

ภาคผนวก ง

---

ใบรับรองการสอบเทียบเครื่องมือ



รายการเครื่องมือที่ใช้ในการวิเคราะห์ / หสสอบ

Sample Name	Parameter	Equipment Name	ID No.	Calibrated Date	Next Cal	Freq. Calibrate (Months)
Stack	Aluminium	Console Control Unit	BKK_F50527	31-Jul-24	31-Jan-25	6
Stack	Aluminium	Pitot Tube	BKK_F50532	31-Jul-24	31-Jan-25	6
Stack	Aluminium	Flue gas Analyzer	RYG_F50563	26-Jan-24	25-Jan-25	12
Stack	Aluminium	ICP-OES	BKK_EL0037	29-Feb-24	28-Feb-25	12
Stack	Carbon Monoxide	Dry Gas	RYG_F50317	10-Jul-24	10-Jan-25	6
Stack	Carbon Monoxide	Dry Gas	BKK_F50465	10-Jul-24	10-Jan-25	6
Stack	Carbon Monoxide	Console Control Unit	BKK_F50518	10-Jul-24	10-Jan-25	6
Stack	Carbon Monoxide	Console Control Unit	BKK_F50527	31-Jul-24	31-Jan-25	6
Stack	Carbon Monoxide	Console Control Unit	BKK_F50468	10-Jul-24	10-Jan-25	6
Stack	Carbon Monoxide	Pitot Tube	BKK_F50522	10-Jul-24	10-Jan-25	6
Stack	Carbon Monoxide	Pitot Tube	BKK_F50532	31-Jul-24	31-Jan-25	6
Stack	Carbon Monoxide	Pitot Tube	BKK_F50531	31-Jul-24	31-Jan-25	6
Stack	Carbon Monoxide	Flue gas Analyzer	RYG_F50464	8-Mar-24	7-Mar-25	12
Stack	Carbon Monoxide	Pitot Tube	BKK_F50472	10-Jul-24	10-Jan-25	6
Stack	Carbon Monoxide	Flue gas Analyzer	RYG_F50564	24-Apr-24	23-Apr-25	12
Stack	Carbon Monoxide	Flue gas Analyzer	RYG_F50563	26-Jan-24	25-Jan-25	12
Stack	Carbon Monoxide	Flue gas Analyzer	RYG_F50465	22-Feb-24	21-Feb-25	12
Stack	Carbon Monoxide	Flue gas Analyzer	RYG_F50464	8-Mar-24	7-Mar-25	12
Stack	Carbon Monoxide	Dry Gas	BKK_F50465	10-Jul-24	10-Jan-25	6
Stack	Carbon Monoxide	CO Analyzer	RYG_EN0034	13-Dec-23	13-Dec-24	12
Stack	Oxides of Nitrogen	Console Control Unit	BKK_F50518	10-Jul-24	10-Jan-25	6
Stack	Oxides of Nitrogen	Console Control Unit	BKK_F50527	31-Jul-24	31-Jan-25	6
Stack	Oxides of Nitrogen	Console Control Unit	BKK_F50468	10-Jul-24	10-Jan-25	6
Stack	Oxides of Nitrogen	Dry Gas	RYG_F50317	10-Jul-24	10-Jan-25	6
Stack	Oxides of Nitrogen	Pitot Tube	BKK_F50522	10-Jul-24	10-Jan-25	6
Stack	Oxides of Nitrogen	Pitot Tube	BKK_F50532	31-Jul-24	31-Jan-25	6
Stack	Oxides of Nitrogen	Pitot Tube	BKK_F50531	31-Jul-24	31-Jan-25	6
Stack	Oxides of Nitrogen	Pitot Tube	BKK_F50472	10-Jul-24	10-Jan-25	6
Stack	Oxides of Nitrogen	Flue gas Analyzer	RYG_F50564	24-Apr-24	23-Apr-25	12
Stack	Oxides of Nitrogen	Flue gas Analyzer	RYG_F50563	26-Jan-24	25-Jan-25	12
Stack	Oxides of Nitrogen	Flue gas Analyzer	RYG_F50464	8-Mar-24	7-Mar-25	12
Stack	Oxides of Nitrogen	Flue gas Analyzer	RYG_F50465	22-Feb-24	21-Feb-25	12
Stack	Oxides of Nitrogen	Vacuum Gauge	RYG_F50332	29-Mar-23	30-Sep-24	18
Stack	Oxides of Nitrogen	Vacuum Gauge	BKK_F50479	20-Aug-24	20-Feb-26	18
Stack	Oxides of Nitrogen	Vacuum Gauge	RYG_F50333	2-Oct-24	2-Apr-26	18
Stack	Oxides of Nitrogen	SPECTROPHOTOMETER	RYG_EN0037	18-Sep-23	18-Mar-25	18
Stack	n-Decane	Console Control Unit	BKK_F50518	10-Jul-24	10-Jan-25	6
Stack	n-Decane	Console Control Unit	BKK_F50527	31-Jul-24	31-Jan-25	6
Stack	n-Decane	Console Control Unit	BKK_F50468	10-Jul-24	10-Jan-25	6
Stack	n-Decane	Pitot Tube	BKK_F50522	10-Jul-24	10-Jan-25	6
Stack	n-Decane	Pitot Tube	BKK_F50531	31-Jul-24	31-Jan-25	6
Stack	n-Decane	Pitot Tube	BKK_F50472	10-Jul-24	10-Jan-25	6
Stack	n-Decane	Flue gas Analyzer	RYG_F50564	24-Apr-24	23-Apr-25	12
Stack	n-Decane	Flue gas Analyzer	RYG_F50563	26-Jan-24	25-Jan-25	12
Stack	n-Decane	Field Rotameter	RYG_F50658	2-Jul-24	2-Oct-24	3
Stack	n-Decane	Flue gas Analyzer	RYG_F50465	22-Feb-24	21-Feb-25	12
Stack	n-Decane	Dry Gas	BKK_F50534	10-Jul-24	10-Jan-25	6
Stack	n-Decane	DRYCAL FLOWMETER	RYG_F51346	29-Jan-24	28-Jan-25	12
Stack	n-Decane	GC-FID	BKK_EN0126	21-Apr-23	21-Oct-24	18

1

alsglobal.com



รายการเครื่องมือที่ใช้ในการวิเคราะห์ / หสสอบ

Sample Name	Parameter	Equipment Name	ID No.	Calibrated Date	Next Cal	Freq. Calibrate (Months)
Stack	Total Suspended Particulate	Console Control Unit	BKK_F50518	10-Jul-24	10-Jan-25	6
Stack	Total Suspended Particulate	Console Control Unit	BKK_F50527	31-Jul-24	31-Jan-25	6
Stack	Total Suspended Particulate	Console Control Unit	BKK_F50468	10-Jul-24	10-Jan-25	6
Stack	Total Suspended Particulate	Pitot Tube	BKK_F50522	10-Jul-24	10-Jan-25	6
Stack	Total Suspended Particulate	Pitot Tube	BKK_F50532	31-Jul-24	31-Jan-25	6
Stack	Total Suspended Particulate	Pitot Tube	BKK_F50531	31-Jul-24	31-Jan-25	6
Stack	Total Suspended Particulate	Pitot Tube	BKK_F50472	10-Jul-24	10-Jan-25	6
Stack	Total Suspended Particulate	Flue gas Analyzer	RYG_F50564	26-Jan-24	25-Jan-25	12
Stack	Total Suspended Particulate	Flue gas Analyzer	RYG_F50464	8-Mar-24	7-Mar-25	12
Stack	Total Suspended Particulate	Flue gas Analyzer	RYG_F50465	22-Feb-24	21-Feb-25	12
Stack	Total Suspended Particulate	Digital Balance	RYG_EN0003	22-Feb-24	22-Feb-25	12
Stack	Dioxin and Furan	Console Control Unit	BKK_F50527	31-Jul-24	31-Jan-25	6
Stack	Dioxin and Furan	Pitot Tube	BKK_F50532	31-Jul-24	31-Jan-25	6
Stack	Dioxin and Furan	Flue gas Analyzer	RYG_F50563	26-Jan-24	25-Jan-25	12
Stack	Dioxin and Furan	HRC/MS	No. 73/2022	14-Feb-22	14-Feb-27	60
Ambient	Particulate Matter (PM-10)	High Volume	RYG_F50185	-	-	On site Calibration
Ambient	Particulate Matter (PM-10)	High Volume	RYG_F50668	-	-	On site Calibration
Ambient	Particulate Matter (PM-10)	High Volume	RYG_F50189	-	-	On site Calibration
Ambient	Particulate Matter (PM-10)	Digital Balance	RYG_EN0001	22-Feb-24	22-Feb-25	12
Ambient	Total Suspended Particulate	High Volume	RYG_F50395	-	-	On site Calibration
Ambient	Total Suspended Particulate	High Volume	RYG_F50174	-	-	On site Calibration
Ambient	Total Suspended Particulate	High Volume	RYG_F50396	-	-	On site Calibration
Ambient	Total Suspended Particulate	High Volume	RYG_F50292	-	-	On site Calibration
Ambient	Total Suspended Particulate	Digital Balance	RYG_EN0001	22-Feb-24	22-Feb-25	12
Ambient	Nitrogen Dioxide	NO <sub>2</sub> Analyzer	RYG_F50252	2-Jul-24	2-Jan-25	6
Ambient	Nitrogen Dioxide	NO <sub>2</sub> Analyzer	BKK_F51064	2-Jul-24	2-Jan-25	6
Ambient	Nitrogen Dioxide	NO <sub>2</sub> Analyzer	RYG_F50533	3-Jul-24	3-Jan-25	6
Ambient	Nitrogen Dioxide	NO <sub>2</sub> Analyzer	RYG_F50455	3-Jul-24	3-Jan-25	6
Ambient	Sulfur Dioxide	SO <sub>2</sub> Analyzer	RYG_F50251	4-Jul-24	4-Jan-25	6
Ambient	Sulfur Dioxide	SO <sub>2</sub> Analyzer	RYG_F50266	4-Jul-24	4-Jan-25	6
Ambient	Sulfur Dioxide	SO <sub>2</sub> Analyzer	RYG_F50532	5-Jul-24	5-Jan-25	6
Ambient	Sulfur Dioxide	SO <sub>2</sub> Analyzer	RYG_F50454	5-Jul-24	5-Jan-25	6
Ambient	Wind Speed / Wind Direction	Wind Speed / Wind Direction	RYG_F50329	18-Aug-23	18-Feb-25	18
Workplace	Chlorine	Field Rotameter	RYG_F50197	1-Jul-24	1-Oct-24	3
Workplace	Total Dust	Field Rotameter	RYG_F50197	1-Jul-24	1-Oct-24	3
Workplace	Total Dust	Digital Balance	RYG_EN0004	22-Feb-24	22-Feb-25	12
Workplace	Respirable Dust	Field Rotameter	RYG_F50197	1-Jul-24	1-Oct-24	3
Workplace	Respirable Dust	Digital Balance	RYG_EN0004	22-Feb-24	22-Feb-25	12
Workplace	Hydrogen Chloride	Field Rotameter	RYG_F50655	2-Jul-24	2-Oct-24	3
Workplace	Hydrogen Chloride	Ion Chromatography	BKK_EN0069	12-Jan-24	12-Jan-25	12
Workplace	Aluminium	Field Rotameter	RYG_F50197	1-Jul-24	1-Oct-24	3
Workplace	Aluminium	ICP-OES	BKK_EL0037	29-Feb-24	28-Feb-25	12
Workplace	Total VOC	TVOC Analyzer	BKK_F50819	19-Jan-24	19-Jul-25	18
Noise	Leq 8 hrs	Sound Calibrator	RYG_F50496	26-Jan-24	25-Jan-25	12
Noise	Leq 8 hrs	Sound Level Meter	NH_F50006	6-Sep-23	6-Sep-24	12
Noise	Leq 8 hrs	Sound Level Meter	NH_F50008	6-Sep-23	6-Sep-24	12
Noise	Leq 8 hrs	Sound Level Meter	NH_F50006	6-Sep-23	6-Sep-24	12
Noise	Leq 8 hrs	Sound Level Meter	NH_F50007	6-Sep-23	6-Sep-24	12
Noise	Leq 8 hrs	Sound Level Meter	NH_F50122	9-Nov-23	9-Nov-24	12
Noise	Leq 24 hrs	Sound Calibrator	RYG_F50496	26-Jan-24	25-Jan-25	12
Noise	Leq 24 hrs	Sound Level Meter	RYG_F50495	23-Feb-24	22-Feb-25	12
Noise	Leq 24 hrs	Sound Level Meter	RYG_F50381	19-Oct-23	19-Oct-24	12
Noise	Leq 24 hrs	Sound Level Meter	RYG_F50615	5-Jan-24	4-Jan-25	12
Noise	Leq 24 hrs	Sound Level Meter	RYG_F50616	5-Jan-24	4-Jan-25	12

2

alsglobal.com



รายการเครื่องมือที่ใช้ในการวิเคราะห์ / หสสอบ

Sample Name	Parameter	Equipment Name	ID No.	Calibrated Date	Next Cal	Freq. Calibrate (Months)
Noise	Leq 24 hrs	Sound Level Meter	RYG_F50389	5-Jan-24	4-Jan-25	12
Noise	Noise Annoyance	Sound Calibrator	RYG_F50496	26-Jan-24	25-Jan-25	12
Noise	Noise Annoyance	Sound Level Meter	RYG_F50495	23-Feb-24	22-Feb-25	12
Noise	Noise Annoyance	Sound Level Meter	RYG_F50381	19-Oct-23	19-Oct-24	12
Noise	Noise Annoyance	Sound Level Meter	RYG_F50615	5-Jan-24	4-Jan-25	12
Noise	Noise Annoyance	Sound Level Meter	RYG_F50616	5-Jan-24	4-Jan-25	12
Noise	Noise Annoyance	Sound Level Meter	RYG_F50389	5-Jan-24	4-Jan-25	12
Noise	Noise Dose, TWA	Dose Badge Reader	RYG_F50210	29-Jan-24	28-Jan-25	12
Heat	Heat Stress	Heat Stress Monitor	RYG_F50223	12-Jan-24	11-Jan-25	12
Heat	Heat Stress	Heat Stress Monitor	RYG_F50224	16-Feb-24	15-Feb-25	12
Heat	Heat Stress	Heat Stress Monitor	RYG_F50226	16-Feb-24	15-Feb-25	12
Rayong Lab	BOD	DO meter with Sensor	RYG_EN0032	24-Jul-23	24-Jan-24	18
Rayong Lab	BOD	Incubator	RYG_EN0154	1-Nov-24	1-May-26	18
Rayong Lab	BOD	Burette	RYG_EN0216	24-Sep-24	24-Sep-25	12
Rayong Lab	COO	Spectrophotometer	RYG_EN0037	18-Sep-23	18-Mar-25	18
Rayong Lab	Fluoride	pH ISE Meter	RYG_EN0152	14-Dec-23	14-Jun-25	18
Rayong Lab	Oil & Grease	Electronic Balance	RYG_EN0002	22-Feb-24	22-Feb-25	12
Rayong Lab	Oil & Grease	Hot Air Oven	RYG_EN0213	21-Mar-24	21-Mar-25	12
Rayong Lab	Oil & Grease	Water Bath	RYG_EN0061	21-Mar-24	21-Sep-25	18
Rayong Lab	pH on site	pH meter	RYG_F50605	30-Aug-24	30-Aug-25	12
Rayong Lab	Total Dissolved Solids 180°C	Electronic Balance	RYG_EN0002	22-Feb-24	22-Feb-25	12
Rayong Lab	Total Dissolved Solids 180°C	Hot Air Oven	RYG_EN0010	21-Mar-24	21-Sep-25	18
Rayong Lab	Total Suspended Solids	Electronic Balance	RYG_EN0002	22-Feb-24	22-Feb-25	12
Rayong Lab	Total Suspended Solids	Hot Air Oven	RYG_EN0010	21-Mar-24	21-Sep-25	18
Water Lab	Hexavalent Chromium	Spectrophotometer	BKK_EN0018	13-Sep-24	13-Sep-25	12

3

alsglobal.com



CONSULE CONTROL UNIT CALIBRATION TEST REPORT

Calibration of Date : 31-Jul-24  
Next Cal. Date : 31-Jan-25  
Reference Dry Gas Meter ID : BKK\_F5122  
Dry Gas Meter ID : A2003240  
Serial No. : 0.9824  
Correction Factor (Y) : 7-Nov-24  
Model No. :  
Reference Dry Gas Meter Data  
Barometric Pressure (mmHg) : 754  
Relative Humidity (%) : 53.0  
Temperature (C°) : 27.0  
Reference Dry Gas Meter Data  
Calibration No. : C-310724-BKK\_F50527  
Dry Gas Meter ID : BKK\_F50527  
Serial No. : 1508053  
Model No. : XC-572-V

ΔH (mm H <sub>2</sub> O)	Θ Minutes	Reference Dry Gas Meter Calibration				Console Control Unit Calibration				Dry Gas Meter Calibration				Office Calibration	
		Vr (liters)		Tr (°C)		Vr (liters)		Tr (°C)		Vr (liters)		Tr (°C)		Factor	ΔAvg
		Initial	Total	Initial	Total	Initial	Total	Initial	Total	Initial	Total	Initial	Total		
15	11:00	150.00	0.00	150.00	28.0	700280.0	700078.0	29.0	29.0	0.9713	29.0	0.9713	41.0823	0.9713	41.0756
25	9:02	150.00	0.00	150.00	29.0	699925.0	699730.0	30.0	30.0	0.9680	29.0	0.9680	40.9138	0.9680	40.9138
50	6:33	150.00	0.00	150.00	29.0	699925.0	699730.0	30.0	30.0	0.9526	30.0	0.9526	41.1709	0.9526	41.1709
80	5:02	150.00	0.00	150.00	29.0	699773.0	699619.0	30.0	30.0	0.9678	30.0	0.9678	41.1947	0.9678	41.1947
120	4:10	150.00	0.00	150.00	29.0	699619.0	699468.0	30.0	30.0	0.9641	30.0	0.9641	41.2075	0.9641	41.2075

Y : Ratio of reading of reference to dry gas meter : tolerance for individual value ± 0.02 from average.  
ΔAvg : Office pressure differential that equates to 21.24 in of air @ 25 C and 760 mm of mercury : tolerance for individual value ± 5.08 from average.  
Procedure: 40 CFR 60 APP A METH SEC 5.3 & 7  
Calibrated by: Saksit Phaisanphrasit  
Approved by: Natthapong Jangwanwong  
(Mr. Saksit Phaisanphrasit)  
(Mr. Natthapong Jangwanwong)  
RYG Field Services Specialist(1)  
FORM NO. 1 06/24 REVISION NO. 2 ISSUE DATE 30 Jan 22



## Stopwatch Calibration Test Report

Calibration Date : 31 Jul 24      Next Cal. Date : 31 Jan 25  
Barometric Pressure (mmHg) : 754      Temperature (°C) : 27.0  
Relative Humidity (%) : 53.0

### Reference Stopwatch Data

Stopwatch ID No. : RYG\_FS0540  
Model : F808  
Serial No. : E18061  
Calibration Date : 4 Jul 24  
Certificate No. : E-2407022

### Console Control Meter Data

Dry Gas Meter No. : BKK\_FS0527  
Model : XC-572-V  
Serial No. : 1508053

Run No.	Time Actual (m:ss.ms)	Time Reading (m:ss)	Diff. (ms)	Diff. (min)
1	5:00:03	5:00	3	0.00005
2	5:00:09	5:00	8	0.00013
3	5:00:09	5:00	9	0.00015
4	5:00:11	5:00	11	0.00018
5	5:00:05	5:00	5	0.00008
6	5:00:06	5:00	6	0.00010
7	5:00:06	5:00	6	0.00010
8	5:00:08	5:00	8	0.00013
9	5:00:09	5:00	9	0.00015
10	5:00:07	5:00	7	0.00012
			Average	0.00012
			SD	0.00004

Calibrate by : Saksit Phaisanphiset      Approved by : Nattapon Jiengwareewong  
Mr. Saksit Phaisanphiset      Mr. Nattapon Jiengwareewong  
RYG Field Service Scientist (4)      RYG Field Service Specialist (1)



## DIGITAL TEMPERATURE CALIBRATION DATA SHEET

Calibration Date :		31 Jul 24	Ambient Temperature (°C)		27
Calibration sheet No. : C-310724-BKK_FS0527			Relative Humidity (%) :		53
Digital Temperature ID : BKK_FS0527			Reference Temperature ID		RYG_FS0681
Serial No. :			Serial No. :		201090014918
Model : XC-572-V			Model :		Digicon-CC-VT-MS
			Next Calibrate :		13 Nov 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
Probe	300	300	0	±3	Pass
	500	501	1	±3	Pass
	100	101	1	±3	Pass
	120	121	1	±3	Pass
	140	141	1	±3	Pass
	100	101	-	±3	-
	120	121	-	±3	-
Oven	140	142	-	±3	-
	100	102	2	±3	Pass
	120	121	1	±3	Pass
Filter	140	141	1	±3	Pass
	0	1	1	±3	Pass
	10	9	-1	±3	Pass
Exit	20	20	0	±3	Pass
	0	-1	-1	±3	Pass
	25	24	-1	±3	Pass
Meter	50	48	-2	±3	Pass
	0	-1	-1	±3	Pass
	25	25	0	±3	Pass
AUX	50	50	0	±3	Pass
	25	25	0	±3	Pass
	50	50	0	±3	Pass

MPE : (Maximum permissible error of measurement) ค่าความผิดพลาดสูงสุดของผลการวัด

Calibrated by : Saksit Phaisanphiset      Approved by : Nattapon Jiengwareewong  
Mr. Saksit Phaisanphiset      ( Mr. Nattapon Jiengwareewong )  
RYG Field Services Scientist (4)      RYG Field Services Specialist (1)  
FORM NO.: F 06-027      REVISION NO.: 2      ISSUE DATE: 16/2/23

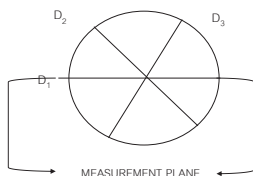


## PROBE NOZZLE DIAMETER CALIBRATION DATA SHEET

Calibration Date : 31 Jul 24		Nozzle Set ID. : BKK_FS0533	
Calibration Sheet No. : C-310724-BKK_FS0533		Vernier Caliper ID. : BKK_FS1123	

Nozzle ID #	Nozzle Diameter (cm.)			Hi - Lo	$(D_1 + D_2 + D_3) / 3$
	D <sub>1</sub>	D <sub>2</sub>	D <sub>3</sub>	$\Delta D$	D <sub>avg</sub>
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	1.600	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.  
 $\Delta D$  = Maximum distance between any two diameters, must be  $\leq 0.100$  mm.  
 $D_{avg}$  =  $(D_1 + D_2 + D_3) / 3$



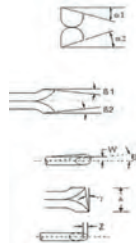
Calibrated by : Saksit Phaisanphiset      Approved by : Nattapon Jiengwareewong  
( Mr. Saksit Phaisanphiset )      ( Mr. Nattapon Jiengwareewong )  
Field Scientist (4)      Field Specialist (1)

FORM NO.: F 06-026      REVISION NO.: 1      ISSUE DATE: 16/2/23



## Type S Pitot Tube Calibration

Date Calibration      31-Jul-24      Due Date      31-Jan-25  
Pitot ID      BKK\_FS0532      Inclinator ID      BKK\_FS1131  
Pitot SN      -      Vernier ID      RYG\_FS0539



Parameter	Value	Allowable Range	Check
$\alpha 1$	-2.4	$-10^\circ < \alpha 1 < +10^\circ$	OK
$\alpha 2$	-1.2	$-10^\circ < \alpha 2 < +10^\circ$	OK
$\beta 1$	-2.0	$-5^\circ < \beta 1 < +5^\circ$	OK
$\beta 2$	1.3	$-5^\circ < \beta 2 < +5^\circ$	OK
$\gamma$	0.3	-	-
$\theta$	0.2	-	-
$Z = A \tan \gamma$	0.005	$Z \leq 0.125''$	OK
$W = A \tan \theta$	0.003	$W \leq 0.031''$	OK
Dt	0.310	0.188" to 0.375"	OK
A/2Dt	1.468	$1.05 \leq A/Dt \leq 1.5$	OK
A	0.91	$2.1Dt \leq A \leq 3Dt$	OK

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

Calibrated by : Saksit Phaisanphiset      Approved By : Nattapon Jiengwareewong  
( Mr. Saksit Phaisanphiset )      ( Mr. Nattapon Jiengwareewong )  
RYG Field Services Scientist (4)      RYG Field Services Specialist (1)

FORM NO.: F 06-124      REVISION NO.: 0      ISSUE DATE: 25/12/23

Certificate No: G 670052  
Date of issue : 26-Jan-24

Instrument description : Blue Gas Analyser  
Instrument model : Testo 350 New  
Control unit serial no. : 03580098/1121  
Instrument serial no. : 62985047/1121  
ID no. or control no. : RYG\_F50563  
Manufacturer : Testo SE & Co. KGaA  
Probe description : -  
Probe model : -  
Probe serial no. : -  
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-240266  
Receiving date : 24-Jan-24  
Parameter of calibration : Gas Calibration (Oxygen 2.50, 10.04, 21.02 %vol, Carbon Monoxide 80.14, 302, 1003 ppm, Nitrogen Dioxide 30.34, 80.96, 201.9 ppm, Nitric Oxide 30.01, 151.5, 322.5 ppm, Sulphur Dioxide 50.36, 100.8, 600.8 ppm)  
Condition of UUC : Used  
Ambient condition : All of the Measurement were carried out the stabilized laboratory  
Temperature : 23 ± 0.5 °C  
Humidity : 55 ± 15 %RH  
Calibration place : 17/121 Soi Ngamwongwan 47 Yaek 48, Tsongsonghong, Lakso, Bangkok 10210  
Calibration procedure no. : This instrument was calibrated by comparison with Standard gas mixture according to calibration Work Instruction 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 and The results relate only to the items tested/calibrated.  
This calibration certificate documents are traceability to national standards, which realize measurement according to the International System of Units (SI).

Date of calibration : 26-Jan-24

Mr. Kwanchai Khamsoung  
Calibration Technician

Mrs. Nongluck Wongsettee  
Technical Manager

FM-CL-09-C Rev.8

Page 1 of 2

Issued Date 26/02/16

Entech Industrial Solution Co., Ltd.

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

Certificate No.: G 670052

Standard References (Table 1)

Standard	Certificate No.	Vendor	Due date
Oxygen ( O2 ) 2.50 % Vol	2412/23	Linde	27-Aug-27
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 ) 302 ppm	1915/23	Linde	16-Jun-25
Carbon monoxide ( CO ) 1003 ppm	2584/23	Linde	10-Sep-25
Nitrogen Dioxide ( NO2 ) 30.34 ppm	2703/22	Linde	22-Aug-24
Nitrogen Dioxide ( NO2 ) 80.96 ppm	3240/21	Linde	26-Jun-24
Nitrogen Dioxide ( NO2 ) 201.9 ppm	1975/23	Linde	17-Jul-25
Nitric Oxide ( NO ) 30.01 ppm	CG-0014-23	Nimt	19-Feb-25
Nitric Oxide ( NO ) 151.5 ppm	0161/23	Linde	22-Jan-25
Nitric Oxide ( NO ) 322.5 ppm	1974/23	Linde	17-Jul-25
Sulphur Dioxide ( SO2 ) 50.36 ppm	2004/23	Linde	17-Jul-25
Sulphur Dioxide ( SO2 ) 100.8 ppm	3507/22	Linde	09-Nov-24
Sulphur Dioxide ( SO2 ) 600.8 ppm	2003/23	Linde	17-Jul-25

Measured room conditions

Temperature : 23.2 °C Humidity : 60.5 %RH Pressure : 1013.4 mbar

Calibration conditions

Gas Temperature : 23 °C Flow rate : 1,200 ml/min Gas pressure : 1017.1 mbar

Calibration Results (Without adjustment) (Table 2)

Parameter of Standard	Standard Values	Mean of UUC	Error	Uncertainty
O2 (%Vol)	2.50	2.46	-0.04	0.15
O2 (%Vol)	10.04	9.93	-0.11	0.20
O2 (%Vol)	21.02	21.69	0.07	0.30
CO (ppm)	80.14	80	-0.14	3.0
CO (ppm)	302	302	0	6.0
CO (ppm)	1003	1005	2	12
NO2 (ppm)	30.34	30.1	-0.24	8.0
NO2 (ppm)	80.96	81.2	0.24	8.0
NO2 (ppm)	201.9	200.8	-1.1	12
NO (ppm)	30.01	31	0.99	8.0
NO (ppm)	151.5	152	0.5	8.0
NO (ppm)	322.5	321	-1.5	12
SO2 (ppm)	50.36	52	1.64	6.0
SO2 (ppm)	100.8	102	1.2	6.0
SO2 (ppm)	600.8	603	2.2	13

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

End of Report

FM-CL-09-C Rev.8

Page 2 of 2

Issued Date 26/02/16

Entech Industrial Solution Co., Ltd.

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

BKK\_EL0037



Agilent CrossLab Start Up Services

Agilent 5100 5110 ICP-OES  
Preventive Maintenance

REVIEW BY :   
APPROVED BY :   
NEXT CAL DATE : 24/02/2025

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.



### 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/agilent/resources>. 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	64901A / M91610005
Instrument System Site and Location	PLS Laboratory Group (Thailand) Co., LTD.

List System Component Product Numbers	List the Serial Numbers of each Component
1. 64901A	M91610005
2. 64901A	A015440764
3. 64901A	1004-00169
4.	
5.	
6.	
7.	
8.	
9.	

ICP-OES Configuration Table	Circle the type or write in the type if other
Nebulizer Type	<u>Spray</u>   OneNeb   Conical   Other
Spray Chamber	Cyclonic Single Pass   <u>Cyclonic Double Pass</u>   Other
Torch	Radial   Dual View   Other
Torch Type	One Piece   <u>Semi Demountable</u>   Fully Demountable   Other
Injector Diameter	2.4mm   <u>1.8mm</u>   1.4mm   0.8mm   Other
Injector Material	<u>Quartz</u>   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 HPLC application systems, if standard sample introduction system was not installed, ask the customer to install it. *or*
- ☒ 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 is 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 FFG 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
- ☐ 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	1511.1	3444.3	1510.0	3427.8
Mn 257.610 nm SRBR	1356.1	12557.6	2549.3	12959.3
Al 396.152 nm SBR	2.2	15.0	5.8	10.3
K 766.491 nm SBR	3.3	64.0	3.6	92.8

\* 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	219.33 V	215.13 V
Mains Current	0.09 A	0.13 A
Instrument Temperature	21.5 °C	23.2 °C
RF Air Flow (sensor speed)	94.0 Hz	23.0 Hz
Plasma Exhaust Temperature	No measurement	50.1 °C
Water Flow Oscillator	No measurement	1.20 L/min
Water Flow Detector	1.14 L/min	1.09 L/min
Water Inlet Temperature	22.8 °C	23.6 °C
Polychromator Temperature	35.0 °C	38.0 °C
CCD Temperature	-40.1 °C	-40.0 °C
Thermal Stabilizer	31.5 °C	34.4 °C
Argon Supply Pressure	614.94 kPa	551.70 kPa
Purge Gas Supply Pressure*1	610.61 kPa	574.30 kPa
Option Gas Supply Pressure*1	— kPa	— kPa
Nebulizer Flow	No measurement	0.70 L/min
Nebulizer Back Pressure	No measurement	216.06 kPa
Plasma Gas Flow	No measurement	11.99 L/min
Auxiliary Gas Flow	No measurement	1.00 L/min
RF Power	No measurement	1199.6 W
RF Supply Current	No measurement	3.64 A
RF Supply Voltage	No measurement	164.11 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	—
Rotor seal for 6-7 port valve for AVS6/7	G8494-60002	G8494A/G8495	—
Rotor seal for 4 port valve for AVS4	G8493-60002	G8493A	—
Rinse solution to rinse station 2.5mm id x 1m	G8410-60123	SPS 4	1
Backwash solution 2.5mm-1.5mm ID	G8410-60124	SPS 4	1
PVC waste tubing 8mm od x 5mm id, 2m	G8410-60122	SPS 4	1
Additional Parts may be required from engineer's stock:			
X axis drive belt	5410047500	SPS 3	—
Z axis drive belt	5410047400	SPS 3	—
Peristaltic pump tubing, PVC SolvaFlex, 3 bridged	3710049000	SPS 4	—

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.

## Service Verification

Service Request Number:

8006602534

Service Engineer Name:

Nelson Leongyan yan

Service Engineer Signature:

Nelson L.

Total number of pages in this document:

14

Date Service Completed:

Feb 19, 2024

Customer Name:

Customer Signature:



### DRY GAS METER CALIBRATION TEST REPORT

Calibration of Date : 10-Jul-24 Barometric Pressure ( mm.Hg ) : 756.2  
Next Calibration Date 10-Jan-25 Relative Humidity (%) 56.2  
Temperature (°C) 26.7

**Dry Gas Meter Data**  
Calibration sheet No. : C-090124-RYG\_FS0317  
Dry Gas Meter ID RYG\_FS0317  
Serial No. 1706003  
Model No. XC-62-CV

**Reference Dry Gas Meter Data**  
Reference Dry Gas Meter ID : BKK\_FS1122  
Serial No. : A2003240  
Correction Factor (Y) : 0.9824  
Next Calibration Date : 7-Nov-24

Reference Dry Gas Meter Calibration				Dry Gas Meter							Dry Gas Meter Correction Factor ( Y )
Vr (Liters)			Tr ( °C )	Vm (Liters)			Ti ( °C )	To ( °C )	Avg. Tm ( °C )		
Final	Initial	Total		Final	Initial	Total					
30.00	0.00	30.00	26.0	30.01	0.00	30.01	26.0	27.0	26.5	0.9837	
30.00	0.00	30.00	26.0	30.01	0.00	30.01	26.0	27.0	26.5	0.9837	
60.00	0.00	60.00	26.0	60.05	0.00	60.05	26.0	27.0	26.5	0.9832	
60.00	0.00	60.00	26.0	60.05	0.00	60.05	26.0	27.0	26.5	0.9832	
90.00	0.00	90.00	26.0	90.02	0.00	90.02	26.0	27.0	26.5	0.9838	
90.00	0.00	90.00	26.0	90.02	0.00	90.02	26.0	27.0	26.5	0.9838	
Avg.										0.9836	

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

Calibrate by :

Mr. ( Jittakorn.Sriwasa )  
RYG Field ServiceScientist (2)

Approved by :

Mr.Natthapol Jengwareewong  
RYG Field ServiceSpecialist (1)

FORM NO.: F 06-023 REVISION NO.: 1 ISSUE DATE: 30/6/22



### DIGITAL TEMPERATURE CALIBRATION DATA SHEET

Calibration Date :		10 Jul 24		Ambient Temperature (°C)		26.7					
Calibration sheet No. :		C-100724-RYG_FS0317		Relative Humidity (%) :		56.2					
Digital Temperature ID :				RYG_FS0317		Reference Temperature ID		RYG_FS0681			
Serial No. :				1706003		Serial No. :		201090014918			
Model :				XC-62-CV		Model :		Digicon-CC-VT-MS			
						Next Calibrate :		13 Nov 24			
Location		Reference Temperature		Digital Temperature		Error		MPE		Pass / Fail	
		°C		°C		°C					
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		251		1		±3		Pass	
Probe		300		301		1		±3		Pass	
		500		501		1		±3		Pass	
		100		101		1		±3		Pass	
		120		121		1		±3		Pass	
		140		141		1		±3		Pass	
Oven		-		-		-		-		-	
		-		-		-		-		-	
Filter		100		101		1		±3		Pass	
		120		121		1		±3		Pass	
		140		141		1		±3		Pass	
Exit		0		0		0		±3		Pass	
		10		10		0		±3		Pass	
		20		20		0		±3		Pass	
Meter		0		0		0		±3		Pass	
		25		25		0		±3		Pass	
		50		50		0		±3		Pass	
AUX		0		1		1		±3		Pass	
		25		26		1		±3		Pass	
		50		51		1		±3		Pass	

MPE : (Maximum permissible error of measurement) ค่าความผิดพลาดสูงสุดของการวัดที่อนุญาต

Calibrated by :

( Mr.Jittakorn.Sriwasa )  
RYG Field Services Scientist (2)

Approved by :

Mr.Natthapol Jengwareewong  
RYG Field Services Specialist (1)

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



### DRY GAS METER CALIBRATION TEST REPORT

Calibration of Date 10-Jul-24 Barometric Pressure ( mm.Hg ) : 749.1  
Next Calibration Date 10-Jan-25 Relative Humidity (%) 46.2  
Temperature (°C) 33.8

**Dry Gas Meter Data**  
Calibration sheet No. : C-100724-BKK\_FS0465  
Dry Gas Meter ID BKK\_FS0465  
Serial No. 1302005  
Model No. XC-60C-V

**Reference Dry Gas Meter Data**  
Reference Dry Gas Meter ID : BKK\_FS1122  
Serial No. : A2003240  
Correction Factor (Y) : 0.9824  
Next Calibration Date : 7 Nov 24

Reference Dry Gas Meter Calibration				Dry Gas Meter							Dry Gas Meter Correction
Vr (Liters)			Tr (°C)	Vm (Liters)			Ti (°C)	To (°C)	Avg. Tm (°C)	Factor (Y)	
Final	Initial	Total		Final	Initial	Total					
30.00	0.00	30.00	33.0	30.48	0.00	30.48	33.0	33.0	33.0	0.9669	
30.00	0.00	30.00	34.0	30.59	0.00	30.59	34.0	34.0	34.0	0.9635	
60.00	0.00	60.00	34.0	61.86	0.00	61.86	35.0	35.0	35.0	0.9560	
60.00	0.00	60.00	34.0	61.86	0.00	61.86	35.0	35.0	35.0	0.9560	
90.00	0.00	90.00	34.0	92.02	0.00	92.02	35.0	35.0	35.0	0.9640	
90.00	0.00	90.00	34.0	92.01	0.00	92.01	35.0	35.0	35.0	0.9641	
Avg.										0.9617	

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

Calibrate by :

Mr. ( Jittakorn.sriwasa )  
RYG Field Service Scientist (2)

Approved by :

Mr.( Natthapol Jengwareewong )  
RYG Field Service Specialist (1)

FORM NO.: F 06-023 REVISION NO.: 1 ISSUE DATE: 30/6/22



### DIGITAL TEMPERATURE CALIBRATION DATA SHEET

Calibration Date :	10 Jul 24	Ambient Temperature (°C)	33.8		
Calibration sheet No. :	C-100724-BKK_FS0467	Relative Humidity (%) :	46.2		
Digital Temperature ID :	BKK_FS0467	Reference Temperature ID	RYG_FS0681		
Serial No. :	1302005	Serial No. :	201090014918		
Model :	XC-572-V	Model :	Digicon-CC-VT-MS		
		Next Calibrate :	13 Nov 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	100	0	±3	Pass
	150	150	0	±3	Pass
	200	199	-1	±3	Pass
	250	249	-1	±3	Pass
Probe	300	299	-1	±3	Pass
	500	500	0	±3	Pass
	100	99	-1	±3	Pass
Oven	120	120	0	±3	Pass
	140	140	0	±3	Pass
	-	-	-	-	-
Filter	-	-	-	-	-
	100	100	0	±3	Pass
	120	120	0	±3	Pass
Exit	140	140	0	±3	Pass
	0	0	0	±3	Pass
	10	9	-1	±3	Pass
Meter	20	19	-1	±3	Pass
	0	0	0	±3	Pass
	25	24	-1	±3	Pass
AUX	50	49	-1	±3	Pass
	0	0	0	±3	Pass
	25	24	-1	±3	Pass
	50	49	-1	±3	Pass

MPE : (Maximum permissible error of measurement) ค่าความผิดพลาดสูงสุดของการวัดที่อนุญาต

Calibrated by :

( Mr.Jittakorn.Sriwasa )  
RYG Field Service Scientist (2)

Approved by :

( Mr.Natthapol Jengwareewong )  
RYG Field Service Specialist (1)

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





CONSOLE CONTROL UNIT CALIBRATION TEST REPORT

Calibration of Date : 10-Jul-24 Barometric Pressure (mmHg) : 752.4  
Next Cal. Date : 10-Jan-25 Relative Humidity (%) : 64.0  
Temperature (°C) : 29.2

**Reference Dry Gas Meter Data**  
Reference Dry Gas Meter ID : BKK\_F51122  
Serial No. : A2003240  
Correction Factor (Y) : 0.9824  
Next Calibration Date : 7-Nov-24

**Console Control Meter Data**  
Calibration No. : C-100724-BKK\_FS0518  
Dry Gas Meter ID : BKK\_FS0518  
Serial No. : 1504025  
Model No. : XC-572-V

ΔH (mm.H <sub>2</sub> O)	Θ Minutes	Reference Dry Gas Meter Calibration					Console Control Dry Gas Meter					Dry Gas Meter Correction Factor (Y)	Orifice Calibration Factor (Y)	ΔH <sub>g</sub>	
		Vr (Liters)			Tr (°C)	Vn (Liters)			Ti (°C)	To (°C)	Avg.Tm (°C)				
		Final	Initial	Total		Final	Initial	Total							
15	12.00	150.00	0.00	150.00	28.0	701379.0	701230.0	149.00	29.0	29.0	30.0	0.9808	44.0579		
25	9.10	150.00	0.00	150.00	29.0	701528.0	701380.0	148.00	30.0	30.0	30.0	0.9865	42.9860		
50	6.34	150.00	0.00	150.00	29.0	701679.0	701530.0	149.00	30.0	30.0	30.0	0.9874	41.1305		
80	5.00	150.00	0.00	150.00	30.0	701830.0	701680.0	150.00	31.0	31.0	31.0	0.9780	41.0663		
120	4.08	150.00	0.00	150.00	30.0	701985.0	701835.0	150.00	31.0	31.0	31.0	0.9742	41.0654		
													Avg	0.9854	41.9278

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

ΔH<sub>g</sub> : Office pressure differential that equates to 21.24 in d air @ 25 °C and 760 mm of mercury . mmH<sub>2</sub>O : tolerance for individual values ± 5.08 from average .

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

Calibrated by : Saksit Phaisanphiset

( Mr. Saksit Phaisanphiset )

Approved by : Nattaporn Jengwareewong

( Mr. Nattaporn Jengwareewong )

RYG Field Service Specialist (4)  
RYG Field Service Scientist (4)  
FORM NO. : F 06-024 REVISION NO. : 2 ISSUE DATE : 30 Jan 22



Stopwatch Calibration Test Report

Calibration Date : 10 Jul 24 Next Cal. Date : 10 Jan 25  
Barometric Pressure (mmHg) : 752.4 Temperature (°C) : 29.2  
Relative Humidity (%) : 64.0

**Reference Stopwatch Data**  
Stopwatch ID No. : RYG\_FS0540  
Model : F808  
Serial No. : E18061  
Calibration Date : 4 Jul 24  
Certificate No. : E-2407022

**Console Control Meter Data**  
Dry Gas Meter No. : BKK\_FS518  
Model : XC-572-V  
Serial No. : 1504025

Run No.	Time Actual (m:ss.ms)	Time Reading (m:ss)	Diff. (ms)	Diff. (min)
1	5:00:03	5:00	3	0.00005
2	5:00:07	5:00	7	0.00012
3	5:00:07	5:00	7	0.00012
4	5:00:08	5:00	8	0.00013
5	5:00:05	5:00	5	0.00008
6	5:00:06	5:00	6	0.00010
7	5:00:06	5:00	6	0.00010
8	5:00:06	5:00	6	0.00010
9	5:00:07	5:00	7	0.00012
10	5:00:07	5:00	7	0.00012
			Average	0.00010
			SD	0.00002

Calibrate by : Saksit Phaisanphiset

Mr. Saksit Phaisanphiset

RYG Field Service Scientist (4)

Approved by : Nattaporn Jengwareewong

Mr. Nattaporn Jengwareewong

RYG Field Service Specialist (1)



DIGITAL TEMPERATURE CALIBRATION DATA SHEET

Calibration Date :		10 Jul 24	Ambient Temperature (°C)		29.2
Calibration sheet No. : C-10724-BKK_FS0519			Relative Humidity (%) : 64		
Digital Temperature ID : BKK_FS0519			Reference Temperature ID RYG_FS0681		
Serial No. : 1504025			Serial No. : 201090014918		
Model : XC-572-V			Model : Digicon-CC-VT-MS		
			Next Calibrate : 13 Nov 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	201	1	±3	Pass
Probe	250	251	1	±3	Pass
	300	301	1	±3	Pass
	500	501	1	±3	Pass
	100	100	0	±3	Pass
	120	121	1	±3	Pass
	140	141	1	±3	Pass
Oven	100	100	0	±3	Pass
	120	121	1	±3	Pass
	140	141	1	±3	Pass
Filter	100	100	0	±3	Pass
	120	121	1	±3	Pass
	140	141	1	±3	Pass
Exit	0	0	0	±3	Pass
	10	9	-1	±3	Pass
	20	19	-1	±3	Pass
Meter	0	0	0	±3	Pass
	25	25	0	±3	Pass
	50	51	1	±3	Pass
AUX	0	0	0	±3	Pass
	25	25	0	±3	Pass
	50	51	1	±3	Pass

MPE : (Maximum permissible error of measurement) ค่าความผิดพลาดสูงสุดของการวัดของมิเตอร์

Calibrated by : Saksit Phaisanphiset

Mr. Saksit Phaisanphiset

RYG Field Service Scientist (4)

Approved by : Nattaporn Jengwareewong

Mr. Nattaporn Jengwareewong

RYG Field Service Specialist (1)

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



PROBE NOZZLE DIAMETER  
CALIBRATION DATA SHEET

Calibration Date :	10 Jul 24	Nozzle Set ID. :	BKK_FS0524
Calibration Sheet No. : C-100724-BKK_FS0524	Vernier Caliper ID.:		BKK_FS1123

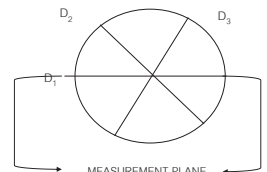
Nozzle ID #	Nozzle Diameter (cm.)			Hi - Lo	(D <sub>1</sub> + D <sub>2</sub> + D <sub>3</sub> ) / 3
	D <sub>1</sub>	D <sub>2</sub>	D <sub>3</sub>	ΔD	D <sub>avg</sub>
1	0.318	0.318	0.318	0.000	0.318
2	0.472	0.474	0.475	0.003	0.474
3	0.632	0.635	0.634	0.003	0.634
4	0.792	0.792	0.792	0.000	0.792
5	0.952	0.952	0.952	0.000	0.952
6	1.091	1.110	1.092	0.019	1.098
7	1.256	1.262	1.262	0.006	1.260
8	1.601	1.598	1.600	0.003	1.600

Where :

D<sub>1</sub>, D<sub>2</sub>, D<sub>3</sub> = There different nozzle diameters at 60 degrees to each other, each measured the nearest 0.025 mm.

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

D<sub>avg</sub> = (D<sub>1</sub> + D<sub>2</sub> + D<sub>3</sub>) / 3



Calibrated by : Saksit Phaisanphiset

( Mr. Saksit Phaisanphiset )

RYG Field Service Scientist (4)

Approved by : Nattaporn Jengwareewong

( Mr. Nattaporn Jengwareewong )

RYG Field Service Specialist (1)

FORM NO. : F 06-026 REVISION NO. : 2 ISSUE DATE : 9 Feb 23





CONSOLE CONTROL UNIT CALIBRATION TEST REPORT

Calibration of Date : 10-Jul-24  
Next Cal. Date : 10-Jan-25  
Barometric Pressure (mmHg) : 749.1  
Relative Humidity (%) : 46.2  
Temperature (°C) : 33.8  
Reference Dry Gas Meter Data  
Reference Dry Gas Meter ID : BKK\_FSI122  
Serial No. : A2003240  
Correction Factor (Y) : 0.9824  
Next Calibration Date : 7-Nov-24  
Console Control Meter Data  
Calibration No. : C-100724-BKK\_FS0468  
Dry Gas Meter ID : BKK\_FS0468  
Serial No. : 1302005  
Model No. : XC-572-V

ΔH (mm.H <sub>2</sub> O)	Θ Minutes	Reference Dry Gas Meter Calibration					Console Control Dry Gas Meter					Dry Gas Meter Correction Factor	Orifice Calibration Factor
		Vr (Liters)			Tr (°C)	Vm (Liters)			Ti (°C)	To (°C)	Avg.Tm (°C)		
		Final	Initial	Total		Final	Initial	Total					
15	11.90	150.00	0.00	150.00	29.0	566896.0	566750.0	148.00	29.0	29.0	29.0	0.9842	43.8072
25	8.90	150.00	0.00	150.00	31.0	567057.0	566910.0	147.00	32.0	32.0	32.0	1.0033	40.9751
50	6.30	150.00	0.00	150.00	31.0	567208.0	567060.0	148.00	32.0	32.0	32.0	0.9841	41.0831
80	4.94	150.00	0.00	150.00	31.0	567357.0	567210.0	147.00	32.0	32.0	32.0	0.9879	40.9965
120	4.10	150.00	0.00	150.00	31.0	567507.0	567360.0	147.00	33.0	33.0	33.0	0.9873	41.6033
										Avg		41.5960	

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

ΔHg : Office pressure differential that equates to 21.24 in d air @ 25 °C and 760 mm of mercury . mmH<sub>2</sub>O : tolerance for individual values ± 5.08 from average .

Procedure: 40 CFR 60 APP A METH- SEC 5.3.8.7

Calibrated by : Saksit Phaisanphiset

( Mr. Saksit Phaisanphiset )

RYG Field Service Scientist (4)

Approved by : Natthapol Jiengwareewong

( Mr. Natthapol Jiengwareewong )

RYG Field Service Specialist (1)

FORM NO.: F 9024 REVISION NO.: 2 ISSUE DATE: 30 Jun 22



Stopwatch Calibration Test Report

Calibration Date : 10 Jul 24  
Barometric Pressure (mmHg) : 749.1  
Relative Humidity (%) : 46.2  
Next Cal. Date : 10 Jan 25  
Temperature (°C) : 33.8  
Reference Stopwatch Data  
Stopwatch ID No. : RYG\_FS0540  
Model : F808  
Serial No. : E18061  
Calibration Date : 4 Jul 24  
Certificate No. : E-2407022  
Console Control Meter Data  
Dry Gas Meter No. : BKK\_FS0468  
Model : XC-572-V  
Serial No. : 1302005

Run No.	Time Actual (m:ss.ms)	Time Reading (m:ss)	Diff. (ms)	Diff. (min)
1	5:00:04	5:00	3	0.00005
2	5:00:08	5:00	8	0.00013
3	5:00:07	5:00	7	0.00012
4	5:00:08	5:00	8	0.00013
5	5:00:06	5:00	6	0.00010
6	5:00:06	5:00	6	0.00010
7	5:00:06	5:00	6	0.00010
8	5:00:08	5:00	8	0.00013
9	5:00:07	5:00	7	0.00012
10	5:00:07	5:00	7	0.00012
			Average	0.00011
			SD	0.00003

Calibrate by : Saksit Phaisanphiset

Mr. Saksit Phaisanphiset

RYG Field Service Scientist (4)

Approved by : Natthapol Jiengwareewong

Mr. Natthapol Jiengwareewong

RYG Field Service Specialist (1)



DIGITAL TEMPERATURE CALIBRATION DATA SHEET

Calibration Date :		10 Jul 24	Ambient Temperature (°C)		33.8
Calibration sheet No. : C-100724-BKK_FS0469			Relative Humidity (%) :		46.2
Digital Temperature ID : BKK_FS0469			Reference Temperature ID RYG_FS0681		
Serial No. : 1302005			Serial No. : 201090014918		
Model : XC-572-V			Model : Digicon-CC-VT-MS		
			Next Calibrate :		13 Nov 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	101	1	±3	Pass
	150	150	0	±3	Pass
	200	201	1	±3	Pass
	250	251	1	±3	Pass
	300	301	1	±3	Pass
Probe	500	501	1	±3	Pass
	100	101	1	±3	Pass
	120	121	1	±3	Pass
	140	141	1	±3	Pass
	100	101	1	±3	Pass
	120	121	1	±3	Pass
	140	141	1	±3	Pass
	100	101	1	±3	Pass
Oven	120	121	1	±3	Pass
	140	141	1	±3	Pass
	100	101	1	±3	Pass
	120	121	1	±3	Pass
	140	141	1	±3	Pass
	100	101	1	±3	Pass
	120	121	1	±3	Pass
	140	141	1	±3	Pass
Filter	0	0	0	±3	Pass
	10	10	0	±3	Pass
	20	20	0	±3	Pass
	0	0	0	±3	Pass
	25	25	0	±3	Pass
	50	49	-1	±3	Pass
	0	0	0	±3	Pass
	25	25	0	±3	Pass
AUX	50	50	0	±3	Pass
	0	0	0	±3	Pass
	25	25	0	±3	Pass
	50	50	0	±3	Pass

MPE : (Maximum permissible error of measurement) ค่าความผิดพลาดสูงสุดของการวัดร้อยละ

Calibrated by : Saksit Phaisanphiset

( Mr. Saksit Phaisanphiset )

RYG Field Service Scientist (4)

Approved by : Natthapol Jiengwareewong

( Mr. Natthapol Jiengwareewong )

RYG Field Service Specialist (1)

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



PROBE NOZZLE DIAMETER  
CALIBRATION DATA SHEET

Calibration Date :	10 Jul 24	Nozzle Set ID. :	BKK_FS0474
Calibration Sheet No. : C-100724-BKK_FS0474		Vernier Caliper ID.:	BKK_FS1123

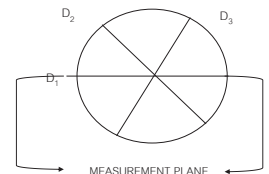
Nozzle ID #	Nozzle Diameter (cm.)			Hi - Lo	(D <sub>1</sub> + D <sub>2</sub> + D <sub>3</sub> ) / 3
	D <sub>1</sub>	D <sub>2</sub>	D <sub>3</sub>	ΔD	D <sub>avg</sub>
1	0.305	0.300	0.305	0.005	0.303
2	0.455	0.455	0.455	0.000	0.455
3	0.604	0.602	0.601	0.003	0.602
4	0.760	0.765	0.770	0.010	0.765
5	0.935	0.945	0.935	0.010	0.938
6	1.095	1.098	1.092	0.006	1.095
7	1.260	1.260	1.260	0.000	1.260
8	1.605	1.600	1.610	0.010	1.605

Where :

D<sub>1</sub>, D<sub>2</sub>, D<sub>3</sub> = There different nozzle diameters at 60 degrees to each other, each measured the nearest 0.025 mm.

