suan Luang, Bangkok, 10250 Thailand

Total pages of certificate : 2 Pages
Receiving no. : L-230166
Receiving date. : 20-Jan-23
Parameter of calibration : Gas Calibration (Oxygen 2.498,10.04,21.02 %Vol, Carbon Monoxide 80.14,309.9,1003 ppm, Nitric Oxide 30.08,150.9,320.6 ppm, Sulphur Dioxide 50.04,80.96,601.1 ppm)
Condition of UUC : Used
Ambient condition : All of the Measurement were carried out the stabilized laboratory
Temperature : 23 ± 5 °C
Humidity : 55 ± 15 %RH
Calibration place : 17/121 Soi Ngamwongwan 47 Yaek 48, Toongsonghong, Laksa, Bangkok 10210

Calibration procedure no. : WI-CL-28-C

The calibration certificate expanded uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by coverage factor $k=2$, which for a normal distribution corresponds to a coverage probability of approximately 95%.
This certificate is applied only to item under test Environmental 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 : 23-Jan-23

Mr. Setaiwut Nueathong
Calibration Technician

Mrs. Nongluck Wongsettee
Technical Manager

Certificate No.: G 660041

Standard References (Table 1)

Standard	Certificate No.	Vendor	Due date
Oxygen (O2) 2.498 % Vol	4219/21	Linde	30-Sep-25
Oxygen (O2) 10.04 % Vol	CG-0153-21	Nimt	18-Nov-26
Oxygen (O2) 21.02 % Vol	CG-0041-22	Nimt	10-Feb-27
Carbon monoxide (CO) 80.14 ppm	CG-0040-22	Nimt	14-Feb-27
Carbon monoxide (CO) 309.9 ppm	2803/21	Linde	22-Jun-23
Carbon monoxide (CO) 1003 ppm	2583/22	Linde	09-Aug-24
Nitric Oxide (NO) 30.08 ppm	SGS10068	Nimt	13-Jun-24
Nitric Oxide (NO) 150.9 ppm	2857/21	Linde	27-Jun-23
Nitric Oxide (NO) 320.6 ppm	2944/21	Linde	02-Jul-23
Sulphur Dioxide (SO2) 50.04 ppm	3205/21	Linde	25-Jul-23
Sulphur Dioxide (SO2) 100.8 ppm	3507/22	Linde	09-Nov-24
Sulphur Dioxide (SO2) 601.1 ppm	3204/21	Linde	20-Jul-23

Measured room conditions

Temperature : 22.6 °C Humidity : 57.8 %RH Pressure : 1015.3 mbar

Calibration conditions

Gas Temperature : 23 °C Flow rate : 600 ml/min Gas pressure : 1016.2 mbar

Calibration Results (before adjustment) (Table 2)

Parameter of Standard	Standard Values	Mean of UUC	Error	Uncertainty (±)
O2 (%Vol)	2.498	2.46	-0.038	0.20
O2 (%Vol)	10.04	9.93	-0.11	0.40
O2 (%Vol)	21.02	21.18	0.16	0.80
CO (ppm)	80.14	84	3.86	3.0
CO (ppm)	309.9	326	16.1	6.0
CO (ppm)	1003	1061	58	12
NO (ppm)	30.08	27	-3.08	8.0
NO (ppm)	150.9	144	-6.9	8.0
NO (ppm)	320.6	309	-11.9	12
SO2 (ppm)	50.04	49	-1.04	6.0
SO2 (ppm)	100.8	99	-1.8	6.0
SO2 (ppm)	601.1	597	-4.1	13

Calibration Results (after adjustment) (Table 3)

Parameter of Standard	Standard Values	Mean of UUC	Error	Uncertainty (±)
O2 (%Vol)	2.498	2.46	-0.038	0.20
O2 (%Vol)	10.04	9.93	-0.11	0.40
O2 (%Vol)	21.02	21.18	0.16	0.80
CO (ppm)	80.14	81	0.86	3.0
CO (ppm)	309.9	309	-0.9	6.0
CO (ppm)	1003	1002	-1	12
NO (ppm)	30.08	30	-0.08	8.0
NO (ppm)	150.9	153	2.1	8.0
NO (ppm)	320.6	316	-4.6	12
SO2 (ppm)	50.04	49	-1.04	6.0
SO2 (ppm)	100.8	99	-1.8	6.0
SO2 (ppm)	601.1	597	-4.1	13

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

End of Report

Certificate No: G 660002
Date of issue : 03-Jan-23

Instrument description : Flue gas Analyzer
Instrument model : Testo 350 New
Instrument serial no. : 62985047
ID no. or control no. : RYG_F50563
Manufacturer : Testo SE & Co. KGaA
Probe description :
Probe model :
Probe serial :
Customer name : ALS LABORATORY GROUP (THAILAND) CO.,LTD.
Customer address : 104 Phatthanakan 40, Phatthanakan Road, Khwaeng Phatthanakan, Khet Suan Luang, Bangkok, 10250 Thailand

Total pages of certificate : 3 Pages
Receiving no. : L-230002
Receiving date. : 27-Dec-22
Parameter of calibration : Gas Calibration (Oxygen 2.498,10.04,21.02 %Vol, Carbon Monoxide 80.14,309.9,1003 ppm, Nitrogen Dioxide 30.34,80.96,202.2 ppm, Nitric Oxide 30.08,150.9,320.6 ppm, Sulphur Dioxide 50.04,100.8,601.1 ppm)

Condition of UUC : Used
Ambient condition : All of the Measurement were carried out the stabilized laboratory
Temperature : 23 ± 5 °C
Humidity : 55 ± 15 %RH
Calibration place : 17/121 Soi Ngamwongwan 47 Yaek 48, Toongsonghong, Laksa, Bangkok 10210
Calibration procedure no. : WI-CL-28-C

The calibration certificate expanded uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by coverage factor $k=2$, which for a normal distribution corresponds to a coverage probability of approximately 95%.
This certificate is applied only to item under test Environmental 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 : 28-Dec-22

Mr. Setaiwut Nueathong
Calibration Technician

Mrs. Nongluck Wongsettee
Technical Manager

Certificate No.: G 660002

Standard References (Table 1)

Standard	Certificate No.	Vendor	Due date
Oxygen (O2) 2.498 % Vol	4219/21	Linde	30-Sep-25
Oxygen (O2) 10.04 % Vol	CG-0153-21	Nimt	18-Nov-26
Oxygen (O2) 21.02 % Vol	CG-0041-22	Nimt	10-Feb-27
Carbon monoxide (CO) 80.14 ppm	CG-0040-22	Nimt	14-Feb-27
Carbon monoxide (CO) 309.9 ppm	2803/21	Linde	22-Jun-23
Carbon monoxide (CO) 1003 ppm	2583/22	Linde	09-Aug-24
Nitrogen Dioxide (NO2) 30.34 ppm	2703/22	Linde	22-Aug-24
Nitrogen Dioxide (NO2) 80.96 ppm	2041/22	Linde	26-Jun-24
Nitrogen Dioxide (NO2) 202.2 ppm	3239/21	Linde	20-Jul-23
Nitric Oxide (NO) 30.08 ppm	CG-0089-22	Nimt	13-Jun-24
Nitric Oxide (NO) 150.9 ppm	2857/21	Linde	27-Jun-23
Nitric Oxide (NO) 320.6 ppm	2944/21	Linde	02-Jul-23
Sulphur Dioxide (SO2) 50.04 ppm	3205/21	Linde	25-Jul-23
Sulphur Dioxide (SO2) 100.8 ppm	3507/22	Linde	09-Nov-24
Sulphur Dioxide (SO2) 601.1 ppm	3204/21	Linde	20-Jul-23

Measured room conditions

Temperature : 23.5 °C Humidity : 58.6 %RH Pressure : 1015.2 mbar

Calibration conditions

Gas Temperature : 23 °C Flow rate : 1,200 ml/min Gas pressure : 1021.2 mbar

Calibration Results Before Adjustment (Table 2)

Parameter of Standard	Standard Values	Mean of UUC	Error	Uncertainty (±)
O2 (%Vol)	2.498	2.44	-0.058	0.20
O2 (%Vol)	10.04	9.91	-0.13	0.40
O2 (%Vol)	21.02	21.14	0.12	0.80
CO (ppm)	80.14	80	-0.14	3.0
CO (ppm)	309.9	309	-0.9	6.0
CO (ppm)	1003	1001	-2	12
NO2 (ppm)	30.34	20.8	-9.54	8.0
NO2 (ppm)	80.96	62.1	-18.86	8.0
NO2 (ppm)	202.2	176.8	-25.4	12
NO (ppm)	30.08	29	-1.08	8.0
NO (ppm)	150.9	149	-1.9	8.0
NO (ppm)	320.6	318	-2.6	12
SO2 (ppm)	50.04	45	-5.04	6.0
SO2 (ppm)	100.8	95	-5.8	6.0
SO2 (ppm)	601.1	568	-33.1	13

Calibration Results After Adjustment (Table 3)

Parameter of Standard	Standard Values	Mean of UUC	Error	Uncertainty (1)
O2 (%Vol)	2.498	2.44	-0.058	0.20
O2 (%Vol)	10.04	9.91	-0.13	0.40
O2 (%Vol)	21.02	21.14	0.12	0.80
CO (ppm)	80.14	80	-0.14	3.0
CO (ppm)	309.9	309	-0.9	6.0
CO (ppm)	1003	1001	-2	12
NO2 (ppm)	30.34	29.2	-1.14	8.0
NO2 (ppm)	80.96	81.4	0.44	8.0
NO2 (ppm)	202.2	205.8	3.6	12
NO (ppm)	30.06	29	-1.06	8.0
NO (ppm)	150.9	149	-1.9	8.0
NO (ppm)	320.6	318	-2.6	12
SO2 (ppm)	50.04	49	-1.04	6.0
SO2 (ppm)	100.8	101	0.2	6.0
SO2 (ppm)	601.1	604	2.9	13

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

End of Report

Agilent CrossLab Start Up Services

Agilent 5100 5110 ICP-OES Preventive Maintenance

REVIEW BY: *Charath I.*
APPROVED BY: *Sarith N.*
NEXT CAL. DATE: 01/03/24

Agilent Preventive Maintenance provides factory recommended service for your analytical instruments to assure reliable operation and the accuracy of your results

Delivered by highly trained and certified service engineers using genuine Agilent parts and supplies, Agilent Preventive Maintenance provides what you need to reduce unplanned downtime and keep your systems operating at their peak performance.

This checklist is used as a guide for completing the preventive maintenance tasks. A signed copy of this checklist is provided for your records.

Agilent 5100, 5110 Preventive Maintenance Checklist



Introduction

Customer Information

- Customers should provide all necessary operating supplies upon request of the engineer.
- A customer representative should be available to the engineer while performing the preventive maintenance procedures. Customers are responsible for regular maintenance and are encouraged to observe the service representative.
- Any parts not included in the Parts Lists section of this document are not part of the recommended Preventive Maintenance service nor are they included in the price of this service.
- If a system requires the use of extra or special procedures and/or parts for the maintenance service, then these must be ordered separately and charged as a repair, which may incur additional costs.
- For customers using HF applications, the instrument should be returned to its standard sample introduction system.

Agilent 5100, 5110 Preventive Maintenance Checklist



Important Customer Web Links

- To access **Agilent University**, visit <http://www.agilent.com/crosslab/university/> to learn about training options, which include online, classroom and onsite delivery. A training specialist can work directly with you to help determine your best options.
- To access the **Agilent Resource Center** web page, visit <https://www.agilent.com/en-us/agilentresources>. The following information topics are available:
 - Sample Prep and Containment
 - Chemical Standards
 - Analysis
 - Service and Support
 - Application Workflows
- The **Agilent Community** is an excellent place to get answers, collaborate with others about applications and Agilent products, and find in-depth documents and videos relevant to Agilent technologies. Visit <https://community.agilent.com/welcome>
- Videos about specific preparation requirements for your instrument can be found by searching the **Agilent YouTube** channel at <https://www.youtube.com/user/agilent>
- Need to place a service call?** Flexible Repair Options | Agilent

Service Engineer's Responsibilities

- Contact the customer and ensure that all necessary supplies are available before the preventive maintenance visit.
- Only select those pages that relate to the system or module being serviced.
- Complete empty fields with the relevant information.
- Complete the relevant checkboxes in the checklist using either a "X" or tick mark "✓".
- Check "Service not applicable" check boxes to indicate services/tasks not delivered, as appropriate.
- Complete the Preventive Maintenance services in the most logical order relevant to the individual system service in the order of the tasks listed.
- Complete the **Service Review** section together with the customer.
- Complete the fields for page numbers at the foot of each selected page.
- Add relevant page numbers to selected pages and complete the total number of pages field in the Service Completion section.
- Ask the customer to sign the Service Verification section including the customer's and your signature.

Instrument Maintenance

System Information

- ☐ Check this box if an instrument configuration report is attached instead of completing the table.

Instrument System Name and ID	G8010A ; M916010005
Instrument System Site and Location	ALS C Bk6

List System Component	Product Numbers	List the Serial Numbers of each Component
1.	G9010A	M916010005
2.	G9410A	AU15440964
3.	G9212	8005-00159
4.	G8485	AU16040115
5.		
6.		
7.		
8.		
9.		

ICP-OES Configuration Table	Circle the type or write in the type if other
Nebulizer Type	SeaSpray OneNeb Conical Other
Spray Chamber	Cyclonic Single Pass Cyclonic Double Pass Other
Torch	Radial Dual View Other
Torch Type	One Pigee Semi Demountable Fully Demountable Other
Injector Diameter	2.4mm 1.8mm 1.4mm 0.8mm Other
Injector Material	Quartz Ceramic Other

Preparation

- ☒ Discuss any specific issues with the customer before starting.
- ☒ Review the instrument logbook for recorded problems and comments.
- ☒ Save instrument control settings before starting the procedure.
- ☒ Perform a general inspection of the system for cleanliness.
- ☒ Check for proper installation of parts, assemblies, sensors etc.
- ☒ Check system for required installation of components and implementation of Service Notes
- ☒ Check for required firmware/software updates and verify with customers if they would like them installed.
- ☒ For HF application systems, if standard sample introduction system was not installed, ask the customer to install it.
- ☐ Ask the customer to remove any samples from the ICP-OES sample introduction area, auto sampler or around the ICP-OES.

Preventive Maintenance Procedures

Record Pre-PM instrument performance

- ☒ Run Instrument Performance test.
- ☒ Record results in Instrument Performance Test Results Table – Pre-PM.

Clean and inspect ICP-OES system

- ☒ Look for any obvious external damage or problems.
- ☒ Inspect water cooling hoses, gas lines and power cord for excessive wear or damage.
- ☒ Perform a general internal inspection of the system for excessive dust accumulation, clean if necessary.
- ☒ Inspect sample introduction components and record any required maintenance in the Service Engineer Comments and notify the customer as the required actions required.
- ☒ Record the instrument operating conditions in the ICP-OES Status Results Table.
- ☒ Replace the polychromator purge filter.
- ☒ Replace the radial pre-optics window.
- ☒ Replace the axial pre-optics window for SVDV and VDV instruments.
- ☒ Check exhaust flow for the correct positive extraction at the exhaust duct to insure they meet minimum specifications.
- ☒ Replace air inlet dust filter.
- ☒ Replace high capacity air inlet dust filter element if installed.
- ☒ Remove and clean instrument water inlet filter.

Agilent Water Recirculator

- ☐ Service not applicable
- ☒ Drain cooling fluid and remove any particles from the chiller reservoir.
- ☒ Remove, clean and reinstall water inlet metal mesh filter if present.
- ☒ Re fill with Agilent Cool Clear cooling fluid.
- ☒ Clean the cooling system Air filter and the condenser.

SPS 3 Auto Sampler

☒ Service not applicable

- ☐ Power cycle the autosampler and verify successful initialization.
- ☐ Inspect X and Z axis belts for wear. Replace as necessary.
- ☐ Clean X and Z axis slide shafts.
- ☐ Using customer's racks and the Agilent software move the sample probe to the 4 outermost corners and rinse port, ensure that the probe is approximately centered in the vial.

SPS 4 Auto sampler

☐ Service not applicable

- ☒ Clean the spill tray, rack location mat, end frames and chassis with a damp soft cloth and diluted mild detergent.
- ☒ Clean the auto sampler cover panels, if cover kit is installed, with domestic window cleaner.
- ☒ Check the X-axis and Z-axis drive belts for cracks, splits, damaged teeth, excessive fraying, color changes or degradation from fumes.
- ☒ Check the X-axis, Theta-axis and Z-axis FFC cables for cracks, incorrect positioning, damaged edges or damaged connectors.
- ☒ Pump Tubing Replacement. Replace peristaltic pump tubing. Replace all tubing that goes from the rinse station to the pump and from the pump to the waste/rinse bottles.
- ☒ Test using customer's tray and move the sample probe to the sample vial 1, wash vial and rinse port and ensure that the probe is centered in the vial. If not use calibration wizard and calibrate the position.

AVS 4, 6, 7 Advanced Valve System

☐ Service not applicable

- ☒ Replace valve rotor seal - inspect
- ☒ Check fittings for signs of leaks
- ☒ Check tubing including autosampler tubing for kinks or excessive wear
- ☒ Check high flow pump for signs of leaks

ICP-OES adjustment

- ☒ Check position of Zn peak, adjust if required.
- ☒ Check Argon Ratio, adjust to specified value if required.
- ☒ Perform Detector Calibration.
- ☒ Perform Instrument Calibration.

Record Post-PM instrument performance

- ☒ Run Instrument Performance test.
- ☒ Record results in Instrument Performance Test Results Table - Post PM.
- ☒ For systems using ICP Expert version 7.3 and above, run the following instrument tests

- ☒ Subsystem Communications Test
- ☒ Air Flow
- ☒ Water Flow
- ☒ Gas Flows
- ☒ RF Generator
- ☒ Camera Test
- ☒ Optics Test
- ☒ Nebulizer Test

- ☒ Record the result in the Instrument Test Results Table

Restore Instrument

- ☐ For HF applications, ask the customer to reinstall their sample introduction system.
- ☒ Leave system in an Idle state: on and purging.
- ☒ Guidance: If the PM service is performed prior to a qualification service, then use the qualification procedure as a guide for final instrument set up and checkout.

Service Review

- ☒ Attach available reports/printouts of all tests to this documentation.
- ☒ Record the Preventive Maintenance service activity in the customer's records/logbook.
- ☒ Record the PM event in the Smart Alerts logbook, if applicable.
- ☒ Update/reset instrument maintenance counters as appropriate.
- ☒ Affix the PM sticker to the system or instrument logbook based on the customer's request.
- ☒ Complete the Service Engineer Comments section if there are additional comments.
- ☒ Review this service, parts replaced, and test results obtained with the customer.
- ☒ If the instrument firmware was updated, record the details of the change in the Service Engineer's Comments box. Systems in a compliant environment may need additional documentation.
- ☐ Complete the Signature Page with both Service Engineer and Customer signatures.

Test Results

Instrument Performance Test Results Table

Note: These measurements do not form part of any specification and are for reference only.

	Pre PM Sensitivity Check		Post PM Sensitivity Check	
	Radial	Axial *	Radial	Axial*
Zn 213.857 nm SRBR	23603.8	144365.1	22,348.2	164,359.5
Mn 257.610 nm SRBR	153678.2	620560.3	159,250.0	212,496.1
Al 396.152 nm SBR	24883.5	200141.2	24,945.9	196,802.0
K 766.491 nm SBR	92616.2	2151222.8	92,399.4	286,9154.9

* Axial result is not applicable for G8016AA, G8012AA Radial View instruments.

Instrument Test Results Table

Note: The Instrument Test results are for systems using ICP Expert version 7.3 and above only.

Instrument Test	Result
Subsystem Communications Test	Pass
Air Flow	Pass
Water Flow	Pass
Gas Flows	Pass
RF Generator	Pass
Camera Test	Pass
Optics Test	Pass
Nebulizer test	Pass

ICP-OES Status Results Table

Note: These measurements do not form part of any specification and are for reference only.

Measurement	Standby Mode	Plasma On
Mains Voltage	219.878 VAC	215.155 VAC
Mains Current	0.217 A	0.116 A
Instrument Temperature	24.4 °C	24.3 °C
RF Air Flow (sensor speed)	16.0 Hz	20.0 Hz
Plasma Exhaust Temperature	No measurement	49.3 °C
Water Flow Oscillator	No measurement	1.20 L/min
Water Flow Detector	1.12 L/min	1.09 L/min
Water Inlet Temperature	28.0 °C	23.5 °C
Polychromator Temperature	35.0 °C	35.0 °C
CCD Temperature	-40.0 °C	-40.0 °C
Thermal Stabilizer	34.8 °C	35.0 °C
Argon Supply Pressure	619.33 kPa	541.92 kPa
Purge Gas Supply Pressure*1	609.38 kPa	567.77 kPa
Option Gas Supply Pressure*1	-- kPa	-- kPa
Nebulizer Flow	No measurement	0.70 L/min
Nebulizer Back Pressure	No measurement	255.36 kPa
Plasma Gas Flow	No measurement	11.98 L/min
Auxiliary Gas Flow	No measurement	1.0 L/min
RF Power	No measurement	1199.9 W
RF Supply Current	No measurement	8.227 A
RF Supply Voltage	No measurement	194.422 V

*1 If option installed

Consumed PM Parts

Part Description	Part Number	Product or Model# where used	Quantity consumed
Axial Pre-Optic Window	G8010-68014	G8010A, G8011A, G8014A/G8015A	1
Radial Pre-Optic Window	G8010-68015	All	1
Agilent Cool Clear Coolant Fluid	5799-0037	Agilent Water Recirculator	1
Purge Gas Filter	G8010-60136	All	1
Air inlet filter	G8000-68002	All	1
High Capacity Air Filter	G8010-60189	Optional	1
Rotor seal for 6-7 port valve for AVS6/7	G8494-60002	G8494A/G8495	1
Rotor seal for 4 port valve for AVS4	G8493-60002	G8493A	1
Rinse solution to rinse station 2.5mm id x 1m	G8410-80123	SPS 4	1
Barb connector 2.5mm-1.5mm ID	G8410-80124	SPS 4	1
PVC waste tubing, 8mm od x 5mm id, 2m	G8410-80122	SPS 4	1
Additional Parts may be required from engineer's stock:			
X axis drive belt	5410047500	SPS 3	1
Z axis drive belt	5410047400	SPS 3	1
Peristaltic pump tubing, PVC SolvaFlex, 3 bridged	3710049000	SPS 4	1

Consumed Parts Reference
(Purchased by customer, not included as part of PM)☐ Section Not Applicable

Part Description	Part Number	Product or Model# where used	Quantity consumed
------------------	-------------	------------------------------	-------------------

Signature Page

Service Engineer Comments (optional)

If there are any specific points you wish to note as part of performing the installation or other items of interest for the customer, please write in this box.

- During PM found water tubing in instrument broken then water leaking inside instrument.
- Replace all water tube inside instrument, after replace found water flow sensor water leak also.
- Replace water module and continue pm without deviation.

Service Verification

Service Request Number: 6005833474 Date Service Completed: 2-May-2023

Service Engineer Name: Burin Ngamvijit Customer Name: Thitiya Saopeng

Service Engineer Signature: Burin Ng. Customer Signature: Thitiya S.

Total number of pages in this document: 1

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 : C0745169

CYLINDER PRESSURE (psig) : 1650

CERTIFIED DATE : Mar 10, 2021

CERTIFIED BY : AIRGAS SPECIALTY GASES

EXPIRED DATE : Mar 10, 2029

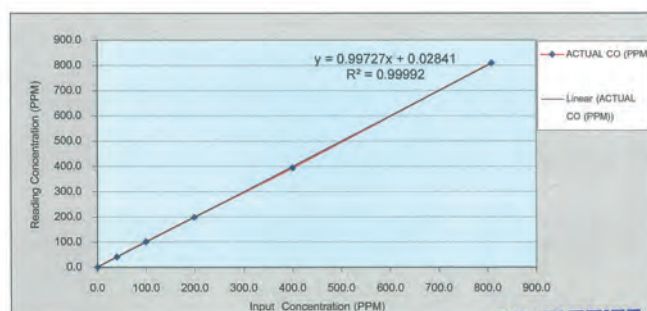
CALIBRATION RESULTS

POINT NO	CALIBRATION RESULTS			
	IDEAL (PPM)	ACTUAL CO (PPM)	ERROR CO (PPM)	% ERROR CO
ZERO	0.000	0.006	0.006	-
1	40.000	40.803	0.803	2.007
2	100.000	101.430	1.430	1.430
3	199.200	199.176	-0.024	-0.012
4	400.600	394.269	-6.331	-1.580
5	808.900	808.951	0.051	0.006
AVERAGE (%)				1.005

REVIEW BY : Thantall.

APPROVED BY : D. B.

NEXT CAL DATE : 31 Dec 25



CALIBRATED BY : คุณพรชัย มาลีวนากิจ

DATE : 21 ธันวาคม 2565

ต้องการข้อมูลทางด้านเทคนิคเพิ่มเติม: คุณพรชัย มาลีวนากิจ โทรศัพท์: 02-515-8987

รายงานผลการซ่อมและปรับเทียบอุปกรณ์ตรวจวัดคุณภาพอากาศ

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

รายชื่ออุปกรณ์ / เครื่องมือ : CO Analyzer

รุ่นของอุปกรณ์ / เครื่องมือ : T300

วันที่ : 21 ธันวาคม 2565

บริษัทผู้ผลิต : Teledyne API

หมายเลขอุปกรณ์ / เครื่องมือ : 1215

TEST VALUES			
API MODEL T300		BEFORE	AFTER
1	RANGE	1 - 1000 PPM	100.0
2	STABILITY	≤ 1 PPM	0.006
3	CO MEASURE	2500 - 4800 mV	3220.1
4	CO REFERENCE	2000 - 4800 mV	2962.6
5	VR RATIO	1.1 - 1.3	1.218
6	PRESEURE	25 - 35 in - Hg-A	29.5
7	SAMPLE FLOW	900 ± 10% cc/min	817
8	SAMPLE TEMP	48 ± 4 °C	45.1
9	BENCH TEMP	48 ± 2 °C	48.0
10	WHEEL TEMP	68 ± 2 °C	67.9
11	BOX TEMP	AMBIENT ± 5 °C	36.2
12	PHI DRIVE	250 - 4750 mV	4176.0
13	CO SLOPE	1.0 ± 0.3	0.870
14	CO OFFSET	0.0 ± 0.3	0.008
15	CO READING (AMBIENT)	PPM	0.696
16	ELECTRICAL TEST	40 ± 2 PPM	40.531
17	VOLTAGE TEST	+5 V +12 V -15 V	5.21 / 12.23 / 16.78 / -15.30
18	ZERO GAS	0.00 PPM	0.195
19	SPAN GAS	40.0 PPM	40.083

หมายเหตุ

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



บริษัท ไคเนติกส์ คอร์ปอเรชั่น จำกัด

(คุณพรชัย ภาภิวันท์)

ลงนามเจ้าพนักงาน (Signature)

ต้องการข้อมูลเพิ่มเติมทางด้านเทคนิค กรุณาติดต่อ : คุณพรชัย ภาภิวันท์ โทรศัทพ์ : 0-2515-8987

เลขที่ 388 ถนนวิภาวดีรังสิต แขวงจันทบุรี เขตจตุจักร กรุงเทพฯ 10900 โทรศัพท์ : 0-2515-8999 โทรสาร : 0-2515-8988 E-Mail : info@kinetics.co.th



CONSOLE CONTROL UNIT CALIBRATION TEST REPORT

Barometric Pressure (mmHg) : 752

Relative Humidity (%) : 55.0

Temperature (°C) : 31.0

Reference Dry Gas Meter Data

Reference Dry Gas Meter ID : BKK_FS0629

Serial No. : 1607009

Correction Factor (Y) : 1.0000

Next Calibration Date : 9 Dec 23

Calibration of Date : 13-Jul-23

Next Cal. Date : 13-Jan-24

Console Control Meter Data

Calibration No. : C-130723-BKK_FS0556

Dry Gas Meter ID : BKK_FS0556

Serial No. : 1606041

Model No. : XC-572-V

ΔH (mm H ₂ O)	Θ Minutes	Reference Dry Gas Meter Calibration				Console Control Dry Gas Meter						Dry Gas Meter Correction Factor (Y)	Orifice Calibration Factor (Y) ΔH _g
		Vr (Liters)		Tr (°C)	Vr (Liters)		Ti (°C)	To (°C)	Avg. Im (°C)				
		Final	Initial		Final	Initial				Total			
15	11.35	150.00	0.00	150.00	31.0	293.8	147.8	30.0	30.0	1.0225	40.9824		
25	8.78	150.00	0.00	150.00	31.0	447.5	300.0	30.0	30.0	1.0111	39.9861		
50	6.16	150.00	0.00	150.00	32.0	745.8	598.3	32.0	32.0	1.0120	39.9846		
80	5.01	150.00	0.00	150.00	32.0	909.2	762.2	33.0	33.0	1.0158	41.5259		
120	4.04	150.00	0.00	150.00	33.0	1083.0	936.4	34.0	34.0	1.0146	40.6372		
Avg.										1.0152	40.3212		

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

ΔHg : Orifice pressure differential that equates to 21.24 in of air @ 25 °C and 760 mm of mercury : mmH₂O : tolerance for individual values ± 5.08 from average.

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

Calibrated by : Saksit Phaisanphisit
(Mr. Saksit Phaisanphisit)
Field Scientist (4)Approved by : Natthapol Jengwarewong
(Mr. Natthapol Jengwarewong)
Field Specialist (1)

Pitot Tube Calibration Data

Pitot Tube Identification Number : BKK_FS0560

Calibration Date : 13 Jul 23

Lab test duct Number : 258-1-13-01

Standard Pitot ID : BKK_FS0441

Calibration Sheet No. : C-130723-BKK_FS0560

Cp Standard : 0.99

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

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

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

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

Calibrated by : Saksit Phaisanphisit

(Mr. Saksit Phaisanphisit)

Field Scientist (4)

Approved by : Natthapol Jengwarewong

(Mr. Natthapol Jengwarewong)

Specialist (1)



Pitot Tube Calibration Data

Pitot Tube Identification Number : BKK_FS0561

Calibration Date : 13 Jul 23

Lab test duct Number : 258-1-13-01

Standard Pitot ID : BKK_FS0441

Calibration Sheet No. : C-130723-BKK_FS0561

Cp Standard : 0.99

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

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

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

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

Calibrated by : Saksit Phaisanphisit

(Mr. Saksit Phaisanphisit)

Field Scientist (4)

Approved by : Natthapol Jengwarewong

(Mr. Natthapol Jengwarewong)

Specialist (1)



DIGITAL TEMPERATURE CALIBRATION DATA SHEET

Calibration Date : 13 Jul 23		Ambient Temperature (°C) 29			
Calibration sheet No. : C-130723-BKK_FS0557		Relative Humidity (%) : 60			
Digital Temperature ID : BKK_FS0557		Reference Temperature ID BKK_FS1144			
Serial No. : 1606041		Serial No. : 201090006013			
Model : XC-572-V		Model : Digicon-CC-VT-MS			
Next Calibrate :		14 Aug 24			
Location	Reference Temperature °C	Digital Temperature °C	Error °C	MPE	Pass / Fail
Stack	0	0	0	±3	Pass
	25	23	-2	±3	Pass
	50	48	-2	±3	Pass
	100	99	-1	±3	Pass
	150	149	-1	±3	Pass
	200	198	-2	±3	Pass
	250	248	-2	±3	Pass
	300	298	-2	±3	Pass
Probe	500	500	0	±3	Pass
	100	99	-1	±3	Pass
	120	119	-1	±3	Pass
	140	139	-1	±3	Pass
Oven	100	100	0	±3	Pass
	120	119	-1	±3	Pass
	140	139	-1	±3	Pass
	100	100	0	±3	Pass
Filter	120	120	0	±3	Pass
	140	140	0	±3	Pass
	0	0	0	±3	Pass
	10	9	-1	±3	Pass
Exit	20	18	-2	±3	Pass
	0	0	0	±3	Pass
	25	25	0	±3	Pass
	50	50	0	±3	Pass
Meter	0	0	0	±3	Pass
	25	23	-2	±3	Pass
	50	48	-2	±3	Pass
	0	0	0	±3	Pass
AUX	25	23	-2	±3	Pass
	50	48	-2	±3	Pass

MPE : (Maximum permissible error of measurement) ค่าความผิดพลาดสูงสุดของการวัดที่อนุญาต

Calibrated by : Saksit Phaisanphiset Approved by : Nattapon Jengwareewong
Mr. Saksit Phaisanphiset Mr. Nattapon Jengwareewong
Field Scientist (4) Specialist (1)

FORM NO.: F 06-027 REVISION NO.: 2 ISSUE DATE: 9 Feb 23



PROBE NOZZLE DIAMETER CALIBRATION DATA SHEET

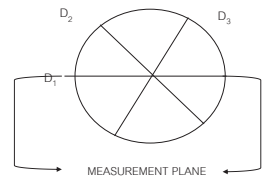
Calibration Date : 13 Jul 23		Nozzle Set ID. : BKK_FS0562			
Calibration Sheet No. : C-130723-BKK_FS0562		Vernier Caliper ID. : BKK_FS1123			
Nozzle ID #	Nozzle Diameter (cm.)			Hi - Lo	$(D_1 + D_2 + D_3) / 3$
	D ₁	D ₂	D ₃	ΔD	D _{avg}
1	0.300	0.302	0.302	0.002	0.301
2	0.480	0.475	0.480	0.005	0.478
3	0.625	0.630	0.630	0.005	0.628
4	0.755	0.750	0.755	0.005	0.753
5	0.975	0.980	0.970	0.010	0.975
6	1.082	1.081	1.080	0.002	1.081
7	1.275	1.275	1.270	0.005	1.273
8	1.610	1.610	1.610	0.000	1.610

Where :

D₁, D₂, D₃ = 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_{avg} = (D₁ + D₂ + D₃) / 3



Calibrated by : Saksit Phaisanphiset Approved by : Nattapon Jengwareewong
(Mr. Saksit Phaisanphiset) (Mr. Nattapon Jengwareewong)
Field Scientist (4) Field Specialist (1)

FORM NO.: F 06-026 REVISION NO.: 1 ISSUE DATE: 9-1-63



CONSOLE CONTROL UNIT CALIBRATION TEST REPORT

Calibration of Date : 13-Jul-23 Barometric Pressure (mmHg) : 751
Next Cal. Date : 13-Jan-24 Relative Humidity (%) : 60.0
Temperature (°C) : 29.0
Reference Dry Gas Meter Data
Reference Dry Gas Meter ID : BKK_FS1122
Serial No. : A2003240
Correction Factor (Y) : 1.0160
Next Calibration Date : 25-Nov-23

ΔH (mm H ₂ O)	Θ Minutes	Reference Dry Gas Meter Calibration				Console Control : Drygas Meter						Dry Gas Meter Correction Factor (Y)	Orifice Calibration Factor (Δg)
		Vr (liters)			Tr (°C)	Vn (liters)			Ti (°C)	To (°C)	Avg Tm (°C)		
		Final	Initial	Total		Final	Initial	Total					
15	12.63	150.00	0.00	150.00	26.0	1768305.0	1768150.0	147.00	26.0	29.0	26.0	1.0421	48.4091
25	9.62	150.00	0.00	150.00	26.0	1768464.0	1768317.0	147.00	26.0	29.0	26.0	1.0411	46.6079
50	6.93	150.00	0.00	150.00	26.0	1768619.0	1768474.0	145.00	29.0	29.0	29.0	1.0564	48.4200
100	4.92	150.00	0.00	150.00	26.0	1768771.0	1768626.0	145.00	29.0	29.0	29.0	1.0513	48.8111
150	3.63	150.00	0.00	150.00	26.0	1768922.0	1768777.0	144.00	29.0	29.0	29.0	1.0535	44.3887
Avg.										Avg.		1.0489	47.3634

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

ΔHg : Orifice pressure differential that equates to 21.24 in of air @ 25 °C and 760 mm of mercury, mmH₂O ; tolerance for individual values ± 5.08 from average .

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

Calibrated by : Saksit Phaisanphiset Approved by : Nattapon Jengwareewong
(Mr. Saksit Phaisanphiset) (Mr. Nattapon Jengwareewong)
Field Scientist (4) Field Specialist (1)

FORM NO.: F 06-024 REVISION NO.: 2 ISSUE DATE: 30 Jan 22



Pitot Tube Calibration Data

Pitot Tube Identification Number : RYG_FS0320 Calibration Date : 13 Jul 23
Lab test duct Number : 258-1-13-01 Standard Pitot ID : BKK_FS0441
Calibration Sheet No. : C-130723-RYG_FS0320 Cp Standard : 0.99

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

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

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

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

Calibrated by : Saksit Phaisanphiset Approved by : Nattapon Jengwareewong
(Mr. Saksit Phaisanphiset) (Mr. Nattapon Jengwareewong)
Field Scientist (4) Specialist (1)

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



Pitot Tube Calibration Data

Pitot Tube Identification Number : RYG_FS0321 Calibration Date : 13 Jul 23
Lab test duct Number : 258-1-13-01 Standard Pitot ID : BKK_FS0441
Calibration Sheet No. : C-130723-RYG_FS0321 Cp Standard : 0.99

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

$$C_p(S) = C_{p_{std}} \sqrt{\frac{\Delta P_{std}}{\Delta P(S)}}$$

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

$$\text{Average deviation(A or B)} = \frac{\sum_{i=1}^n [C_p(s) - C_p(A \text{ or } B)]}{3} \text{ must BE } \leq 0.01$$

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

Approved by : Nattapon Jengwareewong
(Mr.Nattapol Jengwareewong)
Specialist (1)

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



DIGITAL TEMPERATURE CALIBRATION DATA SHEET

Calibration Date :		13 Jul 23	Ambient Temperature (°C)		29
Calibration sheet No. :		C-130723-RYG_FS0315	Relative Humidity (%) :		60
Digital Temperature ID :		RYG_FS0315	Reference Temperature ID		BKK_FS1144
Serial No. :		1706091	Serial No. :		201090006013
Model :		XC-572-V	Model :		Digicon-CC-VT-MS
			Next Calibrate :		14 Aug 24
Location	Reference Temperature °C	Digital Temperature °C	Error °C	MPE	Pass / Fail
Stack	0	-1	-1	±3	Pass
	25	25	0	±3	Pass
	50	50	0	±3	Pass
	100	101	1	±3	Pass
	150	151	1	±3	Pass
	200	200	0	±3	Pass
	250	250	0	±3	Pass
	300	301	1	±3	Pass
Probe	500	502	2	±3	Pass
	100	102	2	±3	Pass
	120	121	1	±3	Pass
Oven	140	141	1	±3	Pass
	100	101	-	±3	-
	120	121	-	±3	-
Filter	140	141	-	±3	-
	100	101	1	±3	Pass
	120	121	1	±3	Pass
Exit	140	141	1	±3	Pass
	0	0	0	±3	Pass
	10	10	0	±3	Pass
Meter	20	20	0	±3	Pass
	0	-1	-1	±3	Pass
	25	24	-1	±3	Pass
AUX	50	48	-2	±3	Pass
	0	0	0	±3	Pass
	25	25	0	±3	Pass
	50	50	0	±3	Pass

MPE : (Maximum permissible error of measurement) ค่าความผิดพลาดสูงสุดของการวัดของวัด

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

Approved by : Nattapon Jengwareewong
(Mr.Nattapol Jengwareewong)
Specialist (1)

FORM NO.: F 06-027 REVISION NO.: 2 ISSUE DATE: 16/2/23

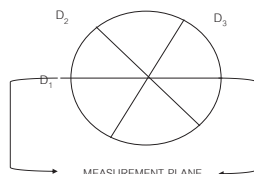


PROBE NOZZLE DIAMETER CALIBRATION DATA SHEET

Calibration Date : 13 Jul 23 Nozzle Set ID. : RYG_FS0319
Calibration Sheet No. : C-130723-RYG_FS0319 Vernier Caliper ID. : BKK_FS1123

Nozzle ID #	Nozzle Diameter (cm.)			ΔD	D_{avg}
	D_1	D_2	D_3		
1	0.298	0.300	0.301	0.003	0.300
2	0.465	0.465	0.465	0.000	0.465
3	0.601	0.602	0.602	0.001	0.602
4	0.770	0.760	0.755	0.015	0.762
5	0.930	0.928	0.930	0.002	0.929
6	1.082	1.080	1.085	0.005	1.082
7	1.240	1.230	1.235	0.010	1.235
8	1.594	1.598	1.597	0.004	1.596

Where :
 D_1, D_2, D_3 = 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_{avg} = $(D_1 + D_2 + D_3) / 3$



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

Approved by : Nattapon Jengwareewong
(Mr.Nattapol Jengwareewong)
Field Specialist (1)

FORM NO.: F 06-026 REVISION NO.: 1 ISSUE DATE: 16 Jun 22



Calibration Certificate

Certificate No: G 660001
Date of issue : 03-Jan-23

Instrument description : Flue gas Analyzer
Instrument model : Testo 340
Instrument serial no. : 63119028
ID no. or control no. : RYG_FS0565
Manufacturer : Testo SE & Co. KGaA
Probe description : -
Probe model : -
Probe serial : -
Customer name : ALS LABORATORY GROUP (THAILAND) CO.,LTD.
Customer address : 104 Phattanakarn 40, Phattanakarn Road, Khwaeng Phattanakarn, Khet Suan Luang, Bangkok, 10250 Thailand.
Total pages of certificate : 3 Pages
Receiving no. : I-230001
Receiving date. : 26-Dec-22
Parameter of calibration : Gas Calibration(Oxygen 2,498,10,04,21.02 %vol, Carbon Monoxide 60,14,309.9,1003 ppm Nitric Oxide 38,08,150.9,320.6 ppm, Sulphur Dioxide 50.04,100.8,601.1 ppm)

REVIEW BY : Nattapon J.
APPROVED BY : Saksit P.
NEXT CAL. DATE : 05/12/23

Condition of UUC. : Used
Ambient condition : All of the Measurement were carried out the stabilized laboratory
Temperature : 23 ± 5 °C
Humidity : 55 ± 15 %RH
Calibration place : 17/121 Soi Ngamwongwan 47 Yaek 48, Toongsonghong, Laksi, Bangkok 10210
Calibration procedure no. : WI-CL-2B-C

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

Mr. Sedawut Nueathong
Calibration Technician

Mrs. Nongluck Wongsettee
Technical Manager

FM-CL-09-C Rev.2

Page 1 of 3

Issued Date 26/02/16

Entech Industrial Solution Co.,Ltd.

17/121 Soi Ngamwongwan 47 Yaek 48, Toongsonghong, Laksi, Bangkok 10210 THAILAND Tel: 0-2779-8888 Calibration@entech.co.th
Tax ID : 0105536035591 www.entech.co.th



Standard References (Table 1)

Standard	Certificate No.	Vendor	Due date
Oxygen (O ₂) 2.498 % Vol	4219/21	Linde	30-Sep-25
Oxygen (O ₂) 10.04 % Vol	CG-0153-21	Nimt	18-Nov-26
Oxygen (O ₂) 21.02 % Vol	CG-0041-22	Nimt	10-Feb-27
Carbon monoxide (CO) 80.14 ppm	CG-0040-22	Nimt	14-Feb-27
Carbon monoxide (CO) 309.9 ppm	2803/21	Linde	22-Jun-23
Carbon monoxide (CO) 1003 ppm	2583/22	Linde	09-Aug-24
Nitric Oxide (NO) 30.08 ppm	CG-0089-22	Nimt	13-Jun-24
Nitric Oxide (NO) 150.9 ppm	2857/21	Linde	27-Jun-23
Nitric Oxide (NO) 320.6 ppm	2944/21	Linde	02-Jul-23
Sulphur Dioxide (SO ₂) 50.04 ppm	3205/21	Linde	25-Jul-23
Sulphur Dioxide (SO ₂) 100.8 ppm	3507/22	Linde	09-Nov-24
Sulphur Dioxide (SO ₂) 601.1 ppm	3204/21	Linde	26-Jul-23

Measured room conditions

Temperature : 23.2 °C Humidity : 56.4 %RH Pressure : 1014.8 mbar

Calibration conditions

Gas Temperature : 23 °C Flow rate : 600 ml/min Gas pressure : 1018.6 mbar

Calibration Results Before Adjustment (Table 2)

Parameter of Standard	Standard Values	Mean of UUC	Error	Uncertainty (1)
O ₂ (%Vol)	2.498	2.47	-0.028	0.20
O ₂ (%Vol)	10.04	9.93	-0.11	0.40
O ₂ (%Vol)	21.02	21.09	0.07	0.80
CO (ppm)	80.14	83	2.86	3.0
CO (ppm)	309.9	319	9.1	6.0
CO (ppm)	1003	1038	35	12
NO (ppm)	30.08	28	-2.08	8.0
NO (ppm)	150.9	139	-11.9	8.0
NO (ppm)	320.6	299	-21.6	12
SO ₂ (ppm)	50.04	46	-4.04	6.0
SO ₂ (ppm)	100.8	98	-2.8	6.0
SO ₂ (ppm)	601.1	593	-8.1	13



Calibration Results After Adjustment (Table 3)

Parameter of Standard	Standard Values	Mean of UUC	Error	Uncertainty (1)
O ₂ (%Vol)	2.498	2.47	-0.028	0.20
O ₂ (%Vol)	10.04	9.93	-0.11	0.40
O ₂ (%Vol)	21.02	21.09	0.07	0.80
CO (ppm)	80.14	81	0.86	3.0
CO (ppm)	309.9	311	1.1	6.0
CO (ppm)	1003	1004	1	12
NO (ppm)	30.08	30	-0.08	8.0
NO (ppm)	150.9	154	3.1	8.0
NO (ppm)	320.6	322	1.4	12
SO ₂ (ppm)	50.04	49	-1.04	6.0
SO ₂ (ppm)	100.8	101	0.2	6.0
SO ₂ (ppm)	601.1	603	1.9	13

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

End of Report



Instrument description : 1. Flue gas Analyzer
Instrument model : 1. Testo 350 New
Instrument serial no. : 1. 62087344
ID no. or control no. : 1. RYG_F50464
Manufacturer : 1. Testo SE & Co. KGaA
Probe description : 1. :
Probe model : 1. :
Probe serial : 1. :
Customer name : 1. ALS LABORATORY GROUP (THAILAND) CO.,LTD.
Customer address : 1. 104 Phatthanakan 40, Phatthanakan Road, Khwaeng Phatthanakan, Khet Suan Luang, Bangkok, 10250 Thailand
Total pages of certificate : 3 Pages
Receiving no. : 1. L-230167
Receiving date. : 1. 20-Jan-23
Parameter of calibration : 1. Gas Calibration(Oxygen 2.498,10.04,21.02 %vol, Carbon Monoxide 80.14,309.9,1003 ppm, Nitrogen Dioxide 30.34,80.96,202.2 ppm, Nitric Oxide 30.08,150.9,320.6 ppm, Sulphur Dioxide 50.04,100.8,601.1 ppm)

Condition of UUC.

1. Used

Ambient condition

1. All of the Measurement were carried out the stabilized laboratory

Temperature : 23 ± 5 °C

Humidity : 55 ± 15 %RH

Calibration place

1. 17/121 Soi Nongwongwan 47 Yaek 48, Toongsonghong, Lak, Bangkok 10210

Calibration procedure no. :

1. WI-CL-28-C

The calibration certificate expanded uncertainty of measurement is stated as the standard uncertainty of measurement Multiplied by coverage factor $k=2$, which for a normal distribution corresponds to a coverage probability of approximately 95%. This certificate is applied only to item under test Environmental 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 : 23-Jan-23

Mr. Seditawut Nueathong
Calibration Technician

Mrs. Nongluck Wongsettee
Technical Manager



Standard References (Table 1)

Standard	Certificate No.	Vendor	Due date
Oxygen (O ₂) 2.498 % Vol	4219/21	Linde	30-Sep-25
Oxygen (O ₂) 10.04 % Vol	CG-0153-21	Nimt	18-Nov-26
Oxygen (O ₂) 21.02 % Vol	CG-0041-22	Nimt	10-Feb-27
Carbon monoxide (CO) 80.14 ppm	CG-0040-22	Nimt	14-Feb-27
Carbon monoxide (CO) 309.9 ppm	2803/21	Linde	22-Jun-23
Carbon monoxide (CO) 1003 ppm	2583/22	Linde	09-Aug-24
Nitrogen Dioxide (NO ₂) 30.34 ppm	2703/22	Linde	22-Aug-24
Nitrogen Dioxide (NO ₂) 80.96 ppm	2041/22	Linde	26-Jun-24
Nitrogen Dioxide (NO ₂) 202.2 ppm	3239/21	Linde	20-Jul-23
Nitric Oxide (NO) 30.08 ppm	CG-0089-22	Nimt	13-Jun-24
Nitric Oxide (NO) 150.9 ppm	2857/21	Linde	27-Jun-23
Nitric Oxide (NO) 320.6 ppm	2944/21	Linde	02-Jul-23
Sulphur Dioxide (SO ₂) 50.04 ppm	3205/21	Linde	25-Jul-23
Sulphur Dioxide (SO ₂) 100.8 ppm	3507/22	Linde	09-Nov-24
Sulphur Dioxide (SO ₂) 601.1 ppm	3204/21	Linde	26-Jul-23

Measured room conditions

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

Calibration conditions

Gas Temperature : 23 °C Flow rate : 1,200 ml/min Gas pressure : 1023.4 mbar

Calibration Results Before Adjustment (Table 2)

Parameter of Standard	Standard Values	Mean of UUC	Error	Uncertainty (1)
O ₂ (%Vol)	2.498	2.47	-0.028	0.20
O ₂ (%Vol)	10.04	9.95	-0.09	0.40
O ₂ (%Vol)	21.02	21.08	0.06	0.80
CO (ppm)	80.14	80	-0.14	3.0
CO (ppm)	309.9	306	-3.9	6.0
CO (ppm)	1003	995	-8	12
NO ₂ (ppm)	30.34	27.8	-2.44	8.0
NO ₂ (ppm)	80.96	74.4	-6.56	8.0
NO ₂ (ppm)	202.2	195.1	-7.1	12
NO (ppm)	30.08	32	1.92	8.0
NO (ppm)	150.9	153	2.1	8.0
NO (ppm)	320.6	315	-5.6	12
SO ₂ (ppm)	50.04	49	-1.04	6.0
SO ₂ (ppm)	100.8	101	0.2	6.0
SO ₂ (ppm)	601.1	603	1.9	13

Calibration Results After Adjustment (Table 3)

Parameter of Standard	Standard Values	Mean of UUC	Error	Uncertainty (±)
O2 (%Vol)	2.498	2.47	-0.028	0.20
O2 (%Vol)	10.04	9.95	-0.09	0.40
O2 (%Vol)	21.02	21.08	0.06	0.80
CO (ppm)	80.14	80	-0.14	3.0
CO (ppm)	309.9	306	-3.9	6.0
CO (ppm)	1003	995	-8	12
NO2 (ppm)	30.34	29.2	-1.14	8.0
NO2 (ppm)	80.96	81.3	0.34	8.0
NO2 (ppm)	202.2	204.4	2.2	12
NO (ppm)	30.08	32	1.92	8.0
NO (ppm)	150.9	153	2.1	8.0
NO (ppm)	320.6	315	-5.6	12
SO2 (ppm)	50.04	49	-1.04	6.0
SO2 (ppm)	100.8	101	0.2	6.0
SO2 (ppm)	601.1	603	1.9	13

Remark : 1 cmol/mol = 1 %vol., 1 umol/mol = 1 ppm.

End of Report

FM-CL-09-C Rev.8

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Issued Date 25/02/15

Entech Industrial Solution Co.,Ltd.

17-121 Soi Niamwongwan 47, Yeak 48, Toongsonthong, Lakki, Bangkok 10210 THAILAND Tel: 0-2779-8888 Calibration@entech.co.th
Fax: 0-2779-0553-4 Tax ID: 0105556035591 www.entech.co.th

CERTIFICATE OF CALIBRATION

FOR

NOMENCLATURE : VACUUM GAUGE
MANUFACTURER : DWYER
MODEL / TYPE : DPGA-00
SERIAL NO. : DVG08[BKK_FS0483]
CLID. NO. : 212300280
JOB CONTROL NO. : 230211016392

CUSTOMER : ALS LABORATORY GROUP (THAILAND) CO., LTD.
104 PHATTHANAKAN 40, PHATTHANAKAN RD.,
KHUANG PHATTHANAKAN, KHET SUAN LUANG, BANGKOK 10250, THAILAND

DATE OF RECEIVED : 11 February 2023

DATE OF ISSUED : 16 February 2023

Report of calibration screening must not be taken in part. Except complete. Without the approval of the Calibration Laboratory Co., Ltd.

Calibrated By : Sittipong Pimdee
Calibration Engineer



Approved By : Mongkol Yotsoontorn
Authorized Signatory
16 February 2023

This Calibration Certificate documents the traceability to national standards, which realize the units of measurement according to the International System of Units (SI)

Certificate No. Q23016392

F3-011-04/01-12

page 1 of 3



REPORT OF CALIBRATION

FOR

NOMENCLATURE : VACUUM GAUGE
MANUFACTURER : DWYER
MODEL / TYPE : DPGA-00
SERIAL NO. : DVG08[BKK_FS0483]
DATE OF CALIBRATION : 14 February 2023

ENVIRONMENT CONDITIONS :

Temperature : (23 ± 2) °C

Relative Humidity : (55 ± 10) %RH

PROCEDURE USED :

This instrument was calibrated under procedure No. CLC-CPPP-05 according to DKD-R 6-1 as calibration guidelines.

The calibration was performed by direct measurement with Document Process Calibrator and Pressure Module which maintained by the Calibration Laboratory Co., Ltd.

REFERENCE STANDARD USED :

Document Process Calibrator, Fluke Model 744 S/N. 9226007 with Pressure Module Model 700PV4 S/N. 19298401.

TRACEABILITY :

The measurements are traceable to International System of Units (SI), through National Institute of Metrology (Thailand).
Certificate No. MP-0195-22, Due Date 18 November 2023.

UNCERTAINTY :

The reported uncertainty is based on a standard uncertainty multiplied by coverage factor of $k=2$. It has been evaluated according to the "Calibration of Pressure Gauges (DKD-R 6-1)" which provides a level of confidence approximately 95%.

Certificate No. Q23016392

F3-011-04/01-12

page 2 of 3



CONDITION OF CALIBRATION ITEM : GOOD

MEASUREMENT RESULTS : (X) without adjustment () adjustment

The DUC was exercised by applying a known pressure from its zero to full scale 1 times. Then 2 series of known gauge pressure were applied. The STD reading were recorded and the means value were reported in the table below.

CALIBRATION DATA

CORRECTION OF PRESSURE

DUC Test point (inHg)	STD Reading (inHg)		Correction (inHg)	
	Up	Down	Up	Down
0.00	0.900	0.900	0.000	0.000
-10.00	-9.961	-9.965	+0.039	+0.035
-20.00	-19.956	-19.959	+0.044	+0.041
-26.00	-25.951	-25.954	+0.049	+0.046
-27.00	-26.946	-26.948	+0.054	+0.052
-28.00	-27.939	-27.939	+0.061	+0.061

Uncertainty of measurement ± 0.007 inHg

Transmitting fluid : Air.

Note: The Scope of Accredited ANAB Certificate No. ACDM-2814 Version 008 Page 36 of 54

This report is valid for the above stated instrument/s only.

End of Certificate

Certificate No. Q23016392

F3-011-04/01-12

page 3 of 3





CALIBRATION LABORATORY CO., LTD.

210-11, 14, 55 Soi Prasert Manukit 29 Yaek 4, Prasert Manukit Rd., Ladphrao, Bangkok 10230
Tel: 02-578-0353-4 Fax: 02-578-2672 www.cal-laboratory.com E-mail: sale@cal-laboratory.com



CERTIFICATE OF CALIBRATION

FOR

NOMENCLATURE : VACUUM GAUGE
MANUFACTURER : DWYER
MODEL / TYPE : DPGA-00
SERIAL NO. : DVG06[BKK_FS0479]
CLID. NO. : 212300278
JOB CONTROL NO. : 230211016390



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

DATE OF RECEIVED : 11 February 2023

DATE OF ISSUED : 16 February 2023

Report of calibration screening must not be taken in part. Except complete. Without the approval of the Calibration Laboratory Co., Ltd.

Calibrated By : Sittipong Pimdee
Calibration Engineer



Approved By : Mongkol Yotsoontorn
Authorized Signatory
16 February 2023

This Calibration Certificate documents the traceability to national standards, which realize the units of measurement according to the International System of Units (SI)

Certificate No. Q23016390

F3-011-04/01-12

page 1 of 3



@clccalibration



CALIBRATION LABORATORY CO., LTD.

210-11, 14, 55 Soi Prasert Manukit 29 Yaek 4, Prasert Manukit Rd., Ladphrao, Bangkok 10230
Tel: 02-578-0353-4 Fax: 02-578-2672 www.cal-laboratory.com E-mail: sale@cal-laboratory.com



REPORT OF CALIBRATION

FOR

NOMENCLATURE : VACUUM GAUGE
MANUFACTURER : DWYER
MODEL / TYPE : DPGA-00
SERIAL NO. : DVG06[BKK_FS0479]
DATE OF CALIBRATION : 14 February 2023

ENVIRONMENT CONDITIONS :

Temperature : $(23 \pm 2) ^\circ\text{C}$

Relative Humidity : $(55 \pm 10) \% \text{RH}$

PROCEDURE USED :

This instrument was calibrated under procedure No. CLC-CPPP-05 according to DKD-R 6-1 as calibration guidelines

The calibration was performed by direct measurement with Document Process Calibrator and Pressure Module which maintained by the Calibration Laboratory Co., Ltd.

REFERENCE STANDARD USED :

Document Process Calibrator, Fluke Model 744 S/N. 9226007 with Pressure Module Model 700PV4 S/N. 19298401.

TRACEABILITY :

The measurements are traceable to International System of Units (SI), through National Institute of Metrology (Thailand).

Certificate No. MP-0195-22, Due Date 18 November 2023.

UNCERTAINTY :

The reported uncertainty is based on a standard uncertainty multiplied by coverage factor of $k=2$. It has been evaluated according to the "Calibration of Pressure Gauges (DKD-R 6-1)" which provides a level of confidence approximately 95%.

Certificate No. Q23016390

F3-011-04/01-12

page 2 of 3



@clccalibration



CALIBRATION LABORATORY CO., LTD.

210-11, 14, 55 Soi Prasert Manukit 29 Yaek 4, Prasert Manukit Rd., Ladphrao, Bangkok 10230
Tel: 02-578-0353-4 Fax: 02-578-2672 www.cal-laboratory.com E-mail: sale@cal-laboratory.com



CONDITION OF CALIBRATION ITEM : GOOD

MEASUREMENT RESULTS : (X) without adjustment () adjustment

The DUC was exercised by applying a known pressure from its zero to full scale 1 times. Then 2 series of known gauge pressure were applied. The STD reading were recorded and the means value were reported in the table below.

CALIBRATION DATA

CORRECTION OF PRESSURE

DUC Test point (inHg)	STD Reading (inHg)		Correction (inHg)	
	Up	Down	Up	Down
0.00	0.000	0.000	0.000	0.000
-10.00	-9.985	-9.986	+0.015	+0.014
-20.00	-19.979	-19.981	+0.021	+0.019
-26.00	-25.976	-25.977	+0.024	+0.023
-27.00	-26.973	-26.974	+0.027	+0.026
-28.00	-27.971	-27.971	+0.029	+0.029

Uncertainty of measurement ± 0.007 inHg

Transmitting fluid : Air.

Note: The Scope of Accredited ANAB Certificate No. ACDM-2814 Version 008 Page 36 of 54

This report is valid for the above stated instrument/s only.

End of Certificate

Certificate No. Q23016390

F3-011-04/01-12

page 3 of 3



@clccalibration



CALIBRATION LABORATORY CO., LTD.

210-11, 14, 55 Soi Prasert Manukit 29 Yaek 4, Prasert Manukit Rd., Ladphrao, Bangkok 10230
Tel: 02-578-0353-4 Fax: 02-578-2672 www.cal-laboratory.com E-mail: sale@cal-laboratory.com



CERTIFICATE OF CALIBRATION

FOR

NOMENCLATURE : VACUUM GAUGE
MANUFACTURER : QUALITYWELL
MODEL / TYPE : N/A
SERIAL NO. : VG02[RYG_FS0333]
CLID. NO. : 212300696
JOB CONTROL NO. : 230329034807



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

DATE OF RECEIVED : 29 March 2023

DATE OF ISSUED : 31 March 2023

Report of calibration screening must not be taken in part. Except complete. Without the approval of the Calibration Laboratory Co., Ltd.

Calibrated By : Sittipong Pimdee
Calibration Engineer



Approved By : Mongkol Yotsoontorn
Authorized Signatory
31 March 2023

This Calibration Certificate documents the traceability to national standards, which realize the units of measurement according to the International System of Units (SI)

Certificate No. Q23034807

F3-011-04/01-12

page 1 of 3



@clccalibration



REPORT OF CALIBRATION

FOR

NOMENCLATURE : VACUUM GAUGE
MANUFACTURER : QUALITYWELL
MODEL / TYPE : N/A
SERIAL NO. : VG02[RYG_FS0333]
DATE OF CALIBRATION : 30 March 2023

ENVIRONMENT CONDITIONS :

Temperature : (23 ± 2) °C

Relative Humidity : (55 ± 10) %RH

PROCEDURE USED :

This instrument was calibrated under procedure No. CLC-CPPP-05 according to DKD-R 6-1 as calibration guidelines.

The calibration was performed by direct measurement with Document Process Calibrator and Pressure Module which maintained by the Calibration Laboratory Co., Ltd.

REFERENCE STANDARD USED :

Document Process Calibrator, Fluke Model 741B S/N. 8295020 with Pressure Module Model 700PD5 S/N. 89404505

TRACEABILITY :

The measurements are traceable to International System of Units (SI), through National Institute of Metrology (Thailand).

Certificate No. MP-0035-23, Due Date 02 February 2024.

UNCERTAINTY :

The reported uncertainty is based on a standard uncertainty multiplied by coverage factor of $k=2$. It has been evaluated according to the "Calibration of Pressure Gauges (DKD-R 6-1)" which provides a level of confidence approximately 95%.

Certificate No. Q23034807

F3-011-04/01-12

page 2 of 3



CONDITION OF CALIBRATION ITEM : GOOD

MEASUREMENT RESULTS : (X) without adjustment () adjustment

The DUC was exercised by applying a known pressure from its zero to full scale 1 times. Then 2 series of known gauge pressure were applied. The STD reading were recorded and the means value were reported in the table below.

CALIBRATION DATA

CORRECTION OF PRESSURE

DUC Test point (inHg)	STD Reading (inHg)		Correction (inHg)	
	Up	Down	Up	Down
-10.0	-9.96	-9.97	+0.04	+0.03
-20.0	-20.11	-20.12	-0.11	-0.12
-26.0	-26.18	-26.19	-0.18	-0.19
-27.0	-27.21	-27.22	-0.21	-0.22
-28.0	-28.30	-28.30	-0.30	-0.30

Uncertainty of measurement = 0.06 inHg

Transmitting fluid : Air.

Note: The Scope of Accredited ANAB Certificate No. ACDM-2814 Version 008 Page 36 of 54

This report is valid for the above stated instrument/s only.

End of Certificate

Certificate No. Q23034807

F3-011-04/01-12

page 3 of 3



Certificate of Calibration

Equipment: SPECTROPHOTOMETER
Model: DR6000
Serial No. (or ID.): 1627845 (RYG_EN0037)
Manufacturer: HACH
Condition: In Condition

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

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

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

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.Pluaekdaeng, Rayong 21140, Thailand.

Calibration By: Mr. Chattaphon Folthong

Calibration Date: 27 September 2022

The Method used: In house method, CAL-WI-24, base on ASTM E 275-08 and ASTM E 387-04

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

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

(Mr. Chattaphon Folthong)
Person in charge

(Mr. Thalemgkeat Pongngam)
Authorized signatory

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

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

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

DKSH Technology Limited
2533 Sukhumvit Road, Bangkok, Prachinburi, Bangkok 10260
Phone: +66 2030 1000 Email: info.cai@dksh.com Website: www.dksh.com/calibration-thailand

Delivering Growth - In Asia and Beyond.

CALFM-C06-13: 20 Jul 2022



Certificate No.: C06220464

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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
637.96	638.3	-0.32	0.14
748.48	748.8	-0.32	0.14
807.03	807.4	-0.37	0.13

Photometric Accuracy (Absorbance)

Wavelength	Standard absorbance	Unit Under Calibration	Correction	Uncertainty
420 nm	0.0000	0.000	0.0000	0.0045
	0.5605	0.563	-0.0025	0.0045
	0.7334	0.737	-0.0036	0.0045
	1.0534	1.057	-0.0036	0.0045
440 nm	0.0000	0.000	0.0000	0.0045
	0.5503	0.553	-0.0027	0.0045
	0.7179	0.720	-0.0021	0.0045
	1.0312	1.034	-0.0028	0.0045
465 nm	0.0000	0.000	0.0000	0.0045
	0.5024	0.506	-0.0036	0.0045
	0.6693	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
	0.6903	0.691	-0.0007	0.0045
	0.9904	0.992	-0.0016	0.0045
590 nm	0.0000	0.000	0.0000	0.0045
	0.5525	0.554	-0.0015	0.0045
	0.7175	0.718	-0.0005	0.0045
	1.0301	1.031	-0.0009	0.0045
635 nm	0.0000	0.000	0.0000	0.0045
	0.5367	0.538	-0.0013	0.0045
	0.6847	0.685	-0.0003	0.0046
	0.9823	0.983	-0.0007	0.0045

DKSH Technology Limited
2533 Sukhumvit Road, Bangkok, Prachinburi, Bangkok 10260
Phone: +66 2030 1000 Email: info.cai@dksh.com Website: www.dksh.com/calibration-thailand

Delivering Growth - In Asia and Beyond.

CALFM-C06-13: 20 Jul 2022

Calibration Results:
Without Adjustment

Photometric Accuracy (Absorbance)				
Wavelength	Standard absorbance	Unit Under Calibration	Correction	Uncertainty
235 nm	0.0000	0.000	0.0000	0.0080
	0.7423	0.744	-0.0017	0.0083
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 % w/v	Peak	Trough	Ratio	SBW
Standard Wavelength (nm)	268.60	266.63	1.39	2.00
UUC: Wavelength (nm)	268.2	266.1		
Std Absorbance (A)	0.4810	0.3176		
Absorbance (A)	0.373	0.268		

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

The End of Certificate

บริษัท ดีเคเอส อีเซีย จำกัด
DKSH Technology Limited
2533 ถนนสุขุมวิท แขวงคลองเตย เขตคลองเตย กรุงเทพมหานคร 10260
Phone: +66 2030 7000 Email: info.calibration@dksh.com Website: www.dksh.com/calibration-thailand

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CALFM-C08-13: 20 Jul 2022

ใบตรวจสอบสภาพเครื่องวัดสิ่งแวดล้อม

เลขที่ใบงาน: KSPR2212224

ชนิดเครื่องมือ: SPECTROPHOTOMETER

รุ่น: DR6000

หมายเลขเครื่อง: 1627845

ตรวจสอบ (รับ)		ตรวจสอบ (ส่ง)		หมายเหตุ
27 Sep 2022		27 Sep 2022		
ปกติ	ไม่ปกติ	ปกติ	ไม่ปกติ	
General				
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	1. ความสมบูรณ์เครื่อง
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	2. ความสะอาด (ช่องใส่ตัวอย่าง, ภายในนอกเครื่อง)
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	3. สวิตช์ ปิด - เปิด เครื่อง (On-Off Switch)
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	4. ปุ่มกด (Keypad)
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	5. หน้าจอ (Display, Screen Contrast)
Spectrophotometer				
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	6. แรงดันไฟฟ้า (Battery Backup) >= 2.5 VDC
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	7. ตัวควบคุมความยาวคลื่น (Wavelength Control)
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	8. ความยาวคลื่น (Wavelength Check) 656.1 nm 656.1 nm
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	9. แหล่งกำเนิดแสง (UV < 3,000 hour)
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	10. แหล่งกำเนิดแสง (Visible < 5,000 hour)
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	11. ช่องวัดหลายตัวอย่าง (Carousel Module)
pH Meter and Conductivity Meter				
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	12. อิเล็กโทรด (Electrode and Connection Cable)
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	13. ระดับสารละลายใน Electrode (Level KCl)
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	14. ฝาปิดกันฝุ่น Electrode (Dust Protection Hood)
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	15. ขาจับอิเล็กโทรด (Stand)
Turbidimeter				
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	16. ค่าความขุ่นที่ต่ำสุด (No Sample)
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	17. ระดับการส่องสว่างของแสง (>= 2.5 ไม่น้อย 3.0)
Automatic titrator				
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	18. สภาพ Piston Burettes
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	19. Function Rinsing and Dosing
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	20. ระบบท่อสายยางและอุปกรณ์ประกอบ

เซ็นเซอร์แนบมา:

Mr. Chattaphon Folthong
Service Engineer

บริษัท ดีเคเอส อีเซีย จำกัด
DKSH Technology Limited
2533 ถนนสุขุมวิท แขวงคลองเตย เขตคลองเตย กรุงเทพมหานคร 10260
Phone: +66 2030 7000 Email: info.calibration@dksh.com Website: www.dksh.com/calibration-thailand

Delivering Growth - In Asia and Beyond.

CAL-FM-R31-03: 20 Jul 2022



ROTA METER CALIBRATION RESULT JULY 2023

Rotameter ID.	Calibration Date	Regression Result	Coefficient (R ²)
BKK_FS0577	03 Jul 23	Y = 1.2484x - 0.6741	0.9931
BKK_FS0579	03 Jul 23	Y = 1.0997x - 0.4918	1.0000
BKK_FS0583	01 Jul 23	Y = 1.0068x + 1.6459	0.9998
BKK_FS0584	01 Jul 23	Y = 0.9804x + 9.469	0.9999
BKK_FS0585	07 Jul 23	Y = 1.0248x + 0.8333	0.9996
BKK_FS0586	01 Jul 23	Y = 0.9907x + 11.074	1.0000
BKK_FS0587	07 Jul 23	Y = 0.986x + 17.77	0.9993
BKK_FS0588	01 Jul 23	Y = 0.9751x + 9.8452	0.9999
BKK_FS0589	03 Jul 23	Y = 1.0174x + 0.0381	1.0000
BKK_FS0590	01 Jul 23	Y = 1.0127x - 3.4333	1.0000
BKK_FS0591	03 Jul 23	Y = 1.0452x - 51.824	0.9998
BKK_FS0592	07 Jul 23	Y = 1.0003x + 14.344	1.0000
BKK_FS0593	01 Jul 23	Y = 1.0386x - 41.415	0.9997
BKK_FS0594	07 Jul 23	Y = 1.0025x + 6.32	0.9999
BKK_FS0595	01 Jul 23	Y = 1.0871x - 114.97	0.9985
BKK_FS0596	03 Jul 23	Y = 1.038x - 51.974	0.9993
BKK_FS0597	01 Jul 23	Y = 1.0059x - 9.9086	1.0000
BKK_FS1004	01 Jul 23	Y = 1.0186x + 6.731	0.9998
BKK_FS1005	01 Jul 23	Y = 0.9922x + 13.993	0.9970
BKK_FS1006	01 Jul 23	Y = 1.1747x - 3.1235	0.9991
BKK_FS1007	07 Jul 23	Y = 1.0737x + 0.8677	0.9997
BKK_FS1008	07 Jul 23	Y = 1.0446x + 1.2156	0.9999
BKK_FS1009	01 Jul 23	Y = 1.1044x - 0.8245	1.0000
BKK_FS1010	03 Jul 23	Y = 1.2271x - 2.0139	1.0000
BKK_FS1011	03 Jul 23	Y = 1.261x - 1.7003	1.0000
BKK_FS1012	03 Jul 23	Y = 0.9978x - 3.7238	0.9990
BKK_FS1013	03 Jul 23	Y = 1.0245x - 28.65	0.9999
BKK_FS1014	01 Jul 23	Y = 1.3135x - 7.0966	0.9961
BKK_FS1015	01 Jul 23	Y = 0.9802x + 3.8214	0.9999
BKK_FS1016	01 Jul 23	Y = 1.0726x - 85.581	0.9995
BKK_FS1020	01 Jul 23	Y = 1.1161x - 1.1986	1.0000
BKK_FS1021	01 Jul 23	Y = 0.9566x + 16.524	0.9987
BKK_FS1022	01 Jul 23	Y = 1.0712x - 89.51	0.9990
BKK_FS1023	01 Jul 23	Y = 1.3791x - 8.8721	0.9944
BKK_FS1024	01 Jul 23	Y = 0.9449x + 11.421	0.9993
BKK_FS1025	01 Jul 23	Y = 1.0477x - 41.116	1.0000
BKK_FS1026	01 Jul 23	Y = 1.3389x - 4.918	1.0000
BKK_FS1027	01 Jul 23	Y = 0.9852x + 1.5238	1.0000
BKK_FS1028	01 Jul 23	Y = 1.0281x - 19.897	0.9996



ROTA METER CALIBRATION RESULT JULY 2023

Rotameter ID.	Calibration Date	Regression Result	Coefficient (R ²)
BKK_FS1029	01 Jul 23	Y = 1.3382x - 8.9776	0.9941
BKK_FS1030	01 Jul 23	Y = 0.9818x + 2.3476	0.9995
BKK_FS1031	01 Jul 23	Y = 1.0526x - 64.415	0.9997
BKK_FS1039	01 Jul 23	Y = 0.998x + 14.823	0.9997
BKK_FS1040	01 Jul 23	Y = 1.0041x - 2.7552	0.9999
BKK_FS1041	01 Jul 23	Y = 1.116x - 1.0078	0.9999
BKK_FS1042	01 Jul 23	Y = 1.0209x + 3.56	0.9980
BKK_FS1043	01 Jul 23	Y = 1.0039x - 5.0143	0.9999
BKK_FS1044	01 Jul 23	Y = 1.0807x + 0.9837	0.9998
BKK_FS1164	03 Jul 23	Y = 1.0589x + 4.6061	0.9996
BKK_FS1165	03 Jul 23	Y = 0.9809x + 7.5262	0.9981
BKK_FS1166	03 Jul 23	Y = 1.0567x - 50.446	0.9999
BKK_FS1200	03 Jul 23	Y = 1.3634x - 1.3816	0.9991
BKK_FS1201	03 Jul 23	Y = 1.0388x - 7.0524	0.9999
BKK_FS1202	03 Jul 23	Y = 1.0518x - 59.531	0.9998
RYG_FS0197	01 Jul 23	Y = 1.0087x - 3.2838	0.9999
RYG_FS0198	01 Jul 23	Y = 0.9877x + 36.487	0.9999
RYG_FS0199	01 Jul 23	Y = 1.0299x - 0.367	0.9992
PHK_FS0027	13 Jul 23	Y = 1.1219x - 2.2432	0.9984
PHK_FS0028	13 Jul 23	Y = 1.0341x - 6.7967	0.9999
PHK_FS0029	13 Jul 23	Y = 0.9977x + 8.7829	0.9999
SGK_FS0135	14 Jul 23	Y = 0.9877x + 11.513	0.9974
SGK_FS0138	13 Jul 23	Y = 1.0571x - 1.1565	0.9991
SGK_FS0139	13 Jul 23	Y = 0.9801x + 8.6267	0.9997
SGK_FS0140	13 Jul 23	Y = 0.9978x + 11.644	1.0000
SGK_FS0141	13 Jul 23	Y = 1.1349x - 2.2667	0.9990
SGK_FS0142	13 Jul 23	Y = 0.9915x + 11.403	0.9994
SGK_FS0143	13 Jul 23	Y = 1.0054x - 4.0648	1.0000

Review By :

(Mr. Wichan Choonharat)
Enviro Field Services Manager

Approved By :

(Mr. Sarayuth Jitranont)
Assistant General Manager

Certificate of System Qualification

GC-OQ

System ID: CN11461066
Organization Name: ALS Laboratory Group (Thailand) Co., Ltd.
Organization Location: 104 Soi 40 Phatthanakan Rd. Khwang Suan Luang, Khet Suan Luang, Bangkok 10250

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

CDS Logon Verification - GC

Logon: Saenguthai Tarak

Overall CDS Logon Verification - GC Test Status

Pass

System Inspection and Basic Safety and Operation

Name: 7890

Setpoint Status: Pass

Overall System Inspection and Basic Safety and Operation Test Status

Pass

Inlet Pressure Decay

Name: 7890
Front SSL

Setpoint Status: Pass
Pressure: 25.0 psi
Pressure Change: -0.1 psi /5 minutes
Agilent Recommended: ≥ -2.0 and ≤ 0.5

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

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Overall Inlet Pressure Decay Test Status

Pass

Inlet Pressure Accuracy

Name: 7890
Front SSL

Setpoint Status: Pass
Setpoint: 25.0 psi Actual: 25.2 psi
Accuracy: 0.2 psi
Agilent Recommended: ≤ 1.2

Overall Inlet Pressure Accuracy Test Status

Pass

Inlet Pressure Decay

Name: 7890
Back SSL

Setpoint Status: Pass
Pressure: 25.0 psi
Pressure Change: 0.0 psi /5 minutes
Agilent Recommended: ≥ -2.0 and ≤ 0.5

Overall Inlet Pressure Decay Test Status

Pass

Inlet Pressure Accuracy

Name: 7890
Back SSL

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

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Setpoint Status: Pass

Setpoint: 25.0 psi Actual: 24.8 psi
Accuracy: 0.2 psi
Agilent Recommended: ≤ 1.2

Overall Inlet Pressure Accuracy Test Status

Pass

Detector Flow Accuracy

Name: 7890
Front FID
Setpoint Status: Pass
Flow Type: Fuel
Setpoint: 30.0 mL/min Measured Flow: 28.9 mL/min
Accuracy: 1.1 mL/min
Agilent Recommended: ≤ 10.0 % setpoint (3.0 mL/min)
Limit is percentage of setpoint or 0.3 mL/minute, whichever is largest.

Setpoint Status: Pass
Flow Type: Oxidizer
Setpoint: 400.0 mL/min Measured Flow: 400 mL/min
Accuracy: 0.0 mL/min
Agilent Recommended: ≤ 10.0 % setpoint (40.0 mL/min)
Limit is percentage of setpoint or 0.5 mL/minute, whichever is largest.

Setpoint Status: Pass
Flow Type: Makeup
Setpoint: 25.0 mL/min Measured Flow: 24.9 mL/min
Accuracy: 0.1 mL/min
Agilent Recommended: ≤ 10.0 % setpoint (2.5 mL/min)
Limit is percentage of setpoint or 0.5 mL/minute, whichever is largest.

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

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Overall Detector Flow Accuracy Test Status

Pass

Detector Flow Accuracy

Name: 7890
Back FID
Setpoint Status: Pass
Flow Type: Fuel
Setpoint: 30.0 mL/min Measured Flow: 30.7 mL/min
Accuracy: 0.7 mL/min
Agilent Recommended: ≤ 10.0 % setpoint (3.0 mL/min)
Limit is percentage of setpoint or 0.5 mL/minute, whichever is largest.

Setpoint Status: Pass
Flow Type: Oxidizer
Setpoint: 400.0 mL/min Measured Flow: 399 mL/min
Accuracy: 1.0 mL/min
Agilent Recommended: ≤ 10.0 % setpoint (40.0 mL/min)
Limit is percentage of setpoint or 0.5 mL/minute, whichever is largest.

Setpoint Status: Pass
Flow Type: Makeup
Setpoint: 25.0 mL/min Measured Flow: 24.6 mL/min
Accuracy: 0.4 mL/min
Agilent Recommended: ≤ 10.0 % setpoint (2.5 mL/min)
Limit is percentage of setpoint or 0.5 mL/minute, whichever is largest.

Overall Detector Flow Accuracy Test Status

Pass

GC Oven Temperature Accuracy

Name: 7890

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

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Setpoint Status: **Pass**
Zone: **Oven**
Setpoint/Actual: **230.0 / 230.6 °C**
Temperature: **230.0 / 230.6 °C**
Accuracy: **0.6 °C**
Agilent Recommended: **>= -1.0 % setpoint in K (-5.0 °C)**
<= 1.0 % setpoint in K (5.0 °C)

Setpoint Status: **Pass**
Zone: **Oven**
Setpoint/Actual: **100.0 / 100.9 °C**
Temperature: **100.0 / 100.9 °C**
Accuracy: **0.9 °C**
Agilent Recommended: **>= -1.0 % setpoint in K (-3.7 °C)**
<= 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: **100.0 / 100.8833 °C**
Temperature: **100.0 / 100.8833 °C**
Stability: **0.1 °C**
Agilent Recommended: **<= 0.5**

Overall GC Oven Temperature Stability Test Status

Pass

Scouting Run

Tested Combination1: **Front SSL / Front FID**
Injection Tower
Name: **7893A**

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

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

Noise and Drift

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

Overall Noise and Drift Test Status

Pass

Injection Precision

Tested Combination1: **Front SSL / Front FID**
Name: **7893A**
Setpoint Status: **Pass**
Injection Volume on Column: **1.0 uL**
Area RSD: **0.32 %**
Retention Time RSD: **0.67 %**
Agilent Recommended: **<= 3.00**

Overall Injection Precision Test Status

Pass

Signal to Noise

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

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

Overall Signal to Noise Test Status

Pass

Scouting Run

Tested Combination2: **Back SSL / Back FID**
Injection Tower
Name: **7893A**
Setpoint Status: **Completed**
Injection Volume on Column: **1.0 uL**
Overall Scouting Run Status: **Completed**

Noise and Drift

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

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

Overall Noise and Drift Test Status

Pass

Injection Precision

Tested Combination2: **Back SSL / Back FID**
Name: **7893A**
Setpoint Status: **Pass**
Injection Volume on Column: **1.0 uL**
Area RSD: **1.28 %**
Retention Time RSD: **0.83 %**
Agilent Recommended: **<= 3.00**

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: **2404398**
Agilent Recommended: **>= 300000**

Overall Signal to Noise Test Status

Pass

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

Instrument Details

Purpose

This section describes the as found system configuration.

Details

System

System ID	CN11461066
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	7693A
Model Number	G4514A
Serial Number	CN15380030
Firmware Revision	A.11.01
Vial Heater	Not Installed

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

Sampler 2

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

Sampler 3

Manufacturer	Agilent Technologies
Type	Injection Tower
Name	7693A
Model Number	G4513A
Serial Number	CN10340103
Firmware Revision	A.10.09
Usage	Sample Injection
Location	Back
Syringe Volume (µL)	10

Mainframe 1

Manufacturer	Agilent Technologies
Name	7690
Model Number	G3440A
Serial Number	CN11461066
Firmware Revision	Version 4.27
Oven Type	Standard

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

Inlet 1

Manufacturer	Agilent Technologies
Name	7890
Type	SSL
Location	Front
Carrier Gas	Helium
Control Type	Electronic Pressure Control (EPC)
Purged Inlet	Yes

Inlet 2

Manufacturer	Agilent Technologies
Name	7890
Type	SSL
Location	Back
Carrier Gas	Helium
Control Type	Electronic Pressure Control (EPC)
Purged Inlet	Yes

Detector 1

Manufacturer	Agilent Technologies
Name	7890
Type	FID
Adapter	Capillary
Control Type	Electronic Pressure Control (EPC)
Location	Front
Makeup Gas	Nitrogen

Detector 2

Manufacturer	Agilent Technologies
Name	7890
Type	FID
Adapter	Capillary
Control Type	Electronic Pressure Control (EPC)
Location	Back
Makeup Gas	Nitrogen

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

Electronic Signature

Purpose

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

Details

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

Regulatory Disclaimer

This document provides a protocol to verify and record instrument configuration and evidence of proper operation. It has been prepared from our interpretation of applicable regulations as well as industry best practices. The document is designed to provide an important component of a complete compliance package. Validation depends upon many factors and use of this protocol alone does not assure compliance. Agilent Technologies makes no 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: April 21, 2023 3:26:38 PM
System ID: CN11461066

User Name: sampathk@lank
Host Name: LAPTOP-CQ3BKQWY
System ID: CN11461066
Print Date: April 21, 2023 3:26:40 PM

GC-6_BKX_ENH127_ALS Transaction Log:

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
April 21, 2023 11:21:36 AM	Auth	Session Created	Session	None
April 21, 2023 11:21:36 AM	Start	Configuration	Session	None
April 21, 2023 11:21:36 AM	Auth	End User Login	Licensing	User is Managing and does not require an unlock code
April 21, 2023 11:22:04 AM	Auth	File Loaded	Session	EQP details for primary method (GC-6) (file path: [Path]P645454/Config/eqp02 EQP02 EQP02 EQP02) EQP File Name: [GC-6 EQP] EQP Name: [AgilentRecommendation] (Path) (file path: [GC-6 EQP])
April 21, 2023 11:22:09 AM	End	Configuration	Session	None
April 21, 2023 11:22:14 AM	Start	Qualification	Session	EQ
April 21, 2023 11:22:14 AM	Start	Execution	CD5 Logon Verification - GC - Qualitative Test	None
April 21, 2023 11:23:14 AM	End	Execution	CD5 Logon Verification - GC - Qualitative Test	Run Count: 1
April 21, 2023 11:23:16 AM	Start	Execution	System Inspection and Safety and Operation - 7890 - Qualitative Test - No samples associated	None
April 21, 2023 11:23:35 AM	End	Execution	System Inspection and Safety and Operation - 7890 - Qualitative Test - No samples associated	Run Count: 1
April 21, 2023 11:23:37 AM	Start	Execution	Initial Pressure Decay - Front	None

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User Name: sampathk@lank
Host Name: LAPTOP-CQ3BKQWY
System ID: CN11461066
Print Date: April 21, 2023 3:26:40 PM

GC-6_BKX_ENH127_ALS Transaction Log:

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
April 21, 2023 11:24:01 AM	End	Execution	Initial Pressure Decay - Front	Run Count: 1
April 21, 2023 11:24:04 AM	Start	Execution	Initial Pressure Accuracy - Front	None
April 21, 2023 11:24:08 AM	End	Execution	Initial Pressure Accuracy - Front	Run Count: 1
April 21, 2023 11:24:11 AM	Start	Execution	Initial Pressure Decay - Back	None
April 21, 2023 11:24:45 AM	End	Execution	Initial Pressure Decay - Back	Run Count: 1
April 21, 2023 11:24:45 AM	Start	Execution	Initial Pressure Accuracy - Back	None
April 21, 2023 11:24:51 AM	End	Execution	Initial Pressure Accuracy - Back	Run Count: 1
April 21, 2023 11:24:53 AM	Start	Execution	Detector Flow Accuracy - Front	None
April 21, 2023 11:25:09 AM	Auth	Data	Detector Flow Accuracy - Front	Manual Data Entry
April 21, 2023 11:25:25 AM	End	Execution	Detector Flow Accuracy - Front	Run Count: 1

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User Name: sampathk@lank
Host Name: LAPTOP-CQ3BKQWY
System ID: CN11461066
Print Date: April 21, 2023 3:26:40 PM

GC-6_BKX_ENH127_ALS Transaction Log:

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
April 21, 2023 11:25:26 AM	Start	Execution	Detector Flow Accuracy - Front	None
April 21, 2023 11:25:45 AM	Auth	Data	Detector Flow Accuracy - Front	Manual Data Entry
April 21, 2023 11:25:42 AM	End	Execution	Detector Flow Accuracy - Front	Run Count: 1
April 21, 2023 11:25:44 AM	Start	Execution	Detector Flow Accuracy - Front	None
April 21, 2023 11:26:01 AM	Auth	Data	Detector Flow Accuracy - Front	Manual Data Entry
April 21, 2023 11:26:04 AM	End	Execution	Detector Flow Accuracy - Front	Run Count: 1
April 21, 2023 11:26:05 AM	Start	Execution	Detector Flow Accuracy - Back	None
April 21, 2023 11:26:19 AM	Auth	Data	Detector Flow Accuracy - Back	Manual Data Entry
April 21, 2023 11:26:22 AM	End	Execution	Detector Flow Accuracy - Back	Run Count: 1
April 21, 2023 11:26:24 AM	Start	Execution	Detector Flow Accuracy - Back	None
April 21, 2023 11:26:36 AM	Auth	Data	Detector Flow Accuracy - Back	Manual Data Entry

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User Name: sampathk@lank
Host Name: LAPTOP-CQ3BKQWY
System ID: CN11461066
Print Date: April 21, 2023 3:26:40 PM

GC-6_BKX_ENH127_ALS Transaction Log:

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
April 21, 2023 11:26:43 AM	End	Execution	Detector Flow Accuracy - Back	Run Count: 1
April 21, 2023 11:26:45 AM	Start	Execution	Detector Flow Accuracy - Back	None
April 21, 2023 11:27:01 AM	Auth	Data	Detector Flow Accuracy - Back	Manual Data Entry
April 21, 2023 11:27:05 AM	End	Execution	Detector Flow Accuracy - Back	Run Count: 1
April 21, 2023 11:27:07 AM	Start	Execution	GC Oven Temperature Accuracy - 7890 - Temperature	None
April 21, 2023 11:27:33 AM	Auth	Data	GC Oven Temperature Accuracy - 7890 - Temperature	Manual Data Entry
April 21, 2023 11:27:35 AM	End	Execution	GC Oven Temperature Accuracy - 7890 - Temperature	Run Count: 1
April 21, 2023 11:27:37 AM	Start	Execution	GC Oven Temperature Accuracy - 7890 - Temperature	None
April 21, 2023 11:27:54 AM	Auth	Data	GC Oven Temperature Accuracy - 7890 - Temperature	Manual Data Entry

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User Name: samsghalib@ars
Hostname: LAPTOP-CQ3SRDMV
System ID: CN11481068
Print Date: April 21, 2023 3:26:49 PM

GC-6_BKK_ENH127_ALS Transaction log :

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
April 21, 2023 11:27:57 AM	End	Execution	GC Oven Temperature	Run Count : 1 Accuracy : 7890° - Temperature - Oven : S: 100.0°C - L: -4.8 AND -<= 0.5 % support in K
April 21, 2023 11:27:58 AM	Start	Execution	GC Oven Temperature Stability	None - 7890° - Temperature : Oven - S: 100.0°C - L: -4.8°C
April 21, 2023 11:28:07 AM	Auto	Data	GC Oven Temperature Stability	Manual Data Entry - 7890° - Temperature : Oven - S: 100.0°C - L: -4.8°C
April 21, 2023 11:28:10 AM	End	Execution	GC Oven Temperature Stability	Run Count : 1 - 7890° - Temperature : Oven - S: 100.0°C - L: -4.8°C
April 21, 2023 11:28:12 AM	Start	Execution	GC Spooling Run - Injection	None Tower, Front SSL, Front FID - Part of System Preparation - No inlets associated
April 21, 2023 11:30:27 AM	Auto	Data	GC Spooling Run - Injection	Gas flow Path : C:\Users\Public\Documents\C hemStation3\Data\GC-6 _ALS_2023-04-20\GC-6 _2023 2023-04-20 14-36-08\FID1-0147.D\FID 1A.ch
April 21, 2023 11:31:04 AM	End	Execution	GC Spooling Run - Injection	Run Count : 1 Tower, Front SSL, Front FID - Part of System Preparation - No inlets associated
April 21, 2023 11:31:07 AM	Start	Execution	Helium and Oxit - Front FID -	None Detector FID - L (Noise) -<= 0.10 pA - L (Drift) -<= 2.50 pA/hour

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User Name: samsghalib@ars
Hostname: LAPTOP-CQ3SRDMV
System ID: CN11481068
Print Date: April 21, 2023 3:26:49 PM

GC-6_BKK_ENH127_ALS Transaction log :

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
April 21, 2023 11:31:43 AM	Auto	Data	Helium and Oxit - Front FID -	Detector FID - L (Noise) -<= 0.10 pA - L (Drift) -<= 2.50 pA/hour Data file Path : C:\Users\Public\Documents\C hemStation3\Data\GC-6 _ALS_2023-04-20\GC-6 _2023 2023-04-20 14-36-08\FID1-0147.D\FID 1A.ch
April 21, 2023 11:32:00 AM	End	Execution	Helium and Oxit - Front FID -	Detector FID - L (Noise) -<= 0.10 pA - L (Drift) -<= 2.50 pA/hour Run Count : 1
April 21, 2023 11:32:03 AM	Start	Execution	Injection Precision - Injection	None Tower, Front SSL, Front FID - GC - L (Area) -<= 3.00% - L (Rel. Time) -<= 1.00%
April 21, 2023 11:32:22 AM	Start	Execution	Injection Precision - Injection	None Tower, Front SSL, Front FID - GC - L (Area) -<= 3.00% - L (Rel. Time) -<= 1.00%
April 21, 2023 11:33:26 AM	Auto	Data	Injection Precision - Injection	Gas flow Path : C:\Users\Public\Documents\C hemStation3\Data\GC-6 _ALS_2023-04-20\GC-6 _2023 2023-04-20 14-36-08\FID1-0147.D\FID 1A.ch
April 21, 2023 11:33:55 AM	Auto	Data	Injection Precision - Injection	Gas flow Path : C:\Users\Public\Documents\C hemStation3\Data\GC-6 _ALS_2023-04-20\GC-6 _2023 2023-04-20 14-36-08\FID1-0147.D\FID 1A.ch