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

D<sub>avg</sub> = (D<sub>1</sub> + D<sub>2</sub> + D<sub>3</sub>) / 3



Calibrated by : Saksit Phaisanphiset

( Mr. Saksit Phaisanphiset )

RYG Field Services Scientist (4)

Approved by : Natthapol Jiengwareewong

( Mr. Natthapol Jiengwareewong )

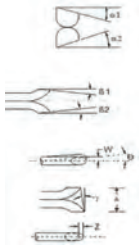
RYG Field Services Specialist

FORM NO.: F 04-026 REVISION NO.: 1 ISSUE DATE: 30 Jun 22



## Type S Pitot Tube Calibration

Date Calibration 10-Jul-24 Due Date 31-Jan-25  
Pitot ID BKK\_FS0522 Inclinator ID BKK\_FS1131  
Pitot SN Vernier ID RYG\_FS0539



Parameter	Value	Allowable Range	Check
$\alpha 1$	-1.8	$-10^\circ < \alpha 1 < +10^\circ$	OK
$\alpha 2$	-1.4	$-10^\circ < \alpha 2 < +10^\circ$	OK
$\beta 1$	-1.7	$-5^\circ < \beta 1 < +5^\circ$	OK
$\beta 2$	-2	$-5^\circ < \beta 2 < +5^\circ$	OK
$\gamma$	-1.3	-	-
$\theta$	-0.4	-	-
$Z = A \tan \gamma$	-0.021	$Z \leq 0.125"$	OK
$W = A \tan \theta$	-0.006	$W \leq 0.031"$	OK
Dt	0.330	$0.188" \text{ to } 0.375"$	OK
A/2Dt	1.394	$1.05 \leq A/2Dt \leq 1.5$	OK
A	0.92	$2.1Dt \leq A \leq 3Dt$	OK

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

Calibrated by: Saksit Phaisanphisit  
(Mr. Saksit Phaisanphisit)  
RYG Field Services Scientist (4)

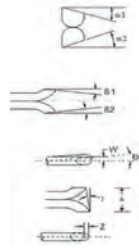
Approved By: Natthapol Jiengwareewong  
(Mr. Natthapol Jiengwareewong)  
RYG Field Services Specialist (1)

FORM NO.: F 06-124 REVISION NO.: 0 ISSUE DATE: 25/12/23



## Type S Pitot Tube Calibration

Date Calibration 31-Jul-24 Due Date 31-Jan-25  
Pitot ID BKK\_FS0531 Inclinator ID BKK\_FS1131  
Pitot SN Vernier ID RYG\_FS0539



Parameter	Value	Allowable Range	Check
$\alpha 1$	0.6	$-10^\circ < \alpha 1 < +10^\circ$	OK
$\alpha 2$	1.4	$-10^\circ < \alpha 2 < +10^\circ$	OK
$\beta 1$	-2.3	$-5^\circ < \beta 1 < +5^\circ$	OK
$\beta 2$	-0.5	$-5^\circ < \beta 2 < +5^\circ$	OK
$\gamma$	-1.1	-	-
$\theta$	1.3	-	-
$Z = A \tan \gamma$	-0.017	$Z \leq 0.125"$	OK
$W = A \tan \theta$	0.020	$W \leq 0.031"$	OK
Dt	0.311	$0.188" \text{ to } 0.375"$	OK
A/2Dt	1.415	$1.05 \leq A/2Dt \leq 1.5$	OK
A	0.88	$2.1Dt \leq A \leq 3Dt$	OK

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

Calibrated by: Saksit Phaisanphisit  
(Mr. Saksit Phaisanphisit)  
RYG Field Services Scientist (4)

Approved By: Natthapol Jiengwareewong  
(Mr. Natthapol Jiengwareewong)  
RYG Field Services Specialist (1)

FORM NO.: F 06-124 REVISION NO.: 0 ISSUE DATE: 25/12/23



## Calibration Certificate



Certificate No.: G 670176  
Date of issue: 08-Mar-24

Instrument description : Fluor Gas Analyzer  
Instrument model : Testo 350 New  
Control unit serial no. : 03401649/1119  
Instrument serial no. : 62087344/1119  
ID no. or control no. : RYG\_FS0464  
Manufacturer : Testo SE & Co. KGaA  
Probe description : -  
Probe model : -  
Probe serial no. : -  
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-240885  
Receiving date : 04-Mar-24  
Parameter of calibration : Gas Calibration (Oxygen 2.50, 10.04, 21.02 %Vol, Carbon Monoxide 80.14, 302, 1003 ppm, Nitrogen Dioxide 30.34, 81.32, 201.9 ppm, Nitric Oxide 30.01, 151.5, 322.5 ppm, Sulphur Dioxide 50.36, 100.8, 600.8 ppm)  
Condition of UUC : Used  
Ambient condition : All of the Measurement were carried out the stabilized laboratory  
Temperature :  $23 \pm 5^\circ \text{C}$   
Humidity :  $55 \pm 15\% \text{RH}$   
Calibration place : 17/121 Soi Ngamwongwan 47 Yaek 48, Toongsongkhong, Laek, Bangkok 10210  
Calibration procedure no.: This instrument was calibrated by comparison with Standard gas mixture according to calibration Work Instruction 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 and The results relate only to the items tested/calibrated.  
This calibration certificate documents are traceability to national standards, which realize measurement according to the International System of Units (SI).

Date of calibration : 08-Mar-24

Kwanchoi Khamdaung  
Mr. Kwanchoi Khamdaung  
Calibration Technician

Wuttan  
Mrs. Nongluck Wongsettee  
Technical Manager



## Calibration Certificate



Certificate No.: G 670176

### Standard References (Table 1)

Standard	Certificate No.	Vendor	Due date
Oxygen (O <sub>2</sub> ) 2.50 % Vol	2412/23	Linde	27-Aug-27
Oxygen (O <sub>2</sub> ) 10.04 % Vol	CG-0153-21	Nimt	18-Nov-26
Oxygen (O <sub>2</sub> ) 21.02 % Vol	CG-0041-22	Nimt	10-Feb-27
Carbon monoxide (CO) 80.14 ppm	CG-0040-22	Nimt	14-Feb-27
Carbon monoxide (CO) 302 ppm	1915/23	Linde	16-Jun-25
Carbon monoxide (CO) 1003 ppm	2584/23	Linde	10-Sep-25
Nitrogen Dioxide (NO <sub>2</sub> ) 30.34 ppm	2703/22	Linde	22-Aug-24
Nitrogen Dioxide (NO <sub>2</sub> ) 81.32 ppm	3546/23	Linde	14-Jan-26
Nitrogen Dioxide (NO <sub>2</sub> ) 201.9 ppm	1975/23	Linde	17-Jul-25
Nitric Oxide (NO) 30.01 ppm	CG-0014-23	Nimt	19-Feb-25
Nitric Oxide (NO) 151.5 ppm	0161/23	Linde	22-Jan-25
Nitric Oxide (NO) 322.5 ppm	1974/23	Linde	17-Jul-25
Sulphur Dioxide (SO <sub>2</sub> ) 50.36 ppm	2004/23	Linde	17-Jul-25
Sulphur Dioxide (SO <sub>2</sub> ) 100.8 ppm	3507/22	Linde	09-Nov-24
Sulphur Dioxide (SO <sub>2</sub> ) 600.8 ppm	2003/23	Linde	17-Jul-25

### Measured room conditions

Temperature : 23.6 °C Humidity : 65.2 %RH Pressure : 1011.2 mbar

### Calibration conditions

Gas Temperature : 23 °C Flow rate : 1,300 ml/min Gas pressure : 1017.1 mbar

### Calibration Results (Before adjustment) (Table 2)

Parameter of Standard	Standard Values	Mean of UUC	Error	Uncertainty (±)
O <sub>2</sub> (%Vol)	2.50	2.45	-0.05	0.15
O <sub>2</sub> (%Vol)	10.04	9.93	-0.11	0.20
O <sub>2</sub> (%Vol)	21.02	21.10	0.08	0.30
CO (ppm)	80.14	81	0.86	3.0
CO (ppm)	302	305	3	6.0
CO (ppm)	1003	1009	6	12
NO <sub>2</sub> (ppm)	30.34	24.2	-6.14	8.0
NO <sub>2</sub> (ppm)	81.32	76.9	-4.42	8.0
NO <sub>2</sub> (ppm)	201.9	188.7	-13.2	12
NO (ppm)	30.01	27	-3.01	8.0
NO (ppm)	151.5	144	-7.5	8.0
NO (ppm)	322.5	304	-18.5	12
SO <sub>2</sub> (ppm)	50.36	50	-0.36	6.0
SO <sub>2</sub> (ppm)	100.8	98	-2.8	6.0
SO <sub>2</sub> (ppm)	600.8	597	-3.8	13

Calibration Results (After adjustment) (Table 3)

Parameter of Standard	Standard Values	Mean of UUC	Error	Uncertainty (1)
O2 (%Vol)	2.500	2.45	-0.05	6.15
O2 (%Vol)	10.04	9.93	-0.11	0.20
O2 (%Vol)	21.02	21.10	0.08	0.30
CO (ppm)	80.14	81	0.86	3.0
CO (ppm)	302	305	3	6.0
CO (ppm)	1003	1009	6	12
NO2 (ppm)	30.34	29.5	-0.84	8.0
NO2 (ppm)	81.32	82.4	1.08	8.0
NO2 (ppm)	201.9	202.4	0.5	12
NO (ppm)	30.01	29	-1.01	8.0
NO (ppm)	151.5	152	0.5	8.0
NO (ppm)	322.5	321	-1.5	12
SO2 (ppm)	50.36	50	-0.36	6.0
SO2 (ppm)	100.8	98	-2.8	6.0
SO2 (ppm)	600.8	597	-3.8	13

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

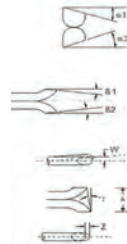
End of Report



Type S Pitot Tube Calibration

Date Calibration 10-Jul-24  
Pitot ID BKK\_FS0472  
Pitot SN

Due Date 10-Jan-25  
Inclinometer ID BKK\_FS1131  
Vernier ID RYG\_FS0539



Parameter	Value	Allowable Range	Check
α1	-5.1	-10° < α1 < +10°	OK
α2	6.7	-10° < α2 < +10°	OK
β1	2.0	-5° < β1 < +5°	OK
β2	-4.2	-5° < β2 < +5°	OK
γ	3.7	-	-
θ	0.2	-	-
Z = A tan γ	0.058	Z ≤ 0.125"	OK
W = A tan θ	0.003	W ≤ 0.031"	OK
Dt	0.30	0.188" to 0.375"	OK
A/2Dt	1.50	1.05 ≤ PA/Dt ≤ 1.5	OK
A	0.9	2.1Dt ≤ A ≤ 3Dt	OK

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

Calibrated by : Saksit Phaisanphut  
( Mr. Saksit Phaisanphut )  
RYG Field Services Scientist (4)

Approved By : Nattaporn Jengwareewong  
( Mr.Nattaporn Jengwareewong )  
RYG Field Services Specialist (1)

Instrument description : Flue Gas Analyzer  
Instrument model : Testo 350 New  
Control unit serial no. : 03580182/1121  
Instrument serial no. : 62985049/1121  
ID no. or control no. : RYG\_FS0564  
Manufacturer : Testo SE & Co. KGaA  
Probe description : -  
Probe model : -  
Probe serial no. : -  
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-241468  
Receiving date. : 11-Apr-24  
Parameter of calibration : Gas Calibration(Oxygen 2.50,10.04,21.02 %vol, Carbon Monoxide 80.14,302,1003 ppm, Nitrogen Dioxide 30.34,80.96, 201.9 ppm, Nitric Oxide 30.01, 151.5, 322.5 ppm, Sulphur Dioxide 50.36, 100.8, 600.8 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, Laksi, Bangkok 10210 THAILAND  
Calibration procedure no. : This instrument was calibrated by comparison with Standard gas mixture according to calibration Work Instruction no. WI-CL-28-C

REVIEW BY : Nongluck Wongsettee  
APPROVED BY : Nongluck Wongsettee  
NEXT CAL DATE : 28/4/25

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 and The results relate only to the items tested/calibrated.  
This calibration certificate documents are traceability to national standards, which realize measurement according to the International System of Units (SI).

Date of calibration : 24-Apr-24

Kwanchai Khumdoung  
Mr. Kwanchai Khumdoung  
Calibration Technician

Nongluck Wongsettee  
Mrs. Nongluck Wongsettee  
Technical Manager

Standard References (Table 1)

Standard	Certificate No.	Vendor	Due date
Oxygen ( O2 ) 2.50 % Vol	2412/23	Linde	27-Aug-27
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 ) 302 ppm	1915/23	Linde	16-Jun-25
Carbon monoxide ( CO ) 1003 ppm	2584/23	Linde	10-Sep-25
Nitrogen Dioxide ( NO2 ) 30.34 ppm	2703/22	Linde	22-Aug-24
Nitrogen Dioxide ( NO2 ) 81.32 ppm	3546/23	Linde	14-Jan-26
Nitrogen Dioxide ( NO2 ) 201.9 ppm	1975/23	Linde	17-Jul-25
Nitric Oxide ( NO ) 30.01 ppm	CG-0014-23	Nimt	19-Feb-25
Nitric Oxide ( NO ) 151.5 ppm	0161/23	Linde	22-Jan-25
Nitric Oxide ( NO ) 322.5 ppm	1974/23	Linde	17-Jul-25
Sulphur Dioxide ( SO2 ) 50.36 ppm	2004/23	Linde	17-Jul-25
Sulphur Dioxide ( SO2 ) 100.8 ppm	3507/22	Linde	09-Nov-24
Sulphur Dioxide ( SO2 ) 600.8 ppm	2003/23	Linde	17-Jul-25

Measured room conditions

Temperature : 22.6 °C Humidity : 64.3 %RH Pressure : 1006.6 mbar

Calibration conditions

Gas Temperature : 24 °C Flow rate : 1,200 ml/min Gas pressure : 1019.2 mbar

Calibration Results (Before adjustment) (Table 2)

Parameter of Standard	Standard Values	Mean of UUC	Error	Uncertainty (±)
O2 (%Vol)	2.50	2.44	-0.06	0.15
O2 (%Vol)	10.04	9.92	-0.12	0.20
O2 (%Vol)	21.02	21.12	0.10	0.30
CO (ppm)	80.14	80	-0.14	3.0
CO (ppm)	302	301	-1	6.0
CO (ppm)	1003	1001	-2	12
NO2 (ppm)	30.34	22.8	-7.54	8.0
NO2 (ppm)	81.32	73.4	-7.92	8.0
NO2 (ppm)	201.9	191.5	-10.4	12
NO (ppm)	30.01	28	-2.01	8.0
NO (ppm)	151.5	147	-4.5	8.0
NO (ppm)	322.5	308	-14.5	12
SO2 (ppm)	50.36	52	1.64	6.0
SO2 (ppm)	100.8	101	0.2	6.0
SO2 (ppm)	600.8	599	-1.8	13





Calibration Results (After adjustment) (Table 3)

Parameter of Standard	Standard Values	Mean of UUC	Error	Uncertainty (±)
O <sub>2</sub> (%Vol)	2.50	2.44	-0.06	0.15
O <sub>2</sub> (%Vol)	10.04	9.92	-0.12	0.20
O <sub>2</sub> (%Vol)	21.02	21.12	0.10	0.30
CO (ppm)	80.14	80	-0.14	3.0
CO (ppm)	302	301	-1	6.0
CO (ppm)	1003	1001	-2	12
NO <sub>2</sub> (ppm)	30.34	27.6	-2.74	8.0
NO <sub>2</sub> (ppm)	81.32	80.2	-1.12	8.0
NO <sub>2</sub> (ppm)	201.9	201.1	-0.8	12
NO (ppm)	30.01	31	0.99	8.0
NO (ppm)	151.5	153	1.5	8.0
NO (ppm)	322.5	324	1.5	12
SO <sub>2</sub> (ppm)	50.36	52	1.64	6.0
SO <sub>2</sub> (ppm)	100.8	101	0.2	6.0
SO <sub>2</sub> (ppm)	600.8	599	-1.8	13

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

End of Report



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

REVIEW BY : *Manohar P*  
APPROVED BY : *[Signature]*  
NEXT CAL DATE : 21/2/25

Total pages of certificate : 2 Pages  
Receiving no. : L-240604  
Receiving date : 19-Feb-24  
Parameter of calibration : Gas Calibration (Oxygen 2.50,10.04,21.02 %vol, Carbon Monoxide 80.14,302,1003 ppm)  
Nitric Oxide 30.01,151.5,322.5 ppm, Sulphur Dioxide 50.36,100.8,600.8 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 Niamwongwan 47 Yaek 48, Toongsonghong, Lakki, Bangkok 10210  
Calibration procedure no. : This instrument was calibrated by comparison with Standard gas mixture according to calibration Work Instruction: 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 and The results relate only to the items tested/calibrated.  
This calibration certificate documents are traceability to national standards, which realize measurement according to the International System of Units (SI).

Date of calibration : 22-Feb-24

*Kwanchoi K.*  
Mrs. Kwanchoi Khandoung  
Calibration Technician

*[Signature]*  
Mrs. Nongluck Wongsettee  
Technical Manager



Standard References (Table 1)

Standard	Certificate No.	Vendor	Due date
Oxygen ( O <sub>2</sub> ) 2.50 % Vol	2412/23	Linde	27-Aug-27
Oxygen ( O <sub>2</sub> ) 10.04 % Vol	CG-0153-21	Nimt	18-Nov-26
Oxygen ( O <sub>2</sub> ) 21.02 % Vol	CG-0041-22	Nimt	10-Feb-27
Carbon monoxide ( CO ) 80.14 ppm	CG-0040-22	Nimt	14-Feb-27
Carbon monoxide ( CO ) 302 ppm	1915/23	Linde	16-Jun-25
Carbon monoxide ( CO ) 1003 ppm	2584/23	Linde	10-Sep-25
Nitric Oxide ( NO ) 30.01 ppm	CG-0014-23	Nimt	19-Feb-25
Nitric Oxide ( NO ) 151.5 ppm	0161/23	Linde	22-Jan-25
Nitric Oxide ( NO ) 322.5 ppm	1974/23	Linde	17-Jul-25
Sulphur Dioxide ( SO <sub>2</sub> ) 50.36 ppm	2004/23	Linde	17-Jul-25
Sulphur Dioxide ( SO <sub>2</sub> ) 100.8 ppm	3507/23	Linde	09-Nov-24
Sulphur Dioxide ( SO <sub>2</sub> ) 600.8 ppm	2003/23	Linde	17-Jul-25

Measured room conditions

Temperature : 22.7 °C Humidity : 60.2 %RH Pressure : 1011.8 mbar

Calibration conditions

Gas Temperature : 23 °C Flow rate : 600 ml/min Gas pressure : 1014.1 mbar

Calibration Results (Without adjustment) (Table 2)

Parameter of Standard	Standard Values	Mean of UUC	Error	Uncertainty (±)
O <sub>2</sub> (%Vol)	2.50	2.44	-0.06	0.15
O <sub>2</sub> (%Vol)	10.04	9.92	-0.12	0.20
O <sub>2</sub> (%Vol)	21.02	21.11	0.09	0.30
CO (ppm)	80.14	81	0.86	3.0
CO (ppm)	302	303	1	6.0
CO (ppm)	1003	1003	0	12
NO (ppm)	30.01	29	-1.01	8.0
NO (ppm)	151.5	151	-0.5	8.0
NO (ppm)	322.5	321	-1.5	12
SO <sub>2</sub> (ppm)	50.36	52	1.64	6.0
SO <sub>2</sub> (ppm)	100.8	102	1.2	6.0
SO <sub>2</sub> (ppm)	600.8	604	3.2	13

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

End of Report

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

CERTIFIED DATE : CC745169

CYLINDER PRESSURE (psig) : 500

CERTIFIED DATE : Mar 10 2021

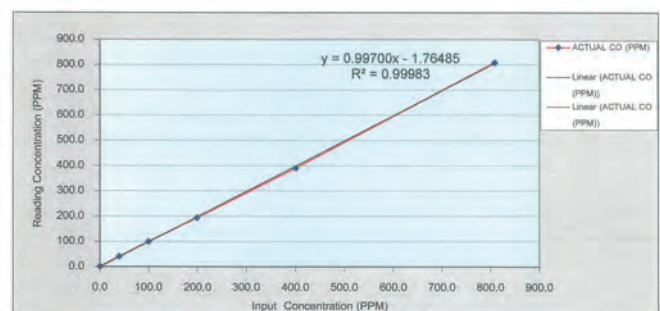
CERTIFIED BY : AIRGAS SPECIALTY GASES

EXPIRED DATE : Mar 10 2029

CALIBRATION RESULTS

POINT NO	CALIBRATION RESULTS			
	IDEAL (PPM)	ACTUAL CO (PPM)	ERROR CO (PPM)	% ERROR CO
ZERO	0.000	0.003	0.003	0.000
1	40.000	40.110	0.110	0.275
2	100.000	99.888	-0.132	-0.132
3	199.200	194.462	-4.738	-2.379
4	400.600	390.569	-10.031	-2.504
5	808.900	808.458	-0.442	-0.055
AVERAGE (%)				0.891

REVIEW BY : *Thanitoll.*  
APPROVED BY : *[Signature]*  
NEXT CAL DATE : 13 Dec 2024



CALIBRATED BY : คุณพรชัย ภาติกรวิทย์

DATE : 13 ธันวาคม 2566

ต้องการข้อมูลทางเทคนิคเพิ่มเติม : คุณพรชัย ภาติกรวิทย์ โทรศัพท์: 02-515-8987

เลขที่ 38 ถนนวิภาวดีรังสิต แขวงจันทน์เกษม เขตจตุจักร กรุงเทพฯ 10900 โทรศัพท์: 0-2515-8999 โทรสาร: 0-2515-8988 E-Mail : info@kinetics.co.th

TEST VALUES			
	API MODEL T300	BEFORE	AFTER
1	RANGE	1 - 1000 PPM	100.0
2	STABILITY	≤ 1 PPM	0.011
3	CO MEASURE	2500 - 4800 mV	3232.1
4	CO REFERENCE	2000 - 4800 mV	2892.6
5	MR RATIO	1.1 - 1.3	1.217
6	PRESEURE	25 - 35 in - Hg-A	29.3
7	SAMPLE FLOW	800 ± 10% cc/min	798
8	SAMPLE TEMP	48 ± 4 °C	45.4
9	BENCH TEMP	48 ± 2 °C	48.0
10	WHEEL TEMP	68 ± 2 °C	68.0
11	BOX TEMP	AMBIENT ± 5 °C	33.5
12	PHI DRIVE	250 - 4750 mV	4312.1
13	CO SLOPE	1.0 ± 0.3	0.915
14	CO OFFSET	0.0 ± 0.3	0.008
15	CO READING (AMBIENT)	PPM	0.961
16	ELECTRICAL TEST	40 ± 2 PPM	39.826
17	VOLTAGE TEST	+5 V +12 V +15 V -15 V	5.21 / 12.15 / 16.78 / -15.28
18	ZERO GAS	0.00 PPM	0.362
19	SPAN GAS	40.0 PPM	39.399

หมายเหตุ

- ทำการสอบเทียบด้วยเครื่องมือ O-ring 2 ชิ้น, SS Filter 1 ชิ้น, Spring 1 ชิ้น

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

เลขที่ 388 ถนนรัชดาภิเษก แขวงจันทราภิรม เขตจตุจักร กรุงเทพมหานคร 10900 โทรศัพท์ : 0-2515-8999 โทรสาร : 0-2515-8988 E-Mail : info@kinetics.co.th

## CERTIFICATE OF CALIBRATION

### FOR

NOMENCLATURE : VACUUM GAUGE  
MANUFACTURER : QUALITYWELL  
MODEL / TYPE : N/A  
SERIAL NO. : VG01(RYG\_FS0332)  
CLID. NO. : 212300695  
JOB CONTROL NO. : 230329034806

REVIEW BY : *Makoon P*  
APPROVED BY : *6/6*  
TEST CAL DATE : 30/9/24

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 : Sitipong Pimdee  
Calibration Engineer

*[Signature]*

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. Q23034806

F3-011-04/01-12

page 1 of 3



## REPORT OF CALIBRATION

### FOR

NOMENCLATURE : VACUUM GAUGE  
MANUFACTURER : QUALITYWELL  
MODEL / TYPE : N/A  
SERIAL NO. : VG01(RYG\_FS0332)  
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  $k = 2$ . 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. Q23034806

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	-9.75	-9.76	+0.25	+0.24
-20.0	-19.90	-19.91	+0.10	+0.09
-26.0	-26.02	-26.03	-0.02	-0.03
-27.0	-27.04	-27.05	-0.04	-0.05
-28.0	-28.05	-28.05	-0.05	-0.05

Uncertainty of measurement ± 0.06 inHg

Transmitting fluid : Air.

Note: The Scope of Accredited ANAB Certificate No. ACDM-2014 Version 008 Page 36 of 54

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

### End of Certificate ###

Certificate No. Q23034806

F3-011-04/01-12

page 3 of 3







## CALIBRATION LABORATORY CO., LTD.

2/10-11, 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. : 240819087098  
CALIBRATION SERVICE : ☒ IN-LABORATORY ☐ ON-SITE



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

DATE OF RECEIVED : 19 August 2024

DATE OF ISSUED : 22 August 2024

The report of calibration shall not be reproduced except in full without approval of the Calibration Laboratory Co., Ltd.

Calibrated By : Sittipong Pimdee  
Calibration Engineer

Approved By : Mongkol Yotsoontorn  
Authorized Signatory  
22 August 2024



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. Q24087098

F3-011-05/12-23

page 1 of 3



@clccalibration



## CALIBRATION LABORATORY CO., LTD.

2/10-11, 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 : 20 August 2024

#### 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 74(B 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-0040-24, Due Date 08 February 2025.

#### 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. Q24087098

F3-011-05/12-23

page 2 of 3



@clccalibration



## CALIBRATION LABORATORY CO., LTD.

2/10-11, 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 : RECEIVED IN GOOD OPERATIONAL CONDITION

#### 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 ( kPa )		Conversion to inHg		Correction ( inHg )	
	Up	Down	Up	Down	Up	Down
0.00	0.000	0.000	0.000	0.000	0.000	0.000
-10.00	-33.836	-33.836	-9.992	-9.992	+0.008	+0.008
-20.00	-67.666	-67.669	-19.982	-19.983	+0.018	+0.017
-26.00	-87.985	-87.989	-25.982	-25.983	+0.018	+0.017
-27.00	-91.375	-91.378	-26.983	-26.984	+0.017	+0.016
-28.00	-94.761	-94.761	-27.983	-27.983	+0.017	+0.017

Uncertainty of measurement  $\pm 0.053$  inHg

Transmitting fluid : Air

Technical Note, Conversion factor 1 kPa : 0.2953003 inHg

Note: The Scope of Accredited ANAB Certificate No. ACDM-2814 Version 012 Page 43 of 67

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

### End of Certificate ###

Certificate No. Q24087098

F3-011-05/12-23

page 3 of 3



@clccalibration



## CALIBRATION LABORATORY CO., LTD.

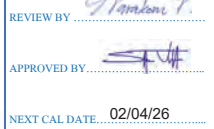
2/10-11, 14, 55 Soi Prasert Manukit 29 Yaek 4, Prasert Manukit Rd., Ladphrao, Bangkok 10230  
Tel: 02-578-0353-4 Fax: 02-578-2672 www.cal-laboratory.com E-mail: sale@cal-laboratory.com



### CERTIFICATE OF CALIBRATION

#### FOR

NOMENCLATURE : VACUUM GAUGE  
MANUFACTURER : QUALITYWELL  
MODEL / TYPE : N/A  
SERIAL NO. : VG02[RYG\_FS0333]  
CLID. NO. : 212300696  
JOB CONTROL NO. : 241002105107  
CALIBRATION SERVICE : ☒ IN-LABORATORY ☐ ON-SITE



CUSTOMER : ALS LABORATORY GROUP (THAILAND) CO., LTD.

104 PHATTHANAKAN 40, PHATTHANAKAN RD.,  
KHWAENG PHATTHANAKAN, KHET SUAN LUANG, BANGKOK 10250, THAILAND

DATE OF RECEIVED : 02 October 2024

DATE OF ISSUED : 04 October 2024

The report of calibration shall not be reproduced except in full without approval of the Calibration Laboratory Co., Ltd.

Calibrated By : Sittipong Pimdee  
Calibration Engineer

Approved By : Mongkol Yotsoontorn  
Authorized Signatory  
04 October 2024



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. Q24105107

F3-011-05/12-23

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 : 03 October 2024

#### 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-0040-24, Due Date 08 February 2025.

#### 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. Q24105107

F3-011-05/12-23

page 2 of 3



@clcalibration

CONDITION OF CALIBRATION ITEM : RECEIVED IN GOOD OPERATIONAL CONDITION

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 ( kPa )		Conversion to inHg		Correction ( inHg )	
	Up	Down	Up	Down	Up	Down
-10.0	-33.62	-33.66	-9.93	-9.94	+0.07	+0.06
-20.0	-67.79	-67.82	-20.02	-20.03	-0.02	-0.03
-26.0	-88.41	-88.41	-26.11	-26.11	-0.11	-0.11
-27.0	-91.86	-91.90	-27.13	-27.14	-0.13	-0.14
-28.0	-95.35	-95.35	-28.16	-28.16	-0.16	-0.16

Uncertainty of measurement ± 0.08 inHg

Transmitting fluid : Air.

Technical Note. Conversion factor 1 kPa ; 0.2953003 inHg

Note, The Scope of Accredited ANAB Certificate No. ACDM-2814 Version 012 Page 43 of 67

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

### End of Certificate ###

Certificate No. Q24105107

F3-011-05/12-23

page 3 of 3



@clcalibration



## 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-00005382  
**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.

**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.Pluaekdaeng, 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 the units of measurement according to the International System of Units (SI). It provides traceability of measurement to international or national standard or other recognized national standard laboratories.

The measurement uncertainty stated is the expanded uncertainty which is obtained from the 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.

บริษัท ดิเคช เทคโนโลยี จำกัด  
2533 หมู่ 5 ตำบลบ้านใหม่ อำเภอราชพฤกษ์ จังหวัดราชบุรี 76120  
2533 Sukhumvit Road, Bangkok, Prachinburi, Bangkok 10200  
Phone: +66 2038 7000 Email: info@dksh.co.th Website: www.dksh.com/certificate-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	
418.61	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	0.0090	0.000	0.0090	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	0.0090	0.000	0.0090	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	0.0090	0.000	0.0090	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	0.0090	0.000	0.0090	0.0045
	0.2461	0.245	0.0011	0.0045
	0.4652	0.466	-0.0008	0.0045
	0.9468	0.946	0.0008	0.0045
590 nm	0.0090	0.000	0.0090	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	0.0090	0.000	0.0090	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

บริษัท ดิเคช เทคโนโลยี จำกัด  
2533 หมู่ 5 ตำบลบ้านใหม่ อำเภอราชพฤกษ์ จังหวัดราชบุรี 76120  
2533 Sukhumvit Road, Bangkok, Prachinburi, Bangkok 10200  
Phone: +66 2038 7000 Email: info@dksh.co.th Website: www.dksh.com/certificate-thailand

Delivering Growth - In Asia and Beyond.

CAL-FM-C06-15: 12 Sep 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
	0.7355	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 % w/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

บริษัท ดีเคเอส อีเซีย จำกัด  
DKSH Technology Limited  
2533 ถนนสุขุมวิท แขวงคลองเตย เขตคลองเตย กรุงเทพมหานคร 10260  
2533 Sukhumvit Road, Bangkok, Phraechang, Bangkok 10260  
Phone: +66 2636 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

## ใบตรวจสอบสภาพเครื่องวัดสิ่งแวดล้อม

ชนิดเครื่องมือ: SPECTROPHOTOMETER รุ่น: DR6000 หมายเลขเครื่อง: 1627845 เลขที่ใบงาน: WO-0005382

ตรวจสอบ (รับ)		รายการตรวจเช็ค	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. แบตเตอรี่ไฟฟ้า (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"/>	
<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)	<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. ขาตั้งอิเล็กทรอนิกส์ (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 ไมล์เกิน 3.0)	<input type="checkbox"/>	<input type="checkbox"/>	
		Automatic titrator			
<input type="checkbox"/>	<input type="checkbox"/>	18. สลัก 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"/>	

เงื่อนไขข้อแนะนำ : \*656.1nm=656.1nm

\*486.0nm=485.5nm

Mr.Nattapat Rungrueang  
Service Engineer

บริษัท ดีเคเอส อีเซีย จำกัด  
DKSH Technology Limited  
2533 ถนนสุขุมวิท แขวงคลองเตย เขตคลองเตย กรุงเทพมหานคร 10260  
2533 Sukhumvit Road, Bangkok, Phraechang, Bangkok 10260  
Phone: +66 2636 7000 Email: info.calibration@dksh.com Website: www.dksh.com/scientific-thailand

Delivering Growth - in Asia and Beyond.

CAL-FM-R31-03: 20 Jul 2022



## ROTA METER CALIBRATION RESULT JULY 2024

Rotameter ID.	Calibration Date	Regression Result	Coefficient (R <sup>2</sup> )
BKK_FS0577	01 Jul 24	Y = 1.0001x + 0.0433	1.0000
BKK_FS0584	01 Jul 24	Y = 1.0056x - 2.7974	1.0000
BKK_FS0585	02 Jul 24	Y = 1.0315x + 3.0033	0.9998
BKK_FS0587	02 Jul 24	Y = 1.0294x + 0.71	1.0000
BKK_FS0588	01 Jul 24	Y = 0.9751x + 9.8452	0.9999
BKK_FS0591	01 Jul 24	Y = 1.0035x - 8.2303	1.0000
BKK_FS0592	02 Jul 24	Y = 1.002x + 14.273	1.0000
BKK_FS0594	02 Jul 24	Y = 1.0003x + 7.0095	1.0000
BKK_FS0595	01 Jul 24	Y = 1.0871x - 114.97	0.9985
BKK_FS1004	02 Jul 24	Y = 0.9826x + 13.51	0.9999
BKK_FS1005	02 Jul 24	Y = 1.0217x - 0.5833	0.9997
BKK_FS1006	02 Jul 24	Y = 1.149x - 1.0422	0.9981
BKK_FS1007	02 Jul 24	Y = 1.1116x + 3.3558	0.9994
BKK_FS1008	02 Jul 24	Y = 1.1273x + 0.4837	0.9999
BKK_FS1009	01 Jul 24	Y = 1.1044x - 0.8245	1.0000
BKK_FS1017	02 Jul 24	Y = 1.0488x + 2.2027	0.9998
BKK_FS1018	02 Jul 24	Y = 1.0173x - 0.1967	0.9999
BKK_FS1019	02 Jul 24	Y = 1.0022x + 5.619	1.0000
BKK_FS1026	01 Jul 24	Y = 1.072x - 2.4954	1.0000
BKK_FS1027	01 Jul 24	Y = 1.0104x - 4.4788	0.9999
BKK_FS1028	01 Jul 24	Y = 1.0009x - 3.7755	1.0000
BKK_FS1029	01 Jul 24	Y = 1.1118x - 4.4431	0.9965
BKK_FS1030	01 Jul 24	Y = 1.0159x - 6.395	1.0000
BKK_FS1031	01 Jul 24	Y = 0.9973x - 5.3371	0.9999
BKK_FS1039	02 Jul 24	Y = 0.9992x + 9.6833	0.9992
BKK_FS1040	01 Jul 24	Y = 1.0034x - 2.5343	1.0000
BKK_FS1041	02 Jul 24	Y = 1.0511x + 1.1272	0.9996
BKK_FS1042	02 Jul 24	Y = 1.0016x + 10.387	0.9995
BKK_FS1043	01 Jul 24	Y = 0.9965x + 9.3743	1.0000
BKK_FS1044	02 Jul 24	Y = 1.1237x - 0.4231	0.9981
BKK_FS1200	01 Jul 24	Y = 1.0337x - 0.1016	0.9994
BKK_FS1201	01 Jul 24	Y = 0.9871x + 5.0931	0.9986
BKK_FS1202	01 Jul 24	Y = 0.7978x + 301.39	0.9334
PHK_FS0027	02 Jul 24	Y = 1.0722x + 3.4395	0.9988
PHK_FS0028	02 Jul 24	Y = 1.0254x + 1.04	1.0000
PHK_FS0029	02 Jul 24	Y = 0.999x + 12.73	1.0000
RYG_FS0197	01 Jul 24	Y = 1.0045x + 10.291	1.0000
RYG_FS0198	01 Jul 24	Y = 1.0056x + 1.8883	1.0000
RYG_FS0199	02 Jul 24	Y = 1.0029x + 3.2381	0.9990



## ROTA METER CALIBRATION RESULT JULY 2024

Rotameter ID.	Calibration Date	Regression Result	Coefficient (R <sup>2</sup> )
RYG_FS0654	02 Jul 24	Y = 1.0421x + 1.4935	1.0000
RYG_FS0655	02 Jul 24	Y = 0.975x + 15.2	0.9994
RYG_FS0656	01 Jul 24	Y = 1.0042x + 7.1067	0.9999
RYG_FS0657	02 Jul 24	Y = 1.0337x + 1.8918	0.9998
RYG_FS0658	02 Jul 24	Y = 0.9921x + 10.87	0.9996
RYG_FS0659	01 Jul 24	Y = 1.0022x + 8.4152	1.0000
SGK_FS0135	02 Jul 24	Y = 1.0193x + 3.6833	0.9999
SGK_FS0136	02 Jul 24	Y = 1.0217x + 1.63	1.0000
SGK_FS0138	02 Jul 24	Y = 1.055x + 4.5833	0.9999
SGK_FS0139	02 Jul 24	Y = 1.0154x + 3.74	0.9998
SGK_FS0140	02 Jul 24	Y = 1.0008x + 13.353	1.0000
SGK_FS0141	02 Jul 24	Y = 1.1185x + 1.4867	0.9998
SGK_FS0142	02 Jul 24	Y = 1.0211x + 1.39	1.0000
SGK_FS0143	02 Jul 24	Y = 1.0045x + 5.6981	1.0000

Review By :   
(Mr. Wichan Choonharat)  
Enviro Field Services ManagerApproved By :   
(Mr. Sarayuth Jittrantont)  
Assistant General Manager



## DRY GAS METER CALIBRATION TEST REPORT

Calibration of Date 10-Jul-24 Barometric Pressure ( mm.Hg ) : 752.4  
Next Calibration Date 10-Jan-25 Relative Humidity (%) 64.0  
Temperature (°C) 29.2

## Dry Gas Meter Data

Calibration sheet No. : C-100724-BKK\_FS0534  
Dry Gas Meter ID BKK\_FS0534  
Serial No. 1509020  
Model No. XC-60-CV

## Reference Dry Gas Meter Data

Reference Dry Gas Meter ID : BKK\_FS1122  
Serial No. : A2003240  
Correction Factor (Y) : 0.9824  
Next Calibration Date : 7-Nov-24

Reference Dry Gas Meter Calibration			Dry Gas Meter							Dry Gas Meter
Vr (Liters)			Tr	Vm (Liters)			Ti	To	Avg. Tm	Correction
Final	Initial	Total	(°C)	Final	Initial	Total	(°C)	(°C)	(°C)	Factor (Y)
30.00	0.00	30.00	29.0	30.23	0.00	30.23	30.0	30.0	30.0	0.9782
30.00	0.00	30.00	29.0	30.11	0.00	30.11	30.0	30.0	30.0	0.9821
60.00	0.00	60.00	30.0	60.17	0.00	60.17	31.0	31.0	31.0	0.9829
60.00	0.00	60.00	30.0	60.42	0.00	60.42	31.0	31.0	31.0	0.9788
90.00	0.00	90.00	30.0	91.83	0.00	91.83	31.0	31.0	31.0	0.9660
90.00	0.00	90.00	31.0	91.95	0.00	91.95	32.0	32.0	32.0	0.9647
Avg.										0.9754

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

Calibrate by :

Mr. ( Jittakorn Sriwasa )  
RYG Field Service Scientist (2)

Approved by :

Mr. ( Natthapol Jengwareewong )  
RYG Field Service Specialist (1)

FORM NO.: F 06-023 REVISION NO.: 1 ISSUE DATE: 30/6/22



## DIGITAL TEMPERATURE CALIBRATION DATA SHEET

Calibration Date :		10 Jul 24		Ambient Temperature (°C)		29.2	
Calibration sheet No. :		C-100724-BKK_FS0534		Relative Humidity (%) :		64	
Digital Temperature ID : BKK_FS0534				Reference Temperature ID RYG_FS0681			
Serial No. : 1509020				Serial No. : 201090014918			
Model : XC-60-CV				Model : Digicon-CC-VT-MS			
				Next Calibrate :		13 Nov 24	
Location		Reference Temperature °C	Digital Temperature °C	Error °C		MPE	Pass / Fail
Stack		0	1	1		±3	Pass
		25	27	2		±3	Pass
		50	51	1		±3	Pass
		100	101	1		±3	Pass
		150	152	2		±3	Pass
		200	201	1		±3	Pass
		250	252	2		±3	Pass
Probe		300	302	2		±3	Pass
		500	502	2		±3	Pass
		100	102	2		±3	Pass
		120	122	2		±3	Pass
		140	142	2		±3	Pass
		100	-	-	-	-	-
		120	-	-	-	-	-
Oven		140	-	-	-	-	-
		100	102	2		±3	Pass
		120	122	2		±3	Pass
		140	142	2		±3	Pass
		0	1	1		±3	Pass
		10	11	1		±3	Pass
		20	21	1		±3	Pass
Filter		0	1	1		±3	Pass
		25	26	1		±3	Pass
		50	51	1		±3	Pass
		0	2	2		±3	Pass
		25	27	2		±3	Pass
		50	51	1		±3	Pass
		0	2	2		±3	Pass
Exit		25	27	2		±3	Pass
		50	51	1		±3	Pass
		0	1	1		±3	Pass
		10	11	1		±3	Pass
		20	21	1		±3	Pass
		0	1	1		±3	Pass
		25	26	1		±3	Pass
Meter		50	51	1		±3	Pass
		0	2	2		±3	Pass
		25	27	2		±3	Pass
		50	51	1		±3	Pass
		0	2	2		±3	Pass
		25	27	2		±3	Pass
		50	51	1		±3	Pass

MPE : (Maximum permissible error of measurement) ค่าความผิดพลาดสูงสุดของผลการวัดที่อนุญาต

Calibrated by :

( Mr.Jittakorn.Sriwasa )

RYG Field Service Scientist (2)

Approved by :

( Mr.Natthapol Jengwareewong )

RYG Field Service Specialist (1)

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

INNOVATIVE INSTRUMENT CALIBRATION LAB  
INNOVATIVE INSTRUMENT CO., LTD. HEAD OFFICE  
713/ MOO 13, SOI SUKUNTANAKORN 11 TAMBON BANG KAE,0  
AMPHOE BANG PHI SAMUT PRAKAN PROVINCE 10540 THAILAND  
TEL: (660) 2116-5860-1 FAX: (660) 2116-7140



Page 1/2

## Certificate of Calibration

Certificate No : 24-AFM-018 Rev.1

Request No : Req-2024-0043

## Customer

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

## Unit Under Calibration Details

Measurement Item : Air Flow Meter  
Manufacturer : Bios  
Model : Defender 510-L  
Serial Number : 206895  
ID : BKK\_FS1346

Sensor Model : -

Sensor Serial Number : -

Location of Calibration : LAB 4 AIR VELOCITY METER

## Calibration Environment and Details

Temperature : 23 °C  $\pm$  3 °C  
Humidity : 55 %RH  $\pm$  20 %RH  
Barometric Pressure : 1013 hPa  $\pm$  10 hPa  
Received Date : 3 January 2024  
Calibration Date : 29 January 2024

Calibration Procedure : In-house method CP-AFM-01 by Comparison technique with Standard Primary Flow Calibrator

Reference Standard	Model	Serial Number	Traceable	Due Calibration
Air Flow Meter	Gilibrator 3 Low flow	18501010006	Sensidyne	12 July 2024
Air Flow Meter	Gilibrator 3 Standard flow	19031011003	Sensidyne	12 July 2024
Temperature meter	GT 11	08000057	Qreborn	27 February 2024
Pressure meter	CPG2400	41000KDU-651882	TPA	9 November 2024

## Traceability :

This Certificate is traceable to SI Unit through Sensidyne A2LA Accreditation No. 3943.01

## Note :

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

This Certificate was issued to replace to Calibration Certificate No. 24-AFM-018

Calibration By :

Mr. Noppadon Luangart  
Service Calibration Engineer

Approved By :

Mr. Patch Mathavon  
Calibration Engineer Supervisor

Issue Date : 1 February 2024

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

FM-708-AFM-01 Rev.01 Issue date 25/01/24

INNOVATIVE INSTRUMENT CALIBRATION LAB  
INNOVATIVE INSTRUMENT CO., LTD. HEAD OFFICE  
713/ MOO 13, SOI SUKUNTANAKORN 11 TAMBON BANG KAE,0  
AMPHOE BANG PHI SAMUT PRAKAN PROVINCE 10540 THAILAND  
TEL: (660) 2116-5860-1 FAX: (660) 2116-7140



Page 2/2

Certificate No : 24-AFM-018 Rev.1

Request No : Req-2024-0043

## Result of Calibration : Without Adjustment

Temperature (°C)	Pressure (kPa)	STD (ml/min)	UUC (ml/min)	Error (ml/min)	Uncertainty (ml/min)
25.00	101.66	20	20.148	0.1	1.3
25.00	101.67	100	99.409	-0.6	2.8
24.90	101.63	199	197.46	-1.5	5.6
25.00	101.61	300	298.15	-1.8	8.4
24.90	101.60	399	400.13	1	11
24.90	101.59	480	478.02	-2.0	6.8

## Note

STD : Standard UUC : Unit Under Calibration

- UUC Reference Condition : At atmospheric pressure and room temperature condition

- Flow Rate was corrected for non-standard operating condition by using equation :

$$Q_{meas} = Q_{ref} \times \frac{P_{ref}}{P} \times \frac{T_{meas}}{T_{ref}}$$

where Q = Flow Rate P = Absolute Pressure T = Absolute Temperature  
Meas = Measurement Condition ref = Standard Condition

\* Indicates non-accredited

End of Certificate

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

FM-708-AFM-01 Rev.01 Issue date 25/01/24





## Calibration Certificate

Certificate No. 610563  
Product 200-510M Defender 510 Medium Flow  
Serial No. 151114  
Cal. Date 21-May-2024

## Sold To:

All calibrations are performed in accordance with ISO 17025 at Mesa Laboratories, Inc., 12100 W. 6th Ave, Lakewood, CO 80228, an ISO 17025:2017 accredited laboratory through NVLAP. This report shall not be reproduced except in full without the written approval of the laboratory. Results only relate to the items calibrated. This report must not be used to claim product certification, approval, or endorsement by NVLAP, NIST, or any agency of the U.S. Government.

## As Received Calibration Data

Technician	Derek Dellape	Lab. Pressure	614.2 mmHg	Lab. Temperature	24.3 °C
Instrument Reading	Lab Standard Reading	Deviation	Allowable Deviation	As Received	
0 ccm	4504.81 ccm	-100.0%	1.00%	Out of Tolerance	
0 ccm	1000.98 ccm	-100.0%	1.00%	Out of Tolerance	
0 ccm	249.55 ccm	-100.0%	1.00%	Out of Tolerance	

## Mesa Laboratories Standards Used

Description	Standard Serial Number	Calibration Date	Calibration Due Date
ML-800-24	117991	13-Nov-2023	13-Nov-2024

Mesa Laboratories Inc. 12100 W. 6th Ave, Lakewood, CO 80228 USA  
(303) 887-8000 www.mesalabs.com Symbol "MLAB" on the NASDAQ

FM-00228 Rev. B



## As Shipped Calibration Data

Certificate No	610563	Lab. Pressure	617 mmHg	Lab. Temperature	24.6 °C
Technician	Derek Dellape				
Instrument Reading	Lab Standard Reading	Deviation	Allowable Deviation	As Shipped	
4482.47 ccm	4493.49 ccm	-0.25%	1.00%	In Tolerance	
997.25 ccm	996.83 ccm	0.04%	1.00%	In Tolerance	
248.51 ccm	248.67 ccm	-0.06%	1.00%	In Tolerance	

## Mesa Laboratories Standards Used

Description	Standard Serial Number	Calibration Date	Calibration Due Date
ML-800-24	211063	04-Oct-2023	04-Oct-2024

## Calibration Notes

The expanded uncertainty of flow has a coverage factor of  $k=2$  for a confidence interval of approximately 95%. Flow testing is in accordance with our test number MP-00672 with an expanded uncertainty of 0.27% using high-purity nitrogen or filtered laboratory air.

Traceability to the International System of Units (SI) is verified by accreditation to ISO/IEC 17025 by NVLAP under NVLAP Code 200661-0.

## Technician Notes:

By:

Approved By:

Derek Dellape  
Production Assembler II

Troy Thacker  
Quality Engineer

Mesa Laboratories, Inc. certifies that the above instrument meets or exceeds published specifications, and that the calibration results in this certificate were obtained using equipment capable of producing results that are traceable through NIST to the International System of Units (SI). Calibration results are in compliance with ISO/IEC 17025:2017. Calibrations process has a Test Uncertainty Ratio (TUR) of 4:1 or greater. Any Pass/Fail determination is made without taking measurement uncertainty into account and is based on UUT performance against required tolerance only.

Mesa Laboratories Inc. 12100 W. 6th Ave, Lakewood, CO 80228 USA  
(303) 887-8000 www.mesalabs.com Symbol "MLAB" on the NASDAQ

FM-00228 Rev. B

INNOVATIVE INSTRUMENT CALIBRATION LAB  
INNOVATIVE INSTRUMENT CO., LTD. HEAD OFFICE  
7/139 MOO 13, SOI SUTINAKORN II TAMBON BANG KAE O,  
AMPHOE BANG PHI SAMUT PRAKAN PROVINCE 10540 THAILAND  
TEL: (66)0-2116-5860-1 FAX: (66)0-2116-7140



Page 1/2

## Certificate of Calibration

Customer ALS Laboratory Group Thailand Co., Ltd.  
Certificate No : 24-AFM-033  
Request No : Req-2024-0241

Address : 104 Soi Phantakanan 40, Phantakanan Road, Suan Luang, Bangkok  
10250

## Unit Under Calibration Details

Measurement Item : Primary Flow Calibrator  
Manufacturer : Bios  
Model : Defender 510-L  
Serial Number : 130027  
ID : RYG\_FS0208  
Sensor Model : -  
Sensor Serial Number : -

Location of Calibration : LAB 4 AIR VELOCITY METER

## Calibration Environment and Details

Temperature : 23 °C ± 3 °C  
Humidity : 55 %RH ± 20 %RH  
Barometric Pressure : 1013 hPa ± 10 hPa  
Received Date : 31 January 2024  
Calibration Date : 13 February 2024

Calibration Procedure : In-house method CP-AFM-01 by Comparison technique with Standard Primary Flow Calibrator

Reference Standard	Model	Serial Number	Traceable	Due Calibration
Air Flow Meter	Gilibrator 3 Low flow	18501010006	Sensidyne	12 July 2024
Air Flow Meter	Gilibrator 3 Standard flow	19031011003	Sensidyne	12 July 2024
Temperature meter	GT 11	08000057	Oreborn	27 February 2024
Pressure meter	CPG2400	41000KDU651882	TPA	9 November 2024

## Traceability :

This Certificate is traceable to SI Unit through Sensidyne A2LA Accreditation No. 3943.01

## Note :

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

Calibration By :   
Mr. Noppadon Luangart  
Service Calibration Engineer

Approved By :   
Mr. Pacit Mathavom  
Calibration Engineer Supervisor  
Issue Date : 13 February 2024

INNOVATIVE INSTRUMENT CALIBRATION LAB  
INNOVATIVE INSTRUMENT CO., LTD. HEAD OFFICE  
7/139 MOO 13, SOI SUTINAKORN II TAMBON BANG KAE O,  
AMPHOE BANG PHI SAMUT PRAKAN PROVINCE 10540 THAILAND  
TEL: (66)0-2116-5860-1 FAX: (66)0-2116-7140



Page 2/2

Certificate No : 24-AFM-033

Request No : Req-2024-0241

## Result of Calibration : Without Adjustment

Temperature (°C)	Pressure (kPa)	STD (cc/min)	UUC (cc/min)	Error (cc/min)	Uncertainty (cc/min)
24.50	101.26	20	19.965	0.0	1.3
24.20	101.25	101	100.50	-0.5	2.8
24.00	101.31	200	199.13	-0.9	5.6
23.90	101.42	301	303.56	2.6	8.4
24.10	101.41	401	404.57	4	11
24.10	101.49	480	483.81	3.8	7.0

## Note

STD : Standard UUC : Unit Under Calibration

- UUC Reference Condition : At atmospheric pressure and room temperature condition

- Flow Rate was corrected for non-standard operating condition by using equation :

$$Q_{meas} = Q_{ref} \times \frac{P_{ref}}{P_{meas}} \times \frac{T_{meas}}{T_{ref}}$$

where Q = Flow Rate P = Absolute Pressure T = Absolute Temperature  
Meas = Measurement Condition ref = Standard Condition

\* Indicates non accredited

End of Certificate



### Certificate of Calibration

#### Customer

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

Certificate No : 24-AFM-032

Request No : Req-2024-0240

#### Unit Under Calibration Details

Measurement Item : Primary Flow Calibrator  
Manufacturer : Bios  
Model : Defender 510-M  
Serial Number : I29958  
ID : RYG\_FS0209  
Location of Calibration : LAB 4 AIR VELOCITY METER

Sensor Model : -

Sensor Serial Number : -

#### Calibration Environment and Details

Temperature : 23 °C ± 3 °C  
Humidity : 55 %RH ± 20 %RH  
Barometric Pressure : 1013 hPa ± 10 hPa  
Received Date : 31 January 2024  
Calibration Date : 13 February 2024

Calibration Procedure : In-house method CP-AFM-01 by Comparison technique with Standard Primary Flow Calibrator


Reference Standard	Model	Serial Number	Traceable	Due Calibration
Air Flow Meter	Gilibrator 3 Low flow	18501010006	Sensidyne	12 July 2024
Air Flow Meter	Gilibrator 3 Standard flow	19031011003	Sensidyne	12 July 2024
Temperature meter	GT 11	08000057	Qreborn	27 February 2024
Pressure meter	CPG2400	41000KDU/651882	TPA	9 November 2024


#### Traceability :

This Certificate is traceable to SI Unit through Sensidyne A2LA Accreditation No. 3943.01

#### Note :

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

Calibration By :   
Mr. Noppadon Luangart  
Service Calibration Engineer

Approved By :   
Mr. Pacit Mathavom  
Calibration Engineer Supervisor  
Issue Date : 13 February 2024

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

FM-708-AFM-01 Rev.01 Issue date 25/01/24

Certificate No : 24-AFM-032

Request No : Req-2024-0240

#### Result of Calibration : Without Adjustment

Temperature (°C)	Pressure (kPa)	STD (cc/min)	UUC (cc/min)	Error (cc/min)	Uncertainty (cc/min)
23.80	101.89	95	100.13	5.1	2.8
23.90	101.71	501	513.93	12.9	7.2
24.18	101.62	1006	1019.3	13	14
24.00	101.81	1997	2023.0	26	29
24.10	101.87	2999	3035.5	37	45
24.60	102.00	3944	3991.8	48	59
24.60	102.08	4739	4790.5	52	72

#### Note

STD : Standard

UUC : Unit Under Calibration

- UUC Reference Condition : At atmospheric pressure and room temperature condition

- Flow Rate was corrected for non-standard operating condition by using equation :

$$Q_{meas} = Q_{ref} \times \frac{P_{ref}}{P} \times \frac{T}{T_{ref}}$$

where Q = Flow Rate

P = Absolute Pressure

T = Absolute Temperature

Meas = Measurement Condition

ref = Standard Condition

\* Indicates non accredited

End of Certificate

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

FM-708-AFM-01 Rev.01 Issue date 25/01/24

### Certificate of Calibration

#### Customer

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

Certificate No : 24-AFM-174

Request No : Req-2024-1861

#### Unit Under Calibration Details

Measurement Item : Air Flow Meter  
Manufacturer : MesaLabs  
Model : 510-M  
Serial Number : 208345  
ID : BKK\_FS1347  
Location of Calibration : LAB 4 AIR VELOCITY METER

Accuracy : 1% of Reading

Sensor Model : -

Sensor Serial Number : -

Instrument Status : Used

#### Calibration Environment and Details

Temperature : 23 °C ± 3 °C  
Humidity : 55 %RH ± 20 %RH  
Barometric Pressure : 1013 hPa ± 10 hPa  
Received Date : 22 August 2024  
Calibration Date : 28 August 2024

Calibration Procedure : In-house method CP-AFM-01 by Comparison technique with Standard Primary Flow Calibrator


Reference Standard	Model	Serial Number	Traceable	Due Calibration
Air Flow Meter	Gilibrator 3 Low flow	18501010006	Sensidyne	6 August 2025
Air Flow Meter	Gilibrator 3 Standard flow	19031011003	Sensidyne	2 August 2025
Temperature meter	GT 11	08000057	Qreborn	1 March 2025
Pressure meter	CPG2400	41000KDU/651882	TPA	9 November 2024


#### Traceability :

This Certificate is traceable to SI Unit through Sensidyne A2LA Accreditation No. 3943.01

#### Note :

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

Calibration By :   
Mr. Noppadon Luangart  
Service Calibration Engineer

Approved By :   
Mr. Pacit Mathavom  
Calibration Engineer Supervisor  
Issue Date : 28 August 2024

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

FM-708-AFM-01 Rev.04 Issue date 17/6/24

Certificate No : 24-AFM-174

Request No : Req-2024-1861

#### Result of Calibration : Without Adjustment

Temperature (°C)	Pressure (kPa)	STD (cc/min)	UUC (cc/min)	Error (cc/min)	Uncertainty (cc/min)	MPE (cc/min)	Result
22.30	100.57	100	99.526	-0.5	2.8	1	N/A
22.40	100.61	499	500.48	1.5	7.3	5	N/A
22.50	100.56	1004	1004.8	1	15	10	N/A
22.60	100.54	2008	2003.3	-5	29	20	N/A
22.80	100.62	3034	3032.1	-2	45	30	N/A
23.20	100.71	4032	4022.4	-10	60	40	N/A
23.40	100.73	5060	5056.4	-4	79	51	N/A

#### Note

STD : Standard

UUC : Unit Under Calibration

- UUC Reference Condition : At atmospheric pressure and room temperature condition

- Flow Rate was corrected for non-standard operating condition by using equation :

$$Q_{meas} = Q_{ref} \times \frac{P_{ref}}{P} \times \frac{T}{T_{ref}}$$

where Q = Flow Rate

P = Absolute Pressure

T = Absolute Temperature

Meas = Measurement Condition

ref = Standard Condition

\* Indicates non accredited

MPE = Maximum Permissible Error (Specified in Manufacturer's Specifications)

N/A = Not Available, Customer does not require a statement of conformity.