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

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User Name: samsghalib@ars
Hostname: LAPTOP-CQ3SRDMV
System ID: CN11481068
Print Date: April 21, 2023 3:26:49 PM

GC-6_BKK_ENH127_ALS Transaction log :

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
April 21, 2023 11:33:55 AM	Auto	Data	Injection Precision - Injection	Gas flow Path : C:\Users\Public\Documents\C hemStation3\Data\GC-6 _ALS_2023-04-20\GC-6 _2023 2023-04-20 14-36-08\FID1-0147.D\FID 1A.ch
April 21, 2023 11:33:58 AM	Auto	Data	Injection Precision - Injection	Gas flow Path : C:\Users\Public\Documents\C hemStation3\Data\GC-6 _ALS_2023-04-20\GC-6 _2023 2023-04-20 14-36-08\FID1-0147.D\FID 1A.ch
April 21, 2023 11:33:59 AM	Auto	Data	Injection Precision - Injection	Gas flow Path : C:\Users\Public\Documents\C hemStation3\Data\GC-6 _ALS_2023-04-20\GC-6 _2023 2023-04-20 14-36-08\FID1-0147.D\FID 1A.ch
April 21, 2023 11:33:59 AM	Auto	Data	Injection Precision - Injection	Gas flow Path : C:\Users\Public\Documents\C hemStation3\Data\GC-6 _ALS_2023-04-20\GC-6 _2023 2023-04-20 14-36-08\FID1-0147.D\FID 1A.ch
April 21, 2023 11:35:05 AM	End	Execution	Injection Precision - Injection	Run Count : 1 Tower, Front SSL, Front FID - GC - L (Area) -<= 3.00% - L (Rel. Time) -<= 1.00%
April 21, 2023 11:35:06 AM	Start	Execution	Signal to Noise - Injection	None Tower, Front SSL, Front FID - Detector FID - L: -<= 300000

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System ID: CN11481068

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User Name: samsghalib@ars
Hostname: LAPTOP-CQ3SRDMV
System ID: CN11481068
Print Date: April 21, 2023 3:26:49 PM

GC-6_BKK_ENH127_ALS Transaction log :

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
April 21, 2023 11:35:08 AM	Auto	Data	Signal to Noise - Injection	Detector FID - L: -<= 300000 Data file Path : C:\Users\Public\Documents\C hemStation3\Data\GC-6 _ALS_2023-04-20\GC-6 _2023 2023-04-20 14-36-08\FID1-0147.D\FID 1A.ch
April 21, 2023 11:36:00 AM	End	Execution	Signal to Noise - Injection	Detector FID - L: -<= 300000 Run Count : 1
April 21, 2023 11:36:02 AM	Start	Execution	GC Spooling Run - Injection	None Tower, Back SSL, Back FID - Part of System Preparation - No inlets associated
April 21, 2023 11:36:36 AM	Auto	Data	GC Spooling Run - Injection	Gas flow Path : C:\Users\Public\Documents\C hemStation3\Data\GC-6 _ALS_2023-04-20\GC-6 _2023 2023-04-20 14-36-08\FID1-0147.D\FID 1A.ch
April 21, 2023 11:37:00 AM	Start	Execution	GC Spooling Run - Injection	Run Count : 1 Tower, Back SSL, Back FID - Part of System Preparation - No inlets associated
April 21, 2023 11:37:30 AM	Start	Execution	Helium and Oxit - Back FID -	None Detector FID - L (Noise) -<= 0.10 pA - L (Drift) -<= 2.50 pA/hour

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Myer Name: saengulha/kook
Hostname: LAPTOP-CQ3SK0WY

System Id: CN15481064
Print Date: April 21, 2022 3:28:40 PM

QC-E BKK EN0177 ALE Transaction log :

Time	Transaction State	Activity Performed	Type of Transaction	Outcodel Information
April 21, 2023 11:58:08 AM Audt		Data	Noise and CR - Back PID - Distillator PID - L (Noise) <= 0.10 pH - L (Dist) <= 2.50 pH/Sec	Data File Path : C:\Users\Public\Documents\henn2\asset3\henn2_OG_GA_ALS_2023-04-20\OG_GA_2023-2023-04-26-14-35-28MS-01-2023-part025.ctd
April 21, 2023 11:58:23 AM End		Execution	Noise and Dist - Back PID - Distillator PID - L (Noise) <= 0.10 pH - L (Dist) <= 2.50 pH/Sec	Run Count : 1
April 21, 2023 11:58:32 AM Blin		Execution	Injection Preblow - Injection Tower, Back BSL, Back PID - GC - L (Prebl) <= 3.00% - L (Blw. Time) <= 1.00%	None
April 21, 2023 11:58:51 AM Blin		Execution	Injection Preblow - Injection Tower, Back BSL, Back PID - GC - L (Prebl) <= 3.00% - L (Blw. Time) <= 1.00%	None
April 21, 2023 11:59:17 AM Audt		Data	Injection Preblow - Injection Tower, Back BSL, Back PID - GC - L (Prebl) <= 3.00% - L (Blw. Time) <= 1.00%	Data File Path : C:\Users\Public\Documents\henn2\asset3\henn2_OG_GA_ALS_2023-04-20\OG_GA_2023_Pbl-2023-04-21-10-57-37Pbl-11-05MS-01F25.ctd
April 21, 2023 11:59:17 AM Audt		Data	Injection Preblow - Injection Tower, Back BSL, Back PID - GC - L (Prebl) <= 3.00% - L (Blw. Time) <= 1.00%	Data File Path : C:\Users\Public\Documents\henn2\asset3\henn2_OG_GA_ALS_2023-04-20\OG_GA_2023_Pbl-2023-04-21-10-57-37Pbl-11-05MS-01F25.ctd

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Date: Apr 21, 2023 3:26:36 PM
System ID: CN11451055

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User Name: spangulhal1000
Hostname: LPTOP-COASHOM

System ID: CN1146100A
Print Date: April 21, 2021 8:36:40 PM

DC-6_BKK_END127_ALS Transaction log

Time	Transaction Status	Activity Performed	Type of Transaction	Optional Information
April 21, 2023 11:40:17 AM	Auto	Data	Injection Precision - Injection Tower, Back SSL, Back PID - GC - L (Area) == 3.00% - L (Rel. Time) == 1.00%	Data File Path : C:\Users\Public\Documents\hemt\src\GenData\GC_2023_Fri_2023-04-21 10-37-32\Fri11-0000.D\F11-28.m
April 21, 2023 11:40:17 AM	Auto	Data	Injection Precision - Injection Tower, Back SSL, Back PID - GC - L (Area) == 3.00% - L (Rel. Time) == 1.00%	Data File Path : C:\Users\Public\Documents\hemt\src\GenData\GC_2023_Fri_2023-04-21 10-37-32\Fri11-0000.D\F11-28.m
April 21, 2023 11:40:21 AM	Auto	Data	Injection Precision - Injection Tower, Back SSL, Back PID - GC - L (Area) == 3.00% - L (Rel. Time) == 1.00%	Data File Path : C:\Users\Public\Documents\hemt\src\GenData\GC_2023_Fri_2023-04-21 10-37-32\Fri11-0000.D\F11-28.m
April 21, 2023 11:40:21 AM	Auto	Data	Injection Precision - Injection Tower, Back SSL, Back PID - GC - L (Area) == 3.00% - L (Rel. Time) == 1.00%	Data File Path : C:\Users\Public\Documents\hemt\src\GenData\GC_2023_Fri_2023-04-21 10-37-32\Fri11-0000.D\F11-28.m
April 21, 2023 11:41:09 AM	End	Execution	Injection Precision - Injection Tower, Back SSL, Back PID - GC - L (Area) == 3.00% - L (Rel. Time) == 1.00%	Run Count : 1
April 21, 2023 11:41:33 AM	Start	Execution	Signal to Notes - Injection Tower, Back SSL, Back PID - Detector, FID - L (Rel. Time) == 1.00%	None

Phone 502.99

Date: April 21, 2023 3:26:38 PM
System ID: CNT1481066

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Utat Név: csorgothal.jarak
 Hostname: LAPTOP-QDQSKOM5

System Id: CN11461061
Print Date: April 25, 2023 3:36:45 PM

GC-5, BKK, FN0127, ALS Transaction fee

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
April 21, 2023 11:42:22 AM	Audit	Data	Signal to Noise - Injection Tower, Back SQL, Back FID - Detector FID - L- 20000	Data file Path : C:\Users\Patel\Documents\New folder\BackSQL_BackFID_2023-04-20SQL_2023-04-20_24-35-08-89_Back.DHT (2) ch
April 21, 2023 11:42:50 AM	Exit	Execution	Signal to Noise - Injection Tower, Back SQL, Back FID - Detector FID - L- 20000	Run Count : 1
April 21, 2023 11:42:53 AM	Exit	Qualification	Session	OQ
April 21, 2023 11:42:53 AM	Start	Rebooting	Session	None
April 21, 2023 1:20:47 PM	Audit	AcqClosed	Session	None
April 21, 2023 3:16:07 PM	Audit	AcqRestarted	Session	None
April 21, 2023 3:16:10 PM	Audit	SessionRestarted	Session	None
April 21, 2023 3:16:31 PM	Start	Qualification	Session	OQ
April 21, 2023 3:30:59 PM	Audit	AcqRestarted	Session	None
April 21, 2023 3:31:05 PM	Audit	SessionRestarted	Session	None
April 21, 2023 3:21:07 PM	Start	Qualification	Session	OQ
April 21, 2023 3:23:45 PM	Audit	Rebooting	Session	Restart Generated.

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Date: Apr 21, 2023 3:26:38 PM
System ID: CN11461058

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



SARTORIUS

REVIEW BY *Thurston*
APPROVED BY *D. [Signature]*
NEXT CAL. DATE *01/03/24*

Certificate of Calibration

Model Number :	MSE224S-100-DU	Certificate No. :	23RCI0115
Description :	Analytical Balance	Issued Date :	Friday, March 03, 2023
Serial Number :	0031709552	Reference No. :	204833
ID No. :	RYG_EN0003		
Manufacturer :	Sartorius	Page No. :	1 of 2

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

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

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

Metrological data:		Ambients Conditions:	
Capacity:	220 g	Temperature:	23.0 °C ± 5.0 °C
Readability:	0.0001 g	Humidity:	56.0 % RH ± 10.0 % RH
Reasons for calibration:		Pressure:	

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

Traceability:

Model Number	Description	Traceability	Certificate No.	Due Date
YCS011-522-00	Sartorius weight set 1mg - 5000g E2.YCS011-522-00	SPC-RT	C02212565	14-Sep-2023
MHB-382SD	Humidity/Barometer/Temp. Lutron MHB-382SD	DKSH	C19220444	5-Sep-2023

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

Mr.chonchai Intramana(Technical Manager



SOP FM 33 03 February 2022

Certificate of Calibration

Model Number : MSE224S-100-DU
Description : Analytical Balance
Serial Number : 0031709552
ID No. : RYG_EN0003
Manufacturer : Sartorius
Certificate No. : 23BCI0115
Issued Date : Friday, March 03, 2023
Reference No. : 204833
Page No. : 2 of 2

Calibration Results : Without Adjustment

Repeatability			Eccentricity (Off-center loading error)		
The reproducibility is the ability of a weighing instrument to display nearly identical readouts under constant test conditions when the same load within a measurement series is placed repeatedly on the weighing pan in the same manner. The standard deviation is used to express reproducibility quantitatively.			The off-center loading error is yielded by the difference between the readout of the load, i.e. 1/3 or 1/4 of maximum capacity, placed in the middle of the weighing pan and between each of four additional measurement points (positions defined according to OIML R76).		
Nominal Value : (Low Load)	20.0000	200.0000	Nominal value :	100	g
20 g	20.0001	200.0000	Tolerance	0.0004	g
Tolerance	0.0001 g	20.0000	Difference		
	20.0000	200.0001	1	0.0001	
	20.0000	200.0000	2	0.0000	
	20.0001	200.0001	3	0.0000	
	20.0000	200.0001	4	0.0000	
Nominal Value : (High Load)	20.0001	200.0001	5	0.0001	
200 g	20.0000	200.0001	6	-	
Tolerance	0.0001 g	20.0000			
	20.0000	200.0000			
	20.0000	200.0001			
	20.0000	200.0001			
Standard Deviation	0.00004	0.00005			

Linearity				
The linearity, also called linearity error. Describes the deviation of the characteristic curve of a weighing instrument from the linear slope.				
Tolerance	0.0002 g			
Nominal Value	Conventional Mass Value	Displayed Value	Deviation	Uncertainty
(g)	(g)	(g)	(g)	(g)
0.01	0.0100	0.0100	0.0000	0.00013
0.05	0.0500	0.0500	0.0000	0.00013
0.1	0.1000	0.1000	0.0000	0.00013
0.5	0.5000	0.5000	0.0000	0.00014
1	1.0000	1.0000	0.0000	0.00014
5	5.0000	5.0000	0.0000	0.00014
10	10.0000	10.0000	0.0000	0.00014
20	20.0000	20.0000	0.0000	0.00024
50	50.0000	50.0000	0.0000	0.00015
100	100.0000	100.0000	0.0000	0.00019
200	200.0000	200.0001	0.0001	0.00032
End of Report				

SOP FM 33 03 February 2022

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

Testing laboratory Workplaces:

1	Prague	Na Harč 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 11, 718 00 Ostrava
6	Plzeň	Lobezská 15, 30146 Plzeň
7	Lovosice	U Zdyrnadel 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 Harč 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 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 ¹	Test procedure/method name	Test procedure/method identification ²	Subject of the test
1	General Chemistry		
1.1 ¹	Determination of elements ⁴¹ by atomic emission spectrometry with inductively coupled plasma and stoichiometric calculations of compounds concentration from measured values ⁵³ including the calculation of total mineralization and calculating the sum of Ca+Mg	CZ_SOP_D06_02_001 (US EPA 2007, ČSN EN ISO 11885, US EPA 6010, SM 3120, ČSN 75 7358)	Water ⁶¹ , extracts ⁶² , liquid samples ⁶¹
1.2 ¹	Determination of elements ⁴¹ by atomic emission spectrometry with inductively coupled plasma and stoichiometric calculations of compounds concentration from measured values ⁵³	CZ_SOP_D06_02_001 (US EPA 2007, ČSN EN ISO 11885, US EPA 6010, SM 3120)	Solid samples ⁶⁵ , building materials ⁶² , materials for building ⁶⁹
1.3 ¹	Determination of elements ⁴¹ by atomic emission spectrometry with inductively coupled plasma and stoichiometric calculations of compounds concentration from measured values ⁵³	CZ_SOP_D06_04_001 (US EPA 2007, ČSN EN ISO 11885)	Food, feed ⁶³
1.4 ¹	Determination of elements ⁴¹ by atomic emission spectrometry with inductively coupled plasma and stoichiometric calculations of compounds concentration from measured values ⁵³	CZ_SOP_D06_04_001 (US EPA 2007, ČSN EN ISO 11885)	Biological materials ⁷⁷



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Český institut pro akreditaci, o.p.s.
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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 - Vysočany, 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

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:

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Ordinal number ¹	Test procedure/method name	Test procedure/method identification ²	Subject of the test
1.5 ¹	Determination of elements ⁴⁷ by atomic emission spectrometry with inductively coupled plasma and calculation of Cr ³⁺ from measured values	CZ_SOP_D06_02_001 (US EPA 2007, ČSN EN ISO 11885, ČSN EN 13211, ČSN EN 14385, ČSN EN 14902, IO 3.4, US EPA 29)	Emission ⁷⁸ , imission ⁷⁹
1.6 ¹	Determination of elements ⁴⁷ by atomic emission spectrometry with inductively coupled plasma	CZ_SOP_D06_04_001 (US EPA 2007, ČSN EN ISO 11885, CL/PhEur/USP)	Pharmaceutical material
1.7 ¹	Determination of elements ⁴¹ by mass spectrometry with inductively coupled plasma and stoichiometric calculations of compounds concentration from measured values ⁵³ including the calculation of total mineralization and calculating the sum of Ca+Mg	CZ_SOP_D06_02_002 (US EPA 2008, ČSN EN ISO 17294-2, US EPA 6020A, ČSN 75 7358)	Water ⁶¹ , extracts ⁶² , liquid samples ⁶¹
1.8 ¹	Determination of elements ⁴¹ by mass spectrometry with inductively coupled plasma and stoichiometric calculations of compounds concentration from measured values	CZ_SOP_D06_02_002 (US EPA 2008, ČSN EN ISO 17294-2, US EPA 6020A)	Solid samples ⁶⁵ , building materials ⁶² , materials for building ⁶⁹
1.9 ¹	Determination of elements ⁴¹ by mass spectrometry with inductively coupled plasma and stoichiometric calculations of compounds concentration from measured values	CZ_SOP_D06_04_002 (US EPA 2008, ČSN EN ISO 17294-2, ČSN EN 15111)	Food, feed ⁶³
1.10 ¹	Determination of elements ⁴¹ by mass spectrometry with inductively coupled plasma and stoichiometric calculations of compounds concentration from measured values	CZ_SOP_D06_04_002 (US EPA 2008, ČSN EN ISO 17294-2)	Biological materials ⁷⁷
1.11 ¹	Determination of elements ⁴¹ by mass spectrometry with inductively coupled plasma and calculation of Cr ³⁺ from measured values	CZ_SOP_D06_02_002 (US EPA 2008, ČSN EN ISO 17294-2, ČSN EN 13211, ČSN EN 14385, ČSN EN 14902, US EPA 29)	Emission ⁷⁸ , imission ⁷⁹
1.12 ¹	Determination of elements ⁴⁰ by mass spectrometry with inductively coupled plasma	CZ_SOP_D06_04_002 (US EPA 2008, ČSN EN ISO 17294-2, ČSN EN 15111, CL/PhEur/USP)	Pharmaceutical material
1.13 ¹	Determination of Hg by atomic absorption spectrometry	CZ_SOP_D06_02_003 (ČSN 46 5735, ČSN 75 7440)	Emission ⁷⁸ , imission ⁷⁹
1.14 ²	Determination of Hg by single-purpose atomic absorption spectrometer	CZ_SOP_D06_07_004 (ČSN 75 7440, ČSN 46 5735)	Water ⁶¹ , extracts ⁶² , liquid samples ⁶¹ , solid samples ⁶⁵
1.15 ²	Determination of elements ⁴⁹ 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 ⁶¹ , extracts ⁶² , liquid samples ⁶¹

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Ordinal number ¹	Test procedure/method name	Test procedure/method identification ²	Subject of the test
		ČSN ISO 7980, ČSN ISO 9964, Perkin-Elmer specifications)	
1.16 ²	Determination of elements ⁴⁹ 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 ⁸⁵
1.17 ²	Determination of elements ⁴⁹ 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, ATIM3-0032)	Water ⁹¹ , extracts ⁹² , liquid samples ⁸¹
1.18 ²	Determination of elements ⁴⁹ 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 ⁸⁵ , solid recovered fuels
1.19 ²	Determination of Kjeldahl nitrogen by spectrophotometry	CZ_SOP_D06_07_007.A (ČSN EN 25663, ČSN ISO 7150-1)	Water ⁹¹ , extracts ⁹²
1.20 ²	Determination of Kjeldahl nitrogen by spectrophotometry	CZ_SOP_D06_07_007.B (ČSN EN 25663, ČSN EN 13342, ČSN ISO 7150-1)	Solid samples ⁸⁵
1.21 ²	Determination of Cr ^{VI} by spectrophotometry with diphenylcarbazide	CZ_SOP_D06_07_008 (ČSN ISO 11083)	Water ⁹¹ , extracts ⁹² , absorption solutions from emission samples
1.22 ²	Determination of total phosphorus and orthophosphate by spectrophotometry and calculation of P ₂ O ₅ from measured values	CZ_SOP_D06_07_009.A (ČSN EN ISO 6878)	Water ⁹¹ , extracts ⁹²
1.23 ²	Determination of total phosphorus by spectrophotometry and calculation of P ₂ O ₅ 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 ²	Determination of nonionic surfactants (BiAS) by spectrophotometry using the HACH cuvette test	CZ_SOP_D06_07_014 (Hach Instruction)	Water ⁹¹ , extracts ⁹²
1.30 ²	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 ² -D)	Water ⁹¹ , extracts ⁹²
1.31 ²	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 ⁸⁵ , building materials ⁴² , materials for building ⁸⁹
1.32 ²	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

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Ordinal number ¹	Test procedure/method name	Test procedure/method identification ²	Subject of the test
1.33 ¹	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 ₄ ²⁻)	Water ⁹¹ , extracts ⁹²
1.34 ²	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 ₂ ⁻ , SM 4500-NO ₃ ⁻)	Liquid samples
1.35 ¹	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 ¹	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 ₂ ⁻ , SM 4500-NO ₃ ⁻)	Water ⁹¹ , extracts ⁹²
1.37 ²	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 ⁹¹ , extracts ⁹² , liquid samples ⁸¹ , absorption solutions from emission samples
1.38 ²	Determination of nitrite nitrogen by spectrophotometry and calculation of nitrite from measured values	CZ_SOP_D06_07_021 (ČSN EN 26777)	Water ⁹¹ , extracts ⁹²
1.39 ¹	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 ⁹¹ , extracts ⁹²
1.40 ²	Determination of chloride by potentiometric titration	CZ_SOP_D06_07_023.A (ČSN 03 8526:1989, ČSN 83 0530-20:1980, SM 4500-Cl ⁻ D)	Water ⁹¹ , extracts ⁹² , liquid samples ⁸¹
1.41 ²	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 ⁸⁵ , building materials ⁴² , materials for building ⁸⁹
1.42 ¹	Determination of Hg by atomic absorption spectrometry	CZ_SOP_D06_04_024 (ČSN 46 5735, ČSN 75 7440, CL/PhEur/USP)	Food, feed ⁴¹ , biological materials ⁷⁷ , Pharmaceutical materials
1.43 ²	Determination of extractable organically bound halogens (EOX) by coulometry	CZ_SOP_D06_07_025.A (DIN 38409-H8, DIN 38414-S17)	Water ⁹¹ , extracts ⁹²

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Ordinal number ¹	Test procedure/method name	Test procedure/method identification ²	Subject of the test
1.44 ²	Determination of extractable organically bound halogens (EOX) by coulometry	CZ_SOP_D06_07_025.B (DIN 38409-H8, DIN 38414-S17)	Solid samples ⁸⁵
1.45 ²	Determination of adsorbable organically bound halogens (AOX) by coulometry	CZ_SOP_D06_07_026 (ČSN EN 16166, DIN 38414-S18)	Solid samples ⁸⁵
1.46 ²	Determination of total halogens (TX) by coulometry	CZ_SOP_D06_07_027 (US EPA 9076)	Solid samples ⁸⁵ , oils, organic solvents
1.47 ²	Determination of adsorbable organically bound halogens (AOX) by coulometry	CZ_SOP_D06_07_028 (ČSN EN ISO 9562, TNI 757531)	Water ⁹¹ , extracts ⁹²
1.48 ²	Determination of phenol index by spectrophotometric method after distillation	CZ_SOP_D06_07_029 (ČSN ISO 6439)	Solid samples ⁸⁵
1.49	Reserved		
1.50 ²	Determination of anionic surfactants by measurement of the methylene blue index (MBAS) by spectrophotometry	CZ_SOP_D06_07_031 (ČSN EN 903, SM 5540 C)	Water ⁹¹ , extracts ⁹²
1.51 ²	Determination of absorbance and transmittance by spectrophotometry	CZ_SOP_D06_07_032 (ČSN 75 7360)	Water ⁹¹ , extracts ⁹²
1.52* 1.23,4,5,6,7, 8,9	Field measurement of turbidity ZFn by turbidimeter	CZ_SOP_D06_01_033 (ČSN EN ISO 7027-1)	Water ⁹¹
1.53 ²	Determination of humic substances by spectrophotometry	CZ_SOP_D06_07_034 (ČSN 75 7536)	Drinking, raw, surface, ground water
1.54 ²	Determination of water colour by spectrophotometric method	CZ_SOP_D06_07_035 (ČSN EN ISO 7887)	Water ⁹¹ , extracts ⁹²
1.55 ²	Determination of electrical conductivity	CZ_SOP_D06_07_036 (ČSN EN 27888)	Water ⁹¹ , extracts ⁹² , liquid samples ⁸¹
1.56 ²	Determination of pH electrochemically	CZ_SOP_D06_07_037 (ČSN ISO 10523)	Water ⁹¹ , extracts ⁹² , liquid samples ⁸¹
1.57 ²	Biodegradation of organic compounds in aqueous medium – Static test (Zahn-Wellens method) calculated from the measured values of COD _{Cr}	CZ_SOP_D06_07_038 (ČSN EN ISO 9888, OECD 302B, with COD _{Cr} determination according to CZ_SOP_D06_07_040)	Chemicals and chemical products, water ⁹¹ and waste leachate ⁹²
1.58	Reserved		
1.59 ²	Determination of chemical oxygen demand using dichromate (COD _{Cr}) by titration	CZ_SOP_D06_07_040 (ČSN ISO 6060)	Water ⁹¹ , extracts ⁹²
1.60	Reserved		
1.61 ²	Determination of analytical water and gross water by gravimetry and calculation of total water from measured values	CZ_SOP_D06_07_041 (ČSN 44 1377, ČSN EN ISO 18134-1, ČSN EN ISO 18134-2, ČSN EN ISO 18134-3, ČSN P CEN/TS 15414-1, ČSN P CEN/TS 15414-2, ČSN EN ISO 21660-3, ČSN EN 12880, ČSN EN 14346, ČSN EN 15002)	Solid fossil fuels, solid biofuels, solid recovered fuels, sludge, waste
1.62 – 1.63	Reserved		

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Ordinal number ¹	Test procedure/method name	Test procedure/method identification ²	Subject of the test
1.64 ¹	Determination of dissolved oxygen (in the laboratory) by electrochemical method with optical sensor	CZ_SOP_D06_02_043 (ČSN ISO 17289)	Water ⁹¹
1.65* 1.23,4,5,6,7, 8,9	Determination of dissolved oxygen by electrochemical method with membrane probe	CZ_SOP_D06_01_044 (ČSN EN ISO 5814)	Water ⁹¹
1.66 ^{1,3}	Determination of dry matter by gravimetry and calculation of moisture from measured values	CZ_SOP_D06_01_045 (ČSN ISO 11465, ČSN EN 12880, ČSN EN 14346:2007)	Solid samples ⁸⁵
1.67 ²	Determination of dry matter by gravimetry and calculation of moisture from measured values	CZ_SOP_D06_07_046 (ČSN ISO 11465, ČSN EN 12880, ČSN EN 14346:2007, ČSN 46 5735)	Solid samples ⁸⁵
1.68 ²	Determination of ash by gravimetry and calculation of loss on ignition from measured values	CZ_SOP_D06_07_047.A (ČSN EN 15169, ČSN EN 15935, ČSN EN 13039, ČSN 72 0103, ČSN 46 5735)	Solid samples ⁸⁵ , silicate materials
1.69	Reserved		
1.70 ²	Determination of ash by gravimetry and calculation of loss on ignition from measured values	CZ_SOP_D06_07_047.C (ČSN ISO 1171, ČSN EN ISO 18122, ČSN EN ISO 21656, ČSN EN ISO 6245)	Solid and liquid fuels
1.71 ¹	Qualitative determination of asbestos by SEM/EDS	CZ_SOP_D06_02_048 (ISO 22262-1, VDI 3866, Part 5, DM06/09/94 GU n° 288 10/12/1994 All. 1 Met. B – quantitative determination)	Solid samples ⁸⁵ (except liquid waste, biowaste) building materials ⁸⁹ , materials for building ⁴²
1.72 ¹	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 ⁸⁵ (except liquid waste, biowaste) building materials ⁸⁹ , materials for building ⁴²
1.73 ²	Determination of water content by Karl Fischer method	CZ_SOP_D06_07_050 (ČSN ISO 760)	Liquid samples ⁸¹ , solid samples ⁸⁵
1.74	Reserved		
1.75 ²	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 (ČSN 75 7350, SM 2540 B, SM 2540 D, SM 2540 E)	Water ⁹¹ , extracts ⁹²
1.76 ²	Determination of suspended solids using glass fibre filters by gravimetry	CZ_SOP_D06_07_053 (ČSN EN 872)	Water ⁹¹ , extracts ⁹²
1.77 ²	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 (ČSN 75 7346, ČSN 75 7347)	Water ⁹¹ , extracts ⁹²

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Ordinal number ¹	Test procedure/method name	Test procedure/method identification ²	Subject of the test
1.78 ²	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 (ČSN EN 13137:2002, ČSN EN 15936, ČSN ISO 10694)	Solid samples ⁸⁵ , building materials ⁸² , materials for building ⁸⁹
1.79 ¹	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 (ČSN EN 1484, SM 5310)	Water ⁹¹ , extracts ⁹²
1.80 ¹	Determination of nonpolar extractive substances by infrared spectrometry and calculation of polar extractive substances from measured values	CZ_SOP_D06_02_057 (ČSN 75 7505:2006, SS 028145, STN 83 0520-27:2015, STN 83 0530-36, STN 830540-4, US EPA 418.1, SM 5520 F, DS/R 209, SFS 3010)	Water ⁹¹ , extracts ⁹²
1.81 ¹	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 (ČSN 028145, TNV 75 8052, ISO/TR 11046, US EPA 418.1, SM 5520 F, DS/R 209, SFS 3010)	Solid samples ⁸⁵
1.82 ¹	Determination of extractive substances by infrared spectrometry and calculation of polar extractive substances from measured values	CZ_SOP_D06_02_059 (ČSN 75 7506, SS 028145, STN 83 0520-27:2015, STN 83 0540-4, DS/R 209, SFS 3010)	Water ⁹¹ , extracts ⁹²
1.83 ¹	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, ČSN 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 ⁹¹
1.86* 1.2,3,4,5,6,7,8, 9	Field measurement of electrical conductivity	CZ_SOP_D06_01_063 (ČSN EN 27888)	Water ⁹¹
1.87* 1.2,3,4,5,6,7, 8,9,12,	Field measurement of pH electrochemically	CZ_SOP_D06_01_064 (ČSN ISO 10523)	Water ⁹¹

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Ordinal number ¹	Test procedure/method name	Test procedure/method identification ²	Subject of the test
1.88 ¹	Sensory analysis of water – determination of odour and taste	CZ_SOP_D06_04_065 (TNV 75 7340:2005, ČSN EN 1622, STN EN 1622)	Drinking water
1.89 ²	Determination of phenols by continuous flow analysis (CFA) method spectrophotometrically	CZ_SOP_D06_07_066 (ČSN EN ISO 14402, SKALAR Company methodology)	Water ⁹¹ , extracts ⁹² , absorption solution from emission sampling
1.90 ²	Determination of anionic surfactants by methylene blue (MBAS) by continuous flow analysis (CFA) method spectrophotometrically	CZ_SOP_D06_07_067 (ČSN ISO 16265, SKALAR Company methodology, ČSN EN 903)	Water ⁹¹ , extracts ⁹²
1.91 ¹	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 (ČSN EN ISO 10304-1)	Water ⁹¹ , extracts ⁹²
1.92	Reserved		
1.93 ¹	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 (ČSN EN 872, ČSN 757350, SM 2540 D, SM 2540 E)	Water ⁹¹ , extracts ⁹²
1.94 ¹	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 (ČSN 75 7346, ČSN 757347, ČSN EN 15216, SM 2540 C, SM 2540 E)	Water ⁹¹ , extracts ⁹²
1.95 ¹	Determination of acid neutralizing capacity (alkalinity) by potentiometric titration and calculation of the carbonate hardness and CO ₂ forms from measured values including the calculation of total mineralization	CZ_SOP_D06_02_072 (ČSN EN ISO 9963-1, ČSN EN ISO 9963-2, ČSN 75 7373, SM 2320)	Water ⁹¹ , extracts ⁹²
1.96 ¹	Determination of base neutralizing capacity (acidity) by potentiometric titration	CZ_SOP_D06_02_073 (ČSN 75 7372)	Water ⁹¹ , extracts ⁹²
1.97 ¹	Determination of turbidity by optical turbidimeter	CZ_SOP_D06_02_074 (ČSN EN ISO 7027-1)	Water ⁹¹ , extracts ⁹²
1.98 ¹	Determination of electrical conductivity by conductometer and calculation of salinity	CZ_SOP_D06_02_075 (ČSN EN 27888, SM 2520 B)	Water ⁹¹ , extracts ⁹² , liquid samples ⁸⁹
1.99 ¹	Determination of chemical oxygen demand using dichromate (COD _{Cr}) by photometry	CZ_SOP_D06_02_076 (ČSN ISO 15705)	Water ⁹¹ , extracts ⁹²
1.100	Reserved		
1.101 ¹	Determination of biochemical oxygen demand electrochemically after n days (BOD _n) by dilution method with allylthiourea addition	CZ_SOP_D06_02_077 (ČSN EN ISO 5815-1)	Water ⁹¹ , extracts ⁹²
1.102 ¹	Determination of biochemical oxygen demand electrochemically after n days (BOD _n) by method for undiluted samples	CZ_SOP_D06_02_078 (ČSN EN 1899-2, ISO 5815-2)	Water ⁹¹ , extracts ⁹²

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Ordinal number ¹	Test procedure/method name	Test procedure/method identification ²	Subject of the test
1.103 ¹	Determination of colour by spectrophotometry	CZ_SOP_D06_02_079 (ČSN EN ISO 7887)	Water ⁹¹ , extracts ⁹²
1.104 ¹	Determination of total phosphorus by discrete spectrophotometry and calculation of phosphorus as P ₂ O ₅ and PO ₄ ³⁻ from measured values	CZ_SOP_D06_02_080 (ČSN EN ISO 6878, ČSN EN ISO 15681-1)	Water ⁹¹ , extracts ⁹²
1.105 ¹	Determination of total nitrogen by discrete spectrophotometry after mineralization with peroxisulphate	CZ_SOP_D06_02_081 (ČSN EN ISO 11905-1)	Water ⁹¹ , extracts ⁹²
1.106 ²	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 ²	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 ²	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 ¹	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 ⁹¹
1.111 ²	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 ⁸⁵
1.112 ^{1,2}	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 ⁸⁵
1.113 ¹	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 ⁹¹ , extracts ⁹² , absorption solutions from emission sampling
1.114 ¹	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 ⁸⁵ , building materials ⁸² , materials for building ⁸⁹
1.115 ¹	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 ⁹¹ , extracts ⁹²

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1.116 ¹	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 ⁸⁵ , building materials ⁸² , materials for building ⁸⁹
1.117 ¹	Determination of fluorides by electrochemical method (ISE)	CZ_SOP_D06_02_091 (ČSN ISO 10359-1)	Water ⁹¹ , extracts ⁹²
1.118 ¹	Determination of chemical oxygen demand using permanganate (COD _{Mn}) by titration	CZ_SOP_D06_02_092 (ČSN EN ISO 8467)	Water ⁹¹ , extracts ⁹²
1.119 ¹	Determination of bound nitrogen (TNb), following oxidation to nitrogen oxides by chemiluminescent detection	CZ_SOP_D06_02_094.A (ČSN EN 12260)	Water ⁹¹ , extracts ⁹²
1.120 ¹	Determination of bound nitrogen (TNb) following oxidation to nitrogen oxides by IR detection	CZ_SOP_D06_02_094.B (ČSN EN 12260)	Water ⁹¹ , extracts ⁹²
1.121 ¹	Qualitative determination of asbestos fibre by polarization microscope	CZ_SOP_D06_02_095 (NIOSH 9002)	Solid samples ⁸⁵ , (except liquid waste, biowaste), building materials ⁸⁹ , materials for building ⁸²
1.122 ¹	Determination of mercury by fluorescence spectrometry	CZ_SOP_D06_02_096 (US EPA 245.7, ČSN EN ISO 17852)	Water ⁹¹ , extracts ⁹²
1.123 ¹	Determination of mercury by fluorescence spectrometry	CZ_SOP_D06_02_096 (ČSN EN ISO 17852, PSA Application Note 025, ISO 16772:2004)	Solid samples ⁸⁵ , building materials ⁸² , materials for building ⁸⁹
1.124	Reserved		
1.125 ¹	Determination of mercury by fluorescence spectrometry	CZ_SOP_D06_02_096 (ČSN EN ISO 17852, ČSN EN 13211, ČSN EN ISO 12846)	Emission ⁷⁸ , imission ⁷⁹
1.126 – 1.127	Reserved		
1.128 ¹	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 ⁹¹ , extracts ⁹²
1.129 ¹	Determination of chloride by discrete spectrophotometry	CZ_SOP_D06_02_099 (US EPA 325.1, SM 4500-Cl)	Water ⁹¹ , extracts ⁹²
1.130 ¹	Determination of extractive substances by gravimetry	CZ_SOP_D06_02_100 (ČSN 75 7508, SM 5520B)	Water ⁹¹
1.131 ²	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 ²	Determination of total nitrogen by modified Kjeldahl method by spectrophotometry	CZ_SOP_D06_07_102 (ČSN ISO 11261)	Solid samples ⁸⁵

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1.133* 1,2,3,4,5,6,7,8,9	Field measurement of oxidation-reduction potential (ORP) by potentiometry	CZ_SOP_D06_01_103 (ČSN 75 7367)	Water ⁹¹
1.134 ¹	Determination of grease and oils by gravimetry (extraction after evaporation)	CZ_SOP_D06_02_104 (ČSN 75 7509)	Water ⁹¹
1.135 ¹	Determination of pH by potentiometry	CZ_SOP_D06_02_105 (ČSN ISO 10523, US EPA 150.1, SM 4500-H-B)	Water ⁹¹ , extracts ⁹² , liquid samples ⁸¹
1.136	Reserved		
1.137 ²	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 ⁹¹ , extracts ⁹²
1.138 ¹	Determination of settleable solids by volumetry	CZ_SOP_D06_02_108 (SM 2540 F)	Water ⁹¹ , extracts ⁹²
1.139 ¹	Determination of dissolved silicates by discrete photometry and calculation of H ₂ SiO ₃ and total mineralization from measured values	CZ_SOP_D06_02_109 (ČSN EN ISO 16264, US EPA 370.1)	Water ⁹¹ , extracts ⁹²
1.140 ¹	Determination of chlorophyll by spectrophotometry	CZ_SOP_D06_02_110 (SM 10200 H)	Surface waters ⁸⁷
1.141	Reserved		
1.142 ²	Determination of phosphorus soluble in sodium hydrogen carbonate solution spectrophotometrically	CZ_SOP_D06_07_112 (ČSN ISO 11263)	Solid samples ⁸⁵
1.143 ²	Determination of pH electrochemically in a suspension in water, KCl, CaCl ₂ , BaCl ₂	CZ_SOP_D06_07_113 (ČSN ISO 10390, ČSN EN 12176:1999, ČSN EN 13037, ČSN EN 15933, ČSN 46 5735, ÖNORM L 1086-1, US EPA 9045D; US EPA 9040C)	Solid samples ⁸⁵ , building materials ⁸² , materials for building ⁸⁹
1.144 ²	Determination of formaldehyde by spectrophotometry	CZ_SOP_D06_07_114 (Chemical and physical methods of water analysis, SNTL Prague 1989)	Water ⁹¹ , extracts ⁹²
1.145	Reserved		
1.146 ²	Determination of iron(II) by spectrophotometry	CZ_SOP_D06_07_116 (ČSN ISO 6332)	Water ⁹¹ , extracts ⁹²
1.147 ²	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 ⁸⁵ , building materials ⁸² , materials for building ⁸⁹
1.148 ²	Determination of permeability by falling head	CZ_SOP_D06_07_118 (ČSN EN ISO 17892-11, chap. 5.2.2.3)	Soil
1.149 ¹	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 ⁹¹

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1.150 ²	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 ⁸⁵ (grain size lower than 63 mm)
1.151 ²	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 ISO 16948, ČSN ISO 19579, ČSN EN 15408, ČSN ISO 10694, ČSN EN ISO 21663)	Solid samples ⁸⁵ , waste, sludge, lubricants, feed ⁸³ , plants, digestates, solid fossil fuels, solid biofuels, solid recovered fuels, building materials ⁸² , materials for building ⁸⁹
1.152 ²	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 ¹	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 ⁹¹ , extracts ⁹²
1.154 ¹	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 ⁸⁵
1.155 – 1.156	Reserved		
1.157 ²	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 ⁸⁹
1.158 ²	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 ^{2,1}	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 ⁸⁹

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1.160 ^{2,1}	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 ²	Determination of laboratory compacted bulk density (LCBD)	CZ_SOP_D06_07_125 (ČSN EN 13040)	Sludge, composts, soils meliorants and growth stimulants
1.162 ²	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 ¹	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 ⁷⁸ , imission ⁷⁹
1.164 ¹	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 ⁷⁸ , imission ⁷⁹
1.165 ¹	Determination of sulphite by ion chromatography method	CZ_SOP_D06_02_129 (ČSN EN ISO 10304-3)	Water ⁹¹ , extracts ⁹²
1.166 ²	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 ²	Determination of sulphite after distillation by titration	CZ_SOP_D06_07_131 (M. Horáková et al.: Chemical and physical methods of water analyses)	Water ⁹¹ , extracts ⁹²
1.168 ²	Determination of respiratory activity (ATa) using respirometer	CZ_SOP_D06_07_132 (ÖNORM S 2027-4)	Wastes, sludge, composts, soils
1.169* 1,2,4,6,7,8,9	Field determination of ozone using HACH sets	CZ_SOP_D06_01_133 (Method 8311 HACH Company, USA)	Drinking water, pool water Emission ⁷⁸
1.170 ¹	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)	
1.171 ¹	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 ⁹¹ , extracts ⁹²
1.172 ¹	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 ⁸⁵

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1.173 ¹	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 ⁸⁷
1.174 ²	Determination of SiO ₂ in silicate materials after decomposition by gravimetry	CZ_SOP_D06_07_137 (ČSN 72 0105-1)	Solid samples ⁸⁵
1.175 ²	Determination of P ₂ O ₅ in silicate materials after decomposition by spectrophotometry	CZ_SOP_D06_07_138 (ČSN 72 0116-1)	Solid samples ⁸⁵
1.176 ²	Determination of total sulfur in silicate materials after decomposition by gravimetry	CZ_SOP_D06_07_139 (ČSN 72 0118)	Solid samples ⁸⁵
1.177	Reserved		
1.178* 1,2,3	Analysis of CH ₄ , CO ₂ , O ₂ , H ₂ S gases by Geotech gas analyzer and calculation of N ₂ from measured values	CZ_SOP_D06_01_141 (BIOGAS 5000 Analyzer Manual)	Gases ⁸⁶
1.179	Reserved		
1.180 ²	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 ⁹¹ , extracts ⁹² , liquid samples ⁸¹
1.181 ²	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 ⁸⁵
1.182 ²	Determination of biomass content by selective dissolution	CZ_SOP_D06_07_144 (ČSN EN 15440, Annex A)	Solid alternative fuels, solid combustible wastes
2	Organic Chemistry		
2.1 ¹	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 ⁸⁵
2.2 ¹	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 EN ISO 9377-2, US EPA 8015, US EPA 3510, TNRCC Method 1006)	Water ⁹¹ , extracts ⁹²
2.3 ¹	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 ⁹¹ , extracts ⁹² , liquid samples ⁸¹
2.4 ¹	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 ⁸⁵

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2.5 ¹	Determination of volatile organic compounds ¹⁹ 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 ¹¹)	Solid sorbents
2.6	Reserved		
2.7 ¹	Determination of volatile organic compounds ⁵ 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 ⁹¹ , extracts ⁹²
2.8 ¹	Determination of volatile organic compounds ⁴ 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 ⁸⁵
2.9 ¹	Determination of volatile organic compounds ⁴ 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 ⁹¹ , extracts ⁹²
2.10 ¹	Determination of volatile organic compounds ⁴ 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 ⁸⁵
2.11 ¹	Determination of organic contaminants ⁵ 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 ⁹¹ , extracts ⁹²

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2.12 ¹	Determination of organic contaminants ⁵ 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 ¹	Determination of phenols, chlorinated phenols and cresols ⁶ 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 ⁹¹
2.14 ¹	Determination of phenols, chlorinated phenols and cresols ⁶ 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 ⁸² , materials for building ⁸⁹ , waste (solid waste, biowaste), sediments, soil, rocks
2.15	Reserved		
2.16 ¹	Determination of phthalates ⁷ 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 ⁹¹ , extracts ⁹²
2.17 ¹	Determination of phthalates ⁷ 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 ⁸² , materials for building ⁸⁹ , waste (solid waste, biowaste), sediments, soil, rocks
2.18 ¹	Determination of phenols and cresols ⁶⁰ 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 ⁹¹ , extracts ⁹²
2.19 ¹	Determination of phenols and cresols ⁶⁰ 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 ⁸² , materials for building ⁸⁹ , waste (solid waste, biowaste), sediments, soil, rocks
2.20 ¹	Determination of semi volatile organic compounds ⁸ 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 ⁹¹ , extracts ⁹²
2.21 ¹	Determination of semi volatile organic compounds ⁸ 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 ⁸² , materials for building ⁸⁹ , waste (solid waste, biowaste), sediments, soil, rocks

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2.22 ¹	Determination of polycyclic aromatic hydrocarbons ¹⁰ 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 ¹	Determination of polycyclic aromatic hydrocarbons ¹⁰ 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 ⁹¹ , extracts ⁹²
2.24 ¹	Determination of polycyclic aromatic hydrocarbons ¹⁰ 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 ⁸⁵
2.25 ¹	Determination of glycols ²⁸ by gas chromatography method with MS detection	CZ_SOP_D06_03_164	Water ⁹¹ , cooling liquids, anti-freeze fluid
2.26 ¹	Determination of polycyclic aromatic hydrocarbons ¹⁰ 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 ⁷⁸ , imission ⁷⁹
2.27 ¹	Determination of polychlorinated biphenyls ¹⁹ 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 ⁹¹ , extracts ⁹²
2.28 ¹	Determination of polychlorinated biphenyls ¹¹ 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 ⁸⁵ , sealing materials
2.29 ¹	Determination of alkylphenols and alkylphenol ethoxylates ²⁴ 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 ¹	Determination of polychlorinated biphenyls ¹¹ - 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 ¹	Determination of organochlorine pesticides and other halogen compounds ¹² 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 ⁹¹ , extracts ⁹²