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

FM-708-AFM-01 Rev.04 Issue date 17/6/24



Certificate No : 24-AFM-174

Request No : Req-2024-1861

#### Decision Rule for Statements of Conformity

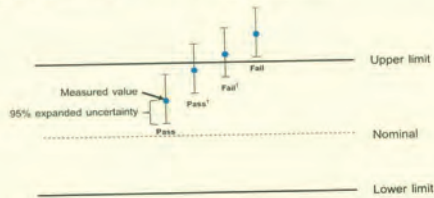
The standard decision rule employed for the statements of conformity to each calibration result will be applied using ILAC-G8:09/2019: Guidelines on the Reporting of Compliance with Specification as following Fig. and statements:

Pass - The measurement result plus the expanded uncertainty with a 95% coverage probability were within the limit.

Pass<sup>1</sup> - The measurement result was within the limit. However, a portion of the expanded uncertainty of measurement at 95% exceeds the limit.

Fail<sup>1</sup> - The measurement result was out of the limit. However, a portion of the expanded uncertainty of measurement at 95% is within the limit.

Fail - The measurement result plus the expanded uncertainty with a 95% coverage probability were outside the limit.



End of Certificate

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

FM-708-AFM-01 Rev 04 Issue date 17/6/24

#### Certificate of Calibration

Certificate No : 24-AFM-177

Request No : Req-2024-1862

#### Customer

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

#### Unit Under Calibration Details

Measurement Item : Air Flow Meter  
Manufacturer : Biot  
Model : Defender 510-L  
Serial Number : 130026  
ID : BKK\_FS0619  
Location of Calibration : LAB 4 AIR VELOCITY METER

Accuracy : 1% of Reading

Sensor Model : -

Sensor Serial Number : -

Instrument Status : Used

#### Calibration Environment and Details

Temperature : 23 °C ± 3 °C  
Humidity : 55 %RH ± 20 %RH  
Barometric Pressure : 1013 hPa ± 10 hPa  
Received Date : 22 August 2024  
Calibration Date : 9 September 2024

Calibration Procedure : In-house method CP-AFM-01 by Comparison technique with Standard Primary Flow Calibrator

Reference Standard	Model	Serial Number	Traceable	Due Calibration
Air Flow Meter	Gilibrator 3 Low flow	18501010006	Sensidyne	6 August 2025
Air Flow Meter	Gilibrator 3 Standard flow	19031011003	Sensidyne	2 August 2025
Temperature meter	GT 11	08000057	Oreborn	1 March 2025
Pressure meter	CPG2400	41000KDU/651882	TPA	9 November 2024

#### Traceability :

This Certificate is traceable to SI Unit through Sensidyne A2LA Accreditation No. 3943.01

#### Note :

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

Calibration By : Mr. Noppadon Luangrat  
Service Calibration Engineer

Approved By : Mr. Pacit Mathavorn  
Calibration Engineer Supervisor  
Issue Date : 9 September 2024

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

FM-708-AFM-01 Rev 04 Issue date 17/6/24

Certificate No : 24-AFM-177

Request No : Req-2024-1862

#### Result of Calibration : Without Adjustment

Temperature (°C)	Pressure (kPa)	STD (cc/min)	UUC (cc/min)	Error (cc/min)	Uncertainty (cc/min)	MPE (cc/min)	Result
24.70	100.92	20	20.192	0.2	1.3	0.2	N/A
24.70	100.90	100	99.923	-0.1	2.8	1.0	N/A
24.70	100.94	201	200.7	-0.3	5.6	2.0	N/A
24.70	100.97	298	300.1	2.1	8.4	3.0	N/A
24.70	100.99	403	399.1	-4	11	4.0	N/A
24.80	101.05	482	477.6	-4.4	6.9	4.8	N/A

Note : STD : Standard UUC : Unit Under Calibration  
- UUC Reference Condition : At atmospheric pressure and room temperature condition  
- Flow Rate was corrected for non-standard operating condition by using equation :

$$Q_{meas} = Q_{ref} \times \frac{P_{ref}}{P_{meas}} \times \frac{T_{meas}}{T_{ref}}$$

where Q = Flow Rate P = Absolute Pressure T = Absolute Temperature  
Meas = Measurement Condition ref = Standard Condition

\* Indicates non accredited

MPE = Maximum Permissible Error (Specified in Manufacturer's Specifications)

N/A = Not Available, Customer does not require a statement of conformity.

Certificate No : 24-AFM-177

Request No : Req-2024-1862

#### Decision Rule for Statements of Conformity

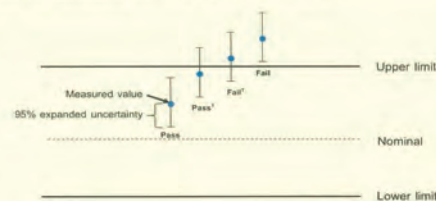
The standard decision rule employed for the statements of conformity to each calibration result will be applied using ILAC-G8:09/2019: Guidelines on the Reporting of Compliance with Specification as following Fig. and statements:

Pass - The measurement result plus the expanded uncertainty with a 95% coverage probability were within the limit.

Pass<sup>1</sup> - The measurement result was within the limit. However, a portion of the expanded uncertainty of measurement at 95% exceeds the limit.

Fail<sup>1</sup> - The measurement result was out of the limit. However, a portion of the expanded uncertainty of measurement at 95% is within the limit.

Fail - The measurement result plus the expanded uncertainty with a 95% coverage probability were outside the limit.



End of Certificate

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

FM-708-AFM-01 Rev 04 Issue date 17/6/24

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

FM-708-AFM-01 Rev 04 Issue date 17/6/24

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

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

Page 1 / 23

## 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:  $\leq 1.2$

## Overall Inlet Pressure Accuracy Test Status

Pass

## Inlet Pressure Decay

Name: 7890  
Back SSL

Setpoint Status: Pass

Pressure: 25.0 psi

Pressure Change: 0.0 psi /5 minutes

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

## Overall Inlet Pressure Decay Test Status

Pass

## Inlet Pressure Accuracy

Name: 7890  
Back SSL

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

Page 2 / 23

Setpoint Status: Pass

Setpoint: 25.0 psi Actual: 24.8 psi

Inlet Pressure: 25.0 psi

Accuracy: 0.2 psi

Agilent Recommended:  $\leq 1.2$

## 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:  $\leq 10.0$  % 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:  $\leq 10.0$  % setpoint ( 40.0 mL/min )

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

Setpoint Status: Pass

Flow Type: Makeup

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

Accuracy: 0.1 mL/min

Agilent Recommended:  $\leq 10.0$  % setpoint ( 2.5 mL/min )

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

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

Page 3 / 23

## 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:  $\leq 10.0$  % setpoint ( 3.0 mL/min )

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

Setpoint Status: Pass

Flow Type: Oxidizer

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

Accuracy: 1.0 mL/min

Agilent Recommended:  $\leq 10.0$  % setpoint ( 40.0 mL/min )

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

Setpoint Status: Pass

Flow Type: Makeup

Setpoint: 25.0 mL/min Measured Flow: 24.6 mL/min

Accuracy: 0.4 mL/min

Agilent Recommended:  $\leq 10.0$  % setpoint ( 2.5 mL/min )

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

## Overall Detector Flow Accuracy Test Status

Pass

## GC Oven Temperature Accuracy

Name: 7890

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

Page 4 / 23



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	CN16289128
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-CQ3SKQWYSystem 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]P645/G6/Config/eqp02.G6.02.02.eqp). EQP File Name: [GC-6.G6.02.02.eqp] EQP Name: AgilentRecommendation (P645) v01 (Rev:01) (G6.02.02)
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 Lepton Verification - GC - News - Qualitative test	
April 21, 2023 11:23:14 AM	End	Execution	CD5 Lepton Verification - GC - Qualitative test	Run Count: 1
April 21, 2023 11:23:16 AM	Start	Execution	System Inspection and Basic Safety and Operation - 7890 - Qualitative Test - No samples associated	
April 21, 2023 11:23:35 AM	End	Execution	System Inspection and Basic Safety and Operation - 7890 - Qualitative Test - No samples associated	Run Count: 1
April 21, 2023 11:23:37 AM	Start	Execution	Inlet Pressure Decay - Front SSI - Pressure Controlled Inlet - S: 25.0 psi - L: >= 2.0 psi and <= 0.5 psi	None

Page 1 / 11

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

Page 13 / 23

User Name: sampathk@lank  
Host Name: LAPTOP-CQ3SKQWYSystem 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	Inlet Pressure Decay - Front SSI - Pressure Controlled Inlet - S: 25.0 psi - L: >= 2.0 psi and <= 0.5 psi	Run Count: 1
April 21, 2023 11:24:04 AM	Start	Execution	Inlet Pressure Accuracy - Front SSI - Pressure Controlled Inlet - S: 25.0 psi - L: <= 1.2 psi	None
April 21, 2023 11:24:08 AM	End	Execution	Inlet Pressure Accuracy - Front SSI - Pressure Controlled Inlet - S: 25.0 psi - L: <= 1.2 psi	Run Count: 1
April 21, 2023 11:24:11 AM	Start	Execution	Inlet Pressure Decay - Back SSI - Pressure Controlled Inlet - S: 25.0 psi - L: >= 2.0 psi and <= 0.5 psi	None
April 21, 2023 11:24:45 AM	End	Execution	Inlet Pressure Decay - Back SSI - Pressure Controlled Inlet - S: 25.0 psi - L: >= 2.0 psi and <= 0.5 psi	Run Count: 1
April 21, 2023 11:24:45 AM	Start	Execution	Inlet Pressure Accuracy - Back SSI - Pressure Controlled Inlet - S: 25.0 psi - L: <= 1.2 psi	None
April 21, 2023 11:24:51 AM	End	Execution	Inlet Pressure Accuracy - Back SSI - Pressure Controlled Inlet - S: 25.0 psi - L: <= 1.2 psi	Run Count: 1
April 21, 2023 11:24:53 AM	Start	Execution	Detector Flow Accuracy - Front FID - Type: Fuel - S: 30.0 mL/min - L: <= 10.0% setpoint	None
April 21, 2023 11:25:09 AM	Auth	Data	Detector Flow Accuracy - Front FID - Type: Fuel - S: 30.0 mL/min - L: <= 10.0% setpoint	Manual Data Entry
April 21, 2023 11:25:25 AM	End	Execution	Detector Flow Accuracy - Front FID - Type: Fuel - S: 30.0 mL/min - L: <= 10.0% setpoint	Run Count: 1

Page 2 / 11

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

Page 14 / 23

User Name: sampathk@lank  
Host Name: LAPTOP-CQ3SKQWYSystem 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 FID - Type: Oxidant - S: 400.0 mL/min - L: <= 10.0% setpoint	None
April 21, 2023 11:25:45 AM	Auth	Data	Detector Flow Accuracy - Front FID - Type: Oxidant - S: 400.0 mL/min - L: <= 10.0% setpoint	Manual Data Entry
April 21, 2023 11:25:42 AM	End	Execution	Detector Flow Accuracy - Front FID - Type: Oxidant - S: 400.0 mL/min - L: <= 10.0% setpoint	Run Count: 1
April 21, 2023 11:25:44 AM	Start	Execution	Detector Flow Accuracy - Front FID - Type: Makeup - S: 25.0 mL/min - L: <= 10.0% setpoint	None
April 21, 2023 11:26:01 AM	Auth	Data	Detector Flow Accuracy - Front FID - Type: Makeup - S: 25.0 mL/min - L: <= 10.0% setpoint	Manual Data Entry
April 21, 2023 11:26:04 AM	End	Execution	Detector Flow Accuracy - Front FID - Type: Makeup - S: 25.0 mL/min - L: <= 10.0% setpoint	Run Count: 1
April 21, 2023 11:26:05 AM	Start	Execution	Detector Flow Accuracy - Back FID - Type: Fuel - S: 30.0 mL/min - L: <= 10.0% setpoint	None
April 21, 2023 11:26:19 AM	Auth	Data	Detector Flow Accuracy - Back FID - Type: Fuel - S: 30.0 mL/min - L: <= 10.0% setpoint	Manual Data Entry
April 21, 2023 11:26:22 AM	End	Execution	Detector Flow Accuracy - Back FID - Type: Fuel - S: 30.0 mL/min - L: <= 10.0% setpoint	Run Count: 1
April 21, 2023 11:26:24 AM	Start	Execution	Detector Flow Accuracy - Back FID - Type: Oxidant - S: 400.0 mL/min - L: <= 10.0% setpoint	None
April 21, 2023 11:26:36 AM	Auth	Data	Detector Flow Accuracy - Back FID - Type: Oxidant - S: 400.0 mL/min - L: <= 10.0% setpoint	Manual Data Entry

Page 3 / 11

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

Page 15 / 23

User Name: sampathk@lank  
Host Name: LAPTOP-CQ3SKQWYSystem 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 FID - Type: Oxidant - S: 400.0 mL/min - L: <= 10.0% setpoint	Run Count: 1
April 21, 2023 11:26:45 AM	Start	Execution	Detector Flow Accuracy - Back FID - Type: Makeup - S: 25.0 mL/min - L: <= 10.0% setpoint	None
April 21, 2023 11:27:01 AM	Auth	Data	Detector Flow Accuracy - Back FID - Type: Makeup - S: 25.0 mL/min - L: <= 10.0% setpoint	Manual Data Entry
April 21, 2023 11:27:05 AM	End	Execution	Detector Flow Accuracy - Back FID - Type: Makeup - S: 25.0 mL/min - L: <= 10.0% setpoint	Run Count: 1
April 21, 2023 11:27:07 AM	Start	Execution	GC Oven Temperature Accuracy - 7890 - Temperature : Oven - S: 230.0°C - L: >= -1.0 AND <= 1.0 % setpoint in K	None
April 21, 2023 11:27:33 AM	Auth	Data	GC Oven Temperature Accuracy - 7890 - Temperature : Oven - S: 230.0°C - L: >= -1.0 AND <= 1.0 % setpoint in K	Manual Data Entry
April 21, 2023 11:27:35 AM	End	Execution	GC Oven Temperature Accuracy - 7890 - Temperature : Oven - S: 230.0°C - L: >= -1.0 AND <= 1.0 % setpoint in K	Run Count: 1
April 21, 2023 11:27:37 AM	Start	Execution	GC Oven Temperature Accuracy - 7890 - Temperature : Oven - S: 100.0°C - L: >= -1.0 AND <= 1.0 % setpoint in K	None
April 21, 2023 11:27:54 AM	Auth	Data	GC Oven Temperature Accuracy - 7890 - Temperature : Oven - S: 100.0°C - L: >= -1.0 AND <= 1.0 % setpoint in K	Manual Data Entry

Page 4 / 11

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

Page 16 / 23

User Name: samsghalib@ars  
Hostname: LAPTOP-CQ25KQWY  
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 : 7897 - Temperature Oven - S: 100.0°C - L: -4.8 AQD <= 1.5 % supports in K
April 21, 2023 11:27:58 AM	Start	Execution	GC Oven Temperature Stability	None - 7897 - 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 - 7897 - 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 - 7897 - 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 PID - 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\G hemStation3\Data\GC-6 _ALS_2023-04-20\GC-6 _2023 2023-04-20 14-36-08\Pre01-0147.D\FID 1A.ch
April 21, 2023 11:31:04 AM	End	Execution	GC Spooling Run - Injection	Run Count : 1 Tower, Front SSL, Front PID - Part of System Preparation - No inlets associated
April 21, 2023 11:31:07 AM	Start	Execution	Helium and Oxit - Front PID -	None Detector FID - L (Noise) <= 0.10 pA - L (Drift) <= 2.50 pA/hour

Page 5 / 11

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

Page 17 / 23

User Name: samsghalib@ars  
Hostname: LAPTOP-CQ25KQWY  
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 PID -	Detector FID - L (Noise) <= 0.10 pA - L (Drift) <= 2.50 pA/hour Data file Path : C:\Users\Public\Documents\G hemStation3\Data\GC-6 _ALS_2023-04-20\GC-6 _2023 2023-04-20 14-36-08\Pre01-0147.D\FID 1A.ch
April 21, 2023 11:32:00 AM	End	Execution	Helium and Oxit - Front PID -	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 PID - 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 PID - 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\G hemStation3\Data\GC-6 _ALS_2023-04-20\GC-6 _2023 2023-04-20 14-36-08\Pre01-0147.D\FID 1A.ch
April 21, 2023 11:33:55 AM	Auto	Data	Injection Precision - Injection	Gas flow Path : C:\Users\Public\Documents\G hemStation3\Data\GC-6 _ALS_2023-04-20\GC-6 _2023 2023-04-20 14-36-08\Pre01-0147.D\FID 1A.ch

Page 6 / 11

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

Page 18 / 23

User Name: samsghalib@ars  
Hostname: LAPTOP-CQ25KQWY  
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\G hemStation3\Data\GC-6 _ALS_2023-04-20\GC-6 _2023 2023-04-20 14-36-08\Pre01-0147.D\FID 1A.ch
April 21, 2023 11:33:58 AM	Auto	Data	Injection Precision - Injection	Gas flow Path : C:\Users\Public\Documents\G hemStation3\Data\GC-6 _ALS_2023-04-20\GC-6 _2023 2023-04-20 14-36-08\Pre01-0147.D\FID 1A.ch
April 21, 2023 11:33:59 AM	Auto	Data	Injection Precision - Injection	Gas flow Path : C:\Users\Public\Documents\G hemStation3\Data\GC-6 _ALS_2023-04-20\GC-6 _2023 2023-04-20 14-36-08\Pre01-0147.D\FID 1A.ch
April 21, 2023 11:33:59 AM	Auto	Data	Injection Precision - Injection	Gas flow Path : C:\Users\Public\Documents\G hemStation3\Data\GC-6 _ALS_2023-04-20\GC-6 _2023 2023-04-20 14-36-08\Pre01-0147.D\FID 1A.ch
April 21, 2023 11:35:05 AM	End	Execution	Injection Precision - Injection	Run Count : 1 Tower, Front SSL, Front PID - 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 PID - Detector FID - L: <= 300000

Page 7 / 11

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

Page 19 / 23

User Name: samsghalib@ars  
Hostname: LAPTOP-CQ25KQWY  
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\G hemStation3\Data\GC-6 _ALS_2023-04-20\GC-6 _2023 2023-04-20 14-36-08\Pre01-0147.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 PID - 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\G hemStation3\Data\GC-6 _ALS_2023-04-20\GC-6 _2023 2023-04-20 14-36-08\Pre01-0147.D\FID 1A.ch
April 21, 2023 11:37:00 AM	Start	Execution	GC Spooling Run - Injection	Run Count : 1 Tower, Back SSL, Back PID - Part of System Preparation - No inlets associated
April 21, 2023 11:37:30 AM	Start	Execution	Helium and Oxit - Back PID -	None Detector FID - L (Noise) <= 0.10 pA - L (Drift) <= 2.50 pA/hour

Page 8 / 11

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

Page 20 / 23

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	Optional Information
April 21, 2023 11:58:08 AM Auct		Data	Noise and CRB - Back FID - Detector FID - L (Noise) == 0.10 pA - L (CRB) == 2.00 pA/Hz	Data File Path : C:\Users\Public\Documents\Kern\Kern3302\3302-04-21_2023-04-20\OQ_OC-4_2023_2023-04-20_14:35:28\OQ-31-0258.D\FID 28.ch
April 21, 2023 11:58:23 AM End		Execution	Noise and CRB - Back FID - Detector FID - L (Noise) == 0.10 pA - L (CRB) == 2.00 pA/Hz	Run Count : 1
April 21, 2023 11:58:32 AM Start		Execution	Injection (Pre-run - Injection Tower, Back ESI, Back FID - GC - L (Flow) == 3.00% - L (Ref. Time) == 1.00s	None
April 21, 2023 11:58:51 AM Start		Execution	Injection (Pre-run - Injection Tower, Back ESI, Back FID - GC - L (Flow) == 3.00% - L (Ref. Time) == 1.00s	None
April 21, 2023 11:59:17 AM Auct		Data	Injection (Pre-run - Injection Tower, Back ESI, Back FID - GC - L (Flow) == 3.00% - L (Ref. Time) == 1.00s	Data File Path : C:\Users\Public\Documents\Kern\Kern3302\3302-04-21_2023-04-20\OQ_OC-4_2023_2023-04-21_15:07:32\Pre11-0248.D\FID 28.ch
April 21, 2023 11:59:17 AM Auct		Data	Injection (Pre-run - Injection Tower, Back ESI, Back FID - GC - L (Flow) == 3.00% - L (Ref. Time) == 1.00s	Data File Path : C:\Users\Public\Documents\Kern\Kern3302\3302-04-21_2023-04-20\OQ_OC-4_2023_2023-04-21_15:07:32\Pre11-0258.D\FID 28.ch

Page 8/11

Date: April 21, 2023 3:26:36 PM  
System ID: CN11461065

Page 21 / 23

User Name: saengulhalim@  
Hostname: LPTOP-COASHOM

System ID: CN11491008  
Print Date: April 25, 2023 3:26:40 PM

BC-6\_BKK\_END127\_ALS Transaction log

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
April 21, 2023 11:40:17 AM	Auth	QoS	Injection Precision - Injection Tower, Back SSL, Back FID - OC - L (Aver) <= 3.00% - L (Rel. Time) <= 1.00%	Data File Path : C:\Users\Public\Documents\hemidation\Qeios\OC_04-AL8_2023-04-21\QO_04-2023_Fm 2023-04-21 10:37:02\Pr11-4009.D\FID 28.ch
April 21, 2023 11:40:17 AM	Auth	Data	Injection Precision - Injection Tower, Back SSL, Back FID - OC - L (Aver) <= 3.00% - L (Rel. Time) <= 1.00%	Data File Path : C:\Users\Public\Documents\hemidation\Qeios\OC_04-AL8_2023-04-21\QO_04-2023_Fm 2023-04-21 10:37:02\Pr11-4009.D\FID 28.ch
April 21, 2023 11:42:21 AM	Auth	Data	Injection Precision - Injection Tower, Back SSL, Back FID - OC - L (Aver) <= 3.00% - L (Rel. Time) <= 1.00%	Data File Path : C:\Users\Public\Documents\hemidation\Qeios\OC_04-AL8_2023-04-21\QO_04-2023_Fm 2023-04-21 10:37:32\Pr11-4009.D\FID 28.ch
April 21, 2023 11:45:21 AM	Auth	Data	Injection Precision - Injection Tower, Back SSL, Back FID - OC - L (Aver) <= 3.00% - L (Rel. Time) <= 1.00%	Data File Path : C:\Users\Public\Documents\hemidation\Qeios\OC_04-AL8_2023-04-21\QO_04-2023_Fm 2023-04-21 10:37:32\Pr11-4009.D\FID 28.ch
April 21, 2023 11:45:21 AM	End	Execution	Injection Precision - Injection Tower, Back SSL, Back FID - OC - L (Aver) <= 3.00% - L (Rel. Time) <= 1.00%	Run Count : 1
April 21, 2023 11:41:33 AM	Signal	Execution	Signal to Noise - Injection Tower, Back SSL, Back FID - OC - L (Aver) <= 3.00% - L (Rel. Time) <= 1.00%	None

Phone 502.99

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

Page 22 / 22

Uter Nerve: divergent, later  
electronic, later, and later

System Id: CH1140106

GC-8, BKK, FN0127, ALS Transaction fee

Time	Transaction State	Activity/Performance	Type of Transaction	Optimal Information
April 21, 2023 11:42:22 AM	Audit	Data	Signal to Noise - Injection Tower, Back SQL, Back FID - Detector FID - LC = 30000	Data files Path: C:\knowledg\Public\Documents\New\kabin\2023_04_20\QC_ALS_2023-04-20\QC_ALS_2023-04-20_2103-0828.D\FID,DFID2.D, run
April 21, 2023 11:42:58 AM	Env	Execution	Signal to Noise - Injection Tower, Back SQL, Back FID - Detector FID - LC = 30000	Run Count: 1
April 21, 2023 11:42:53 AM	Env	Qualification	Session	OQ
April 21, 2023 11:42:51 AM	Start	Reporting	Session	Name
April 21, 2023 1:20:47 PM	Audit	Acquisition	Session	Name
April 21, 2023 3:16:07 PM	Audit	Acquisition	Session	Name
April 21, 2023 3:16:10 PM	Audit	Session(Retained)	Session	Name
April 21, 2023 3:16:30 PM	Start	Acquisition	Session	OQ
April 21, 2023 3:30:59 PM	Audit	Acquisition	Session	Name
April 21, 2023 3:31:05 PM	Audit	Session(Retained)	Session	Name
April 21, 2023 3:21:07 PM	Start	Qualification	Session	OQ
April 21, 2023 3:23:45 PM	Audit	Reporting	Session	Report Generated

Page 11 / 11

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

Page 23/27

**Sartorius (Thailand) Co., Ltd.**  
129 Rama 9 Road, Huaykwang, Huaykwang, Bangkok 10310  
Tel: +66 2843 8361-6, e-mail: service.thailand@sartorius.com



SARTORIUS

# Certificate of Calibration

REVIEW BY Tranibb  
APPROVED BY D. H.  
NEXT CAL. DATE 02/02/2025

Model Number :	MSU224S-100-DU	Certificate No. :	24BC10073
Description :	Analytical Balance	Issued Date :	Friday, February 23, 2024
Serial Number :	0031709552	Reference No. :	229195
ID No. :	RYG_EN0003		
Manufacturer :	Sartorius	Page No. :	1 of 2

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

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

Calibrated By: Mr.Chonghai Inthana  
Calibration Date: Thursday, February 22, 2024

Calibration  
Procedure No. : This calibration was conducted by  
Using in-house calibration procedure number (WI-003)  
Based on UKAS LAB 14 : 2016

Metrological data: Capacity: 220 g Readability: 0.0001 g Ambient Conditions: Temperature: 23.7°C ± 0.2°C

Reasons for calibration		Humidity :	62.0 % RH	±	10.0 % RH
		Pressure		±	
<input type="checkbox"/> New Installation	<input type="checkbox"/> Service / Repaired	<input checked="" type="checkbox"/> Re-calibration/ Maintenance	Equipment Condition		
			<input type="checkbox"/> Good	<input type="checkbox"/> Poor	<input type="checkbox"/> 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 Metrolological Specifications.

**Traceability:**

Model Number	Description	Traceability	Certificate No.	Due Date
YCS011-622-00	Sartorius weight set 1mg - 5000g E2 YCS011-622-00	TCS	M2308197S	23-Aug-2025
MHB-382SD	Humidity/Barmeter/Temp Lutron MHB-382SD	DKSH	C1923184S	23-Aug-2024

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

SOP FM 33 03 February 2022

Mr. Chonchai Intrathana (Technical Manager)





# Certificate of Calibration

Model Number : MSU224S-100-DU Certificate No. : 248C10073  
Description : Analytical Balance Issued Date : Friday, February 23, 2024  
Serial Number : 0031708552 Reference No. : 229196  
ID No. : RYG\_EN0003  
Manufacturer : Sartorius Page No. : 2 of 2

## Calibration Results : Without Adjustment

Repeatability			Eccentricity (Off-center loading error)		
The repeatability is the ability of a weighing instrument to display nearly identical readings under constant test conditions when the same load within a measurement device 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 readings of the load, i.e. 100 or 10 g 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	200.0001	Nominal value :	100	g
20 g	20.0000	200.0000	Tolerance	0.0004	g
Tolerance	0.0001 g	200.0001			
	20.0000	200.0001			
Nominal Value : (High Load)	20.0000	200.0001			
200 g	19.9999	200.0001			
Tolerance	0.0001 g	200.0000			
	20.0000	200.0000			
Standard Deviation	0.00005	0.00005			
	0.00005	0.00005			

Linearity				
The linearity, also called linearity error, describes the deviation of the characteristic curve of a weighing instrument from the linear slope.				
Tolerance: 0.0002 g				
Nominal Value (g)	Conventional Mass Value (g)	Displayed Value (g)	Deviation (g)	Uncertainty (g)
0.01	0.0100	0.0100	0.0000	0.00013
0.1	0.1000	0.1000	0.0000	0.00013
0.5	0.5000	0.5000	0.0000	0.00013
1	1.0000	1.0000	0.0000	0.00013
5	5.0000	5.0000	0.0000	0.00013
10	10.0000	10.0000	0.0000	0.00013
20	20.0000	20.0000	0.0000	0.00013
50	50.0000	50.0000	0.0000	0.00024
100	100.0000	99.9999	-0.0001	0.00018
200	200.0000	199.9999	-0.0001	0.00029
End of Report				

SOP FM 33 03 February 2022



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

issues

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

## CERTIFICATE OF ACCREDITATION

No. 73/2022

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

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

Scope of accreditation:

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

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

ČSN EN ISO/IEC 17025:2018

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

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

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

Prague: 14. 2. 2022



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

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

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

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

### Testing laboratory Workplaces:

- |    |                      |  |
|----|----------------------|--|
| 1  | Prague               | Na Harfě 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 Zdymské 827, 410 02 Lovosice                         |
| 8  | Rožnov pod Radhoštěm | 1. Máje 823, budova C6,<br>756 61 Rožnov pod Radhoštěm |
| 9  | Kroměříž             | Kotojedská 2588/91, 767 01 Kroměříž                    |
| 10 | Prague               | Na Harfě 916/9a, 190 00 Praha 9                        |
| 11 | Prague               | Kolbenova 942/38a, 190 00 Praha 9                      |
| 12 | Liberec              | Jugoslávská 11, 460 07 Liberec                         |

The Laboratory has a flexible scope of accreditation permitted as detailed in the Annex.

Updated list of activities provided within the required flexible scope of accreditation is available on the laboratory website [www.alsglobal.cz](http://www.alsglobal.cz) or at the Quality Manager.

The Laboratory provides expert opinions and interprets test results.

The Laboratory is qualified to carry out independent sampling.

### Tests:

Ordinal number <sup>1</sup>	Test procedure/method name	Test procedure/method identification <sup>2</sup>	Subject of the test
1	General Chemistry		
1.1 <sup>1</sup>	Determination of elements <sup>41</sup> by atomic emission spectrometry with inductively coupled plasma and stoichiometric calculations of compounds concentration from measured values <sup>53</sup> including the calculation of total mineralization and calculating the sum of Ca+Mg	CZ_SOP_D06_02_001 (US EPA 200.7, ČSN EN ISO 11885, US EPA 6010, SM 3120, ČSN 75 7358)	Water <sup>61</sup> , extracts <sup>62</sup> , liquid samples <sup>63</sup>
1.2 <sup>1</sup>	Determination of elements <sup>41</sup> by atomic emission spectrometry with inductively coupled plasma and stoichiometric calculations of compounds concentration from measured values <sup>53</sup>	CZ_SOP_D06_02_001 (US EPA 200.7, ČSN EN ISO 11885, US EPA 6010, SM 3120)	Solid samples <sup>65</sup> , building materials <sup>62</sup> , materials for building <sup>69</sup>
1.3 <sup>1</sup>	Determination of elements <sup>41</sup> by atomic emission spectrometry with inductively coupled plasma and stoichiometric calculations of compounds concentration from measured values <sup>53</sup>	CZ_SOP_D06_04_001 (US EPA 200.7, ČSN EN ISO 11885)	Food, feed <sup>63</sup>
1.4 <sup>1</sup>	Determination of elements <sup>41</sup> by atomic emission spectrometry with inductively coupled plasma and stoichiometric calculations of compounds concentration from measured values <sup>53</sup>	CZ_SOP_D06_04_001 (US EPA 200.7, ČSN EN ISO 11885)	Biological materials <sup>77</sup>

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

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

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

Ordinal number <sup>1</sup>	Test procedure/method name	Test procedure/method identification <sup>2</sup>	Subject of the test
1.5 <sup>1</sup>	Determination of elements <sup>47</sup> by atomic emission spectrometry with inductively coupled plasma and calculation of Cr <sup>3+</sup> from measured values	CZ_SOP_D06_02_001 (US EPA 200.7, ČSN EN ISO 11885, ČSN EN 13211, ČSN EN 14385, ČSN EN 14902, IO 3.4, US EPA 29)	Emission <sup>78</sup> , imission <sup>79</sup>
1.6 <sup>1</sup>	Determination of elements <sup>47</sup> by atomic emission spectrometry with inductively coupled plasma	CZ_SOP_D06_04_001 (US EPA 200.7, ČSN EN ISO 11885, CL/PhEur/USP)	Pharmaceutical material
1.7 <sup>1</sup>	Determination of elements <sup>41</sup> by mass spectrometry with inductively coupled plasma and stoichiometric calculations of compounds concentration from measured values <sup>53</sup> including the calculation of total mineralization and calculating the sum of Ca+Mg	CZ_SOP_D06_02_002 (US EPA 200.8, ČSN EN ISO 17294-2, US EPA 6020A, ČSN 75 7358)	Water <sup>61</sup> , extracts <sup>62</sup> , liquid samples <sup>63</sup>
1.8 <sup>1</sup>	Determination of elements <sup>41</sup> by mass spectrometry with inductively coupled plasma and stoichiometric calculations of compounds concentration from measured values	CZ_SOP_D06_02_002 (US EPA 200.8, ČSN EN ISO 17294-2, US EPA 6020A)	Solid samples <sup>65</sup> , building materials <sup>62</sup> , materials for building <sup>69</sup>
1.9 <sup>1</sup>	Determination of elements <sup>41</sup> by mass spectrometry with inductively coupled plasma and stoichiometric calculations of compounds concentration from measured values	CZ_SOP_D06_04_002 (US EPA 200.8, ČSN EN ISO 17294-2, ČSN EN 15111)	Food, feed <sup>63</sup>
1.10 <sup>1</sup>	Determination of elements <sup>41</sup> by mass spectrometry with inductively coupled plasma and stoichiometric calculations of compounds concentration from measured values	CZ_SOP_D06_04_002 (US EPA 200.8, ČSN EN ISO 17294-2)	Biological materials <sup>77</sup>
1.11 <sup>1</sup>	Determination of elements <sup>41</sup> by mass spectrometry with inductively coupled plasma and calculation of Cr <sup>3+</sup> from measured values	CZ_SOP_D06_02_002 (US EPA 200.8, ČSN EN ISO 17294-2, ČSN EN 13211, ČSN EN 14385, ČSN EN 14902, US EPA 29)	Emission <sup>78</sup> , imission <sup>79</sup>
1.12 <sup>1</sup>	Determination of elements <sup>40</sup> by mass spectrometry with inductively coupled plasma	CZ_SOP_D06_04_002 (US EPA 200.8, ČSN EN ISO 17294-2, ČSN EN 15111, CL/PhEur/USP)	Pharmaceutical material
1.13 <sup>1</sup>	Determination of Hg by atomic absorption spectrometry	CZ_SOP_D06_02_003 (ČSN 46 5735, ČSN 75 7440)	Emission <sup>78</sup> , imission <sup>79</sup>
1.14 <sup>2</sup>	Determination of Hg by single-purpose atomic absorption spectrometer	CZ_SOP_D06_07_004 (ČSN 75 7440, ČSN 46 5735)	Water <sup>61</sup> , extracts <sup>62</sup> , liquid samples <sup>63</sup> , solid samples <sup>65</sup>
1.15 <sup>2</sup>	Determination of elements <sup>49</sup> by flame AAS method and stoichiometric calculations of compounds concentration from measured values	CZ_SOP_D06_07_005 (ČSN ISO 8288, ČSN 75 7400, ČSN EN 1233)	Water <sup>61</sup> , extracts <sup>62</sup> , liquid samples <sup>63</sup>

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

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

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

Ordinal number <sup>1</sup>	Test procedure/method name	Test procedure/method identification <sup>2</sup>	Subject of the test
		ČSN ISO 7980, ČSN ISO 9964, Perkin-Elmer specifications)	
1.16 <sup>2</sup>	Determination of elements <sup>49</sup> by flame AAS method and stoichiometric calculations of compounds concentration from measured values	CZ_SOP_D06_07_005 (ČSN ISO 8288, ČSN 75 7400, ČSN EN 1233, ČSN ISO 7980, ČSN ISO 9964, Perkin-Elmer specifications)	Solid samples <sup>45</sup>
1.17 <sup>2</sup>	Determination of elements <sup>49</sup> by atomic emission spectrometry with inductively coupled plasma and stoichiometric calculations of compounds concentration from measured values	CZ_SOP_D06_07_006 (ČSN EN ISO 11885, ATIM3-0032)	Water <sup>91</sup> , extracts <sup>92</sup> , liquid samples <sup>41</sup>
1.18 <sup>2</sup>	Determination of elements <sup>49</sup> by atomic emission spectrometry with inductively coupled plasma and stoichiometric calculations of compounds concentration from measured values	CZ_SOP_D06_07_006 (ČSN EN ISO 11885, ČSN EN 15410, ČSN EN 15411)	Solid samples <sup>45</sup> , solid recovered fuels
1.19 <sup>2</sup>	Determination of Kjeldahl nitrogen by spectrophotometry	CZ_SOP_D06_07_007.A (ČSN EN 25663, ČSN ISO 7150-1)	Water <sup>91</sup> , extracts <sup>92</sup>
1.20 <sup>2</sup>	Determination of Kjeldahl nitrogen by spectrophotometry	CZ_SOP_D06_07_007.B (ČSN EN 25663, ČSN EN 13342, ČSN ISO 7150-1)	Solid samples <sup>45</sup>
1.21 <sup>2</sup>	Determination of Cr <sup>VI</sup> by spectrophotometry with diphenylcarbazide	CZ_SOP_D06_07_008 (ČSN ISO 11083)	Water <sup>91</sup> , extracts <sup>92</sup> , absorption solutions from emission samples
1.22 <sup>2</sup>	Determination of total phosphorus and orthophosphate by spectrophotometry and calculation of P <sub>2</sub> O <sub>5</sub> from measured values	CZ_SOP_D06_07_009.A (ČSN EN ISO 6878)	Water <sup>91</sup> , extracts <sup>92</sup>
1.23 <sup>2</sup>	Determination of total phosphorus by spectrophotometry and calculation of P <sub>2</sub> O <sub>5</sub> from measured values	CZ_SOP_D06_07_009.B (ČSN EN 14672, ČSN EN ISO 6878)	Sludge, technological sludge products
1.24 – 1.28	Reserved		
1.29 <sup>2</sup>	Determination of nonionic surfactants (BiAS) by spectrophotometry using the HACH cuvette test	CZ_SOP_D06_07_014 (Hach Instruction)	Water <sup>91</sup> , extracts <sup>92</sup>
1.30 <sup>2</sup>	Determination of sum of sulfane and sulfide by spectrophotometry and calculation of free sulfane from measured values	CZ_SOP_D06_07_015.A (ČSN 83 0520-16:1978, ČSN 83 0530-31:1980 SM 4500-S <sup>2</sup> -D)	Water <sup>91</sup> , extracts <sup>92</sup>
1.31 <sup>2</sup>	Determination of sum of sulfane and sulfide by spectrophotometry	CZ_SOP_D06_07_015.B (ČSN 83 0520-16:1978, ČSN 83 0530-31:1980)	Solid samples <sup>45</sup> , building materials <sup>42</sup> , materials for building <sup>49</sup>
1.32 <sup>2</sup>	Determination of sum of sulfane and sulfide by spectrophotometry	CZ_SOP_D06_07_015.C (ČSN 83 0520-16:1978, ČSN 83 0530-31:1980, ČSN 83 4712 No. 3)	Absorption solutions from emission samples

Page 3 of 45

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

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

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

Ordinal number <sup>1</sup>	Test procedure/method name	Test procedure/method identification <sup>2</sup>	Subject of the test
1.33 <sup>1</sup>	Determination of sulfate by turbidimetry using discrete spectrophotometry and calculation of sulfate sulfur from measured values	CZ_SOP_D06_02_016 (US EPA 375.4, SM 4500-SO <sub>4</sub> <sup>2-</sup> )	Water <sup>91</sup> , extracts <sup>92</sup>
1.34 <sup>2</sup>	Determination of nitrite sum and sum of nitrite and nitrate nitrogen by discrete spectrophotometry and calculation of nitrites and nitrates from measured values	CZ_SOP_D06_02_019 (ČSN EN ISO 11732, ČSN EN ISO 13395, SM 4500-NO <sub>2</sub> <sup>-</sup> , SM 4500-NO <sub>3</sub> <sup>-</sup> )	Liquid samples
1.35 <sup>1</sup>	Determination of the number of asbestos and mineral fibers by SEM / EDS	CZ_SOP_D06_02_018 (ISO 14966, except chap. 5, 6.1 and 6.2, VDI 3492, except chap. 5 and 6, Decree No. 6/2003 Coll., Government Decree No. 361/2007 Coll., Annex No. 3)	Outdoor and indoor air, working environment - exposed filters
1.36 <sup>1</sup>	Determination of sum of ammonium and ammonium ions, nitrite and the sum of nitrite and nitrate ions by discrete spectrophotometry and calculation of nitrite, nitrate, ammonia, inorganic, organic, total nitrogen, free ammonia, and dissociated ammonium ions from measured values including the calculation of total mineralization	CZ_SOP_D06_02_019 (ČSN EN ISO 11732, ČSN EN ISO 13395, SM 4500-NO <sub>2</sub> <sup>-</sup> , SM 4500-NO <sub>3</sub> <sup>-</sup> )	Water <sup>91</sup> , extracts <sup>92</sup>
1.37 <sup>2</sup>	Determination of sum of ammonia and ammonium ions by spectrophotometry and calculation of ammonia nitrogen, free ammonia, and dissociated ammonium ions from measured values	CZ_SOP_D06_07_020 (ČSN ISO 7150-1, ČSN EN ISO 21877)	Water <sup>91</sup> , extracts <sup>92</sup> , liquid samples <sup>41</sup> , absorption solutions from emission samples
1.38 <sup>2</sup>	Determination of nitrite nitrogen by spectrophotometry and calculation of nitrite from measured values	CZ_SOP_D06_07_021 (ČSN EN 26777)	Water <sup>91</sup> , extracts <sup>92</sup>
1.39 <sup>1</sup>	Determination of orthophosphate by discrete spectrophotometry and calculation of orthophosphate phosphorus from measured values including the calculation of total mineralization	CZ_SOP_D06_02_022 (ČSN EN ISO 6878, SM 4500-P)	Water <sup>91</sup> , extracts <sup>92</sup>
1.40 <sup>2</sup>	Determination of chloride by potentiometric titration	CZ_SOP_D06_07_023.A (ČSN 03 8526:1989, ČSN 83 0530-20:1980, SM 4500-Cl <sup>-</sup> D)	Water <sup>91</sup> , extracts <sup>92</sup> , liquid samples <sup>41</sup>
1.41 <sup>2</sup>	Determination of chloride by potentiometric titration and calculation of NaCl from measured values	CZ_SOP_D06_07_023.B (ČSN EN 480-10)	Solid samples <sup>45</sup> , building materials <sup>42</sup> , materials for building <sup>49</sup>
1.42 <sup>1</sup>	Determination of Hg by atomic absorption spectrometry	CZ_SOP_D06_04_024 (ČSN 46 5735, ČSN 75 7440, Cl/PhEur/USP)	Food, feed <sup>41</sup> , biological materials <sup>47</sup> , Pharmaceutical materials
1.43 <sup>2</sup>	Determination of extractable organically bound halogens (EOX) by coulometry	CZ_SOP_D06_07_025.A (DIN 38409-H8, DIN 38414-S17)	Water <sup>91</sup> , extracts <sup>92</sup>

Page 4 of 45

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

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

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

Ordinal number <sup>1</sup>	Test procedure/method name	Test procedure/method identification <sup>2</sup>	Subject of the test
1.44 <sup>2</sup>	Determination of extractable organically bound halogens (EOX) by coulometry	CZ_SOP_D06_07_025.B (DIN 38409-H8, DIN 38414-S17)	Solid samples <sup>45</sup>
1.45 <sup>2</sup>	Determination of adsorbable organically bound halogens (AOX by coulometry)	CZ_SOP_D06_07_026 (ČSN EN 16166, DIN 38414-S18)	Solid samples <sup>45</sup>
1.46 <sup>2</sup>	Determination of total halogens (TX) by coulometry	CZ_SOP_D06_07_027 (US EPA 9076)	Solid samples <sup>45</sup> , oils, organic solvents
1.47 <sup>2</sup>	Determination of adsorbable organically bound halogens (AOX by coulometry)	CZ_SOP_D06_07_028 (ČSN EN ISO 9562, TNI 757531)	Water <sup>91</sup> , extracts <sup>92</sup>
1.48 <sup>2</sup>	Determination of phenol index by spectrophotometric method after distillation	CZ_SOP_D06_07_029 (ČSN ISO 6439)	Solid samples <sup>45</sup>
1.49	Reserved		
1.50 <sup>2</sup>	Determination of anionic surfactants by measurement of the methylene blue index (MBAS) by spectrophotometry	CZ_SOP_D06_07_031 (ČSN EN 903, SM 5540 C)	Water <sup>91</sup> , extracts <sup>92</sup>
1.51 <sup>2</sup>	Determination of absorbance and transmittance by spectrophotometry	CZ_SOP_D06_07_032 (ČSN 75 7360)	Water <sup>91</sup> , extracts <sup>92</sup>
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 <sup>91</sup>
1.53 <sup>2</sup>	Determination of humic substances by spectrophotometry	CZ_SOP_D06_07_034 (ČSN 75 7536)	Drinking, raw, surface, ground water
1.54 <sup>2</sup>	Determination of water colour by spectrophotometric method	CZ_SOP_D06_07_035 (ČSN EN ISO 7887)	Water <sup>91</sup> , extracts <sup>92</sup>
1.55 <sup>2</sup>	Determination of electrical conductivity	CZ_SOP_D06_07_036 (ČSN EN 27888)	Water <sup>91</sup> , extracts <sup>92</sup> , liquid samples <sup>41</sup>
1.56 <sup>2</sup>	Determination of pH electrochemically	CZ_SOP_D06_07_037 (ČSN ISO 10523)	Water <sup>91</sup> , extracts <sup>92</sup> , liquid samples <sup>41</sup>
1.57 <sup>2</sup>	Biodegradation of organic compounds in aqueous medium – Static test (Zahn-Wellens method) calculated from the measured values of COD <sub>Cr</sub>	CZ_SOP_D06_07_038 (ČSN EN ISO 9888, OECD 302B, with COD <sub>Cr</sub> determination according to CZ_SOP_D06_07_040)	Chemicals and chemical products, water <sup>91</sup> and waste leachate <sup>92</sup>
1.58	Reserved		
1.59 <sup>2</sup>	Determination of chemical oxygen demand using dichromate (COD <sub>Cr</sub> ) by titration	CZ_SOP_D06_07_040 (ČSN ISO 6060)	Water <sup>91</sup> , extracts <sup>92</sup>
1.60	Reserved		
1.61 <sup>2</sup>	Determination of analytical water and gross water by gravimetry and calculation of total water from measured values	CZ_SOP_D06_07_041 (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		

Page 5 of 45

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

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

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

Ordinal number <sup>1</sup>	Test procedure/method name	Test procedure/method identification <sup>2</sup>	Subject of the test
1.64 <sup>1</sup>	Determination of dissolved oxygen (in the laboratory) by electrochemical method with optical sensor	CZ_SOP_D06_02_043 (ČSN ISO 17289)	Water <sup>91</sup>
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 <sup>91</sup>
1.66 <sup>1,3</sup>	Determination of dry matter by gravimetry and calculation of moisture from measured values	CZ_SOP_D06_01_045 (ČSN ISO 11465, ČSN EN 12880, ČSN EN 14346:2007)	Solid samples <sup>45</sup>
1.67 <sup>2</sup>	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 <sup>45</sup>
1.68 <sup>2</sup>	Determination of ash by gravimetry and calculation of loss on ignition from measured values	CZ_SOP_D06_07_047.A (ČSN EN 15169, ČSN EN 15935, ČSN EN 13039, ČSN 72 0103, ČSN 46 5735)	Solid samples <sup>45</sup> , silicate materials
1.69	Reserved		
1.70 <sup>2</sup>	Determination of ash by gravimetry and calculation of loss on ignition from measured values	CZ_SOP_D06_07_047.C (ČSN ISO 1171, ČSN EN ISO 18122, ČSN EN ISO 21656, ČSN EN ISO 6245)	Solid and liquid fuels
1.71 <sup>1</sup>	Qualitative determination of asbestos by SEM/EDS	CZ_SOP_D06_02_048 (ISO 22262-1, VDI 3866, Part 5, DM06/09/94 GU n° 288 10/12/1994 All. 1 Met. B – quantitative determination)	Solid samples <sup>45</sup> (except liquid waste, biowaste) building materials <sup>49</sup> , materials for building <sup>42</sup>
1.72 <sup>1</sup>	Qualitative determination of asbestos by SEM/EDS	CZ_SOP_D06_02_049 (VDI 3866, Part 5, DM 06/09/94 GU n° 288 10/12/1994 All. 1 Met. B.)	Solid samples <sup>45</sup> (except liquid waste, biowaste) building materials <sup>49</sup> , materials for building <sup>42</sup>
1.73 <sup>2</sup>	Determination of water content by Karl Fischer method	CZ_SOP_D06_07_050 (ČSN ISO 760)	Liquid samples <sup>41</sup> , solid samples <sup>45</sup>
1.74	Reserved		
1.75 <sup>2</sup>	Determination of suspended solids, fixed suspended solids, total solids and fixed total solids by gravimetry and calculation of volatile suspended solids and volatile total solids from measured values	CZ_SOP_D06_07_052 (ČSN 75 7350, SM 2540 B, SM 2540 D, SM 2540 E)	Water <sup>91</sup> , extracts <sup>92</sup>
1.76 <sup>2</sup>	Determination of suspended solids using glass fibre filters by gravimetry	CZ_SOP_D06_07_053 (ČSN EN 872)	Water <sup>91</sup> , extracts <sup>92</sup>
1.77 <sup>2</sup>	Determination of dissolved solids (RL105) and fixed dissolved solids (RAS) using glass fibre filters by gravimetry and calculation of volatile dissolved solids from measured values	CZ_SOP_D06_07_054 (ČSN 75 7346, ČSN 75 7347)	Water <sup>91</sup> , extracts <sup>92</sup>

Page 6 of 45

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

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

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

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

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

Ordinal number <sup>1</sup>	Test procedure/method name	Test procedure/method identification <sup>2</sup>	Subject of the test
1.88 <sup>1</sup>	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 <sup>2</sup>	Determination of phenols by continuous flow analysis (CFA) method spectrophotometrically	CZ_SOP_D06_07_066 (ČSN EN ISO 14402, SKALAR Company methodology)	Water <sup>91</sup> , extracts <sup>92</sup> , absorption solution from emission sampling
1.90 <sup>2</sup>	Determination of anionic surfactants by methylene blue (MBAS) by continuous flow analysis (CFA) method spectrophotometrically	CZ_SOP_D06_07_067 (ČSN ISO 16265, SKALAR Company methodology, ČSN EN 903)	Water <sup>91</sup> , extracts <sup>92</sup>
1.91 <sup>1</sup>	Determination of dissolved fluoride, chloride, nitrite, bromide, nitrate and sulphate by ion liquid chromatography and calculation of nitrite nitrogen and nitrate nitrogen and sulphate sulphur from measured values including the calculation of total mineralization	CZ_SOP_D06_02_068 (ČSN EN ISO 10304-1)	Water <sup>91</sup> , extracts <sup>92</sup>
1.92	Reserved		
1.93 <sup>1</sup>	Determination of dry suspended solids and annealed suspend solids by gravimetry and calculation of loss of ignition of suspend solids and total solids from measured values	CZ_SOP_D06_02_070 (ČSN EN 872, ČSN 757350, SM 2540 D, SM 2540 E)	Water <sup>91</sup> , extracts <sup>92</sup>
1.94 <sup>1</sup>	Determination of dissolved solids (RL) and dissolved solid annealed (RAS) using glass fibre filters by gravimetry and calculation of loss on ignition of dissolved solids (RL550) from measured values	CZ_SOP_D06_02_071 (ČSN 75 7346, ČSN 757347, ČSN EN 15216, SM 2540 C, SM 2540 E)	Water <sup>91</sup> , extracts <sup>92</sup>
1.95 <sup>1</sup>	Determination of acid neutralizing capacity (alkalinity) by potentiometric titration and calculation of the carbonate hardness and CO <sub>2</sub> forms from measured values including the calculation of total mineralization	CZ_SOP_D06_02_072 (ČSN EN ISO 9963-1, ČSN EN ISO 9963-2, ČSN 75 7373, SM 2320)	Water <sup>91</sup> , extracts <sup>92</sup>
1.96 <sup>1</sup>	Determination of base neutralizing capacity (acidity) by potentiometric titration	CZ_SOP_D06_02_073 (ČSN 75 7372)	Water <sup>91</sup> , extracts <sup>92</sup>
1.97 <sup>1</sup>	Determination of turbidity by optical turbidimeter	CZ_SOP_D06_02_074 (ČSN EN ISO 7027-1)	Water <sup>91</sup> , extracts <sup>92</sup>
1.98 <sup>1</sup>	Determination of electrical conductivity by conductometer and calculation of salinity	CZ_SOP_D06_02_075 (ČSN EN 27888, SM 2520 B)	Water <sup>91</sup> , extracts <sup>92</sup> , liquid samples <sup>89</sup>
1.99 <sup>1</sup>	Determination of chemical oxygen demand using dichromate (COD <sub>Cr</sub> ) by photometry	CZ_SOP_D06_02_076 (ČSN ISO 15705)	Water <sup>91</sup> , extracts <sup>92</sup>
1.100	Reserved		
1.101 <sup>1</sup>	Determination of biochemical oxygen demand electrochemically after n days (BOD <sub>n</sub> ) by dilution method with allylthiourea addition	CZ_SOP_D06_02_077 (ČSN EN ISO 5815-1)	Water <sup>91</sup> , extracts <sup>92</sup>
1.102 <sup>1</sup>	Determination of biochemical oxygen demand electrochemically after n days (BOD <sub>n</sub> ) by method for undiluted samples	CZ_SOP_D06_02_078 (ČSN EN 1899-2, ISO 5815-2)	Water <sup>91</sup> , extracts <sup>92</sup>

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

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

Ordinal number <sup>1</sup>	Test procedure/method name	Test procedure/method identification <sup>2</sup>	Subject of the test
1.103 <sup>1</sup>	Determination of colour by spectrophotometry	CZ_SOP_D06_02_079 (ČSN EN ISO 7887)	Water <sup>91</sup> , extracts <sup>92</sup>
1.104 <sup>1</sup>	Determination of total phosphorus by discrete spectrophotometry and calculation of phosphorus as P <sub>2</sub> O <sub>5</sub> and PO <sub>4</sub> <sup>3-</sup> from measured values	CZ_SOP_D06_02_080 (ČSN EN ISO 6878, ČSN EN ISO 15681-1)	Water <sup>91</sup> , extracts <sup>92</sup>
1.105 <sup>1</sup>	Determination of total nitrogen by discrete spectrophotometry after mineralization with peroxisulphate	CZ_SOP_D06_02_081 (ČSN EN ISO 11905-1)	Water <sup>91</sup> , extracts <sup>92</sup>
1.106 <sup>2</sup>	Determination of chloride in absorption solution from emission sample of inorganic compounds of chlorine by potentiometric titration and calculation of hydrogen chloride from measured values	CZ_SOP_D06_07_082 (ČSN EN 1911)	Absorption solutions from emission sampling
1.107 <sup>2</sup>	Determination of fluoride in absorption solution from emission sample of inorganic compounds of fluorine after separation by distillation by direct potentiometry and calculation of hydrogen fluoride from measured values	CZ_SOP_D06_07_083 (ČSN 83 4752-3:1989)	Absorption solutions from emission sampling
1.108	Reserved		
1.109 <sup>2</sup>	Determination of ammonia in absorption solution from emission sample by photometry after distillation	CZ_SOP_D06_07_085 (ČSN 83 4728-4)	Absorption solutions from emission sampling
1.110 <sup>1</sup>	Determination of total solids by gravimetry	CZ_SOP_D06_02_086 (ČSN 75 7346, ČSN 757347, ČSN EN 872, SM 2540 B, C, D)	Water <sup>91</sup>
1.111 <sup>2</sup>	Determination of pH, temperature and electrical conductivity in extracts prepared by a bottom-up percolation test (under specific conditions)	CZ_SOP_D06_07_087 (ČSN EN 14405, ČSN ISO 10523, ČSN 75 7342, ČSN EN 27888)	Solid samples <sup>85</sup>
1.112 <sup>1,2</sup>	Determination of pH, temperature and electrical conductivity in extracts prepared by a two-stage batch test (under specific conditions)	CZ_SOP_D06_07_088 (ČSN EN 12457-3, ČSN ISO 10523, ČSN 75 7342, ČSN EN 27888)	Solid samples <sup>85</sup>
1.113 <sup>1</sup>	Determination of total cyanide by spectrophotometry and calculation of complex-forming cyanides from measured values	CZ_SOP_D06_02_089.A (ČSN 75 7415, ČSN EN ISO 14403-2)	Water <sup>91</sup> , extracts <sup>92</sup> , absorption solutions from emission sampling
1.114 <sup>1</sup>	Determination of total cyanide by spectrophotometry and calculation of complex-forming cyanides from measured values	CZ_SOP_D06_02_089.B (ČSN 75 7415, ČSN EN ISO 17380, ČSN EN ISO 14403-2, SM 4500 CN)	Solid samples <sup>85</sup> , building materials <sup>82</sup> , materials for building <sup>89</sup>
1.115 <sup>1</sup>	Determination of easily releasable cyanide (free cyanide) and cyanide dissociated by weak acid by spectrophotometry	CZ_SOP_D06_02_090.A (ČSN ISO 6703-2, ČSN EN ISO 14403-2, SM 4500 CN)	Water <sup>91</sup> , extracts <sup>92</sup>

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

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

Ordinal number <sup>1</sup>	Test procedure/method name	Test procedure/method identification <sup>2</sup>	Subject of the test
1.116 <sup>1</sup>	Determination of easily releasable cyanide (free cyanide) and cyanide dissociated by weak acid by spectrophotometry	CZ_SOP_D06_02_090.B (ČSN 75 7415, ČSN EN ISO 17380, ČSN EN ISO 14403-2, SM 4500 CN)	Solid samples <sup>85</sup> , building materials <sup>82</sup> , materials for building <sup>89</sup>
1.117 <sup>1</sup>	Determination of fluorides by electrochemical method (ISE)	CZ_SOP_D06_02_091 (ČSN ISO 10359-1)	Water <sup>91</sup> , extracts <sup>92</sup>
1.118 <sup>1</sup>	Determination of chemical oxygen demand using permanganate (COD <sub>Mn</sub> ) by titration	CZ_SOP_D06_02_092 (ČSN EN ISO 8467)	Water <sup>91</sup> , extracts <sup>92</sup>
1.119 <sup>1</sup>	Determination of bound nitrogen (TNb), following oxidation to nitrogen oxides by chemiluminescent detection	CZ_SOP_D06_02_094.A (ČSN EN 12260)	Water <sup>91</sup> , extracts <sup>92</sup>
1.120 <sup>1</sup>	Determination of bound nitrogen (TNb) following oxidation to nitrogen oxides by IR detection	CZ_SOP_D06_02_094.B (ČSN EN 12260)	Water <sup>91</sup> , extracts <sup>92</sup>
1.121 <sup>1</sup>	Qualitative determination of asbestos fibre by polarization microscope	CZ_SOP_D06_02_095 (NIOSH 9002)	Solid samples <sup>85</sup> , (except liquid waste, biowaste), building materials <sup>89</sup> , materials for building <sup>82</sup>
1.122 <sup>1</sup>	Determination of mercury by fluorescence spectrometry	CZ_SOP_D06_02_096 (US EPA 245.7, ČSN EN ISO 17852)	Water <sup>91</sup> , extracts <sup>92</sup>
1.123 <sup>1</sup>	Determination of mercury by fluorescence spectrometry	CZ_SOP_D06_02_096 (ČSN EN ISO 17852, PSA Application Note 025, ISO 16772:2004)	Solid samples <sup>85</sup> , building materials <sup>82</sup> , materials for building <sup>89</sup>
1.124	Reserved		
1.125 <sup>1</sup>	Determination of mercury by fluorescence spectrometry	CZ_SOP_D06_02_096 (ČSN EN ISO 17852, ČSN EN 13211, ČSN EN ISO 12846)	Emission <sup>78</sup> , imission <sup>79</sup>
1.126 – 1.127	Reserved		
1.128 <sup>1</sup>	Determination of dissolved bromate, chlorate and chlorite by ion liquid chromatography method and calculation of the sum of chlorate and chlorite from measured values	CZ_SOP_D06_02_098 (ČSN EN ISO 15061, ČSN EN ISO 10304-4)	Water <sup>91</sup> , extracts <sup>92</sup>
1.129 <sup>1</sup>	Determination of chloride by discrete spectrophotometry	CZ_SOP_D06_02_099 (US EPA 325.1, SM 4500-Cl <sup>-</sup> )	Water <sup>91</sup> , extracts <sup>92</sup>
1.130 <sup>1</sup>	Determination of extractive substances by gravimetry	CZ_SOP_D06_02_100 (ČSN 75 7508, SM 5520B)	Water <sup>91</sup>
1.131 <sup>2</sup>	Determination of reactive and non-labile aluminium by continuous flow analysis (CFA) spectrophotometrically and calculation of labile aluminium from measured values	CZ_SOP_D06_07_101 (SKALAR Company method)	Drinking, surface water
1.132 <sup>2</sup>	Determination of total nitrogen by modified Kjeldahl method by spectrophotometry	CZ_SOP_D06_07_102 (ČSN ISO 11261)	Solid samples <sup>85</sup>



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 Harřě 336/9, 190 00 Praha 9 - Vysočany

Ordinal number <sup>1</sup>	Test procedure/method name	Test procedure/method identification <sup>2</sup>	Subject of the test
1.133* 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 <sup>91</sup>
1.134 <sup>1</sup>	Determination of grease and oils by gravimetry (extraction after evaporation)	CZ_SOP_D06_02_104 (ČSN 75 7509)	Water <sup>91</sup>
1.135 <sup>1</sup>	Determination of pH by potentiometry	CZ_SOP_D06_02_105 (ČSN ISO 10523, US EPA 150.1, SM 4500-H-B)	Water <sup>91</sup> , extracts <sup>92</sup> , liquid samples <sup>81</sup>
1.136	Reserved		
1.137 <sup>2</sup>	Determination of total nitrogen by modified Kjeldahl method by spectrophotometry	CZ_SOP_D06_07_107 (ČSN EN 25663, ČSN ISO 7150-1, SFS 5505)	Water <sup>91</sup> , extracts <sup>92</sup>
1.138 <sup>1</sup>	Determination of settleable solids by volumetry	CZ_SOP_D06_02_108 (SM 2540 F)	Water <sup>91</sup> , extracts <sup>92</sup>
1.139 <sup>1</sup>	Determination of dissolved silicates by discrete photometry and calculation of H <sub>2</sub> SiO <sub>3</sub> and total mineralization from measured values	CZ_SOP_D06_02_109 (ČSN EN ISO 16264, US EPA 370.1)	Water <sup>91</sup> , extracts <sup>92</sup>
1.140 <sup>1</sup>	Determination of chlorophyll by spectrophotometry	CZ_SOP_D06_02_110 (SM 10200 H)	Surface waters <sup>87</sup>
1.141	Reserved		
1.142 <sup>2</sup>	Determination of phosphorus soluble in sodium hydrogen carbonate solution spectrophotometrically	CZ_SOP_D06_07_112 (ČSN ISO 11263)	Solid samples <sup>85</sup>
1.143 <sup>2</sup>	Determination of pH electrochemically in a suspension in water, KCl, CaCl <sub>2</sub> , BaCl <sub>2</sub>	CZ_SOP_D06_07_113 (ČSN ISO 10390, ČSN EN 12176:1999, ČSN EN 13037, ČSN EN 15933, ČSN 46 5735, ÖNORM L 1086-1, US EPA 9045D; US EPA 9040C)	Solid samples <sup>85</sup> , building materials <sup>82</sup> , materials for building <sup>89</sup>
1.144 <sup>2</sup>	Determination of formaldehyde by spectrophotometry	CZ_SOP_D06_07_114 (Chemical and physical methods of water analysis, SNTL Prague 1989)	Water <sup>91</sup> , extracts <sup>92</sup>
1.145	Reserved		
1.146 <sup>2</sup>	Determination of iron(II) by spectrophotometry	CZ_SOP_D06_07_116 (ČSN ISO 6332)	Water <sup>91</sup> , extracts <sup>92</sup>
1.147 <sup>2</sup>	Determination of total carbon (TC), total organic carbon (TOC) by the combustion method with IR detection and calculation of total inorganic carbon (TIC), carbonates and organic matter from measured values	CZ_SOP_D06_07_117 (Elementar Company methodology, ČSN ISO 10694, ČSN EN 13137:2002, ČSN EN 15936)	Solid samples <sup>85</sup> , building materials <sup>82</sup> , materials for building <sup>89</sup>
1.148 <sup>2</sup>	Determination of permeability by falling head	CZ_SOP_D06_07_118 (ČSN EN ISO 17892-11, chap. 5.2.2.3)	Soil
1.149 <sup>1</sup>	Determination of aggressive carbon dioxide by the Heyer's method using calculation from alkalinity	CZ_SOP_D06_02_119 (ČSN 83 0530-14:2000)	Water <sup>91</sup>

Page 11 of 45

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

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

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

Ordinal number <sup>1</sup>	Test procedure/method name	Test procedure/method identification <sup>2</sup>	Subject of the test
1.150 <sup>2</sup>	Determination of graininess of solid samples by the combined method of suspension density, sieve analyses and laser diffraction and calculation of permeability from measured values according to USBSC	CZ_SOP_D06_07_120 (ČSN EN ISO 17892-4, ČSN EN 933-1, ČSN EN 933-2, BS ISO 11277, Instructions TOM 23/1, ISO 13320)	Solid samples <sup>85</sup> (grain size lower than 63 mm)
1.151 <sup>2</sup>	Determination of total carbon, total sulfur, and hydrogen by combustion method with IR detection, determination of total nitrogen by combustion method with TCD detection and calculation of oxygen from measured values	CZ_SOP_D06_07_121.A (LECO Company methodology, ČSN ISO 29541, ČSN EN ISO 16994, ČSN ISO 16948, ČSN ISO 19579, ČSN EN 15408, ČSN ISO 10694, ČSN EN ISO 21663)	Solid samples <sup>85</sup> , waste, sludge, lubricants, feed <sup>83</sup> , plants, digestates, solid fossil fuels, solid biofuels, solid recovered fuels, building materials <sup>82</sup> , materials for building <sup>89</sup>
1.152 <sup>2</sup>	Determination of carbon, sulfur and hydrogen by combustion method with IR detection and determination of nitrogen by combustion method with TCD detection and calculation of oxygen from measured values	CZ_SOP_D06_07_121.B (LECO Company methodology)	Oil, liquid fuels, combustible liquid and solid wastes
1.153 <sup>1</sup>	Determination of hexavalent chromium by ion chromatography with spectrophotometric detection and calculation of trivalent chromium from measured values	CZ_SOP_D06_02_122, except chap. 10.2; 11.3.2; 11.5; 12.2.2; 15.5 (US EPA 7199, SM 3500-Cr)	Water <sup>91</sup> , extracts <sup>92</sup>
1.154 <sup>1</sup>	Determination of hexavalent chromium by ion chromatography with spectrophotometric detection and calculation of trivalent chromium from measured values	CZ_SOP_D06_02_122, except chap. 10.1; 11.3.1; 12.2.1; 15.4 (ČSN EN ISO 15192, EPA 3060A)	Solid samples <sup>85</sup>
1.155 – 1.156	Reserved		
1.157 <sup>2</sup>	Determination of gross calorific value by calorimetric method and calculation of net calorific value and emission factor from measured values	CZ_SOP_D06_07_124.A (ČSN ISO 1928, ČSN EN ISO 18125, ČSN EN ISO 21654, ČSN EN 15170, ČSN DIN 51900-1, ČSN DIN 51900-2, ČSN DIN 51900-3, ČSN P CEN/TS 16023)	Solid fossil fuels, solid biofuels, solid recovered fuels, waste, sludge, combustible building materials <sup>89</sup>
1.158 <sup>2</sup>	Determination of gross calorific value by calorimetric method and calculation of net calorific value and emission factor from measured values	CZ_SOP_D06_07_124.B (ČSN DIN 51900-1, ČSN DIN 51900-2, ČSN DIN 51900-3)	Oils, liquid fuels, combustible liquid, and solid wastes
1.159 <sup>2,1</sup>	Determination of total bromine, chlorine, fluorine, and sulphur by calculation from the measured values of bromide, chloride, fluoride and sulphate by IC method after burning the sample	CZ_SOP_D06_07_124.C (ČSN EN ISO 16994, ČSN EN 15408, ČSN EN 14582)	Solid fossil fuels, solid biofuels, solid recovered fuels, waste, sludge, combustible building materials <sup>89</sup>

Page 12 of 45

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 Harřě 336/9, 190 00 Praha 9 - Vysočany

Ordinal number <sup>1</sup>	Test procedure/method name	Test procedure/method identification <sup>2</sup>	Subject of the test
1.160 <sup>2,1</sup>	Determination of total bromine, chlorine, fluorine and sulphur by calculation from the measured values of bromide, chloride, fluoride and sulphate by IC method after burning the sample	CZ_SOP_D06_07_124.D (ČSN DIN 51900-1, ČSN DIN 51900-2, ČSN DIN 51900-3)	Oils, liquid fuels, combustible liquid and solid wastes
1.161 <sup>2</sup>	Determination of laboratory compacted bulk density (LCBD)	CZ_SOP_D06_07_125 (ČSN EN 13040)	Sludge, composts, soils meliorants and growth stimulants
1.162 <sup>2</sup>	Determination of electrical conductivity	CZ_SOP_D06_07_126 (ČSN EN 13038, ČSN ISO 11265, ČSN P CEN/TS 15937)	Sludge, composts, soils, soils meliorants and growth stimulants, modified bio waste
1.163 <sup>1</sup>	Determination of hexavalent chromium by ion chromatography with spectrophotometric detection and calculation of trivalent chromium from measured values	CZ_SOP_D06_02_127 (ISO 16740, EPA 425)	Emission <sup>78</sup> , imission <sup>79</sup>
1.164 <sup>1</sup>	Determination of nitrogen dioxide and sulphur dioxide in passive samplers by ion chromatography method and results recalculation to the volume of air	CZ_SOP_D06_02_128 (Materials of Institute Fondazione Salvatore Maugeri, ČSN EN ISO 10304-1, ČSN EN ISO 10304-3)	Emission <sup>78</sup> , imission <sup>79</sup>
1.165 <sup>1</sup>	Determination of sulphite by ion chromatography method	CZ_SOP_D06_02_129 (ČSN EN ISO 10304-3)	Water <sup>91</sup> , extracts <sup>92</sup>
1.166 <sup>2</sup>	Determination of volatile matter by gravimetry and calculation of fixed carbon from the measured values	CZ_SOP_D06_07_130 (ČSN ISO 562, ČSN ISO 5071-1, ČSN EN ISO 18123, ČSN EN ISO 22167)	Solid fossil fuels, solid biofuels, solid recovered fuels
1.167 <sup>2</sup>	Determination of sulphite after distillation by titration	CZ_SOP_D06_07_131 (M. Horáková et al.: Chemical and physical methods of water analyses)	Water <sup>91</sup> , extracts <sup>92</sup>
1.168 <sup>2</sup>	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 <sup>78</sup>
1.170 <sup>1</sup>	Determination of fluoride, chloride, and sulphate in absorption solution from emission sampling by ion chromatographic method and calculation of hydrogen fluoride, hydrogen chloride and sulphur dioxide from measured values	CZ_SOP_D06_02_134 (ČSN EN 1911, STN ISO 15713, ČSN EN 14791, ČSN EN ISO 10304-1)	
1.171 <sup>1</sup>	Determination of non-polar extractable compounds by UV spectrometry	CZ_SOP_D06_02_135, except chap. 10.2 (ČSN 83 0540-4:1998, STN 83 0540-4)	Water <sup>91</sup> , extracts <sup>92</sup>
1.172 <sup>1</sup>	Determination of non-polar extractable compounds by UV spectrometry	CZ_SOP_D06_02_135, except chap. 10.1 (ČSN 83 0540-4:1998, STN 83 0540-4)	Solid samples <sup>85</sup>

Page 13 of 45

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

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

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

Ordinal number <sup>1</sup>	Test procedure/method name	Test procedure/method identification <sup>2</sup>	Subject of the test
1.173 <sup>1</sup>	Determination of total dust concentration and respirable dust fraction by gravimetry and results recalculation to the volume of air	CZ_SOP_D06_02_136 (ČSN EN 481, ČSN EN 482, ČSN EN 689+AC, NIOSH 0500, NIOSH 0600, GR No. 361/2007 Coll.)	Working environment <sup>87</sup>
1.174 <sup>2</sup>	Determination of SiO <sub>2</sub> in silicate materials after decomposition by gravimetry	CZ_SOP_D06_07_137 (ČSN 72 0105-1)	Solid samples <sup>85</sup>
1.175 <sup>2</sup>	Determination of P <sub>2</sub> O <sub>5</sub> in silicate materials after decomposition by spectrophotometry	CZ_SOP_D06_07_138 (ČSN 72 0116-1)	Solid samples <sup>85</sup>
1.176 <sup>2</sup>	Determination of total sulfur in silicate materials after decomposition by gravimetry	CZ_SOP_D06_07_139 (ČSN 72 0118)	Solid samples <sup>85</sup>
1.177	Reserved		
1.178* 1,2,3	Analysis of CH <sub>4</sub> , CO <sub>2</sub> , O <sub>2</sub> , H <sub>2</sub> S gases by Geotech gas analyzer and calculation of N <sub>2</sub> from measured values	CZ_SOP_D06_01_141 (BIOGAS 5000 Analyzer Manual)	Gases <sup>86</sup>
1.179	Reserved		
1.180 <sup>2</sup>	Determination of total inorganic fluorine after separation by distillation by direct potentiometry	CZ_SOP_D06_07_143, except chap. 10 and 13.1 (ČSN ISO 10359-2, ČSN 83 4752-3:1989)	Water <sup>91</sup> , extracts <sup>92</sup> , liquid samples <sup>81</sup>
1.181 <sup>2</sup>	Determination of total inorganic fluorine after separation by distillation by direct potentiometry	CZ_SOP_D06_07_143 (ČSN ISO 10359-2, ČSN 83 4752-3:1989)	Solid samples <sup>85</sup>
1.182 <sup>2</sup>	Determination of biomass content by selective dissolution	CZ_SOP_D06_07_144 (ČSN EN 15440, Annex A)	Solid alternative fuels, solid combustible wastes
2	<b>Organic Chemistry</b>		
2.1 <sup>1</sup>	Determination of extractable compounds in the range of hydrocarbons C10 – C40, their fractions calculated from the measured values by gas chromatography method with FID detection	CZ_SOP_D06_03_150 (ČSN EN 14039, ČSN EN ISO 16703, ČSN P CEN ISO/TS 16558-2, US EPA 8015, US EPA 3550, TNRCC Method 1006)	Solid samples <sup>85</sup>
2.2 <sup>1</sup>	Determination of extractable compounds in the range of hydrocarbons C10 – C40, their fractions calculated from the measured values by gas chromatography method with FID detection	CZ_SOP_D06_03_151 (ČSN EN ISO 9377-2, US EPA 8015, US EPA 3510, TNRCC Method 1006)	Water <sup>91</sup> , extracts <sup>92</sup>
2.3 <sup>1</sup>	Determination of extractable compounds in the range of hydrocarbons C5 – C40, their fractions calculated from the measured values by gas chromatography method with FID detection	CZ_SOP_D06_03_152, except chap. 9.1 (TNRCC Method 1006, TNRCC Method 1005)	Water <sup>91</sup> , extracts <sup>92</sup> , liquid samples <sup>81</sup>
2.4 <sup>1</sup>	Determination of extractable compounds in the range of hydrocarbons C5 – C40, their fractions calculated from the measured values by gas chromatography method with FID detection	CZ_SOP_D06_03_152, except chap. 9.2 (TNRCC Method 1006, TNRCC Method 1005)	Solid samples <sup>85</sup>

Page 14 of 45

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

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

Ordinal number <sup>1</sup>	Test procedure/method name	Test procedure/method identification <sup>2</sup>	Subject of the test
2.5 <sup>1</sup>	Determination of volatile organic compounds <sup>19</sup> by gas chromatography method with FID and MS detection and calculation of volatile organic compounds sums from measured values and results recalculation to the volume of air	CZ_SOP_D06_03_153 (CEN/TS 13649, NIOSH <sup>11</sup> )	Solid sorbents
2.6	Reserved		
2.7 <sup>1</sup>	Determination of volatile organic compounds <sup>5</sup> by gas chromatography method with FID and MS detection and calculation of volatile organic compounds sums from measured values	CZ_SOP_D06_03_155 except chap. 10.5 and 10.6 (US EPA 624, US EPA 5021A, US EPA 8260, US EPA 8015, ČSN EN ISO 10301, MADEP 2004, rev. 1.1, ČSN ISO 11423, ČSN EN ISO 15680)	Water <sup>91</sup> , extracts <sup>92</sup>
2.8 <sup>1</sup>	Determination of volatile organic compounds <sup>4</sup> by gas chromatography method with FID and MS detection and calculation of volatile organic compounds sums from measured values	CZ_SOP_D06_03_155, except chap. 10.4 (US EPA 8260, US EPA 5021A, US EPA 5021, US EPA 8015, ČSN EN ISO 22155, ČSN EN ISO 15009, ČSN EN ISO 16558-1, MADEP 2004, rev. 1.1.)	Solid samples <sup>85</sup>
2.9 <sup>1</sup>	Determination of volatile organic compounds <sup>4</sup> by gas chromatography method with FID and ECD detection and calculation of volatile organic compounds sums from measured values	CZ_SOP_D06_03_156, except chap. 11.3 - 11.5 (US EPA 601, US EPA 8260, US EPA 8015, RBCA Petroleum Hydrocarbon Methods, ČSN EN ISO 11423, ČSN EN ISO 15680)	Water <sup>91</sup> , extracts <sup>92</sup>
2.10 <sup>1</sup>	Determination of volatile organic compounds <sup>4</sup> by gas chromatography method with FID and ECD detection and calculation of volatile organic compounds sums from measured values	CZ_SOP_D06_03_156, except chap. 11.1 and 11.2 (US EPA 8260, US EPA 8015, ČSN EN ISO 22155, ČSN EN ISO 15009, ČSN EN ISO 16558-1, RBCA Petroleum Hydrocarbon Methods)	Solid samples <sup>85</sup>
2.11 <sup>1</sup>	Determination of organic contaminants <sup>5</sup> by gas chromatography method with MS detection (SPIMFAB) and calculation of organic contaminants sums from measured values	CZ_SOP_D06_03_157, except chap. 9.2 (SPIMFAB)	Water <sup>91</sup> , extracts <sup>92</sup>

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

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

Ordinal number <sup>1</sup>	Test procedure/method name	Test procedure/method identification <sup>2</sup>	Subject of the test
2.12 <sup>1</sup>	Determination of organic contaminants <sup>5</sup> by gas chromatography method with MS detection (SPIMFAB) and calculation of organic contaminants sums from measured values	CZ_SOP_D06_03_157, except chap. 9.1 (SPIMFAB)	Waste (solid waste, biowaste), sediments, soil, rocks
2.13 <sup>1</sup>	Determination of phenols, chlorinated phenols and cresols <sup>6</sup> by gas chromatography method with MS and ECD detection and calculation of phenols, chlorinated phenols and cresols sums from measured values	CZ_SOP_D06_03_158, except chap. 9.3 and 9.4 (US EPA 8041, US EPA 3500, ČSN EN 12673)	Water <sup>91</sup>
2.14 <sup>1</sup>	Determination of phenols, chlorinated phenols and cresols <sup>6</sup> by gas chromatography method with MS and ECD detection and calculation of phenols, chlorinated phenols and cresols sums from measured values	CZ_SOP_D06_03_158, except chap. 9.1, 9.2 and 9.4 (US EPA 8041, US EPA 3500, DIN ISO 14154)	Building materials <sup>82</sup> , materials for building <sup>89</sup> , waste (solid waste, biowaste), sediments, soil, rocks
2.15	Reserved		
2.16 <sup>1</sup>	Determination of phthalates <sup>7</sup> by gas chromatography method with MS detection and calculation of phthalates sums from measured values	CZ_SOP_D06_03_159, except chap. 9.2 and 9.3 (US EPA 8061A)	Water <sup>91</sup> , extracts <sup>92</sup>
2.17 <sup>1</sup>	Determination of phthalates <sup>7</sup> by gas chromatography method with MS detection and calculation of phthalates sums from measured values	CZ_SOP_D06_03_159, except chap. 9.1 (US EPA 8061A, CPSC-CH-C1001-09.3)	Building materials <sup>82</sup> , materials for building <sup>89</sup> , waste (solid waste, biowaste), sediments, soil, rocks
2.18 <sup>1</sup>	Determination of phenols and cresols <sup>60</sup> by gas chromatography method with MS detection and calculation of phenols and cresols sums from measured values	CZ_SOP_D06_03_160, except chap. 9.2 (US EPA 8041A, US EPA 3500)	Water <sup>91</sup> , extracts <sup>92</sup>
2.19 <sup>1</sup>	Determination of phenols and cresols <sup>60</sup> by gas chromatography method with MS detection and calculation of phenols and cresols sums from measured values	CZ_SOP_D06_03_160, except chap. 9.1 (US EPA 8041A, US EPA 3500)	Building materials <sup>82</sup> , materials for building <sup>89</sup> , waste (solid waste, biowaste), sediments, soil, rocks
2.20 <sup>1</sup>	Determination of semi volatile organic compounds <sup>8</sup> by gas chromatography method with MS or MS/MS detection and calculation of semi volatile organic compounds sums from measured values	CZ_SOP_D06_03_161 except chap. 10.1.3 – 10.1.5 (US EPA 8270D, US EPA 8082A, ČSN EN ISO 6468, US EPA 8000D)	Water <sup>91</sup> , extracts <sup>92</sup>
2.21 <sup>1</sup>	Determination of semi volatile organic compounds <sup>8</sup> by gas chromatography method with MS or MS/MS detection and calculation of semi volatile organic compounds sums from measured values	CZ_SOP_D06_03_161 except chap. 10.1.1, 10.1.2, 10.2.1, 10.2.2 (US EPA 8270D, US EPA 8082A, ČSN EN 15527, ISO 18287, ISO 10382, ČSN EN 17322)	Building materials <sup>82</sup> , materials for building <sup>89</sup> , waste (solid waste, biowaste), sediments, soil, rocks

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

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

Ordinal number <sup>1</sup>	Test procedure/method name	Test procedure/method identification <sup>2</sup>	Subject of the test
2.22 <sup>1</sup>	Determination of polycyclic aromatic hydrocarbons <sup>9</sup> by liquid chromatography method with FLD and PDA detection and calculation of polycyclic aromatic hydrocarbons sums from measured values	CZ_SOP_D06_03_162 (US EPA 550)	Drinking, table and infant water
2.23 <sup>1</sup>	Determination of polycyclic aromatic hydrocarbons <sup>10</sup> by liquid chromatography method with detection FLD and PDA and calculation of polycyclic aromatic hydrocarbons sums from measured values	CZ_SOP_D06_03_163, except chap. 9.1.2, 9.4.2 (US EPA 610, ČSN EN ISO 17993)	Water <sup>91</sup> , extracts <sup>92</sup>
2.24 <sup>1</sup>	Determination of polycyclic aromatic hydrocarbons <sup>10</sup> by liquid chromatography method with FLD and PDA detection and calculation of polycyclic aromatic hydrocarbons sums from measured values	CZ_SOP_D06_03_163, except chap. 9.1.1, 9.4.1 (US EPA 610, US EPA 3550, ČSN EN 16181)	Solid samples <sup>85</sup>
2.25 <sup>1</sup>	Determination of glycols <sup>28</sup> by gas chromatography method with MS detection	CZ_SOP_D06_03_164	Water <sup>91</sup> , cooling liquids, anti-freeze fluid
2.26 <sup>1</sup>	Determination of polycyclic aromatic hydrocarbons <sup>10</sup> by liquid chromatography method with FLD and PDA detection and calculation of polycyclic aromatic hydrocarbons sums from measured values and results recalculation to the volume of air	CZ_SOP_D06_03_165 (ISO 11338-2)	Emission <sup>78</sup> , imission <sup>79</sup>
2.27 <sup>1</sup>	Determination of polychlorinated biphenyls <sup>39</sup> by gas chromatography method with ECD detection and calculation of polychlorinated biphenyls sums from measured values	CZ_SOP_D06_03_166 except chap. 10.1 – 10.3 (DIN 38407-3, US EPA 8082)	Water <sup>91</sup> , extracts <sup>92</sup>
2.28 <sup>1</sup>	Determination of polychlorinated biphenyls <sup>11</sup> by gas chromatography method with ECD detection and calculation of polychlorinated biphenyls sums from measured values	CZ_SOP_D06_03_166 except chap. 10.4 (US EPA 8082, ISO 10382, ČSN EN 17322)	Solid samples <sup>85</sup> , sealing materials
2.29 <sup>1</sup>	Determination of alkylphenols and alkylphenol ethoxylates <sup>24</sup> by gas chromatography method with MS or MS/MS detection and calculation of alkylphenols and alkylphenol ethoxylates sums from measured values	CZ_SOP_D06_03_167 (European Standard BT WI CSS99040)	Sediments, soils, rocks
2.30 <sup>1</sup>	Determination of polychlorinated biphenyls <sup>11</sup> - congener analyses by gas chromatography method with ECD detection and calculation of polychlorinated biphenyls sums from measured values	CZ_SOP_D06_03_168 (ČSN EN 12766-1, ČSN EN 61619)	Oil hydrocarbons, used oils, insulating liquids
2.31 <sup>1</sup>	Determination of organochlorine pesticides and other halogen compounds <sup>12</sup> by gas chromatography method with ECD detection and calculation of organochlorine pesticides and other halogen compounds sums from measured values	CZ_SOP_D06_03_169 except chap. 10.1 (ČSN EN ISO 6468, US EPA 8081, DIN 38407-3)	Water <sup>91</sup> , extracts <sup>92</sup>

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

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

Ordinal number <sup>1</sup>	Test procedure/method name	Test procedure/method identification <sup>2</sup>	Subject of the test
2.32 <sup>1</sup>	Determination of organochlorine pesticides and other halogen compounds <sup>12</sup> by gas chromatography method with ECD detection and calculation of organochlorine pesticides and other halogen compounds sums from measured values	CZ_SOP_D06_03_169 except chap. 10.2 (US EPA 8081, ISO 10382)	Solid samples <sup>85</sup>
2.33 <sup>1</sup>	Determination of perchlorates by liquid chromatography with MS/MS detection	CZ_SOP_D06_03_170.A (US EPA 6850)	Drinking water
2.34 <sup>1</sup>	Determination of perchlorates by liquid chromatography with MS/MS detection	CZ_SOP_D06_03_170.B (US EPA 6850)	Sediments, sludges, soils, rocks
2.35 <sup>3</sup>	Determination of polychlorinated dibenzo- <i>p</i> -dioxins and dibenzofuranes <sup>13</sup> in emissions by isotope dilution method using HRGC-HRMS and calculation of TEQ parameters from measured values	CZ_SOP_D06_06_170 (US EPA 23, US EPA 23A)	Emission <sup>78</sup>
2.36 <sup>3</sup>	Determination of polychlorinated dibenzo- <i>p</i> -dioxins and dibenzofuranes <sup>13</sup> in immission by isotope dilution method using HRGC-HRMS and calculation of TEQ parameters from measured values	CZ_SOP_D06_06_171 (US EPA TO-9A)	Imission <sup>79</sup>
2.37 <sup>3</sup>	Determination of coplanar polychlorinated biphenyls <sup>14</sup> in stationary emission sources by isotope dilution method using HRGC-HRMS and calculation of PCB sums and TEQ parameter from measured values	CZ_SOP_D06_06_172 (JIS K 0311)	Emission <sup>78</sup> , imission <sup>79</sup>
2.38 <sup>3</sup>	Determination of polychlorinated biphenyls <sup>14</sup> by isotope dilution method using HRGC-HRMS and calculation of PCB sums and TEQ parameter from measured values	CZ_SOP_D06_06_173, except chap. 10.2.3.2-10.2.3.8, 10.2.4, 10.2.5 (US EPA 1668A, ČSN EN 16190)	Water <sup>91</sup>
2.39 <sup>3</sup>	Determination of polychlorinated biphenyls <sup>14</sup> by isotope dilution method using HRGC-HRMS and calculation of PCB sums and TEQ parameter from measured values	CZ_SOP_D06_06_173, except chap. 10.2.3.1, 10.2.3.7, 10.2.3.8, 10.2.5 (US EPA 1668A, ČSN EN 16190)	Solid samples <sup>85</sup> , building materials <sup>82</sup> , materials for building <sup>89</sup>
2.40 <sup>3</sup>	Determination of polychlorinated biphenyls <sup>14</sup> by isotope dilution method using HRGC-HRMS and calculation of PCB sums and TEQ parameter from measured values	CZ_SOP_D06_06_173, except chap. 10.2.3.1-10.2.3.7, 10.2.4 (US EPA 1668A, ČSN EN 16190)	Biological materials <sup>77</sup> , vegetable materials <sup>88</sup> , animal materials <sup>93</sup>
2.41 <sup>3</sup>	Determination of polychlorinated biphenyls <sup>14</sup> by isotope dilution method using HRGC-HRMS and calculation of PCB sums and TEQ parameter from measured values	CZ_SOP_D06_06_173, except chap. 10.2.3.1-10.2.3.6 (US EPA 1668A, ČSN EN 16190)	SPMD, food, feed <sup>81</sup> , biotic materials
2.42 <sup>3</sup>	Determination of polychlorinated dibenzo- <i>p</i> -dioxins and dibenzofuranes <sup>13</sup> in emission samples by isotope dilution method using HRGC-HRMS and calculation of TEQ parameters from measured values	CZ_SOP_D06_06_174 (ČSN EN 1948-2, ČSN EN 1948-3)	Emission <sup>78</sup>

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

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

Ordinal number <sup>1</sup>	Test procedure/method name	Test procedure/method identification <sup>2</sup>	Subject of the test
2.43 <sup>3</sup>	Determination of tetra- to octa-chlorinated dioxins and furanes <sup>13</sup> by isotope dilution method using HRGC-HRMS and calculation of TEQ parameters from measured values	CZ_SOP_D06_06_175, except chap. 10.2.3.2 - 10.2.3.8, 10.2.4, 10.2.5 (US EPA 1613B, ČSN EN 16190)	Water <sup>91</sup>
2.44 <sup>3</sup>	Determination of tetra- to octa-chlorinated dioxins and furanes <sup>13</sup> by isotope dilution method using HRGC-HRMS and calculation of TEQ parameters from measured values	CZ_SOP_D06_06_175, except chap. 10.2.3.1, 10.2.3.7, 10.2.3.8, 10.2.5 (US EPA 1613 B, ČSN EN 16190)	Solid samples <sup>85</sup> , building materials <sup>82</sup> , materials for building <sup>89</sup>
2.45 <sup>3</sup>	Determination of tetra- to octa-chlorinated dioxins and furanes <sup>13</sup> by isotope dilution method using HRGC-HRMS and calculation of TEQ parameters from measured values	CZ_SOP_D06_06_175, except chap. 10.2.3.1 - 10.2.3.7, 10.2.4 (US EPA 1613B, ČSN EN 16190)	Biological materials <sup>77</sup> , vegetable materials <sup>88</sup> , animal materials <sup>93</sup>
2.46 <sup>3</sup>	Determination of tetra- to octa-chlorinated dioxins and furanes <sup>13</sup> by isotope dilution method using HRGC-HRMS and calculation of TEQ parameters from measured values	CZ_SOP_D06_06_175 except chap. 10.2.3.1 - 10.2.3.6 (US EPA 1613B, ČSN EN 16190)	SPMD, food, feed <sup>83</sup> , biotic materials
2.47 <sup>3</sup>	Determination of polychlorinated dibenzodioxins (PCDD) and polychlorinated dibenzofurans (PCDF) <sup>13</sup> using HRGC-HRMS and calculation of TEQ parameters from measured values	CZ_SOP_D06_06_176, except chap. 10.2.3.2 - 10.2.3.7, 10.2.4, 10.2.5 (US EPA 8290A)	Water <sup>91</sup>
2.48 <sup>3</sup>	Determination of polychlorinated dibenzodioxins (PCDD) and polychlorinated dibenzofurans (PCDF) <sup>13</sup> using HRGC-HRMS and calculation of TEQ parameters from measured values	CZ_SOP_D06_06_176, except chap. 10.2.3.1, 10.2.3.6, 10.2.5 (US EPA 8290A)	Solid samples <sup>85</sup>
2.49 <sup>3</sup>	Determination of polychlorinated dibenzodioxins (PCDD) and polychlorinated dibenzofurans (PCDF) <sup>13</sup> using HRGC-HRMS and calculation of TEQ parameters from measured values	CZ_SOP_D06_06_176, except chap. 10.2.3.1 - 10.2.3.6, 10.2.4 (US EPA 8290A)	Biological materials <sup>77</sup>
2.50 <sup>3</sup>	Determination of polychlorinated dibenzodioxins (PCDD) and polychlorinated dibenzofurans (PCDF) <sup>13</sup> using HRGC-HRMS and calculation of TEQ parameters from measured values	CZ_SOP_D06_06_176, except chap. 10.2.3.1 - 10.2.3.6 (US EPA 8290A)	Food, feed <sup>83</sup> , biotic materials
2.51 <sup>3</sup>	Determination of selected brominated flame retardants (BFR) <sup>15</sup> by isotope dilution method using HRGC-HRMS and calculation of brominated flame retardants sums from measured values	CZ_SOP_D06_06_177, except chap. 10.2.3.2 - 10.2.3.8, 10.2.4, 10.2.5 (US EPA 1614)	Water <sup>91</sup>
2.52 <sup>3</sup>	Determination of selected brominated flame retardants (BFR) <sup>15</sup> by isotope dilution method using HRGC-HRMS and calculation of brominated flame retardants sums from measured values	CZ_SOP_D06_06_177, except chap. 10.2.3.1, 10.2.3.7, 10.2.3.8, 10.2.5 (US EPA 1614, ČSN EN 16377, ČSN EN ISO 22032)	Solid samples <sup>85</sup> , building materials <sup>82</sup> , materials for building <sup>89</sup>

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

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

Ordinal number <sup>1</sup>	Test procedure/method name	Test procedure/method identification <sup>2</sup>	Subject of the test
2.53 <sup>3</sup>	Determination of selected brominated flame retardants (BFR) <sup>15</sup> by isotope dilution method using HRGC-HRMS and calculation of brominated flame retardants sums from measured values	CZ_SOP_D06_06_177, except chap. 10.2.3.1 - 10.2.3.7, 10.2.4 (US EPA 1614)	Biological materials <sup>77</sup> , vegetable materials <sup>88</sup> , animal materials <sup>93</sup>
2.54 <sup>3</sup>	Determination of selected brominated flame retardants (BFR) <sup>15</sup> by isotope dilution method using HRGC-HRMS and calculation of brominated flame retardants sums from measured values	CZ_SOP_D06_06_177, except chap. 10.2.3.1 - 10.2.3.6, (US EPA 1614)	SPMD, food, feed <sup>83</sup> , biotic materials
2.55 <sup>1</sup>	Determination of alkylphenols and alkylphenol ethoxylates <sup>46</sup> by gas chromatography method with MS or MS/MS detection and calculation of alkylphenols and alkylphenol ethoxylates sums from measured values	CZ_SOP_D06_03_178 (ČSN EN ISO 18857-2)	Water <sup>91</sup> , extracts <sup>82</sup>
2.56 <sup>3</sup>	Determination of PCB <sup>14</sup> in emission samples by isotope dilution method using HRGC-HRMS and calculation of PCB sums from measured values	CZ_SOP_D06_06_179 (ČSN EN 1948-4, US EPA TO-4-A)	Emission <sup>78</sup> , imission <sup>79</sup> , working environment <sup>87</sup>
2.57 <sup>3</sup>	Determination of polycyclic aromatic hydrocarbons <sup>44</sup> by isotope dilution method using HRGC-HRMS and calculation of the sums of polycyclic aromatic hydrocarbons from the measured values	CZ_SOP_D06_06_180 except chap. 10.3.3.1 - 10.3.3.6, 10.3.3.8 - 10.3.3.10, 10.3.5 (US EPA 429, ISO 11338, US EPA 3540)	Solid samples <sup>85</sup> , building materials <sup>82</sup> , materials for building <sup>89</sup>
2.58 <sup>3</sup>	Determination of polycyclic aromatic hydrocarbons <sup>44</sup> by isotope dilution method using HRGC-HRMS and calculation of the sums of polycyclic aromatic hydrocarbons from the measured values	CZ_SOP_D06_06_180, except chap. 10.3.3.6 - 10.3.3.10, 10.3.4, 10.3.5 (US EPA 429, ISO 11338, US EPA TO-13A, ČSN EN 15549)	Emission <sup>78</sup> , imission <sup>79</sup> , working environment <sup>87</sup>
2.59 <sup>3</sup>	Determination of polycyclic aromatic hydrocarbons <sup>44</sup> by isotope dilution method using HRGC-HRMS and calculation of polyaromatic hydrocarbons sums from measured values	CZ_SOP_D06_06_180, except chap. 10.3.3.1 - 10.3.3.9, 10.3.4 (US EPA 429, STN EN 16619)	Biological materials <sup>77</sup> , vegetable materials <sup>88</sup> , animal materials <sup>93</sup>
2.60 <sup>3</sup>	Determination of polycyclic aromatic hydrocarbons <sup>44</sup> by isotope dilution method using HRGC-HRMS and calculation of polyaromatic hydrocarbons sums from measured values	CZ_SOP_D06_06_180, except chap. 10.3.3.1 - 10.3.3.8 (US EPA 429, STN EN 16619)	SPMD, food, feed <sup>83</sup> , biotic materials
2.61 <sup>3</sup>	Determination of polycyclic aromatic hydrocarbons <sup>44</sup> by isotope dilution method using HRGC-HRMS and calculation of polyaromatic hydrocarbons sums from measured values	CZ_SOP_D06_06_180, except chap. 10.3.3.1 - 10.3.3.7, 10.3.3.9, 10.3.3.10, 10.3.4, 10.3.5 (US EPA 429, ISO 11338, IP 346)	Oils

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

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

Ordinal number <sup>1</sup>	Test procedure/method name	Test procedure/method identification <sup>2</sup>	Subject of the test
2.62 <sup>1</sup>	Determination of semi-volatile organic compounds <sup>7</sup> by gas chromatography method with MS detection and calculation of semi-volatile organic compounds sums from measured values	CZ_SOP_D06_03_181 (US EPA 429, US EPA 1668, US EPA 3550)	Sediments, soils, rocks
2.63 <sup>1</sup>	Determination of acidic herbicides, drug residues and other pollutants <sup>29</sup> by liquid chromatography method with MS/MS detection and calculation of acidic herbicides, drug residues and other pollutants sums from measured values	CZ_SOP_D06_03_182.A (DIN 38407:35)	Water <sup>91</sup>
2.64 <sup>1</sup>	Determination of acidic herbicides and drug residues <sup>17</sup> by liquid chromatography method with MS/MS detection	CZ_SOP_D06_03_182.B (ČSN EN 15637, US EPA 1694)	Sediments, sludges, soils, rocks
2.65 <sup>1</sup>	Determination of pesticides, pesticide metabolites, drug residues and other pollutants <sup>30</sup> by liquid chromatography method with MS/MS detection and calculation of pesticides, pesticide metabolites, drug residues and other pollutants sums from measured values	CZ_SOP_D06_03_183.A (US EPA 535, US EPA 1694)	Water <sup>91</sup>
2.66 <sup>1</sup>	Determination of pesticides, pesticide metabolites, drug residues and other pollutants <sup>70</sup> and <sup>71</sup> 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 <sup>82</sup> , materials for building <sup>89</sup>
2.67 <sup>1</sup>	Determination of pesticides, pesticide metabolites, drug residues and other pollutants <sup>72</sup> 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 <sup>88</sup> , animal materials <sup>93</sup>
2.68 <sup>1</sup>	Determination of pesticides <sup>11</sup> by gas chromatography method with MS or MS/MS detection and calculation of pesticides sums from measured values	CZ_SOP_D06_03_184 (US EPA 8141B, US EPA 3535A, ČSN EN 12918)	Water <sup>91</sup>
2.69 <sup>1</sup>	Determination of pesticides and pesticide metabolites <sup>12</sup> by derivatization and liquid chromatography method with MS/MS detection and calculation of pesticides and pesticide metabolites sums from measured values	CZ_SOP_D06_03_185.A (ČSN ISO 21458)	Water <sup>91</sup>
2.70 <sup>1</sup>	Determination of pesticides and pesticide metabolites <sup>8</sup> by derivatization and liquid chromatography method with MS/MS detection	CZ_SOP_D06_03_185.B (Journal of Chromatography A, 1292 (2013) 132-141, EC Decision No. 2002/657/EC)	Sediments, sludges, soils, rocks
2.71 <sup>1</sup>	Determination of complexing substances <sup>33</sup> by gas chromatography method with MS detection	CZ_SOP_D06_03_186 (ČSN EN ISO 16588)	Water <sup>91</sup>
2.72 <sup>1</sup>	Determination of polycyclic aromatic hydrocarbons derivatives <sup>36</sup> by liquid chromatography method with MS detection	CZ_SOP_D06_03_187 (Journal of Chromatography A, 1133 (2006) 241-247)	Emission <sup>78</sup> , imission <sup>79</sup>

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

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

Ordinal number <sup>1</sup>	Test procedure/method name	Test procedure/method identification <sup>2</sup>	Subject of the test
2.73 <sup>1</sup>	Determination of organic acids <sup>37</sup> by capillary electrophoresis method with UV detection	CZ_SOP_D06_03_188.A (Lumex Company manual, Kudrjashova, M.: Capillary electrophoretic monitoring of microbial growth: determination of organic acids, COPYRIGHT 2004 Estonian Academy Publishers, June 2004 Source Volume: 53 Source Issue: 2, ISSN: 1406-0124)	Water <sup>91</sup>
2.74 <sup>1</sup>	Determination of organic acids <sup>37</sup> by capillary electrophoresis method with UV detection	CZ_SOP_D06_03_188.B (Lumex Company manual, Kudrjashova, M.: Capillary electrophoretic monitoring of microbial growth: determination of organic acids, COPYRIGHT 2004 Estonian Academy Publishers, June 2004 Source Volume: 53 Source Issue: 2, ISSN: 1406-0124)	Feed <sup>83</sup> , composts, digestate
2.75 <sup>1</sup>	Determination of gases <sup>38</sup> by gas chromatography method with detection FID and TCD	CZ_SOP_D06_03_189 (EPA Method RSK-175)	Water <sup>91</sup> , liquid samples <sup>81</sup>
2.76 <sup>1</sup>	Low limit determination of volatile organic compounds <sup>5</sup> by gas chromatography method with MS detection and calculation of volatile organic compounds sums from measured values	CZ_SOP_D06_03_190, except chap. 12.1, 13.1.1, 13.1.2, 14.1, 16.1 (US EPA 5021, US EPA 8260)	Water <sup>91</sup>
2.77 <sup>1</sup>	Low limit determination of volatile organic compounds <sup>5</sup> by gas chromatography method with MS detection and calculation of volatile organic compounds sums from measured values	CZ_SOP_D06_03_190, except chap. 12.2, 13.2.1, 13.2.2, 14.2, 16.2 (US EPA 5021, US EPA 8260)	Solid samples <sup>85</sup>
2.78 <sup>1</sup>	Determination of chlorinated alkanes <sup>34</sup> by gas chromatography method with MS/MS detection	CZ_SOP_D06_03_192.A (ČSN EN ISO 12010)	Water <sup>91</sup>
2.79 <sup>1</sup>	Determination of chlorinated alkanes <sup>34</sup> by gas chromatography method with MS/MS detection	CZ_SOP_D06_03_192.B (ČSN EN ISO 12010, ČSN EN ISO 18635)	Building materials <sup>82</sup> , materials for building <sup>89</sup> , sediments, soils
2.80 <sup>1</sup>	Determination of aniline and aniline derivatives <sup>21</sup> by gas chromatography method with MS detection	CZ_SOP_D06_03_193 (US EPA 8270)	Sediments, sludges, soils, rocks
2.81 <sup>1</sup>	Determination of chlorinated phenols <sup>35</sup> by liquid chromatography method with MS/MS detection	CZ_SOP_D06_03_194 (2002/657/ES, 96/23/ES)	Water <sup>91</sup>
2.82 <sup>1</sup>	Determination of drug residues <sup>46</sup> by liquid chromatography with MS/MS detection and results recalculation to the volume of air	CZ_SOP_D06_03_195 (Jia Yu et al.: Biomed. Chromatogr. 2011; 25: 511-516)	Working environment <sup>87</sup>
2.83 <sup>1</sup>	Determination of epichlorohydrin by gas chromatography method with MS/MS detection	CZ_SOP_D06_03_196 (Agilent Technologies Application list 5990-6433EN)	Water <sup>91</sup>
2.84 <sup>1</sup>	Determination of perfluorinated and brominated compounds <sup>48</sup> by liquid chromatography with MS/MS detection	CZ_SOP_D06_03_197.A (US EPA 537, ČSN P CEN/TS 15968)	Water <sup>91</sup> , extracts <sup>82</sup>



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

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

Ordinal number <sup>1</sup>	Test procedure/method name	Test procedure/method identification <sup>2</sup>	Subject of the test
2.85 <sup>1</sup>	Determination of per fluorinated and brominated compounds <sup>73</sup> by liquid chromatography with MS/MS detection	CZ_SOP_D06_03_197.B (DIN 38414-14)	Sediments, sludges, soils, rocks
2.86 <sup>1</sup>	Determination of volatile organic compounds <sup>99</sup> by gas chromatography method with TCD and FID detection and calculation of volatile organic compounds percentage from measured values	CZ_SOP_D06_03_198 (ČSN EN ISO 11890-2)	Organic solvents
2.87 <sup>3</sup>	Determination of fat by gravimetry	CZ_SOP_D06_06_199 (US EPA 1613)	Food, feed <sup>43</sup> , biological materials <sup>77</sup>
2.88 <sup>1</sup>	Determination of 3-chloro-1,2-propanediol by gas chromatography method with MS detection	CZ_SOP_D06_03_200 (LMBG 52.02(1))	Spices
2.89 <sup>1</sup>	Determination of drug residues and narcotic and psychotropic substances <sup>80</sup> by liquid chromatography method with MS/MS detection	CZ_SOP_D06_03_201.A (US EPA 1694)	Water <sup>91</sup>
2.90 <sup>1</sup>	Determination of organic acids <sup>84</sup> by gas chromatography method with FID detection	CZ_SOP_D06_03_202 (Determination of Volatile Fatty Acids in sewage sludge 1979 HMSO.ISBN 0-11-75462-4)	Digestates
2.91 <sup>1</sup>	Determination of polycyclic aromatic hydrocarbons <sup>24</sup> by gas chromatography with MS/MS detection, calculation of sums of polycyclic aromatic hydrocarbons from measured values and conversion of results to air volume	CZ_SOP_D06_03_203 (ISO 11338-2, ČSN EN 15549)	Emission <sup>78</sup> , imission <sup>99</sup>
3	<b>Food Organic Chemistry</b>		
3.1 <sup>1</sup>	Determination of fatty acids <sup>18</sup> by gas chromatography method with FID detection and calculation sum of SAFA, MUFA, PUFA, TFA, Omega 3, Omega 6 <sup>35</sup>	CZ_SOP_D06_04_202 (ČSN EN ISO 12966-1, ČSN EN ISO 12966-2)	Food, feed <sup>43</sup> , dietary supplements
3.2 <sup>1</sup>	Determination of cholesterol by gas chromatography method with FID detection	CZ_SOP_D06_04_205 (Prof. ing. 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 <sup>1</sup>	Determination of retinol and alpha tocopherol by liquid chromatography method with FLD detection	CZ_SOP_D06_04_206 (ČSN EN 12823-1, ČSN EN 12822)	Fats, fatty food, non-fatty food, dietary supplements, feed <sup>43</sup> and premixes
3.4 <sup>1</sup>	Determination of vitamin C (ascorbic acid) by liquid chromatography method with PDA detection	CZ_SOP_D06_04_207 (ČSN EN 14130:2004)	Beverages, candy, non-fatty food, dietary supplements, fruit, vegetables
3.5 <sup>1</sup>	Determination of Soya protein by ELISA by commercial set	CZ_SOP_D06_04_208 (R-Biopharm Manual – Ridascree FAST Soya)	Food, swap
3.6 <sup>1</sup>	Determination of substitute sweeteners <sup>23</sup> by liquid chromatography method with PDA detection	CZ_SOP_D06_04_209 (ČSN EN 12856)	Beverages, milk products, jams, dietary supplements, fishes
3.7 <sup>1</sup>	Determination of caffeine, theobromine, and theophylline by liquid chromatography method with PDA detection	CZ_SOP_D06_04_210 (ČSN EN 12856)	Beverages, tea, coffee, cocoa, chocolate