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2.32 ¹	Determination of organochlorine pesticides and other halogen compounds ¹² 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 ⁸⁵
2.33 ¹	Determination of perchlorates by liquid chromatography with MS/MS detection	CZ_SOP_D06_03_170.A (US EPA 6850)	Drinking water
2.34 ¹	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 ³	Determination of polychlorinated dibenzo- <i>p</i> -dioxins and dibenzofuranes ¹³ 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 ⁷⁸
2.36 ³	Determination of polychlorinated dibenzo- <i>p</i> -dioxins and dibenzofuranes ¹³ 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 ⁷⁹
2.37 ³	Determination of coplanar polychlorinated biphenyls ¹⁴ 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 ⁷⁸ , imission ⁷⁹
2.38 ³	Determination of polychlorinated biphenyls ¹⁴ 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 ⁹¹
2.39 ³	Determination of polychlorinated biphenyls ¹⁴ 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 ⁸⁵ , building materials ⁸² , materials for building ⁸⁹
2.40 ³	Determination of polychlorinated biphenyls ¹⁴ 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 ⁷⁷ , vegetable materials ⁸⁸ , animal materials ⁹³
2.41 ³	Determination of polychlorinated biphenyls ¹⁴ 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 ⁸³ , biotic materials
2.42 ³	Determination of polychlorinated dibenzo- <i>p</i> -dioxins and dibenzofuranes ¹³ 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 ⁷⁸

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2.43 ³	Determination of tetra- to octa-chlorinated dioxins and furanes ¹³ 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 ⁹¹
2.44 ³	Determination of tetra- to octa-chlorinated dioxins and furanes ¹³ 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 ⁸⁵ , building materials ⁸² , materials for building ⁸⁹
2.45 ³	Determination of tetra- to octa-chlorinated dioxins and furanes ¹³ 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 ⁷⁷ , vegetable materials ⁸⁸ , animal materials ⁹³
2.46 ³	Determination of tetra- to octa-chlorinated dioxins and furanes ¹³ 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 ⁸³ , biotic materials
2.47 ³	Determination of polychlorinated dibenzodioxins (PCDD) and polychlorinated dibenzofurans (PCDF) ¹³ 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 ⁹¹
2.48 ³	Determination of polychlorinated dibenzodioxins (PCDD) and polychlorinated dibenzofurans (PCDF) ¹³ 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 ⁸⁵
2.49 ³	Determination of polychlorinated dibenzodioxins (PCDD) and polychlorinated dibenzofurans (PCDF) ¹³ 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 ⁷⁷
2.50 ³	Determination of polychlorinated dibenzodioxins (PCDD) and polychlorinated dibenzofurans (PCDF) ¹³ 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 ⁸³ , biotic materials
2.51 ³	Determination of selected brominated flame retardants (BFR) ¹⁵ 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 ⁹¹
2.52 ³	Determination of selected brominated flame retardants (BFR) ¹⁵ 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 ⁸⁵ , building materials ⁸² , materials for building ⁸⁹

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2.53 ³	Determination of selected brominated flame retardants (BFR) ¹⁵ 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 ⁷⁷ , vegetable materials ⁸⁸ , animal materials ⁹³
2.54 ³	Determination of selected brominated flame retardants (BFR) ¹⁵ 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 ⁸³ , biotic materials
2.55 ¹	Determination of alkylphenols and alkylphenol ethoxylates ⁴⁶ 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 ⁹¹ , extracts ⁸²
2.56 ³	Determination of PCB ¹⁴ 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 ⁷⁸ , imission ⁷⁹ , working environment ⁸⁷
2.57 ³	Determination of polycyclic aromatic hydrocarbons ⁴⁴ 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 ⁸⁵ , building materials ⁸² , materials for building ⁸⁹
2.58 ³	Determination of polycyclic aromatic hydrocarbons ⁴⁴ 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 ⁷⁸ , imission ⁷⁹ , working environment ⁸⁷
2.59 ³	Determination of polycyclic aromatic hydrocarbons ⁴⁴ 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 ⁷⁷ , vegetable materials ⁸⁸ , animal materials ⁹³
2.60 ³	Determination of polycyclic aromatic hydrocarbons ⁴⁴ 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 ⁸³ , biotic materials
2.61 ³	Determination of polycyclic aromatic hydrocarbons ⁴⁴ 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

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2.62 ¹	Determination of semi-volatile organic compounds ⁷ 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 ¹	Determination of acidic herbicides, drug residues and other pollutants ²⁹ 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 ⁹¹
2.64 ¹	Determination of acidic herbicides and drug residues ¹⁷ 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 ¹	Determination of pesticides, pesticide metabolites, drug residues and other pollutants ³⁰ 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 ⁹¹
2.66 ¹	Determination of pesticides, pesticide metabolites, drug residues and other pollutants ⁷⁰ and ⁷¹ by liquid chromatography method with MS/MS detection and calculation of pesticides, pesticides 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 ⁸² , materials for building ⁸⁹
2.67 ¹	Determination of pesticides, pesticide metabolites, drug residues and other pollutants ⁷² by liquid chromatography method with MS/MS detection and calculation of pesticides, pesticides metabolites, drug residues and other pollutants sums from measured values	CZ_SOP_D06_03_183.C (ČSN EN 15662)	Vegetal materials ⁸⁸ , animal materials ⁹³
2.68 ¹	Determination of pesticides ¹¹ 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 ⁹¹
2.69 ¹	Determination of pesticides and pesticide metabolites ¹² 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 ⁹¹
2.70 ¹	Determination of pesticides and pesticide metabolites ⁸ 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 ¹	Determination of complexing substances ³³ by gas chromatography method with MS detection	CZ_SOP_D06_03_186 (ČSN EN ISO 16588)	Water ⁹¹
2.72 ¹	Determination of polycyclic aromatic hydrocarbons derivatives ³⁶ by liquid chromatography method with MS detection	CZ_SOP_D06_03_187 (Journal of Chromatography A, 1133 (2006) 241-247)	Emission ⁷⁸ , imission ⁷⁹

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2.73 ¹	Determination of organic acids ³⁷ by capillary electrophoresis method with UV detection	CZ_SOP_D06_03_188.A (Luxem 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 ⁹¹
2.74 ¹	Determination of organic acids ³⁷ by capillary electrophoresis method with UV detection	CZ_SOP_D06_03_188.B (Luxem 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 ⁸³ , composts, digestate
2.75 ¹	Determination of gases ³⁸ by gas chromatography method with detection FID and TCD	CZ_SOP_D06_03_189 (EPA Method RSK-175)	Water ⁹¹ , liquid samples ⁸¹
2.76 ¹	Low limit determination of volatile organic compounds ⁵ 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 ⁹¹
2.77 ¹	Low limit determination of volatile organic compounds ⁵ 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 ⁸⁵
2.78 ¹	Determination of chlorinated alkanes ³⁴ by gas chromatography method with MS/MS detection	CZ_SOP_D06_03_192.A (ČSN EN ISO 12010)	Water ⁹¹
2.79 ¹	Determination of chlorinated alkanes ³⁴ by gas chromatography method with MS/MS detection	CZ_SOP_D06_03_192.B (ČSN EN ISO 12010, ČSN EN ISO 18635)	Building materials ⁸² , materials for building ⁸⁹ , sediments, soils
2.80 ¹	Determination of aniline and aniline derivatives ²¹ by gas chromatography method with MS detection	CZ_SOP_D06_03_193 (US EPA 8270)	Sediments, sludges, soils, rocks
2.81 ¹	Determination of chlorinated phenols ³⁵ by liquid chromatography method with MS/MS detection	CZ_SOP_D06_03_194 (2002/657/ES, 96/23/ES)	Water ⁹¹
2.82 ¹	Determination of drug residues ⁴⁶ 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 ⁸⁷
2.83 ¹	Determination of epichlorohydrin by gas chromatography method with MS/MS detection	CZ_SOP_D06_03_196 (Agilent Technologies Application list 5990-6433EN)	Water ⁹¹
2.84 ¹	Determination of perfluorinated and brominated compounds ⁴⁸ by liquid chromatography with MS/MS detection	CZ_SOP_D06_03_197.A (US EPA 537, ČSN P CEN/TS 15968)	Water ⁹¹ , extracts ⁸²

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2.85 ¹	Determination of per fluorinated and brominated compounds ⁷³ by liquid chromatography with MS/MS detection	CZ_SOP_D06_03_197.B (DIN 38414-14)	Sediments, sludges, soils, rocks
2.86 ¹	Determination of volatile organic compounds ⁹⁹ 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 ³	Determination of fat by gravimetry	CZ_SOP_D06_06_199 (US EPA 1613)	Food, feed ⁴³ , biological materials ⁷⁷
2.88 ¹	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 ¹	Determination of drug residues and narcotic and psychotropic substances ⁸⁰ by liquid chromatography method with MS/MS detection	CZ_SOP_D06_03_201.A (US EPA 1694)	Water ⁹¹
2.90 ¹	Determination of organic acids ⁸⁴ 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 ¹	Determination of polycyclic aromatic hydrocarbons ²⁴ 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 ⁷⁸ , imission ⁹⁹
3	Food Organic Chemistry		
3.1 ¹	Determination of fatty acids ¹⁸ by gas chromatography method with FID detection and calculation sum of SAFA, MUFA, PUFA, TFA, Omega 3, Omega 6 ³⁵	CZ_SOP_D06_04_202 (ČSN EN ISO 12966-1, ČSN EN ISO 12966-2)	Food, feed ⁴³ , dietary supplements
3.2 ¹	Determination of cholesterol by gas chromatography method with FID detection	CZ_SOP_D06_04_205 (Prof. ing. Jifi 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 ¹	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 ⁴³ and premixes
3.4 ¹	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 ¹	Determination of Soya protein by ELISA by commercial set	CZ_SOP_D06_04_208 (R-Biopharm Manual – Ridascree FAST Soya)	Food, swap
3.6 ¹	Determination of substitute sweeteners ²³ by liquid chromatography method with PDA detection	CZ_SOP_D06_04_209 (ČSN EN 12856)	Beverages, milk products, jams, dietary supplements, fishes
3.7 ¹	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

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3.8 ¹	Determination of preserving agents ²⁴ 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 ¹	Determination of aflatoxin B ₁ , B ₂ , G ₁ and G ₂ by liquid chromatography method with FLD detection	CZ_SOP_D06_04_212 (ČSN EN 14123)	Food with low water content, beverages, feed ⁴³
3.10 ¹	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 ⁴³
3.11 ¹	Determination of zearalenone by liquid chromatography method with FLD detection	CZ_SOP_D06_04_214 (ČSN EN 15850)	Cereals, feed ⁴³
3.12 ¹	Determination of aflatoxin M1 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 ¹	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 ¹	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 ⁴³
3.15 ¹	Determination of vitamins B ₁ , B ₂ and B ₆ 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 ⁴³ , dietary supplements
3.16 ¹	Determination of folic acid by ELISA method by commercial set	CZ_SOP_D06_04_219 (R-Biopharm– Ridascree Folic Acid Manual)	Food, feed ⁴³ , dietary supplements
3.17 ¹	Determination of biotin by ELISA method by commercial set	CZ_SOP_D06_04_220 (Demedtec Manual)	Milk, milk products, cereals and cereal products, non-alcoholic beverages, baby food, feed ⁴³ , dietary supplements
3.18 ¹	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 ¹	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 ⁸⁰
3.20 ¹	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 ¹	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 ¹	Determination of mustard allergen by ELISA method by commercial set	CZ_SOP_D06_04_224 (Bio-Check– Mustard Check Manual)	Food, dietary supplements, swabs

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Ordinal number ¹	Test procedure/method name	Test procedure/method identification ²	Subject of the test
3.23 ¹	Determination of niacin by liquid chromatography method with PDA detection	CZ_SOP_D06_04_225 (ČSN EN 15652)	Fatty food, non-fatty food, feed ⁴³ , dietary supplements
3.24 ¹	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 ¹	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 ¹	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 ⁴³ , dietary supplements
3.27 ¹	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 ⁴³ , premixes
3.28 ¹	Determination of Vitamin B12 by ELISA method by commercial set	CZ_SOP_D06_04_230 (R-Biopharm– Ridascree Fast Vitamin B12 Manual)	Food, feed ⁴³ , dietary supplements
3.29 ¹	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 ¹	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 ¹	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 ¹	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 ¹	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 ¹	Determination of milk allergen (casein and β-lactoglobulin proteins by ELISA method by commercial set	CZ_SOP_D06_04_236 (Bio-Check– Milk Check Manual)	Food, dietary supplements, swabs
3.35 ¹	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 ¹	Determination of pantothenic acid by liquid chromatography with PDA detection	CZ_SOP_D06_04_238	Dietary supplements
4	Water Microbiology		
4.1 ¹	Enumeration of mesophilic bacteria by cultivation	ČSN 75 7841	Surface, ground, waste, pool water
4.2 ¹	Enumeration of psychrophilic bacteria by cultivation	ČSN 75 7842	Surface, ground, waste, pool water
4.3 ¹	Enumeration of intestinal enterococci by membrane filtration	ČSN EN ISO 7899-2 STN EN ISO 7899-2	Drinking, bottled, pool, raw, treated ⁹⁰ , ground, surface, waste water
4.4 ¹	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 ⁹⁰ , ground water

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Ordinal number ¹	Test procedure/method name	Test procedure/method identification ²	Subject of the test
4.5 ¹	Enumeration of thermotolerant coliform bacteria and <i>Escherichia coli</i> by membrane filtration	ČSN 75 7835	Drinking, surface, ground, pool, waste water
4.6 ¹	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 ⁹⁰ , ground water
4.7 ¹	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 ¹	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 ¹	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 ¹	Enumeration of <i>Clostridium perfringens</i> by membrane filtration	CZ_SOP_D06_04_259 (GR 252/2004 Coll., Annex 6, GR No. 354/2006 Coll., Annex.3)	Drinking, bottled, pool, natural mineral, raw, treated ⁹⁰ , ground water
4.11 ¹	Detection of <i>Salmonella</i> by membrane filtration	ČSN ISO 19250	Drinking, surface, ground, pool, waste water
4.12 ¹	Determination of bioseston by microscopy	ČSN 75 7712 STN 757711	Drinking, bottled, raw, treated ⁹⁰ , ground water
4.13 ¹	Determination of abioseston by microscopy	ČSN 75 7713 STN 757712	Drinking, bottled, raw, treated ⁹⁰ , ground water
4.14 ¹	Detection and enumeration of <i>Legionella</i> by cultivation and membrane filtration	ČSN EN ISO 11731	Water ⁹¹ , treated water ⁹⁰
4.15 ¹	Detection and enumeration of <i>Legionella</i> by cultivation	ČSN EN ISO 11731	Sediments, alluvium, growths
4.16 ¹	Detection and enumeration of <i>Legionella</i> by cultivation	ČSN EN ISO 11731	Swabs
4.17 ¹	Enumeration of Coliform bacteria by membrane filtration	ČSN 75 7837	Non-disinfected water
4.18 ¹	Enumeration of sulphite the spores of sulfite-reducing anaerobes (<i>Clostridium</i>) by membrane filtration	ČSN EN 26461-2	Water ⁹¹
4.19 ¹	Microbiological testing of water for haemodialysis. Enumeration of viable microorganisms	CZ_SOP_D06_04_266 (ČSN EN ISO 23500-3)	Dialysis water
4.20 ¹	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 ¹	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 fluid, water purified, water highly purified, water for injection
4.22 ¹	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

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4.23 ¹	Test for specific micro-organisms – Detection of <i>Pseudomonas Aeruginosa</i> bacteria	CZ_SOP_D06_04_270 (Ph. Eur chap 6.3:0008, 6.3:1927, 6.3:0169)	Water purified, water highly purified, water for injection
5	Microbiology		
5.1 ¹	Enumeration of microorganisms by cultivation	ČSN EN ISO 4833-1	Food, feed ⁴³ , dietary supplements
5.2 ¹	Enumeration of coliform bacteria by cultivation	ČSN ISO 4832	Food, feed ⁴³ , dietary supplements
5.3 ¹	Enumeration of enterococci by cultivation	CZ_SOP_D06_04_302 (ČSN 56 0100:1994)	Food, feed ⁴³ , dietary supplements
5.4 ¹	Enumeration of <i>Bacillus cereus</i> by cultivation	ČSN EN ISO 7932	Food, feed ⁴³ , dietary supplements
5.5 ¹	Enumeration of coagulase-positive staphylococci (<i>Staphylococcus aureus</i> and other species) by cultivation	ČSN EN ISO 6888-1	Food, feed ⁴³ , dietary supplements
5.6 ¹	Enumeration of <i>Clostridium perfringens</i> by cultivation	ČSN EN ISO 7937	Food, feed ⁴³ , dietary supplements
5.7 ¹	Detection of <i>Salmonella</i> by cultivation	ČSN EN ISO 6579-1	Food, feed ⁴³ , dietary supplements
5.8 ¹	Detection of <i>Salmonella</i> by cultivation	CZ_SOP_D06_04_307, except chap. 9.1.2 (ČSN EN ISO 6579, AHEM No. 1/2008)	Sludge, bio waste, compost, substrates, soils
5.9 ¹	Detection of <i>Salmonella</i> by cultivation	CZ_SOP_D06_04_307, except chap. 9.1.1 (ČSN EN ISO 6579, AHEM No. 1/2008)	Biological materials ^{2,7}
5.10 ¹	Determination of inhibiting substances by Delvotest method	CZ_SOP_D06_04_308 (O.K. Servis BioPro Manual)	Milk
5.11 ¹	Detection of <i>Salmonella</i> by ELISA method - commercial set Solus Salmonella	CZ-SOP-D06_04_309 (Solus Manual)	Food, feed ⁴³ , dietary supplements
5.12 ¹	Enumeration of yeasts and moulds by cultivation	ČSN ISO 21527-1,2	Food, feed ⁴³ , dietary supplements
5.13 ¹	Detection of <i>Enterobacteriaceae</i> by cultivation	ČSN ISO 21528-1	Food, feed ⁴³ , dietary supplements
5.14 ¹	Enumeration of spore-forming microorganisms by cultivation	CZ_SOP_D06_04_312 (ČSN 56 0100:1994, Article 87)	Food, feed ⁴³
5.15 ¹	Detection of <i>Vibrio parahaemolyticus</i> and <i>Vibrio species</i> by cultivation	ČSN EN ISO 21872-1,2	Food, feed ⁴³
5.16 ¹	Enumeration of mesophilic lactic acid bacteria by cultivation	ČSN ISO 15214	Food, feed ⁴³ , dietary supplements
5.17 ¹	Detection of <i>Shigella spp.</i> by cultivation	ČSN EN ISO 21567	Food, feed ⁴³
5.18 ¹	Detection of <i>Campylobacter spp.</i> by cultivation	ČSN EN ISO 10272-1	Food, feed ⁴³
5.19 ¹	Detection of presumptive pathogenic <i>Yersinia enterocolitica</i> by cultivation	ČSN EN ISO 10273	Food, feed ⁴³
5.20 ¹	Enumeration of Enterobacteriaceae by cultivation	ČSN ISO 21528-2	Food, feed ⁴³ , dietary supplements
5.21 ¹	Enumeration of beta-glucuronidase-positive <i>Escherichia coli</i> by cultivation	ČSN ISO 16649-2	Food, feed ⁴³ , dietary supplements

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Ordinal number ¹	Test procedure/method name	Test procedure/method identification ²	Subject of the test
5.22 ¹	Detection and enumeration of <i>Listeria monocytogenes</i> by cultivation	ČSN EN ISO 11290-1 ČSN EN ISO 11290-2	Food, feed ⁴³ , dietary supplements
5.23 ¹	Enumeration of potentially toxigenic moulds on special media by cultivation	CZ_SOP_D06_04_321 (AHEM No. 1/2003)	Food, feed ⁴³
5.24 ¹	Enumeration of microorganisms in air by aeroscopy and sedimentation method	CZ_SOP_D06_04_322 (ČSN 56 0100:1994, Article 149, 150 AHEM No. 1/2002)	Internal air environment
5.25 ¹	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 ¹	Enumeration of thermotolerant coliform bacteria and <i>Escherichia coli</i> by cultivation	CZ_SOP_D06_04_324 (AHEM No. 1/2008, ČSN ISO 16649-2)	Sludge, bio waste, compost, substrates, soils, sand
5.27 ¹	Enumeration of enterococci by cultivation	CZ_SOP_D06_04_325 (AHEM No. 1/2008, ČSN EN ISO 7899-2)	Sludge, bio waste, compost, substrates, soils, sand
5.28 ¹	Detection of <i>Listeria</i> by ELISA method - commercial set Solus Listeria	CZ_SOP_D06_04_326 (Solus Manual)	Food, feed ⁴³ , dietary supplements
5.29 ¹	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 ⁴³ , dietary supplements
5.30 ¹	Determination of low numbers of <i>Bacillus cereus</i> - method of detection	ČSN EN ISO 21871	Food, feed ⁴³ , dietary supplements
5.31 ¹	Detection of <i>Cronobacter (Enterobacter) sakazakii</i> by cultivation	ČSN EN ISO 22964	Milk and milk products
5.32 ¹	Detection and enumeration of aerobic mesophilic bacteria by cultivation	ČSN EN ISO 21149	Cosmetics
5.33 ¹	Detection of <i>Pseudomonas aeruginosa</i> by cultivation	ČSN EN ISO 22717 ČSN EN ISO 18415	Cosmetics
5.34 ¹	Detection of <i>Staphylococcus aureus</i> by cultivation	ČSN EN ISO 22718 ČSN EN ISO 18415	Cosmetics
5.35 ¹	Detection of <i>Candida albicans</i> by cultivation	ČSN EN ISO 18416 ČSN EN ISO 18415	Cosmetics
5.36 ¹	Detection of <i>Escherichia coli</i> by cultivation	ČSN EN ISO 21150 ČSN EN ISO 18415	Cosmetics
5.37 ¹	Enumeration of yeast and mould by cultivation	ČSN EN ISO 16212	Cosmetics
5.38 ¹	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 ¹	Horizontal method for the detection and enumeration of presumptive <i>Escherichia coli</i> - Technique of most probable number	ČSN ISO 7251 expect article 9.2	Food, feed ⁴³
5.40 ¹	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 ¹	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.

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Ordinal number ¹	Test procedure/method name	Test procedure/method identification ²	Subject of the test
			veterinary medicines, biopreparations, dietary supplements
6	Ecotoxicology		
6.1 ²	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 ⁴⁴ , extracts of waste, solutions and extracts of chemical substances and agents
6.2 ²	Determination of the inhibition of the mobility of <i>Daphnia magna Straus</i> - Acute toxicity test	CZ_SOP_D06_07_351 (ČSN EN ISO 6341, STN 83 8303)	Surface, ground and waste water ⁴⁴ , extracts of waste, solutions and extracts of chemical substances and agents
6.3 ²	Freshwater algal growth inhibition test	CZ_SOP_D06_07_352 (ČSN EN ISO 8692, STN 83 8303)	Surface, ground and waste water ⁴⁴ , extracts of waste, solutions and extracts of chemical substances and agents
6.4 ²	Toxicity test on seeds of white mustard (<i>Sinapis alba</i>)	CZ_SOP_D06_07_353 (Ministry of Environment Bulletin, Volume <i>XVII</i> , 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 ⁴⁴ , extracts of waste, solutions and extracts of chemical substances and agents
6.5 ²	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 ⁴⁴ , extracts ⁸² , percolation water, saline, and brackish water
6.6 ²	<i>Folsomia candida</i> reproduction test – determination of the inhibition.	CZ_SOP_D06_07_355 (ČSN EN ISO 11267)	Waste, soils, sediments
6.7 ²	<i>Enchytraeus crypticus</i> reproduction test – determination of inhibition	CZ_SOP_D06_07_356 (ČSN EN ISO 16387)	Waste, soils, sediments
6.8 ²	<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 ²	Determination of nitrification activity and its inhibition	CZ_SOP_D06_07_358 (ČSN ISO 15685)	Waste, soils, sediments
6.10 ²	Determination of the inhibition of the growth, germination, and germination index (phytoxicity) 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 ⁴⁴ , extracts of waste and composts, solutions and extracts of chemical substances and agents
6.11 ²	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 ⁴⁴ , extracts of waste and composts, solutions and extracts of chemical substances and agents

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7	Radiology		
7.1 ²	Determination of gross alpha activity by measuring evaporated residue in a mixture with ZnS(Ag) scintillator	ČSN 75 7611, chap. 4	Water ⁹¹ , extracts ⁸²
7.2 ²	Determination of gross alpha activity by measuring incinerated evaporated residue by means of proportional detector	ČSN 75 7611, chap. 5	Water ⁹¹ , extracts ⁸²
7.3 ²	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 ⁹¹ , extracts ⁸²
7.4 ²	Determination of radium 226 after concentration by scintillation emanometry	ČSN 75 7622	Water ⁹¹ , extracts ⁸²
7.5 ²	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 ⁹¹ , extracts ⁸²
7.6 ²	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 ⁹¹ , extracts ⁸²
7.7 ²	Determination of radon 222 by liquid scintillation counting method (LSC)	CZ_SOP_D06_7_363.C (ČSN 75 7625)	Water ⁹¹
7.8 ²	Determination of uranium by spectrophotometry after separation on silica gel and calculation of ²³⁸ U from measured values	CZ_SOP_D06_07_364 (ČSN 75 7614)	Water ⁹¹ , extracts ⁸²
7.9 ²	Determination of tritium volume activity by liquid scintillation counting method (LSC)	CZ_SOP_D06_07_365 (ČSN EN ISO 9698)	Water ⁹¹ , extracts ⁸²
7.10 ²	Determination of polonium 210 after its concentration by sorption on ZnS(Ag) by the measurement of emitted scintillations	ČSN 75 7626	Water ⁹¹ , extracts ⁸²
7.11 ²	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 ²	Non-destructive determination of radionuclides ²⁵⁾ 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 ⁹¹ , liquid samples ⁸¹
7.13 ²	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 ⁸⁵ pulverized for grain size below 100 µm, liquid samples ⁸⁶ with boiling point above 100 °C

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7.14 ²	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 ⁸⁵ pulverized for grain size below 100 µm, liquid samples ⁸⁶ with boiling point above 100 °C
7.15 ²	Determination of lead 210 after its sorption on ZnS-colloid by beta radiation analyzer	CZ_SOP_D06_07_370 (ČSN 75 7627)	Water ⁹¹ , extracts ⁹² (with low content of suspended solids or filtrated through 0.45 µm filter)
7.16 ²	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 ⁹¹ , extracts ⁹²
7.17 ²	Calculation of Indicative Dose (ID) ⁶⁹ 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 ⁹¹
7.18 ²	Determination of strontium 90 by proportional detector after separation	CZ_SOP_D06_07_373 (ASTM D5811-00)	Water ⁹¹
7.19 ²	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 ²	Determination of strontium 90 by proportional detector after separation	CZ_SOP_D06_07_373 (ASTM D5811-00, ASTM C1507-20)	Biological materials ⁷⁷ , food, feed ⁸³
7.21 ²	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 ⁹¹ , soils, sludge, sediments, bioindicators ⁷⁶ , food
7.22 ²	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 ²	Determination of radium 226 and 228 by liquid scintillation measurement method (LSC)	CZ_SOP_D06_07_376 (ČSN EN ISO 22908)	Water ⁹¹
8	Tribology		
8.1 ¹¹	Determination of kinematic viscosity by viscometer and viscosity index by calculation	CZ_SOP_D06_05_400 (ČSN EN ISO 3104, ČSN ISO 2009, ASTM D7279, ASTM D7042)	Liquid fuels, lubricating oils
8.2 ¹¹	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

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8.3 ¹¹	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 ¹¹	Determination of base number by potentiometric titration	CZ_SOP_D06_05_403 (ČSN ISO 3771)	Lubricating oils, additives to lubricants
8.5 ¹¹	Determination of neutralization number by potentiometric titration	CZ_SOP_D06_05_404 (ČSN ISO 6619)	Lubricating oils, additives to lubricants
8.6 ¹¹	Determination of water content by coulometric method	CZ_SOP_D06_05_405 (ASTM D6304)	Liquid fuels, lubricating oils
8.7 ¹¹	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 ¹¹	Determination of Cold Filter Plugging Point (CFPP) by the method of gradual cooling	CZ_SOP_D06_05_407 (ČSN EN 116, ASTM D6371)	Diesel, light fuel oils
9	General Food Chemistry		
9.1 ¹	Determination of organic acids ⁶⁸ content by capillary isotachopheresis method	CZ_SOP_D06_04_450 (Recman - Laboratory technique – Application sheets No. 35, 39, 70)	Food, feed ⁸³
9.2 ¹	Gravimetric determination of fat	CZ_SOP_D06_04_451 (ČSN ISO 1443, ČSN ISO 1444, ČSN 46 7092-7)	Food, feed ⁸³
9.3 ¹	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 ⁸³ , dietary supplements
9.4 ¹	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 ⁸³
9.5 ¹	Determination of phosphates by capillary isotachopheresis	CZ_SOP_D06_04_454 (ITP: Application sheet No. 35 VILLA LABECO s.r.o.)	Food, feed ⁸³
9.6 ¹	Gravimetric determination of water extract content	ČSN 58 0113, Article 38	Coffee
9.7 ¹	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 ¹	Determination of polyols ⁷⁵ by ion chromatographic method with EC detection	CZ_SOP_D06_04_457 (ČSN EN 15086, DIONEX Technical Note 20)	Food, feed ⁸³ , dietary supplements
9.9 ¹	Gravimetric determination of ash	CZ_SOP_D06_04_458 (ČSN 56 0116-4)	Food, feed ⁸³
9.10 ¹	Determination of crude fibre by oxidation hydrolysis method	CZ_SOP_D06_04_459 (ČSN ISO 5498, ČSN EN ISO 6865)	Feed ⁸³
9.11 ¹	Determination of pH by potentiometry	CZ_SOP_D06_04_460 (ČSN ISO 2917, ČSN ISO 1842)	Food, feed ⁸³
9.12 ¹	Determination of sand by gravimetry	CZ_SOP_D06_04_461 (ČSN 56 0246-12)	Food, feed ⁸³

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Ordinal number ¹	Test procedure/method name	Test procedure/method identification ²	Subject of the test
9.13 ¹	Determination of relative density of liquids by pycnometer	CZ_SOP_D06_04_462 (ČSN EN 1131)	Low viscosity liquids
9.14 ¹	Titrimetric determination of acidity	CZ_SOP_D06_04_463 (ČSN ISO 750, ASTM 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 ¹	Determination of moisture content – distillation method	CZ_SOP_D06_04_464 (ČSN ISO 939)	Spices, mixed condiments
9.16 ¹	Determination of dietary fibre enzymatically by commercial set Megazyme	CZ_SOP_D06_04_465 (AOAC Method 985.29)	Food, dietary supplements
9.17 ¹	Determination of starch content by polarimetry	CZ_SOP_D06_04_466 (ČSN 46 7092-21)	Cereals, baking products, cereal feeds ⁸³
9.18 ¹	Determination of chloride by coulometric titration	CZ_SOP_D06_04_467 (O.K. SERVIS company Chloride Analyser manual)	Food, feed ⁸³ , dietary supplements
9.19 ¹	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 ⁸³ , dietary supplements
9.20 ¹	Determination of alkalinity of water-soluble ash by titration	ČSN ISO 1578	Tea
9.21 ¹	Gravimetric determination of total ash	ČSN ISO 1575	Tea
9.22 ¹	Gravimetric determination of water-soluble and water-insoluble ash	ČSN ISO 1576	Tea
9.23 ¹	Gravimetric determination of acid-insoluble ash	ČSN ISO 1577	Tea
9.24 ¹	Gravimetric determination of water extract	ČSN ISO 9768	Tea
9.25 ¹	Gravimetric determination of loos in mass at 103°C	ČSN ISO 1573	Tea
9.26 ¹	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 ⁸³ , dietary supplements
9.27 ¹	Volumetric determination of volatile oils (essential oils) by distillation with steam	ČSN EN ISO 6571	Spices, spicing agents, herbs
9.28 ¹	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 ⁸³ , dietary supplements
9.29 ¹	Determination of the meat content in meat products and products containing meat by calculation from measured values ⁸³	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 ¹	Determination of carbohydrates and energy values by calculation from measured values ⁶⁴	CZ_SOP_D06_04_479 (Regulation (EU) 1169/2011, Decree 330/2009 Coll.)	Food, raw materials for production of food, dietary supplements

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Ordinal number ¹	Test procedure/method name	Test procedure/method identification ²	Subject of the test
9.31 ¹	Determination of non-protein content substances by calculation ⁶⁵	ČSN 46 7092-24	Feed ⁸³
9.32 ¹	Determination of 4-hydroxyproline by spectrophotometry and calculation of collagen from measured values	CZ_SOP_D06_04_481 (ISO 3496)	Meat products
9.33 ¹	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 ⁹⁵ and raw materials for production of food, feed ⁸³ , dietary supplements
9.34 ¹	Volumetric determination of peroxide value	CZ_SOP_D06_04_483 (ČSN EN ISO 3960)	Fats and vegetable oils
9.35 ¹	Determination of water activity by capacitive sensor method	ČSN ISO 21807	Food, raw materials for production of food, dietary supplements
9.36 ¹	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 ¹	Identification of synthetic dyes ⁸⁷ by thin-layer chromatography method	CZ_SOP_D06_04_486 (Davidek J., Laboratory Manual of Food Analysis, 1981)	Food
9.38 ¹	Determination of piperine content by spectrophotometry	ČSN ISO 5564	Black pepper and white pepper, whole or ground
9.39 ¹	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 ¹	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 ¹	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 ¹⁰	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 ¹⁰	Sensory testing – comparison to standard	CZ_SOP_D06_04_491 (ČSN ISO 6658, ČSN ISO EN 8589, ČSN EN ISO 13299, ČSN ISO 13300-1,2)	Food, cosmetics, packaging materials for food, consumer goods
9.44 ¹⁰	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 ¹	Determination of density by density meter	CZ_SOP_D06_04_493 (ČSN 57 0530)	Milk and milk products

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Ordinal number ¹	Test procedure/method name	Test procedure/method identification ²	Subject of the test
9.46 ¹	Determination of sugars ⁶⁰ by ion chromatography method with EC detection	CZ_SOP_D06_04_494 (ČSN EN 12630)	Food, feed ⁴³ , dietary supplements
9.47 ¹	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 ¹	Sampling procedure name	Sampling procedure identification ²	Subject of sampling
1 ^{1,2,4,5,6,7,8,9}	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 ^{1,2,3,4,5,6,7,8,9}	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 ⁴⁴
3 ^{1,2,3,4,5,6,7,8,9,12}	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

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Ordinal number ¹	Sampling procedure name	Sampling procedure identification ²	Subject of sampling
4 ^{1,2,3,4,5,6,7,8,9}	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 ⁴⁴
5 ^{1,2,3,4,5,7,8,9}	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 5667-7, ČSN EN ISO 5667-14)	Treated water ⁵⁰
6 ^{1,2,3,4,5,6,7,8,9}	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 5667-4, 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 ^{1,2,3,4,5,6,7,8,9}	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 ^{1,2,4,5,6,7,8,9}	Sampling of surface swab manually	CZ_SOP_D06_01_V08 (ČSN 56 0100:1994, ČSN EN ISO18593, Decree No. 289/2007 Coll., ČSN EN ISO 5667-1, ČSN EN ISO 5667-3, ČSN EN ISO 5667-14)	Contaminated surfaces
9 ^{1,2,4,5,6,7,8,9}	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 ^{1,2,3,4,5,6,7,8,9}	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 ^{1,2,3,4,5,6,7,8,9}	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

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Ordinal number ¹	Sampling procedure name	Sampling procedure identification ²	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 ^{1,2,3,4,5,6,7,8,9}	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 ^{1,2,4,5,6,7}	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 ⁸⁷
14	Reserved		
15 ^{1,2,7}	Gas sampling for the determination of ammonia	CZ_SOP_D06_01_V15 (ČSN 834728)	Gases ⁸⁶
16 ¹	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 ISO 16000-7; ČSN EN 482, GR No. 361/2007, Coll. Annex No. 3)	Outdoor and indoor air, working environment ⁸⁷
17 ¹	Sampling for the asbestos determination	CZ_SOP_D06_01_V17 (VDI 3866, part 1)	Building materials ⁸² , materials for building ⁸⁹ ,

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Used abbreviations

AHEM	Acta hygienica, epidemiologica et microbiologica
AITM	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 Alii. I Met. B.	Decree of 06/09/1994 (Decreto Ministeriale 6 settembre 1994), published in Bulletin No. 288 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	Isotachopheresis
LDN	Labor Diagnostika Nord GmbH & Co.KG
LSC	Liquid Scintillation Counting method for the determination of alpha- or beta- radiation emittingradionuclides
MS	Mass Detector
MUFA	Monounsaturated Fatty Acids
NEN	Nederlands Normalisatie-Instituut
NIOSH	National Institute for Occupation Safety and Health
NIOSH ¹⁾	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	Polymunsaturated Fatty Acids
RI	Refractometric Detector
SAFA	Saturated Fatty Acids
SEM/EDS	Scanning Electron Microscope / Energy Dispersive Spectrometer
SFS	The Finish Standard Association

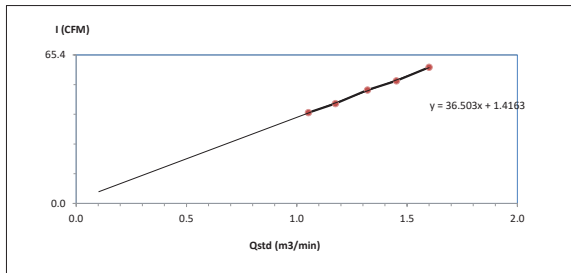
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High Volume Air Sampler Calibration Worksheet

Project Site :	UACJ (Thailand) Co., Ltd.	Barometric Pressure (mm Hg) :	756
Calibrate Location :	บ้านหวายไคหนัว (Ban Huay Kai Nhow)	Temperature (°C) :	31
Calibrate Date :	22-Aug-23	High Volume ID :	RYG_FS0662
CalibrationSheet No.:	C-220823-RYG_FS0662	High Volume Model :	TE-5009X
Calibrator ID:	RYG_FS0206	High Volume S/N :	6259
Calibrator Model :	TE-5028A	Calibrator Slope :	1.47433
Calibrator S/N :	1543	Calibrator Intercept :	-0.01503

Test No.	Delta H ₂ O (inch)	Q _{std} (m ³ /min)	I : Chart (CFM)	Linear Regression
1	2.4	1.0526	40	Slope : 36.5031 Intercept : 1.4163 Correlation Coefficient : 0.9991
2	3.0	1.1751	44	
3	3.8	1.3207	50	
4	4.6	1.4515	54	
5	5.6	1.6000	60	



Calibrated by Sawai T. (Mr.Sawai Tonpho) Field Scientist(2)
Approved by : [Signature] (Mr. Noppong Juntarupan) Enviro Field Coordinator Scientist (3)

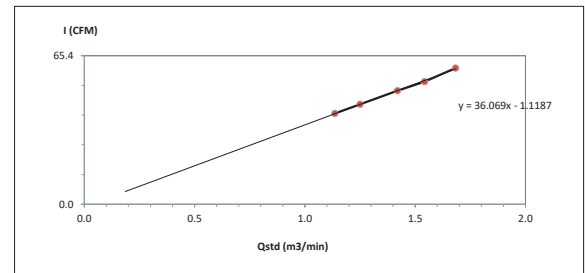
FORM NO.: F 06-073 REVISION NO.: - ISSUE DATE: 14/03/16



High Volume Air Sampler Calibration Worksheet

Project Site :	UACJ (Thailand) Co., Ltd.	Barometric Pressure (mm Hg) :	756
Calibrate Location :	บ้านหวายไคหนัว (Ban Wang Tan Mhon)	Temperature (°C) :	31
Calibrate Date :	22-Aug-23	High Volume ID :	RYG_FS0173
CalibrationSheet No.:	C-220823-RYG_FS0173	High Volume Model :	TE-5170D
Calibrator ID:	RYG_FS0206	High Volume S/N :	4799
Calibrator Model :	TE-5028A	Calibrator Slope :	1.47433
Calibrator S/N :	1543	Calibrator Intercept :	-0.01503

Test No.	Delta H ₂ O (inch)	Q _{std} (m ³ /min)	I : Chart (CFM)	Linear Regression
1	2.8	1.1358	40	Slope : 36.0686 Intercept : -1.1187 Correlation Coefficient : 0.9991
2	3.4	1.2500	44	
3	4.4	1.4200	50	
4	5.2	1.5423	54	
5	6.2	1.6828	60	



Calibrated by Sawai T. (Mr.Sawai Tonpho) Field Scientist(2)
Approved by : [Signature] (Mr. Noppong Juntarupan) Enviro Field Coordinator Scientist (3)

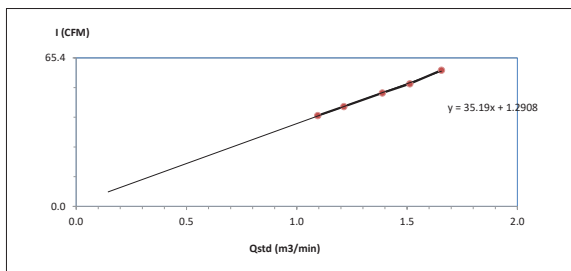
FORM NO.: F 06-073 REVISION NO.: - ISSUE DATE: 14/03/16



High Volume Air Sampler Calibration Worksheet

Project Site :	UACJ (Thailand) Co., Ltd.	Barometric Pressure (mm Hg) :	756
Calibrate Location :	บ้านหวายไคหนัว (Ban Map Yang Porn)	Temperature (°C) :	31
Calibrate Date :	22-Aug-23	High Volume ID :	RYG_FS0664
CalibrationSheet No.:	C-220823-RYG_FS0664	High Volume Model :	TE-5009X
Calibrator ID:	RYG_FS0206	High Volume S/N :	6261
Calibrator Model :	TE-5028A	Calibrator Slope :	1.47433
Calibrator S/N :	1543	Calibrator Intercept :	-0.01503

Test No.	Delta H ₂ O (inch)	Q _{std} (m ³ /min)	I : Chart (CFM)	Linear Regression
1	2.6	1.0950	40	Slope : 35.1895 Intercept : 1.2908 Correlation Coefficient : 0.9990
2	3.2	1.2132	44	
3	4.2	1.3877	50	
4	5.0	1.5127	54	
5	6.0	1.6556	60	



Calibrated by Sawai T. (Mr.Sawai Tonpho) Field Scientist(2)
Approved by : [Signature] (Mr. Noppong Juntarupan) Enviro Field Coordinator Scientist (3)

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

RYG_EN0001

Sartorius (Thailand) Co., Ltd.
129 Rama 9 Road, Huaykwang, Huaykwang, Bangkok 10310
Tel: +66 2643 8351-6, e-mail: service.thailand@sartorius.com



Certificate of Calibration

Model Number :	LA130S-F	Certificate No. :	23BCI0110
Description :	Analytical Balance	Issued Date :	Friday, March 03, 2023
Serial Number :	25409684	Reference No. :	204833
ID No. :	RYG_EN0001	Page No. :	1 of 2
Manufacturer :	Sartorius		

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

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

Calibrated Place : ALS Laboratory Group (Thailand) Co., Ltd. (Balance Room)

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

Calibrated By : Mr.Chonchai Inthana

Calibration Date : Wednesday, March 01, 2023

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

Metrological data :

Capacity : 150 g Readability : 0.0001 g

Ambients Conditions:

Temperature : 24.2 °C ± 5.0 °C

Humidity : 60.0 % RH ± 10.0 % RH

Pressure : ±

Reasons for calibration

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

Equipment Condition:

☒ Good Operate ☐ Fair

Measurement Method UKAS Publication Ref :Lab 14

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

Traceability:

Model Number	Description	Traceability	Certificate No.	Due Date
YCS011-522-00	Sartorius weight set 1mg - 5000g E2.YCS011-522-00	SPC-RT	C02212565	14-Sep-2023
MHB-382SD	Humidity/Barometer/Temp Luton MHB-382SD	DKSH	C19220444	5-Sep-2023

This certificate relate and apply this equipment only.

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

Mr.chonchai inthana(Technical Manager)



SOP FM 33 03 February 2022



Certificate of Calibration

Model Number : LA130S-F
Description : Analytical Balance
Serial Number : 25409664
ID No. : RYG_EN0001
Manufacturer : Sartorius

Certificate No. : 23BCI0110
Issued Date : Friday, March 03, 2023
Reference No. : 204833
Page No. : 2 of 2

Calibration Results : Without Adjustment

Repeatability
The reproducibility is the ability of a weighing instrument to display nearly identical readouts under constant test conditions when the same load within a measurement series is placed repeatedly on the weighing pan in the same manner. The standard deviation is used to express reproducibility quantitatively.

Nominal Value : (Low Load)	10.0000	100.0001
10 g	10.0000	100.0002
Tolerance	10.0001	100.0001
0.0001 g	10.0000	100.0000
	9.9999	100.0002
Nominal Value : (High Load)	10.0000	100.0001
100 g	10.0001	100.0001
Tolerance	10.0000	100.0001
0.0001 g	9.9999	100.0002
	9.9998	100.0001
Standard Deviation	0.00009	0.00006

Eccentricity (Off-center loading error)
The off-center loading error is yielded by the difference between the readout of the load, i.e. 1/3 or 1/4 of maximum capacity, placed in the middle of the weighing pan and between each of four additional measurement points (positions defined according to OIML R76).