Page 23 of 45

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

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

Ordinal number <sup>1</sup>	Test procedure/method name	Test procedure/method identification <sup>2</sup>	Subject of the test
3.8 <sup>1</sup>	Determination of preserving agents <sup>24</sup> in food by liquid chromatography method with PDA detection	CZ_SOP_D06_04_211 (ČSN EN 12856)	Beverages, jams, vegetable and fruit sauces and pastes, mustard, fatty and milk products, dietary supplements
3.9 <sup>1</sup>	Determination of aflatoxin B <sub>1</sub> , B <sub>2</sub> , G <sub>1</sub> and G <sub>2</sub> by liquid chromatography method with FLD detection	CZ_SOP_D06_04_212 (ČSN EN 14123)	Food with low water content, beverages, feed <sup>43</sup>
3.10 <sup>1</sup>	Determination of the content of ochratoxin A by liquid chromatography method with FLD detection	CZ_SOP_D06_04_213 (ČSN EN 15829, ČSN EN 14133, ČSN EN 14132)	Food with low water content, beverages, dietary supplements, feed <sup>43</sup>
3.11 <sup>1</sup>	Determination of zearalenone by liquid chromatography method with FLD detection	CZ_SOP_D06_04_214 (ČSN EN 15850)	Cereals, feed <sup>43</sup>
3.12 <sup>1</sup>	Determination of aflatoxin 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 <sup>1</sup>	Determination of patulin by liquid chromatography method with PDA detection	CZ_SOP_D06_04_216 (ČSN EN 14177)	Food with high water content, dietary supplements, beverages
3.14 <sup>1</sup>	Determination of deoxynivalenol by liquid chromatography method with PDA detection	CZ_SOP_D06_04_217 (ČSN EN 15791, ČSN EN 15891)	Food with low water content, beverages, dietary supplements, feed <sup>43</sup>
3.15 <sup>1</sup>	Determination of vitamins B <sub>1</sub> , B <sub>2</sub> and B <sub>6</sub> by liquid chromatography method with FLD detection	CZ_SOP_D06_04_218 (ČSN EN 14122, ČSN EN 14152, ČSN EN 14663)	Fats, fatty food, non-fatty food, feed <sup>43</sup> , dietary supplements
3.16 <sup>1</sup>	Determination of folic acid by ELISA method by commercial set	CZ_SOP_D06_04_219 (R-Biopharm– Ridascree Folic Acid Manual)	Food, feed <sup>43</sup> , dietary supplements
3.17 <sup>1</sup>	Determination of biotin by ELISA method by commercial set	CZ_SOP_D06_04_220 (Demedietic Manual)	Milk, milk products, cereals and cereal products, non-alcoholic beverages, baby food, feed <sup>43</sup> , dietary supplements
3.18 <sup>1</sup>	Determination of gliadin (gluten) by sandwich enzyme immunoassay ELISA Method by commercial set	CZ_SOP_D06_04_221.A (R-Biopharm– Ridascree Gliadin Manual)	Fatty food, non-fatty food, dietary supplements, swabs
3.19 <sup>1</sup>	Determination of gliadin (gluten) by competitive immunoassay ELISA Method by commercial set	CZ_SOP_D06_04_221.B (R-Biopharm– Ridascree Gliadin Manual)	Fermented and hydrolyzed foods and beverages <sup>80</sup>
3.20 <sup>1</sup>	Determination of casein allergen by ELISA method by commercial set	CZ_SOP_D06_04_222 (Bio-Check - Casein Check Manual)	Food, dietary supplements, swabs
3.21 <sup>1</sup>	Determination of β-lactoglobulin allergen by ELISA method with a commercial kit	CZ_SOP_D06_04_223 (Bio-Check– β-lactoglobulin Check Manual)	Food, dietary supplements, swabs
3.22 <sup>1</sup>	Determination of mustard allergen by ELISA method by commercial set	CZ_SOP_D06_04_224 (Bio-Check– Mustard Check Manual)	Food, dietary supplements, swabs

Page 24 of 45

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

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

Ordinal number <sup>1</sup>	Test procedure/method name	Test procedure/method identification <sup>2</sup>	Subject of the test
3.23 <sup>1</sup>	Determination of niacin by liquid chromatography method with PDA detection	CZ_SOP_D06_04_225 (ČSN EN 15652)	Fatty food, non-fatty food, feed <sup>43</sup> , dietary supplements
3.24 <sup>1</sup>	Determination of soya protein by ELISA method by commercial set	CZ_SOP_D06_04_226 (Biokits Neogen– Soya assay Biokits Manual)	Meat products
3.25 <sup>1</sup>	Determination of parabens contain by liquid chromatography method with PDA detection	CZ_SOP_D06_04_227 (HPLC for Food Analysis, Agilent Technologies 1996-2001)	Cosmetics
3.26 <sup>1</sup>	Determination of peanut protein allergen by ELISA method by commercial set	CZ_SOP_D06_04_228 (Bio-Check– Peanut Check Manual)	Fatty food, non-fatty food, feed <sup>43</sup> , dietary supplements
3.27 <sup>1</sup>	Determination of fat-soluble vitamins (D2 and D3) by two-dimensional liquid chromatography method with PDA detection	CZ_SOP_D06_04_229 (AN-1069 Thermo – Application list)	Fats, fatty food, non-fatty food, dietary supplements, feed <sup>43</sup> , premixes
3.28 <sup>1</sup>	Determination of Vitamin B12 by ELISA method by commercial set	CZ_SOP_D06_04_230 (R-Biopharm– Ridascree Fast Vitamin B12 Manual)	Food, feed <sup>43</sup> , dietary supplements
3.29 <sup>1</sup>	Determination of fat-soluble vitamins (vitamins A, E) by liquid chromatography method with FLD detection	CZ_SOP_D06_04_231 (ČSN EN 128 23-1, ČSN EN 128 22)	Cosmetic masks
3.30 <sup>1</sup>	Determination of water-soluble vitamins (vitamin C) by liquid chromatography method with PDA detection	CZ_SOP_D06_04_232 (ČSN EN 14130:2004)	Cosmetic masks
3.31 <sup>1</sup>	Determination of almond allergen by ELISA method by commercial set	CZ_SOP_D06_04_233 (Bio-Check– Almonde Check Manual)	Food, dietary supplements, swabs
3.32 <sup>1</sup>	Determination of hazelnut allergen by ELISA method by commercial set	CZ_SOP_D06_04_234 (Bio-Check– Hazelnut Check Manual)	Food, dietary supplements, swabs
3.33 <sup>1</sup>	Determination of egg allergen (egg white proteins) by ELISA method by commercial set	CZ_SOP_D06_04_235 (Bio-Check– Egg Check Manual)	Food, dietary supplements, swabs
3.34 <sup>1</sup>	Determination of milk allergen (casein and 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 <sup>1</sup>	Determination of sesame allergen by ELISA method by commercial set	CZ_SOP_D06_04_237 (Bio-Check– Sesame Check Manual)	Food, dietary supplements, swabs
3.36 <sup>1</sup>	Determination of pantothenic acid by liquid chromatography with PDA detection	CZ_SOP_D06_04_238	Dietary supplements
4	<b>Water Microbiology</b>		
4.1 <sup>1</sup>	Enumeration of mesophilic bacteria by cultivation	ČSN 75 7841	Surface, ground, waste, pool water
4.2 <sup>1</sup>	Enumeration of psychrophilic bacteria by cultivation	ČSN 75 7842	Surface, ground, waste, pool water
4.3 <sup>1</sup>	Enumeration of intestinal enterococci by membrane filtration	ČSN EN ISO 7899-2 STN EN ISO 7899-2	Drinking, bottled, pool, raw, treated <sup>90</sup> , ground, surface, waste water
4.4 <sup>1</sup>	Enumeration of culturable microorganisms a) at 22 °C b) at 36 °C by cultivation	ČSN EN ISO 6222 STN EN ISO 6222	Drinking, bottled, natural, mineral, pool, raw, treated <sup>90</sup> , ground water

Page 25 of 45

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

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

Ordinal number <sup>1</sup>	Test procedure/method name	Test procedure/method identification <sup>2</sup>	Subject of the test
4.5 <sup>1</sup>	Enumeration of thermotolerant coliform bacteria and <i>Escherichia coli</i> by membrane filtration	ČSN 75 7835	Drinking, surface, ground, pool, waste water
4.6 <sup>1</sup>	Enumeration of <i>Escherichia coli</i> and coliform bacteria by membrane filtration	ČSN EN ISO 9308-1 STN EN ISO 9308-1	Drinking, pool, bottled, raw, treated <sup>90</sup> , ground water
4.7 <sup>1</sup>	Enumeration of <i>Pseudomonas aeruginosa</i> by membrane filtration	ČSN EN ISO 16266 STN EN ISO 16266	Drinking, bottled, natural mineral, pool, surface, waste water
4.8 <sup>1</sup>	Enumeration of coagulase-positive staphylococci ( <i>Staphylococcus Aureus</i> and other species) by membrane filtration	ČSN EN ISO 6888-1 ČSN EN ISO 8199	Pool, surface, waste, drinking, ground water
4.9 <sup>1</sup>	Enumeration of <i>Candida</i> yeasts by membrane filtration	CZ_SOP_D06_04_258 (Hausler, J.: Microbiological Culture Methods of Quality Inspection, Volume III, 1995)	Pool, surface, waste water
4.10 <sup>1</sup>	Enumeration of <i>Clostridium perfringens</i> by membrane filtration	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 <sup>90</sup> , ground water
4.11 <sup>1</sup>	Detection of <i>Salmonella</i> by membrane filtration	ČSN ISO 19250	Drinking, surface, ground, pool, waste water
4.12 <sup>1</sup>	Determination of bioseston by microscopy	ČSN 75 7712 STN 757711	Drinking, bottled, raw, treated <sup>90</sup> , ground water
4.13 <sup>1</sup>	Determination of abioseston by microscopy	ČSN 75 7713 STN 757712	Drinking, bottled, raw, treated <sup>90</sup> , ground water
4.14 <sup>1</sup>	Detection and enumeration of <i>Legionella</i> by cultivation and membrane filtration	ČSN EN ISO 11731	Water <sup>91</sup> , treated water <sup>90</sup>
4.15 <sup>1</sup>	Detection and enumeration of <i>Legionella</i> by cultivation	ČSN EN ISO 11731	Sediments, alluvium, growths
4.16 <sup>1</sup>	Detection and enumeration of <i>Legionella</i> by cultivation	ČSN EN ISO 11731	Swabs
4.17 <sup>1</sup>	Enumeration of Coliform bacteria by membrane filtration	ČSN 75 7837	Non-disinfected water
4.18 <sup>1</sup>	Enumeration of sulphite the spores of sulfite-reducing anaerobes ( <i>Clostridium</i> ) by membrane filtration	ČSN EN 26461-2	Water <sup>91</sup>
4.19 <sup>1</sup>	Microbiological testing of water for haemodialysis. Enumeration of viable microorganisms	CZ_SOP_D06_04_266 (ČSN EN ISO 23500-3)	Dialysis water
4.20 <sup>1</sup>	Microbiological testing of dialysis fluid for haemodialysis. Enumeration of viable microorganisms	CZ_SOP_D06_04_267 (ČSN EN ISO 23500-5)	Dialysis fluid
4.21 <sup>1</sup>	Determination of the concentration of bacterial endotoxins by the LAL test: turbidimetric kinetic method	CZ_SOP_D06_04_268 (Ph. Eur. chapter 2.6.14)	Dialysis fluid, water purified, water highly purified, water for injection
4.22 <sup>1</sup>	Determination of the total number of microorganisms	CZ_SOP_D06_04_269 (Ph. Eur chapter 6.3:0008, 6.3:1927, 6.3:0169)	Water purified, water highly purified, water for injection

Page 26 of 45

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

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

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

Page 27 of 45

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

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

Ordinal number <sup>1</sup>	Test procedure/method name	Test procedure/method identification <sup>2</sup>	Subject of the test
5.22 <sup>1</sup>	Detection and enumeration of <i>Listeria monocytogenes</i> by cultivation	ČSN EN ISO 11290-1 ČSN EN ISO 11290-2	Food, feed <sup>43</sup> , dietary supplements
5.23 <sup>1</sup>	Enumeration of potentially toxigenic moulds on special media by cultivation	CZ_SOP_D06_04_321 (AHEM No. 1/2003)	Food, feed <sup>43</sup>
5.24 <sup>1</sup>	Enumeration of microorganisms in air by aeroscopy and sedimentation method	CZ_SOP_D06_04_322 (ČSN 56 0100:1994, Article 149, 150 AHEM No. 1/2002)	Internal air environment
5.25 <sup>1</sup>	Determination of microbial contamination of areas, surface of equipment and packages using swab method	CZ_SOP_D06_04_323 (ČSN 56 0100:1994, Article 145)	Areas, surface, packaging materials, surface of food
5.26 <sup>1</sup>	Enumeration of thermotolerant coliform bacteria and <i>Escherichia coli</i> by cultivation	CZ_SOP_D06_04_324 (AHEM No. 1/2008, ČSN ISO 16649-2)	Sludge, bio waste, compost, substrates, soils, sand
5.27 <sup>1</sup>	Enumeration of enterococci by cultivation	CZ_SOP_D06_04_325 (AHEM No. 1/2008, ČSN EN ISO 7899-2)	Sludge, bio waste, compost, substrates, soils, sand
5.28 <sup>1</sup>	Detection of <i>Listeria</i> by ELISA method - commercial set Solus Listeria	CZ_SOP_D06_04_326 (Solus Manual)	Food, feed <sup>43</sup> , dietary supplements
5.29 <sup>1</sup>	Determination of the number of coagulase-positive staphylococci ( <i>Staphylococcus aureus</i> and other species) - method of detection	ČSN EN ISO 6888-3	Food, feed <sup>43</sup> , dietary supplements
5.30 <sup>1</sup>	Determination of low numbers of <i>Bacillus cereus</i> - method of detection	ČSN EN ISO 21871	Food, feed <sup>43</sup> , dietary supplements
5.31 <sup>1</sup>	Detection of <i>Cronobacter (Enterobacter) sakazakii</i> by cultivation	ČSN EN ISO 22964	Milk and milk products
5.32 <sup>1</sup>	Detection and enumeration of aerobic mesophilic bacteria by cultivation	ČSN EN ISO 21149	Cosmetics
5.33 <sup>1</sup>	Detection of <i>Pseudomonas aeruginosa</i> by cultivation	ČSN EN ISO 22717 ČSN EN ISO 18415	Cosmetics
5.34 <sup>1</sup>	Detection of <i>Staphylococcus aureus</i> by cultivation	ČSN EN ISO 22718 ČSN EN ISO 18415	Cosmetics
5.35 <sup>1</sup>	Detection of <i>Candida albicans</i> by cultivation	ČSN EN ISO 18416 ČSN EN ISO 18415	Cosmetics
5.36 <sup>1</sup>	Detection of <i>Escherichia coli</i> by cultivation	ČSN EN ISO 21150 ČSN EN ISO 18415	Cosmetics
5.37 <sup>1</sup>	Enumeration of yeast and mould by cultivation	ČSN EN ISO 16212	Cosmetics
5.38 <sup>1</sup>	Evaluation of antimicrobial protection of cosmetic product, test of conservation effectiveness	CZ_SOP_D06_04_336 (ČSN EN ISO 11930, Ph. Eur., chapter 5.1.3)	Cosmetics
5.39 <sup>1</sup>	Horizontal method for the detection and enumeration of presumptive <i>Escherichia coli</i> - Technique of most probable number	ČSN ISO 7251 expect article 9.2	Food, feed <sup>43</sup>
5.40 <sup>1</sup>	Microbiological testing of non-sterile products – Determination of the number of microorganisms	CZ_SOP_D06_04_338 (Ph. Eur., chapter 2.6.12)	Pharmaceutical products, intermediates, raw materials, veterinary medicines, biopreparations, dietary supplements
5.41 <sup>1</sup>	Microbiological testing of non-sterile products – Tests for specific micro-organisms	CZ_SOP_D06_04_339 (Ph. Eur., chapter 2.6.13)	Pharmaceutical products, intermediates, raw materials.

Page 28 of 45

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

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

Ordinal number <sup>1</sup>	Test procedure/method name	Test procedure/method identification <sup>2</sup>	Subject of the test
			veterinary medicines, biopreparations, dietary supplements
6	<b>Ecotoxicology</b>		
6.1 <sup>2</sup>	Determination of the acute lethal toxicity of substance to a freshwater fish	CZ_SOP_D06_07_350 (ČSN EN ISO 7346-1, ČSN EN ISO 7346-2, STN 83 8303)	Surface, ground and waste water <sup>44</sup> , extracts of waste, solutions and extracts of chemical substances and agents
6.2 <sup>2</sup>	Determination of the inhibition of the mobility of <i>Daphnia magna Straus</i> - Acute toxicity test	CZ_SOP_D06_07_351 (ČSN EN ISO 6341, STN 83 8303)	Surface, ground and waste water <sup>44</sup> , extracts of waste, solutions and extracts of chemical substances and agents
6.3 <sup>2</sup>	Freshwater algal growth inhibition test	CZ_SOP_D06_07_352 (ČSN EN ISO 8692, STN 83 8303)	Surface, ground and waste water <sup>44</sup> , extracts of waste, solutions and extracts of chemical substances and agents
6.4 <sup>2</sup>	Toxicity test on seeds of white mustard ( <i>Sinapis alba</i> )	CZ_SOP_D06_07_353 (Ministry of Environment Bulletin, Volume <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 <sup>44</sup> , extracts of waste, solutions and extracts of chemical substances and agents
6.5 <sup>2</sup>	Determination of the inhibitory effect of water samples on the light emission of <i>Vibrio fischeri</i>	CZ_SOP_D06_07_354 (ČSN EN ISO 11348-2)	Surface, ground and waste water <sup>44</sup> , extracts <sup>82</sup> , percolation water, saline, and brackish water
6.6 <sup>2</sup>	<i>Folsomia candida</i> reproduction test – determination of the inhibition.	CZ_SOP_D06_07_355 (ČSN EN ISO 11267)	Waste, soils, sediments
6.7 <sup>2</sup>	<i>Enchytraeus crypticus</i> reproduction test – determination of inhibition	CZ_SOP_D06_07_356 (ČSN EN ISO 16387)	Waste, soils, sediments
6.8 <sup>2</sup>	<i>Lactuca sativa</i> – determination of inhibition of root growth	CZ_SOP_D06_07_357 (ČSN EN ISO 11269-1)	Waste, soils, sediments
6.9 <sup>2</sup>	Determination of nitrification activity and its inhibition	CZ_SOP_D06_07_358 (ČSN ISO 15685)	Waste, soils, sediments
6.10 <sup>2</sup>	Determination of the inhibition of the growth, germination, and germination index (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 <sup>44</sup> , extracts of waste and composts, solutions and extracts of chemical substances and agents
6.11 <sup>2</sup>	Determination of the inhibition of the growth of Lesser Duckweed ( <i>Lemna minor</i> ) - Acute toxicity test	CZ_SOP_D06_07_1350 (ČSN EN ISO 20079)	Surface, ground and waste water <sup>44</sup> , extracts of waste and composts, solutions and extracts of chemical substances and agents

Page 29 of 45

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

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

Ordinal number <sup>1</sup>	Test procedure/method name	Test procedure/method identification <sup>2</sup>	Subject of the test
7	<b>Radiology</b>		
7.1 <sup>2</sup>	Determination of gross alpha activity by measuring evaporated residue in a mixture with ZnS(Ag) scintillator	ČSN 75 7611, chap. 4	Water <sup>91</sup> , extracts <sup>82</sup>
7.2 <sup>2</sup>	Determination of gross alpha activity by measuring incinerated evaporated residue by means of proportional detector	ČSN 75 7611, chap. 5	Water <sup>91</sup> , extracts <sup>82</sup>
7.3 <sup>2</sup>	Determination of gross beta activity by measuring evaporated residue by means of proportional detector and calculation of gross beta activity corrected for potassium 40 from measured values	CZ_SOP_D06_07_361 (ČSN 75 7612, ČSN EN ISO 9697, SÚJB Recommendation „Measurement and assessment of the content of natural radionuclides in drinking water from public sources and bottled water“, DR-RO-5.1 (Rev. 0.0), Prague 2017)	Water <sup>91</sup> , extracts <sup>82</sup>
7.4 <sup>2</sup>	Determination of radium 226 after concentration by scintillation emanometry	ČSN 75 7622	Water <sup>91</sup> , extracts <sup>82</sup>
7.5 <sup>2</sup>	Determination of radon 222 by scintillation emanometry after its transportation into scintillation chamber using vacuum	CZ_SOP_D06_07_363.A (ČSN 75 7624, chap. 5)	Water <sup>91</sup> , extracts <sup>82</sup>
7.6 <sup>2</sup>	Determination of radon 222 by scintillation gamma-spectrometry with a well type NaI(Tl) crystal	CZ_SOP_D06_07_363.B (ČSN 75 7624, chap. 6)	Water <sup>91</sup> , extracts <sup>82</sup>
7.7 <sup>2</sup>	Determination of radon 222 by liquid scintillation counting method (LSC)	CZ_SOP_D06_7_363.C (ČSN 75 7625)	Water <sup>91</sup>
7.8 <sup>2</sup>	Determination of uranium by spectrophotometry after separation on silica gel and calculation of <sup>238</sup> U from measured values	CZ_SOP_D06_07_364 (ČSN 75 7614)	Water <sup>91</sup> , extracts <sup>82</sup>
7.9 <sup>2</sup>	Determination of tritium volume activity by liquid scintillation counting method (LSC)	CZ_SOP_D06_07_365 (ČSN EN ISO 9698)	Water <sup>91</sup> , extracts <sup>82</sup>
7.10 <sup>2</sup>	Determination of polonium 210 after its concentration by sorption on ZnS(Ag) by the measurement of emitted scintillations	ČSN 75 7626	Water <sup>91</sup> , extracts <sup>82</sup>
7.11 <sup>2</sup>	Determination of polonium 210 after total decomposition and after its concentration by sorption on ZnS(Ag) by the measurement of emitted scintillations	CZ_SOP_D06_07_366 (ČSN 75 7626)	Soils, sludge, sediments, filters
7.12 <sup>2</sup>	Non-destructive determination of radionuclides <sup>25)</sup> by high resolution gamma-spectrometry and calculation of the mass activity index I (ACI) from the measured volumetric activities of individual radionuclides	CZ_SOP_D06_07_367 (ČSN EN ISO 10703, SÚJB Recommendation "Measurement and evaluation of natural radionuclides in building materials", DR-RO-5.2 (Rev. 0.0), Prague 2017	Solid samples with granularity up to 4 mm, food, water <sup>91</sup> , liquid samples <sup>81</sup>
7.13 <sup>2</sup>	Determination of gross alpha mass activity by direct measurement of the sample by means of alpha radiation analyser	CZ_SOP_D06_07_368 (ČSN 75 7611, ISO 9696)	Solid samples <sup>85</sup> pulverized for grain size below 100 µm, liquid samples <sup>86</sup> with boiling point above 100 °C

Page 30 of 45

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

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

Ordinal number <sup>1</sup>	Test procedure/method name	Test procedure/method identification <sup>2</sup>	Subject of the test
7.14 <sup>2</sup>	Determination of gross beta mass activity by direct measurement of the sample by means of beta radiation analyser	CZ_SOP_D06_07_369 (ČSN 75 7612, ČSN EN ISO 9697)	Solid samples <sup>85</sup> pulverized for grain size below 100 µm, liquid samples <sup>86</sup> with boiling point above 100 °C
7.15 <sup>2</sup>	Determination of lead 210 after its sorption on ZnS-colloid by beta radiation analyzer	CZ_SOP_D06_07_370 (ČSN 75 7627)	Water <sup>91</sup> , extracts <sup>92</sup> (with low content of suspended solids or filtered through 0.45 µm filter)
7.16 <sup>2</sup>	Determination of gross alpha activity by co-precipitation method by measurement of filtered precipitate by means of proportional detector	CZ_SOP_D06_07_371 (ČSN 75 7610)	Water <sup>91</sup> , extracts <sup>92</sup>
7.17 <sup>2</sup>	Calculation of Indicative Dose (ID) <sup>69</sup> from the measured values of volume activities of individual radionuclides	CZ_SOP_D06_07_372 (SÚJB Recommendation „Measurement and assessment of the content of natural radionuclides in drinking water from public sources and bottled water“, DR-RO-5.1 (Rev. 0.0), Prague 2017, Council Directive 2013/51 / EURATOM of 22. 10. 2013)	Water <sup>91</sup>
7.18 <sup>2</sup>	Determination of strontium 90 by proportional detector after separation	CZ_SOP_D06_07_373 (ASTM D5811-00)	Water <sup>91</sup>
7.19 <sup>2</sup>	Determination of strontium 90 by proportional detector after separation	CZ_SOP_D06_07_373 (ASTM D5811-00, ASTM C1507-20)	Soils, sludge, sediments
7.20 <sup>2</sup>	Determination of strontium 90 by proportional detector after separation	CZ_SOP_D06_07_373 (ASTM D5811-00, ASTM C1507-20)	Biological materials <sup>77</sup> , food, feed <sup>83</sup>
7.21 <sup>2</sup>	Determination of carbon 14 by liquid scintillation method after separation	CZ_SOP_D06_07_374 (ČSN EN ISO 13162, ČSN EN 16640 US EPA 520/5-84-006)	Water <sup>91</sup> , soils, sludge, sediments, bioindicators <sup>76</sup> , food
7.22 <sup>2</sup>	Determination of total volume alpha and beta activities by liquid scintillation counting method (LSC)	CZ_SOP_D06_07_375 (ČSN EN ISO 11704, ASTM D7283-17)	Non salted water
7.23 <sup>2</sup>	Determination of radium 226 and 228 by liquid scintillation measurement method (LSC)	CZ_SOP_D06_07_376 (ČSN EN ISO 22908)	Water <sup>91</sup>
8	<b>Tribology</b>		
8.1 <sup>11</sup>	Determination of kinematic viscosity by viscometer and viscosity index by calculation	CZ_SOP_D06_05_400 (ČSN EN ISO 3104, ČSN ISO 2009, ASTM D7279, ASTM D7042)	Liquid fuels, lubricating oils
8.2 <sup>11</sup>	Determination of flash point - Pensky-Martens closed cup method by flash point analyser	CZ_SOP_D06_05_401 (ČSN EN ISO 2719, ASTM D93)	Diesel, light fuel oils

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

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

Ordinal number <sup>1</sup>	Test procedure/method name	Test procedure/method identification <sup>2</sup>	Subject of the test
8.3 <sup>11</sup>	Determination of liquid cleanliness code by particle counter	CZ_SOP_D06_05_402 (User Manual for Lase Net Fines-C use and maintenance, ČSN ISO 4406)	Liquid fuels, lubricating oils
8.4 <sup>11</sup>	Determination of base number by potentiometric titration	CZ_SOP_D06_05_403 (ČSN ISO 3771)	Lubricating oils, additives to lubricants
8.5 <sup>11</sup>	Determination of neutralization number by potentiometric titration	CZ_SOP_D06_05_404 (ČSN ISO 6619)	Lubricating oils, additives to lubricants
8.6 <sup>11</sup>	Determination of water content by coulometric method	CZ_SOP_D06_05_405 (ASTM D6304)	Liquid fuels, lubricating oils
8.7 <sup>11</sup>	Determination of flash point and burning point in open cup according to Cleveland by flash point analyser	CZ_SOP_D06_05_406 (ASTM D92)	Liquid fuels, lubricating oils
8.8 <sup>11</sup>	Determination of Cold Filter Plugging Point (CFPP) by the method of gradual cooling	CZ_SOP_D06_05_407 (ČSN EN 116, ASTM D6371)	Diesel, light fuel oils
9	<b>General Food Chemistry</b>		
9.1 <sup>1</sup>	Determination of organic acids <sup>68</sup> content by capillary isotachopheresis method	CZ_SOP_D06_04_450 (Recman - Laboratory technique – Application sheets No. 35, 39, 70)	Food, feed <sup>83</sup>
9.2 <sup>1</sup>	Gravimetric determination of fat	CZ_SOP_D06_04_451 (ČSN ISO 1443, ČSN ISO 1444, ČSN 46 7092-7)	Food, feed <sup>83</sup>
9.3 <sup>1</sup>	Gravimetric determination of dry matter and calculation of moisture from measured value	CZ_SOP_D06_04_452 (Journal of AOAC International vol 88, No1,2005; Journal of AOAC International vol 86, No6, 2003)	Food, feed <sup>83</sup> , dietary supplements
9.4 <sup>1</sup>	Determination of nitrate and nitrite by capillary isotachopheresis	CZ_SOP_D06_04_453 (ITP: Application sheet No. 33 VILLA LABECO s.r.o.)	Food, feed <sup>83</sup>
9.5 <sup>1</sup>	Determination of phosphates by capillary isotachopheresis	CZ_SOP_D06_04_454 (ITP: Application sheet No. 35 VILLA LABECO s.r.o.)	Food, feed <sup>83</sup>
9.6 <sup>1</sup>	Gravimetric determination of water extract content	ČSN 58 0113, Article 38	Coffee
9.7 <sup>1</sup>	Determination of acid value and acidity by titration	CZ_SOP_D06_04_456 (ČSN EN ISO 660)	Animal and vegetable fats and oils
9.8 <sup>1</sup>	Determination of polyols <sup>75</sup> by ion chromatographic method with EC detection	CZ_SOP_D06_04_457 (ČSN EN 15086, DIONEX Technical Note 20)	Food, feed <sup>83</sup> , dietary supplements
9.9 <sup>1</sup>	Gravimetric determination of ash	CZ_SOP_D06_04_458 (ČSN 56 0116-4)	Food, feed <sup>83</sup>
9.10 <sup>1</sup>	Determination of crude fibre by oxidation hydrolysis method	CZ_SOP_D06_04_459 (ČSN ISO 5498, ČSN EN ISO 6865)	Feed <sup>83</sup>
9.11 <sup>1</sup>	Determination of pH by potentiometry	CZ_SOP_D06_04_460 (ČSN ISO 2917, ČSN ISO 1842)	Food, feed <sup>83</sup>
9.12 <sup>1</sup>	Determination of sand by gravimetry	CZ_SOP_D06_04_461 (ČSN 56 0246-12)	Food, feed <sup>83</sup>

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

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

Ordinal number <sup>1</sup>	Test procedure/method name	Test procedure/method identification <sup>2</sup>	Subject of the test
9.13 <sup>1</sup>	Determination of relative density of liquids by pycnometer	CZ_SOP_D06_04_462 (ČSN EN 1131)	Low viscosity liquids
9.14 <sup>1</sup>	Titrimetric determination of acidity	CZ_SOP_D06_04_463 (ČSN ISO 750, 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 <sup>1</sup>	Determination of moisture content – distillation method	CZ_SOP_D06_04_464 (ČSN ISO 939)	Spices, mixed condiments
9.16 <sup>1</sup>	Determination of dietary fibre enzymatically by commercial set Megazyme	CZ_SOP_D06_04_465 (AOAC Method 985.29)	Food, dietary supplements
9.17 <sup>1</sup>	Determination of starch content by polarimetry	CZ_SOP_D06_04_466 (ČSN 46 7092-21)	Cereals, baking products, cereal feeds <sup>83</sup>
9.18 <sup>1</sup>	Determination of chloride by coulometric titration	CZ_SOP_D06_04_467 (O.K. SERVIS company Chloride Analyser manual)	Food, feed <sup>83</sup> , dietary supplements
9.19 <sup>1</sup>	Determination of reducing sugars and total sugars after iodometric inversion and calculation of non-reducing sugars from measured values	CZ_SOP_D06_04_468 (ČSN 56 0146)	Food, feed <sup>83</sup> , dietary supplements
9.20 <sup>1</sup>	Determination of alkalinity of water-soluble ash by titration	ČSN ISO 1578	Tea
9.21 <sup>1</sup>	Gravimetric determination of total ash	ČSN ISO 1575	Tea
9.22 <sup>1</sup>	Gravimetric determination of water-soluble and water-insoluble ash	ČSN ISO 1576	Tea
9.23 <sup>1</sup>	Gravimetric determination of acid-insoluble ash	ČSN ISO 1577	Tea
9.24 <sup>1</sup>	Gravimetric determination of water extract	ČSN ISO 9768	Tea
9.25 <sup>1</sup>	Gravimetric determination of loos in mass at 103°C	ČSN ISO 1573	Tea
9.26 <sup>1</sup>	Determination of total nitrogen by Dumas method by analyser and protein calculation from measured values	CZ_SOP_D06_04_475 (ČSN EN ISO 14891, ČSN EN ISO 16634-1, ČSN EN ISO 16634-2)	Food, feed <sup>83</sup> , dietary supplements
9.27 <sup>1</sup>	Volumetric determination of volatile oils (essential oils) by distillation with steam	ČSN EN ISO 6571	Spices, spicing agents, herbs
9.28 <sup>1</sup>	Determination of the weight of consumer packaging of food and animal feeding stuff products by gravimetry	CZ_SOP_D06_04_477 (ČSN 560305, ČSN 570146-3, ČSN 580170-3)	Food, feed <sup>83</sup> , dietary supplements
9.29 <sup>1</sup>	Determination of the meat content in meat products and products containing meat by calculation from measured values <sup>83</sup>	CZ_SOP_D06_04_478 (Commission Directive No. 2001/101/EC, Commission Regulation No. 2004/2002/EC, Commission Regulation No. 2429/86/EEC, Decree 330/2009 Coll.)	Meat products
9.30 <sup>1</sup>	Determination of carbohydrates and energy values by calculation from measured values <sup>64</sup>	CZ_SOP_D06_04_479 (Regulation (EU) 1169/2011, Decree 330/2009 Coll.)	Food, raw materials for production of food, dietary supplements

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

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

Ordinal number <sup>1</sup>	Test procedure/method name	Test procedure/method identification <sup>2</sup>	Subject of the test
9.31 <sup>1</sup>	Determination of non-protein content substances by calculation <sup>65</sup>	ČSN 46 7092-24	Feed <sup>83</sup>
9.32 <sup>1</sup>	Determination of 4-hydroxyproline by spectrophotometry and calculation of collagen from measured values	CZ_SOP_D06_04_481 (ISO 3496)	Meat products
9.33 <sup>1</sup>	Determination of fat content by NMR method	CZ_SOP_D06_04_482 (Journal of AOAC International vol 88, No. 1, 2005, Journal of AOAC International vol 86, No. 6, 2003)	Selected food <sup>95</sup> and raw materials for production of food, feed <sup>83</sup> , dietary supplements
9.34 <sup>1</sup>	Volumetric determination of peroxide value	CZ_SOP_D06_04_483 (ČSN EN ISO 3960)	Fats and vegetable oils
9.35 <sup>1</sup>	Determination of water activity by capacitive sensor method	ČSN ISO 21807	Food, raw materials for production of food, dietary supplements
9.36 <sup>1</sup>	Determination of net muscle protein by calculation from the content of collagen and protein	CZ_SOP_D06_04_485 (Decree No. 69/2016 Coll.)	Meat, meat products
9.37 <sup>1</sup>	Identification of synthetic dyes <sup>87</sup> by thin-layer chromatography method	CZ_SOP_D06_04_486 (Davidek J., Laboratory Manual of Food Analysis, 1981)	Food
9.38 <sup>1</sup>	Determination of piperine content by spectrophotometry	ČSN ISO 5564	Black pepper and white pepper, whole or ground
9.39 <sup>1</sup>	Determination of starch in meat products by titration	CZ_SOP_D06_04_488 (BS 4401 Part 12:1979 Determination of Starch Content of Meat Products)	Meat products
9.40 <sup>1</sup>	Determination of total sulphur dioxide after distillation by titration	CZ_SOP_D06_04_489 (Prof. Ing. J. Davidek, DrSc. et al.: Laboratory Manual of Food Analysis, SNTL 1981)	Food and raw materials for food production, dietary supplements
9.41 <sup>1</sup>	Determination of total sulphur dioxide after distillation by ITP	CZ_SOP_D06_04_489 (Prof. Ing. J. Davidek, DrSc. et al.: Laboratory Manual of Food Analysis, SNTL 1981, Application sheet No. 33 Villa Labeco)	Food and raw materials for food production, dietary supplements
9.42 <sup>10</sup>	Sensory testing – description test	CZ_SOP_D06_04_490 (ČSN ISO 6658, ČSN EN ISO 8589, ČSN EN ISO 13299, ČSN ISO 13300-1,2)	Food, cosmetics, packaging materials for food, consumer goods
9.43 <sup>10</sup>	Sensory testing – comparison to standard	CZ_SOP_D06_04_491 (ČSN ISO 6658, ČSN ISO EN 8589, ČSN EN ISO 13299, ČSN ISO 13300-1,2)	Food, cosmetics, packaging materials for food, consumer goods
9.44 <sup>10</sup>	Assessment of characteristics of food	CZ_SOP_D06_04_492 (ČSN EN ISO 8589, ČSN EN ISO 13299, ČSN ISO 13300-1,2)	Food
9.45 <sup>1</sup>	Determination of density by density meter	CZ_SOP_D06_04_493 (ČSN 57 0530)	Milk and milk products



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

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

Ordinal number <sup>1</sup>	Test procedure/method name	Test procedure/method identification <sup>2</sup>	Subject of the test
9.46 <sup>1</sup>	Determination of sugars <sup>60</sup> by ion chromatography method with EC detection	CZ_SOP_D06_04_494 (ČSN EN 12630)	Food, feed <sup>43</sup> , dietary supplements
9.47 <sup>1</sup>	Determination of ethanol after distillation by gravimetry	CZ_SOP_D06_04_495 (ČSN 56 0186-5, ČSN 56 0210, ČSN 56 0216)	Alcoholic beverages

Annex:

Flexible scope of accreditation

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

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

#### Sampling:

Ordinal number <sup>1</sup>	Sampling procedure name	Sampling procedure identification <sup>2</sup>	Subject of sampling
1 <sup>1,2,4,5,6,7,8,9</sup>	Sampling of grab sample of surface water manually	CZ_SOP_D06_01_V01 (ČSN EN ISO 5667-1, ČSN EN ISO 5667-3, ČSN ISO 5667-4, ČSN EN ISO 5667-6, ČSN EN ISO 5667-14)	Surface water
2 <sup>1,2,3,4,5,6,7,8,9</sup>	Sampling of grab sample of waste water manually	CZ_SOP_D06_01_V02 (ČSN EN ISO 5667-1, ČSN EN ISO 5667-3, ČSN ISO 5667-10, ČSN EN ISO 5667-14,)	Waste water <sup>44</sup>
3 <sup>1,2,3,4,5,6,7,8,9,12</sup>	Sampling of drinking water and hot drinking water manually	CZ_SOP_D06_01_V03 (ČSN EN ISO 5667-1, ČSN EN ISO 5667-3, ČSN ISO 5667-5, ČSN EN ISO 5667-14, ČSN EN ISO 5667-21, ČSN EN ISO 19458, Decree 252/2004 Coll., Decree of SÚJB No. 307/2002 Coll.)	Drinking water, hot water

Page 35 of 45

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

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

Ordinal number <sup>1</sup>	Sampling procedure name	Sampling procedure identification <sup>2</sup>	Subject of sampling
4 <sup>1,2,3,4,5,6,7,8,9</sup>	Sampling of mixed sample of waste water manually and using an automatic sampler	CZ_SOP_D06_01_V04 (ČSN EN ISO 5667-1, ČSN EN ISO 5667-3, ČSN ISO 5667-10, ČSN EN ISO 5667-14)	Waste water <sup>44</sup>
5 <sup>1,2,3,4,5,7,8,9</sup>	Sampling of treated water manually	CZ_SOP_D06_01_V05 (ČSN EN ISO 5667-1, ČSN EN ISO 5667-3, ČSN ISO 5667-5, ČSN ISO 5667-7, ČSN EN ISO 5667-14)	Treated water <sup>50</sup>
6 <sup>1,2,3,4,5,6,7,8,9</sup>	Sampling of water from artificial bathing site manually	CZ_SOP_D06_01_V06 (ČSN EN ISO 5667-1, ČSN EN ISO 5667-3, ČSN ISO 5667-4, 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 <sup>1,2,3,4,5,6,7,8,9</sup>	Sampling of grab sample of ground water manually and using pumps	CZ_SOP_D06_01_V07 (ČSN EN ISO 5667-1, ČSN EN ISO 5667-3, ČSN ISO 5667-11, ČSN EN ISO 5667-14)	Ground water from boreholes and wells
8 <sup>1,2,4,5,6,7,8,9</sup>	Sampling of surface swab manually	CZ_SOP_D06_01_V08 (ČSN 56 0100:1994, ČSN EN ISO18593, Decree No. 289/2007 Coll., ČSN EN ISO 5667-1, ČSN EN ISO 5667-3, ČSN EN ISO 5667-14)	Contaminated surfaces
9 <sup>1,2,4,5,6,7,8,9</sup>	Sampling of sludge from sewage and treatment plants manually	CZ_SOP_D06_01_V09 (ČSN EN ISO 5667-1, ČSN EN ISO 5667-3, ČSN EN ISO 5667-13, ČSN EN ISO 5667-14, ČSN EN ISO 5667-15, ČSN EN ISO 19458)	Sludge from water treatment plants, sludge dumps
10 <sup>1,2,3,4,5,6,7,8,9</sup>	Sampling of bottom sediments manually	CZ_SOP_D06_01_V10 (ČSN EN ISO 5667-1, ČSN EN ISO 5667-3, ČSN ISO 5667-12, ČSN EN ISO 5667-14, ČSN EN ISO 5667-15, ČSN ISO 5667-17)	Bottom sediments from streams and reservoirs
11 <sup>1,2,3,4,5,6,7,8,9</sup>	Sampling of soils manually	CZ_SOP_D06_01_V11 (ČSN EN ISO 5667-1, ČSN EN ISO 5667-3, ČSN EN ISO 5667-13, ČSN EN ISO 5667-14,	Soils

Page 36 of 45

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

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

Ordinal number <sup>1</sup>	Sampling procedure name	Sampling procedure identification <sup>2</sup>	Subject of sampling
		ČSN EN ISO 5667-15, TNI CEN/TR 15310-1, TNI CEN/TR 15310-2, TNI CEN/TR 15310-3, TNI CEN/TR 15310-4, TNI CEN/TR 15310-5, ČSN 015110, ČSN 015111, ČSN EN 14899, ČSN EN ISO 19458)	
12 <sup>1,2,3,4,5,6,7,8,9</sup>	Sampling of waste manually	CZ_SOP_D06_01_V12 (ČSN EN ISO 5667-1, ČSN EN ISO 5667-3, ČSN EN ISO 5667-13, ČSN EN ISO 5667-14, ČSN EN ISO 5667-15, TNI CEN/TR 15310-1, TNI CEN/TR 15310-2, TNI CEN/TR 15310-3, TNI CEN/TR 15310-4, TNI CEN/TR 15310-5, ČSN 015110, ČSN 015111, ČSN 015112, ČSN EN 14899, ČSN EN ISO 19458, ČSN EN ISO 3170, Methodological Guide of ME for Waste Sampling 2008, 101s)	Waste
13 <sup>1,2,4,5,6,7</sup>	Air sampling by personal pump	CZ_SOP_D06_01_V13 (ČSN EN 481, ČSN EN 482, ČSN EN 689+AC, GR No. 361/2007 Coll.)	Working environment <sup>87</sup>
14	Reserved		
15 <sup>1,2,7</sup>	Gas sampling for the determination of ammonia	CZ_SOP_D06_01_V15 (ČSN 834728)	Gases <sup>36</sup>
16 <sup>1</sup>	Stationary air sampling for the determination of the number of asbestos and mineral fibers	CZ_SOP_D06_01_V16 (ISO 14966, chap. 5; VDI 3492, chap. 5 and 6, ČSN EN ISO 16000-7; ČSN EN 482, GR No. 361/2007, Coll. Annex No. 3)	Outdoor and indoor air, working environment <sup>87</sup>
17 <sup>1</sup>	Sampling for the asbestos determination	CZ_SOP_D06_01_V17 (VDI 3866, part 1)	Building materials <sup>82</sup> , materials for building <sup>49</sup> ,

Page 37 of 45

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

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

#### 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 Ali. 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 <sup>1)</sup>	Methods used for CZ_SOP_D06_03_153 - NIOSH 1400, NIOSH 1450, NIOSH 1457, NIOSH 1500, NIOSH 1501, NIOSH 1003, NIOSH 1005, NIOSH 1007, NIOSH 1022, NIOSH 1602, NIOSH 1609
PBB	Polybrominated biphenyls
PhEur	European Pharmacopoeia
PDA	Photo-Diode-Array detector
PUFA	Polymunsaturated Fatty Acids
RI	Refractometric Detector
SAFA	Saturated Fatty Acids
SEM/EDS	Scanning Electron Microscope / Energy Dispersive Spectrometer
SFS	The Finish Standard Association

Page 38 of 45



Page 43 of 45

Page 44 of 45

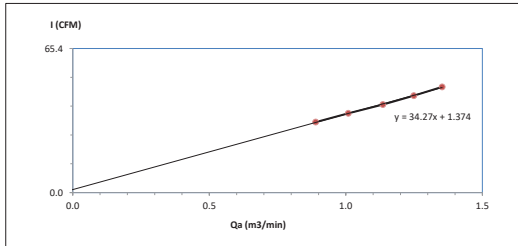




### High Volume Air Sampler Calibration Worksheet

Project Site : UAC(Thailand) Co.,Ltd Barometric Pressure (mm Hg) : 756.8  
Calibrate Location : บ้านวังหลวง Temperature (°C) : 32.6  
Calibrate Date : 19-Aug-24 High Volume ID : RYG-FS0185  
CalibrationSheet No. : C-190824-RYG-FS0185 High Volume Model : TE-5009X  
Calibrator ID : RYG-FS0205 High Volume S/N : 4793  
Calibrator Model : TE-S028A Calibrator Slope : 0.95561  
Calibrator S/N : 1166 Calibrator Intercept : -0.02266

Test No.	Delta H <sub>2</sub> O (inch)	Qa (m <sup>3</sup> /min)	I : Chart (CFM)	Linear Regression
1	1.7	0.890	32	Slope : 34.2705 Intercept : 1.3740 Correlation Coefficient : 0.9994
2	2.2	1.009	36	
3	2.8	1.135	40	
4	3.4	1.249	44	
5	4.0	1.353	48	



Calibrated by :   
( Mr. Santi Chaichana )  
Field Scientist(2)

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

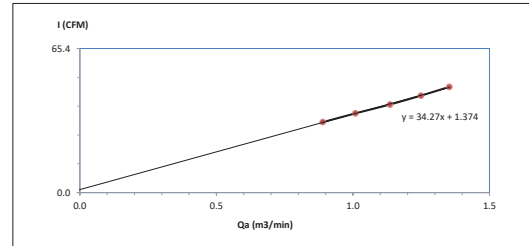
FORM NO.: F 06-074 REVISION NO.:2 ISSUE DATE: 20/11/23



### High Volume Air Sampler Calibration Worksheet

Project Site : UAC(Thailand) Co.,Ltd Barometric Pressure (mm Hg) : 756.8  
Calibrate Location : บ้านวังหลวง Temperature (°C) : 32.6  
Calibrate Date : 19-Aug-24 High Volume ID : RYG-FS0668  
CalibrationSheet No. : C-190824-RYG-FS0668 High Volume Model : TE-5009X  
Calibrator ID : RYG-FS0205 High Volume S/N : 6267  
Calibrator Model : TE-S028A Calibrator Slope : 0.95561  
Calibrator S/N : 1166 Calibrator Intercept : -0.02266

Test No.	Delta H <sub>2</sub> O (inch)	Qa (m <sup>3</sup> /min)	I : Chart (CFM)	Linear Regression
1	1.7	0.890	32	Slope : 34.2705 Intercept : 1.3740 Correlation Coefficient : 0.9994
2	2.2	1.009	36	
3	2.8	1.135	40	
4	3.4	1.249	44	
5	4.0	1.353	48	



Calibrated by :   
( Mr. Santi Chaichana )  
Field Scientist(2)

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

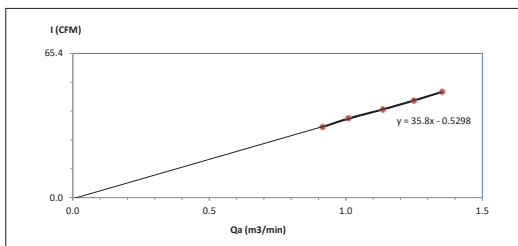
FORM NO.: F 06-074 REVISION NO.:2 ISSUE DATE: 20/11/23



### High Volume Air Sampler Calibration Worksheet

Project Site : UAC(Thailand) Co.,Ltd Barometric Pressure (mm Hg) : 756.8  
Calibrate Location : บ้านวังหลวง Temperature (°C) : 32.6  
Calibrate Date : 19-Aug-24 High Volume ID : RYG-FS0189  
CalibrationSheet No. : C-190824-RYG-FS0189 High Volume Model : TE-5009X  
Calibrator ID : RYG-FS0205 High Volume S/N : 4797  
Calibrator Model : TE-S028A Calibrator Slope : 0.95561  
Calibrator S/N : 1166 Calibrator Intercept : -0.02266

Test No.	Delta H <sub>2</sub> O (inch)	Qa (m <sup>3</sup> /min)	I : Chart (CFM)	Linear Regression
1	1.8	0.915	32	Slope : 35.7999 Intercept : -0.5298 Correlation Coefficient : 0.9991
2	2.2	1.009	36	
3	2.8	1.135	40	
4	3.4	1.249	44	
5	4.0	1.353	48	



Calibrated by :   
( Mr. Santi Chaichana )  
Field Scientist(2)

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

FORM NO.: F 06-074 REVISION NO.:2 ISSUE DATE: 20/11/23

Sartorius (Thailand) Co., Ltd.  
129 Rama 9 Road, Huaykhwang, Huaykhwang, Bangkok 10310  
Tel: +66 2043 0351-6, e-mail: service.thailand@sartorius.com



SARTORIUS

## Certificate of Calibration

Model Number : LA1305-F Certificate No. : 24BCI0068  
Description : Analytical Balances Issued Date : Friday, February 23, 2024  
Serial Number : 25409664 Reference No. : 22B196  
ID No. : RYG\_ENC001  
Manufacturer : Sartorius Page No. : 1 of 5

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

Calibrated By : Mr. Chonchai Inthana  
Calibration Date : Thursday, February 22, 2024  
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  
Reasons for calibration : ☐ New Installation ☐ Service / Repaired ☒ Recalibration/ 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 realize the unit of measurement according to the International Standard System of Units (SI). Report of Tolerance came from list of Sartorius Metrological Specifications.

Model Number	Description	Traceability	Certificate No.	Due Date
YCS011-522-00	Sartorius weight set 1mg - 5000g E2, YCS011-522-00	TCS	M2306197S	23-Aug-2025
MHB-362SD	Humidity/Balometer/Temp. Lutron MHB-362SD	DKSH	C16231945	23-Aug-2024

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





# Certificate of Calibration

Model Number: LA130S-F Certificate No.: 24BCI0068  
Description: Analytical Balance Issued Date: Friday, February 23, 2024  
Serial Number: 25409884 Reference No.: 229186  
ID No.: RYG\_EN0001  
Manufacturer: Sartorius Page No.: 2 of 2

## Calibration Results : Without Adjustment

**Repeatability**  
The repeatability is the ability of a weighing instrument to display nearly identical readings under constant test conditions when the same load within a measurement range 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	99.9999
10 g	10.0000	100.0000
Tolerance	10.0000	100.0001
0.0001 g	10.0000	100.0001
	9.9999	100.0000

**Nominal Value: (High Load)**  
100 g  
Tolerance 10.0000 100.0001  
0.0001 g 10.0000 100.0001  
9.9999 100.0002  
9.9999 100.0001

Standard Deviation 0.00005 0.00008

**Eccentricity (Off-center loading error)**  
The off-center loading error is judged 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
1	2	3	4	5	6
	-0.0001	0.0001	0.0002	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 (g)	Conventional Mass Value (g)	Displayed Value (g)	Deviation (g)	Uncertainty (g)
0.01	0.0100	0.0100	0.0000	0.00020
0.05	0.0500	0.0500	0.0000	0.00021
0.1	0.1000	0.1000	0.0000	0.00021
0.5	0.5000	0.5000	0.0000	0.00021
1	1.0000	1.0000	0.0000	0.00021
2	2.0000	2.0000	0.0000	0.00021
5	5.0000	5.0000	0.0000	0.00021
10	10.0000	10.0001	0.0001	0.00024
20	20.0000	20.0001	0.0001	0.00021
100	100.0000	99.9999	-0.0001	0.00024

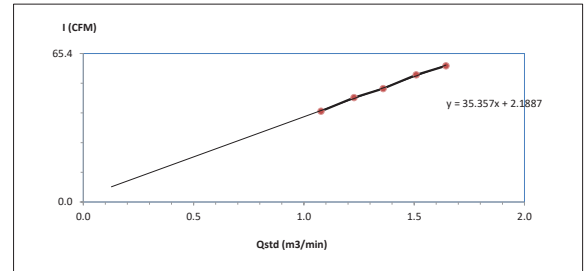
End of Report.

SOP FM 33 03 February 2022

## High Volume Air Sampler Calibration Worksheet

Project Site: UAC(Thailand) Co.,Ltd Barometric Pressure (mm Hg): 756.8  
Calibrate Location: บ้านท่าเรือ Temperature (°C): 32.6  
Calibrate Date: 19-Aug-24 High Volume ID: RYG\_FS0395  
Calibration Sheet No.: C-190824-RYG\_FS0395 High Volume Model: TE-5170D  
Calibrator ID: RYG\_FS0205 High Volume S/N: 5692  
Calibrator Model: TE-5028A Calibrator Slope: 1.52567  
Calibrator S/N: 1166 Calibrator Intercept: -0.03613

Test No.	Delta H <sub>2</sub> O (inch)	Q <sub>std</sub> (m <sup>3</sup> /min)	I: Chart (CFM)	Linear Regression
1	2.6	1.0776	40	Slope: 35.3571
2	3.4	1.2271	46	Intercept: 2.1887
3	4.2	1.3598	50	Correlation Coefficient: 0.9987
4	5.2	1.5090	56	
5	6.2	1.6444	60	



Calibrated by: (Mr.Santi Chaichana) Field Scientist(2)

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

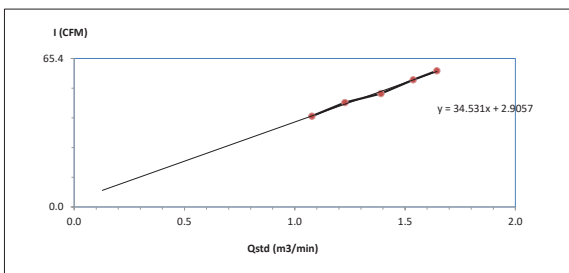
FORM NO.: F 06-073 REVISION NO.:2 ISSUE DATE: 20/11/23



## High Volume Air Sampler Calibration Worksheet

Project Site: UAC(Thailand) Co.,Ltd Barometric Pressure (mm Hg): 756.8  
Calibrate Location: บ้านท่าเรือ Temperature (°C): 32.6  
Calibrate Date: 19-Aug-24 High Volume ID: RYG\_FS0174  
Calibration Sheet No.: C-190824-RYG\_FS0174 High Volume Model: TE-5170D  
Calibrator ID: RYG\_FS0205 High Volume S/N: 4800  
Calibrator Model: TE-5028A Calibrator Slope: 1.52567  
Calibrator S/N: 1166 Calibrator Intercept: -0.03613

Test No.	Delta H <sub>2</sub> O (inch)	Q <sub>std</sub> (m <sup>3</sup> /min)	I: Chart (CFM)	Linear Regression
1	2.6	1.0776	40	Slope: 34.5314
2	3.4	1.2271	46	Intercept: 2.9057
3	4.4	1.3909	50	Correlation Coefficient: 0.9970
4	5.4	1.5370	56	
5	6.2	1.6444	60	



Calibrated by: (Mr.Santi Chaichana) Field Scientist(2)

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

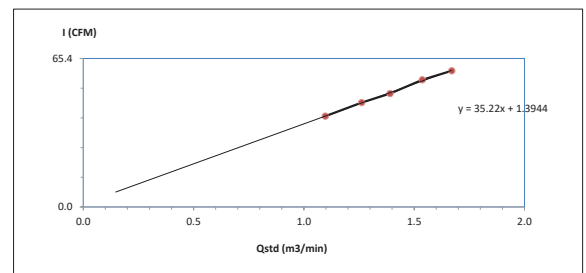
FORM NO.: F 06-073 REVISION NO.:2 ISSUE DATE: 20/11/23



## High Volume Air Sampler Calibration Worksheet

Project Site: UAC(Thailand) Co.,Ltd Barometric Pressure (mm Hg): 756.8  
Calibrate Location: บ้านท่าเรือ Temperature (°C): 32.6  
Calibrate Date: 19-Aug-24 High Volume ID: RYG\_FS0396  
Calibration Sheet No.: C-190824-RYG\_FS0396 High Volume Model: TE-5170D  
Calibrator ID: RYG\_FS0205 High Volume S/N: 5688  
Calibrator Model: TE-5028A Calibrator Slope: 1.52567  
Calibrator S/N: 1166 Calibrator Intercept: -0.03613

Test No.	Delta H <sub>2</sub> O (inch)	Q <sub>std</sub> (m <sup>3</sup> /min)	I: Chart (CFM)	Linear Regression
1	2.7	1.0974	40	Slope: 35.2200
2	3.6	1.2616	46	Intercept: 1.3944
3	4.4	1.3909	50	Correlation Coefficient: 0.9991
4	5.4	1.5370	56	
5	6.4	1.6701	60	



Calibrated by: (Mr.Santi Chaichana) Field Scientist(2)

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

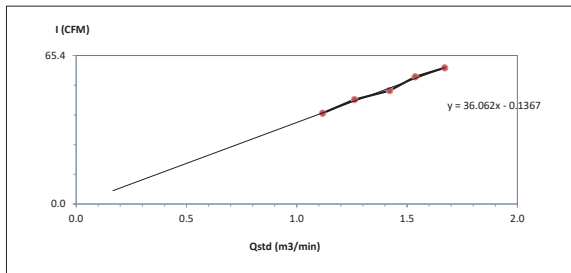
FORM NO.: F 06-073 REVISION NO.:2 ISSUE DATE: 20/11/23



### High Volume Air Sampler Calibration Worksheet

Project Site : UAC(Thailand) Co.,Ltd Barometric Pressure (mm Hg) : 756.8  
Calibrate Location : กรุงเทพมหานคร Temperature (°C) : 32.6  
Calibrate Date : 19-Aug-24 High Volume ID : RYG\_FS0292  
Calibration Sheet No. : C-190824-RYG\_FS0292 High Volume Model : TE-5170D  
Calibrator ID : RYG\_FS0205 High Volume S/N : 5497  
Calibrator Model : TE-5028A Calibrator Slope : 1.52567  
Calibrator S/N : 1166 Calibrator Intercept : -0.03613

Test No.	Delta H <sub>2</sub> O (inch)	Q <sub>std</sub> (m <sup>3</sup> /min)	I : Chart (CFM)	Linear Regression
1	2.8	1.1169	40	Slope : 36.0616 Intercept : -0.1367 Correlation Coefficient : 0.9956
2	3.6	1.2616	46	
3	4.6	1.4214	50	
4	5.4	1.5370	56	
5	6.4	1.6701	60	



Calibrated by

(Mr.Santi Chaichana)  
Field Scientist(2)

Approved by :

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

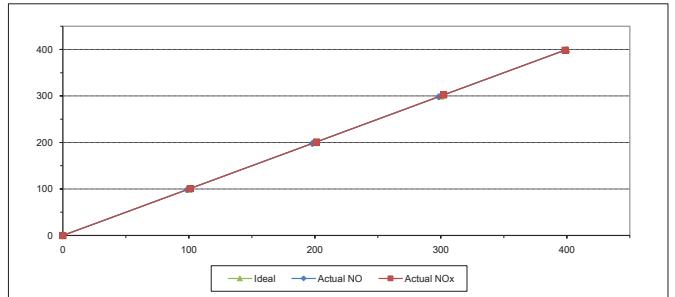
FORM NO.: F 06-073 REVISION NO.:2 ISSUE DATE: 20/11/23



### MULTIPOINT CALIBRATION REPORT

Calibration Date : 2-Jul-24 Equipment Name : NOx Analyzer  
Manufacturer : Teledyne API Model : T200  
Serial No. : 2198 Equipment ID : RYG\_FS0252  
Calibrator Manufacturer : Teledyne API Model : 700  
Serial No. : 947  
Std. Gas Concentration (PPM) : 55.88 Cylinder No. : GN0027222  
Cylinder Pressure (psi) : 1800 Certified By : Airgas Inc.  
Certified Date : 9-Feb-22 Expired Date : 9-Feb-30

Point	CALIBRATION RESULTS						
	Ideal	Actual NO	Error NO	%Error NO	Actual NOx	Error NOx	%Error NOx
ZERO	0.00	0.10	0.10	0.10	0.10	0.10	0.10
1	100.00	98.70	-1.30	-1.30	101.00	1.00	1.00
2	200.00	198.00	-2.00	-1.00	201.30	1.30	0.65
3	300.00	298.50	-1.50	-0.50	302.30	2.30	0.77
4	400.00	398.20	-1.80	-0.45	398.60	-1.40	-0.35
AVERAGE (%)				-0.63			0.43



Calibrated By

(Mr.Jirawut Sakam)

Field Environmental Scientist (3)

Approved By

(Mr.Sarayuth Jitranont)

Assistant General Manager

ALS Laboratory Group

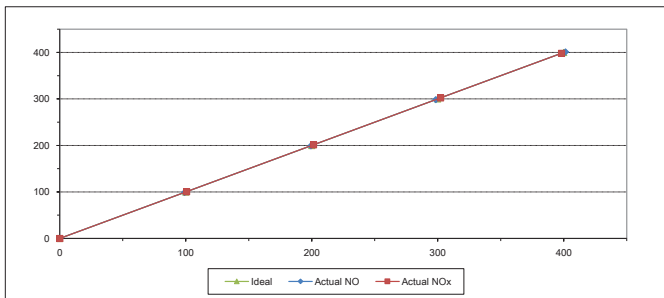
FORM NO.: F 06-056 REVISION NO.: - ISSUE DATE: 02/04/12



### MULTIPOINT CALIBRATION REPORT

Calibration Date : 2-Jul-24 Equipment Name : NOx Analyzer  
Manufacturer : HORIBA Model : APNA-370  
Serial No. : 148EH0E0 Equipment ID : BKK\_FS1084  
Calibrator Manufacturer : Teledyne API Model : 700  
Serial No. : 947  
Std. Gas Concentration (PPM) : 55.88 Cylinder No. : GN0027222  
Cylinder Pressure (psi) : 1800 Certified By : Airgas Inc.  
Certified Date : 9-Feb-22 Expired Date : 9-Feb-30

Point	CALIBRATION RESULTS						
	Ideal	Actual NO	Error NO	%Error NO	Actual NOx	Error NOx	%Error NOx
ZERO	0.00	0.10	0.10	0.10	0.10	0.10	0.10
1	100.00	99.10	-0.90	-0.90	100.70	0.70	0.70
2	200.00	199.30	-0.70	-0.35	201.40	1.40	0.70
3	300.00	298.50	-1.50	-0.50	302.30	2.30	0.77
4	400.00	401.40	1.40	0.35	398.30	-1.70	-0.42
AVERAGE (%)				-0.26			0.37



Calibrated By

(Mr.Jirawut Sakam)

Field Environmental Scientist (3)

Approved By

(Mr.Sarayuth Jitranont)

Assistant General Manager

ALS Laboratory Group

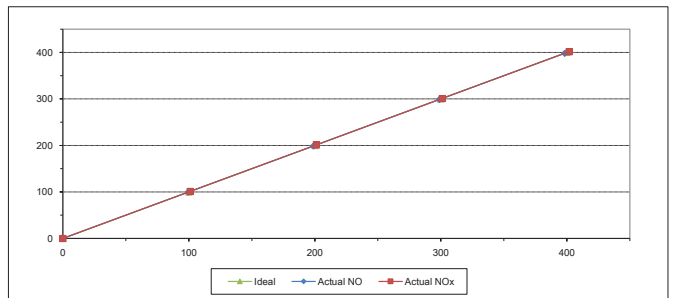
FORM NO.: F 06-056 REVISION NO.: - ISSUE DATE: 02/04/12



### MULTIPOINT CALIBRATION REPORT

Calibration Date : 3-Jul-24 Equipment Name : NOx Analyzer  
Manufacturer : Teledyne API Model : T200  
Serial No. : 7238 Equipment ID : RYG\_FS0533  
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	99.50	-0.50	-0.50	101.10	1.10	1.10
2	200.00	198.90	-1.10	-0.55	201.20	1.20	0.60
3	300.00	298.80	-1.20	-0.40	301.10	1.10	0.37
4	400.00	398.30	-1.70	-0.42	401.80	1.80	0.45
AVERAGE (%)				-0.35			0.52



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

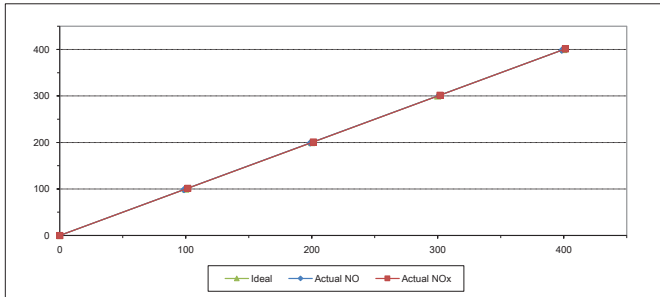




### MULTIPOINT CALIBRATION REPORT

Calibration Date	3-Jul-24	Equipment Name	NOx Analyzer
Manufacturer	HORIBA	Model	APNA-370
Serial No.	ALP0V0WY	Equipment ID	RYG_FS0455
Calibrator Manufacturer	Teledyne API	Model	700
Serial No.	947		
Std. Gas Concentration (PPM)	55.88	Cylinder No.	GN0027222
Cylinder Pressure (psi)	1800	Certified By	Airgas Inc.
Certified Date	9-Feb-22	Expired Date	9-Feb-30

Point	CALIBRATION RESULTS						
	Ideal	Actual NO	Error NO	%Error NO	Actual NOx	Error NOx	%Error NOx
ZERO	0.00	0.10	0.10	0.10	0.10	0.10	0.10
1	100.00	98.60	-1.40	-1.40	101.60	1.60	1.60
2	200.00	198.80	-1.20	-0.60	201.30	1.30	0.65
3	300.00	301.00	1.00	0.33	301.80	1.80	0.60
4	400.00	398.50	-1.50	-0.38	401.30	1.30	0.33
AVERAGE (%)				-0.39			0.66



Calibrated By

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

Approved By

(Mr. Sarayuth Jitranont)  
Assistant General Manager

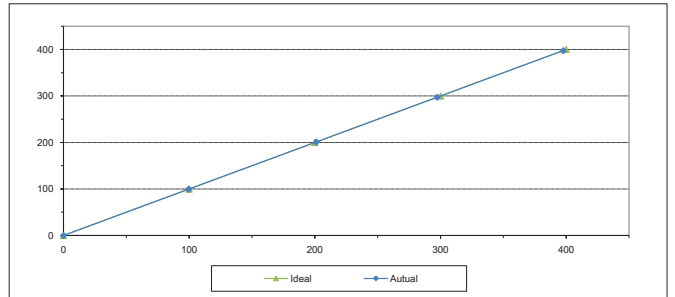
ALS Laboratory Group  
FORM NO.: F 06-056 REVISION NO.: - ISSUE DATE: 02/04/12



### MULTIPOINT CALIBRATION REPORT

Calibration Date	4-Jul-24	Equipment Name	SO2 Analyzer
Manufacturer	Teledyne API	Model	T100
Serial No.	1773	Equipment ID	RYG_FS0251
Calibrator Manufacturer	Teledyne API	Model	700
Serial No.	947		
Std. Gas Concentration (PPM)	56.3	Cylinder No.	GN0027222
Cylinder Pressure (psi)	1800	Certified By	Airgas Inc.
Certified Date	9-Feb-22	Expired Date	9-Feb-30

Point	CALIBRATION RESULTS			
	Ideal	Actual	Error	%Error
ZERO	0.00	0.10	0.10	0.10
1	100.00	99.60	-0.40	-0.40
2	200.00	201.20	1.20	0.60
3	300.00	297.30	-2.70	-0.90
4	400.00	397.60	-2.40	-0.60
AVERAGE (%)				-0.24



Calibrated By

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

Approved By

(Mr. Sarayuth Jitranont)  
Assistant General Manager

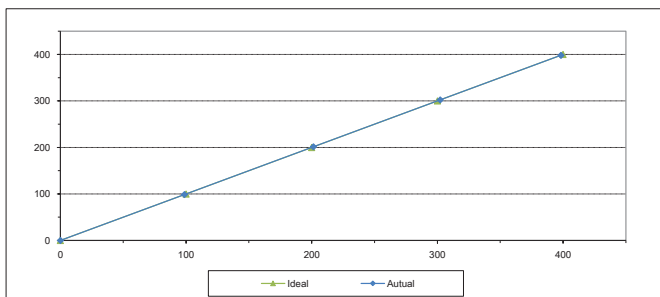
ALS Laboratory Group  
FORM NO.: F 06-056 REVISION NO.: - ISSUE DATE: 02/04/12



### MULTIPOINT CALIBRATION REPORT

Calibration Date	4-Jul-24	Equipment Name	SO2 Analyzer
Manufacturer	HORIBA	Model	APSA-370
Serial No.	NM3M2D5M	Equipment ID	RYG_FS0266
Calibrator Manufacturer	Teledyne API	Model	700
Serial No.	947		
Std. Gas Concentration (PPM)	56.3	Cylinder No.	GN0027222
Cylinder Pressure (psi)	1800	Certified By	Airgas Inc.
Certified Date	9-Feb-22	Expired Date	9-Feb-30

Point	CALIBRATION RESULTS			
	Ideal	Actual	Error	%Error
ZERO	0.00	0.10	0.10	0.10
1	100.00	98.70	-1.30	-1.30
2	200.00	201.40	1.40	0.70
3	300.00	302.30	2.30	0.77
4	400.00	398.30	-1.70	-0.42
AVERAGE (%)				-0.03



Calibrated By

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

Approved By

(Mr. Sarayuth Jitranont)  
Assistant General Manager

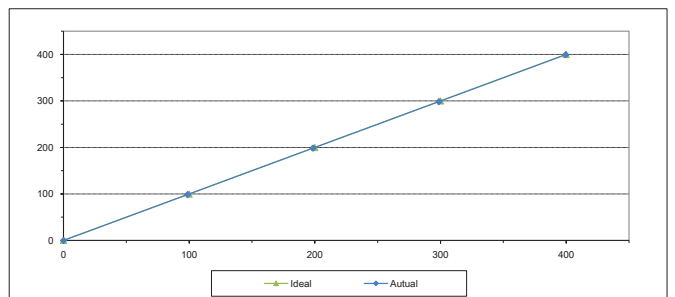
ALS Laboratory Group  
FORM NO.: F 06-056 REVISION NO.: - ISSUE DATE: 02/04/12



### MULTIPOINT CALIBRATION REPORT

Calibration Date	5-Jul-24	Equipment Name	SO2 Analyzer
Manufacturer	Teledyne API	Model	T100
Serial No.	6060	Equipment ID	RYG_FS0532
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	98.80	-1.20	-1.20
2	200.00	198.60	-1.40	-0.70
3	300.00	298.70	-1.30	-0.43
4	400.00	399.60	-0.40	-0.10
AVERAGE (%)				-0.47



Calibrated By

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

Approved By

(Mr. Sarayuth Jitranont)  
Assistant General Manager

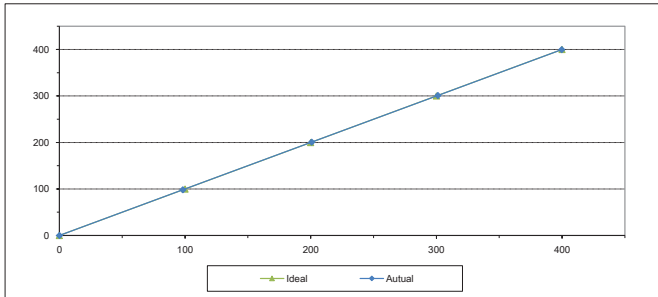
ALS Laboratory Group  
FORM NO.: F 06-056 REVISION NO.: - ISSUE DATE: 02/04/12



## MULTIPOINT CALIBRATION REPORT

Calibration Date	5-Jul-24	Equipment Name	SO2 Analyzer
Manufacturer	HORIBA	Model	APSA-370
Serial No.	H053D9FA	Equipment ID	RYG_FS0454
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	98.30	-1.70	-1.70
2	200.00	200.80	0.80	0.40
3	300.00	301.20	1.20	0.40
4	400.00	399.70	-0.30	-0.08
AVERAGE (%)				-0.18



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



JIRANATEE ASSOCIATES CO., LTD.

Jiranatee Associates Co., Ltd.  
62/14-15, 67/35-36  
Petchkasem 7/71, Rd. Wattana, Bangkok,  
Bangkok 10500 (Thailand)  
Tel: +6688888812  
Mobile: +6688888813  
E-mail: jnac-calibration@jiranatee.com  
Web site: www.jiranatee.com

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

Air speed measurement laboratory  
Calibration services department.

REVIEW BY: *Manaborn P*  
APPROVED BY: *Stt*  
NEXT CAL DATE: 18/2/25

Certificate Number

CWS-003-66

## CERTIFICATE OF CALIBRATION

Page 1 of 2 Pages

MEASUREMENT ITEM: Cup anemometer  
MANUFACTURER: Novallix  
MODEL/TYPE: Sensor: WS-02F  
Data logger: 200-WS-25LB  
SERIAL NUMBER: Sensor: WSD-A5190  
Data logger: AS190  
ID NUMBER: RYG\_FS0329  
CONDITION AS-RECEIVED: Used item  
CUSTOMER: J NAC laboratory group (Thailand) Co., Ltd.  
104 Phatthanakan 40, Phatthanakan Rd, Khwaeng Suan Luang,  
Khet Suan Luang, Bangkok 10250 Thailand.

RECEIVED DATE: 11 Aug 2023  
MEASUREMENT DATE: 18 Aug 2023  
ISSUE DATE: 21 Aug 2023

### ENVIRONMENTAL CONDITIONS:

Ambient condition in the laboratory are as follow:

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

### PLACE OF CALIBRATION

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

### CALIBRATION CONDITIONS

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

Preconditioning: 24 hours at ambient conditions.

Measurement Condition: The average values during measurement are (24.3) °C, (43.1) %RH and (1005.59) hPa.

### TABULATION OF RESULTS:

The table on next page give the measured values.

### Calibrated by:

Mr. Sorawit Thichthad  
Miss Jitragorn Lertsomphol



### Approved signatory:

Mr. Parinya Booncharoen  
Calibration Department Manager

### Remarks:

<sup>1</sup> Nozzle cross-section area of the wind tunnel  
<sup>2</sup> Projected cross-section area of the tested object include mounting pipe  
<sup>3</sup> Diameter of mounting pipe  
<sup>4</sup> Ratio  $S_{obj}/S_{ref}$

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

CWS-003-66

Page 2 of 2 Pages

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

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

$v_{ref}$ (m/s)	Temp. wind tunnel (°C)	Temp. room (°C)	$v_{meas}$ (m/s)	Error (m/s)	$U$ (k=2) (m/s)
1.032	24.10	24.30	0.9	-0.1	0.31
2.095	24.54	24.30	1.9	-0.2	0.31
3.006	24.08	24.30	2.9	-0.1	0.31
4.220	24.04	24.30	4.0	-0.2	0.31
5.00	23.78	24.30	4.9	-0.1	0.31
5.97	23.82	24.30	5.9	-0.1	0.31
7.01	23.78	24.30	6.9	-0.1	0.31
8.13	24.00	24.30	8.0	-0.1	0.31
9.07	23.82	24.30	9.0	-0.1	0.31
10.07	23.90	24.30	9.9	-0.1	0.31
11.13	23.84	24.30	11.1	0.0	0.31
12.13	23.80	24.30	12.0	-0.1	0.31
13.19	23.82	24.30	13.2	0.0	0.31
14.24	23.74	24.30	14.1	-0.1	0.31
15.20	23.80	24.30	15.2	0.0	0.31
16.26	23.74	24.30	16.1	-0.2	0.31

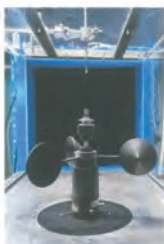
### Remarks:

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

<sup>2</sup> Velocity of standard

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

### PHOTO OF CALIBRATION SET-UP



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



JIRANATEE ASSOCIATES CO., LTD.

Jiranatee Associates Co., Ltd.  
62/14-15, 67/35-36  
Petchkasem 7/71, Rd. Wattana, Bangkok,  
Bangkok 10500 (Thailand)  
Tel: +6688888812  
Mobile: +6688888813  
E-mail: jnac-calibration@jiranatee.com  
Web site: www.jiranatee.com

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

Air speed measurement laboratory  
Calibration services department.

Certificate Number

CWO-003-66

## CERTIFICATE OF CALIBRATION

Page 1 of 2 Pages

MEASUREMENT ITEM: Wind Direction Sensor  
MANUFACTURER: Novallix  
MODEL/TYPE: Sensor: WS-02F  
Data logger: 200-WS-25LB  
SERIAL NUMBER: Sensor: WSD-A5190  
Data logger: AS190  
ID NUMBER: RYG\_FS0329  
CONDITION AS-RECEIVED: Used item  
CUSTOMER: J NAC laboratory group (Thailand) Co., Ltd.  
104 Phatthanakan 40, Phatthanakan Rd, Khwaeng Suan Luang,  
Khet Suan Luang, Bangkok 10250 Thailand.

RECEIVED DATE: 11 Aug 2023  
MEASUREMENT DATE: 18 Aug 2023  
ISSUE DATE: 21 Aug 2023

### ENVIRONMENTAL CONDITIONS:

Ambient condition in the laboratory are as follow:

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

### PLACE OF CALIBRATION

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

### CALIBRATION CONDITION

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

Preconditioning: 24 hours at ambient conditions.

Measurement Condition: The average values during measurement are (23.9) °C, (44.8) %RH and (1009.2) hPa.

### TABULATION OF RESULTS:

The table on next page give the measured values.

### Calibrated by:

Mr. Sorawit Thichthad  
Miss Jitragorn Lertsomphol



### Approved signatory:

Mr. Parinya Booncharoen  
Calibration Department Manager

### Remarks:

<sup>1</sup> Nozzle cross-section area of the wind tunnel  
<sup>2</sup> Projected cross-section area of the tested object include mounting pipe  
<sup>3</sup> Diameter of mounting pipe  
<sup>4</sup> Ratio  $S_{obj}/S_{ref}$

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



MEASUREMENT RESULTS<sup>1</sup>

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

Air speed m/s	D <sup>+</sup> <sub>rot</sub> Degree (°)	D <sup>-</sup> <sub>rot</sub> Degree (°)	Error Degree (°)	U (k=2) Degree (°)
5.00	45.000	41	-4	1.0
	90.000	87	-3	1.0
	135.001	132	-3	1.0
	180.000	178	-2	1.0
	225.000	226	1	1.0
	270.000	272	2	1.0
	315.000	319	4	1.0
	360.000	359	-1	1.0

## Remarks:

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

<sup>2</sup> Direction of standard

Direction of Unit Under Calibration

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



Sartorius (Thailand) Co., Ltd.  
128 Rama 9 Road, Huaykwang, Huaykwang, Bangkok 10310  
Tel: +66 2843 8361-6 Fax: +66 2843-8367, e-mail: service.thailand@sartorius.com

SARTORIUS

## Certificate of Calibration

Model Number : MSE125P-100-DU Certificate No. : 248C0071  
Description : Semi-micro Balance Issued Date : Friday, February 23, 2024  
Serial Number : 0033108993 Reference No. : 229196  
ID No. : RYG\_EN0004  
Manufacturer : Sartorius Page No. : 2 of 3

## Calibration Results : Without Adjustment

<b>Repeatability</b> 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.		<b>Eccentricity (Off-center loading error)</b> The off-center loading error is yielded by the difference between the readout of the load, i.e. 1/3 or 1/4 of maximum capacity, placed in the middle of the weighing pan and between each of four additional measurement points (positions defined according to GIM, R70).	
Nominal Value : (Low Load) 5 g	5.00003 5.00001 5.00003 5.00002 5.00001 5.00003 5.00002 5.00002 5.00002	50.00003 50.00003 50.00002 50.00003 50.00003 50.00003 50.00002 50.00003 50.00002	Nominal value : 50 g Tolerance 0.00015 g  Difference 1 - 2 -0.00001 3 0.00000 4 0.00001 5 0.00001 6 -
Nominal Value : (High Load) 50 g	50.00002 50.00001 50.00001 50.00002 50.00002 50.00002 50.00002 50.00002 50.00002	50.00003 50.00003 50.00003 50.00002 50.00003 50.00003 50.00002 50.00003 50.00002	        
Tolerance 0.000015 g			Standard Deviation 0.000008 0.000005

## 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)
0.1	0.01000	0.01000	0.00000	0.000024
0.1	0.10000	0.10000	0.00000	0.000025
1	1.00000	1.00000	0.00000	0.000027
2	2.00002	2.00002	0.00000	0.000028
5	5.00002	5.00003	0.00001	0.000031
10	10.00002	10.00004	0.00002	0.000036
20	20.00002	20.00002	0.00000	0.000049
30	30.00004	30.00003	-0.00001	0.000089
40	40.00005	40.00003	-0.00002	0.000089
50	50.00002	50.00001	-0.00001	0.000089

Sartorius (Thailand) Co., Ltd.  
128 Rama 9 Road, Huaykwang, Huaykwang, Bangkok 10310  
Tel: +66 2843 8361-6, e-mail: service.thailand@sartorius.com



MSC-TB-113 17023  
CALIBRATION 0436

SARTORIUS

## Certificate of Calibration

REVIEW BY: Thawit  
APPROVED BY: [Signature]  
NEXT CAL. DATE: 02/07/2025

Model Number : MSE125P-100-DU Certificate No. : 248C0071  
Description : Semi-micro Balance Issued Date : Friday, February 23, 2024  
Serial Number : 0033108993 Reference No. : 229196  
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 : Thursday, February 22, 2024 Using in-house calibration procedure number (WI-005)  
Based on UKAS LAB 14 : 2019

Metrological data : Capacity : 80,1120 g Readability : 0.00001/0.0001 g  
Reasons for calibration : ☐ New Installation ☐ Service / Repair ☒ Re-calibration Maintenance  
Ambients Conditions : Temperature : 24.0 °C ± 5.0 °C  
Humidity : 60.0 % RH ± 10.0 % RH  
Pressure : ±  
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
YC5011-522-00	Sartorius weight set 1mg - 5000g E2.YC5011-522-00	TCS	M2306197S	23-Aug-2025
MHB-382SD	Humidity/Balance/Temp. Lutron MHB-382SD	DKSH	C19231845	23-Aug-2024

This certificate relate and apply this equipment only.

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

SOP FM 33 03 February 2022

Mr.chonchai inthana(Technical Manager)



Sartorius (Thailand) Co., Ltd.  
128 Rama 9 Road, Huaykwang, Huaykwang, Bangkok 10310  
Tel: +66 2843 8361-6 Fax: +66 2843-8367, e-mail: service.thailand@sartorius.com

SARTORIUS

## Certificate of Calibration

REVIEW BY: Thawit  
APPROVED BY: [Signature]  
NEXT CAL. DATE: 02/07/2025

Model Number : MSE125P-100-DU Certificate No. : 248C0071  
Description : Semi-micro Balance Issued Date : Friday, February 23, 2024  
Serial Number : 0033108993 Reference No. : 229196  
ID No. : RYG\_EN0004  
Manufacturer : Sartorius Page No. : 3 of 3

## Calibration Results : Without Adjustment

<b>Repeatability</b> 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.		<b>Eccentricity (Off-center loading error)</b> The off-center loading error is yielded by the difference between the readout of the load, i.e. 1/3 or 1/4 of maximum capacity, placed in the middle of the weighing pan and between each of four additional measurement points (positions defined according to GIM, R70).	
Nominal Value : (Low Load) g	100.0000 100.0000 100.0000 100.0000 100.0000 100.0000 100.0000 100.0000 100.0000	50 g Tolerance 0.00015 g Difference 1 - 2 - 3 - 4 - 5 - 6 -	Nominal value : 50 g Tolerance 0.00015 g  Difference 1 - 2 - 3 - 4 - 5 - 6 -
Nominal Value : (High Load) 100 g	100.0000 100.0001 100.0000 100.0000 100.0000 100.0000 100.0000 100.0000 100.0000		
Tolerance 0.000015 g			Standard Deviation 0.00003

## Linearity

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

Nominal Value (g)	Conventional Mass Value (g)	Displayed Value (g)	Deviation (g)	Uncertainty (g)
65	65.0000	65.0000	0.0000	0.00015
70	70.0000	70.0000	0.0000	0.00015
75	75.0001	75.0000	-0.0001	0.00015
80	80.0001	80.0000	-0.0001	0.00016
85	85.0001	85.0001	0.0000	0.00018
90	90.0001	90.0001	0.0000	0.00017
95	95.0001	95.0001	0.0000	0.00019
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.





## Certificate of Calibration

### ICS-2100: Anion (ID#659)

This certificate is to verify that instrument below are calibrated  
by Archemica 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, 2024

(Mr. Nutdanai Laekhwan)

Application Chemist

REVIEW BY: Auchawan S.  
APPROVED BY: Tamngitong  
NEXT CAL. DATE: 12 Jun 2025



บริษัท เอกเสควิทีพี เทรดดิ้ง จำกัด (สำนักงานใหญ่)  
48/194-5 ซอยประชาชื่นรังสิต 19 ถนนประชาชื่นรังสิต แขวงลาดพร้าว เขตคลองจั่น กรุงเทพมหานคร 10230  
TEL (662) 515-0145-50 FAX (662) 515-0144 www.etthai.com E-mail : info@etthai.com

ที่ RA 015/24

## ใบรายงานผลการปรับเทียบ

ชื่อผู้ขอรับบริการ : บริษัท เอกเสควิทีพี เทรดดิ้ง จำกัด (ประเทศไทย) จำกัด.  
ที่อยู่ : 104 ซ.พัฒนาการ 40 ถ.พัฒนาการ แขวงสวนหลวง เขตสวนหลวง กรุงเทพมหานคร 10250.  
ปรับเทียบที่ : บริษัท เอกเสควิทีพี เทรดดิ้ง จำกัด  
ที่อยู่ : 48/194-5 ซอยประชาชื่นรังสิต 19 ถนนประชาชื่นรังสิต แขวงลาดพร้าว เขตคลองจั่น กรุงเทพมหานคร 10230

รายละเอียดเครื่องมือที่ทำการปรับเทียบ : สภาวะแวดล้อม :  
เครื่องมือ : เครื่องตรวจวัดไอระเหยจากสารเคมี อุณหภูมิ :  $(25 \pm 3) ^\circ\text{C}$   
ผลิตภัณฑ์ : RAE Systems ความชื้นสัมพัทธ์ :  $(43 \pm 15) \%$   
รุ่น : MiniRAE3000 ความดันบรรยากาศ : 760 มิลลิเมตรปรอท  
หมายเลขเครื่อง : 592-906493  
ID : BKK\_FS0819

วันที่ปรับเทียบมาตรฐาน : 19 มกราคม 2567  
วิธีการปรับเทียบมาตรฐาน : ปรับเทียบโดยใช้ Standard Reference Gas  
- Isobutylene Standard Gas 100 ppm; Lot number: 302-402431506.

### 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)	93.2 ppm	100.0 ppm	0.0 ppm	Pass

Flow Rate of Pump : 480 cc/min.

Accuracy :  $\pm 3 \%$  at calibration point

ผู้ปรับเทียบ : สุรินทร์พร สายเนตร  
(นายสุรินทร์พร สายเนตร)  
Service Engineer

ผู้ตรวจสอบ : สุวิทย์ กองทองสังข์  
(นายสุวิทย์ กองทองสังข์)  
Service Engineer Manager

ผลการสอบเทียบปรับเทียบนี้ มีผลเฉพาะตัวเครื่องและรายการที่ใช้ระบุไว้เท่านั้น  
การนำผลการสอบเทียบไปใช้เพื่อวัตถุประสงค์อื่นโดยไม่ขอแจ้งต่อทางบริษัทฯ ได้รับอนุญาตเป็นลายลักษณ์อักษรจากบริษัทฯ

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



บริษัท เอกเสควิทีพี เทรดดิ้ง จำกัด (สำนักงานใหญ่)  
48/194-5 ซอยประชาชื่นรังสิต 19 ถนนประชาชื่นรังสิต แขวงลาดพร้าว เขตคลองจั่น กรุงเทพมหานคร 10230  
TEL (662) 515-0145-50 FAX (662) 515-0144 www.etthai.com E-mail : info@etthai.com

No. RA 015/24

## 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 :  $(43 \pm 15) \%$   
Model Name : MiniRAE3000 Pressure : 760 mmHg  
Serial Number : 592-906493  
ID : BKK\_FS0819

Date of Calibration : January 19, 2024

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: 302-402431506.

### 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)	93.2 ppm	100.0 ppm	0.0 ppm	Pass

Flow Rate of Pump : 480 cc/min.

Accuracy :  $\pm 3 \%$  at calibration point

Calibrated By : สุรินทร์พร สายเนตร  
(Mr. Surinthon Sainate)  
Service Engineer

Approved By : สุวิทย์ กองทองสังข์  
(Mr. Suttiwong Kongtongsang.)  
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 เอกเสควิทีพี เทรดดิ้ง จำกัด (สำนักงานใหญ่)  
48/194-5 ซอยประชาชื่นรังสิต 19 ถนนประชาชื่นรังสิต แขวงลาดพร้าว เขตคลองจั่น กรุงเทพมหานคร 10230  
TEL (662) 515-0145-50 FAX (662) 515-0144 www.etthai.com E-mail : info@etthai.com

ที่ RA 015/24

## ใบรายงานการตรวจเช็คเครื่องตรวจวัดก๊าซ รุ่น MiniRAE3000

หมายเลขเครื่อง : 592-906493 วันที่ตรวจเช็ค : 19 มกราคม 2567

ลำดับที่	รายละเอียดการตรวจสอบ	RAW COUNT		สรุป	หมายเหตุ
		REF.	REAL		
1.	PID RAW COUNT				เปลี่ยนใหม่
	Ch.H	10000-62500	47933	■ YES □ NO	
	Ch.L	<62500	52971	■ YES □ NO	
2.	Lamp	>40	45	■ YES □ NO	

ลำดับที่	รายละเอียดการตรวจซ่อม	การแก้ไข	สรุป	หมายเหตุ
1.	Motor Pump	Check flow rate	■ YES □ NO	480 cc/min.
2.	Buzzer	-	■ YES □ NO	-
3.	Li-ion Battery	-	■ YES □ NO	-
4.	Key Pad	-	■ YES □ NO	-
	Y/+	-	■ YES □ NO	-
	N/-	-	■ YES □ NO	-
	MODE	-	■ YES □ NO	-
5.	LCD Display	-	■ YES □ NO	-
6.	THP sensor	-	■ YES □ NO	-
7.	Light Sensor	-	■ YES □ NO	-
8.	Pocket Clip	-	□ YES □ NO	-
9.	PC Port	-	■ YES □ NO	-
10.	Slim Rubber Boot	-	■ YES □ NO	-

ผู้ตรวจเช็ค : สุรินทร์พร สายเนตร  
(นายสุรินทร์พร สายเนตร)  
Service Engineer

ผลการสอบเทียบปรับเทียบนี้ มีผลเฉพาะตัวเครื่องและรายการที่ใช้ระบุไว้เท่านั้น  
การนำผลการสอบเทียบไปใช้เพื่อวัตถุประสงค์อื่นโดยไม่ขอแจ้งต่อทางบริษัทฯ ได้รับอนุญาตเป็นลายลักษณ์อักษรจากบริษัทฯ

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





CALGAZ,  
A DIVISION OF AIRGAS USA LLC  
821 Chesapeake Drive,  
Cambridge, MD 21613  
USA Tel: 1-800-538-1197  
www.calgaz.com

### CERTIFICATE OF ANALYSIS

Date: 06/08/2022  
Order Number: 1110821892  
Lot Number: 302-402431506

Customer: EXECUTIVE TRADING LIMITED  
Part Number: 600-0002-000  
Use Before: JUN 6, 2027

Component	Concentration (± 2%)
ISOBUTYLENE AIR	100PPM Balance

Cylinder Size: 1.2 Cu. Ft.  
Contents: 34 Liter

Valve: CGA600  
Pressure: 494 PSIG

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

Analyst:

*Chris Donnelly*

Chris Donnelly

Honeywell

Honeywell Analytics - Singapore Office  
17 Changi Business Park Central 1  
Singapore 486733  
Cert Ref: 00098

### CERTIFICATE of Attendance

It is hereby certified that

**Mr Surinthorn Sainate**  
**(Executive Trading Limited)**

has successfully completed the

**RAE Service Training Course**

Conducted by

**HONEYWELL**

on 2<sup>nd</sup> August 2022

Conducted by: Desmond Tan  
Service Engineer / Technical Trainer  
Date of Issue: 2<sup>nd</sup> August 2022  
Certificate valid for 2 years from date of issue

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

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

SITHIPORN  
associates



Cert. No.: ACC24008  
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,  
KHAENG PHATTHANAKAN, KHET SUAN LUANG,  
BANGKOK, 10250 THAILAND.

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

Received Date: 19 JANUARY 2024  
Calibration Date: 26 JANUARY 2024  
Date of Issue: 29 JANUARY 2024

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.

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

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

SITHIPORN  
associates



Cert. No.: ACC24008  
Job No.: VC67AC0058  
Pages: 2 of 3

Calibration Procedure: CP-AC-03

#### Calibration Method:

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

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

#### Condition of this result of calibration:

1. Reference Standard Instruments:

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

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

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

3.1 National Institute of Metrology (Thailand).

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

*T. Petchurai*

Cert. No. : ACC24008  
Job No. : VC67AC0058  
Pages : 3 of 3

## Result of calibration :

## 1. Sound pressure level

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

## 2. Frequency

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

## 3. Total distortion

Measured value (%)	Uncertainty (%)	Acceptance limit (%)
0.83	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

T. Petchur

Cert. No. : ACL23281  
Pages : 1 of 8

## Calibration Certificate

Equipment : SOUND LEVEL METER  
Manufacturer : RION  
Model : NL-42/ Microphone UC-52 / Preamplifier NH-24  
Serial No.: 00472122 / 169435 / 72456  
ID No.: NKH\_FS0006

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 ± 20.1 ) %

Received Date : 28 AUGUST 2023  
Calibration Date : 06 SEPTEMBER 2023  
Date of Issue : 13 SEPTEMBER 2023

VIEW BY : *Nathakorn P*  
APPROVED BY : *T. Petchur*  
NEXT CAL DATE : 6/9/29

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. : ACL23281  
Job No. : VC66AC0098  
Pages : 2 of 8

Calibration Procedure : CP-AC-01

## Calibration Method :

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

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

## Condition of this result of calibration :

## 1. Reference Standard Instruments :

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

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

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

3.1 National Institute of Metrology (Thailand).

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

## Continuation of Calibration Certificate

Cert. No. : ACL23281  
Job No. : VC66AC0098  
Pages : 3 of 8

## Summary of Measurement Result :

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

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



## Continuation of Calibration Certificate

Cert. No. : ACL23281  
Job No. : VC66AC0098  
Pages : 4 of 8

## Result of calibration :

## 1. Absolute sensitivity

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

## 2. Self-generated noise

## 2.1 Normal test

Measured Value ( dB )
15.1

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	17.9
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	0.0	0.0	0.0	± 1.5
1000	-0.1	-0.1	-0.1	± 1.0
8000	0.4	0.5	0.5	±5.0

QF-TS12-04-04-020664

T. Petch

## Continuation of Calibration Certificate

Cert. No. : ACL23281  
Job No. : VC66AC0098  
Pages : 5 of 8

## 4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz

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

## 5. Frequency and time weightings at 1 kHz

## 5.1 Frequency weightings at 1 kHz

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

## 5.2 Time weighting at 1 kHz

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

## 6. Long - term stability

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

QF-TS12-04-04-020664

T. Petch

## Continuation of Calibration Certificate

Cert. No. : ACL23281  
Job No. : VC66AC0098  
Pages : 6 of 8

## 7. Level linearity on the reference level range

Anticipated Value ( dB )	Measured Value ( dB )	Deviated Value ( dB )	Acceptance Limits
137.0	137.0	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	63.9	-0.1	± 1.1
59.0	59.0	0.0	± 1.1
54.0	53.9	-0.1	± 1.1
49.0	49.0	0.0	± 1.1
44.0	43.9	-0.1	± 1.1
39.0	39.0	0.0	± 1.1
34.0	34.0	0.0	± 1.1
30.0	30.0	0.0	± 1.1
29.0	29.0	0.0	± 1.1
28.0	28.1	0.1	± 1.1
27.0	27.1	0.1	± 1.1
26.0	26.3	0.3	± 1.1
25.0	25.2	0.2	± 1.1

QF-TS12-04-04-020664

T. Petch

## Continuation of Calibration Certificate

Cert. No. : ACL23281  
Job No. : VC66AC0098  
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, L <sub>peak</sub> ( dB )	Deviated Value ( dB )	Acceptance Limits ( dB )
Continuous	133.0	133.0	0.0	±3.0
One	136.4	135.3	-1.1	±3.0

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

QF-TS12-04-04-020664

T. Petch



Continuation of Calibration Certificate

Cert. No. : ACL23281  
Job No. : VC66AC0098  
Pages : 8 of 8

11. Overload indication

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

12. High level stability

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

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

End of Calibration Certificate

QF-TS12-04-04-020664

*T. Petchur*

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

Cert. No. : ACL23283  
Pages : 1 of 8

Calibration Certificate

Equipment : SOUND LEVEL METER  
Manufacturer : RION  
Model : NL-42/ Microphone UC-52 / Preamplifier NH-24  
Serial No.: 00472124 / 172180 / 72458  
ID No.: NKH\_FS0008

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 AUGUST 2023  
Calibration Date : 06 SEPTEMBER 2023  
Date of Issue : 13 SEPTEMBER 2023

REVIEW BY: *Nithakorn P.*  
APPROVED BY: *T. Petchur*  
NEXT CAL DATE: 6/9/24

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. : ACL23283  
Job No. : VC66AC0098  
Pages : 2 of 8

Calibration Procedure : CP-AC-01

Calibration Method :

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

Condition of this result of calibration :

1. Reference Standard Instruments :

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

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

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

3.1 National Institute of Metrology (Thailand).

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

Continuation of Calibration Certificate

Cert. No. : ACL23283  
Job No. : VC66AC0098  
Pages : 3 of 8

Summary of Measurement Result :

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

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

QF-TS12-04-04-020664

*T. Petchur*

QF-TS12-04-04-020664

*T. Petchur*



## Continuation of Calibration Certificate

Cert. No. : ACL23283  
Job No. : VC66AC0098  
Pages : 4 of 8

## Result of calibration :

## 1. Absolute sensitivity

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

## 2. Self-generated noise

## 2.1 Normal test

Measured Value ( dB )
14.6

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

Frequency Weighting	Measured value ( dB )
A - weight	11.3
C - weight	17.6
Flat	23.4

## 3. Acoustical signal tests of frequency weightings

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

Frequency ( Hz )	Deviation from various frequency weighting response curve (dB)			
	Flat	C-weight	A-weight	Acceptance Limits
125	0.2	0.2	0.2	± 1.5
1000	-0.1	-0.1	-0.1	± 1.0
8000	-0.4	-0.3	-0.3	±5.0

QF-TS12-04-04-020664

T. Petch

## Continuation of Calibration Certificate

Cert. No. : ACL23283  
Job No. : VC66AC0098  
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	0.1	±1.5
250	0.1	0.1	0.0	±1.5
500	0.0	0.1	0.0	±1.5
1000	0.0	0.0	0.0	±1.0
2000	0.0	0.1	0.0	±2.0
4000	0.0	0.1	0.0	±3.0
8000	0.0	0.1	0.1	±5.0

## 5. Frequency and time weightings at 1 kHz

## 5.1 Frequency weightings at 1 kHz

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

## 5.2 Time weighting at 1 kHz

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

## 6. Long - term stability

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

QF-TS12-04-04-020664

T. Petch

## Continuation of Calibration Certificate

Cert. No. : ACL23283  
Job No. : VC66AC0098  
Pages : 6 of 8

## 7. Level linearity on the reference level range

Anticipated Value ( dB )	Measured Value ( dB )	Deviated Value ( dB )	Acceptance Limits ( dB )
137.0	137.0	0.0	± 1.1
136.0	136.0	0.0	± 1.1
135.0	135.0	0.0	± 1.1
134.0	134.0	0.0	± 1.1
133.0	133.0	0.0	± 1.1
132.0	132.0	0.0	± 1.1
131.0	131.0	0.0	± 1.1
129.0	129.0	0.0	± 1.1
124.0	124.0	0.0	± 1.1
119.0	119.0	0.0	± 1.1
114.0	114.0	0.0	± 1.1
109.0	109.0	0.0	± 1.1
104.0	104.1	0.1	± 1.1
99.0	99.0	0.0	± 1.1
94.0	94.0	0.0	± 1.1
89.0	89.0	0.0	± 1.1
84.0	84.0	0.0	± 1.1
79.0	79.0	0.0	± 1.1
74.0	74.0	0.0	± 1.1
69.0	69.0	0.0	± 1.1
64.0	64.0	0.0	± 1.1
59.0	59.0	0.0	± 1.1
54.0	54.0	0.0	± 1.1
49.0	49.0	0.0	± 1.1
44.0	44.0	0.0	± 1.1
39.0	39.0	0.0	± 1.1
34.0	34.0	0.0	± 1.1
30.0	30.0	0.0	± 1.1
29.0	29.0	0.0	± 1.1
28.0	28.1	0.1	± 1.1
27.0	27.0	0.0	± 1.1
26.0	26.1	0.1	± 1.1
25.0	25.1	0.1	± 1.1

QF-TS12-04-04-020664

T. Petch

## Continuation of Calibration Certificate

Cert. No. : ACL23283  
Job No. : VC66AC0098  
Pages : 7 of 8

## 8. Level linearity including the level range control

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

## 9. Tone burst response

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

## 10. Peak C sound level

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

QF-TS12-04-04-020664

T. Petch



Continuation of Calibration Certificate

Cert. No. : ACL23283  
Job No. : VC66AC0098  
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 Sindhorn 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. : ACL23284  
Pages : 1 of 8

Calibration Certificate

Equipment : SOUND LEVEL METER  
Manufacturer : RION  
Model : NL-42/ Microphone UC-52 / Preamplifier NH-24  
Serial No. : 01173613 / 172175 / 74025  
ID No. : NKH\_FS0026

Condition As Found : GOOD

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

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

Received Date : 28 AUGUST 2023  
Calibration Date : 06 SEPTEMBER 2023  
Date of Issue : 13 SEPTEMBER 2023

REVIEW BY: *Nithakorn P.*  
APPROVED BY: *T. Petchur*  
NEXT CAL DATE: 6/9/24

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. : ACL23284  
Job No. : VC66AC0098  
Pages : 2 of 8

Calibration Procedure : CP-AC-01

Calibration Method :

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

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

Condition of this result of calibration :

1. Reference Standard Instruments :

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

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

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

3.1 National Institute of Metrology (Thailand).

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

Continuation of Calibration Certificate

Cert. No. : ACL23284  
Job No. : VC66AC0098  
Pages : 3 of 8

Summary of Measurement Result :

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

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

QF-TS12-04-04-020664

*T. Petchur*

QF-TS12-04-04-020664

*T. Petchur*



## Continuation of Calibration Certificate

Cert. No. : ACL23284  
Job No. : VC66AC0098  
Pages : 4 of 8

## Result of calibration :

## 1. Absolute sensitivity

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

## 2. Self-generated noise

## 2.1 Normal test

Measured Value ( dB )
20.1

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

Frequency Weighting	Measured value ( dB )
A - weight	15.1
C - weight	21.3
Flat	26.8

## 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	0.0	0.1	0.1	± 1.5
1000	-0.1	-0.1	-0.1	± 1.0
8000	1.4	1.5	1.5	±5.0

QF-TS12-04-04-020664

T. Petch.

## Continuation of Calibration Certificate

Cert. No. : ACL23284  
Job No. : VC66AC0098  
Pages : 5 of 8

## 4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

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

## 5. Frequency and time weightings at 1 kHz

## 5.1 Frequency weightings at 1 kHz

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

## 5.2 Time weighting at 1 kHz

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

## 6. Long - term stability

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

QF-TS12-04-04-020664

T. Petch.

## Continuation of Calibration Certificate

Cert. No. : ACL23284  
Job No. : VC66AC0098  
Pages : 6 of 8

## 7. Level linearity on the reference level range

Anticipated Value ( dB )	Measured Value ( dB )	Deviated Value ( dB )	Acceptance Limits ( dB )
137.0	137.0	0.0	± 1.1
136.0	136.0	0.0	± 1.1
135.0	135.0	0.0	± 1.1
134.0	134.0	0.0	± 1.1
133.0	132.9	-0.1	± 1.1
132.0	131.9	-0.1	± 1.1
131.0	130.9	-0.1	± 1.1
129.0	129.0	0.0	± 1.1
124.0	124.0	0.0	± 1.1
119.0	119.0	0.0	± 1.1
114.0	114.0	0.0	± 1.1
109.0	109.0	0.0	± 1.1
104.0	104.0	0.0	± 1.1
99.0	99.0	0.0	± 1.1
94.0	94.0	0.0	± 1.1
89.0	89.0	0.0	± 1.1
84.0	84.0	0.0	± 1.1
79.0	79.0	0.0	± 1.1
74.0	74.0	0.0	± 1.1
69.0	69.0	0.0	± 1.1
64.0	64.0	0.0	± 1.1
59.0	59.0	0.0	± 1.1
54.0	54.0	0.0	± 1.1
49.0	49.0	0.0	± 1.1
44.0	44.0	0.0	± 1.1
39.0	39.0	0.0	± 1.1
34.0	34.0	0.0	± 1.1
30.0	30.0	0.0	± 1.1
29.0	29.0	0.0	± 1.1
28.0	28.0	0.0	± 1.1
27.0	26.9	-0.1	± 1.1
26.0	26.0	0.0	± 1.1
25.0	24.9	-0.1	± 1.1

QF-TS12-04-04-020664

T. Petch.

## Continuation of Calibration Certificate

Cert. No. : ACL23284  
Job No. : VC66AC0098  
Pages : 7 of 8

## 8. Level linearity including the level range control

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

## 9. Tone burst response

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

## 10. Peak C sound level

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

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

QF-TS12-04-04-020664

T. Petch.



## Continuation of Calibration Certificate

Cert. No. : ACL23284  
Job No. : VC66AC0098  
Pages : 8 of 8

## 11. Overload indication

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

## 12. High level stability

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

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

End of Calibration Certificate

QF-TS12-04-04-020664

T. Petchur

451-451/1 Sirinithom 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. : ACL23285  
Pages : 1 of 8

## Calibration Certificate

Equipment : SOUND LEVEL METER  
Manufacturer : RION  
Model : NL-42/ Microphone UC-52 / Preamplifier NH-24  
Serial No. : 01173614 / 172176 / 74026  
ID No. : NKH\_FS0027

Condition As Found : GOOD

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

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

Received Date : 28 AUGUST 2023  
Calibration Date : 06 SEPTEMBER 2023  
Date of Issue : 13 SEPTEMBER 2023

Calibrated by : Nathakorn Pisutpaisan

Approved by :

T. Petchur  
( Thanakul Petchur )

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

QF-TS12-04-04-020664

## Continuation of Calibration Certificate

Cert. No. : ACL23285  
Job No. : VC66AC0098  
Pages : 2 of 8

Calibration Procedure : CP-AC-01

## Calibration Method :

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

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

## Condition of this result of calibration :

## 1. Reference Standard Instruments :

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

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

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

3.1 National Institute of Metrology (Thailand).

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

## Continuation of Calibration Certificate

Cert. No. : ACL23285  
Job No. : VC66AC0098  
Pages : 3 of 8

## Summary of Measurement Result :

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

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

QF-TS12-04-04-020664

T. Petchur

QF-TS12-04-04-020664

T. Petchur



## Continuation of Calibration Certificate

Cert. No. : ACL23285  
Job No. : VC66AC0098  
Pages : 4 of 8

## Result of calibration :

## 1. Absolute sensitivity

Reference Acoustic Signal ( dB )	Measured Value ( dB )	Deviation ( dB )	Acceptance Limit ( dB )
93.9 (93.9%)	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	18.1
Flat	24.0

## 3. Acoustical signal tests of frequency weightings

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

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

QF-TS12-04-04-020664

T. Petch

## Continuation of Calibration Certificate

Cert. No. : ACL23285  
Job No. : VC66AC0098  
Pages : 5 of 8

## 4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

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

## 5. Frequency and time weightings at 1 kHz

## 5.1 Frequency weightings at 1 kHz

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

## 5.2 Time weighting at 1 kHz

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

## 6. Long - term stability

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

QF-TS12-04-04-020664

T. Petch

## Continuation of Calibration Certificate

Cert. No. : ACL23285  
Job No. : VC66AC0098  
Pages : 7 of 8

## 8. Level linearity including the level range control

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

## 9. Tone burst response

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

## 10. Peak C sound level

Number of cycle in test signal	Anticipated Value ( dB )	Measured Value, Lcpeak ( dB )	Deviated Value ( dB )	Acceptance Limits ( dB )
Continuous	133.0	133.0	0.0	±3.0
One	136.4	136.3	-0.1	±3.0

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

QF-TS12-04-04-020664

T. Petch

## Continuation of Calibration Certificate

Cert. No. : ACL23285  
Job No. : VC66AC0098  
Pages : 8 of 8

## 11. Overload indication

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

## 12. High level stability

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

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

End of Calibration Certificate

QF-TS12-04-04-020664

T. Petch



Cert. No. : ACL23353  
Pages : 1 of 8

## Calibration Certificate

Equipment : SOUND LEVEL METER  
Manufacturer : RION  
Model : NL-42A / Microphone UC-52 / Preamplifier NH-24  
Serial No.: 00422901 / 197431 / 25838  
ID No.: NKH\_FS0122

Condition As Found : GOOD

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

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

Received Date : 07 NOVEMBER 2023  
Calibration Date : 09-10 NOVEMBER 2023  
Date of Issue : 14 NOVEMBER 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. : ACL23353  
Job No. : VC67AC0024  
Pages : 2 of 8

Calibration Procedure : CP-AC-01

## Calibration Method :

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

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

## Condition of this result of calibration :

## 1. Reference Standard Instruments :

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

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

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

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

QF-TS12-04-04-020664

## Continuation of Calibration Certificate

Cert. No. : ACL23353  
Job No. : VC67AC0024  
Pages : 3 of 8

## Summary of Measurement Result :

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

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

QF-TS12-04-04-020664

## Continuation of Calibration Certificate

Cert. No. : ACL23353  
Job No. : VC67AC0024  
Pages : 4 of 8

## Result of calibration :

## 1. Absolute sensitivity

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

## 2. Self-generated noise

## 2.1 Normal test

Measured Value (dB)
14.6

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

Frequency Weighting	Measured value (dB)
A - weight	11.6
C - weight	17.5
Flat	23.1

## 3. Acoustical signal tests of frequency weightings

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

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

QF-TS12-04-04-020664



## Continuation of Calibration Certificate

Cert. No. : ACL23353  
Job No. : VC67AC0024  
Pages : 5 of 8

## 4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

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

## 5. Frequency and time weightings at 1 kHz

## 5.1 Frequency weightings at 1 kHz

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

## 5.2 Time weighting at 1 kHz

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

## 6. Long - term stability

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

QF-TS12-04-04-020664

T. Petch

## Continuation of Calibration Certificate

Cert. No. : ACL23353  
Job No. : VC67AC0024  
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	26.1	0.1	± 1.1
25.0	25.2	0.2	± 1.1

QF-TS12-04-04-020664

T. Petch

## Continuation of Calibration Certificate

Cert. No. : ACL23353  
Job No. : VC67AC0024  
Pages : 7 of 8

## 8. Level linearity including the level range control

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

## 9. Tone burst response

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

## 10. Peak C sound level

Number of cycle in test signal	Anticipated Value ( dB )	Measured Value, L <sub>peak</sub> ( dB )	Deviated Value ( dB )	Acceptance Limits ( dB )
Continuous	133.0	133.0	0.0	±3.0
One	136.4	136.3	-0.1	±3.0

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

QF-TS12-04-04-020664

T. Petch

## Continuation of Calibration Certificate

Cert. No. : ACL23353  
Job No. : VC67AC0024  
Pages : 8 of 8

## 11. Overload indication

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

## 12. High level stability

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

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

End of Calibration Certificate

QF-TS12-04-04-020664

T. Petch





THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-67/0232

MTC No. EEL. BP. 179/0167

## CALIBRATION CERTIFICATE

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

Address : 104 Phatthanakan 40, Phatthanakan Rd., Kluwaeng Phatthanakan, Khet Suan Luang, Bangkok 10250.