Nominal value :	50 g
Tolerance	0.0004 g

Difference

1	2	3	4	5	6
-	0.0000	-0.0001	0.0001	0.0000	-

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

Tolerance	0.0002 g			
Nominal Value	Conventional Mass Value	Displayed Value	Deviation	Uncertainty
(g)	(g)	(g)	(g)	(g)
0.01	0.0100	0.0100	0.0000	0.00022
0.05	0.0500	0.0500	0.0000	0.00023
0.1	0.1000	0.1000	0.0000	0.00023
0.5	0.5000	0.5000	0.0000	0.00023
1	1.0000	1.0000	0.0000	0.00023
2	2.0000	2.0000	0.0000	0.00023
5	5.0000	5.0000	0.0000	0.00022
10	10.0000	10.0001	0.0001	0.00024
20	20.0000	20.0001	0.0001	0.00023
100	100.0000	100.0002	0.0002	0.00026

End of Report

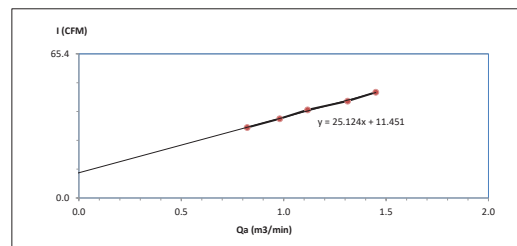
SOP FM 33 03 February 2022

High Volume Air Sampler Calibration Worksheet

Project Site : UACJ (Thailand) Co., Ltd.
Calibrate Location : บ้านกล้วย (Ban Phusai)
Calibrate Date : 22-Aug-23
CalibrationSheet No. : C-220823-RYG_FS0668
Calibrator ID : RYG_FS0206
Calibrator Model : TE-5028A
Calibrator S/N : 1543

Barometric Pressure (mm Hg) : 756
Temperature (°C) : 31
High Volume ID : RYG_FS0668
High Volume Model : TE-5009X
High Volume S/N : 6267
Calibrator Slope : 0.92345
Calibrator Intercept : -0.0095

Test No.	Delta H ₂ O (inch)	Qa (m ³ /min)	I: Chart (CFM)	Linear Regression
1	1.4	0.822	32	Slope : 25.1236
2	2.0	0.981	36	Intercept : 11.4509
3	2.6	1.117	40	Correlation Coefficient : 0.9986
4	3.6	1.312	44	
5	4.4	1.450	48	



Calibrated by : Sawai T.
(Mr.Sawai Tonpho)
Field Scientist(2)

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

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

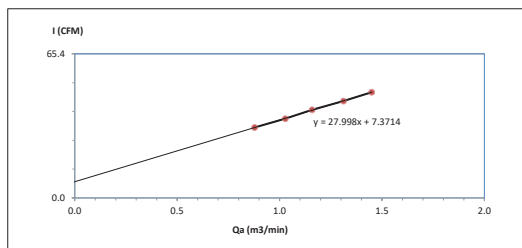


High Volume Air Sampler Calibration Worksheet

Project Site : UACJ (Thailand) Co., Ltd.
Calibrate Location : บ้านกล้วย (Ban Huay Kai Nhow)
Calibrate Date : 22-Aug-23
CalibrationSheet No. : C-220823-RYG_FS0666
Calibrator ID : RYG_FS0206
Calibrator Model : TE-5028A
Calibrator S/N : 1543

Barometric Pressure (mm Hg) : 756
Temperature (°C) : 31
High Volume ID : RYG_FS0666
High Volume Model : TE-5009X
High Volume S/N : 6265
Calibrator Slope : 0.92345
Calibrator Intercept : -0.0095

Test No.	Delta H ₂ O (inch)	Qa (m ³ /min)	I: Chart (CFM)	Linear Regression
1	1.6	0.878	32	Slope : 27.9976
2	2.2	1.028	36	Intercept : 7.3714
3	2.8	1.159	40	Correlation Coefficient : 0.9998
4	3.6	1.312	44	
5	4.4	1.450	48	



Calibrated by : Sawai T.
(Mr.Sawai Tonpho)
Field Scientist(2)

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

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

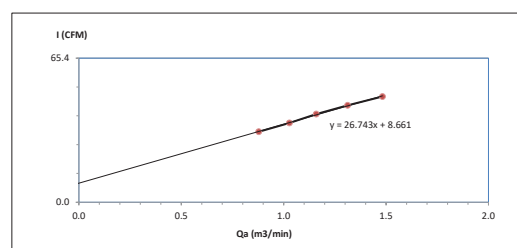


High Volume Air Sampler Calibration Worksheet

Project Site : UACJ (Thailand) Co., Ltd.
Calibrate Location : บ้านวังตาหมอน (Ban Wang Tan Mhon)
Calibrate Date : 22-Aug-23
CalibrationSheet No. : C-220823-RYG_FS0400
Calibrator ID : RYG_FS0206
Calibrator Model : TE-5028A
Calibrator S/N : 1543

Barometric Pressure (mm Hg) : 756
Temperature (°C) : 31
High Volume ID : RYG_FS0400
High Volume Model : TE-5009X
High Volume S/N : 5691
Calibrator Slope : 0.92345
Calibrator Intercept : -0.0095

Test No.	Delta H ₂ O (inch)	Qa (m ³ /min)	I: Chart (CFM)	Linear Regression
1	1.6	0.878	32	Slope : 26.7425
2	2.2	1.028	36	Intercept : 8.6610
3	2.8	1.159	40	Correlation Coefficient : 0.9990
4	3.6	1.312	44	
5	4.6	1.482	48	



Calibrated by : Sawai T.
(Mr.Sawai Tonpho)
Field Scientist(2)

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

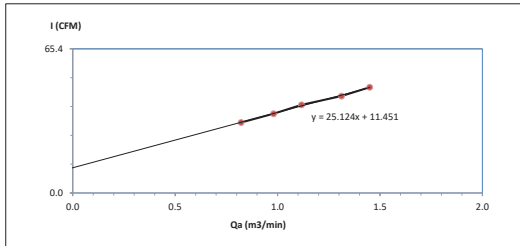
FORM NO.: F 06-074 REVISION NO.: ISSUE DATE: 14/03/16



High Volume Air Sampler Calibration Worksheet

Project Site :	UACJ (Thailand) Co., Ltd.	Barometric Pressure (mm Hg) :	756
Calibrate Location :	บ้านบางยาง (Ban Map Yang Ponn)	Temperature (°C) :	31
Calibrate Date :	22-Aug-23	High Volume ID :	RYG_FS0665
Calibration Sheet No.:	C-220823-RYG_FS0665	High Volume Model :	TE-5009X
Calibrator ID:	RYG_FS0206	High Volume S/N :	6264
Calibrator Model :	TE-5028A	Calibrator Slope :	0.92345
Calibrator S/N :	1543	Calibrator Intercept :	-0.0095

Test No.	Delta H ₂ O (inch)	Q _a (m ³ /min)	I : Chart (CFM)	Linear Regression
1	1.4	0.822	32	Slope : 25.1236 Intercept : 11.4509 Correlation Coefficient : 0.9986
2	2.0	0.981	36	
3	2.6	1.117	40	
4	3.6	1.312	44	
5	4.4	1.450	48	



Calibrated by : **Sawai T.**
(Mr. Sawai Tonpho)
Field Scientist (2)

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

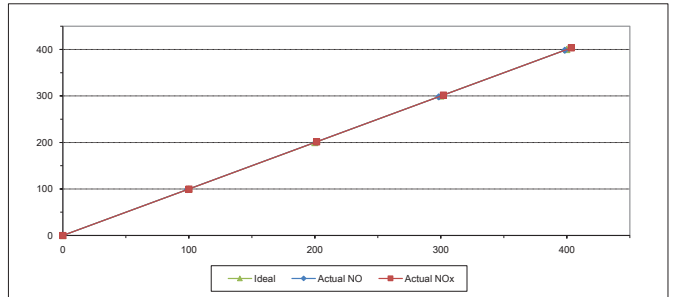
FORM NO.: F 06-074 REVISION NO.: - ISSUE DATE: 14/03/16



MULTIPOINT CALIBRATION REPORT

Calibration Date	1-Jul-23	Equipment Name	NOx Analyzer
Manufacturer	HORIBA	Model	APNA-370
Serial No.	T95HWM41	Equipment ID	RYG_FS0461
Calibrator Manufacturer	Teledyne API	Model	700
Serial No.	947		
Std. Gas Concentration (PPM)	55.88	Cylinder No.	GN0027222
Cylinder Pressure (psi)	1800	Certified By	Airgas Inc.
Certified Date	9-Feb-22	Expired Date	9-Feb-30

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



Calibrated By : **[Signature]**
(Mr. Jirawut Sakam)
Field Environmental Scientist (3)

Approved By : **[Signature]**
(Mr. Sarayuth Jitranont)
Assistant General Manager

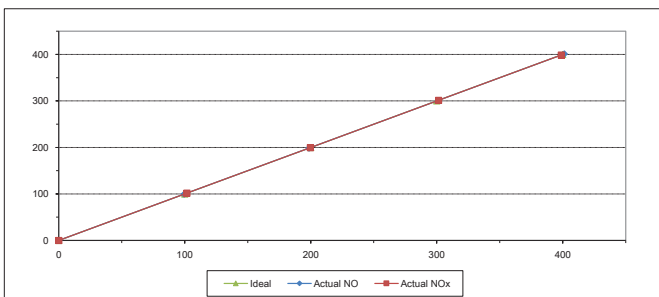
ALS Laboratory Group
FORM NO.: F 06-056 REVISION NO.: - ISSUE DATE: 02/04/12



MULTIPOINT CALIBRATION REPORT

Calibration Date	1-Jul-23	Equipment Name	NOx Analyzer
Manufacturer	HORIBA	Model	APNA-370
Serial No.	NV0ER3YH	Equipment ID	RYG_FS0459
Calibrator Manufacturer	Teledyne API	Model	700
Serial No.	947		
Std. Gas Concentration (PPM)	55.88	Cylinder No.	GN0027222
Cylinder Pressure (psi)	1800	Certified By	Airgas Inc.
Certified Date	9-Feb-22	Expired Date	9-Feb-30

Point	CALIBRATION RESULTS						
	Ideal	Actual NO	Error NO	%Error NO	Actual NOx	Error NOx	%Error NOx
ZERO	0.00	0.05	0.05	0.05	0.10	0.10	0.10
1	100.00	99.50	-0.50	-0.50	101.80	1.80	1.80
2	200.00	198.70	-1.30	-0.65	199.70	-0.30	-0.15
3	300.00	301.10	1.10	0.37	301.50	1.50	0.50
4	400.00	401.30	1.30	0.33	398.90	-1.10	-0.28
AVERAGE (%)				-0.08			0.39



Calibrated By : **[Signature]**
(Mr. Jirawut Sakam)
Field Environmental Scientist (3)

Approved By : **[Signature]**
(Mr. Sarayuth Jitranont)
Assistant General Manager

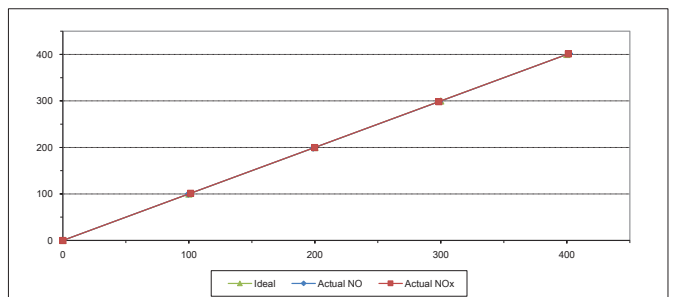
ALS Laboratory Group
FORM NO.: F 06-056 REVISION NO.: - ISSUE DATE: 02/04/12



MULTIPOINT CALIBRATION REPORT

Calibration Date	1-Jul-23	Equipment Name	NOx Analyzer
Manufacturer	HORIBA	Model	APNA-370
Serial No.	AWXG87CR	Equipment ID	RYG_FS0453
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	99.60	-0.40	-0.40	101.40	1.40	1.40
2	200.00	198.60	-1.40	-0.70	199.80	-0.20	-0.10
3	300.00	299.00	-1.00	-0.33	298.50	-1.50	-0.50
4	400.00	402.10	2.10	0.53	401.20	1.20	0.30
AVERAGE (%)				-0.16			0.24



Calibrated By : **[Signature]**
(Mr. Jirawut Sakam)
Field Environmental Scientist (3)

Approved By : **[Signature]**
(Mr. Sarayuth Jitranont)
Assistant General Manager

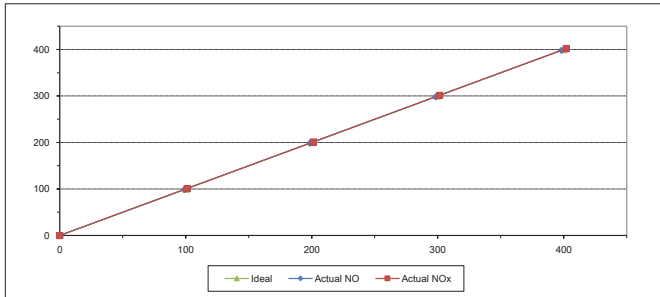
ALS Laboratory Group
FORM NO.: F 06-056 REVISION NO.: - ISSUE DATE: 02/04/12



MULTIPOINT CALIBRATION REPORT

Calibration Date	1-Jul-23	Equipment Name	NOx Analyzer
Manufacturer	HORIBA	Model	APNA-370
Serial No.	U8AOEAGK	Equipment ID	RYG_FS0551
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	101.00	1.00	1.00
2	200.00	198.50	-1.50	-0.75	201.30	1.30	0.65
3	300.00	298.40	-1.60	-0.53	301.50	1.50	0.50
4	400.00	398.20	-1.80	-0.45	402.00	2.00	0.50
AVERAGE (%)				-0.53			0.55



Calibrated By

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

Approved By

(Mr. Sarayuth Jitranont)
Assistant General Manager

ALS Laboratory Group

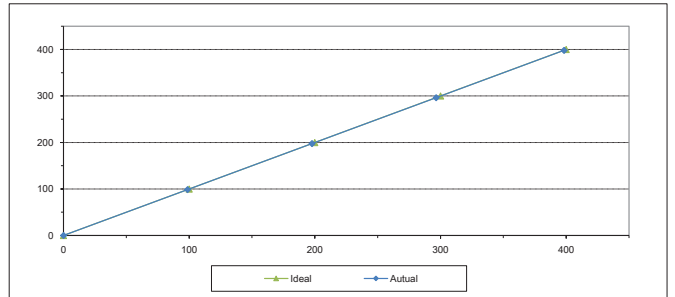
FORM NO.: F 06-056 REVISION NO.: - ISSUE DATE: 02/04/12



MULTIPOINT CALIBRATION REPORT

Calibration Date	2-Jul-23	Equipment Name	SO2 Analyzer
Manufacturer	HORIBA	Model	APSA-370
Serial No.	VABF9LSH	Equipment ID	RYG_FS0480
Calibrator Manufacturer	Teledyne API	Model	700
Serial No.	947		
Std. Gas Concentration (PPM)	56.3	Cylinder No.	GN0027222
Cylinder Pressure (psi)	1800	Certified By	Airgas Inc.
Certified Date	9-Feb-22	Expired Date	9-Feb-30

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



Calibrated By

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

Approved By

(Mr. Sarayuth Jitranont)
Assistant General Manager

ALS Laboratory Group

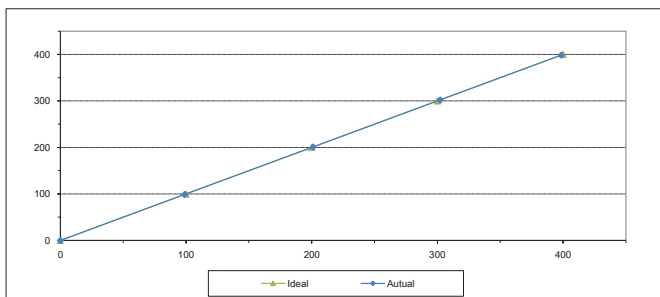
FORM NO.: F 06-056 REVISION NO.: - ISSUE DATE: 02/04/12



MULTIPOINT CALIBRATION REPORT

Calibration Date	2-Jul-23	Equipment Name	SO2 Analyzer
Manufacturer	HORIBA	Model	APSA-370
Serial No.	PAUY077A	Equipment ID	RYG_FS0458
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	201.10	1.10	0.55
3	300.00	302.30	2.30	0.77
4	400.00	398.60	-1.40	-0.35
AVERAGE (%)				-0.01



Calibrated By

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

Approved By

(Mr. Sarayuth Jitranont)
Assistant General Manager

ALS Laboratory Group

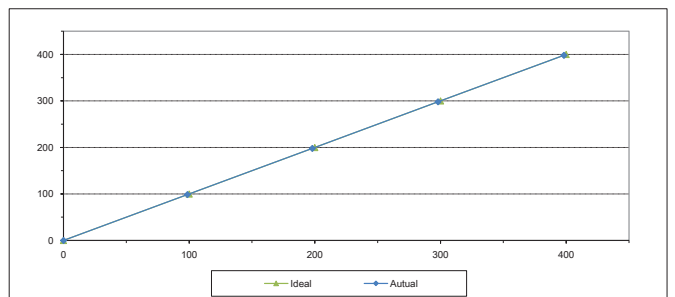
FORM NO.: F 06-056 REVISION NO.: - ISSUE DATE: 02/04/12



MULTIPOINT CALIBRATION REPORT

Calibration Date	2-Jul-23	Equipment Name	SO2 Analyzer
Manufacturer	HORIBA	Model	APSA-370
Serial No.	90U0XJ31	Equipment ID	RYG_FS0452
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	98.60	-1.40	-1.40
2	200.00	198.00	-2.00	-1.00
3	300.00	298.10	-1.90	-0.63
4	400.00	398.20	-1.80	-0.45
AVERAGE (%)				-0.68



Calibrated By

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

Approved By

(Mr. Sarayuth Jitranont)
Assistant General Manager

ALS Laboratory Group

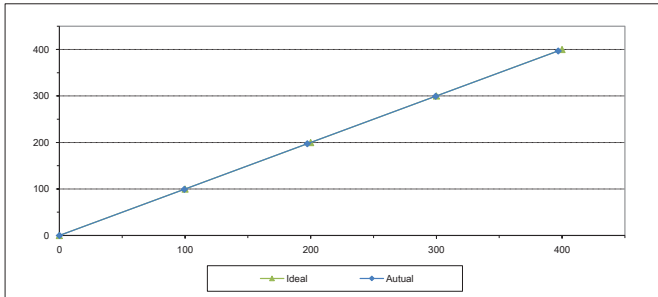
FORM NO.: F 06-056 REVISION NO.: - ISSUE DATE: 02/04/12



MULTIPOINT CALIBRATION REPORT

Calibration Date	2-Jul-23	Equipment Name	SO2 Analyzer
Manufacturer	HORIBA	Model	APSA-370
Serial No.	24PH0KNA	Equipment ID	RYG_FS0257
Calibrator Manufacturer	Teledyne API	Model	700
Serial No.	947		
Std. Gas Concentration (PPM)	58.3	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	99.40	-0.60	-0.60
2	200.00	197.30	-2.70	-1.35
3	300.00	299.50	-0.50	-0.17
4	400.00	397.00	-3.00	-0.75
AVERAGE (%)				-0.55



Calibrated By

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

Approved By

(Mr. Sarayuth Jitranont)
Assistant General Manager

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



Jirante Associates Co., Ltd.
63/4-15, 87/35-36
Petchkasem 7/71, Rd. Wattana, Bangkok,
Bangkok 10000 (Thailand)
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Mobile: +66(0)999453
E-mail: nac-calibration@jiranate.com
Web site: www.jiranate.com

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

Air speed measurement laboratory
Calibration services department

REVIEW BY: *Manahm P.*
APPROVED BY: *stt*
NEXT CAL. DATE: 5/1/24

Certificate Number:
CL-002-66

CERTIFICATE OF CALIBRATION

Page 1 of 2 Pages

MEASUREMENT ITEM	: Cup anemometer
MANUFACTURER	: Novatek
MODEL/TYPE	: Sensor: WS-02F Data logger: WS-250L
SERIAL NUMBER	: Sensor: - Data logger: A4562
ID NUMBER	: BAK_F50143
CONDITION AS-RECEIVED	: Used Item
CUSTOMER	: ALS laboratory group (Thailand) Co., Ltd. 104 Phatthanakan 40, Phatthanakan Rd, Khwaeng Suan Luang, Khet Suan Luang, Bangkok 10250 Thailand.

RECEIVED DATE	: 28 Dec 2022
MEASUREMENT DATE	: 05 Jan 2023
ISSUE DATE	: 09 Jan 2023

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

PLACE OF CALIBRATION : Eiffel-type wind tunnel of Jiranate Associates Co., Ltd.

CALIBRATION CONDITIONS	
Wind tunnel cross-section area ¹	900 cm ²
Win direction frontal area ²	100 cm ²
Diameter of mounting pipe ³	0.111 mm
Blockage ratio of test object ⁴	0.111 [-]

Preconditioning	: 24 hours at ambient conditions.
Measurement Condition	: The average values during measurement are (23.0) °C, (50.4) %RH and (1014.5) hPa.

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

Calibrated by:
☒ Mr. Sarawit Thichulad
☐ Miss Jitraporn Jitranont



Approved signatory: *26/1/23*
Mr. Parinya Booncharoen
Calibration Department Manager

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

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

Certificate Number

CL-002-66

Page 2 of 2 Pages

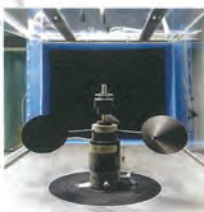
MEASUREMENT RESULTS⁵

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

v_{ref} (m/s)	Temp. wind tunnel (°C)	Temp. room (°C)	v_{uuc} (m/s)	Error (m/s)	$U (k=2)$ (m/s)
0.989	24.10	24.00	0.7	-0.3	0.15
2.034	23.96	24.00	1.7	-0.3	0.16
3.051	24.06	24.00	2.9	-0.2	0.29
4.138	24.00	24.00	3.9	-0.2	0.19
4.99	24.00	24.00	4.8	-0.1	0.26
5.98	24.00	24.00	5.9	-0.1	0.18
7.05	23.90	24.00	6.9	-0.1	0.21
8.16	23.90	24.00	8.0	-0.2	0.21
9.09	23.72	24.00	9.1	0.0	0.30
10.09	23.80	24.00	9.9	-0.1	0.24
11.16	23.80	24.00	11.1	-0.1	0.28
12.13	23.90	24.00	12.1	0.0	0.28
13.21	23.90	24.00	13.2	0.0	0.34
14.27	23.96	24.00	14.4	0.1	0.22
15.26	23.88	24.00	15.1	-0.1	0.27
16.32	24.00	24.00	16.4	0.1	0.28

Remark:
⁵ Calibration results only count for the tested circumstances and environmental conditions during which calibration took place
⁶ Velocity of standard
⁷ Velocity of Unit Under Calibration

PHOTO OF CALIBRATION SET-UP



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



Jirante Associates Co., Ltd.
63/4-15, 87/35-36
Petchkasem 7/71, Rd. Wattana, Bangkok,
Bangkok 10000 (Thailand)
Tel: +66(0)660913
Mobile: +66(0)999453
E-mail: nac-calibration@jiranate.com
Web site: www.jiranate.com

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

Air speed measurement laboratory
Calibration services department

Certificate Number:
CL-002-66

CERTIFICATE OF CALIBRATION

Page 1 of 2 Pages

MEASUREMENT ITEM	: Wind Direction Sensor
MANUFACTURER	: Novatek
MODEL/TYPE	: Sensor: WS-02F Data logger: WS-250L
SERIAL NUMBER	: Sensor: - Data logger: A4562
ID NUMBER	: BAK_F50143
CONDITION AS-RECEIVED	: Used Item
CUSTOMER	: ALS laboratory group (Thailand) Co., Ltd. 104 Phatthanakan 40, Phatthanakan Rd, Khwaeng Suan Luang, Khet Suan Luang, Bangkok 10250 Thailand.

RECEIVED DATE	: 28 Dec 2022
MEASUREMENT DATE	: 06 Jan 2023
ISSUE DATE	: 09 Jan 2023

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

PLACE OF CALIBRATION : Eiffel-type wind tunnel of Jiranate Associates Co., Ltd.

CALIBRATION CONDITION	
Wind tunnel cross-section area ¹	900 cm ²
Win direction frontal area ²	129 cm ²
Diameter of mounting pipe ³	0.143 mm
Blockage ratio of test object ⁴	0.143 [-]

Preconditioning	: 24 hours at ambient conditions.
Measurement Condition	: The average values during measurement are (23.0) °C, (50.1) %RH and (1015.7) hPa.

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

Calibrated by:
☒ Mr. Sarawit Thichulad
☐ Miss Jitraporn Jitranont



Approved signatory: *26/1/23*
Mr. Parinya Booncharoen
Calibration Department Manager

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

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

Certificate Number

CI-002-66

Page 2 of 2 Pages

MEASUREMENT RESULTS¹

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

Air speed m/s	D ₁₀₀ Degree (°)	D ₁₀₀ Degree (°)	Error Degree (°)	U (k=2) Degree (°)
	0.000	0	0	0.58
	45.000	41	-4	0.74
	90.000	87	-3	0.74
4.98	135.000	134	-1	0.74
	180.001	182	2	0.74
	225.000	228	3	0.68
	270.000	272	2	0.74
	315.000	318	3	0.74

Remarks:

¹ Calibration results only valid for the tested circumstances and environment. ² End of certificate of calibration.

³ Direction of standard.

⁴ Direction of Unit Under Calibration.



End of Certificate of Calibration

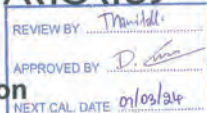
Sartorius (Thailand) Co., Ltd.
129 Rama 9 Road, Huaykwang, Huaykwang, Bangkok 10310
Tel: +66 2643 8361-6, e-mail: service.thailand@sartorius.com



SARTORIUS

NSC-TISI-TIS 17025

CALIBRATION 0426



Certificate of Calibration

Model Number : MSE125P-100-DU Certificate No. : 23BCI0114
Description : Semi-micro Balance Issued Date : Friday, March 03, 2023
Serial Number : 0033108993 Reference No. : 204833
ID No. : RYG_EN0004
Manufacturer : Sartorius Page No. : 1 of 3

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

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

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

Metrological data : Capacity : 120 g Readability : 0.00001 g Ambients Conditions:
Temperature : 24.0 °C ± 5.0 °C
Humidity : 63.0 % RH ± 10.0 % RH
Pressure : ±
Reasons for calibration : ☐ New Installation ☐ Service / Repaired ☒ Re-calibration/ Maintenance Equipment Condition: ☒ Good Operate ☐ Fail

Measurement Method UKAS Publication Ref :Lab 14

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

Traceability:

Model Number	Description	Traceability	Certificate No.	Due Date
YCS011-522-00	Sartorius weight set 1mg - 5000g E2.YCS011-522-00	SPC-RT	C02212565	14-Sep-2023
MHB-382SD	Humidity/Barometer/Temp Lutron MHB-382SD	DKSH	C19220444	5-Sep-2023

This certificate relate and apply this equipment only.

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

Mr.chonchai inthana(Technical Manager)

SOP FM 33 03 February 2022



Sartorius (Thailand) Co., Ltd.
129 Rama 9 Road, Huaykwang, Huaykwang, Bangkok 10310
Tel: +66 2643 8361-6 Fax: +66 2643 8367, e-mail: service.thailand@sartorius.com

SARTORIUS

Certificate of Calibration

Model Number : MSE125P-100-DU Certificate No. : 23BCI0114
Description : Semi-micro Balance Issued Date : Friday, March 03, 2023
Serial Number : 0033108993 Reference No. : 204833
ID No. : RYG_EN0004
Manufacturer : Sartorius Page No. : 2 of 3

Calibration Results : Without Adjustment

Repeatability	Eccentricity (Off-center loading error)
The repeatability is the ability of a weighing instrument to display nearly identical readouts under constant test conditions when the same load within a measurement series is placed repeatedly on the weighing pan in the same manner. The standard deviation is used to express repeatability quantitatively.	The off-center loading error is yielded by the difference between the readout of the load, i.e. 1/3 or 1/4 of maximum capacity, placed in the middle of the weighing pan and between each of four additional measurement points (positions defined according to OIML R76).
Nominal Value : (Low Load) 5 g Tolerance 0.000015 g	Nominal value : 50 g Tolerance 0.00015 g
Nominal Value : (High Load) 50 g Tolerance 0.000015 g	Difference 1 - 2 -0.00001 3 0.00000 4 0.00002 5 0.00002 6 -
Standard Deviation 0.000007 0.000009	

Linearity

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

Tolerance		0.00004 g		
Nominal Value	Conventional Mass Value	Displayed Value	Deviation	Uncertainty
(g)	(g)	(g)	(g)	(g)
0.01	0.01000	0.01000	0.00000	0.000026
0.1	0.10000	0.10000	0.00000	0.000026
1	1.00000	1.00000	0.00000	0.000028
2	2.00002	2.00002	0.00000	0.000030
5	5.00002	5.00001	-0.00001	0.000033
10	10.00002	10.00002	0.00000	0.000038
20	20.00000	20.00000	0.00000	0.000048
30	30.00002	30.00002	0.00000	0.000040
40	40.00003	40.00002	-0.00001	0.000087
50	50.00002	50.00001	-0.00001	0.000081

SOP FM 33 03 February 2022

Sartorius (Thailand) Co., Ltd.
129 Rama 9 Road, Huaykwang, Huaykwang, Bangkok 10310
Tel: +66 2643 8361-6 Fax: +66 2643 8367, e-mail: service.thailand@sartorius.com

SARTORIUS

Certificate of Calibration

Model Number : MSE125P-100-DU Certificate No. : 23BCI0114
Description : Semi-micro Balance Issued Date : Friday, March 03, 2023
Serial Number : 0033108993 Reference No. : 204833
ID No. : RYG_EN0004
Manufacturer : Sartorius Page No. : 3 of 3

Calibration Results : Without Adjustment

Repeatability	Eccentricity (Off-center loading error)
The repeatability is the ability of a weighing instrument to display nearly identical readouts under constant test conditions when the same load within a measurement series is placed repeatedly on the weighing pan in the same manner. The standard deviation is used to express repeatability quantitatively.	The off-center loading error is yielded by the difference between the readout of the load, i.e. 1/3 or 1/4 of maximum capacity, placed in the middle of the weighing pan and between each of four additional measurement points (positions defined according to OIML R76).
Nominal Value : (Low Load) g Tolerance 0.000015 g	Nominal value : 50 g Tolerance 0.00015 g
Nominal Value : (High Load) 100 g Tolerance 0.000015 g	Difference 1 - 2 - 3 - 4 - 5 - 6 -
Standard Deviation 0.000003	

Linearity

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

Tolerance 0.0001 g				
Nominal Value	Conventional Mass Value	Displayed Value	Deviation	Uncertainty
(g)	(g)	(g)	(g)	(g)
65	65.0000	65.0000	0.0000	0.00015
70	70.0000	70.0000	0.0000	0.00015
75	75.0000	75.0000	0.0000	0.00016
80	80.0000	80.0000	0.0000	0.00017
85	85.0001	85.0001	0.0000	0.00018
90	90.0001	90.0001	0.0000	0.00018
95	95.0001	95.0001	0.0000	0.00020
100	100.0000	100.0000	0.0000	0.00024
110	110.0000	110.0000	0.0000	0.00026
120	120.0000	120.0000	0.0000	0.00026

End of Report

SOP FM 33 03 February 2022



REVIEW BY: Autcharawan S.
APPROVED BY: Sunont M.
NEXT CAL. DATE: 12/2023

Certificate of Calibration

ICS-2100: Anion (ID#659)

This certificate is to verify that instrument below are calibrated

by Archimica Lab Co., Ltd.

ICS-2100 S/N: 15010977

AS-HV S/N: 5450A36659

For

ALS Laboratory Group (Thailand) Co., Ltd.

Operator Signature: Nutdanai Date: Jan 12, 2023

(Mr. Nutdanai Laekhwan)

Application Chemist



บริษัท เอกเสควิฟ เทคคิง จำกัด (สำนักงานใหญ่)
48/194-5 ซอยประดิษฐ์มนูธรรม 19 ถนนประดิษฐ์มนูธรรม แขวงลาดพร้าว เขตคลองจั่น กรุงเทพฯ 10230
TEL (662) 515-0145-50 FAX (662) 515-0144 www.etlthai.com E-mail : info@etlthai.com

ที่ RA 032/22

ใบรายงานผลการปรับเทียบ

ชื่อผู้ขอรับบริการ : บริษัท เอกเสควิฟ เทคคิง จำกัด (ประเทศไทย) จำกัด.
ที่อยู่ : 104 ซ.พัฒนาการ 40 ถ.พัฒนาการ แขวงสวนหลวง เขตสวนหลวง กรุงเทพมหานคร 10250.
ปรับเทียบที่ : บริษัท เอกเสควิฟ เทคคิง จำกัด
ที่อยู่ : 48/194-5 ซอย ประดิษฐ์มนูธรรม 19 ถนนประดิษฐ์มนูธรรม แขวงคลองลาดพร้าว กรุงเทพฯ 10230

รายละเอียดเครื่องมือที่ทำการปรับเทียบ : **สถานะแวดล้อม :**
เครื่องมือ : เครื่องตรวจวัดไอระเหยจากสารเคมี อุณหภูมิ : $(25 \pm 3) ^\circ\text{C}$
ผลิตภัณฑ์ : RAE Systems ความชื้นสัมพัทธ์ : $(35 \pm 15) \%$
รุ่น : MiniRAE3000 ความดันบรรยากาศ : 760 มิลลิเมตรปรอท
หมายเลขเครื่อง : 592-906502
ID : BKK_FS0820

REVIEW BY: Pinakorn P.
APPROVED BY: [Signature]
NEXT CAL. DATE: 31/8/23

วันที่ปรับเทียบมาตรฐาน : 2 มีนาคม 2565
วิธีการปรับเทียบมาตรฐาน : ปรับเทียบโดยใช้ Standard Reference Gas ผลิตภัณฑ์ GASCO
Isobutylene Standard Gas 100 ppm; Lot number: 304-402089381-1.

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)	81.1 ppm	100.0 ppm	0.0 ppm	Pass

Flow Rate of Pump : 485 cc/min.

Accuracy : $\pm 2 \%$ at calibration point

ผู้ปรับเทียบ : [Signature]
(นายสุรินทร์ สายเนตร)
Service Engineer

ผู้ตรวจสอบ : [Signature]
(นายสุทิวท กงทองสังข์)
Service Engineer Manager

ผลการสอบเทียบปรับเทียบ นี้ ครอบคลุมเฉพาะตัวเครื่องและรายการที่ได้ระบุไว้เท่านั้น
การนำรายงานผล/ใบรับรองนี้ไปโฆษณาและการค้าอย่างอื่นโดยไม่ขอความเห็นชอบจาก ET จะถือว่าผิดกฎหมายและจะถือว่า ET ไม่รับผิดชอบในสิ่งที่ปรากฏในรายงานฉบับนี้

EXECUTIVE TRADING LIMITED 48/194-5 SOI PRADITMANUTHAM 19, PRADITMANUTHAM ROAD, LATPHRAO, BANGKOK 10230



บริษัท เอกเสควิฟ เทคคิง จำกัด (สำนักงานใหญ่)
48/194-5 ซอยประดิษฐ์มนูธรรม 19 ถนนประดิษฐ์มนูธรรม แขวงลาดพร้าว เขตคลองจั่น กรุงเทพฯ 10230
TEL (662) 515-0145-50 FAX (662) 515-0144 www.etlthai.com E-mail : info@etlthai.com

No. RA 032/22

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 : Environmental Condition :
Instrument : Gas Detector Temperature : $(25 \pm 3) ^\circ\text{C}$
Product : RAE Systems Relative Humidity : $(35 \pm 15) \%$
Model Name : MiniRAE3000 Pressure : 760 mmHg
Serial Number : 592-906502
ID : BKK_FS0820

Date of Calibration : March 2, 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)	81.1 ppm	100.0 ppm	0.0 ppm	Pass

Flow Rate of Pump : 485 cc/min.

Accuracy : $\pm 2 \%$ at calibration point

Calibrated By : Sutinthorn S. Approved By : [Signature]
(Mr. Sutinthorn Sainate) (Mr. Suttiwong Kongtongsang.)
Service Engineer 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 เอกเสควิฟ เทคคิง จำกัด (สำนักงานใหญ่)
48/194-5 ซอยประดิษฐ์มนูธรรม 19 ถนนประดิษฐ์มนูธรรม แขวงลาดพร้าว เขตคลองจั่น กรุงเทพฯ 10230
TEL (662) 515-0145-50 FAX (662) 515-0144 www.etlthai.com E-mail : info@etlthai.com

ที่ RA 032/22

ใบรายงานการตรวจเช็คเครื่องตรวจวัดก๊าซ รุ่น MiniRAE3000

หมายเลขเครื่อง : 592-906502 วันที่ตรวจเช็ค : 2 มีนาคม 2565

ลำดับที่	รายละเอียดการตรวจสอบ	RAW COUNT		สรุป	หมายเหตุ
		REF.	REAL		
1.	PID RAW COUNT				
	Ch.H	10000-62500	53126	■ YES □ NO	
	Ch.L	<62500	53950	■ YES □ NO	
2.	Lamp	>40	42	■ YES □ NO	

ลำดับที่	รายละเอียดการตรวจเช็ค	การแก้ไข	สรุป	หมายเหตุ
1.	Motor Pump	Check flow rate	■ YES □ NO	485 cc/min.
2.	Buzzer	-	■ YES □ NO	-
3.	Li-ion Battery	-	■ YES □ NO	-
4.	Key Pad			
	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	-

ผู้ตรวจเช็ค : [Signature]
(นายสุรินทร์ สายเนตร)
Service Engineer

ผลการสอบเทียบปรับเทียบ นี้ ครอบคลุมเฉพาะตัวเครื่องและรายการที่ได้ระบุไว้เท่านั้น

การนำรายงานผล/ใบรับรองนี้ไปโฆษณาและการค้าอย่างอื่นโดยไม่ขอความเห็นชอบจาก ET จะถือว่าผิดกฎหมายและจะถือว่า ET ไม่รับผิดชอบในสิ่งที่ปรากฏในรายงานฉบับนี้

EXECUTIVE TRADING LIMITED 48/194-5 SOI PRADITMANUTHAM 19, PRADITMANUTHAM ROAD, LATPHRAO, BANGKOK 10230



GASCO AFFILIATES, LLC.

320 Scarlet Blvd.
Oldsmar, FL 34877
(800) 910-0051
Fax: (888) 755-8820
www.gascogas.com

CERTIFICATE OF ANALYSIS

Date: May 14, 2021 Customer: R.C. Systems Co Inc
Order Number: 58376
Lot Number: 304-402069381-1 Use Before: 05/14/2025

Component	Requested Concentration	Analytical Result (+/- 2%)
Isobutylene Air	100 PPM Balance	101.2 PPM Balance

Cylinder Size: 3.70 Cu. Ft.
Contents: 106 Liter
Valve: 5/8"-18 UNF
Pressure: 1200 psig

Product composition verified by direct comparison to calibration standards (acceptable to N.I.S.T. weights and/or N.I.S.T. Gas Mixture reference materials)

Analyst:

[Signature]
Honeywell

Honeywell Analytics - Singapore Office
17 Changi Business Park Central 1
Singapore 486073
Cert Ref: 00317



Honeywell Gas Detection
THE POWER OF CONNECTED

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 **31st July to 2nd August 2018**

[Signature]
Conducted by: Desmond Tan
Service Engineer/Technical Trainer
Date of Issue: 2nd August 2018
Valid for 2 years from date of issue

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.: ACC23005
Pages: 1 of 3

Calibration Certificate

Equipment : SOUND CALIBRATOR
Manufacturer : RION
Model : NC-75
Serial No.: 35002736
ID No.: RYG_FS0496

Condition As Found : GOOD

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

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

Received Date : 06 JANUARY 2023
Calibration Date : 17 JANUARY 2023
Date of Issue : 19 JANUARY 2023

Calibrated by : Nathakorn Pisutpaisan

Approved by :

[Signature]
(Thanakul Petchurai)

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

SITHIPORN ASSOCIATES CO.,LTD. CALIBRATION LABORATORY

Continuation of Calibration Certificate

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

Calibration Procedure : CP-AC-03

Calibration Method :

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

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

Condition of this result of calibration :

1. Reference Standard Instruments :

Instrument	Model	Serial No.	Cert. No.	Due Date
Waveform Generator	33511B	MY52302742	EF-0008-22	04-Feb-23
Digital Multimeter	33461A	MY53220104	EEL-BP_04/0265	09-Feb-23
Digital Multimeter	33461A	MY53220076	EEL-BP_03/0265	09-Feb-23
Digital Multimeter	33461A	MY60024273	EEL-BP_05/0265	09-Feb-23
Programmable Attenuator	MAT-1070	62100114	EF-0009-22	07-Feb-23
Condenser Microphone	4180	2977900	AA-1013-22	24-Feb-23
Measuring Amplifier	NA-42KA1	34560495	AA-3005-22	22-Feb-23
Audio Analyzer	AVR-3360A	V744B6069	EF-0010-22	07-Feb-23

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

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

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

[Signature]

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

Result of calibration :

1. Sound pressure level

Specified sound pressure level (dB)	Measured value (dB)	Deviated value (dB)	Uncertainty (dB)	Tolerance limit (dB)
94	93.98	-0.02	0.14	0.40

2. Frequency

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

3. Total distortion

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

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

End of Calibration Certificate

QF-TS12-04-04-020664

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. : ACL22231
Pages : 1 of 8

Calibration Certificate

Equipment : SOUND LEVEL METER
Manufacturer : RION
Model : NL-42/ Microphone UC-52 / Preamplifier NH-24
Serial No.: 00472126 / 176915 / 88180
ID No.: RYG_FS0301

Condition As Found : GOOD

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

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

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

REVIEW BY: *Nathakorn P.*
APPROVED BY: *Nathakorn P.*
NEXT CAL. DATE: 11/10/23

Calibrated by : Nathakorn Pisutpaisan

Approved by :

T. Petchurui
(Thanakul Petchurui)

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

QF-TS12-04-04-020664

Cert. No. : ACL22231
Job No. : VC65AC0088
Pages : 2 of 8

Calibration Procedure : CP-AC-01

Calibration Method :

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

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

Condition of this result of calibration :

1. Reference Standard Instruments :

Instrument	Model	Serial No.	Cert. No.	Due Date
Waveform Generator	33210A	MY48017076	EF-0007-22	04-Feb-23
Waveform Generator	33511B	MY52302742	EF-0008-22	04-Feb-23
Digital Multimeter	33461A	MY53220104	EEL_BP_04/0265	09-Feb-23
Digital Multimeter	33461A	MY53220076	EEL_BP_03/0265	09-Feb-23
Digital Multimeter	34461A	MY60024273	EEL_BP_05/0265	09-Feb-23
Programmable Attenuator	MAT-1070	62100114	EF-0009-22	07-Feb-23
Condenser Microphone	4180	2977900	AA-1013-22	24-Feb-23
Measuring Amplifier	NA-42KAI	34560495	AA-3005-22	22-Feb-23

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

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

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

QF-TS12-04-04-020664

Cert. No. : ACL22231
Job No. : VC65AC0088
Pages : 3 of 8

Summary of Measurement Result :

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

QF-TS12-04-04-020664

Continuation of Calibration Certificate

Cert. No. : ACL22231
Job No. : VC65AC0088
Pages : 4 of 8

Result of calibration :

1. Absolute sensitivity

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

2. Self-generated noise

2.1 Normal test

Measured Value (dB)
14.6

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

Frequency Weighting	Measured value (dB)
A - weight	9.9
C - weight	16.7
Flat	22.5

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	-7.6	-7.6	-7.3	± 1.5
1000	0.5	0.5	0.5	± 1.0
8000	-5.1	-5.1	-5.1	±5.0

QF-TS12-04-04-020664

T. Rth.

Continuation of Calibration Certificate

Cert. No. : ACL22231
Job No. : VC65AC0088
Pages : 5 of 8

4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)			
	Flat	C-weight	A-weight	Acceptance Limits
63	-0.1	-0.1	-0.1	±2.0
125	0.0	0.0	-0.1	±1.5
250	0.0	-0.1	-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. Rth.

Continuation of Calibration Certificate

Cert. No. : ACL22231
Job No. : VC65AC0088
Pages : 6 of 8

7. Level linearity on the reference level range

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

QF-TS12-04-04-020664

T. Rth.

Continuation of Calibration Certificate

Cert. No. : ACL22231
Job No. : VC65AC0088
Pages : 7 of 8

8. Level linearity including the level range control

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

9. Tone burst response

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

10. Peak C sound level

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

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

QF-TS12-04-04-020664

T. Rth.

Continuation of Calibration Certificate

Cert. No. : ACL22231
Job No. : VC65AC0088
Pages : 8 of 8

11. Overload indication

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

12. High level stability

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

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

End of Calibration Certificate

QF-TS12-04-04-020664

T. 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.comCert. No. : ACL22234
Pages : 1 of 8

Calibration Certificate

Equipment : SOUND LEVEL METER
Manufacturer : RION
Model : NL-42/ Microphone UC-52 / Preamplifier NH-24
Serial No.: 01073608 / 172153 / 85748
ID No.: RYG_FS0387

Condition As Found : GOOD

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

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

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

REVIEW BY: *Muhammad P*
APPROVED BY: *Thanaikul Petchur*
NEXT CAL. DATE: 19/10/23

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. : ACL22234
Job No. : VC65AC0088
Pages : 2 of 8

Calibration Procedure : CP-AC-01

Calibration Method :

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

Condition of this result of calibration :

1. Reference Standard Instruments :

Instrument	Model	Serial No.	Cert. No.	Due Date
Waveform Generator	33210A	MY48017076	EF-0007-22	04-Feb-23
Waveform Generator	33511B	MY52302742	EF-0008-22	04-Feb-23
Digital Multimeter	33461A	MY53220104	EEL_BP_04/0265	09-Feb-23
Digital Multimeter	33461A	MY53220076	EEL_BP_03/0265	09-Feb-23
Digital Multimeter	34461A	MY60024273	EEL_BP_05/0265	09-Feb-23
Programmable Attenuator	MAT-1070	62100114	EF-0009-22	07-Feb-23
Condenser Microphone	4180	2977900	AA-1013-22	24-Feb-23
Measuring Amplifier	NA-42KAI	34560495	AA-3005-22	22-Feb-23

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

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

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

QF-TS12-04-04-020664

T. Petchur

Continuation of Calibration Certificate

Cert. No. : ACL22234
Job No. : VC65AC0088
Pages : 3 of 8

Summary of Measurement Result :

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

QF-TS12-04-04-020664

T. Petchur

Continuation of Calibration Certificate

Cert. No. : ACL22234
Job No. : VC65AC0088
Pages : 4 of 8

Result of calibration :

1. Absolute sensitivity

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

2. Self-generated noise

2.1 Normal test

Measured Value (dB)
15.4

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	23.8

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	0.4	0.3	0.4	± 1.5
1000	0.0	0.0	0.0	± 1.0
8000	-1.0	-0.9	-0.9	±5.0

QF-TS12-04-04-020664

7. Petch

Continuation of Calibration Certificate

Cert. No. : ACL22234
Job No. : VC65AC0088
Pages : 5 of 8

4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

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

5. Frequency and time weightings at 1 kHz

5.1 Frequency weightings at 1 kHz

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

5.2 Time weighting at 1 kHz

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

6. Long - term stability

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

QF-TS12-04-04-020664

7. Petch

Continuation of Calibration Certificate

Cert. No. : ACL22234
Job No. : VC65AC0088
Pages : 6 of 8

7. Level linearity on the reference level range

Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
137.0	137.0	0.0	± 1.1
136.0	136.0	0.0	± 1.1
135.0	135.0	0.0	± 1.1
134.0	134.0	0.0	± 1.1
133.0	133.0	0.0	± 1.1
132.0	132.0	0.0	± 1.1
131.0	131.0	0.0	± 1.1
129.0	129.0	0.0	± 1.1
124.0	124.0	0.0	± 1.1
119.0	119.0	0.0	± 1.1
114.0	114.0	0.0	± 1.1
109.0	109.0	0.0	± 1.1
104.0	104.0	0.0	± 1.1
99.0	99.0	0.0	± 1.1
94.0	94.0	0.0	± 1.1
89.0	89.0	0.0	± 1.1
84.0	84.1	0.1	± 1.1
79.0	79.0	0.0	± 1.1
74.0	74.1	0.1	± 1.1
69.0	69.0	0.0	± 1.1
64.0	64.0	0.0	± 1.1
59.0	59.1	0.1	± 1.1
54.0	54.0	0.0	± 1.1
49.0	49.0	0.0	± 1.1
44.0	44.0	0.0	± 1.1
39.0	39.0	0.0	± 1.1
34.0	34.0	0.0	± 1.1
30.0	29.9	-0.1	± 1.1
29.0	28.9	-0.1	± 1.1
28.0	27.9	-0.1	± 1.1
27.0	26.9	-0.1	± 1.1
26.0	25.9	-0.1	± 1.1
25.0	24.8	-0.2	± 1.1

QF-TS12-04-04-020664

7. Petch

Continuation of Calibration Certificate

Cert. No. : ACL22234
Job No. : VC65AC0088
Pages : 7 of 8

8. Level linearity including the level range control

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

9. Tone burst response

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

10. Peak C sound level

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

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

7. Petch

Continuation of Calibration Certificate

Cert. No. : ACL22234
Job No. : VC65AC0088
Pages : 8 of 8

11. Overload indication

Measured value (dB)		Deviated Value (dB)	Acceptance Limits (dB)
Positive one-half cycle	Negative one-half cycle		
119.6	89.7	-29.9	±1.5

12. High level stability

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

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

End of Calibration Certificate

QF-TS12-04-04-020664

T. Petchur

451-451/1 Sirinthorn Rd, Bangbunru, Bangplud Bangkok 10700 THAILAND.
Tel:0-2435-8800 Fax:0-2433-1679 e-mail:cal-center@sithiporn.com http://www.sithiporn.comCert. No. : ACL22235
Pages : 1 of 8

Calibration Certificate

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

Condition As Found : GOOD

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

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

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



Calibrated by : Nathakorn Pisutpaisan

Approved by :

T. Petchur
(Thanakul Petchurai)

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QF-TS12-04-04-020664

Continuation of Calibration Certificate

Cert. No. : ACL22235
Job No. : VC65AC0088
Pages : 2 of 8

Calibration Procedure : CP-AC-01

Calibration Method :

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

Condition of this result of calibration :

1. Reference Standard Instruments :

Instrument	Model	Serial No.	Cert. No.	Due Date
Waveform Generator	33210A	MY48017076	EF-0007-22	04-Feb-23
Waveform Generator	33511B	MY52302742	EF-0008-22	04-Feb-23
Digital Multimeter	33461A	MY53220104	EEL_BP_04/0265	09-Feb-23
Digital Multimeter	33461A	MY53220076	EEL_BP_03/0265	09-Feb-23
Digital Multimeter	34461A	MY60024273	EEL_BP_05/0265	09-Feb-23
Programmable Attenuator	MAT-1070	62100114	EF-0009-22	07-Feb-23
Condenser Microphone	4180	2977900	AA-1013-22	24-Feb-23
Measuring Amplifier	NA-42KAI	34560495	AA-3005-22	22-Feb-23

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

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

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

QF-TS12-04-04-020664

T. Petchur

Continuation of Calibration Certificate

Cert. No. : ACL22235
Job No. : VC65AC0088
Pages : 3 of 8

Summary of Measurement Result :

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

QF-TS12-04-04-020664

T. Petchur

Continuation of Calibration Certificate

Cert. No. : ACL22235
Job No. : VC65AC0088
Pages : 4 of 8

Result of calibration :

1. Absolute sensitivity

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

2. Self-generated noise

2.1 Normal test

Measured Value (dB)
15.1

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

Frequency Weighting	Measured value (dB)
A - weight	12.0
C - weight	18.0
Flat	23.7

3. Acoustical signal tests of frequency weightings

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

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)			
	Flat	C-weight	A-weight	Acceptance Limits
125	0.2	0.2	0.3	± 1.5
1000	0.0	0.0	0.0	± 1.0
8000	-0.6	-0.5	-0.5	±5.0

QF-TS12-04-04-020664

T. Reth.

Continuation of Calibration Certificate

Cert. No. : ACL22235
Job No. : VC65AC0088
Pages : 5 of 8

4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

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

Continuation of Calibration Certificate

Cert. No. : ACL22235
Job No. : VC65AC0088
Pages : 6 of 8

7. Level linearity on the reference level range

Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
137.0	137.0	0.0	± 1.1
136.0	136.0	0.0	± 1.1
135.0	135.0	0.0	± 1.1
134.0	134.0	0.0	± 1.1
133.0	133.0	0.0	± 1.1
132.0	132.0	0.0	± 1.1
131.0	131.0	0.0	± 1.1
129.0	129.0	0.0	± 1.1
124.0	124.0	0.0	± 1.1
119.0	119.0	0.0	± 1.1
114.0	114.0	0.0	± 1.1
109.0	109.0	0.0	± 1.1
104.0	104.0	0.0	± 1.1
99.0	99.0	0.0	± 1.1
94.0	94.0	0.0	± 1.1
89.0	89.0	0.0	± 1.1
84.0	84.0	0.0	± 1.1
79.0	79.0	0.0	± 1.1
74.0	74.0	0.0	± 1.1
69.0	69.0	0.0	± 1.1
64.0	64.0	0.0	± 1.1
59.0	59.0	0.0	± 1.1
54.0	53.9	-0.1	± 1.1
49.0	49.0	0.0	± 1.1
44.0	44.0	0.0	± 1.1
39.0	38.9	-0.1	± 1.1
34.0	33.9	-0.1	± 1.1
30.0	29.9	-0.1	± 1.1
29.0	28.9	-0.1	± 1.1
28.0	27.9	-0.1	± 1.1
27.0	26.8	-0.2	± 1.1
26.0	25.8	-0.2	± 1.1
25.0	24.8	-0.2	± 1.1

QF-TS12-04-04-020664

T. Reth.

Continuation of Calibration Certificate

Cert. No. : ACL22235
Job No. : VC65AC0088
Pages : 7 of 8

8. Level linearity including the level range control

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

9. Tone burst response

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

10. Peak C sound level

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

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

QF-TS12-04-04-020664

T. Reth.

Continuation of Calibration Certificate

Cert. No. : ACL22235
Job No. : VC65AC0088
Pages : 8 of 8

11. Overload indication

Measured value (dB)		Deviated Value (dB)	Acceptance Limits (dB)
Positive one-half cycle	Negative one-half cycle		
89.5	89.5	0.0	±1.5

12. High level stability

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

The reported uncertainty is based on a standard uncertainty multiplied by coverage factor $k = 2$ 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 Sirinthon Rd., Bangbunru, Bangplud Bangkok 10700 THAILAND.
Tel:0-2435-8800 Fax:0-2433-1679 e-mail:cal-center@sithiporn.com http://www.sithiporn.comCert. No. : ACL23079
Pages : 1 of 8

Calibration Certificate

Equipment : SOUND LEVEL METER
Manufacturer : RION
Model : NL-42/ Microphone UC-52 / Preamplifier NH-24
Serial No.: 00296516 / 180412 / 88182
ID No.: RYG_PS0433

Condition As Found : GOOD

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

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

Received Date : 24 JANUARY 2023
Calibration Date : 25-26 JANUARY 2023
Date of Issue : 27 JANUARY 2023



Calibrated by : Nathakorn Pisutpaisan

Approved by :

T. 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. : ACL23079
Job No. : VC66AC0031
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).

Continuation of Calibration Certificate

Cert. No. : ACL23079
Job No. : VC66AC0031
Pages : 3 of 8

Summary of Measurement Result :

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

QF-TS12-04-04-020664

T. Petchur

QF-TS12-04-04-020664

T. Petchur

Continuation of Calibration Certificate

Cert. No. : ACL23079
Job No. : VC66AC0031
Pages : 4 of 8

Result of calibration :

1. Absolute sensitivity

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

2. Self-generated noise

2.1 Normal test

Measured Value (dB)
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	17.5
Flat	23.3

3. Acoustical signal tests of frequency weightings

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

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

QF-TS12-04-04-020664

T. Petch

Continuation of Calibration Certificate

Cert. No. : ACL23079
Job No. : VC66AC0031
Pages : 5 of 8

4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

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

QF-TS12-04-04-020664

T. Petch

Continuation of Calibration Certificate

Cert. No. : ACL23079
Job No. : VC66AC0031
Pages : 6 of 8

7. Level linearity on the reference level range

Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
137.0	137.0	0.0	± 1.1
136.0	136.0	0.0	± 1.1
135.0	135.0	0.0	± 1.1
134.0	134.0	0.0	± 1.1
133.0	133.0	0.0	± 1.1
132.0	132.0	0.0	± 1.1
131.0	131.0	0.0	± 1.1
129.0	129.0	0.0	± 1.1
124.0	124.0	0.0	± 1.1
119.0	119.0	0.0	± 1.1
114.0	114.0	0.0	± 1.1
109.0	109.0	0.0	± 1.1
104.0	104.0	0.0	± 1.1
99.0	99.0	0.0	± 1.1
94.0	94.0	0.0	± 1.1
89.0	89.0	0.0	± 1.1
84.0	84.0	0.0	± 1.1
79.0	79.0	0.0	± 1.1
74.0	74.0	0.0	± 1.1
69.0	69.0	0.0	± 1.1
64.0	64.0	0.0	± 1.1
59.0	59.0	0.0	± 1.1
54.0	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	29.8	-0.2	± 1.1
29.0	28.8	-0.2	± 1.1
28.0	27.8	-0.2	± 1.1
27.0	26.9	-0.1	± 1.1
26.0	25.8	-0.2	± 1.1
25.0	24.8	-0.2	± 1.1

QF-TS12-04-04-020664

T. Petch

Continuation of Calibration Certificate

Cert. No. : ACL23079
Job No. : VC66AC0031
Pages : 7 of 8

8. Level linearity including the level range control

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

9. Tone burst response

Time Weighting	Tone burst duration, 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, Lepeak (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.0	0.0	-
One	136.4	136.3	-0.1	±3.0

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

QF-TS12-04-04-020664

T. Petch

Continuation of Calibration Certificate

Cert. No. : ACL23079
Job No. : VC66AC0031
Pages : 8 of 8

11. Overload indication

Measured value (dB)		Deviated Value	Acceptance Limits
Positive one-half cycle	Negative one-half cycle	(dB)	(dB)
89.5	89.7	0.2	±1.5

12. High level stability

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

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

End of Calibration Certificate

QF-TS12-04-04-020664

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.comCert. No. : ACL23088
Pages : 1 of 8

Calibration Certificate

Equipment : SOUND LEVEL METER
Manufacturer : RION
Model : NL-52A / Microphone UC-59 / Preamplifier NH-25
Serial No. : 01120937 / 21845 / 22326
ID No. : -

Condition As Found : GOOD

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

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

Received Date : 24 JANUARY 2023
Calibration Date : 26-30 JANUARY 2023
Date of Issue : 31 JANUARY 2023

Calibrated by : Nathakorn Pisutpaisani

Approved by :

T. Petchur
(Thanakul Petchur)

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QF-TS12-04-04-020664

Continuation of Calibration Certificate

Cert. No. : ACL23088
Job No. : VC66AC0030
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).

Continuation of Calibration Certificate

Cert. No. : ACL23088
Job No. : VC66AC0030
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	✓	-	0.3	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. : ACL23088
Job No. : VC66AC0030
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)	94.0	0.0	±0.3

2. Self-generated noise

2.1 Normal test

Measured Value (dB)
14.6

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

Frequency Weighting	Measured value (dB)
A - weight	9.9
C - weight	14.9
Flat	20.4

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	± 1.0
1000	0.2	0.2	0.2	± 0.7
8000	-0.4	-0.4	-0.4	+ 1.5, - 2.5

QF-TS12-04-04-020664

7. Peter

Cert. No. : ACL23088
Job No. : VC66AC0030
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4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)			
	Flat	C-weight	A-weight	Acceptance Limits
63	0.0	-0.1	0.0	±1.0
125	0.0	0.0	0.0	±1.0
250	0.0	0.0	0.0	±1.0
500	0.0	0.0	0.0	±1.0
1000	0.0	0.0	0.0	±1.0
2000	0.0	0.0	0.0	±1.0
4000	0.0	0.0	0.0	±1.0
8000	0.0	0.1	0.1	+ 1.5, - 2.5
16000	0.0	-1.2	-1.2	+ 2.5, -16.0

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	± 0.1

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7. Peter

Cert. No. : ACL23088
Job No. : VC66AC0030
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	±0.8
136.0	136.0	0.0	±0.8
135.0	135.0	0.0	±0.8
134.0	134.0	0.0	±0.8
133.0	133.0	0.0	±0.8
132.0	132.0	0.0	±0.8
131.0	131.0	0.0	±0.8
129.0	129.0	0.0	±0.8
124.0	124.0	0.0	±0.8
119.0	119.0	0.0	±0.8
114.0	114.0	0.0	±0.8
109.0	109.0	0.0	±0.8
104.0	104.0	0.0	±0.8
99.0	99.0	0.0	±0.8
94.0	94.0	0.0	±0.8
89.0	89.0	0.0	±0.8
84.0	84.0	0.0	±0.8
79.0	79.0	0.0	±0.8
74.0	74.1	0.1	±0.8
69.0	69.0	0.0	±0.8
64.0	64.0	0.0	±0.8
59.0	59.0	0.0	±0.8
54.0	54.0	0.0	±0.8
49.0	49.0	0.0	±0.8
44.0	44.0	0.0	±0.8
39.0	39.0	0.0	±0.8
34.0	34.0	0.0	±0.8
30.0	30.0	0.0	±0.8
29.0	29.0	0.0	±0.8
28.0	28.0	0.0	±0.8
27.0	27.0	0.0	±0.8
26.0	26.0	0.0	±0.8
25.0	24.9	-0.1	±0.8

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7. Peter

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8. Level linearity including the level range control

Range	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Auto	94.0	94.0	0.0	±0.8

9. Tone burst response

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

10. Peak C sound level

Number of cycle in test signal	Anticipated Value (dB)	Measured Value, L _{peak} (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.0	0.0	-
One	136.4	136.3	-0.1	±2.0

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	±1.0
Negative half cycle	135.4	135.2	-0.2	±1.0

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7. Peter

Continuation of Calibration Certificate

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11. Overload indication

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

12. High level stability

Frequency Weighting	SLM Display at initial (dB)	SLM Display at final (dB)	Deviated Value (dB)	Acceptance Limits (dB)
A - weight	137.0	137.0	0.0	±0.1

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.,Bangbunmu, Bangplud Bangkok 10700 THAILAND.
Tel.0-2435-8800 Fax.0-2433-1679 e-mail:cal-center@sithiporn.com http://www.sithiporn.comCert. No. : ACL23089
Pages : 1 of 8

Calibration Certificate

Equipment : SOUND LEVEL METER
Manufacturer : RION
Model : NL-52A / Microphone UC-59 / Preamplifier NH-25
Serial No. : 01120938 / 21888 / 22327
ID No. : -

Condition As Found : GOOD

Customer : ALS LABORATORY GROUP (THAILAND) CO., LTD.
104 PHATTHANAKAN 40, PHATTHANAKAN ROAD,
KHWAENG PHATTHANAKAN, KHET SUAN LUANG,
BANGKOK, 10250 THAILAND.Location : -
Ambient Temperature : (23.0 ± 3) °C
Pressure : (101.3 ± 3) kPa
Relative Humidity : (50.0 ± 20) %Received Date : 24 JANUARY 2023
Calibration Date : 26-30 JANUARY 2023
Date of Issue : 31 JANUARY 2023

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. : ACL23089
Job No. : VC66AC0030
Pages : 2 of 8

Calibration Procedure : CP-AC-01

Calibration Method :

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

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

Condition of this result of calibration :

1. Reference Standard Instruments :

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

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

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

3.1 National Institute of Metrology (Thailand).

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

QF-TS12-04-04-020664

Continuation of Calibration Certificate

Cert. No. : ACL23089
Job No. : VC66AC0030
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	✓	-	0.3	1.0
5. Frequency and time weightings at 1 kHz	✓	-	0.2	0.2
6. Long - term stability	✓	-	0.1	0.1
7. Level linearity on the reference level range	✓	-	0.2	0.3
8. Level linearity including the level range control	✓	-	0.2	0.3
9. Tone burst response	✓	-	0.2	0.3
10. Peak C sound level	✓	-	0.2	0.35
11. Overload indication	✓	-	0.2	0.25
12. High level stability	✓	-	0.1	0.1

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Cert. No. : ACL23089
Job No. : VC66AC0030
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)	94.0	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 (Hz)	Measured value (dB)
A - weight	9.9
C - weight	15.1
Flat	20.7

3. Acoustical signal tests of frequency weightings

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

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)			
	Flat	C-weight	A-weight	Acceptance Limits
125	0.0	0.0	0.0	± 1.0
1000	0.1	0.1	0.1	± 0.7
8000	0.0	0.0	0.0	+ 1.5, - 2.5

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7. Petch

Cert. No. : ACL23089
Job No. : VC66AC0030
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	±1.0
125	0.1	0.1	0.0	±1.0
250	0.0	0.0	0.0	±1.0
500	0.0	0.1	0.0	±1.0
1000	0.0	0.0	0.0	±1.0
2000	0.0	0.1	0.0	±1.0
4000	0.0	0.0	0.0	±1.0
8000	0.0	0.1	0.1	+ 1.5, - 2.5
16000	0.0	-1.2	-1.2	+ 2.5, -16.0

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	± 0.1

QF-TS12-04-04-020664

7. Petch

Cert. No. : ACL23089
Job No. : VC66AC0030
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	±0.8
136.0	136.0	0.0	±0.8
135.0	135.0	0.0	±0.8
134.0	134.0	0.0	±0.8
133.0	133.0	0.0	±0.8
132.0	132.0	0.0	±0.8
131.0	131.0	0.0	±0.8
129.0	129.0	0.0	±0.8
124.0	124.0	0.0	±0.8
119.0	119.0	0.0	±0.8
114.0	114.0	0.0	±0.8
109.0	109.0	0.0	±0.8
104.0	104.0	0.0	±0.8
99.0	99.0	0.0	±0.8
94.0	94.0	0.0	±0.8
89.0	89.0	0.0	±0.8
84.0	84.0	0.0	±0.8
79.0	79.0	0.0	±0.8
74.0	74.0	0.0	±0.8
69.0	69.0	0.0	±0.8
64.0	64.0	0.0	±0.8
59.0	59.0	0.0	±0.8
54.0	54.0	0.0	±0.8
49.0	49.0	0.0	±0.8
44.0	44.0	0.0	±0.8
39.0	39.0	0.0	±0.8
34.0	34.0	0.0	±0.8
30.0	29.9	-0.1	±0.8
29.0	28.9	-0.1	±0.8
28.0	27.9	-0.1	±0.8
27.0	26.9	-0.1	±0.8
26.0	25.9	-0.1	±0.8
25.0	24.9	-0.1	±0.8

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7. Petch

Cert. No. : ACL23089
Job No. : VC66AC0030
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	±0.8

9. Tone burst response

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

10. Peak C sound level

Number of cycle in test signal	Anticipated Value (dB)	Measured Value, L _{peak} (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.0	0.0	-
One	136.4	135.4	-1.0	±2.0

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	±1.0
Negative half cycle	135.4	135.1	-0.3	±1.0

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7. Petch

Continuation of Calibration Certificate

Cert. No. : ACL23089
Job No. : VC66AC0030
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	89.5	-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	±0.1

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. : ACL23090
Pages : 1 of 8

Calibration Certificate

Equipment : SOUND LEVEL METER
Manufacturer : RION
Model : NL-52A / Microphone UC-59 / Preamplifier NH-25
Serial No. : 01120939 / 21940 / 22328
ID No. :

Condition As Found : GOOD

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

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

Received Date : 24 JANUARY 2023
Calibration Date : 26-30 JANUARY 2023
Date of Issue : 31 JANUARY 2023



Calibrated by : Nathakorn Pisutpaisan

Approved by :

T. Petchur
(Thanakul Petchurai)

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

QF-TS12-04-04-020664

Continuation of Calibration Certificate

Cert. No. : ACL23090
Job No. : VC66AC0030
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. : ACL23090
Job No. : VC66AC0030
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	✓	-	0.3	1.0
5. Frequency and time weightings at 1 kHz	✓	-	0.2	0.2
6. Long - term stability	✓	-	0.1	0.1
7. Level linearity on the reference level range	✓	-	0.2	0.3
8. Level linearity including the level range control	✓	-	0.2	0.3
9. Tone burst response	✓	-	0.2	0.3
10. Peak C sound level	✓	-	0.2	0.35
11. Overload indication	✓	-	0.2	0.25
12. High level stability	✓	-	0.1	0.1

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T. Petchur

Continuation of Calibration Certificate

Cert. No. : ACL23090
Job No. : VC66AC0030
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)	94.0	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	14.9
Flat	20.7

3. Acoustical signal tests of frequency weightings

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

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)			
	Flat	C-weight	A-weight	Acceptance Limits
125	0.1	0.1	0.1	± 1.0
1000	0.1	0.1	0.1	± 0.7
8000	-0.7	-0.7	-0.7	+ 1.5, - 2.5

QF-TS12-04-04-020664

T. Petch

Continuation of Calibration Certificate

Cert. No. : ACL23090
Job No. : VC66AC0030
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	±1.0
125	0.0	0.0	0.0	±1.0
250	0.0	0.0	0.0	±1.0
500	0.0	0.0	0.0	±1.0
1000	0.0	0.0	0.0	±1.0
2000	0.0	0.0	0.0	±1.0
4000	0.0	0.0	0.0	±1.0
8000	0.0	0.1	0.1	+ 1.5, - 2.5
16000	0.0	-1.2	-1.2	+ 2.5, -16.0

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	± 0.1

QF-TS12-04-04-020664

T. Petch

Continuation of Calibration Certificate

Cert. No. : ACL23090
Job No. : VC66AC0030
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	±0.8
136.0	136.0	0.0	±0.8
135.0	135.0	0.0	±0.8
134.0	134.0	0.0	±0.8
133.0	133.0	0.0	±0.8
132.0	132.0	0.0	±0.8
131.0	131.0	0.0	±0.8
129.0	129.0	0.0	±0.8
124.0	124.0	0.0	±0.8
119.0	119.0	0.0	±0.8
114.0	114.0	0.0	±0.8
109.0	109.0	0.0	±0.8
104.0	104.0	0.0	±0.8
99.0	99.0	0.0	±0.8
94.0	94.0	0.0	±0.8
89.0	89.0	0.0	±0.8
84.0	84.0	0.0	±0.8
79.0	79.0	0.0	±0.8
74.0	74.0	0.0	±0.8
69.0	69.0	0.0	±0.8
64.0	64.0	0.0	±0.8
59.0	59.0	0.0	±0.8
54.0	54.0	0.0	±0.8
49.0	49.0	0.0	±0.8
44.0	44.0	0.0	±0.8
39.0	39.0	0.0	±0.8
34.0	34.0	0.0	±0.8
30.0	30.0	0.0	±0.8
29.0	29.0	0.0	±0.8
28.0	28.0	0.0	±0.8
27.0	27.0	0.0	±0.8
26.0	26.0	0.0	±0.8
25.0	25.0	0.0	±0.8

QF-TS12-04-04-020664

T. Petch

Continuation of Calibration Certificate

Cert. No. : ACL23090
Job No. : VC66AC0030
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	±0.8

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	136.1	-0.3	±2.0

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	±1.0
Negative half cycle	135.4	135.2	-0.2	±1.0

QF-TS12-04-04-020664

T. Petch

Continuation of Calibration Certificate

Cert. No. : ACL23090
Job No. : VC66AC0030
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 at initial	SLM Display at final	Deviated	Acceptance
Weighting	(dB)	(dB)	Value	Limits
			(dB)	(dB)
A - weight	137.0	137.0	0.0	±0.1

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, Bangumru, Bangplud Bangkok 10700 THAILAND.
Tel:0-2435-8800 Fax:0-2433-1679 e-mail:cal-center@sithiporn.com http://www.sithiporn.comCert. No. : ACL23044
Pages : 1 of 8

Calibration Certificate

Equipment : SOUND LEVEL METER
Manufacturer : RION
Model : NL-42/ Microphone UC-52 / Preamplifier NH-24
Serial No.: 00900073 / 188466 / 01735
ID No.: RYG_FS0494

Condition As Found : GOOD

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

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

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



Calibrated by : Nathakorn Pisutpaisan

Approved by :

T. Petchumai
(Thanakul Petchumai)

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

QF-TS12-04-04-020664

Continuation of Calibration Certificate

Cert. No. : ACL23044
Job No. : VC66AC0024
Pages : 2 of 8

Calibration Procedure : CP-AC-01

Calibration Method :

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

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

Condition of this result of calibration :

1. Reference Standard Instruments :

Instrument	Model	Serial No.	Cert. No.	Due Date
Waveform Generator	33210A	MY48017076	EF-0007-22	04-Feb-23
Waveform Generator	33511B	MY52302742	EF-0008-22	04-Feb-23
Digital Multimeter	33461A	MY53220104	EEL_BP_04/0265	09-Feb-23
Digital Multimeter	33461A	MY53220076	EEL_BP_03/0265	09-Feb-23
Digital Multimeter	34461A	MY60024273	EEL_BP_05/0265	09-Feb-23
Programmable Attenuator	MAT-1070	62100114	EF-0009-22	07-Feb-23
Condenser Microphone	4180	2977900	AA-1013-22	24-Feb-23
Measuring Amplifier	NA-42KAI	34560495	AA-3005-22	22-Feb-23

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

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

3.1 National Institute of Metrology (Thailand).

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

QF-TS12-04-04-020664

Continuation of Calibration Certificate

Cert. No. : ACL23044
Job No. : VC66AC0024
Pages : 3 of 8

Summary of Measurement Result :

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

QF-TS12-04-04-020664

Continuation of Calibration Certificate

Cert. No. : ACL23044
Job No. : VC66AC0024
Pages : 4 of 8

Result of calibration :

1. Absolute sensitivity

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

2. Self-generated noise

2.1 Normal test

Measured Value (dB)
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	23.7

3. Acoustical signal tests of frequency weightings

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

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

QF-TS12-04-04-020664

P.T.H.

Continuation of Calibration Certificate

Cert. No. : ACL23044
Job No. : VC66AC0024
Pages : 5 of 8

4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

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

P.T.H.

Continuation of Calibration Certificate

Cert. No. : ACL23044
Job No. : VC66AC0024
Pages : 6 of 8

7. Level linearity on the reference level range

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

QF-TS12-04-04-020664

P.T.H.

Continuation of Calibration Certificate

Cert. No. : ACL23044
Job No. : VC66AC0024
Pages : 7 of 8

8. Level linearity including the level range control

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

9. Tone burst response

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

10. Peak C sound level

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

Number of cycle in test signal	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	132.9	-0.1	-
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.H.

Continuation of Calibration Certificate

Cert. No. : ACL23044
Job No. : VC66AC0024
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 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@sithiporn.com http://www.sithiporn.comCert. No. : ACL22228
Pages : 1 of 8

Calibration Certificate

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

Condition As Found : GOOD

Customer : ALS LABORATORY GROUP (THAILAND) CO., LTD.
104 PHATTHANAKAN 40, PHATTHANAKAN ROAD,
KHWAENG PHATTHANAKAN, KHET SUAN LUANG,
BANGKOK, 10250 THAILAND.Location : -
Ambient Temperature : (23.0 ± 3) °C
Pressure : (101.3 ± 3) kPa
Relative Humidity : (50.0 ± 20) %Received Date : 28 SEPTEMBER 2022
Calibration Date : 12-17 OCTOBER 2022
Date of Issue : 18 OCTOBER 2022

Calibrated by : Nathakorn Pisutpaisan

Approved by :

T. 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. : ACL22228
Job No. : VC65AC0086
Pages : 2 of 8

Calibration Procedure : CP-AC-01

Calibration Method :

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

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

Condition of this result of calibration :

1. Reference Standard Instruments :

Instrument	Model	Serial No.	Cert. No.	Due Date
Waveform Generator	33210A	MY48017076	EF-0007-22	04-Feb-23
Waveform Generator	33511B	MY52302742	EF-0008-22	04-Feb-23
Digital Multimeter	33461A	MY53220104	EEL_BP_04/0265	09-Feb-23
Digital Multimeter	33461A	MY53220076	EEL_BP_03/0265	09-Feb-23
Digital Multimeter	34461A	MY60024273	EEL_BP_05/0265	09-Feb-23
Programmable Attenuator	MAT-1070	62100114	EF-0009-22	07-Feb-23
Condenser Microphone	4180	2977900	AA-1013-22	24-Feb-23
Measuring Amplifier	NA-42KAI	34560495	AA-3005-22	22-Feb-23

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

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

3.1 National Institute of Metrology (Thailand).

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

QF-TS12-04-04-020664

T. Petchur

Continuation of Calibration Certificate

Cert. No. : ACL22228
Job No. : VC65AC0086
Pages : 3 of 8

Summary of Measurement Result :

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

QF-TS12-04-04-020664

T. Petchur

Continuation of Calibration Certificate

Cert. No. : ACL22228
Job No. : VC65AC0086
Pages : 4 of 8

Result of calibration :

1. Absolute sensitivity

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

2. Self-generated noise

2.1 Normal test

Measured Value (dB)
14.2

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

Frequency Weighting	Measured value (dB)
A - weight	9.9
C - weight	16.5
Flat	22.2

3. Acoustical signal tests of frequency weightings

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

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)			
	Flat	C-weight	A-weight	Acceptance Limits
125	0.2	0.2	0.2	± 1.5
1000	0.0	0.0	0.0	± 1.0
8000	1.0	1.1	1.1	±5.0

QF-TS12-04-04-020664

T. Reth.

Continuation of Calibration Certificate

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

4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

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

5. Frequency and time weightings at 1 kHz

5.1 Frequency weightings at 1 kHz

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

5.2 Time weighting at 1 kHz

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

6. Long - term stability

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

QF-TS12-04-04-020664

T. Reth.

Continuation of Calibration Certificate

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

7. Level linearity on the reference level range

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

QF-TS12-04-04-020664

T. Reth.

Continuation of Calibration Certificate

Cert. No. : ACL22228
Job No. : VC65AC0086
Pages : 7 of 8

8. Level linearity including the level range control

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

9. Tone burst response

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

10. Peak C sound level

Number of cycle in test signal	Anticipated Value (dB)	Measured Value, Lcpeak (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.0	0.0	-
One	136.4	135.8	-0.6	±3.0

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

QF-TS12-04-04-020664

T. Reth.

Continuation of Calibration Certificate

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

11. Overload indication

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

12. High level stability

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

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

End of Calibration Certificate

QF-TS12-04-04-020664

T. Petchur

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. : ACL22230
Pages : 1 of 8

Calibration Certificate

Equipment : SOUND LEVEL METER
Manufacturer : RION
Model : NL-42A / Microphone UC-S2 / Preamplifier NH-24
Serial No. : 00623391 / 198638 / 26419
ID No. : -

Condition As Found : GOOD

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

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

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



Calibrated by : Nathakorn Pisutpaisan

Approved by :

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

Calibration Procedure : CP-AC-01

Calibration Method :

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

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

Condition of this result of calibration :

1. Reference Standard Instruments :

Instrument	Model	Serial No.	Cert. No.	Due Date
Waveform Generator	33210A	MY48017076	EF-0007-22	04-Feb-23
Waveform Generator	33511B	MY52302742	EF-0008-22	04-Feb-23
Digital Multimeter	33461A	MY53220104	EEL_BP_04/0265	09-Feb-23
Digital Multimeter	33461A	MY53220076	EEL_BP_03/0265	09-Feb-23
Digital Multimeter	34461A	MY60024273	EEL_BP_05/0265	09-Feb-23
Programmable Attenuator	MAT-1070	62100114	EF-0009-22	07-Feb-23
Condenser Microphone	4180	2977900	AA-1013-22	24-Feb-23
Measuring Amplifier	NA-42KAI	34560495	AA-3005-22	22-Feb-23

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

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

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

Continuation of Calibration Certificate

Cert. No. : ACL22230
Job No. : VC65AC0086
Pages : 3 of 8

Summary of Measurement Result :

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

QF-TS12-04-04-020664

T. Petchur

QF-TS12-04-04-020664

T. Petchur

Continuation of Calibration Certificate

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

Result of calibration :

1. Absolute sensitivity

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

2. Self-generated noise

2.1 Normal test

Measured Value (dB)
15.7

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

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

3. Acoustical signal tests of frequency weightings

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

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

QF-TS12-04-04-020664

T. R. L.

Continuation of Calibration Certificate

Cert. No. : ACL22230
Job No. : VC65AC0086
Pages : 5 of 8

4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

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

5. Frequency and time weightings at 1 kHz

5.1 Frequency weightings at 1 kHz

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

5.2 Time weighting at 1 kHz

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

6. Long - term stability

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

QF-TS12-04-04-020664

T. R. L.

Continuation of Calibration Certificate

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

7. Level linearity on the reference level range

Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
137.0	137.1	0.1	± 1.1
136.0	136.1	0.1	± 1.1
135.0	135.1	0.1	± 1.1
134.0	134.1	0.1	± 1.1
133.0	133.0	0.0	± 1.1
132.0	132.0	0.0	± 1.1
131.0	131.0	0.0	± 1.1
129.0	129.0	0.0	± 1.1
124.0	124.0	0.0	± 1.1
119.0	119.1	0.1	± 1.1
114.0	114.1	0.1	± 1.1
109.0	109.0	0.0	± 1.1
104.0	104.1	0.1	± 1.1
99.0	99.1	0.1	± 1.1
94.0	94.0	0.0	± 1.1
89.0	89.0	0.0	± 1.1
84.0	84.0	0.0	± 1.1
79.0	79.0	0.0	± 1.1
74.0	74.0	0.0	± 1.1
69.0	69.0	0.0	± 1.1
64.0	64.0	0.0	± 1.1
59.0	59.0	0.0	± 1.1
54.0	54.0	0.0	± 1.1
49.0	49.0	0.0	± 1.1
44.0	44.0	0.0	± 1.1
39.0	39.0	0.0	± 1.1
34.0	34.0	0.0	± 1.1
30.0	30.1	0.1	± 1.1
29.0	29.1	0.1	± 1.1
28.0	28.1	0.1	± 1.1
27.0	27.1	0.1	± 1.1
26.0	26.1	0.1	± 1.1
25.0	25.2	0.2	± 1.1

QF-TS12-04-04-020664

T. R. L.

Continuation of Calibration Certificate

Cert. No. : ACL22230
Job No. : VC65AC0086
Pages : 7 of 8

8. Level linearity including the level range control

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

9. Tone burst response

Time Weighting	Tone burst duration, Tb (ms)	Cycle	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Fast	0.25	1	108.0	107.9	-0.1	1.5 ; -5.0
	2	8	117.0	116.9	-0.1	1.0 ; -2.5
	200	800	134.0	134.0	0.0	±1.0
Slow	2	8	108.0	108.0	0.0	1.5 ; -5.0
	200	800	127.6	127.6	0.0	±1.0
SEL	0.25	1	99.0	98.8	-0.2	1.5 ; -5.0
	2	8	108.0	107.9	-0.1	1.0 ; -2.5
	200	800	128.0	128.0	0.0	±1.0

10. Peak C sound level

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

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

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T. R. L.

8. 25

Continuation of Calibration Certificate

Cert. No. : ACL22238
Job No. : VC65AC0089
Pages : 4 of 8

Result of calibration :

1. Absolute sensitivity

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

2. Self-generated noise

2.1 Normal test

Measured Value (dB)
15.1

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

Frequency Weighting (Hz)	Measured value (dB)
A - weight	12.0
C - weight	18.4
Flat	24.4

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	0.8	0.8	0.8	±5.0

QF-TS12-04-04-020664

Continuation of Calibration Certificate

Cert. No. : ACL22238
Job No. : VC65AC0089
Pages : 5 of 8

4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

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

5. Frequency and time weightings at 1 kHz

5.1 Frequency weightings at 1 kHz

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

5.2 Time weighting at 1 kHz

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

6. Long - term stability

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

QF-TS12-04-04-020664

Continuation of Calibration Certificate

Cert. No. : ACL22238
Job No. : VC65AC0089
Pages : 6 of 8

7. Level linearity on the reference level range

Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
137.0	137.0	0.0	± 1.1
136.0	136.0	0.0	± 1.1
135.0	135.0	0.0	± 1.1
134.0	134.0	0.0	± 1.1
133.0	133.0	0.0	± 1.1
132.0	132.0	0.0	± 1.1
131.0	131.0	0.0	± 1.1
129.0	129.0	0.0	± 1.1
124.0	124.0	0.0	± 1.1
119.0	119.0	0.0	± 1.1
114.0	114.0	0.0	± 1.1
109.0	109.0	0.0	± 1.1
104.0	104.0	0.0	± 1.1
99.0	99.0	0.0	± 1.1
94.0	94.0	0.0	± 1.1
89.0	89.0	0.0	± 1.1
84.0	84.0	0.0	± 1.1
79.0	79.0	0.0	± 1.1
74.0	74.0	0.0	± 1.1
69.0	69.0	0.0	± 1.1
64.0	64.0	0.0	± 1.1
59.0	59.0	0.0	± 1.1
54.0	53.9	-0.1	± 1.1
49.0	49.0	0.0	± 1.1
44.0	44.0	0.0	± 1.1
39.0	38.9	-0.1	± 1.1
34.0	33.9	-0.1	± 1.1
30.0	29.9	-0.1	± 1.1
29.0	28.9	-0.1	± 1.1
28.0	27.9	-0.1	± 1.1
27.0	26.9	-0.1	± 1.1
26.0	25.8	-0.2	± 1.1
25.0	24.8	-0.2	± 1.1

QF-TS12-04-04-020664

Continuation of Calibration Certificate

Cert. No. : ACL22238
Job No. : VC65AC0089
Pages : 7 of 8

8. Level linearity including the level range control

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

9. Tone burst response

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

10. Peak C sound level

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

Continuation of Calibration Certificate

Cert. No. : ACL22238
Job No. : VC65AC0089
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



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

Cert. No. : ACL22239
Pages : 1 of 8

Calibration Certificate

Equipment : SOUND LEVEL METER
Manufacturer : RION
Model : NL-42A/ Microphone UC-52 / Preampifier NH-24
Serial No. : 00623393 / 198640 / 26421
ID No. : - 3 m 17 89 12

Condition As Found : GOOD

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

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

Received Date : 07 OCTOBER 2022
Calibration Date : 20-21 OCTOBER 2022
Date of Issue : 21 OCTOBER 2022



Calibrated by : Nathakorn Pisutpaisan

Approved by : T. Petchurai
(Thanakul Petchurai)

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

QF-TS12-04-04-020664

Continuation of Calibration Certificate

Cert. No. : ACL22239
Job No. : VC65AC0089
Pages : 2 of 8

Calibration Procedure : CP-AC-01

Calibration Method :

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

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

Condition of this result of calibration :

1. Reference Standard Instruments :

Instrument	Model	Serial No.	Cert. No.	Due Date
Waveform Generator	33210A	MY48017076	EF-0007-22	04-Feb-23
Waveform Generator	33511B	MY52302742	EF-0008-22	04-Feb-23
Digital Multimeter	33461A	MY53220104	EEL_BP_04-0265	09-Feb-23
Digital Multimeter	33461A	MY53220076	EEL_BP_03-0265	09-Feb-23
Digital Multimeter	34461A	MY60024273	EEL_BP_05-0265	09-Feb-23
Programmable Attenuator	MAT-1070	62100114	EF-0009-22	07-Feb-23
Condenser Microphone	4180	2977900	AA-1013-22	24-Feb-23
Measuring Amplifier	NA-42KAI	34560495	AA-3005-22	22-Feb-23

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

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

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

QF-TS12-04-04-020664

Continuation of Calibration Certificate

Cert. No. : ACL22239
Job No. : VC65AC0089
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. : ACL22239
Job No. : VC65AC0089
Pages : 4 of 8

Result of calibration :

1. Absolute sensitivity

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

2. Self-generated noise

2.1 Normal test

Measured Value (dB)
14.6

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

Frequency Weighting	Measured value (dB)
A - weight	11.2
C - weight	17.5
Flat	23.3

3. Acoustical signal tests of frequency weightings

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

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

QF-TS12-04-04-020664

- P.L.A.

Continuation of Calibration Certificate

Cert. No. : ACL22239
Job No. : VC65AC0089
Pages : 5 of 8

4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

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

- P.L.A.

Continuation of Calibration Certificate

Cert. No. : ACL22239
Job No. : VC65AC0089
Pages : 6 of 8

7. Level linearity on the reference level range

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

QF-TS12-04-04-020664

- P.L.A.

Continuation of Calibration Certificate

Cert. No. : ACL22239
Job No. : VC65AC0089
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 _{peak} (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.0	0.0	-
One	136.4	135.6	-0.8	±3.0

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

QF-TS12-04-04-020664

- P.L.A.

Continuation of Calibration Certificate

Cert. No. : ACL22239
Job No. : VC65AC0089
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

CERTIFICATE OF CALIBRATION

ISSUED BY Cirrus Research plc
DATE OF ISSUE 23 May 2023 CERTIFICATE NUMBER 192438

Cirrus Research plc
Acoustic House
Bridlington Road
Hunmanby
North Yorkshire
YO14 0PH
United Kingdom

Page 1 of 1
Test engineer:
Nigel Smith
Electronically signed:

doseBadge Reader

Instrument

Manufacturer: Cirrus Research plc
Model Number: RC110A
Serial Number: 73729
Notes:

Calibration Procedure

The tests were carried out in accordance with the requirements of IEC 60942:2003 where applicable.
Date of Calibration: 22 May 2023

Functionality Results

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

Calibration Results

	Level (dB)	Frequency (Hz)	Distortion (% THD + Noise)
Initial	114.17	998.2	0.66
Adjusted	114.00	998.2	0.66
Uncertainty	± 0.11	± 0.14	± 0.10
Tolerances	± 0.60	± 2.00	± 4.00

Environmental Conditions

Pressure: 101.51 kPa
Temperature: 22.2 °C
Humidity: 43.5 %

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%.

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



CERTIFICATE OF CALIBRATION

Certificate No. : CL-136-65
Page 1 of 2

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

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

Received date: 23 Aug 2022
Calibration date: 25 Aug 2022
Issue date: 9 Sep 2022

Reference Used During Calibration
1. Standard Temperature Probe Model: STS-100 A500, Serial No.: 667682-09, Due date: 23 Mar 2023
2. Digital Temperature Indicator Model: DTI-1000-A MK II, Serial No.: 671407-00591 Due date: 22 July 2023

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

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

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

REVIEW BY
APPROVED BY
NEXT CAL. DATE 29/8/23

Calibrated by
☐ Mr. Sorawit Thachalad
☒ Miss Jitraporn Lertsomphol



Approved Signatory:
Mr. Parinya Booncharoen
Calibration Department Manager

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



Certificate No. : CL-136-65
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: 15003276.
Dimension: Diameter 14 mm, Length 170 mm.

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
30	20.043	20.1	0.1	0.099
30	25.038	25.1	0.1	0.099
30	30.032	30.0	0.0	0.099
30	35.026	35.0	0.0	0.099
30	40.017	40.0	0.0	0.099

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

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
70	20.044	20.3	0.2	0.099
70	25.038	25.1	0.1	0.099
70	30.032	30.0	0.0	0.099
70	35.025	34.8	-0.2	0.099
70	40.018	39.7	-0.3	0.099

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

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
110	20.044	20.0	0.0	0.099
110	25.038	25.0	0.0	0.099
110	30.032	30.0	0.0	0.099
110	35.026	35.0	0.0	0.099
110	40.018	40.0	0.0	0.099

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

★ End of Certificate ★



CERTIFICATE OF CALIBRATION

Certificate No.: CL-137-65
Page 1 of 2

Equipment Name: Heat Stress Monitor
Manufacturer: Delta OHM
Model: HD32.2
Serial No: 15020734
ID No: RYG_FS0230

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

Received date: 23 Aug 2022
Calibration date: 25 Aug 2022
Issue date: 9 Sep 2022

Reference Used During Calibration

1. Standard Temperature Probe Model: STS-100 A500,
Serial No.: 667682-09, Due date: 23 Mar 2023
2. Digital Temperature Indicator Model: DTI-1000-A MK
II, Serial No.: 671407-00591 Due date: 22 July 2023

Calibration Condition

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

Calibration Procedure

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

Traceability

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



Calibrated by
☐ Mr. Sorawit Thachalad
☒ Miss Jitraporn Lertsomphol

Approved Signatory:
Mr. Parinya Booncharoen
Calibration Department Manager



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

Certificate No.: CL-137-65
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: 17015112.
Dimension: Diameter 14 mm. Length 170 mm.

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
30	20.044	20.0	0.0	0.099
30	25.038	25.0	-0.1	0.14
30	30.032	29.9	-0.1	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: 15033222.
Dimension: Diameter 14 mm. Length 150 mm.

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
70	20.044	20.2	0.2	0.099
70	25.038	25.0	0.0	0.099
70	30.032	29.8	-0.2	0.099
70	35.025	34.6	-0.4	0.099
70	40.018	39.4	-0.6	0.099

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

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
110	20.044	20.1	0.1	0.099
110	25.038	25.1	0.1	0.099
110	30.032	30.1	0.1	0.099
110	35.025	35.1	0.1	0.099
110	40.019	40.0	0.0	0.099

UUC*: Unit Under Calibration

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

★ End of Certificate ★



CERTIFICATE OF CALIBRATION

Certificate No.: CL-038-66
Page 1 of 2

Equipment Name: Heat Stress Monitor
Manufacturer: Delta OHM
Model: HD32.2
Serial No: 15020736
ID No: RYG_FS0232

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: 07 Feb 2023
Calibration date: 14 Feb 2023
Issue date: 14 Feb 2023

Reference Used During Calibration

1. Standard Temperature Probe Model: STS-100 A500,
Serial No.: 667682-09, Due date: 23 Mar 2023
2. Digital Temperature Indicator Model: DTI-1000-A MK
II, Serial No.: 671407-00591 Due date: 22 July 2023

Calibration Condition

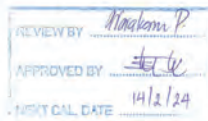
Temperature: (23±3)°C
Relative Humidity: (55±15)%

Calibration Procedure

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

Traceability

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



Calibrated by
☐ Mr. Sorawit Thachalad
☒ Miss Jitraporn Lertsomphol

Approved Signatory:
Mr. Parinya Booncharoen
Calibration Department Manager



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TION HAS BEEN OBTAINED IN WRITING FROM THE LABORATORY.

Certificate No.: CL-038-66
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: 15027737.
Dimension: Diameter 14 mm. Length 170 mm.

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
60	20.047	20.1	0.1	0.099
60	25.058	25.1	0.0	0.099
60	30.049	30.2	0.2	0.099
60	35.046	35.1	0.1	0.099
60	40.046	40.1	0.1	0.099

Table 2: This equipment was connected with temperature probe Model: TP3207.2 S/N: 15015503.
Dimension: Diameter 14 mm. Length 150 mm.