Calibrated at : Electrical and Electronic Standards Laboratory, Industrial Metrology and Testing Service Centre,  
Soi 1C, Bangpoo Industrial Estate, Sukhumvit Rd., A.Muang, Samutprakan 10280.

## Instrument Calibrated :

Description : Sound Level Meter

Manufacturer : Rion

Model : NL-42

Serial No. : 00900074 (ID:RYG\_FS0495)

Microphone : UC-52 No.188467

Preamplifier : NH-24 No.01736

## Standards used :

1. Band Pass Filter Wavetek 752A S/N 90010494.
2. Condenser Microphone Brüel&Kjær 4180 S/N 2889871.
3. Decade Attenuator Ando AL-205 S/N 00464602.
4. Function/Arbitrary Waveform Generator Agilent 33220A S/N MY44042668.
5. Digital Function Synthesizer NF Electronic Instruments DF-193A S/N 122037.
6. Digital Multimeter Fluke 8520A S/N 4985007.
7. Pistonphone Rion NC-72 S/N 00402446.
8. Measuring Amplifier Brüel&Kjær 2636 S/N 1537484.

Date of Receipt : 24 Jan. 2024

Date of Calibration : 23 Feb.2024-1 Mar.2024

1/9

The results relate only to the items tested/calibrated or value assigned.

Advertising the Report/Certificate and publicity of the results, except in full are prohibited unless written permission is obtained from the Governor of TISTR.

FM.BLMTC.002 Rev.4

Head Office  
35 Mu 3 Tambon Khlong Ha, Amphoe Khlong Luang,  
Changwat Pathumthani 12120, Thailand  
Tel. (66) 0 2577 9000  
Fax. (66) 0 2577 9009  
E-mail : hump@tistr.or.th Website:www.tistr.or.th

Office/Laboratory  
Soi 1C, Bangpoo Industrial Estate, Sukhumvit Road,  
Amphoe Muang, Changwat Samutprakan 10280, Thailand  
Tel. (66) 0 2523 1672-80 ext. 115, 116  
Fax. (66) 0 2523 9165  
E-mail : mtc@tistr.or.th

Office  
196 Phahonyothin Road, Chatuchak, Bangkok 10900,  
Thailand  
Tel. (66) 0 2579 1121-30 ext. 5219, 5225, 5217  
Fax. (66) 0 2579 8592  
E-mail : sumalee@tistr.or.th



THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-67/0232

MTC No. EEL. BP. 179/0167

9. Power Amplifier Brüel&Kjær 2706 S/N 1517650.
10. Speaker Tannoy Limited, Great Britain British Patent No. 2153000.
11. Digital Multimeter Agilent 34401A S/N MY44005560.
12. Programmable Attenuator Tamagawa TPA-303A S/N 2212.

## Calibration Procedure :

This instrument was calibrated by using calibration procedures no CP-102-02 and CP-102-03, which were based on IEC 61672-3 Electroacoustics - Sound Level Meters - Part 3 : Periodic tests (2013). These calibration procedures were related to the electrical and acoustic signal tests. The electrical signal test was carried out with the direct measurement method. The acoustic signal test was performed in an anechoic room with the comparison measurement method.

This instrument has been calibrated against standards maintained at the Electrical and Electronic Standards Laboratory (EEL), which are traceable to the International System of Units through the National Institute of Metrology (Thailand).

The information on actual reading is attached herewith and the uncertainty limits quoted refer to the measured values only.

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

Date of Calibration : 23 Feb.2024-1 Mar.2024

2/9

The results relate only to the items tested/calibrated or value assigned.

Advertising the Report/Certificate and publicity of the results, except in full are prohibited unless written permission is obtained from the Governor of TISTR.

FM.BLMTC.002 Rev.4

Head Office  
35 Mu 3 Tambon Khlong Ha, Amphoe Khlong Luang,  
Changwat Pathumthani 12120, Thailand  
Tel. (66) 0 2577 9000  
Fax. (66) 0 2577 9009  
E-mail : hump@tistr.or.th Website:www.tistr.or.th

Office/Laboratory  
Soi 1C, Bangpoo Industrial Estate, Sukhumvit Road,  
Amphoe Muang, Changwat Samutprakan 10280, Thailand  
Tel. (66) 0 2523 1672-80 ext. 115, 116  
Fax. (66) 0 2523 9165  
E-mail : mtc@tistr.or.th

Office  
196 Phahonyothin Road, Chatuchak, Bangkok 10900,  
Thailand  
Tel. (66) 0 2579 1121-30 ext. 5219, 5225, 5217  
Fax. (66) 0 2579 8592  
E-mail : sumalee@tistr.or.th



THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-67/0232

MTC No. EEL. BP. 179/0167

## 1. Absolute Sensitivity

Reference Acoustic Signal (dB)	Measured value (dB)		Deviation value (dB)	Acceptance limit (class 2) ( $\pm$ dB)	Uncertainty ( $\pm$ dB)	Maximum-permitted uncertainty of measurement ( $\pm$ dB)
	Before adjust	After adjust				
113.94	114.1	113.9	0.0	1.0	0.30	N/A

Note: The external calibration adjustment was firstly performed. The internal calibration adjustment was then completed at the display of 124.2 dB.

## 2. Self-generated noise

## 2.1 Normal test

Measured value (dB)	Uncertainty ( $\pm$ dB)	Maximum-permitted uncertainty of measurement ( $\pm$ dB)
16.5	0.10	N/A

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

Frequency Weighting	Measured value (dB)	Uncertainty ( $\pm$ dB)	Maximum-permitted uncertainty of measurement ( $\pm$ dB)
A-Weight	11.7	0.10	N/A
C-Weight	17.2	0.10	N/A
Flat	22.5	0.10	N/A

Date of Calibration : 23 Feb.2024-1 Mar.2024

3/9

The results relate only to the items tested/calibrated or value assigned.

Advertising the Report/Certificate and publicity of the results, except in full are prohibited unless written permission is obtained from the Governor of TISTR.

FM.BLMTC.002 Rev.4

Head Office  
35 Mu 3 Tambon Khlong Ha, Amphoe Khlong Luang,  
Changwat Pathumthani 12120, Thailand  
Tel. (66) 0 2577 9000  
Fax. (66) 0 2577 9009  
E-mail : hump@tistr.or.th Website:www.tistr.or.th

Office/Laboratory  
Soi 1C, Bangpoo Industrial Estate, Sukhumvit Road,  
Amphoe Muang, Changwat Samutprakan 10280, Thailand  
Tel. (66) 0 2523 1672-80 ext. 115, 116  
Fax. (66) 0 2523 9165  
E-mail : mtc@tistr.or.th

Office  
196 Phahonyothin Road, Chatuchak, Bangkok 10900,  
Thailand  
Tel. (66) 0 2579 1121-30 ext. 5219, 5225, 5217  
Fax. (66) 0 2579 8592  
E-mail : sumalee@tistr.or.th



THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-67/0232

MTC No. EEL. BP. 179/0167

## 3. Acoustical signal test of frequency weightings

Frequency (Hz)	Deviation from frequency response (dB)			Acceptance limit class 2 ( $\pm$ dB)	Uncertainty ( $\pm$ dB)	Maximum-permitted uncertainty of measurement ( $\pm$ dB)
	A-weight	C-weight	Flat			
125	0.2	0.3	0.3	1.5	0.45	0.6
1 000	-0.2	-0.2	-0.2	1.0	0.45	0.6
8 000	-0.7	-0.8	-0.8	5.0	0.45	0.7

## 4. Electrical signal test of frequency weightings

Frequency (Hz)	Deviation from frequency response (dB)			Acceptance limit class 2 ( $\pm$ dB)	Uncertainty ( $\pm$ dB)	Maximum-permitted uncertainty of measurement ( $\pm$ dB)
	A-weight	C-weight	Flat			
63	-0.1	-0.1	0.0	2.0	0.20	0.6
125	-0.1	0.0	0.0	1.5	0.20	0.6
250	-0.1	0.0	0.0	1.5	0.20	0.6
500	0.0	0.0	0.0	1.5	0.20	0.6
1 000	0.0	0.0	0.0	1.0	0.20	0.6
2 000	-0.1	-0.1	0.0	2.0	0.20	0.6
4 000	-0.1	-0.1	0.0	3.0	0.20	0.6
8 000	0.0	0.0	0.0	5.0	0.20	0.7

Date of Calibration : 23 Feb.2024-1 Mar.2024

4/9

The results relate only to the items tested/calibrated or value assigned.

Advertising the Report/Certificate and publicity of the results, except in full are prohibited unless written permission is obtained from the Governor of TISTR.

FM.BLMTC.002 Rev.4

Head Office  
35 Mu 3 Tambon Khlong Ha, Amphoe Khlong Luang,  
Changwat Pathumthani 12120, Thailand  
Tel. (66) 0 2577 9000  
Fax. (66) 0 2577 9009  
E-mail : hump@tistr.or.th Website:www.tistr.or.th

Office/Laboratory  
Soi 1C, Bangpoo Industrial Estate, Sukhumvit Road,  
Amphoe Muang, Changwat Samutprakan 10280, Thailand  
Tel. (66) 0 2523 1672-80 ext. 115, 116  
Fax. (66) 0 2523 9165  
E-mail : mtc@tistr.or.th

Office  
196 Phahonyothin Road, Chatuchak, Bangkok 10900,  
Thailand  
Tel. (66) 0 2579 1121-30 ext. 5219, 5225, 5217  
Fax. (66) 0 2579 8592  
E-mail : sumalee@tistr.or.th





THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-67/0232

MTC No. EEL. BP. 179/0167

## 5. Long-term stability

Time	Measured value (dB)	Deviated value (dB)	Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
Begin	94.0	0.0	0.3	0.10	0.1
End	94.0				

## 6. Frequency and time weightings at 1 kHz

## 6.1 Frequency weightings at 1 kHz

Frequency Weighting	Measured value (dB)	Deviated value (dB)	Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
A-weight	94.0	0.0	0.2	0.20	0.2
C-weight	94.0	0.0	0.2	0.20	0.2
Flat	94.0	0.0	0.2	0.20	0.2

## 6.2 Time weightings at 1 kHz

Frequency Weighting	Measured value (dB)	Deviated value (dB)	Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
Fast	94.0	0.0	0.1	0.20	0.2
Slow	94.0	0.0	0.1	0.20	0.2
Lsq	94.0	0.0	0.1	0.20	0.2

Date of Calibration : 23 Feb.2024-1 Mar.2024

5 / 9

The results relate only to the items tested/calibrated or value assigned.

Advertising this Report/Certificate and publicity of the results except in full are prohibited unless written permission is obtained from the governor of TISTR.

FM.BL.MTC.002 Rev.4

Head Office  
35 Mu 3 Tambon Khlong Ha, Amphoe Khlong Luang,  
Changwat Pathumthani 12120, Thailand  
Tel. (66) 0 2577 9000  
Fax. (66) 0 2577 9009  
E-mail : runpa@tistr.or.th Website:www.tistr.or.th

Office/Laboratory  
Soi. 1C, Bangpoo Industrial Estate, Sukhumvit Road,  
Amphoe Muang, Changwat Samutprakan 10280, Thailand  
Tel. (66) 0 2523 1672-80 ext. 115, 116  
Fax. (66) 0 2523 9165  
E-mail : mtc@tistr.or.th

Office  
196 Phahonyothin Road, Chutechak, Bangkok 10900,  
Thailand  
Tel. (66) 0 2579 1121-30 ext. 5219, 5225, 5217  
Fax. (66) 0 2579 8592  
E-mail : sutale@tistr.or.th



THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-67/0232

MTC No. EEL. BP. 179/0167

## 7. Level linearity on the reference level range

Anticipated value (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
136	136.0	0.0	1.1	0.30	0.3
135	135.0	0.0	1.1	0.30	0.3
134	134.0	0.0	1.1	0.30	0.3
133	133.0	0.0	1.1	0.30	0.3
132	132.0	0.0	1.1	0.30	0.3
131	131.0	0.0	1.1	0.30	0.3
130	130.0	0.0	1.1	0.30	0.3
129	129.0	0.0	1.1	0.30	0.3
124	124.0	0.0	1.1	0.30	0.3
119	119.0	0.0	1.1	0.30	0.3
114	114.0	0.0	1.1	0.30	0.3
109	109.0	0.0	1.1	0.30	0.3
104	104.0	0.0	1.1	0.30	0.3
99	99.0	0.0	1.1	0.30	0.3
94	94.0	0.0	1.1	0.30	0.3
89	89.0	0.0	1.1	0.30	0.3
84	84.0	0.0	1.1	0.30	0.3
79	79.0	0.0	1.1	0.30	0.3
74	74.0	0.0	1.1	0.30	0.3
69	68.9	-0.1	1.1	0.30	0.3

Date of Calibration : 23 Feb.2024-1 Mar.2024

6 / 9

The results relate only to the items tested/calibrated or value assigned.

Advertising this Report/Certificate and publicity of the results except in full are prohibited unless written permission is obtained from the governor of TISTR.

FM.BL.MTC.002 Rev.4

Head Office  
35 Mu 3 Tambon Khlong Ha, Amphoe Khlong Luang,  
Changwat Pathumthani 12120, Thailand  
Tel. (66) 0 2577 9000  
Fax. (66) 0 2577 9009  
E-mail : runpa@tistr.or.th Website:www.tistr.or.th

Office/Laboratory  
Soi. 1C, Bangpoo Industrial Estate, Sukhumvit Road,  
Amphoe Muang, Changwat Samutprakan 10280, Thailand  
Tel. (66) 0 2523 1672-80 ext. 115, 116  
Fax. (66) 0 2523 9165  
E-mail : mtc@tistr.or.th

Office  
196 Phahonyothin Road, Chutechak, Bangkok 10900,  
Thailand  
Tel. (66) 0 2579 1121-30 ext. 5219, 5225, 5217  
Fax. (66) 0 2579 8592  
E-mail : sutale@tistr.or.th



THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-67/0232

MTC No. EEL. BP. 179/0167

## 7. Level linearity on the reference level range (cont.)

Anticipated value (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
64	63.9	-0.1	1.1	0.30	0.3
59	58.9	-0.1	1.1	0.30	0.3
54	53.9	-0.1	1.1	0.30	0.3
49	48.9	-0.1	1.1	0.30	0.3
44	43.9	-0.1	1.1	0.30	0.3
39	38.9	-0.1	1.1	0.30	0.3
34	33.9	-0.1	1.1	0.30	0.3
29	28.9	-0.1	1.1	0.30	0.3
28	27.9	-0.1	1.1	0.30	0.3
27	26.9	-0.1	1.1	0.30	0.3
26	25.9	-0.1	1.1	0.30	0.3
25	24.8	-0.2	1.1	0.30	0.3

## 8. Level linearity including the level range control

At reference sound level on the reference level range

Range	Anticipated value (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
30-130	94.0	94.0	0.0	1.1	0.30	0.3

Date of Calibration : 23 Feb.2024-1 Mar.2024

7 / 9

The results relate only to the items tested/calibrated or value assigned.

Advertising this Report/Certificate and publicity of the results except in full are prohibited unless written permission is obtained from the governor of TISTR.

FM.BL.MTC.002 Rev.4

Head Office  
35 Mu 3 Tambon Khlong Ha, Amphoe Khlong Luang,  
Changwat Pathumthani 12120, Thailand  
Tel. (66) 0 2577 9000  
Fax. (66) 0 2577 9009  
E-mail : runpa@tistr.or.th Website:www.tistr.or.th

Office/Laboratory  
Soi. 1C, Bangpoo Industrial Estate, Sukhumvit Road,  
Amphoe Muang, Changwat Samutprakan 10280, Thailand  
Tel. (66) 0 2523 1672-80 ext. 115, 116  
Fax. (66) 0 2523 9165  
E-mail : mtc@tistr.or.th

Office  
196 Phahonyothin Road, Chutechak, Bangkok 10900,  
Thailand  
Tel. (66) 0 2579 1121-30 ext. 5219, 5225, 5217  
Fax. (66) 0 2579 8592  
E-mail : sutale@tistr.or.th



THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-67/0232

MTC No. EEL. BP. 179/0167

## 8. Level linearity including the level range control

At reference level at 5 dB greater than the under-range on a level range

Range	Anticipated value (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
30-130	35.0	35.0	0.0	1.1	0.30	0.3

## 9. Tone burst response

Time Weighting	Toneburst Duration, Tb (ms)	Measured value (dB)	Deviated value (dB)	Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
Fast	200	126.0	0.0	±1.0	0.20	0.3
	2	108.9	-0.1	+1.0; -2.5	0.20	0.3
	0.25	99.9	-0.1	+1.5; -5.0	0.20	0.3
Slow	200	119.6	0.0	±1.0	0.20	0.3
	2	100.0	0.0	+1.0; -5.0	0.20	0.3
	200	120.0	0.0	±1.0	0.20	0.3
SEL	2	100.0	0.0	+1.0; -2.5	0.20	0.3
	0.25	90.8	-0.2	+1.5; -5.0	0.20	0.3

Date of Calibration : 23 Feb.2024-1 Mar.2024

8 / 9

The results relate only to the items tested/calibrated or value assigned.

Advertising this Report/Certificate and publicity of the results except in full are prohibited unless written permission is obtained from the governor of TISTR.

FM.BL.MTC.002 Rev.4

Head Office  
35 Mu 3 Tambon Khlong Ha, Amphoe Khlong Luang,  
Changwat Pathumthani 12120, Thailand  
Tel. (66) 0 2577 9000  
Fax. (66) 0 2577 9009  
E-mail : runpa@tistr.or.th Website:www.tistr.or.th

Office/Laboratory  
Soi. 1C, Bangpoo Industrial Estate, Sukhumvit Road,  
Amphoe Muang, Changwat Samutprakan 10280, Thailand  
Tel. (66) 0 2523 1672-80 ext. 115, 116  
Fax. (66) 0 2523 9165  
E-mail : mtc@tistr.or.th

Office  
196 Phahonyothin Road, Chutechak, Bangkok 10900,  
Thailand  
Tel. (66) 0 2579 1121-30 ext. 5219, 5225, 5217  
Fax. (66) 0 2579 8592  
E-mail : sutale@tistr.or.th





THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-67/0232

MTC No. EEL BP. 179.0167

## 10. Peak C sound level

Number of cycles in test signal	Anticipated value (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
Complete cycle	125.4	125.4	0.0	3.0	0.20	0.35
Positive half cycle	124.4	124.1	-0.3	2.0	0.20	0.35
Negative half cycle	124.4	124.1	-0.3	2.0	0.20	0.35

## 11. Overload indication

Measured value (dB)		Deviated value (dB)	Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
Positive one-half cycle	Negative one-half cycle				
135.0	135.0	0.0	1.5	0.20	0.25

## 12. High-level stability

Time	Measured value (dB)	Deviated value (dB)	Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
Begin	129.0	0.0	0.3	0.10	0.1
End	129.0				

Calibrated by :

Approved by :

(Mr. Tawikiat Iamsaniran)

(Mr. Prawade Kiatyao)

Electrical and Electronic Standards Laboratory  
Industrial Metrology and Testing Service Centre

Date of Calibration : 23 Feb.2024-1 Mar.2024

Date of Issue : 1 Mar. 2024

Ref : 2011267012400347009

End of Certificate

9 / 9

The results relate only to the items tested/calibrated in value assigned.

Adjusting this Report/Certificate and publicity of the results except in full are prohibited unless written permission is obtained from the customer of TISTR.

FABLMTC.002 Rev.4

Head Office  
39 Raj 3 Taniwan Khing Rd., Bangpho Khlong Luang,  
Changwat Pathumthani 12120, Thailand  
Tel: (66) 0 2577 9000  
Fax: (66) 0 2577 9009  
E-mail : tistr@tistr.or.th Website: www.tistr.or.thOffice/Laboratory  
Soc. IC, Bangkok Industrial Estate, Sukhumvit Road,  
Anghoe Muang, Changwat Samutprakan 10380, Thailand  
Tel: (66) 0 2323 1672-80 ext: 115, 116  
Fax: (66) 0 2323 9165  
E-mail : info@tistr.or.thOffice  
176 Phatthana Road, Chatsak, Bangkok 10900,  
Thailand  
Tel: (66) 0 2579 1121-30 ext: 5219, 5225, 5217  
Fax: (66) 0 2579 5562  
E-mail : sumee@tistr.or.thSITHIPORN ASSOCIATES CO.,LTD.  
CALIBRATION LABORATORY451-451/1 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. : ACL23323  
Pages : 1 of 8

## Calibration Certificate

Equipment : SOUND LEVEL METER  
Manufacturer : RION  
Model : NL-42/ Microphone UC-52 / Pre-amplifier NH-24  
Serial No.: 00873057 / 171591 / 73333  
ID No.: RYG\_FS0381

Condition As Found : GOOD

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

Location :  
Ambient Temperature : ( 23.0 ± 3 ) °C  
Pressure : ( 101.3 ± 3 ) kPa  
Relative Humidity : ( 50.0 ± 20 ) %  
Received Date : 11 OCTOBER 2023  
Calibration Date : 19-20 OCTOBER 2023  
Date of Issue : 24 OCTOBER 2023



Calibrated by : Nathakorn Pisutpaisan

Approved by :

( Thanakul Petchurai )

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

QP-TS12-04-04-020664

SITHIPORN ASSOCIATES CO.,LTD.  
CALIBRATION LABORATORY

## Continuation of Calibration Certificate

Cert. No. : ACL23323  
Job No. : VC67AC0011  
Pages : 2 of 8

Calibration Procedure : CP-AC-01

## Calibration Method :

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

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

## Condition of this result of calibration :

1. Reference Standard Instruments :

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

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

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

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

SITHIPORN ASSOCIATES CO.,LTD.  
CALIBRATION LABORATORY

## Continuation of Calibration Certificate

Cert. No. : ACL23323  
Job No. : VC67AC0011  
Pages : 3 of 8

## Summary of Measurement Result :

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

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

QP-TS12-04-04-020664

QP-TS12-04-04-020664



## Continuation of Calibration Certificate

Cert. No. : ACL23323  
Job No. : VC67AC0011  
Pages : 4 of 8

## Result of calibration :

## 1. Absolute sensitivity

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

## 2. Self-generated noise

## 2.1 Normal test

Measured Value ( dB )
15.8

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

Frequency Weighting	Measured value ( dB )
A - weight	12.0
C - weight	18.2
Flat	24.0

## 3. Acoustical signal tests of frequency weightings

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

Frequency ( Hz )	Deviation from various frequency weighting response curve (dB)			
	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	0.5	0.6	0.6	±5.0

QF-TS12-04-04-020664

T. Petch

## Continuation of Calibration Certificate

Cert. No. : ACL23323  
Job No. : VC67AC0011  
Pages : 5 of 8

## 4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

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

## 5. Frequency and time weightings at 1 kHz

## 5.1 Frequency weightings at 1 kHz

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

## 5.2 Time weighting at 1 kHz

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

## 6. Long - term stability

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

QF-TS12-04-04-020664

T. Petch

## Continuation of Calibration Certificate

Cert. No. : ACL23323  
Job No. : VC67AC0011  
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	25.9	-0.1	± 1.1
25.0	24.8	-0.2	± 1.1

QF-TS12-04-04-020664

T. Petch

## Continuation of Calibration Certificate

Cert. No. : ACL23323  
Job No. : VC67AC0011  
Pages : 7 of 8

## 8. Level linearity including the level range control

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

## 9. Tone burst response

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

## 10. Peak C sound level

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

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

QF-TS12-04-04-020664

T. Petch



## Continuation of Calibration Certificate

Cert. No. : ACL23323  
Job No. : VC67AC0011  
Pages : 8 of 8

## 11. Overload indication

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

## 12. High level stability

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

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

End of Calibration Certificate

QF-TS12-04-04-020664

T. Petch

451-451/1 Srinthorn Road, Bangbunmu, Bangkok, 10700 Thailand  
Tel. +66 2433 8331 Email : calibration@sithiporn.comCert. No. : ACL24012  
Pages : 1 of 8

## Calibration Certificate

Equipment : SOUND LEVEL METER  
Manufacturer : RION  
Model : NL-42A / Microphone UC-52 / Preamplifier NH-24  
Serial No. : 00623390 / 198637 / 26418  
ID No. : RYG\_FS0615

Condition As Found : GOOD

Customer : ALS LABORATORY GROUP (THAILAND) CO., LTD.  
104 PHATTHANAKAN 40, PHATTHANAKAN ROAD,  
KHAENG PHATTHANAKAN, KHET SUAN LUANG,  
BANGKOK, 10250 THAILAND.Location : -  
Ambient Temperature : ( 23.0 ± 3 ) °C  
Pressure : ( 101.3 ± 3 ) kPa  
Relative Humidity : ( 50.0 ± 20 ) %Received Date : 19 DECEMBER 2023  
Calibration Date : 05-08 JANUARY 2024  
Date of Issue : 09 JANUARY 2024

Calibrated by : Nathakorn Pisupaisan

Approved by : T. Petch  
( Thanakul Petchurai )

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

451-451/1 Srinthorn Road, Bangbunmu, Bangkok, 10700 Thailand  
Tel. +66 2433 8331 Email : calibration@sithiporn.comCert. No. : ACL24012  
Job No. : VC67AC0044  
Pages : 2 of 8

Calibration Procedure : CP-AC-01

## Calibration Method :

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

## Condition of this result of calibration :

## 1. Reference Standard Instruments :

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

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

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

3.1 National Institute of Metrology (Thailand).

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

T. Petch

451-451/1 Srinthorn Road, Bangbunmu, Bangkok, 10700 Thailand  
Tel. +66 2433 8331 Email : calibration@sithiporn.comCert. No. : ACL24012  
Job No. : VC67AC0044  
Pages : 3 of 8

## Summary of Measurement Result :

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

T. Petch



Cert. No. : ACL24012  
Job No. : VC67AC0044  
Pages : 4 of 8

**Result of calibration :**

**1. Absolute sensitivity**

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

**2. Self-generated noise**

**2.1 Normal test**

Measured Value ( dB )
14.6

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

Frequency Weighting	Measured value ( dB )
A - weight	12.6
C - weight	19.2
Flat	24.8

**3. Acoustical signal tests of frequency weightings**

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

Frequency ( Hz )	Deviation from various frequency weighting response curve (dB)			
	Flat	C-weight	A-weight	Acceptance Limits
125	0.3	0.3	0.3	± 1.5
1000	0.0	0.0	0.0	± 1.0
8000	1.0	1.1	1.1	±5.0

*T. Retan*

Cert. No. : ACL24012  
Job No. : VC67AC0044  
Pages : 5 of 8

**4. Electrical signal tests of frequency weightings**

Weighting network response with relative to 1 kHz.

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

**5. Frequency and time weightings at 1 kHz**

**5.1 Frequency weightings at 1 kHz**

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

**5.2 Time weighting at 1 kHz**

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

**6. Long - term stability**

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

*T. Retan*

Cert. No. : ACL24012  
Job No. : VC67AC0044  
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	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	26.8	-0.2	±1.1
26.0	25.9	-0.1	±1.1
25.0	24.9	-0.1	±1.1

*T. Retan*

Cert. No. : ACL24012  
Job No. : VC67AC0044  
Pages : 7 of 8

**8. Level linearity including the level range control**

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

**9. Tone burst response**

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

**10. Peak C' sound level**

Number of cycle in test signal	Anticipated Value ( dB )	Measured Value, L <sub>peak</sub> ( dB )	Deviated Value ( dB )	Acceptance Limits ( dB )
Continuous	133.0	133.0	0.0	±3.0
One	136.4	136.3	-0.1	±3.0

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

*T. Retan*



SITHIPORN ASSOCIATES CO., LTD.  
CALIBRATION LABORATORY

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

SITHIPORN  
associates



Cert. No. : ACL24012  
Job No. : VC67AC0044  
Pages : 8 of 8

11. Overload indication

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

12. High level stability

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

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

End of Calibration Certificate

*T. Petchurai*

SITHIPORN ASSOCIATES CO., LTD.  
CALIBRATION LABORATORY

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

SITHIPORN  
associates



Cert. No. : ACL24013  
Pages : 1 of 8

Calibration Certificate

Equipment : SOUND LEVEL METER  
Manufacturer : RION  
Model : NL-42A / Microphone UC-52 / Preamplifier NH-24  
Serial No. : 00623391 / 198638 / 26419  
ID No. : RYG\_FS0616

Condition As Found : GOOD

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

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

Received Date : 19 DECEMBER 2023  
Calibration Date : 05-08 JANUARY 2024  
Date of Issue : 09 JANUARY 2024

Calibrated by : 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.

SITHIPORN ASSOCIATES CO., LTD.  
CALIBRATION LABORATORY

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

SITHIPORN  
associates



Cert. No. : ACL24013  
Job No. : VC67AC0044  
Pages : 2 of 8

Calibration Procedure : CP-AC-01

Calibration Method :

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

Condition of this result of calibration :

1. Reference Standard Instruments :

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

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

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

3.1 National Institute of Metrology (Thailand).

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

*T. Petchurai*

SITHIPORN ASSOCIATES CO., LTD.  
CALIBRATION LABORATORY

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

SITHIPORN  
associates



Cert. No. : ACL24013  
Job No. : VC67AC0044  
Pages : 3 of 8

Summary of Measurement Result :

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

*T. Petchurai*



Cert. No. : ACL24013  
Job No. : VC67AC0044  
Pages : 4 of 8

**Result of calibration :**

**1. Absolute sensitivity**

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

**2. Self-generated noise**

**2.1 Normal test**

Measured Value ( dB )
15.1

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

Frequency Weighting	Measured value ( dB )
A - weight	13.8
C - weight	20.3
Flat	25.8

**3. Acoustical signal tests of frequency weightings**

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

Frequency ( Hz )	Deviation from various frequency weighting response curve (dB)			
	Flat	C-weight	A-weight	Acceptance Limits
125	0.2	0.2	0.2	± 1.5
1000	0.0	0.0	0.0	± 1.0
8000	1.5	1.6	1.6	±5.0

*g. Reth...*

Cert. No. : ACL24013  
Job No. : VC67AC0044  
Pages : 5 of 8

**4. Electrical signal tests of frequency weightings**

Weighting network response with relative to 1 kHz.

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

**5. Frequency and time weightings at 1 kHz**

**5.1 Frequency weightings at 1 kHz**

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

**5.2 Time weighting at 1 kHz**

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

**6. Long - term stability**

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

*g. Reth...*

Cert. No. : ACL24013  
Job No. : VC67AC0044  
Pages : 6 of 8

**7. Level linearity on the reference level range**

Anticipated Value ( dB )	Measured Value ( dB )	Deviated Value ( dB )	Acceptance Limits ( dB )
137.0	137.0	0.0	± 1.1
136.0	136.0	0.0	± 1.1
135.0	135.0	0.0	± 1.1
134.0	134.0	0.0	± 1.1
133.0	133.0	0.0	± 1.1
132.0	132.0	0.0	± 1.1
131.0	131.0	0.0	± 1.1
129.0	129.0	0.0	± 1.1
124.0	124.0	0.0	± 1.1
119.0	119.0	0.0	± 1.1
114.0	114.0	0.0	± 1.1
109.0	109.0	0.0	± 1.1
104.0	104.0	0.0	± 1.1
99.0	99.0	0.0	± 1.1
94.0	94.0	0.0	± 1.1
89.0	89.1	0.1	± 1.1
84.0	84.1	0.1	± 1.1
79.0	79.0	0.0	± 1.1
74.0	74.1	0.1	± 1.1
69.0	69.1	0.1	± 1.1
64.0	64.0	0.0	± 1.1
59.0	59.1	0.1	± 1.1
54.0	54.0	0.0	± 1.1
49.0	49.0	0.0	± 1.1
44.0	44.0	0.0	± 1.1
39.0	39.0	0.0	± 1.1
34.0	34.1	0.1	± 1.1
30.0	30.1	0.1	± 1.1
29.0	29.1	0.1	± 1.1
28.0	28.1	0.1	± 1.1
27.0	27.2	0.2	± 1.1
26.0	26.2	0.2	± 1.1
25.0	25.3	0.3	± 1.1

*g. Reth...*

Cert. No. : ACL24013  
Job No. : VC67AC0044  
Pages : 7 of 8

**8. Level linearity including the level range control**

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

**9. Tone burst response**

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

**10. Peak C sound level**

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

Number of cycle in test signal	Anticipated Value ( dB )	Measured Value ( dB )	Deviated Value ( dB )	Acceptance Limits ( dB )
Continuous	133.0	133.1	0.1	±2.0
Positive half cycle	135.4	135.2	-0.2	±2.0
Negative half cycle	135.4	135.3	-0.1	±2.0

*g. Reth...*



SITHIPORN ASSOCIATES CO., LTD.  
CALIBRATION LABORATORY

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

SITHIPORN  
associates



Cert. No. : ACL24013  
Job No. : VC67AC0044  
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	89.8	0.3	±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

SITHIPORN ASSOCIATES CO., LTD.  
CALIBRATION LABORATORY

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

SITHIPORN  
associates



Cert. No. : ACL24008  
Pages : 1 of 8

Calibration Certificate

Equipment : SOUND LEVEL METER  
Manufacturer : RION  
Model : NL-42 / Microphone UC-52 / Preamplifier NH-24  
Serial No. : 01173610 / 143485 / 22619  
ID No. : RYG\_FS0389

Condition As Found : GOOD

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

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

Received Date : 19 DECEMBER 2023  
Calibration Date : 05-08 JANUARY 2024  
Date of Issue : 09 JANUARY 2024



Calibrated by : Nathakorn Pisutpaisan

Approved by :   
( Thanakul Petchurai )

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

SITHIPORN ASSOCIATES CO., LTD.  
CALIBRATION LABORATORY

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

SITHIPORN  
associates



Cert. No. : ACL24008  
Job No. : VC67AC0044  
Pages : 2 of 8

Calibration Procedure : CP-AC-01

Calibration Method :

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

Condition of this result of calibration :

1. Reference Standard Instruments :

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

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

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

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

SITHIPORN ASSOCIATES CO., LTD.  
CALIBRATION LABORATORY

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

SITHIPORN  
associates



Cert. No. : ACL24008  
Job No. : VC67AC0044  
Pages : 3 of 8

Summary of Measurement Result :

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



Cert. No. : ACL24008  
Job No. : VC67AC0044  
Pages : 4 of 8

**Result of calibration :**

**1. Absolute sensitivity**

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

**2. Self-generated noise**

**2.1 Normal test**

Measured Value ( dB )
18.6

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

Frequency Weighting	Measured value ( dB )
A - weight	16.2
C - weight	22.1
Flat	28.0

**3. Acoustical signal tests of frequency weightings**

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

Frequency ( Hz )	Deviation from various frequency weighting response curve (dB)			
	Flat	C-weight	A-weight	Acceptance Limits
125	0.4	0.5	0.5	± 1.5
1000	0.0	0.0	0.0	± 1.0
8000	0.5	0.5	0.6	±5.0

*T. Petin*

Cert. No. : ACL24008  
Job No. : VC67AC0044  
Pages : 5 of 8

**4. Electrical signal tests of frequency weightings**

Weighting network response with relative to 1 kHz.

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

**5. Frequency and time weightings at 1 kHz**

**5.1 Frequency weightings at 1 kHz**

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

**5.2 Time weighting at 1 kHz**

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

**6. Long - term stability**

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

*T. Petin*

Cert. No. : ACL24008  
Job No. : VC67AC0044  
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	79.1	0.1	± 1.1
74.0	74.1	0.1	± 1.1
69.0	69.1	0.1	± 1.1
64.0	64.0	0.0	± 1.1
59.0	59.1	0.1	± 1.1
54.0	54.0	0.0	± 1.1
49.0	49.0	0.0	± 1.1
44.0	44.0	0.0	± 1.1
39.0	39.0	0.0	± 1.1
34.0	34.1	0.1	± 1.1
30.0	30.1	0.1	± 1.1
29.0	29.1	0.1	± 1.1
28.0	28.2	0.2	± 1.1
27.0	27.4	0.4	± 1.1
26.0	26.3	0.3	± 1.1
25.0	25.4	0.4	± 1.1

*T. Petin*

Cert. No. : ACL24008  
Job No. : VC67AC0044  
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	±3.0
One	136.4	135.7	-0.7	±3.0

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

*T. Petin*



SITHIPORN ASSOCIATES CO., LTD.  
CALIBRATION LABORATORY

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



Cert. No. : ACL24008  
Job No. : VC67AC0044  
Pages : 8 of 8

11. Overload indication

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

CERTIFICATE OF CALIBRATION

ISSUED BY Cirrus Research plc  
DATE OF ISSUE 29 January 2024 CERTIFICATE NUMBER 207437

REVIEW BY *Northern P*  
APPROVED BY *hsk*  
NEXT CAL DATE 28/1/26

Cirrus Research plc  
Acoustic House  
Bridlington Road  
Hunmanby  
North Yorkshire  
YO14 0PH  
United Kingdom

Page 1 of 2

Approved signatory  
N.Smith  
Electronically signed:

doseBadge Reader : IEC 60942:2003

Instrument information

Manufacturer: Cirrus Research plc  
Model: RC110A  
Serial number: 73729  
Class: 2

Notes:

Test summary

Date of calibration: 29 January 2024

The doseBadge reader detailed above has been calibrated to the published data as described in the operating manual and in the full configuration. The procedures and techniques used are as described in IEC60942\_2003 Annex B - Periodic Tests and three determinations of the sound pressure level, frequency and total distortion were made.

The sound pressure level was measured using a WS2F condenser microphone type MK224 manufactured by Cirrus Research plc.

The results have been corrected to the reference pressure of 101.33 kPa using the manufacturer's data.

The doseBadge Reader has been shown to conform to the Class 2 requirements for periodic testing, described in Annex B of IEC 60942:2003 for the sound pressure level(s) and frequency(ies) stated, for the environmental conditions under which the tests were performed.

However, as public evidence was not available, from a testing organisation responsible for pattern approval, to demonstrate that the model of doseBadge Reader conformed to the requirements for pattern evaluation described in Annex A of IEC 60942:2003, no general statement or conclusion can be made about conformance of the doseBadge Reader to the requirements of IEC 60942:2003.

Notes:

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

CERTIFICATE OF CALIBRATION

Certificate Number:  
207437

Page 2 of 2

Environmental conditions

The following conditions were recorded at the time of the test:

Before Pressure: 101.44 kPa Temperature: 21.3 °C Humidity: 35.8 %  
After Pressure: 101.44 kPa Temperature: 21.3 °C Humidity: 35.9 %

Test equipment

Equipment	Manufacturer	Model	Serial number
Distortion Meter	Keithley	2015	0994818
Acoustic Calibrator	Bruel and Kjaer	4231	2610257
Environmental Monitor	Comet	T7510	21962628

Initial Acoustic Results

	Expected	Sample 1	Sample 2	Sample 3	Average	Deviation	Tolerance	Uncertainty
Level (dB)	114.00	114.31	114.31	114.29	114.30	0.30	±0.75	0.11 dB
Distortion (%)	< 4.00	0.32	0.26	0.40	0.33	0.33	+4.00	0.13 %
Frequency (Hz)	1000.0	998.2	998.3	998.3	998.3	-1.7	±20.0	0.1 Hz

The measured quantities or deviations (as applicable), extended by the expanded combined uncertainty of measurement, must not exceed the corresponding tolerance.

Adjusted Acoustic Results

	Expected	Sample 1	Sample 2	Sample 3	Average	Deviation	Tolerance	Uncertainty
Level (dB)	114.00	114.01	114.01	114.02	114.01	0.01	±0.75	0.11 dB
Distortion (%)	< 4.00	0.30	0.34	0.34	0.33	0.33	+4.00	0.13 %
Frequency (Hz)	1000.0	998.1	998.3	998.3	998.2	-1.8	±20.0	0.1 Hz

Functionality Results

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

End of results



JIRANATEE ASSOCIATES CO., LTD.

Jiranatee Associates Co., Ltd.  
83/31-33, 87/25-36  
Petchburi 7, 7/11, 8/6, Wattana, Bangkok,  
Bangkok 10500 (Thailand)  
Tel: +6620680812  
Mobile: +6620680812  
E-mail: jnac-calibration@iranatee.com  
Web site: www.jiranatee.com

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

Temperature measurement laboratory  
Calibration services department



NSC - TISI - TIS 17025  
CALIBRATION 0367

CERTIFICATE OF CALIBRATION

Certificate No. : CDT-017-67

Page 1 of 2 Pages

MEASUREMENT ITEM : Heat Stress Monitor  
MANUFACTURER : Delta OHM  
MODEL/TYPE : HD32.2  
SERIAL NUMBER : 15006718  
ID NUMBER : RYG\_F50223  
CONDITION AS-RECEIVED : Used item  
CUSTOMER : ALS laboratory group (thailand) Co., Ltd.  
104 Phatthanakan 40, Phatthanakan Rd.,  
Khaeng Suan Luang, Khet Suan Luang,  
Bangkok 10250 Thailand.

RECEIVED DATE : 11 Jan 2024  
MEASUREMENT DATE : 12 Jan 2024  
ISSUE DATE : 17 Jan 2024

ENVIRONMENTAL CONDITIONS:

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

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

TABULATION OF RESULTS:

The table on next page give the measured values.

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 (NIMT) Certificate number: TT-0038-23, Certificate number: ER-0101-23

Reference Used During Calibration:

1. Standard Temperature Probe  
Model: STS-100 ASD0, Serial No.: 667682-09,  
Due date: 28 Mar 2024  
2. Digital Temperature Indicator  
Model: DTI-1000-A MK II, Serial No.: 671407-00591 Due date: 14 Sep 2024

Uncertainty of Measurement:

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

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



Approved signatory:

Mr. Parinyi Booncharoen  
Calibration Department Manager

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



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: 18009588.  
Dimension: Diameter 3.3 mm. Length 170 mm.

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
80	20.053	20.1	0.0	0.099
80	25.045	25.1	0.1	0.099
80	30.040	30.1	0.1	0.099
80	35.039	35.1	0.1	0.099
80	40.030	40.0	0.0	0.099

Table 2: This equipment was connected with Globe thermometer probe Model: TP3276.2 S/N: 20019638.  
Dimension: Diameter 3.3 mm. Length 205 mm.

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
110	20.053	20.1	0.1	0.14
110	25.045	25.2	0.2	0.099
110	30.040	30.3	0.3	0.099
110	35.039	35.3	0.3	0.099
110	40.030	40.3	0.3	0.099

Table 3: This equipment was connected with temperature probe Model: TP3207.2 S/N: 15015496.  
Dimension: Diameter 14 mm. Length 150 mm.

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
75	20.053	20.2	0.1	0.099
75	25.045	25.1	0.1	0.099
75	30.040	30.0	0.0	0.099
75	35.039	34.9	-0.1	0.099
75	40.030	39.8	-0.2	0.099

UUC\*: Unit Under Calibration

Remark: The reported uncertainty of measurement is 0.14, based on standard uncertainty multiplied by a coverage factor k=2.14 providing a level of confidence of approximately 95%.

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



Jiranatee Associates Co.,Ltd  
63/14-15, 67/35-36  
Pochaisarn 7,7/1, Rd, Wattana, Bangkok  
Bangkok 10500(Thailand)  
Tel: +66(0)80812  
Mobile: +66(0)2999453  
E-mail: jnac-calibration@jiranatee.com  
Web site: www.jiranatee.com

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

Temperature measurement laboratory  
Calibration services department.

**CERTIFICATE OF CALIBRATION**

Certificate No. : CDT-056-67

Page 1 of 2 Pages

MEASUREMENT ITEM : Heat Stress Monitor  
MANUFACTURER : Delta OHM  
MODEL/TYPE : HD32.2  
SERIAL NUMBER : 15006720  
ID NUMBER : RYG\_F50224  
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 : 12 Feb 2024  
MEASUREMENT DATE : 16 Feb 2024  
ISSUE DATE : 20 Feb 2024

**ENVIRONMENTAL CONDITIONS:**

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

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

**TABULATION OF RESULTS:**

The table on next page give the measured values.



Approved signature:

Mr. Parinya Booncharoen  
Calibration Department Manager

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

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: 15015854.  
Dimension: Diameter 3.3 mm. Length 170 mm.

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
80	20.054	19.7	-0.4	0.099
80	25.054	24.7	-0.4	0.099
80	30.041	29.7	-0.3	0.099
80	35.032	34.7	-0.3	0.099
80	40.020	39.6	-0.4	0.099

Table 2: This equipment was connected with Globe thermometer probe Model: TP3276.2 S/N: 20008279.  
Dimension: Diameter 3.3 mm. Length 205 mm.

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
110	20.054	20.1	0.0	0.099
110	25.055	25.1	0.0	0.099
110	30.041	30.1	0.1	0.099
110	35.032	35.1	0.1	0.099
110	40.020	40.2	0.2	0.099

Table 3: This equipment was connected with temperature probe Model: TP3207.2 S/N: 15015498.  
Dimension: Diameter 14 mm. Length 150 mm.

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
75	20.054	20.3	0.2	0.099
75	25.054	25.2	0.1	0.099
75	30.041	30.1	0.1	0.099
75	35.032	35.0	0.0	0.099
75	40.019	39.9	-0.1	0.099

UUC\*: Unit Under Calibration

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



Jiranatee Associates Co.,Ltd  
63/14-15, 67/35-36  
Pochaisarn 7,7/1, Rd, Wattana, Bangkok  
Bangkok 10500(Thailand)  
Tel: +66(0)80812  
Mobile: +66(0)2999453  
E-mail: jnac-calibration@jiranatee.com  
Web site: www.jiranatee.com

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

Temperature measurement laboratory  
Calibration services department.

**CERTIFICATE OF CALIBRATION**

Certificate No. : CDT-057-67

Page 1 of 2 Pages

MEASUREMENT ITEM : Heat Stress Monitor  
MANUFACTURER : Delta OHM  
MODEL/TYPE : HD32.2  
SERIAL NUMBER : 15006726  
ID NUMBER : RYG\_F50226  
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 : 12 Feb 2024  
MEASUREMENT DATE : 16 Feb 2024  
ISSUE DATE : 20 Feb 2024

**ENVIRONMENTAL CONDITIONS:**

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

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

**TABULATION OF RESULTS:**

The table on next page give the measured values.



Approved signature:

Mr. Parinya Booncharoen  
Calibration Department Manager

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



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: 15015841.  
Dimension: Diameter 3.3 mm. Length 170 mm.

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
80	20.054	20.0	-0.1	0.099
80	25.055	25.0	-0.1	0.099
80	30.041	30.0	0.0	0.099
80	35.032	35.0	0.0	0.099
80	40.018	40.0	0.0	0.099

Table 2: This equipment was connected with Globe thermometer probe Model: TP3276.2 S/N: 20008282.  
Dimension: Diameter 3.3 mm. Length 205 mm.

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
110	20.054	20.0	-0.1	0.099
110	25.055	25.1	0.0	0.099
110	30.041	30.1	0.1	0.099
110	35.032	35.1	0.1	0.099
110	40.018	40.1	0.1	0.099

Table 3: This equipment was connected with temperature probe Model: TP3207.2 S/N: 15015494.  
Dimension: Diameter 14 mm. Length 150 mm.

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
75	20.054	20.2	0.1	0.099
75	25.054	25.0	-0.1	0.099
75	30.041	29.9	-0.1	0.099
75	35.032	34.8	-0.2	0.099
75	40.018	39.7	-0.3	0.099


UUC\*: Unit Under Calibration

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



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 Bulkruea  
(x) Sathip Meangmai  
( ) Warakorn Lemgatrakul  
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  
( ) Ponthippa Tameyakul  
( ) Malee Bulkruea  
(x) Suwit Injai  
Issue Date : 31 July 2023

The Uncertainties are for a confidence probability of approximately 95%

This certificate may not be reproduced other than in full, except with the prior written approval of the head of Corporate Services 3 : Equipment Calibration and Testing Services.

A 0053616



Equipment : DO Meter with Sensor  
Condition As-Received : Used Item  
Reference : 2307-0713DSC-2  
Procedure Used :-

Calibration were conducted using in-house calibration procedure CP-OT01 according to comparison with Industrial Platinum Resistance Thermometer ( IPRT ) into Temperature Bath.  
The temperature scale used was based on ITS-90.

#### Condition of this result of calibration

1. Reference standard instrument:-

Instrument	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 %.

-00o-

a 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



## Certificate of Calibration

Cert. No.: 24TM1663  
Page : 1 of 3

Equipment : Low Temp. Incubator

Manufacturer : Memmert

Model : IPP750

Serial No. : V818.0084

ID No. : RYG\_EN0154

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

Received Order : 01 November 2024

Calibration Date : 01 November 2024

Ambient Temperature : ( 26 ± 10 ) °C

Relative Humidity : ( 50 ± 30 ) %

AC Line Voltage : ( 220 ± 22 ) V

Calibrated by : Krisda Malee

Approved by :

( ) Ponpan Paipim  
( ) Suwit Imjai  
(✓) Kunchit Promprat

Issue Date : 07 November 2024

The Uncertainties are for a confidence probability of approximately 95%

This certificate may not be reproduced other than in full, except with the prior written Approval of the head of Corporate Services 3: Equipment Calibration and Testing Services.

REVIEW BY : *Thanitak*

APPROVED BY : *Dharmaraj*

NEXT CAL DATE : 01/05/26



Equipment : Low Temp. Incubator  
Condition As-Received : Used Item  
Reference : 2411-0002OC-1  
Procedure Used :-

Calibration were conducted using calibration procedure CP-OT02 based on TLAS G-20 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	Serial No.	Cert. No.	Traceable	Due Date
1) Data Acquisition	MY44073381	24LM73	TPA	18 May 2025

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

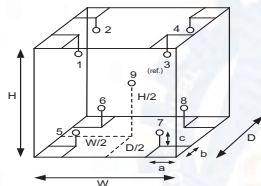
3. This certification is traceable to the International System of Unit.

Remark : TPA : Technology Promotion Association ( Thailand - Japan )

Result of Calibration :- ( \* ) Without Adjustment

Function of UUC\* : Temperature Source

Fresh air setting : Close



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 = 0.72 m<sup>3</sup>

Environment during calibration		
	Beginning	Finished
Temp. ( °C )	24	25
REL.Humid. ( % )	55	53
AC Supply ( Volt )	220	221

Position :	Ref. Std. ID No.:
1	1RTD-2/1
2	1RTD-2/2
3	22-01RTD-03
4	1RTD-2/4
5	1RTD-2/5
6	1RTD-2/6
7	23-01RTD-07
8	1RTD-2/8
9 (ref.)	23-01RTD-09



Equipment : Low Temp. Incubator  
Condition As-Received : Used Item  
Reference : 2411-0002OC-1  
Result of Calibration :- ( \* ) Without Adjustment  
Function of UUC\* : Temperature Source  
Fresh air setting : Close

Cert. No.: 24TM1663  
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	0.026	0.26	0.53	2

Calibration Point ( °C )	Measured Temperature ( °C )									Uncertainty ( ± °C )
	1	2	3	4	5	6	7	8	9 (ref.)	
20.0	20.071	19.915	20.273	20.179	19.977	19.782	20.056	20.026	20.033	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 %.