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
70	20.048	20.1	0.1	0.099
70	25.058	25.0	-0.1	0.099
70	30.049	29.9	-0.1	0.099
70	35.046	34.8	-0.2	0.099
70	40.046	39.6	0.4	0.099

Table 3: This equipment was connected with Globe thermometer probe Model: TP3276.2 S/N: 15031164.
Dimension: Diameter 8 mm. Length 170 mm.

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
110	20.048	20.1	0.1	0.099
110	25.058	25.1	0.0	0.099
110	30.049	30.1	0.1	0.099
110	35.046	35.1	0.1	0.099
110	40.046	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 ★





Cert.No.: 23TW168
Page.: 1 of 2

Certificate of Testing

Equipment : DO Meter
Manufacturer : YSI
Model : 5000-115V
Serial No. : 15E102796
ID No. : RYG_EN0032
Received Date : 21 July 2023
Test Date : 24 July 2023
Reference : 2307-0713DSC-1
Submitted by : ALS Laboratory Group (Thailand) Co.,Ltd.
Rayong Branch
616/10 Moo 5, T.Maenam Khu, A.Pluakdaeng,
Rayong 21140, Thailand
Laboratory Condition : Temperature (25 ± 5) °C
Humidity (50 ± 20) %
Test Procedure : In - house method : CP-CH9
by Comparison Technique with Azide Modification Method
Tested by : Walalak Sirithean
Approved by :
Approved Signatory
() Malee Butkruea
(✓) Saitthip Meangmal
() Warakorn Lemgagrakul
Issue Date : 26 July 2023

0320211



Cert.No.: 23TW168
Page.: 2 of 2

Condition of this result of calibration

1. Reference Standard Instruments :

This certification is traceable to the International System of Unit through the reference standards laboratory of Industrial Calibration Center, Technology Promotion Association (Thailand-Japan).

Instruments	Serial No.	ID No.	Certificate No.	Due Date
1) Burette	-	130BU10	23CG1172	22 Mar 2025
2) Balance	1126143764	140RC004	22MM50	20 Sep 2023

2. Standard Material :-

Material	Manufacturer	Lot.No.	Assay
Sodium Thiosulfate pentahydrate	Merck	AM1763316	100.2%

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)
8.18	8.17	0.0055

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.

-000-

1172155



Cert. No.: 23LM125
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 : 25 July 2023
Calibrated Date : 27 July 2023
Ambient Temperature : (26 ± 10) °C
Relative Humidity : (50 ± 30) %
AC Line Voltage : (220 ± 22) V
Calibrated by : Preecha Hlahib
Approved by :
Approved Signatory
() Pornthippa Tamayakul
() Malee Butkruea
(✓) Suwit Injai
Issue Date : 31 July 2023

The Uncertainties are for a confidence probability of approximately 95%

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A 0053616



Equipment : DO Meter with Sensor
Condition As-Received : Used Item
Reference : 2307-0713DSC-2

Cert. No.: 23LM125
Page.: 2 of 2

Procedure Used :-

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

The temperature scale used was based on ITS-90.

Condition of this result of calibration

1. Reference standard instrument:-

Instrument	Serial No.	Cert. No.	Traceable	Due Date
1) Digital Thermometer	2188080	2211285	TPA	21 Oct 2023

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

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

Remark : TPA : Technology Promotion Association (Thailand - Japan)

Result of Calibration :- (*) Without Adjustment

Function : Temperature measurement.

This instrument was connected with temperature sensor, S/N.: 1228475367

Calibration Point (°C)	Immersion Depth (mm)	Standard Temperature (°C)	UUC* Reading (°C)	Error (°C)	Uncertainty (± °C)	Coverage Factor k
20.00	100	20.011	19.91	-0.101	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-

1159515



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES
534/4 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG BANGKOK 10250
TEL. 0-2717-3000-29 FAX. 0-2719-9484



Cert. No.: 23TM962
Page : 1 of 3

Certificate of Calibration

Equipment : Low Temp. Incubator
Manufacturer : Memmert
Model : IPP750
Serial No. : V818.0084
ID No. : RYG_EN0154
Submitted by : ALS Laboratory Group (Thailand) Co., Ltd.
(Rayong Branch)
616/10 Moo 5 T: Maenam Khu,
A. Pluakdaeng, Rayong 21140 Thailand
Location : BOD Room
Received Order : 29 May 2023
Calibration Date : 29 May 2023
Ambient Temperature : $(26 \pm 10) ^\circ\text{C}$
Relative Humidity : $(50 \pm 30) \%$
Calibrated by : Man Pattanapongpaiboon

Approved by :
Approved Signatory

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

Issue Date : 7 June 2023

The Uncertainties are for a confidence probability of approximately 95%

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

A 0054967



Equipment : Low Temp. Incubator
Condition As-Received : Used Item
Reference : 2305-0898OC-2
Procedure Used :-

Cert. No.: 23TM962
Page : 2 of 3

Calibration were conducted using calibration procedure CP-OT02 according to direct measurement method with Data Acquisition which connected with Resistance Temperature Detector (RTD).
The temperature scale used was based on ITS-90.

Condition of this result of calibration

1. Reference standard instrument:-

Instrument	Model	Serial No.	Cert. No.	Due Date
1) Data Acquisition	34972A	MY57013711	22LM93	02 Jul 2023

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

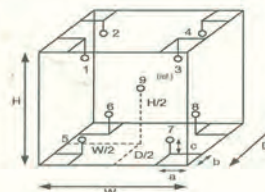
3. This certification is traceable to the International System of Unit.

Result of Calibration :- (*) Without Adjustment

Function of UUC* : Temperature Source

Fresh air setting : Close

Environment during calibration		
	Beginning	Finished
Temp. (°C)	23	23
REL.Humid. (%)	54	56
AC Supply (Volt)	223	222



Probe Installation Details :

a = 10 cm
b = 10 cm
c = 10 cm

Dimension of Chamber :

D = 0.60 m
W = 1.0 m
H = 1.2 m
Capacity = 0.75 m³

Position :	Ref. Std. ID No.:
1	18-18RTD-01
2	18-18RTD-02
3	18-18RTD-03
4	18-18RTD-04
5	18-18RTD-05
6	18-18RTD-06
7	18-18RTD-07
8	22-18RTD-08
9 (ref.)	18-18RTD-09

a 1165130



Equipment : Low Temp. Incubator
Condition As-Received : Used Item
Reference : 2305-0898OC-2
Result of Calibration :- (*) Without Adjustment
Function of UUC* : Temperature Source
Fresh air setting : Close

Cert. No.: 23TM962
Page : 3 of 3

Calibration Point (°C)	UUC* Setting (°C)	UUC* Reading (°C)	Temperature stability (± °C)	Temperature uniformity (°C)	Overall Variation (°C)	Coverage Factor k
20.0	20.0	20.0	0.019	0.72	1.0	2

Calibration Point (°C)	Measured Temperature (°C)									Uncertainty (± °C)
	1	2	3	4	5	6	7	8	9 (ref.)	
20.0	19.547	19.780	19.487	19.529	19.408	20.139	20.112	20.406	20.116	0.30

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 1165129



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES
534/4 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG BANGKOK 10250
TEL. 0-2717-3000-29 FAX. 0-2719-9484



Cert.No.: 23CG3704
Page.: 1 of 2

Certificate of Calibration

Equipment : Burette
Capacity : 50 mL
Serial No. :
ID. No. : RYG_EN0216
Manufacturer : Witeg
Made in : Germany
Submitted by : ALS Laboratory Group (Thailand) Co., Ltd.
Rayong Branch
616/10 Moo 5, T.Maenam Khu
A.Pluaakdaeng, Rayong 21140 Thailand
Ambient Temperature : $(20 \pm 2.5) ^\circ\text{C}$
Relative Humidity : $(50 \pm 10) \%$
Barometric Pressure : 756 mmHg
Calibration Procedure : ASTM E 542 - 01
Calibrated by : Srisuda Khamtha

Approved by :
Approved Signatory

() Ponpan Paipim
(✓) Srisuda Khamtha
() Sa-ngeunkam Wongsa

Issue Date : 28 September 2023

The Uncertainties are for a confidence probability of approximately 95%

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

A 0058881



Equipment : Burette
Received Date : 19 September 2023
Condition As-Received : Used Item
Calibration Date : 25 September 2023
Reference : 2309-0635DSC-31

Cert.No.: 23CG3704
Page.: 2 of 2

Condition of this result of calibration

1. Reference Standard Instruments :

Instruments	Model	Serial No.	ID. No.	Certificate No.	Traceability	Due date
1) Balance	MS204TS	C226356983	140RC010	TH2068-012	METTLER	29 Sep 2023
2) Thermo-Hygrograph	THDX-CE	00016540	140EC001	23H1275	TPA	09 June 2024
3) Thermometer	-	1594592	140EC010	23I158	TPA	12 Feb 2024

This certification is traceable to SI Unit

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

3. True value is converted to true volume at the standard temperature of 20 °C

Calibration result :

Nominal capacity (mL)	Reading (mL)	Uncertainty (± mL)	k Factor
10	10.0224	0.0082	2.00
20	20.0064	0.0085	2.00
30	29.9931	0.0089	2.00
40	39.9910	0.0094	2.00
50	49.9806	0.010	2.00

Remark mL = cm³

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 1182477



Certificate of Calibration

Equipment: SPECTROPHOTOMETER
Model: DR6000
Serial No. (or ID.): 1627845 (RYG_EN0037)
Manufacturer: HACH
Condition: In Condition

Certificate No.: C06230441
Issued Date: 19 September 2023
Job No.: WO-0005382
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 23.9 °C ± 0.2
Humidity 65.3 %RH ± 1.4

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.Nattapat Rungueang
Calibration Date: 18 September 2023

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 Starna Scientific Limited.

The standard for Wavelength Certificate No. 111583 and 111584

The standard for Photometric Certificate No. 9114984 and 111588

The standard for Stray light Certificate No. 111586 and 111585

The standard for Spectral resolution Certificate No. 111587

(Mr. Nattapat Rungueang)
Person in charge

(Mr. Nitinun Srihawan)
Authorized signatory

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

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

DKSH Technology Limited

2533 Sukhumvit Road, Bangkok, Prachinburi, Bangkok 10260

Phone: +66 2639 7000 Email: info.calibration@dksh.com Website: www.dksh.com/scientific-thailand

Delivering Growth - in Asia and Beyond.

CAL-FM-C06-15: 12 Sep 2022



Certificate No.: C06230441

Page 2 of 3

Calibration Results: Without Adjustment

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

Standard Wavelength	Unit Under Calibration	Correction	Uncertainty
418.81	418.3	0.31	0.13
536.66	536.6	0.06	0.13
637.98	638.3	-0.32	0.13
748.48	748.7	-0.22	0.13
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
	0.2930	0.289	0.0040	0.0045
	0.5168	0.519	-0.0022	0.0045
	1.0298	1.029	0.0008	0.0045
440 nm	0.0000	0.000	0.0000	0.0045
	0.2867	0.283	0.0037	0.0045
	0.5073	0.509	-0.0017	0.0045
	1.0083	1.007	0.0013	0.0045
465 nm	0.0000	0.000	0.0000	0.0045
	0.2516	0.250	0.0016	0.0045
	0.4595	0.462	-0.0025	0.0045
	0.9334	0.933	0.0004	0.0045
546.1 nm	0.0000	0.000	0.0000	0.0045
	0.2481	0.245	0.0011	0.0045
	0.4652	0.466	-0.0008	0.0045
	0.9468	0.946	0.0008	0.0045
590 nm	0.0000	0.000	0.0000	0.0045
	0.2594	0.259	0.0004	0.0045
	0.5040	0.505	-0.0010	0.0045
	1.0032	1.002	0.0012	0.0045
635 nm	0.0000	0.000	0.0000	0.0045
	0.2579	0.257	0.0009	0.0045
	0.4971	0.497	0.0001	0.0045
	0.9720	0.971	0.0010	0.0045

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CAL-FM-C06-15: 12 Sep 2022



Certificate No.: C06230441

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
	0.7355	0.737	-0.0015	0.0080
257 nm	0.0000	0.000	0.0000	0.0080
	0.8574	0.857	0.0004	0.0080
313 nm	0.0000	0.000	0.0000	0.0080
	0.2864	0.290	-0.0036	0.0080
350 nm	0.0000	0.000	0.0000	0.0080
	0.6374	0.637	0.0004	0.0080

Stray light *

Standard: cut-off	UUC: Wavelength (nm)	UUC: Transmission (%)	Absorbance (A)
260.62 +/- 0.11 nm	260.6	1.3	1.886
391.44 +/- 0.11 nm	391.4	1.3	1.886

Spectral Resolution *

Nominal Concentration 0.02 % v/v	Peak	Trough	Ratio	SBW
Standard Wavelength (nm)	268.66	266.69	1.38	2.00
UUC: Wavelength (nm)	268.2	266.1		
Std Absorbance (A)	0.4566	0.2780		
Absorbance (A)	0.413	0.300		

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

The End of Certificate

DKSH Technology Limited
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CAL-FM-C06-15: 12 Sep 2022

ใบตรวจสอบสภาพเครื่องวัดสิ่งแวดล้อม

เลขที่ใบงาน: WO-0005382

ชนิดเครื่องมือ: SPECTROPHOTOMETER

รุ่น: DR6000

หมายเลขเครื่อง: 1627845

ตรวจสอบ (รับ)		รายการตรวจสอบ	ตรวจสอบ (ส่ง)		หมายเหตุ
18 Sep 2023			18 Sep 2023		
ปกติ	ไม่ปกติ		ปกติ	ไม่ปกติ	
General					
<input checked="" type="checkbox"/>	<input type="checkbox"/>	1. ความสมบูรณ์เครื่อง	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	2. ความสะอาด (ช่องใส่ตัวอย่าง, ภายใน-นอกเครื่อง)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	3. สวิตช์ ปิด – เปิด เครื่อง (On-Off Switch)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	4. ปุ่มกด (Keypad)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	5. หน้าจอ (Display, Screen Contrast)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
Spectrophotometer					
<input type="checkbox"/>	<input type="checkbox"/>	6. แรงดันไฟฟ้า (Battery Backup) ≥ 2.5 VDC	<input type="checkbox"/>	<input type="checkbox"/>	
<input type="checkbox"/>	<input type="checkbox"/>	7. ตัวควบคุมความยาวคลื่น (Wavelength Control)	<input type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	8. ความยาวคลื่น (Wavelength Check)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	*
<input checked="" type="checkbox"/>	<input type="checkbox"/>	9. แหล่งกำเนิดแสง (UV $< 3,000$ hour)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	9.2 Hours
<input checked="" type="checkbox"/>	<input type="checkbox"/>	10. แหล่งกำเนิดแสง (Visible $< 5,000$ hour)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	741.5 Hours
<input checked="" type="checkbox"/>	<input type="checkbox"/>	11. ช่องวัดหลายตัวอย่าง (Carousel Module)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
pH Meter and Conductivity Meter					
<input type="checkbox"/>	<input type="checkbox"/>	12. อิเล็กโทรด (Electrode and Connection Cable)	<input type="checkbox"/>	<input type="checkbox"/>	
<input type="checkbox"/>	<input type="checkbox"/>	13. ระดับสารละลายใน Electrode (Level KCl)	<input type="checkbox"/>	<input type="checkbox"/>	
<input type="checkbox"/>	<input type="checkbox"/>	14. ฝาปิดกันปลาย Electrode (Dust Protection Hood)	<input type="checkbox"/>	<input type="checkbox"/>	
<input type="checkbox"/>	<input type="checkbox"/>	15. ขาตั้งอิเล็กโทรด (Stand)	<input type="checkbox"/>	<input type="checkbox"/>	
Turbidimeter					
<input type="checkbox"/>	<input type="checkbox"/>	16. ค่าความขุ่นที่ต่ำสุด (No Sample)	<input type="checkbox"/>	<input type="checkbox"/>	
<input type="checkbox"/>	<input type="checkbox"/>	17. ระดับการส่องสว่างของแสง (≥ 2.5 ไม่นับ 3.0)	<input type="checkbox"/>	<input type="checkbox"/>	
Automatic Titrator					
<input type="checkbox"/>	<input type="checkbox"/>	18. สภาพ Piston Burettes	<input type="checkbox"/>	<input type="checkbox"/>	
<input type="checkbox"/>	<input type="checkbox"/>	19. Function Rinsing and Dosing	<input type="checkbox"/>	<input type="checkbox"/>	
<input type="checkbox"/>	<input type="checkbox"/>	20. ระบบท่อสายยางและอุปกรณ์ประกอบ	<input type="checkbox"/>	<input type="checkbox"/>	

เขียนขึ้นด้วย: *656.1nm=656.1nm

*486.0nm=485.5nm

Mr.Nattapat Rungrueang
Service Engineer

DKSH Technology Limited
2533 ถนนสุขุมวิท แขวงคลองเตย เขตคลองเตย กรุงเทพมหานคร 10260
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Phone: +66 2630 7000 Email: info.calibration@dksh.com Website: www.dksh.com/scientific-thailand

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CAL-FM-R31-03: 20 Jul 2022



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TEL. 0-2717-3000-24 FAX. 0-2719-9484



Certificate of Calibration

Certificate No.: 23E3924
Page: 1 of 2

Equipment: pH Meter
Manufacturer: Mettler Toledo
Model: SevenExcellence
Serial No.: B834291445
ID No.: RYG_EN0152

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Condition As-Received: Used Item
Received Date: 08 December 2023
Calibration Date: 14 December 2023

Reference: 2312-0151DSC
Ambient Temperature: $(23 \pm 2) ^\circ\text{C}$
Relative Humidity: $(50 \pm 10) \%$

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

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

Procedure used: Calibration were conducted using calibration procedure No. CP-E17 according to EURAMET cg-15.

Condition of this result of calibration

1.Reference standards instruments:

Instrument	Model	Serial No.	Certificate No.	Due Date
1) Multi-Product Calibrator	5502A	2435802	EE-0041-23	26 Apr 2024

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 through:-

-National Institute of Metrology Thailand (NIMT)

REVIEW BY *Ni.Banruir*
APPROVED BY *D. S.*
NEXT CAL DATE *10/12/24*

Calibrated by: Napechanok Prasomsosiri
Issue Date: 15 December 2023

Approved Signatory:
[] Phalinee Prabpaipal
[x] Nuntawat Khamchai
[] Pongsagorn Boonyaporn

B 0331106



Cert. No.: 23E3924
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)	($\pm \mu\text{V}$)	
-200.0000	-199.9	0.1	68	
-150.0000	-150.0	0.0	65	
-100.0000	-100.0	0.0	63	
-50.0000	-50.0	0.0	61	
0.0000	0.0	0.0	58	
50.0000	50.0	0.0	61	
100.0000	100.0	0.0	63	
150.0000	150.0	0.0	65	
200.0000	199.9	-0.1	68	

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

UUC*= Unit Under Calibration.

-o0o-



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TEL. 0-2717-3000-29 FAX. 0-2719-9484



Certificate of Calibration

Cert.No.: 23CH1574
Page: 1 of 3

Equipment: pH Meter
Manufacturer: Mettler Toledo
Model: SevenExcellence
Serial No.: B834291445
ID No.: RYG_EN0152

Condition As-Received: Used Item
Received Date: 08 December 2023
Calibration Date: 15 December 2023

Reference: 2312-0151DSC-3

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

Ambient Temperature: $(25 \pm 2.5) ^\circ\text{C}$
Relative Humidity: $(50 \pm 15) \%$
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: *R2*
Approved Signatory

() Salthip Meangmai
() Warakorn Lemgagrakul
(x) Ponpan Palpin

Issue Date: 19 December 2023

The Uncertainties are for a confidence probability of approximately 95%

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a 1193422

A 0061696



Cert.No.: 23CH1574
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	23E2802	27 Aug 2024
2) Ref. Standard Thermometer	4982054	110RC044	23I908	26 July 2024

This certification is traceable to the International System of Unit maintained through:-
- Technology Promotion Association (Thailand-Japan)

2. Certified Reference Materials

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

Buffer Solution	Manufacturer	Lot No.	Exp. date
pH 4.008	CPA chem	913598	14 July 2025
pH 6.986	CPA chem	931959	01 Oct 2024
pH 9.997	CPA chem	940106	02 Nov 2024

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

Calibration Results

Function : mV Measurement

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

Unit Under Calibration	Nominal Value		Standard Voltage Input		Actual Reading		Uncertainty of Measurement (\pm mV)	Coverage factor k
	pH	mV	mV	pH	mV	pH		
pH Meter S/N.: B834291445	4.000	177.48	177.3	4.000	0.058	2.00	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		

RL

a 1193852



Cert.No.: 23CH1574
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.: 3225368	4.008	4.013	184.1	0.0045	2.00
	6.986	6.998	8.7	0.0084	2.00
	9.997	10.002	-164.7	0.0088	2.11

Function : Temperature Measurement

(*) Without adjustment

This equipment was connected with Temperature Probe:

- Model : InLab®Expert Pro-ISM
- Serial No. : 3225368

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	25.003	24.3	-0.703	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 %.

-00-

RL

a 1193851

RYG_EN0002

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



NSC-TIS-TIS 17025
CALIBRATION 0426

SARTORIUS

REVIEW BY: *Thiraporn*
APPROVED BY: *D. B.*
NEXT CAL DATE: 01/03/24

Certificate of Calibration

Model Number : MSE224S-100-DU
Description : Analytical Balance
Serial Number : 0026207038
ID No. : RYG_EN0002
Manufacturer : Sartorius

Certificate No. : 23BCI0112
Issued Date : Friday, March 03, 2023
Reference No. : 204833
Page No. : 1 of 2

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

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

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

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

Metrological data :
Capacity : 220 g Readability : 0.0001 g

Ambients Conditions:
Temperature : 23.6 °C \pm 5.0 °C
Humidity : 60.0 % RH \pm 10.0 % RH
Pressure : \pm

Reasons for calibration
☐ New Installation ☐ Service / Repaired ☒ Re-calibration/ Maintenance

Equipment Condition: ☒ Good Operate ☐ Fair

Measurement Method UKAS Publication Ref :Lab 14

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

Traceability:

Model Number	Description	Traceability	Certificate No.	Due Date
YCS011-522-00	Sartorius weight set 1mg - 5000g E2.YCS011-522-00	SPC-RT	C02212565	14-Sep-2023
MHB-382SD	Humidity/Barometer/Temp Lutron MHB-382SD	DKSH	C19220444	5-Sep-2023

This certificate relate and apply this equipment only.

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

Mr.chonchai inthana(Technical Manager)



SOP FM 33 03 February 2022

Sartorius (Thailand) Co., Ltd.
129 Rama 9 Road, Huaykwang, Huaykwang, Bangkok 10310
Tel: +66 2643 8361-6 Fax: +66 2643-8367, e-mail: service.thailand@sartorius.com

SARTORIUS

Certificate of Calibration

Model Number : MSE224S-100-DU
Description : Analytical Balance
Serial Number : 0026207038
ID No. : RYG_EN0002
Manufacturer : Sartorius

Certificate No. : 23BCI0112
Issued Date : Friday, March 03, 2023
Reference No. : 204833
Page No. : 2 of 2

Calibration Results : Without Adjustment

Repeatability			Eccentricity (Off-center loading error)		
The reproducibility is the ability of a weighing instrument to display nearly identical readings under constant test conditions when the same load within a measurement series is placed repeatedly on the weighing pan in the same manner. The standard deviation is used to express reproducibility quantitatively.			The off-center loading error is yielded by the difference between the readings of the load, i.e. 1/3 or 1/4 of maximum capacity, placed in the middle of the weighing pan and between each of four additional measurement points (positions defined according to OIML R76).		
Nominal Value : (Low Load)	20.0000 g	199.9999 g	Nominal value :	100 g	
Tolerance	0.0001 g	0.0000 g	Tolerance	0.0004 g	
Nominal Value : (High Load)	200 g	199.9999 g			
Tolerance	0.0001 g	0.0000 g			
Standard Deviation			Difference		
	0.00003	0.00005			

Linearity

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

Nominal Value (g)	Conventional Mass Value (g)	Displayed Value (g)	Deviation (g)	Uncertainty (g)
0.01	0.0100	0.0100	0.0000	0.00014
0.05	0.0500	0.0500	0.0000	0.00014
0.1	0.1000	0.1000	0.0000	0.00014
0.5	0.5000	0.5000	0.0000	0.00014
1	1.0000	1.0000	0.0000	0.00014
5	5.0000	5.0000	0.0000	0.00014
10	10.0000	10.0001	0.0001	0.00014
20	20.0000	20.0000	0.0000	0.00024
50	50.0000	50.0000	0.0000	0.00015
100	100.0000	99.9999	-0.0001	0.00019
200	200.0000	200.0000	0.0000	0.00032

End of Report

SOP FM 33 03 February 2022



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



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

Certificate of Calibration

Equipment : Hot Air Oven
Manufacturer : Memmert
Model : UM 400
Serial No. : b495.0899
ID No. : RYG_EN0006
Submitted by : ALS Laboratory Group (Thailand) Co.,Ltd. (Rayong Branch)
616/10 Moo 5, T. Maenam Khu,
A. Pluakdaeng,
Rayong 21140, Thailand
Location : Oven Room
Received Order : 20 October 2022
Calibration Date : 20 October 2022
Ambient Temperature : (26 ± 10) °C
Relative Humidity : (50 ± 30) %
Calibrated by : Preecha Hiahib
Approved by :
() Pornthippa Tameyakul
(✓) Malee Butkruea
() Suwit Imjai

Issue Date : 2 November 2022

The Uncertainties are for a confidence probability of approximately 95%

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

A 0046905



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

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.

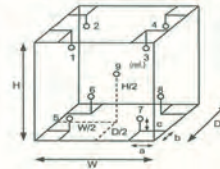
3. This certification is traceable to the International System of Unit.

Result of Calibration :- (°) Without Adjustment

Function of UUC* : Temperature Source

Fresh air setting : Close

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



Probe Installation Details :

a = 5.0 cm
b = 5.0 cm
c = 5.0 cm

Dimension of Chamber :

D = 0.33 m
W = 0.40 m
H = 0.40 m
Capacity = 0.053 m³

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 %.

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a 1132472



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
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Cert. No.: 22TM1491
Page : 1 of 3

Certificate of Calibration

Equipment : Water Bath
Manufacturer : Memmert
Model : WNB22
Serial No. : L513.0648
ID No. : RYG_EN00061
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 :
() Pornthippa Tameyakul
(✓) Malee Butkruea
() Suwit Imjai
Issue Date : 2 November 2022

The Uncertainties are for a confidence probability of approximately 95%

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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

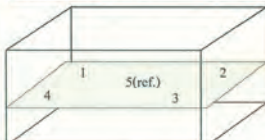
2. This certificate is valid only to the item calibrated on date and place of calibration.

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.)	
Beginning of Calibration	24	53	222
Finished of Calibration	24	50	221



Front

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

Melu

a 1132471



Equipment : Water Bath
Condition As-Received : Used Item
Reference : 2210-0376OC-4
Result of Calibration :- (*) Without Adjustment
Function of UUC* : Temperature Source

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

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

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

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

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

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

UUC* : Unit Under Calibration

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

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

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Melu

a 1132470



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Cert.No.: 23CH829
Page: 1 of 3

Certificate of Calibration

Equipment : pH Meter
Manufacturer : Mettler Toledo
Model : SevenGo S2
Serial No. : C222171773
ID No. : RYG_FS0595
Condition As-Received : Used Item
Received Date : 30 June 2023
Calibration Date : 03 July 2023
Reference : 2306-0984DSC-5
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 Lerngagrakul

Approved by : Melu
Approved Signatory

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

Issue Date : 6 July 2023

The Uncertainties are for a confidence probability of approximately 95%

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

A 0055862



Cert.No.: 23CH829
Page: 2 of 3

Condition of this calibration result

1. Reference Standard Instrument :-

Instrument	Serial No.	ID No.	Cert. No.	Due Date
1) Document Process Calibrator	54030049	130RC116	22E2769	24 Aug 2023
2) Ref. Standard Thermometer	4982054	110RC044	22I1306	27 Oct 2023

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

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

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

Buffer Solution	Manufacturer	Lot No.	Exp. date
pH 4.008	CPA chem	863832	28 Dec 2024
pH 6.986	CPA chem	863833	28 Dec 2023
pH 10.010	CPA chem	863835	28 Dec 2023

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

Calibration Results

Function : mV Measurement

Performing standard curve by Fluke at pH (4.7,10)

Unit Under Calibration	Nominal Value	Standard Voltage Input	Actual Reading		Uncertainty of Measurement (±mV)	Coverage factor k
			mV	pH		
pH Meter	4.00	177.48	178	4.00	0.58	2.00
S/N.: C222171773	7.00	0.00	0	7.00	0.58	2.00
	10.00	-177.48	-178	10.00	0.58	2.00

Melu

a 1169605



Cert.No.: 23CH829
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	4.008	4.01	178	0.0071	2.00
S/N.: 2103795	6.986	6.99	5	0.0099	2.00
	10.010	10.01	-172	0.0092	2.00

Function : Temperature Measurement

(*) Without adjustment

This equipment was connected with Temperature Probe;

- Model : InLab®Expert Go-ISM

- Serial No. : 2103795

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	25.3	0.298	0.13	2.00
30.0	30.002	30.3	0.298	0.13	2.00

Remark : - UUC* = Unit Under Calibration

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

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Malu

a 1169604



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
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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)
618/10 Moo 5 T. Maenam Khu,
A. Phrakdaeng,
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 : Malu
Approved Signatory

() Ponthippa Tameyakul
(x) Malee Butkrues
() Suwit Imjai

Issue Date : 2 November 2022

The Uncertainties are for a confidence probability of approximately 95%

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Approval of the head of Corporate Services-1 : Equipment Calibration and Testing Services.

A 0046908



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

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

Procedure Used :-

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

The temperature scale used was based on ITS-90.

Condition of this result of calibration

1. Reference standard instrument:-

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

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

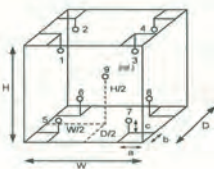
3. This certification is traceable to the International System of Unit.

Result of Calibration :- (*) Without Adjustment

Function of UUC* : Temperature Source

Fresh air setting : Close

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



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

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

Malu

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 (\pm °C)	Temperature uniformity (°C)	Overall Variation (°C)	Uncertainty (\pm °C)	Coverage Factor k
104.0	104.0	104.0	0.076	0.52	0.60	0.42	2
180.0	180.0	180.0	0.13	0.88	1.2	1.1	2

Calibration Point (°C)	Measured Temperature (°C)								
	Position								
104.0	1	2	3	4	5	6	7	8	9 (ref.)
104.0	103.788	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 %.

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Malu

a 1132465

Certificate of Calibration

Certificate No. BSCC-UV-367/23
Equipment UV/Vis Spectrophotometer
Model UV-1800
Manufacturer Shimadzu
Serial No. A11454908533CD
ID No. BKK_EN0018
Date of receipt 15 September 2023
Date of calibration 15 September 2023
Date of issue 22 September 2023

Number of Page(s) 1 of 3

REVIEW BY *Siruk P.*
APPROVED BY *KLAL*
NEXT CAL DATE *15/9/2024*

Customer name ALS Laboratory Group (Thailand) Co., Ltd.
Address 104 Soi Phattanakarn 40, Phattanakarn Road, Phattanakarn, Suan Luang, Bangkok 10250

Temperature (23.4 - 24.7) °C (On site)
Humidity (55.5 - 61.2) %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. 95937 and 95924
Stray Light is traceable to certificate No. 95908
The above certificate are traceable to SI unit through Starra Scientific Ltd.
(UKAS accredited calibration laboratory NO. 0659)

Calibrated by Mr.Wanchana Janloy

Approved by

[Signature]

Mr.Kanchit Choothep
Technical Manager

The above results are valid exclusively for the calibrated item(s) as mention in this report / certificate.
Advertising the 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.

Certificate of Calibration

Certificate No. BSCC-UV-367/23

Number of Page(s) 2 of 3

Calibration Results:

1.Wavelength Accuracy

Certified Wavelength (nm)	UUC (nm)	Error (nm)	Uncertainty (±nm)
241.70	241.67	-0.03	0.18
334.02	334.03	0.01	0.18
418.53	418.59	0.06	0.18
572.99	573.14	0.15	0.18
879.41	879.21	-0.20	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	0.7460	-0.0007	0.0075
257	0.0000	0.0000	0.0000	0.0075
	0.8662	0.8646	-0.0016	0.0075
313	0.0000	0.0000	0.0000	0.0075
	0.2904	0.2908	0.0004	0.0075
350	0.0000	0.0001	0.0001	0.0075
	0.6429	0.6415	-0.0014	0.0075

*CNR = Customer not request

The above results are valid exclusively for the calibrated item(s) as mention in this report / certificate.
Advertising the report / Certificate and publicity of the results are prohibited and also shall not be reproduced
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FM-UV-708-02 Rev.01 (23/01/63)

Certificate of Calibration

Certificate No. BSCC-UV-367/23

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	0.5793	0.0010	0.0042
	0.7628	0.7624	-0.0004	0.0042
	1.0206	1.0216	0.0010	0.0042
440.0	0.0000	0.0000	0.0000	0.0042
	0.5621	0.5625	0.0004	0.0042
	0.7455	0.7452	-0.0003	0.0042
	0.9985	0.9989	0.0004	0.0042
465.0	0.0000	0.0000	0.0000	0.0042
	0.5227	0.5229	0.0002	0.0042
	0.6880	0.6873	-0.0007	0.0042
	0.9487	0.9486	-0.0001	0.0042
546.1	0.0000	0.0000	0.0000	0.0042
	0.5207	0.5211	0.0004	0.0042
	0.6973	0.6960	-0.0013	0.0042
	0.9959	0.9944	-0.0015	0.0042
590.0	0.0000	0.0000	0.0000	0.0042
	0.5544	0.5538	-0.0006	0.0042
	0.7253	0.7236	-0.0017	0.0042
	1.0942	1.0925	-0.0017	0.0042
635.0	0.0000	0.0000	0.0000	0.0042
	0.5616	0.5612	-0.0004	0.0042
	0.6927	0.6909	-0.0018	0.0042
	1.0881	1.0866	-0.0015	0.0042

*CNR = Customer not request

4.Stray Light*

Standard cut-off wavelength (nm)	Wavelength (nm)	Transmission (%T)	Absorbance (A)
200.96±0.11nm	200.55	0.9770	2.0104

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

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FM-UV-708-02 Rev.01 (23/01/63)

ภาคผนวก จ

สำเนาหนังสืออนุญาตขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์เอกชน

๓๖) นายสมบุญมี บุตรจันทร์
๓๗) นายวิรัตน์ โขนาบ
๓๘) นายบุญเอก เก่งขุน
๓๙) นายจันทน์ ราชอ้อ
๔๐) นายสมโภช วิสา
๔๑) นายสิน นามณี
๔๒) นายอัฐิพันธุ์ ปาปะประเสริฐ
๔๓) นายฉัตรเทพ จ้อสาร
๔๔) นายประเสริฐ สุระชัย
๔๕) นายสุภร จันทน์เมือง
๔๖) นายพิพัฒน์ ทองคุณปริดา
๔๗) นายอนุพล ทองนุ
๔๘) นายอนุวัฒน์ ม่วงเพชร
๔๙) นายเจตกรวณีย์ ปิตะธนะ
๕๐) นายฤกษ์เดช สายวรรณ
๕๑) นายสิทธิ์ บุญศรี
๕๒) นายภาณุพงศ์ ไชยรัตน์
๕๓) นายสุภากร ไชยรัตน์
๕๔) นายสุวิทย์ โกวิทบาน
๕๕) นายสุวิทย์ ศรีประเสริฐ
๕๖) นายชวัลชัย นาคพรม
๕๗) นายสมทรง ศรีพิพัฒน์
๕๘) ว่าที่ร้อยตรี ภาณุพงศ์ แสนศิริ
๕๙) นายสิทธิ์โชค พาสิดา
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๖๑) นายสุวรรณ์ธิดา ทาสิริชัย
๖๒) นายสุรทินพิพัฒน์ นิลกุล
๖๓) นายสารพจน์ สิงห์สมบูรณ์
๖๔) นายสาธิตวัฒน์ พรหมจันทร์
๖๕) นายกิตติ ทวีราช
๖๖) นายจักรีน หุ่นวิชา
๖๗) นายอัครวิทย์ หุ่นวิชา
๖๘) นายสวนวัน พิทยะทอง
๖๙) นายสุทธผล สมนอก
๗๐) นายโกศลรัตน์ สุขศรี
๗๑) นายธนพร นามะบุญญา
๗๒) นายพิเชษฐ์ บัวแดง

[illegible]

(นายสิระ จันทร์เจ็ด)

นักวิทยาศาสตร์รับรางวัลการพิเศษ จากพระราชกฤษฎีกา
ผู้ชำนาญการกองวิจัยและพัฒนาผลิตภัณฑ์โรคมาน
เบิกใช้ราชการตามคุณสมบัติพิเศษจากกองวิจัยและพัฒนาผลิตภัณฑ์โรคมาน

๓๐๘) นายบทชัย...

- ๑๓๐) นาสถาปนิก ฐานันท์
- ๑๓๑) นาสถาปนิก สมุหบดี
- ๑๓๒) นาสถาปนิกหัวหน้า สาน
- ๑๓๓) นาสถาปนิก พนมพร
- ๑๓๔) นาสถาปนิก โสภะ
- ๑๓๕) นาสถาปนิก กำฟ้า
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- ๑๔๒) นาสถาปนิก สาน
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- ๑๕๐) นาสถาปนิก สาน

[illegible]

(นายสิระ จันทร์เจ็ด)

นักวิทยาศาสตร์ชำนาญการพิเศษ นักบริหารการเฉพาะ
ผู้อำนวยการกองวิจัยและพัฒนาเภสัชกรรม
ผู้อำนวยการกองวิจัยและพัฒนาเภสัชกรรม

๑๕๖) นางสาวบุตทาภรณ์...

- ๓๓๖) นางสาวสุพรรณรัตน์ สุนทรสมาน
- ๓๓๗) นางสาววราจุฑารัตน์ นนท์ประสพ
- ๓๓๘) นางสาวจันทิมากร บึงเมืองลาด
- ๓๓๙) นางสาวกัญญารัตน์ ศรีนิสา
- ๓๔๐) นางสาวณัฐพร คำจันทร์
- ๓๔๑) นายบุญฤทธิ์ เสี่ยงเทศ
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- ๓๔๓) นางสาวศุภรดา บัณฑิต
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- ๓๔๖) นางสาวณภกรณณ์ อุระ
- ๓๔๗) นางสาวอารยา มีชัย
- ๓๔๘) นางสาวจิตกมล ประมัยสุข
- ๓๔๙) นางสาวกัญญา วิริยศิริธรรม
- ๓๕๐) นางสาววิรุษา นาคผดุง
- ๓๕๑) นางสาวพนิดา ยอดอินทร์
- ๓๕๒) นางสาวนันทิยา นาคประทุม

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(นายสิระ จันทร์เจิด)
 นักวิทยาศาสตร์ชำนาญการพิเศษ วิชาการการเกษตร
 ผู้อำนวยการศูนย์วิจัยและฝึกอบรมสัตว์ไร้รบกวน
 ปฏิบัติราชการตามอัตรากำลังว่างงานอุตสาหกรรม

เอกสารแนบท้ายหนังสือรับคำอายุขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์เอกชน

บริษัท เอแอลเอส แลบบอราทอรี กรู๊ป (ประเทศไทย) จำกัด

เลขทะเบียน 7-๒๐๕

ที่ ยก ๐๓๑๐(๓)/* ๑๐๖๕ ลงวันที่ ๑

ขอข่ายสารมลพิษที่ได้รับขึ้นทะเบียนจากกรมโรงงานอุตสาหกรรม จำนวน ๓๖๓ รายการ

น้ำเสีย จำนวน 59 รายการ

ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
1	Aldicarb	High-Performance Liquid Chromatographic Method ⁽⁴⁾
2	Aldicarb Sulfone	High-Performance Liquid Chromatographic Method ⁽⁴⁾
3	Aldicarb Sulfoxide	High-Performance Liquid Chromatographic Method ⁽⁴⁾
4	Aldrin	Liquid-Liquid Extraction, Gas Chromatographic Method ⁽⁴⁾
5	Arsenic	1) Digestion, Inductively Coupled Plasma Method ⁽⁴⁾ 2) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method ⁽⁴⁾
6	Barium	1) Digestion, Inductively Coupled Plasma Method ⁽⁴⁾ 2) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method ⁽⁴⁾
7	α -BHC	Liquid-Liquid Extraction, Gas Chromatographic Method ⁽⁴⁾
8	β -BHC	Liquid-Liquid Extraction, Gas Chromatographic Method ⁽⁴⁾
9	δ -BHC	Liquid-Liquid Extraction, Gas Chromatographic Method ⁽⁴⁾
10	γ -BHC	Liquid-Liquid Extraction, Gas Chromatographic Method ⁽⁴⁾
11	Biochemical Oxygen Demand	1) 5-Day BOD Test, Azide Modification Method ⁽⁴⁾ 2) 5-Day BOD Test, Membrane Electrode Method ⁽⁴⁾
12	Carbaryl	High-Performance Liquid Chromatographic Method ⁽⁴⁾
13	Carbofuran	High-Performance Liquid Chromatographic Method ⁽⁴⁾
14	Cadmium	1) Digestion, Inductively Coupled Plasma Method ⁽⁴⁾ 2) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method ⁽⁴⁾
15	Chemical Oxygen Demand	1) Closed Reflux, Colorimetric Method ⁽⁴⁾ 2) Closed Reflux, Titrimetric Method ⁽⁴⁾
16	Chlordane	Liquid-Liquid Extraction, Gas Chromatographic Method ⁽⁴⁾
17	Chromium	1) Digestion, Inductively Coupled Plasma Method ⁽⁴⁾ 2) Digestion, Inductively Coupled Plasma/Mass Spectrometric Method ⁽⁴⁾
18	Coliform	ADMI Weighted, Ordinate Spectrophotometric Method

route

(นางวิภาณูจน์ จัตรสกุลวิไล)
ผู้อำนวยการศูนย์บริหารงานวิชาการและพัฒนาระบบอาชีพ
มหาวิทยาลัยราชภัฏวไลยอลงกรณ์

19 Copper...

ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
19	Copper	1) Digestion, Inductively Coupled Plasma Method ⁽⁴⁾ 2) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method ⁽⁴⁾
20	Cyanide	Distillation, Colorimetric Method ⁽⁴⁾
21	2,4'-DDD	Liquid-Liquid Extraction, Gas Chromatographic Method ⁽⁴⁾
22	4,4'-DDD	Liquid-Liquid Extraction, Gas Chromatographic Method ⁽⁴⁾
23	2,4'-DDE	Liquid-Liquid Extraction, Gas Chromatographic Method ⁽⁴⁾
24	4,4'-DDE	Liquid-Liquid Extraction, Gas Chromatographic Method ⁽⁴⁾
25	2,4'-DDT	Liquid-Liquid Extraction, Gas Chromatographic Method ⁽⁴⁾
26	4,4'-DDT	Liquid-Liquid Extraction, Gas Chromatographic Method ⁽⁴⁾
27	Dieldrin	Liquid-Liquid Extraction, Gas Chromatographic Method ⁽⁴⁾
28	Endosulfan Sulfate	Liquid-Liquid Extraction, Gas Chromatographic Method ⁽⁴⁾
29	Endosulfan I	Liquid-Liquid Extraction, Gas Chromatographic Method ⁽⁴⁾
30	Endosulfan II	Liquid-Liquid Extraction, Gas Chromatographic Method ⁽⁴⁾
31	Endrin	Liquid-Liquid Extraction, Gas Chromatographic Method ⁽⁴⁾
32	Endrin Aldehyde	Liquid-Liquid Extraction, Gas Chromatographic Method ⁽⁴⁾
33	Formaldehyde	Distillation, Colorimetric Method ⁽⁴⁾
34	Free Chlorine	1) DPD Ferrous Titrimetric Method ⁽⁴⁾ 2) Iodometric Method ⁽⁴⁾
35	Heptachlor	Liquid-Liquid Extraction, Gas Chromatographic Method ⁽⁴⁾
36	Heptachlor epoxide	Liquid-Liquid Extraction, Gas Chromatographic Method ⁽⁴⁾
37	Hexavalent Chromium	Filtration, Colorimetric Method ⁽⁴⁾
38	3-Hydroxycarbofuran	High-Performance Liquid Chromatographic Method ⁽⁴⁾
39	Lead	1) Digestion, Inductively Coupled Plasma Method ⁽⁴⁾ 2) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method ⁽⁴⁾
40	Manganese	1) Digestion, Inductively Coupled Plasma Method ⁽⁴⁾ 2) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method ⁽⁴⁾
41	Mercury	1) Digestion, Cold-Vapor Atomic Absorption Spectrometric Method ⁽⁴⁾ 2) Digestion, Inductively Coupled Plasma/Mass spectrometric Method ⁽⁴⁾
42	Methiocarb	High-Performance Liquid Chromatographic Method ⁽⁴⁾
43	Methoxychlor	Liquid-Liquid Extraction, Gas Chromatographic Method ⁽⁴⁾

วิมล
(นางรักกัญจน์ อัครสกุลวิไล)
ผู้อำนวยการศูนย์มาตรฐานวิธีการวิเคราะห์มลพิษ
กรมการสิ่งแวดล้อม

44 Methomyl...

ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
44	Methomyl	High-Performance Liquid Chromatographic Method ⁽⁴⁾
45	Nickel	1) Digestion, Inductively Coupled Plasma Method ⁽⁴⁾ 2) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method ⁽⁴⁾
46	Oil & Grease	1) Liquid-Liquid, Partition-Gravimetric Method ⁽⁴⁾ 2) Soxhlet Extraction Method ⁽⁴⁾
47	Oxamyl	High-Performance Liquid Chromatographic Method ⁽⁴⁾
48	Propoxur	High-Performance Liquid Chromatographic Method ⁽⁴⁾
49	pH	Electrometric Method ⁽⁴⁾
50	Phenols	1) Distillation, Chloroform Extraction Method ⁽⁴⁾ 2) Distillation, Direct Photometric Method ⁽⁴⁾
51	Selenium	1) Digestion, Inductively Coupled Plasma Method ⁽⁴⁾ 2) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method ⁽⁴⁾
52	Sulfide	Iodometric Method ⁽⁴⁾
53	Temperature	Laboratory and Field Methods ⁽⁴⁾
54	Total Dissolved Solids	Dried at 180 °C ⁽⁴⁾
55	Total Kjeldahl Nitrogen	Semi-Micro Kjeldahl Method ⁽⁴⁾
56	Total Suspended Solids	Dried at 103-105 °C ⁽⁴⁾
57	Toxaphene	Liquid-Liquid Extraction, Gas Chromatographic Method ⁽⁴⁾
58	Trivalent Chromium	1) Digestion, Inductively Coupled Plasma Method; Colorimetric Method; Calculation ⁽⁴⁾ 2) Digestion, inductively Coupled Plasma/ Mass Spectrometric Method; Colorimetric Method; Calculation ⁽⁴⁾
59	Zinc	1) Digestion, Inductively Coupled Plasma Method ⁽⁴⁾ 2) Digestion, Inductively Coupled Plasma/Mass Spectrometric Method ⁽⁴⁾

น้ำใต้ดิน จำนวน 126 รายการ

ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
1	Acenaphthene	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
2	Acetone	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾

วิมล
(นางรักกัญจน์ อัครสกุลวิไล)
ผู้อำนวยการศูนย์มาตรฐานวิธีการวิเคราะห์มลพิษ
กรมการสิ่งแวดล้อม

3 Aldrin...

ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
3	Aldrin	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
4	Anthracene	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
5	Antimony	1) Digestion, Inductively Coupled Plasma Method ⁽⁴⁾ 2) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method ⁽⁴⁾
6	Arsenic	1) Digestion, Inductively Coupled Plasma Method ⁽⁴⁾ 2) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method ⁽⁴⁾
7	Atrazine	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
8	Barium	1) Digestion, Inductively Coupled Plasma Method ⁽⁴⁾ 2) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method ⁽⁴⁾
9	Benz(a)anthracene	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
10	Benzene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
11	Benzo(b)fluoranthene	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
12	Benzo(k)fluoranthene	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
13	Benzoic Acid	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
14	Benzo(a)pyrene	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
15	Benzo(g,h,i)perylene	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
16	Beryllium	1) Digestion, Inductively Coupled Plasma Method ⁽⁴⁾ 2) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method ⁽⁴⁾
17	Bis(2-chloroethyl)ether	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾

วิมล
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กรมการสิ่งแวดล้อม

18 Bis(2-ethylhexyl)phthalate...

ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
18	Bis(2-ethylhexyl)phthalate	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
19	Bromodichloromethane	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
20	Bromoform	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
21	Butanol	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
22	Butyl Benzyl Phthalate	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
23	Cadmium	1) Digestion, Inductively Coupled Plasma Method ⁽⁴⁾ 2) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method ⁽⁴⁾
24	Carbazole	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
25	Carbon Disulfide	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
26	Carbon tetrachloride	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
27	Chlordane	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
28	p-Chloroaniline	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
29	Chlorobenzene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
30	Chlorodibromomethane	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
31	Chloroform	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
32	2-Chlorophenol	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
33	Chromium	1) Digestion, Inductively Coupled Plasma Method ⁽⁴⁾ 2) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method ⁽⁴⁾

วิมล
(นางรักกัญจน์ อัครสกุลวิไล)
ผู้อำนวยการศูนย์มาตรฐานวิธีการวิเคราะห์มลพิษ
กรมการสิ่งแวดล้อม


34 Chromium (III)...

ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
34	Chromium (III)	1) Digestion, Inductively Coupled Plasma Method; Colorimetric Method; Calculation ⁽⁴⁾ 2) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method; Colorimetric Method; Calculation ⁽⁸⁾
35	Chromium (VI)	Colorimetric Method ⁽⁴⁾
36	Chrysene	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
37	Cyanide	Distillation, Colorimetric Method ⁽⁴⁾
38	2,4-D	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
39	DDD	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
40	DDE	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
41	DDT	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
42	Dibenz(a,h)anthracene	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
43	Di-n-Butyl Phthalate	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
44	1,2-Dichlorobenzene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
45	1,3-Dichlorobenzene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
46	1,4-Dichlorobenzene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
47	3,3-Dichlorobenzidine	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
48	1,1-Dichloroethane	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
49	1,2-Dichloroethane	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
50	1,1-Dichloroethylene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾


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 กรมควบคุมมลพิษ (ก/อ.ส.อ.)


51 cis-1,2-Dichloroethylene...

ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
51	cis-1,2-Dichloroethylene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
52	trans-1,2-Dichloroethylene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
53	2,4-Dichlorophenol	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
54	1,2-Dichloropropane	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
55	1,3-Dichloropropane	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
56	1,3-Dichloropropene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
57	Dieldrin	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
58	Diethyl Phthalate	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
59	2,4-Dimethylphenol	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
60	2,4-Dinitrophenol	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
61	2,4-Dinitrotoluene	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
62	2,6-Dinitrotoluene	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
63	Di-n-Octyl Phthalate	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
64	Endosulfan	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
65	Endrin	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
66	Ethylbenzene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
67	Fluoranthene	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾


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
68 Fluorene...

ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
68	Fluorene	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
69	Heptachlor	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
70	Heptachlor epoxide	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
71	Hexachlorobenzene	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
72	Hexachloro-1,3-butadiene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
73	n-Hexane	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
74	α-HCH	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
75	β-HCH	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
76	γ-HCH	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
77	Hexachlorocyclopentadiene	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
78	Hexachloroethane	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
79	Indeno(1,2,3-cd)pyrene	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
80	Isophorone	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
81	Lead	1) Digestion, Inductively Coupled Plasma Method ⁽⁴⁾ 2) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method ⁽⁴⁾
82	Manganese	1) Digestion, Inductively Coupled Plasma Method ⁽⁴⁾ 2) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method ⁽⁴⁾
83	Mercury	1) Cold Vapor Atomic Absorption Spectrometric Method ⁽⁴⁾ 2) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method ⁽⁴⁾


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84 Methanol...

ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
84	Methanol	1) Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾ 2) Equilibrium Headspace, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
85	Methoxychlor	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
86	Methyl Bromide	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
87	Methylene Chloride	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
88	2-Methylphenol	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
89	2-Methylnaphthalene	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
90	Methyl tert-Butyl Ether	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
91	Naphthalene	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
92	Nickel	1) Digestion, Inductively Coupled Plasma Method ⁽⁴⁾ 2) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method ⁽⁴⁾
93	Nitrobenzene	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
94	N-Nitrosodiphenylamine	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
95	N-Nitrosodi-n-Propylamine	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
96	Polychlorinated Biphenyls - PCB 1016 - PCB 1221 - PCB 1232 - PCB 1242 - PCB 1248 - PCB 1254 - PCB 1260	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾


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97 Pentachlorophenol...

ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
97	Pentachlorophenol	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
98	pH	Electrometric Method ⁽⁴⁾
99	Phenanthrene	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
100	Phenol	1) Distillation, Direct Photometric Method ⁽⁴⁾ 2) Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
101	Pyrene	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
102	Selenium	1) Digestion, Inductively Coupled Plasma Method ⁽⁴⁾ 2) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method ⁽⁴⁾
103	Silver	1) Digestion, Inductively Coupled Plasma Method ⁽⁴⁾ 2) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method ⁽⁴⁾
104	Styrene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
105	1,1,2,2-Tetrachloroethane	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
106	Tetrachloroethylene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
107	Toluene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
108	Toxaphene	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
109	TPH (C ₈ -C ₆)	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ^(1,3,20)
110	TPH (C ₈ -C ₁₂)	Solvent Extraction, Gas Chromatographic Method ^(9,21)
111	TPH (C ₁₃ -C ₃₃)	Solvent Extraction, Gas Chromatographic Method ^(9,21)
112	1,2,4-Trichlorobenzene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
113	1,1,1-Trichloroethane	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾

114 1,1,2-Trichloroethane...

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และประเมินผลกระทบสิ่งแวดล้อม

ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
114	1,1,2-Trichloroethane	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
115	Trichloroethylene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
116	2,4,5-Trichlorophenol	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
117	2,4,6-Trichlorophenol	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
118	1,3,5-Trimethylbenzene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
119	Vanadium	1) Digestion, Inductively Coupled Plasma Method ⁽⁴⁾ 2) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method ⁽⁴⁾
120	Vinyl Acetate	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
121	Vinyl Chloride	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
122	m-Xylene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
123	o-Xylene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
124	p-Xylene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
125	Xylene (Total)	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
126	Zinc	1) Digestion, Inductively Coupled Plasma Method ⁽⁴⁾ 2) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method ⁽⁴⁾

ภาคเคมี (ต่อเนื่องจาก) จำนวน 16 รายการ

ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
1	Antimony	Isokinetic, Digestion, Inductively Coupled Plasma Method ⁽⁴⁾
2	Arsenic	Isokinetic, Digestion, Inductively Coupled Plasma Method ⁽⁴⁾

3 Carbon Monoxide...

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ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
3	Carbon Monoxide	1) Sampling Bag Non-Dispersive Infrared Method ⁽⁴⁾ 2) Non-Dispersive Infrared Method ⁽⁴⁾ 3) Instrumental Analyzer Method ⁽⁴⁾
4	Chlorine	1) Absorption Sampling, Ion Chromatographic Method ⁽⁴⁾ 2) Isokinetic Sampling, Ion Chromatographic Method ⁽⁴⁾
5	Copper	Isokinetic, Digestion, Inductively Coupled Plasma Method ⁽⁴⁾
6	Dioxins	Isokinetic Sampling, Analysis by ISO/IEC 17025 Accredited Laboratory or Analysis by Department of Industrial Works Registered Laboratory (Dioxins/Furans Analysis Approved) ⁽⁴⁾
7	Hydrogen Chloride	1) Absorption Sampling, Ion Chromatographic Method ⁽⁴⁾ 2) Isokinetic Sampling, Ion Chromatographic Method ⁽⁴⁾
8	Hydrogen Sulfide	Absorption Sampling, Iodometric Method ⁽⁴⁾
9	Lead	Isokinetic, Digestion, Inductively Coupled Plasma Method ⁽⁴⁾
10	Mercury	1) Isokinetic Sampling, Digestion, Cold-Vapor Atomic Absorption Spectrometric Method ⁽⁴⁾ 2) Isokinetic, Digestion, Inductively Coupled Plasma Method ⁽⁴⁾
11	Opacity	Ringelmann's Method ⁽²⁾
12	Oxides of Nitrogen	1) Absorption Sampling, Phenoldisulfonic Acid Method ⁽⁴⁾ 2) Chemiluminescence Method ⁽⁴⁾ 3) Instrumental Analyzer Method ⁽⁴⁾
13	Sulfur Dioxide	1) Absorption Sampling, Barium-Thorin Titrimetric Method ⁽⁴⁾ 2) UV Fluorescence Method ⁽⁴⁾ 3) Instrumental Analyzer Method ⁽⁴⁾
14	Sulfuric Acid	Isokinetic Sampling, Barium-Thorin Titrimetric Method ⁽⁴⁾
15	Total Suspended Particulate	Isokinetic Sampling, Gravimetric Method ⁽⁴⁾
16	Xylene	Absorption Sampling, Gas Chromatographic Method ⁽⁴⁾

สิ่งบ่งชี้...

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
สิ่งบ่งชี้หรือวัตถุที่ไม่ใช่แล้ว จำนวน 35 รายการ

ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
1	Aldrin	1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ^(1,3,20) 2) Soxhlet Extraction, Gas Chromatographic Method ^(10,22) 3) Automated Soxhlet Extraction, Gas Chromatographic Method ^(22,31)
2	Antimony	1) Waste Extraction, Digestion, Inductively Coupled Plasma Method ^(1,6,13) 2) Waste Extraction, Digestion, Inductively Coupled Plasma/Mass Spectrometric Method ^(1,6,16) 3) Digestion, Inductively Coupled Plasma Method ^(7,15) 4) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method ^(7,16)
3	Arsenic	1) Waste Extraction, Digestion, Inductively Coupled Plasma Method ^(1,6,13) 2) Waste Extraction, Digestion, Inductively Coupled Plasma/Mass Spectrometric Method ^(1,6,16) 3) Digestion, Inductively Coupled Plasma Method ^(7,15) 4) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method ^(7,16)
4	Barium	1) Waste Extraction, Digestion, Inductively Coupled Plasma Method ^(1,6,13) 2) Waste Extraction, Digestion, Inductively Coupled Plasma/Mass Spectrometric Method ^(1,6,16) 3) Digestion, Inductively Coupled Plasma Method ^(7,15) 4) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method ^(7,16)
5	Beryllium	1) Waste Extraction, Digestion, Inductively Coupled Plasma Method ^(1,6,13) 2) Waste Extraction, Digestion, Inductively Coupled Plasma/Mass Spectrometric Method ^(1,6,16) 3) Digestion, Inductively Coupled Plasma Method ^(7,15) 4) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method ^(7,16)

6 Cadmium...


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และประเมินผลกระทบสิ่งแวดล้อม

ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
6	Cadmium	1) Waste Extraction, Digestion, Inductively Coupled Plasma Method ^(1,6,15) 2) Waste Extraction, Digestion, Inductively Coupled Plasma/Mass Spectrometric Method ^(1,6,16) 3) Digestion, Inductively Coupled Plasma Method ^(7,15) 4) Digestion, Inductively Coupled Plasma/Mass Spectrometric Method ^(7,16)
7	Chlordane	1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ^(1,9,20) 2) Soxhlet Extraction, Gas Chromatographic Method ^(10,22) 3) Automated Soxhlet Extraction, Gas Chromatographic Method ^(22,31)
8	Chromium	1) Waste Extraction, Digestion, Inductively Coupled Plasma Method ^(1,6,15) 2) Waste Extraction, Digestion, Inductively Coupled Plasma/Mass Spectrometric Method ^(1,6,16) 3) Digestion, Inductively Coupled Plasma Method ^(7,15) 4) Digestion, Inductively Coupled Plasma/Mass Spectrometric Method ^(7,16)
9	Chromium (III)	1) Waste Extraction, Digestion, Inductively Coupled Plasma Method; Waste Extraction, Colorimetric Method; Calculation Method ^(1,6,13,17) 2) Waste Extraction, Digestion, Inductively Coupled Plasma/Mass Spectrometric Method; Waste Extraction, Colorimetric Method; Calculation Method ^(1,6,16,17) 3) Digestion, Inductively Coupled Plasma Method; Alkaline Digestion, Colorimetric Method; Calculation Method ^(7,8,13,17) 4) Digestion, Inductively Coupled Plasma/Mass Spectrometric Method; Alkaline Digestion, Colorimetric Method; Calculation Method ^(7,8,16,17)
10	Chromium (VI)	1) Waste Extraction, Colorimetric Method ^(1,6,17) 2) Alkaline Digestion, Colorimetric Method ^(8,17)


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
11 Cobalt...

ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
11	Cobalt	1) Waste Extraction, Digestion, Inductively Coupled Plasma Method ^(1,6,15) 2) Waste Extraction, Digestion, Inductively Coupled Plasma/Mass Spectrometric Method ^(1,6,16) 3) Digestion, Inductively Coupled Plasma Method ^(7,15) 4) Digestion, Inductively Coupled Plasma/Mass Spectrometric Method ^(7,16)
12	Copper	1) Waste Extraction, Digestion, Inductively Coupled Plasma Method ^(1,6,15) 2) Waste Extraction, Digestion, Inductively Coupled Plasma/Mass Spectrometric Method ^(1,6,16) 3) Digestion, Inductively Coupled Plasma Method ^(7,15) 4) Digestion, Inductively Coupled Plasma/Mass Spectrometric Method ^(7,16)
13	2,4-D	1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ^(1,9,20) 2) Soxhlet Extraction, Gas Chromatographic Method ^(10,22) 3) Automated Soxhlet Extraction, Gas Chromatographic Method ^(22,31)
14	DDD	1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ^(1,9,20) 2) Soxhlet Extraction, Gas Chromatographic Method ^(10,22) 3) Automated Soxhlet Extraction, Gas Chromatographic Method ^(22,31)
15	DDE	1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ^(1,9,20) 2) Soxhlet Extraction, Gas Chromatographic Method ^(10,22) 3) Automated Soxhlet Extraction, Gas Chromatographic Method ^(22,31)
16	DDT	1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ^(1,9,20)


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
2) Soxhlet...

ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
17	Dieldrin	2) Soxhlet Extraction, Gas Chromatographic Method ^(10,22) 3) Automated Soxhlet Extraction, Gas Chromatographic Method ^(22,31) 1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ^(1,9,20) 2) Soxhlet Extraction, Gas Chromatographic Method ^(10,22) 3) Automated Soxhlet Extraction, Gas Chromatographic Method ^(22,31)
18	Endrin	1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ^(1,9,20) 2) Soxhlet Extraction, Gas Chromatographic Method ^(10,22) 3) Automated Soxhlet Extraction, Gas Chromatographic Method ^(22,31)
19	Heptachlor	1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ^(1,9,20) 2) Soxhlet Extraction, Gas Chromatographic Method ^(10,22) 3) Automated Soxhlet Extraction, Gas Chromatographic Method ^(22,31)
20	Lead	1) Waste Extraction, Digestion, Inductively Coupled Plasma Method ^(1,6,15) 2) Waste Extraction, Digestion, Inductively Coupled Plasma/Mass Spectrometric Method ^(1,6,16) 3) Digestion, Inductively Coupled Plasma Method ^(7,15) 4) Digestion, Inductively Coupled Plasma/Mass Spectrometric Method ^(7,16)
21	Lindane	1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ^(1,9,20) 2) Soxhlet Extraction, Gas Chromatographic Method ^(10,22) 3) Automated Soxhlet Extraction, Gas Chromatographic Method ^(22,31)
22	Mercury	1) Waste Extraction, Digestion, Cold-Vapor Atomic Absorption Spectrometric Method ^(1,6,18)


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 กรมควบคุมมลพิษ

2) Waste Extraction...

ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
		2) Waste Extraction, Thermal Decomposition Amalgamation and Atomic Absorption Spectrometric Method ^(1,6,19) 3) Waste Extraction, Digestion, Cold-Vapor Atomic Fluorescence Spectrometric Method ^(1,6,20) 4) Digestion, Cold-Vapor Atomic Absorption Spectrometric Method ^(1,8) 5) Thermal Decomposition Amalgamation and Atomic Absorption Spectrometric Method ⁽⁹⁾ 6) Digestion, Cold-Vapor Atomic Fluorescence Spectrometric Method ⁽²⁰⁾
23	Methoxychlor	1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ^(1,9,20) 2) Soxhlet Extraction, Gas Chromatographic Method ^(10,22) 3) Automated Soxhlet Extraction, Gas Chromatographic Method ^(22,31)
24	Mirex	1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ^(1,9,20) 2) Soxhlet Extraction, Gas Chromatographic Method ^(10,22) 3) Automated Soxhlet Extraction, Gas Chromatographic Method ^(22,31)
25	Molybdenum	1) Waste Extraction, Digestion, Inductively Coupled Plasma Method ^(1,6,15) 2) Waste Extraction, Digestion, Inductively Coupled Plasma/Mass Spectrometric Method ^(1,6,16) 3) Digestion, Inductively Coupled Plasma Method ^(7,15) 4) Digestion, Inductively Coupled Plasma/Mass Spectrometric Method ^(7,16)
26	Nickel	1) Waste Extraction, Digestion, Inductively Coupled Plasma Method ^(1,6,15) 2) Waste Extraction, Digestion, Inductively Coupled Plasma/Mass Spectrometric Method ^(1,6,16) 3) Digestion, Inductively Coupled Plasma Method ^(7,15) 4) Digestion, Inductively Coupled Plasma/Mass Spectrometric Method ^(7,16)


 (นางกัญจน์ ชีรสุกุลกิจ)
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 กรมควบคุมมลพิษ

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 - Nonachlorobiphenyl	1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic Method ^(1,6,23) 2) Soxhlet Extraction, Gas Chromatographic Method ^(10,23) 3) Automated Soxhlet Extraction, Gas Chromatographic Method ^(22,31)

28 PentachlorophenoL...

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ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
28	Pentachlorophenol	1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ^(1,9,23) 2) Soxhlet Extraction, Gas Chromatographic Method ^(10,22) 3) Automated Soxhlet Extraction, Gas Chromatographic Method ^(22,31)
29	pH	Electrometric Method ^(29,30)
30	Selenium	1) Waste Extraction, Digestion, Inductively Coupled Plasma Method ^(1,4,13) 2) Waste Extraction, Digestion, Inductively Coupled Plasma/Mass Spectrometric Method ^(1,6,16) 3) Digestion, Inductively Coupled Plasma Method ^(7,13) 4) Digestion, Inductively Coupled Plasma/Mass Spectrometric Method ^(7,16)
31	Silver	1) Waste Extraction, Digestion, Inductively Coupled Plasma Method ^(1,4,13) 2) Waste Extraction, Digestion, Inductively Coupled Plasma/Mass Spectrometric Method ^(1,4,16)
32	Thallium	1) Waste Extraction, Digestion, Inductively Coupled Plasma Method ^(1,4,13) 2) Waste Extraction, Digestion, Inductively Coupled Plasma/Mass Spectrometric Method ^(1,4,16) 3) Digestion, Inductively Coupled Plasma Method ^(7,13) 4) Digestion, Inductively Coupled Plasma/Mass Spectrometric Method ^(7,16)
33	Toxaphene	1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ^(1,9,23) 2) Soxhlet Extraction, Gas Chromatographic Method ^(10,22) 3) Automated Soxhlet Extraction, Gas Chromatographic Method ^(22,31)
34	Vanadium	1) Waste Extraction, Digestion, Inductively Coupled Plasma Method ^(1,4,13) 2) Waste Extraction, Digestion, Inductively Coupled Plasma/Mass Spectrometric Method ^(1,6,16) 3) Digestion, Inductively Coupled Plasma Method ^(7,13)

4) Digestion...

(นางวิภาญจน์ อัครสกุลวิไล)
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ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
35	Zinc	4) Digestion, Inductively Coupled Plasma/Mass Spectrometric Method ^(7,16) 1) Waste Extraction, Digestion, Inductively Coupled Plasma Method ^(1,6,13) 2) Waste Extraction, Digestion, Inductively Coupled Plasma/Mass Spectrometric Method ^(1,6,16) 3) Digestion, Inductively Coupled Plasma Method ^(7,13) 4) Digestion, Inductively Coupled Plasma/Mass Spectrometric Method ^(7,16)

ดิน จำนวน 125 รายการ

ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
1	Acenaphthene	Automated Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method ^(25,31)
2	Acetone	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^(13,20)
3	Aldrin	1) Soxhlet Extraction, Gas Chromatographic Method ^(10,22) 2) Automated Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method ^(25,31)
4	Anthracene	Automated Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method ^(25,31)
5	Antimony	1) Digestion, Inductively Coupled Plasma Method ^(7,13) 2) Digestion, Inductively Coupled Plasma/Mass Spectrometric Method ^(7,16)
6	Arsenic	1) Digestion, Inductively Coupled Plasma Method ^(7,13) 2) Digestion, Inductively Coupled Plasma/Mass Spectrometric Method ^(7,16)
7	Atrazine	1) Soxhlet Extraction, Gas Chromatographic Method ^(10,22) 2) Automated Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method ^(25,31)
8	Barium	1) Digestion, Inductively Coupled Plasma Method ^(7,13) 2) Digestion, Inductively Coupled Plasma/Mass Spectrometric Method ^(7,16)

9 Benz(a)anthracene...

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ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
9	Benz(a)anthracene	Automated Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method ^(25,31)
10	Benzene	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^(14,20)
11	Benzo(b)fluoranthene	Automated Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method ^(25,31)
12	Benzo(k)fluoranthene	Automated Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method ^(25,31)
13	Benzolc acid	Automated Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method ^(25,31)
14	Benzo(a)pyrene	Automated Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method ^(25,31)
15	Benzo(g,h,i)perylene	Automated Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method ^(25,31)
16	Beryllium	1) Digestion, Inductively Coupled Plasma Method ^(7,13) 2) Digestion, Inductively Coupled Plasma/Mass Spectrometric Method ^(7,16)
17	Bis(2-chloroethyl)ether	Automated Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method ^(25,31)
18	Bis(2-ethylhexyl)phthalate	Automated Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method ^(25,31)
19	Bromodichloromethane	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^(14,20)
20	Bromoform	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^(14,20)
21	Butanol	Equilibrium Headspace, Gas Chromatographic/Mass Spectrometric Method ^(12,20)
22	Butyl Benzyl Phthalate	Automated Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method ^(25,31)
23	Cadmium	1) Digestion, Inductively Coupled Plasma Method ^(7,13) 2) Digestion, Inductively Coupled Plasma/Mass Spectrometric Method ^(7,16)
24	Carbazole	Automated Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method ^(25,31)
25	Carbon Disulfide	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^(14,20)

26 Carbon tetrachloride...

(นางวิภาญจน์ อัครสกุลวิไล)
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ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
26	Carbon tetrachloride	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ^(14,24)
27	Chlordane	1) Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method ^(10,22) 2) Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method ^(25,31)
28	p-Chloroaniline	Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method ^(25,31)
29	Chlorobenzene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ^(14,24)
30	Chlorodibromomethane	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ^(14,24)
31	Chloroform	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ^(14,24)
32	2-Chlorophenol	Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method ^(25,31)
33	Chromium	1) Digestion, Inductively Coupled Plasma Method ^(7,15) 2) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method ^(7,16)
34	Chromium (III)	1) Digestion, Inductively Coupled Plasma Method; Alkaline Digestion, Colorimetric Method; Calculation Method ^(7,15,17) 2) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method; Alkaline Digestion, Colorimetric Method; Calculation Method ^(7,16,17)
35	Chromium (VI)	Alkaline Digestion, Colorimetric Method ^(8,17)
36	Chrysene	Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method ^(25,31)
37	Cyanide	Extraction, Distillation, Colorimetric Method ^(25,28)
38	2,4-D	1) Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method ^(10,22) 2) Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method ^(25,31)
39	DDO	1) Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method ^(10,22) 2) Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method ^(25,31)

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40 DDE...

ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
40	DDE	1) Soxhlet Extraction, Gas Chromatographic/ Method ^(10,22) 2) Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method ^(25,31)
41	DDT	1) Soxhlet Extraction, Gas Chromatographic/ Method ^(10,22) 2) Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method ^(25,31)
42	Dibenz(a,h)anthracene	Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method ^(25,31)
43	Di-n-Butyl Phthalate	Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method ^(25,31)
44	1,2-Dichlorobenzene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ^(14,24)
45	1,3-Dichlorobenzene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ^(14,24)
46	1,4-Dichlorobenzene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ^(14,24)
47	3,3-Dichlorobenzidine	Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method ^(25,31)
48	1,1-Dichloroethane	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ^(14,24)
49	1,2-Dichloroethane	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ^(14,24)
50	1,1-Dichloroethylene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ^(14,24)
51	cis-1,2-Dichloroethylene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ^(14,24)
52	trans-1,2-Dichloroethylene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ^(14,24)
53	2,4-Dichlorophenol	Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method ^(25,31)
54	1,2-Dichloropropane	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ^(14,24)
55	1,3-Dichloropropane	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ^(14,24)
56	1,3-Dichloropropene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ^(14,24)

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57 Dieldrin...

ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
57	Dieldrin	1) Soxhlet Extraction, Gas Chromatographic/ Method ^(10,22) 2) Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method ^(25,31)
58	Diethyl Phthalate	Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method ^(25,31)
59	2,4-Dimethylphenol	Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method ^(25,31)
60	2,4-Dinitrophenol	Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method ^(25,31)
61	2,4-Dinitrotoluene	Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method ^(25,31)
62	2,6-Dinitrotoluene	Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method ^(25,31)
63	Di-n-Octyl Phthalate	Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method ^(25,31)
64	Endosulfan	1) Soxhlet Extraction, Gas Chromatographic/ Method ^(10,22) 2) Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method ^(25,31)
65	Endrin	1) Soxhlet Extraction, Gas Chromatographic/ Method ^(10,22) 2) Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method ^(25,31)
66	Ethylbenzene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ^(14,24)
67	Fluoranthene	Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method ^(25,31)
68	Fluorene	Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method ^(25,31)
69	Heptachlor	1) Soxhlet Extraction, Gas Chromatographic/ Method ^(10,22) 2) Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method ^(25,31)
70	Heptachlor Epoxide	1) Soxhlet Extraction, Gas Chromatographic/ Method ^(10,22) 2) Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method ^(25,31)

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ผู้อำนวยการศูนย์การวิเคราะห์ทางเคมี

71 Hexachlorobenzene...

ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
71	Hexachlorobenzene	1) Soxhlet Extraction, Gas Chromatographic/ Method ^(10,22) 2) Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method ^(25,31)
72	Hexachloro-1,3-butadiene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ^(14,24)
73	n-Hexane	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ^(14,24)
74	α-HCH	1) Soxhlet Extraction, Gas Chromatographic/ Method ^(10,22) 2) Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method ^(25,31)
75	β-HCH	1) Soxhlet Extraction, Gas Chromatographic/ Method ^(10,22) 2) Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method ^(25,31)
76	γ-HCH	1) Soxhlet Extraction, Gas Chromatographic/ Method ^(10,22) 2) Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method ^(25,31)
77	Hexachlorocyclopentadiene	Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method ^(25,31)
78	Hexachloroethane	Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method ^(25,31)
79	Indeno(1,2,3-cd)pyrene	Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method ^(25,31)
80	Isophorone	Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method ^(25,31)
81	Lead	1) Digestion, Inductively Coupled Plasma Method ^(7,15) 2) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method ^(7,16)
82	Manganese	1) Digestion, Inductively Coupled Plasma Method ^(7,15) 2) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method ^(7,16)
83	Mercury	1) Digestion, Cold-Vapor Atomic Absorption Spectrometric Method ⁽¹⁸⁾

วิทย์
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2) Thermal...

ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
84	Methanol	2) Thermal Decomposition, Amalgamation, and Atomic Absorption Spectrophotometry ⁽¹⁹⁾
85	Methoxychlor	3) Digestion, Cold-Vapor Atomic Fluorescence Spectrometric Method ⁽²⁰⁾
86	Methyl Bromide	Equilibrium Headspace, Gas Chromatographic/Mass Spectrometric Method ^(12,24)
87	Methylene Chloride	1) Soxhlet Extraction, Gas Chromatographic Method ^(25,22)
88	2-methylphenol	2) Automated Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method ^(25,31)
89	2-Methylnaphthalene	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^(14,24)
90	Methyl tert-Butyl Ether	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^(14,24)
91	Naphthalene	Automated Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method ^(25,31)
92	Nickel	1) Digestion, Inductively Coupled Plasma Method ^(7,13)
93	Nitrobenzene	2) Digestion, Inductively Coupled Plasma/Mass Spectrometric Method ^(7,14)
94	N-Nitrosodiphenylamine	Automated Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method ^(25,31)
95	N-Nitrosodipropylamine	Automated Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method ^(25,31)
96	Polychlorinated biphenyls (PCBs)	1) Soxhlet Extraction, Gas Chromatographic Method ^(10,22)
	- Aroclor 1016	2) Automated Soxhlet Extraction, Gas Chromatographic Method ^(25,31)
	- Aroclor 1221	
	- Aroclor 1232	

สำนักงานสิ่งแวดล้อม
(นางวิภาดา ชัยกุลกิจ)

- Aroclor 1242...

ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
	- Aroclor 1242	
	- Aroclor 1248	
	- Aroclor 1254	
	- Aroclor 1260	
	- 2-Chlorobiphenyl	
	- 2,2',3,3'-Tetrachlorobiphenyl	
	- 2,2',3,4'-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 ^(25,31)
98	Phenanthrene	Automated Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method ^(25,31)
99	Phenol	Automated Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method ^(25,31)
100	Pyrene	Automated Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method ^(25,31)

สำนักงานสิ่งแวดล้อม
(นางวิภาดา ชัยกุลกิจ)

101 Selenium...

ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
101	Selenium	1) Digestion, Inductively Coupled Plasma Method ^(7,15)
		2) Digestion, Inductively Coupled Plasma/Mass Spectrometric Method ^(7,14)
102	Silver	1) Digestion, Inductively Coupled Plasma Method ^(7,15)
		2) Digestion, Inductively Coupled Plasma/Mass Spectrometric Method ^(7,14)
103	Styrene	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^(14,24)
104	1,1,2,2-Tetrachloroethane	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^(14,24)
105	Tetrachloroethylene	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^(14,24)
106	Toluene	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^(14,24)
107	Toxaphene	1) Soxhlet Extraction, Gas Chromatographic Method ^(10,22)
		2) Automated Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method ^(25,31)
108	TPH (C ₉ -C ₉)	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^(14,24)
109	TPH (C ₉ -C ₁₆)	1) Solvent Extraction, Gas Chromatographic Method ^(11,21)
		2) Automated Soxhlet Extraction, Gas Chromatographic Method ^(25,31)
110	TPH (C ₁₆ -C ₃₂)	1) Solvent Extraction, Gas Chromatographic Method ^(11,21)
		2) Automated Soxhlet Extraction, Gas Chromatographic Method ^(25,31)
111	1,2,4-Trichlorobenzene	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^(14,24)
112	1,1,1-Trichloroethane	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^(14,24)
113	1,1,2-Trichloroethane	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^(14,24)
114	Trichloroethylene	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^(14,24)
115	2,4,5-Trichlorophenol	Automated Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method ^(25,31)

สำนักงานสิ่งแวดล้อม
(นางวิภาดา ชัยกุลกิจ)

116 2,4,6-Trichlorophenol...

ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
116	2,4,6-Trichlorophenol	Automated Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method ^(25,31)
117	1,3,5-Trimethylbenzene	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^(14,24)
118	Vanadium	1) Digestion, Inductively Coupled Plasma Method ^(7,15)
		2) Digestion, Inductively Coupled Plasma/Mass Spectrometric Method ^(7,14)
119	Vinyl Acetate	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^(14,24)
120	Vinyl Chloride	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^(14,24)
121	m-Xylene	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^(14,24)
122	o-Xylene	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^(14,24)
123	p-Xylene	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^(14,24)
124	Xylene (Total)	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^(14,24)
125	Zinc	1) Digestion, Inductively Coupled Plasma Method ^(7,15)
		2) Digestion, Inductively Coupled Plasma/Mass Spectrometric Method ^(7,14)


เอกสารอ้างอิง

- กระทรวงอุตสาหกรรม. ประกาศกระทรวงอุตสาหกรรม, พ.ศ. 2548. เรื่อง การกำจัดสิ่งปฏิกูลหรือวัสดุที่ไม่ใช้แล้ว.ราชกิจจานุเบกษา. 25 มกราคม 2549. เล่มที่ 123 ตอนที่ 11ง.
- กระทรวงอุตสาหกรรม. ประกาศกระทรวงอุตสาหกรรม, พ.ศ. 2549. เรื่อง กำหนดค่าปริมาณแอมโมเนียที่เจือปนในอากาศที่ระบายออกจากปล่องของหน่วยในโรงงานที่ใช้แก๊สเป็นเชื้อเพลิง.ราชกิจจานุเบกษา. 4 ธันวาคม 2549. เล่มที่ 123 ตอนที่ 125ง.
- สมาคมวิศวกรสิ่งแวดล้อมแห่งประเทศไทย. คู่มือวิเคราะห์น้ำเสีย. พิมพ์ครั้งที่ 4. กรุงเทพฯ: เรืองแก้วการพิมพ์, 2547.
- APHA, AWWA, WEF. Standard Methods for the Examination of Water and Wastewater. 23rd 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.

สำนักงานสิ่งแวดล้อม
(นางวิภาดา ชัยกุลกิจ)


7. United States...

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.


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ผู้อำนวยการศูนย์มาตรฐานวิธีการวิเคราะห์ของมลพิษ
(ประเทศไทย) มีเดีย

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.


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ผู้อำนวยการศูนย์มาตรฐานวิธีการวิเคราะห์ของมลพิษ
(ประเทศไทย) มีเดีย

กลุ่มมาตรฐานวิธีการวิเคราะห์ของมลพิษและทะเบียนห้องปฏิบัติการ การวิจัยและเตือนภัยมลพิษโรงงาน กรมโรงงานอุตสาหกรรม โทร. ๐ ๒๒๐๓ ๔๐๐๒, ๔๐๐๓



ที่ อก ๐๓๓๐(๑)/ ๕๓๗ ๕

กรมโรงงานอุตสาหกรรม
ถนนพระรามที่ ๖ แขวงทุ่งพญาไท
เขตราชเทวี กรุงเทพฯ ๑๐๕๐๐

๐๕ 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 นิยมวิทย์พันธ์ | 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 เชื้อละออง | ทะเบียนเลขที่ ๖-๒๐๔-๕๓๗๕ |
| ๑๒) นางสาวกาญจนา คงสุข | ทะเบียนเลขที่ ๖-๒๐๔-๕๓๗๕ |
| ๑๓) นางสาววันฉัตร นิยมกลาง | ทะเบียนเลขที่ ๖-๒๐๔-๕๓๗๕ |
| ๑๔) นางสาวกัญญารัตน์ ศรีนิลลา | ทะเบียนเลขที่ ๖-๒๐๔-๕๓๗๕ |
| ๑๕) นายศิริวัฒน์ พาณิชย์ | ทะเบียนเลขที่ ๖-๒๐๔-๕๓๗๕ |
| ๑๖) นางสาวกนกภรณ์ อูระ | ทะเบียนเลขที่ ๖-๒๐๔-๕๓๗๕ |
| ๑๗) นางสาวจิตติภา ปะเทืองสุข | ทะเบียนเลขที่ ๖-๒๐๔-๕๓๗๕ |
| ๑๘) นางสาวอริสา วิริยะขันติธรรม | ทะเบียนเลขที่ ๖-๒๐๔-๕๓๗๕ |
| ๑๙) นางสาวภาณิดา ยอดอินทร์ | ทะเบียนเลขที่ ๖-๒๐๔-๕๓๗๕ |

๒. ให้เพิ่มเจ้าหน้าที่...

๒. ให้เพิ่มเจ้าหน้าที่ประจำห้องปฏิบัติการวิเคราะห์ จำนวน ๕ ราย
- ๑) นายกาญจน์พิศ กิตติคุณนิษฐ์
- ๒) นายภัทรพล สว่างใจธรรม
- ๓) นายวรวิทย์ เพ็ญชัยคำ
- ๔) นายศิริโชค พงษ์ประสม
- ๕) นายณัฐนันท์ คังแพง

อนึ่ง หนังสือฉบับนี้จะส่งต่อมายังหน่วยงานที่เกี่ยวข้องกับขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์เอกชน
ที่ อก ๐๓๓๐(๑)/๑๐๖๔ ลงวันที่ ๒๘ มกราคม ๒๕๖๕ คือในวันที่ ๒ กันยายน ๒๕๖๖ ทั้งนี้ สามารถยื่นคำขอ
ผ่านระบบอิเล็กทรอนิกส์ได้ที่หน้าเว็บไซต์กรมโรงงานอุตสาหกรรม ตาม QR Code ที่แนบหนังสือฉบับนี้

จึงเรียนมาเพื่อทราบ

ขอแสดงความนับถือ



(นางริกาญจน์ นัครสกุลวิไล)

นักวิทยาศาสตร์ชำนาญการพิเศษ วิทยาการการแทน
ผู้อำนวยการกองวิจัยและเตือนภัยมลพิษโรงงาน
ปฏิบัติการการแทนอธิบดีกรมโรงงานอุตสาหกรรม

กองวิจัยและเตือนภัยมลพิษโรงงาน
กลุ่มมาตรฐานวิธีการวิเคราะห์ของมลพิษและทะเบียนห้องปฏิบัติการ
โทร. ๐ ๒๒๐๓ ๔๐๑๒ ต่อ ๒๒๐๓-๕
โทรสาร ๐ ๒๒๐๓ ๔๐๑๒ ต่อ ๒๒๐๓-๕
ไปรษณีย์อิเล็กทรอนิกส์ sarabangudw@mail.go.th



"อุตสาหกรรมสีเขียว ประเทศไทยอย่างยั่งยืน"



ကျေးဇူးတင်

อนึ่ง หนังสือฉบับนี้จะหมดอายุพร้อมหนังสือรับขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์เอกชน
ที่ อก ๐๓๑๐(๓)/๖๔๗๐ ลงวันที่ ๒๘ มิถุนายน ๒๕๖๔ คือในวันที่ ๒๘ มิถุนายน ๒๕๖๗ ทั้งนี้ สามารถยื่นคำขอผ่าน
ระบบอิเล็กทรอนิกส์ได้ที่หน้าเว็บไซต์กรมโรงงานอุตสาหกรรมตาม QR Code ท้ายหนังสือนี้

จึงเรียนมาเพื่อทราบ

ขอแสดงความนับถือ

(นายทวี อ้าพาทิน)

ผู้อำนวยการศูนย์วิจัยและเตือนภัยมลพิษโรงงานภาคตะวันออก
ปฏิบัติราชการแทนอธิบดีกรมโรงงานอุตสาหกรรม

ศูนย์วิจัยและเตือนภัยมลพิษโรงงานภาคตะวันออก
โทร. ๐ ๖๓๓๓ ๖๐๕๔ ต่อ ๕๐๐๑-๒
ไปรษณีย์อิเล็กทรอนิกส์ einw@diw.mail.go.th



ยื่นคำขอผ่านระบบอิเล็กทรอนิกส์



อุตสาหกรรมก้าวหน้า ประเทศไทยก้าวหน้า ร่วมกันพัฒนา อุตสาหกรรมสีเขียว



ที่ อก ๐๓๑๐/๖๕๖๗

กรมโรงงานอุตสาหกรรม
ถนนพระรามที่ ๖ แขวงทุ่งพญาไท
เขตราชเทวี กรุงเทพฯ ๑๐๕๐๐

๑๐ พ.ย. ๒๕๖๗

เรื่อง เปลี่ยนแปลงสารมลพิษของห้องปฏิบัติการวิเคราะห์

เรียน กรรมการผู้จัดการ บริษัท แอลแอล เอสเอราทอรี่ กรุ๊ป (ประเทศไทย) จำกัด

อ้างถึง คำขอเปลี่ยนแปลงสารมลพิษของห้องปฏิบัติการวิเคราะห์เอกชน ลงวันที่ ๒๕ ตุลาคม ๒๕๖๖

สิ่งที่ส่งมาด้วย เอกสารแนบท้ายหนังสือเปลี่ยนแปลงสารมลพิษของห้องปฏิบัติการวิเคราะห์เอกชน

บริษัท แอลแอล เอสเอราทอรี่ กรุ๊ป (ประเทศไทย) จำนวน ๑ แผ่น

ตามหนังสือที่อ้างถึง บริษัท แอลแอล เอสเอราทอรี่ กรุ๊ป (ประเทศไทย) จำกัด ห้องปฏิบัติการ
วิเคราะห์เอกชน เลขทะเบียน ๖-๓๒๓ สถานที่ตั้งเลขที่ ๖๑๖/๑๐ หมู่ที่ ๕ ตำบลแม่ป่าดู่ อำเภอลำลูกก
จังหวัดระยอง ขอเปลี่ยนแปลงสารมลพิษของห้องปฏิบัติการวิเคราะห์ ความละเอียดแจ้งแล้ว นั้น

กรมโรงงานอุตสาหกรรมพิจารณาแล้ว ให้นายทวี แอลแอล เอสเอราทอรี่ กรุ๊ป (ประเทศไทย)
จำกัด เพิ่มขอบข่ายสารมลพิษที่วิเคราะห์ในน้ำเสีย จำนวน ๑๓ รายการ และน้ำใต้ดิน ๓ รายการ ตามสิ่งที่ส่ง
มาด้วย

อนึ่ง หนังสือฉบับนี้จะหมดอายุพร้อมหนังสือต่ออายุรับขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์
เอกชนที่ อก ๐๓๑๐(๓)/๖๔๗๐ ลงวันที่ ๒๘ มิถุนายน ๒๕๖๔ คือในวันที่ ๒๘ มิถุนายน ๒๕๖๗ ทั้งนี้ สามารถ
ยื่นคำขอผ่านระบบอิเล็กทรอนิกส์ได้ที่หน้าเว็บไซต์กรมโรงงานอุตสาหกรรม

จึงเรียนมาเพื่อทราบ

ขอแสดงความนับถือ

(นายทวี อ้าพาทิน)

ผู้อำนวยการศูนย์วิจัยและเตือนภัยมลพิษโรงงานภาคตะวันออก
ปฏิบัติราชการแทนอธิบดีกรมโรงงานอุตสาหกรรม

ศูนย์วิจัยและเตือนภัยมลพิษโรงงานภาคตะวันออก
โทร. ๐ ๖๓๓๓ ๖๐๕๔ ต่อ ๕๐๐๑-๒
ไปรษณีย์อิเล็กทรอนิกส์ einw@diw.mail.go.th



อุตสาหกรรมก้าวหน้า ประเทศไทยก้าวหน้า ร่วมกันพัฒนา อุตสาหกรรมสีเขียว



เอกสารแนบท้ายหนังสือเปลี่ยนแปลงสารมลพิษของห้องปฏิบัติการวิเคราะห์เอกชน
บริษัท แอลแอล เอสเอราทอรี่ กรุ๊ป (ประเทศไทย) จำกัด เลขทะเบียน ๖-๓๒๓
ที่ อก ๐๓๑๐/๖๕๖๗ ลงวันที่ ๑๐ พ.ย. ๒๕๖๗

ขอขยายสารมลพิษที่ได้รับขึ้นทะเบียนจากกรมโรงงานอุตสาหกรรม จำนวน ๑๖ รายการ
น้ำเสีย จำนวน 13 รายการ

ลำดับ ที่	สารมลพิษ	วิธีวิเคราะห์
1	Biochemical Oxygen Demand	1) 5-Day BOD Test, Membrane Electrode Method 2) 5-Day BOD Test, Azide Modification Method
2	Chemical Oxygen Demand	1) Open Reflux, Titrimetric Method 2) Closed Reflux, Colorimetric Method 3) Closed Reflux, Titrimetric Method
3	Color	ADMI Weighted-Ordinate Spectrophotometric Method
4	Cyanide	Distillation, Colorimetric Method
5	Free Chlorine	DPD Ferrous Titrimetric Method
6	Oil and Grease	Liquid-Liquid, Partition-Gravimetric Method
7	pH	Electrometric Method
8	Phenols	1) Distillation, Chloroform Extraction Method 2) Distillation, Direct Photometric Method
9	Sulfide	ZnS Precipitation, Iodometric Method
10	Temperature	Field Method
11	Total Dissolved Solids	Dried at 180 °C
12	Total Kjeldahl Nitrogen	Semi-Macro Kjeldahl Method
13	Total Suspended Solids	Dried at 103-105 °C

น้ำใต้ดิน จำนวน 3 รายการ

ลำดับ ที่	สารมลพิษ	วิธีวิเคราะห์
1	Cyanide	Distillation, Colorimetric Method
2	pH	Electrometric Method
3	Phenols	Distillation, Direct Photometric Method

เอกสารอ้างอิง

APHA, AWWA, WEF. Standard Methods for the Examination of Water and
Wastewater. 24th ed. Washington, DC : APHA, 2023



บริษัท เอแอลเอส แลборาทอรี กรุ๊ป (ประเทศไทย) จำกัด

104 ซอยพัฒนาการ 40 ถนนพัฒนาการ แขวงพัฒนาการ เขตสวนหลวง กรุงเทพมหานคร 10250

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