-00o-





## Certificate of Calibration

Cert.No.: 24CG3711  
Page: 1 of 2

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.Pluakdaeng  
Rayong 21140, Thailand  
Ambient Temperature : (20 ± 2.5) °C  
Relative Humidity : (50 ± 10) %  
Barometric Pressure : 756 mmHg  
Calibration Procedure : ASTM E 542 - 01  
Calibrated by : Sa-nguankam Wongsu

Approved by :  
(✓) Srisuda Khamtha  
( ) Ponpan Palpim  
( ) Unnopphol Harachai

Issue Date : 24 September 2024

The Uncertainties are for a confidence probability of approximately 95%

This certificate may not be reproduced other than in full, except with the prior written approval of the head of Corporate Services 3: Equipment Calibration and Testing Services.



Equipment : Burette  
Received Date : 19 September 2024  
Condition As-Received : Used Item  
Calibration Date : 24 September 2024  
Reference : 2409-0756DSC-3

Cert.No.: 24CG3711  
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	XP205	B134206712	140RC007	24MM316	TPA	15 July 2025
2) Data Logger	HL-20D	20683159	140EC012	23H2174	TPA	10 Oct 2024
3) Thermometer	-	1594592	140EC010	24I175	TPA	20 Feb 2025

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	10.0259	0.0082	2.00
20	20.0214	0.0085	2.00
30	30.0006	0.0089	2.00
40	40.0003	0.0094	2.00
50	49.9988	0.011	2.00

Remark mL = cm<sup>3</sup>

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-



## 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  
Condition As-Received: Used Item  
Received Date: 08 December 2023  
Calibration Date: 14 December 2023  
Reference: 2312-0151DSC  
Ambient Temperature: (23 ± 2) °C  
Relative Humidity: (50 ± 10) %  
Submitted by: ALS Laboratory Group (Thailand) Co.,Ltd. Rayong Branch  
616/10 Moo 5, T.Maenam Khu, A.Pluakdaeng,  
Rayong 21140, Thailand

Procedure used: Calibration were conducted using 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 request 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: N. Banwit  
APPROVED BY: D. Banwit  
NEXT CAL. DATE: 14 Dec 2025

Calibrated by: Krapachonk Phrasomsakul  
Issue Date: 15 December 2023  
Approved Signatory: Phrasomsakul Phrasomsakul  
Nuntawit Khumchai  
Pongsakorn Boonyasri

R 0331106



Cert. No.: 23E3924  
Page: 2 of 2

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

Function: DC voltage measurement	Range: 2000 mV	Standard Value ( mV )	UUC* Reading ( mV )	Error ( mV )	Uncertainty ( ± μV )
		-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.

-000-

a 1193422



Cert.No.: 23CH1574  
Page.: 1 of 3

## Certificate of Calibration

Equipment : pH Meter  
Manufacturer : Mettler Toledo  
Model : SevenExcellence  
Serial No. : B834291445  
ID No. : RYG\_EN0152  
Condition As-Received: Used Item  
Received Date : 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 ± 2.5) °C  
Relative Humidity : (50 ± 15) %  
Calibration Procedure : In-house method  
- CP-CH5 by direct measurement with standard  
voltage calibrator and direct measurement with  
certified reference material (CRM)  
- CP-CH8 by comparison with standard thermometer

Calibrated by : Warakorn Lemgagrakul

Approved by :

( ) Saitip Meangmal  
( ) Warakorn Lemgagrakul  
(x) Ponpan Palpim

Issue Date : 19 December 2023

The Uncertainties are for a confidence probability of approximately 95%

1. This certificate may not be reproduced in whole or in part without the prior written  
approval of the issuing organization. 2. Business Calibration and Testing Services

A 0061695



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	231906	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 4.006	CPA chem	913598	14 July 2025
pH 6.866	CPA chem	931959	01 Oct 2024
pH 8.997	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	Coverage factor
	pH	mV	mV	pH	(±mV)	k
pH Meter	4.000	177.48	177.3	4.000	0.059	2.00
S/N.: B834291445	7.000	0.00	-0.1	7.000	0.058	2.00
	10.000	-177.48	-177.5	10.000	0.058	2.00



Cert.No.: 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 (±)	Coverage factor k
pH Electrode	4.006	4.013	184.1	0.0045	2.00
S/N.: 3225368	6.986	6.996	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-JSM

- 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 (± °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%.

-000-

Sartorius (Thailand) Co., Ltd.

128 Rama 9 Road, Huaywing, Huaywing, Bangkok 10210  
Tel: +66 2943 9351-6, e-mail: service.thailand@sartorius.com



SARTORIUS

NSC-TSI-TS 17025  
CALIBRATION 0426

# Certificate of Calibration

REVIEW BY: Tran-Pall  
APPROVED BY: D. K.  
NEXT CAL. DATE: 02/02/2025

Model Number : MSE224S-100-DU  
Description : Analytical Balance  
Serial Number : 0028207039  
ID No. : RYG\_EN0002  
Manufacturer : Sartorius  
Certificate No. : 24B-0005  
Issued Date : Friday, February 23, 2024  
Reference No. : 229196  
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 : Thursday, February 22, 2024

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  
Temperature : 24.2 °C ± 5.0 °C  
Humidity : 57.0 % RH ± 10.0 % RH  
Pressure : ±  
Reasons for calibration  
☐ New Installation ☐ Service / Repair ☐ Re-calibration / Maintenance  
Equipment Condition: ☒ Good Operator: ☐ 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	TCS	M23061975	23-Aug-2025
MHB-382SD	Humidity/Balometer/Temp. Lutron MHB-382SD	DKSH	C16231645	23-Aug-2024

This certificate relate and apply this equipment only.

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

SOP FM 33 03 February 2022

Mr.chonchai inthana(Technical Manager)




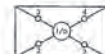
A 1133851



# Certificate of Calibration

Model Number : MSE224S-100-DU Certificate No. : 24BCI0089  
Description : Analytical Balance Issued Date : Friday, February 23, 2024  
Serial Number : 0026207038 Reference No. : 229196  
ID No. : RYG\_EN0002  
Manufacturer : Sartorius Page No. : 2 of 2

## Calibration Results : Without Adjustment

Repeatability			Eccentricity (Off-center loading error)																
The repeatability is the ability of a weighing instrument to display nearly identical readings under constant test conditions when the same load within a measurement range is placed repeatedly on the weighing pan in the same manner. The standard deviation is used to express repeatability quantitatively.			The off-center loading error is yielded by the difference between the 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	199.9999	Nominal value :	100	g														
20 g	20.0000	200.0000	Tolerance	0.0004	g														
Tolerance	20.0001	200.0000	<table><tr><th colspan="2">Difference</th></tr><tr><td>1</td><td>-</td></tr><tr><td>2</td><td>-0.0001</td></tr><tr><td>3</td><td>-0.0001</td></tr><tr><td>4</td><td>0.0000</td></tr><tr><td>5</td><td>-0.0001</td></tr><tr><td>6</td><td>-</td></tr></table>			Difference		1	-	2	-0.0001	3	-0.0001	4	0.0000	5	-0.0001	6	-
Difference																			
1	-																		
2	-0.0001																		
3	-0.0001																		
4	0.0000																		
5	-0.0001																		
6	-																		
0.0001 g	20.0000	199.9999																	
	20.0001	200.0000																	
Nominal Value : (High Load)	19.9999	200.0000																	
200 g	20.0000	200.0000																	
Tolerance	20.0000	199.9999																	
0.0001 g	19.9999	200.0001																	
	19.9999	200.0000																	
Standard Deviation	0.00007	0.00006																	

Linearity				
The linearity, also called linearity error, describes the deviation of the characteristic curve of a weighing instrument from the linear slope.				
Tolerance: 0.0002 g				
Nominal Value (g)	Conventional Mass Value (g)	Displayed Value (g)	Deviation (g)	Uncertainty (g)
0.01	0.0100	0.0100	0.0000	0.00018
0.05	0.0500	0.0500	0.0000	0.00018
0.1	0.1000	0.1000	0.0000	0.00018
0.5	0.5000	0.5000	0.0000	0.00018
1	1.0000	1.0000	0.0000	0.00018
5	5.0000	5.0000	0.0000	0.00018
10	10.0000	10.0000	0.0000	0.00018
20	20.0000	20.0000	0.0000	0.00024
50	50.0000	49.9999	-0.0001	0.00019
100	100.0000	100.0000	0.0000	0.00023
200	200.0000	199.9999	-0.0001	0.00032

End of Report.

SOP FM 33 03 February 2022



## Certificate of Calibration

Cert. No.: 24TM634  
Page : 1 of 3

Equipment : Hot Air Oven  
Manufacturer : Memmert  
Model : UF 110  
Serial No. : B423.0853  
ID No. : RYG\_EN0213

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

Received Order : 21 March 2024  
Calibration Date : 21 - 22 March 2024  
Ambient Temperature : (26 ± 10) °C  
Relative Humidity : (50 ± 30) %

Calibrated by : Man Pattanapongpaiboon

Approved by :   
Approved Signatory

( ) Pomthippa Tameyakul  
( ) Unnopphol Harachai  
(x) Suwit Imjai

Issue Date : 23 March 2024

The Uncertainties are for a confidence probability of approximately 95%

This certificate may not be reproduced other than in full, except with the prior written approval of the head of Corporate Services 3: Equipment Calibration and Testing Services.



Equipment : Hot Air Oven  
Condition As-Received : Used Item  
Reference : 2403-0563OC-3  
Cert. No.: 24TM634  
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	Serial No.	Cert. No.	Traceable	Due Date
1) Data Acquisition	MY57013711	23LM115	TPA	11 Jul 2024

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.

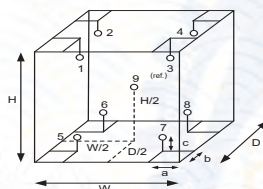
Remark : TPA : Technology Promotion Association (Thailand - Japan)

Result of Calibration :- (\*) Without Adjustment

Function of UUC\* : Temperature Source

Fresh air setting : Close

Environment during calibration		
	Beginning	Finished
Temp. (°C)	27	27
REL.Humid. (%)	59	59
AC Supply (Volt)	224	223



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	18-18TC-01	18-18RTD-01
2	18-18TC-02	18-18RTD-02
3	18-18TC-03	18-18RTD-03
4	18-18TC-04	18-18RTD-04
5	18-18TC-05	18-18RTD-05
6	18-18TC-06	23-18RTD-06
7	18-18TC-07	18-18RTD-07
8	18-18TC-08	22-18RTD-08
9 (ref.)	18-18TC-09	18-18RTD-09



Equipment : Hot Air Oven  
Condition As-Received : Used Item  
Reference : 2403-0563OC-3  
Cert. No.: 24TM634  
Page : 3 of 3

### Result of Calibration :-

Function of UUC\* : Temperature Source  
Fresh air setting : Close

Calibration Point (°C)	UUC* Setting (°C)	UUC* Reading (°C)	Temperature stability (± °C)	Temperature uniformity (°C)	Overall Variation (°C)	Coverage Factor k
104.0	104.0	104.0	0.065	0.52	0.90	2
180.0	180.0	180.0	0.20	1.2	2.0	2

Calibration Point (°C)	Measured Temperature (°C)									Uncertainty (± °C)
	1	2	3	4	5	6	7	8	9 (ref.)	
104.0	104.169	103.506	103.898	103.712	103.772	103.730	104.289	103.805	103.798	0.42
180.0	180.701	179.239	179.935	179.999	180.127	180.138	180.895	179.313	180.211	1.1

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 %.

-o0o-





## Certificate of Calibration

Cert. No.: 24TM635  
Page : 1 of 3

Equipment : Water Bath  
Manufacturer : Memmert  
Model : WNB22  
Serial No. : L513.0648  
ID No. : RYG\_EN0061  
Submitted by : ALS Laboratory Group (Thailand) Co.,Ltd. (Rayong Branch)  
616/10 Moo 5, T. Maenam Khu,  
A. Pluakdaeng,  
Rayong 21140, Thailand  
Location : Wet Chemistry Lab  
Received Order : 21 March 2024  
Calibration Date : 21 March 2024  
Ambient Temperature : (26 ± 10) °C  
Relative Humidity : (50 ± 30) %

Calibrated by : Man Pattanapongpaiboon

Approved by :  
( ) Pornthipha Tameyakul  
( ) Unnopphol Harachai  
(✓) Suwit Imjai

Issue Date : 23 March 2024

The Uncertainties are for a confidence probability of approximately 95%

This certificate may not be reproduced other than in full, except with the prior written  
Approval of the head of Corporate Services 3 : Equipment Calibration and Testing Services.



Equipment : Water Bath  
Condition As-Received : Used Item  
Reference : 2403-0563OC-4  
Procedure Used :-

Cert. No.: 24TM635  
Page : 2 of 3

Calibration were conducted using in-house calibration procedure CP-OT04 Based on ASTM E715 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	Serial No.	Cert. No.	Traceable	Due Date
1) Data Acquisition	MY57013711	23LM115	TPA	11 Jul 2024

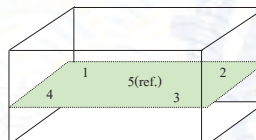
2. This certificate is valid only to the item calibrated on date and place of calibration.  
3. This certification is traceable to the International System of Unit.

Remark : TPA : Technology Promotion Association (Thailand - Japan )  
Result of Calibration :- ( \* ) Without Adjustment

Function of UUC\* : Temperature Source

Heat transfer medium used : Water

	Environmental		AC Voltage Supply
	( °C )	( %R.H. )	( Volt )
Beginning of Calibration	25	55	222
Finished of Calibration	25	57	223



Front

Position :	Ref. Std. ID No.:
1	4803988-001
2	4803988-002
3	4803988-003
4	4803988-004
5(ref.)	4803988-005



Equipment : Water Bath  
Condition As-Received : Used Item  
Reference : 2403-0563OC-4  
Result of Calibration :- ( \* ) Without Adjustment  
Function of UUC\* : Temperature Source

Cert. No.: 24TM635  
Page : 3 of 3

Calibration point ( °C )	UUC* Setting ( °C )	UUC* Reading ( °C )	Average* Standard Reading ( °C )					Uncertainty ( ± °C )
			1	2	3	4	5 (ref.)	
85.0	85.0	85.0	84.428	84.424	84.489	84.507	84.477	0.18

Calibration point ( °C )	Uniformity ( °C )	Stability ( ± °C )	Coverage Factor k
85.0	0.19	0.11	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 %.

-oOo-



## Certificate of Calibration

Cert.No.: 24CH1079  
Page.: 1 of 2

Equipment : pH Meter  
Manufacturer : Mettler Toledo  
Model : Seven2Go S2  
Serial No. : C232588424  
ID No. : RYG\_FS0605  
Condition As-Received: Used Item  
Received Date : 29 August 2024  
Calibration Date : 30 August 2024  
Reference : 2408-0988DSC-1  
Submitted by : ALS Laboratory Group (Thailand) Co.,Ltd. (Rayong Branch)  
616/10 Moo 5, T.Maenam Khu,  
A.Pluaekdaeng, Rayong 21140, Thailand

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

Calibrated by : Warakorn Lernagatrakul

Approved by :  
( ) Unnopphol Harachai  
( ) Ponpan Paipim  
(✓) Saithip Meangmai

Issue Date : 2 September 2024

The Uncertainties are for a confidence probability of approximately 95%

This certificate may not be reproduced other than in full, except with the prior written  
Approval of the head of Corporate Services 3 : Equipment Calibration and Testing Services.





Cert.No.: 24CH1079  
Page.: 2 of 2

#### Condition of this calibration result

##### 1. Reference Standard Instrument

Instrument	Serial No.	ID No.	Cert. No.	Due Date
1) Document Process Calibrator	58440003	130RC120	23E3607	13 Nov 2024

- This Certification is traceable to SI Through Technology Promotion Association (Thailand - Japan)

##### 2. Certified Reference Materials

: The measurement results are traceable to SI through Hach Lenge GmbH Ltd.,  
Deutsche Akkreditierungsstelle, Accredited No.D-RM-15184-01-00  
: 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 4.006	Hach Lenge GmbH	C03146	23 Feb 2026
pH 7.000	Hach Lenge GmbH	C03020	13 Dec 2024
pH 9.997	CPA chem	970853	25 Apr 2025

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 Document Process Calibrator 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		
pH Meter	4.00	177.48	178	4.00	0.58	2.00
S/N.: C232588424	7.00	0.00	0	7.00	0.58	2.00
	10.00	-177.48	-177	10.00	0.58	2.00

##### Function : pH Measurement

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

Unit Under Calibration	Standard pH Buffer Solution	Actual pH Reading	Actual mV Reading (mV)	Uncertainty of pH Measurement ( $\pm$ )	Coverage factor k
pH Electrode	4.006	4.01	168	0.0084	2.00
S/N.: 2465869	7.000	7.00	-9	0.0092	2.05
	9.997	10.00	-181	0.0092	2.00

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

-oOo-



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



## Certificate of Calibration

Cert. No.: 24LM139  
Page.: 1 of 2

Equipment : pH Meter with Sensor  
Manufacturer : Mettler Toledo  
Model : SevenGo S2  
Serial No. : C232588424  
ID No. : RYG\_FS0605  
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 : 29 August 2024  
Calibrated Date : 30 August 2024  
Ambient Temperature : ( $26 \pm 10$ ) °C  
Relative Humidity : ( $50 \pm 30$ ) %  
AC Line Voltage : ( $220 \pm 22$ ) V

Calibrated by : Warakorn Lemgagrakul

Approved by :

( ) Ponpan Paipim  
( ) Suwit Imjai  
(✓) Kunchit Promprat

Issue Date : 02 September 2024

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

This certificate may not be reproduced other than in full, except with the prior written  
Approval of the head of Corporate Services 3 : Equipment Calibration and Testing Services.



Equipment : pH Meter with Sensor  
Condition As-Received : Used Item  
Reference : 2408-0988DSC-2

Cert. No.: 24LM139  
Page.: 2 of 2

#### Procedure Used :-

Calibration were conducted using in-house calibration procedure CP-OT01 according to comparison with Industrial Platinum Resistance Thermometer (IPRT) into Temperature Bath.  
The temperature scale used was based on ITS-90.

#### Condition of this result of calibration

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

Instrument	Serial No.	Cert. No.	Traceable	Due Date
1) Digital Thermometer	20410013	24I851	TPA	08 Aug 2025

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.: 2465869

Calibration Point (°C)	Immersion Depth (mm)	Standard Temperature (°C)	UUC* Reading (°C)	Error (°C)	Uncertainty ( $\pm$ °C)	Coverage Factor k
25.0	100	25.003	25.3	0.297	0.16	2.00
30.0	100	30.002	30.3	0.298	0.16	2.00
40.0	100	40.002	40.4	0.398	0.16	2.00
50.0	100	50.003	50.4	0.397	0.16	2.00

UUC\* : Unit Under Calibration

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

-oOo-



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



## Certificate of Calibration

Cert. No.: 24TM632  
Page : 1 of 3

Equipment : Hot Air Oven  
Manufacturer : Memmert  
Model : UFE 500  
Serial No. : G511.1572  
ID No. : RYG\_EN0010  
Submitted by : ALS Laboratory Group (Thailand) Co.,Ltd. (Rayong Branch)  
616/10 Moo 5 T. Maenam Khu,  
A. Pluakdaeng,  
Rayong 21140 Thailand  
Location : Oven Room  
Received Order : 21 March 2024  
Calibration Date : 21 March 2024  
Ambient Temperature : ( $26 \pm 10$ ) °C  
Relative Humidity : ( $50 \pm 30$ ) %  
Calibrated by : Man Pattanapongpaiboon  
Approved by :  
( ) Pornthippa Tameyakul  
( ) Unnopphol Harachai  
(✓) Suwit Imjai  
Issue Date : 22 March 2024

REVIEW BY *Thanitak*  
APPROVED BY *Dhuan*  
NEXT CAL DATE: 21/09/25

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

This certificate may not be reproduced other than in full, except with the prior written  
Approval of the head of Corporate Services 3 : Equipment Calibration and Testing Services.



Equipment : Hot Air Oven  
Condition As-Received : Used Item  
Reference : 2403-0563OC-1

Cert. No.: 24TM632  
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	Serial No.	Cert. No.	Traceable	Due Date
1 ) Data Acquisition	MY57013711	23LM115	TPA	11 Jul 2024

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

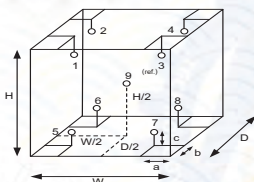
3. This certification is traceable to the International System of Unit.

Remark : TPA : Technology Promotion Association ( Thailand - Japan )

Result of Calibration :- ( \* ) Without Adjustment

Function of UUC\* : Temperature Source

Fresh air setting : Close



#### 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 m <sup>3</sup>

Environment during calibration		
	Beginning	Finished
Temp. ( °C )	27	27
REL.Humid. ( % )	57	59
AC Supply ( Volt )	222	224

Ref. Std. ID No. : @ Calibration Point		
Position :	( 180 ) °C	( 104 ) °C
1	18-18TC-01	18-18RTD-01
2	18-18TC-02	18-18RTD-02
3	18-18TC-03	18-18RTD-03
4	18-18TC-04	18-18RTD-04
5	18-18TC-05	18-18RTD-05
6	18-18TC-06	23-18RTD-06
7	18-18TC-07	18-18RTD-07
8	18-18TC-08	22-18RTD-08
9 (ref.)	18-18TC-09	18-18RTD-09



Equipment : Hot Air Oven  
Condition As-Received : Used Item  
Reference : 2403-0563OC-1

Cert. No.: 24TM632  
Page : 3 of 3

#### Result of Calibration :-

Function of UUC\* : ( \* ) Without Adjustment

Temperature Source

Fresh air setting : Close

Calibration Point ( °C )	UUC* Setting ( °C )	UUC* Reading ( °C )	Temperature stability ( ± °C )	Temperature uniformity ( °C )	Overall Variation ( °C )	Coverage Factor k
104.0	104.0	104.0	0.051	0.59	0.62	2
180.0	180.0	180.0	0.15	1.3	1.7	2

Calibration Point ( °C )	Measured Temperature ( °C )									Uncertainty ( ± °C )
	1	2	3	4	5	6	7	8	9 (ref.)	
104.0	103.921	103.786	103.757	103.759	103.950	103.817	104.213	103.672	103.673	0.42
180.0	179.614	179.270	179.145	179.599	180.001	180.423	180.293	180.629	179.429	1.1

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 %.

-00-



Bara Scientific Co., Ltd.  
968 U Chu Liang Building Floor7 Rama4 Road  
Siam Bangkok Bangkok Thailand 10500  
Tel : 02-6324300 Fax : 02-6375496-7  
www.barascientific.com



## Certificate of Calibration

Number of Page(s) 1 of 3

Certificate No. BSCC-UV-374/24  
Equipment UV/Vis Spectrophotometer  
Model UV-1800  
Manufacturer Shimadzu  
Serial No. A11454908533 CD  
ID No. BKK\_EN0018  
Date of receipt 13 September 2024  
Date of calibration 13 September 2024  
Date of issue 13 SEP 2024

Customer name ALS Laboratory Group (Thailand) Co., Ltd.

Address 104 Soi Phattananan 40, Phattananan Road, Phattananan, Suan Luang, Bangkok 10250

Temperature (25.3 - 26.7) °C (On site)  
Humidity (50.4 - 55.9) %RH (On site)

Equipment condition Good Operation

Calibration Location Organic Preparation Lab

Calibration Procedure In-house method WI-UV-702-01 based on ASTM E275-01

Traceability Wavelength Accuracy is traceable to certificate No. 106372 and 106371  
Photometric Accuracy is traceable to certificate No. 106364 and 111398  
UV Light intensity is traceable to certificate No. 106377  
UV source performance are traceable to SI unit through Sarna Scientific Ltd.  
(UKAS accredited calibration laboratory NO. 0659)

Calibrated by Mr.Wanchana Janloey

REVIEW BY: Jada K  
APPROVED BY: Sath P  
NEXT CAL DATE: 13/09/2025

Approved by

Mr.Sonthi Temboonsakdi  
Service 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.

BM-UV-305-07-01-04-05 (23/01/23)



Bara Scientific Co., Ltd.  
968 U Chu Liang Building Floor7 Rama4 Road  
Siam Bangkok Bangkok Thailand 10500  
Tel : 02-6324300 Fax : 02-6375496-7  
www.barascientific.com



## Certificate of Calibration

Certificate No. BSCC-UV-374/24

Number of Page(s) 2 of 3

#### Calibration Results:

##### 1.Wavelength Accuracy

Certified Wavelength (nm)	UUC (nm)	Error (nm)	Uncertainty (±nm)
241.70	241.55	-0.15	0.18
334.02	333.85	-0.17	0.18
418.53	418.57	0.04	0.18
572.99	572.97	-0.02	0.18
879.41	879.17	-0.24	0.18

##### 2.Photometric Accuracy (UV)

Wavelength (nm)	Certified Absorbance (A)	UUC (A)	Error (A)	Uncertainty (±A)
235	0.0000	0.0000	0.0000	0.0075
	0.7171	0.7169	-0.0002	0.0075
	0.0000	0.0000	0.0000	0.0075
257	0.0000	0.0000	0.0000	0.0075
	0.8354	0.8345	-0.0009	0.0075
	0.0000	0.0000	0.0000	0.0075
313	0.2786	0.2781	-0.0005	0.0075
	0.0000	0.0000	0.0000	0.0075
	0.6199	0.6194	-0.0005	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  
except in full, without written approval of the Bara Scientific Co., Ltd.

FM-UV-708-02 Rev.01 (23/01/23)



# Certificate of Calibration

Certificate No. **BSCC-UV-374/24** 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
	0.5761	0.5765	0.0004	0.0042
	0.7159	0.7105	-0.0014	0.0042
	1.0165	1.0174	-0.0015	0.0042
	0.0000	0.0000	0.0000	0.0042
440.0	0.5610	0.5613	0.0003	0.0042
	0.7001	0.6984	-0.0017	0.0042
	1.0026	1.0011	-0.0015	0.0042
	0.0000	0.0000	0.0000	0.0042
	0.5235	0.5232	-0.0003	0.0042
465.0	0.9614	0.9598	-0.0016	0.0042
	0.9456	0.9444	-0.0012	0.0042
	0.0000	0.0000	0.0000	0.0042
	0.5249	0.5245	-0.0004	0.0042
	0.6976	0.6956	-0.0019	0.0042
546.1	1.0009	0.9994	-0.0015	0.0042
	0.0000	0.0000	0.0000	0.0042
	0.5590	0.5586	-0.0004	0.0042
	0.7725	0.7708	-0.0017	0.0042
	1.1125	1.1114	-0.0011	0.0042
590.0	0.0000	0.0000	0.0000	0.0042
	0.5666	0.5666	0.0000	0.0042
	0.7620	0.7604	-0.0016	0.0042
	1.0982	1.0971	-0.0011	0.0042

\*CNR = Customer not request

### 4. Stray Light\*

Standard cut-off wavelength (nm)	Wavelength (nm)	Transmission (%T)	Absorbance (A)
200.85±0.11nm	199.58	0.0520	2.0217

The Stray light transmission reference is less than 1.0%T and Stray light absorbance reference is greater than 2.00A

\*Stray Light not NSC-ONSC Accredited

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

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

The above results are valid exclusively for the calibrated item(s) as mention in this report / certificate.  
Advertising 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.

ภาคผนวก จ

---

สำเนาหนังสืออนุญาตขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์เอกชน







(๓๓๔) นายอนันต์ชัย

๑๕๓) นางสาวกมล...

True

ค. ขอบข่ายสารมลพิษที่ได้รับขึ้นทะเบียนจากกรมโรงงานอุตสาหกรรม จำนวน ๓๗๔ รายการ  
น้ำเสีย จำนวน 60 รายการ

19 Copper..



ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
19	Copper	1) Digestion, Inductively Coupled Plasma Method <sup>(4)</sup> 2) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method <sup>(4)</sup>
20	Cyanide	Distillation, Colorimetric Method <sup>(4)</sup>
21	2,4'-DDD	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
22	4,4'-DDD	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
23	2,4'-DDE	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
24	4,4'-DDE	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
25	2,4'-DDT	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
26	4,4'-DDT	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
27	Dieldrin	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
28	Endosulfan Sulfate	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
29	Endosulfan I	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
30	Endosulfan II	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
31	Endrin	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
32	Endrin Aldehyde	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
33	Formaldehyde	Distillation, Colorimetric Method <sup>(3)</sup>
34	Free Chlorine	1) DPD Ferrous Titrimetric Method <sup>(3)</sup> 2) DPD Colorimetric Method <sup>(4)</sup>
35	Heptachlor	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
36	Heptachlor Epoxide	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
37	Hexavalent Chromium	Colorimetric Method <sup>(4)</sup>
38	3-Hydroxycarbofuran	High-Performance Liquid Chromatographic Method <sup>(4)</sup>
39	Lead	1) Digestion, Inductively Coupled Plasma Method <sup>(4)</sup> 2) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method <sup>(4)</sup>

40 Manganese...

ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
40	Manganese	1) Digestion, Inductively Coupled Plasma Method <sup>(4)</sup> 2) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method <sup>(4)</sup>
41	Mercury	1) Digestion, Cold-Vapor Atomic Absorption Spectrometric Method <sup>(4)</sup> 2) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method <sup>(4)</sup>
42	Methiocarb	High-Performance Liquid Chromatographic Method <sup>(4)</sup>
43	Methoxychlor	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
44	Methomyl	High-Performance Liquid Chromatographic Method <sup>(4)</sup>
45	Nickel	1) Digestion, Inductively Coupled Plasma Method <sup>(4)</sup> 2) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method <sup>(4)</sup>
46	Oil & Grease	1) Liquid-Liquid, Partition-Gravimetric Method <sup>(4)</sup> 2) Soxhlet Extraction Method <sup>(4)</sup>
47	Oxamyl	High-Performance Liquid Chromatographic Method <sup>(4)</sup>
48	Propoxur	High-Performance Liquid Chromatographic Method <sup>(4)</sup>
49	pH	Electrometric Method <sup>(3)</sup>
50	Phenols	1) Distillation, Chloroform Extraction Method <sup>(4)</sup> 2) Distillation, Direct Photometric Method <sup>(4)</sup>
51	Selenium	1) Digestion, Inductively Coupled Plasma Method <sup>(4)</sup> 2) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method <sup>(4)</sup>
52	Sulfide	Iodometric Method <sup>(4)</sup>
53	Temperature	Laboratory and Field Methods <sup>(4)</sup>
54	Total Dissolved Solids	Dried at 180 °C <sup>(4)</sup>
55	Total Kjeldahl Nitrogen	Semi-Micro Kjeldahl Method <sup>(4)</sup>
56	Total Phosphorous	Digestion, Colorimetric Method <sup>(4)</sup>
57	Total Suspended Solids	Dried from 103-105 °C <sup>(4)</sup>
58	Toxaphene	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
59	Trivalent Chromium	1) Digestion, Inductively Coupled Plasma Method; Colorimetric Method; Calculation <sup>(4)</sup> 2) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method; Colorimetric Method; Calculation <sup>(4)</sup>
60	Zinc	1) Digestion, Inductively Coupled Plasma Method <sup>(4)</sup> 2) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method <sup>(4)</sup>

น้ำใต้ดิน...

## น้ำใต้ดิน จำนวน 126 รายการ

ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
1	Acenaphthene	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
2	Acetone	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
3	Aldrin	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
4	Anthracene	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
5	Antimony	1) Digestion, Inductively Coupled Plasma Method <sup>(4)</sup> 2) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method <sup>(4)</sup>
6	Arsenic	1) Digestion, Inductively Coupled Plasma Method <sup>(4)</sup> 2) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method <sup>(4)</sup>
7	Atrazine	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
8	Barium	1) Digestion, Inductively Coupled Plasma Method <sup>(4)</sup> 2) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method <sup>(4)</sup>
9	Benz(a)anthracene	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
10	Benzene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
11	Benzo(b)fluoranthene	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
12	Benzo(k)fluoranthene	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
13	Benzoic Acid	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
14	Benzo(a)pyrene	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
15	Benzo(g,h,i)perylene	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
16	Beryllium	1) Digestion, Inductively Coupled Plasma Method <sup>(4)</sup> 2) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method <sup>(4)</sup>
17	Bis(2-chloroethyl)ether	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>

18 Bis(2-ethylhexyl)phthalate...

ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
18	Bis(2-ethylhexyl)phthalate	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
19	Bromodichloromethane	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
20	Bromoform	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
21	Butanol	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
22	Butyl benzyl phthalate	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
23	Cadmium	1) Digestion, Inductively Coupled Plasma Method <sup>(4)</sup> 2) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method <sup>(4)</sup>
24	Carbazole	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
25	Carbon disulfide	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
26	Carbon tetrachloride	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
27	Chlordane	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
28	p-Chloroaniline	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
29	Chlorobenzene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
30	Chlorodibromomethane	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
31	Chloroform	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
32	2-Chlorophenol	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
33	Chromium	1) Digestion, Inductively Coupled Plasma Method <sup>(4)</sup> 2) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method <sup>(4)</sup>
34	Chromium (III)	1) Digestion, Inductively Coupled Plasma Method; Colorimetric Method; Calculation <sup>(4)</sup> 2) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method; Colorimetric Method; Calculation <sup>(4)</sup>
35	Chromium (VI)	Colorimetric Method <sup>(4)</sup>

36 Chrysene...



ลำดับที่	สารเคมี	วิธีวิเคราะห์
36	Chrysene	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
37	Cyanide	Distillation, Colorimetric Method <sup>(4)</sup>
38	2,4-D	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
39	DDD	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
40	DDE	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
41	DDT	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
42	Dibenz(a,h)anthracene	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
43	Di-n-Butyl Phthalate	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
44	1,2-Dichlorobenzene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
45	1,3-Dichlorobenzene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
46	1,4-Dichlorobenzene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
47	3,3-Dichlorobenzidine	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
48	1,1-Dichloroethane	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
49	1,2-Dichloroethane	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
50	1,1-Dichloroethylene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
51	cis-1,2-Dichloroethylene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
52	trans-1,2-Dichloroethylene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
53	2,4-Dichlorophenol	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
54	1,2-Dichloropropane	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
55	1,3-Dichloropropane	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>

56 1,3-Dichloropropene...

ลำดับที่	สารเคมี	วิธีวิเคราะห์
56	1,3-Dichloropropene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
57	Dieldrin	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
58	Diethyl Phthalate	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
59	2,4-Dimethylphenol	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
60	2,4-Dinitrophenol	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
61	2,4-Dinitrotoluene	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
62	2,6-Dinitrotoluene	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
63	Di-n-octyl phthalate	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
64	Endosulfan	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
65	Endrin	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
66	Ethylbenzene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
67	Fluoranthene	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
68	Fluorene	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
69	Heptachlor	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
70	Heptachlor epoxide	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
71	Hexachlorobenzene	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
72	Hexachloro-1,3-butadiene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
73	n-Hexane	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
74	α-HCH	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
75	β-HCH	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>

76 γ-HCH...

ลำดับที่	สารเคมี	วิธีวิเคราะห์
76	γ-HCH	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
77	Hexachlorocyclopentadiene	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
78	Hexachloroethane	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
79	Indeno(1,2,3-cd)pyrene	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
80	Isophorone	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
81	Lead	1) Digestion, Inductively Coupled Plasma Method <sup>(4)</sup> 2) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method <sup>(4)</sup>
82	Manganese	1) Digestion, Inductively Coupled Plasma Method <sup>(4)</sup> 2) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method <sup>(4)</sup>
83	Mercury	1) Digestion, Cold Vapor Atomic Absorption Spectrometric Method <sup>(4)</sup> 2) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method <sup>(4)</sup>
84	Methanol	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
85	Methoxychlor	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
86	Methyl bromide	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
87	Methylene chloride	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
88	2-Methylphenol	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
89	2-Methylnaphthalene	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
90	Methyl tert-butyl Ether	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
91	Naphthalene	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
92	Nickel	1) Digestion, Inductively Coupled Plasma Method <sup>(4)</sup> 2) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method <sup>(4)</sup>
93	Nitrobenzene	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>

94 N-Nitrosodiphenylamine...

ลำดับที่	สารเคมี	วิธีวิเคราะห์
94	N-Nitrosodiphenylamine	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
95	N-Nitrosodi-n-Propylamine	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
96	Polychlorinated Biphenyls - PCB 1016 - PCB 1221 - PCB 1232 - PCB 1242 - PCB 1248 - PCB 1254 - PCB 1260	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
97	Pentachlorophenol	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
98	pH	Electrometric Method <sup>(4)</sup>
99	Phenanthrene	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
100	Phenol	1) Distillation, Chloroform Extraction Method <sup>(4)</sup> 2) Distillation, Direct Photometric Method <sup>(4)</sup> 3) Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
101	Pyrene	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
102	Selenium	1) Digestion, Inductively Coupled Plasma Method <sup>(4)</sup> 2) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method <sup>(4)</sup>
103	Silver	1) Digestion, Inductively Coupled Plasma Method <sup>(4)</sup> 2) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method <sup>(4)</sup>
104	Styrene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
105	1,1,2,2-Tetrachloroethane	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
106	Tetrachloroethylene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
107	Toluene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
108	Toxaphene	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
109	TPH (C <sub>9</sub> -C <sub>14</sub> )	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(4,25)</sup>

110 TPH (C<sub>10</sub>-C<sub>19</sub>)...



ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
110	TPH (C <sub>10</sub> -C <sub>16</sub> )	Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic Method <sup>(9,22)</sup>
111	TPH (C <sub>11</sub> -C <sub>15</sub> )	Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic Method <sup>(9,22)</sup>
112	1,2,4-Trichlorobenzene	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method <sup>(4)</sup>
113	1,1,1-Trichloroethane	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method <sup>(4)</sup>
114	1,1,2-Trichloroethane	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method <sup>(4)</sup>
115	Trichloroethylene	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method <sup>(4)</sup>
116	2,4,5-Trichlorophenol	Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(4)</sup>
117	2,4,6-Trichlorophenol	Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(4)</sup>
118	1,3,5-Trimethylbenzene	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method <sup>(4)</sup>
119	Vanadium	1) Digestion, Inductively Coupled Plasma Method <sup>(4)</sup> 2) Digestion, Inductively Coupled Plasma/Mass Spectrometric Method <sup>(4)</sup>
120	Vinyl acetate	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method <sup>(4)</sup>
121	Vinyl chloride	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method <sup>(4)</sup>
122	m-Xylene	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method <sup>(4)</sup>
123	o-Xylene	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method <sup>(4)</sup>
124	p-Xylene	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method <sup>(4)</sup>
125	Xylene (Total)	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method <sup>(4)</sup>
126	Zinc	1) Digestion, Inductively Coupled Plasma Method <sup>(4)</sup> 2) Digestion, Inductively Coupled Plasma/Mass Spectrometric Method <sup>(4)</sup>

จากผลเสีย

จากผลเสีย (ปล่อยรวม) จำนวน 28 รายการ

ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
1	Antimony	1) Isokinetic Sampling, Digestion, Inductively Coupled Plasma Method <sup>(5)</sup> 2) Isokinetic Sampling, Digestion, Inductively Coupled Plasma/Mass Spectrometric Method <sup>(5)</sup>
2	Arsenic	1) Isokinetic Sampling, Digestion, Inductively Coupled Plasma Method <sup>(5)</sup> 2) Isokinetic Sampling, Digestion, Inductively Coupled Plasma/Mass Spectrometric Method <sup>(5)</sup>
3	Beryllium	1) Isokinetic Sampling, Digestion, Inductively Coupled Plasma Method <sup>(5)</sup> 2) Isokinetic Sampling, Digestion, Inductively Coupled Plasma/Mass Spectrometric Method <sup>(5)</sup>
4	Cadmium	1) Isokinetic Sampling, Digestion, Inductively Coupled Plasma Method <sup>(5)</sup> 2) Isokinetic Sampling, Digestion, Inductively Coupled Plasma/Mass Spectrometric Method <sup>(5)</sup>
5	Carbon Monoxide	1) Instrumental Analyzer Method <sup>(5)</sup> 2) Sampling Bag Non-Dispersive Infrared Method <sup>(5)</sup>
6	Chlorine	1) Adsorption Sampling, Ion Chromatographic Method <sup>(5)</sup> 2) Isokinetic Sampling, Ion Chromatographic Method <sup>(5)</sup>
7	Chromium	1) Isokinetic Sampling, Digestion, Inductively Coupled Plasma Method <sup>(5)</sup> 2) Isokinetic Sampling, Digestion, Inductively Coupled Plasma/Mass Spectrometric Method <sup>(5)</sup>
8	Cobalt	1) Isokinetic Sampling, Digestion, Inductively Coupled Plasma Method <sup>(5)</sup> 2) Isokinetic Sampling, Digestion, Inductively Coupled Plasma/Mass Spectrometric Method <sup>(5)</sup>
9	Copper	1) Isokinetic Sampling, Digestion, Inductively Coupled Plasma Method <sup>(5)</sup> 2) Isokinetic Sampling, Digestion, Inductively Coupled Plasma/Mass Spectrometric Method <sup>(5)</sup>
10	Cresol	Adsorption Sampling, Gas Chromatographic Method <sup>(5)</sup>
11	Dioxins	Isokinetic Sampling <sup>(5)</sup>
12	Hydrogen Chloride	1) Adsorption Sampling, Ion Chromatographic Method <sup>(5)</sup> 2) Isokinetic Sampling, Ion Chromatographic Method <sup>(5)</sup>
13	Hydrogen Fluoride	1) Adsorption Sampling, Ion Chromatographic Method <sup>(5)</sup> 2) Isokinetic Sampling, Ion Chromatographic Method <sup>(5)</sup>
14	Hydrogen Sulfide	Absorption Sampling, Iodometric Method <sup>(5)</sup>

15 Lead...

ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
15	Lead	1) Isokinetic Sampling, Digestion, Inductively Coupled Plasma Method <sup>(5)</sup> 2) Isokinetic Sampling, Digestion, Inductively Coupled Plasma/Mass Spectrometric Method <sup>(5)</sup>
16	Manganese	1) Isokinetic Sampling, Digestion, Inductively Coupled Plasma Method <sup>(5)</sup> 2) Isokinetic Sampling, Digestion, Inductively Coupled Plasma/Mass Spectrometric Method <sup>(5)</sup>
17	Mercury	1) Isokinetic Sampling, Digestion, Cold-Vapor Atomic Absorption Spectrometric Method <sup>(5)</sup> 2) Isokinetic Sampling, Digestion, Cold-Vapor Atomic Fluorescence Spectrometric Method <sup>(5)</sup>
18	Nickel	1) Isokinetic Sampling, Digestion, Inductively Coupled Plasma Method <sup>(5)</sup> 2) Isokinetic Sampling, Digestion, Inductively Coupled Plasma/Mass Spectrometric Method <sup>(5)</sup>
19	Opacity	Ringelmann's Method <sup>(5)</sup>
20	Oxides of Nitrogen	1) Absorption Sampling, Phenoldisulfonic Acid Method <sup>(5)</sup> 2) Absorption Sampling, Alkaline Permanganate/Colorimetric Method <sup>(5)</sup> 3) Instrumental Analyzer Method <sup>(5)</sup>
21	Selenium	1) Isokinetic Sampling, Digestion, Inductively Coupled Plasma Method <sup>(5)</sup> 2) Isokinetic Sampling, Digestion, Inductively Coupled Plasma/Mass Spectrometric Method <sup>(5)</sup>
22	Sulfur Dioxide	1) Absorption Sampling, Barium-Thorin Titrimetric Method <sup>(5)</sup> 2) Instrumental Analyzer Method <sup>(5)</sup>
23	Sulfuric Acid	Isokinetic Sampling, Barium-Thorin Titrimetric Method <sup>(5)</sup>
24	Tellurium	1) Isokinetic Sampling, Digestion, Inductively Coupled Plasma Method <sup>(5)</sup> 2) Isokinetic Sampling, Digestion, Inductively Coupled Plasma/Mass Spectrometric Method <sup>(5)</sup>
25	Tin	1) Isokinetic Sampling, Digestion, Inductively Coupled Plasma Method <sup>(5)</sup> 2) Isokinetic Sampling, Digestion, Inductively Coupled Plasma/Mass Spectrometric Method <sup>(5)</sup>
26	Total Suspended Particulate	1) Isokinetic Sampling, Gravimetric Method <sup>(5)</sup> 2) Paired Train, Isokinetic Sampling, Gravimetric Method <sup>(5)</sup>

27 Vanadium...

ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
27	Vanadium	1) Isokinetic Sampling, Digestion, Inductively Coupled Plasma Method <sup>(5)</sup> 2) Isokinetic Sampling, Digestion, Inductively Coupled Plasma/Mass Spectrometric Method <sup>(5)</sup>
28	Xylene	Adsorption Sampling, Gas Chromatographic Method <sup>(5)</sup>

สิ่งปลูกสร้างหรือวัตถุที่ไม่ใช่พื้นผิว จำนวน 35 รายการ

ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
1	Aldrin	1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(1,9,26)</sup> 2) Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(9,26)</sup> 3) Automated Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(1,26)</sup>
2	Antimony	1) Waste Extraction, Digestion, Inductively Coupled Plasma Method <sup>(1,16)</sup> 2) Waste Extraction, Digestion, Inductively Coupled Plasma/Mass Spectrometric Method <sup>(1,17)</sup> 3) Digestion, Inductively Coupled Plasma Method <sup>(7,16)</sup> 4) Digestion, Inductively Coupled Plasma/Mass Spectrometric Method <sup>(7,17)</sup>
3	Arsenic	1) Waste Extraction, Digestion, Inductively Coupled Plasma Method <sup>(1,16)</sup> 2) Waste Extraction, Digestion, Inductively Coupled Plasma/Mass Spectrometric Method <sup>(1,17)</sup> 3) Digestion, Inductively Coupled Plasma Method <sup>(7,16)</sup> 4) Digestion, Inductively Coupled Plasma/Mass Spectrometric Method <sup>(7,17)</sup>
4	Barium	1) Waste Extraction, Digestion, Inductively Coupled Plasma Method <sup>(1,16)</sup> 2) Waste Extraction, Digestion, Inductively Coupled Plasma/Mass Spectrometric Method <sup>(1,17)</sup> 3) Digestion, Inductively Coupled Plasma Method <sup>(7,16)</sup> 4) Digestion, Inductively Coupled Plasma/Mass Spectrometric Method <sup>(7,17)</sup>

5 Beryllium...



ลำดับที่	สารพิษ	วิธีการหา
5	Beryllium	1) Waste Extraction, Digestion, Inductively Coupled Plasma Method <sup>(1,4,16)</sup> 2) Waste Extraction, Digestion, Inductively Coupled Plasma/Mass Spectrometric Method <sup>(1,4,17)</sup> 3) Digestion, Inductively Coupled Plasma Method <sup>(7,18)</sup> 4) Digestion, Inductively Coupled Plasma/Mass Spectrometric Method <sup>(7,17)</sup>
6	Cadmium	1) Waste Extraction, Digestion, Inductively Coupled Plasma Method <sup>(1,6,16)</sup> 2) Waste Extraction, Digestion, Inductively Coupled Plasma/Mass Spectrometric Method <sup>(1,4,17)</sup> 3) Digestion, Inductively Coupled Plasma Method <sup>(7,16)</sup> 4) Digestion, Inductively Coupled Plasma/Mass Spectrometric Method <sup>(7,17)</sup>
7	Chlordane	1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(1,9,28)</sup> 2) Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(9,28)</sup> 3) Automated Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(1,26)</sup>
8	Chromium	1) Waste Extraction, Digestion, Inductively Coupled Plasma Method <sup>(1,6,16)</sup> 2) Waste Extraction, Digestion, Inductively Coupled Plasma/Mass Spectrometric Method <sup>(1,4,17)</sup> 3) Digestion, Inductively Coupled Plasma Method <sup>(7,16)</sup> 4) Digestion, Inductively Coupled Plasma/Mass Spectrometric Method <sup>(7,17)</sup>
9	Chromium (III)	1) Waste Extraction, Digestion, Inductively Coupled Plasma Method; Waste Extraction, Colorimetric Method; Calculation Method <sup>(1,6,16,17)</sup> 2) Waste Extraction, Digestion, Inductively Coupled Plasma/Mass Spectrometric Method; Waste Extraction, Colorimetric Method; Calculation Method <sup>(1,4,17,19)</sup> 3) Digestion, Inductively Coupled Plasma Method; Alkaline Digestion, Colorimetric Method; Calculation Method <sup>(7,16,19)</sup> 4) Digestion, Inductively Coupled Plasma/Mass Spectrometric Method; Alkaline Digestion, Colorimetric Method, Calculation Method <sup>(7,8,17,19)</sup>

10 Chromium (VI)...

ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
10	Chromium (VI)	1) Waste Extraction, Colorimetric Method <sup>(1,6,19)</sup> 2) Alkaline Digestion, Colorimetric Method <sup>(8,40)</sup>
11	Cobalt	1) Waste Extraction, Digestion, Inductively Coupled Plasma Method <sup>(1,6,16)</sup> 2) Waste Extraction, Digestion, Inductively Coupled Plasma/Mass Spectrometric Method <sup>(1,6,17)</sup> 3) Digestion, Inductively Coupled Plasma Method <sup>(7,11)</sup> 4) Digestion, Inductively Coupled Plasma/Mass Spectrometric Method <sup>(1,17)</sup>
12	Copper	1) Waste Extraction, Digestion, Inductively Coupled Plasma Method <sup>(1,6,18)</sup> 2) Waste Extraction, Digestion, Inductively Coupled Plasma/Mass Spectrometric Method <sup>(1,6,17)</sup> 3) Digestion, Inductively Coupled Plasma Method <sup>(7,14)</sup> 4) Digestion, Inductively Coupled Plasma/Mass Spectrometric Method <sup>(7,17)</sup>
13	2,4-D	1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(1,9,26)</sup> 2) Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(10,28)</sup> 3) Automated Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(11,29)</sup>
14	DDD	1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(1,9,26)</sup> 2) Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(10,28)</sup> 3) Automated Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(11,29)</sup>
15	DDE	1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(1,9,26)</sup> 2) Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(10,28)</sup> 3) Automated Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(11,29)</sup>
16	DDT	1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(1,9,26)</sup>

2) Soxhlet...

ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
17	Dieldrin	2) Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(10,26)</sup> 3) Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(11,26)</sup>
18	Endrin	1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(1,9,26)</sup> 2) Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(9,26)</sup> 3) Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(11,26)</sup>
19	Heptachlor	1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(1,9,26)</sup> 2) Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(9,26)</sup> 3) Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(11,26)</sup>
20	Lead	1) Waste Extraction, Digestion, Inductively Coupled Plasma Method <sup>(1,6,16)</sup> 2) Waste Extraction, Digestion, Inductively Coupled Plasma/Mass Spectrometric Method <sup>(1,6,17)</sup> 3) Digestion, Inductively Coupled Plasma Method <sup>(7,16)</sup> 4) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method <sup>(7,17)</sup>
21	Lindane	1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(9,26)</sup> 2) Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(9,26)</sup> 3) Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(11,26)</sup>

22 Mercury..

ลำดับที่	สารพิษ	วิธีการหา
22	Mercury	1) Waste Extraction, Digestion, Cold-Vapor Atomic Absorption Spectrometric Method <sup>(8,6,20)</sup> 2) Waste Extraction, Digestion, Cold-Vapor Atomic Fluorescence Spectrometric Method <sup>(1,6,30)</sup> 3) Digestion, Cold-Vapor Atomic Absorption Spectrometric Method <sup>(20)</sup> 4) Digestion, Cold-Vapor Atomic Fluorescence Spectrometric Method <sup>(30)</sup> 5) Thermal Decomposition Amalgamation and Atomic Absorption Spectrometric Method <sup>(21)</sup>
23	Methoxychlor	1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(9,28)</sup> 2) Soxhlet Extraction, Gas Chromatographic / Mass Spectrometric Method <sup>(9,28)</sup> 3) Automated Soxhlet Extraction, Gas Chromatographic / Mass Spectrometric Method <sup>(1,26)</sup>
24	Mirex	1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(9,28)</sup> 2) Soxhlet Extraction, Gas Chromatographic / Mass Spectrometric Method <sup>(9,28)</sup> 3) Automated Soxhlet Extraction, Gas Chromatographic / Mass Spectrometric Method <sup>(1,26)</sup>
25	Molybdenum	1) Waste Extraction, Digestion, Inductively Coupled Plasma Method <sup>(1,4,14)</sup> 2) Waste Extraction, Digestion, Inductively Coupled Plasma/Mass Spectrometric Method <sup>(1,4,17)</sup> 3) Digestion, Inductively Coupled Plasma Method <sup>(7,14)</sup> 4) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method <sup>(7,17)</sup>
26	Nickel	1) Waste Extraction, Digestion, Inductively Coupled Plasma Method <sup>(1,4,14)</sup> 2) Waste Extraction, Digestion, Inductively Coupled Plasma/Mass Spectrometric Method <sup>(1,4,17)</sup> 3) Digestion, Inductively Coupled Plasma Method <sup>(7,14)</sup> 4) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method <sup>(7,17)</sup>
27	Polychlorinated biphenyls (PCBs) - Aroclor 1016 - Aroclor 1221 - Aroclor 1232 - Aroclor 1242 - Aroclor 1248 - Aroclor 1254 - Aroclor 1260	1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(1,9,24)</sup> 2) Soxhlet Extraction, Gas Chromatographic Method <sup>(10,29)</sup> 3) Automated Soxhlet Extraction, Gas Chromatographic Method <sup>(1,26)</sup>

- 2-ChlorobiphenylL...



ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
28	- 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',5,5',6-Nonachlorobiphenyl Pentachlorophenol	1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(1,9,24)</sup> 2) Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(10,26)</sup> 3) Automated Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(11,26)</sup> Electrometric Method <sup>(25,25)</sup> 4) Digestion, Inductively Coupled Plasma Method <sup>(1,6,16)</sup> 5) Waste Extraction, Digestion, Inductively Coupled Plasma/Mass Spectrometric Method <sup>(1,6,17)</sup> 6) Digestion, Inductively Coupled Plasma Method <sup>(7,16)</sup> 7) Digestion, Inductively Coupled Plasma/Mass Spectrometric Method <sup>(7,17)</sup>
29	pH	
30	Selenium	1) Waste Extraction, Digestion, Inductively Coupled Plasma Method <sup>(1,6,16)</sup> 2) Waste Extraction, Digestion, Inductively Coupled Plasma/Mass Spectrometric Method <sup>(1,6,17)</sup> 3) Digestion, Inductively Coupled Plasma Method <sup>(7,16)</sup> 4) Digestion, Inductively Coupled Plasma/Mass Spectrometric Method <sup>(7,17)</sup>

31 Silver...

ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
31	Silver	1) Waste Extraction, Digestion, Inductively Coupled Plasma Method <sup>(1,6,16)</sup> 2) Waste Extraction, Digestion, Inductively Coupled Plasma/Mass Spectrometric Method <sup>(1,6,17)</sup> 3) Digestion, Inductively Coupled Plasma Method <sup>(7,16)</sup> 4) Digestion, Inductively Coupled Plasma/Mass Spectrometric Method <sup>(7,17)</sup>
32	Thallium	1) Waste Extraction, Digestion, Inductively Coupled Plasma Method <sup>(1,6,16)</sup> 2) Waste Extraction, Digestion, Inductively Coupled Plasma/Mass Spectrometric Method <sup>(1,6,17)</sup> 3) Digestion, Inductively Coupled Plasma Method <sup>(7,16)</sup> 4) Digestion, Inductively Coupled Plasma/Mass Spectrometric Method <sup>(7,17)</sup>
33	Toxaphene	1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(1,9,24)</sup> 2) Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(10,26)</sup> 3) Automated Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(11,26)</sup>
34	Vanadium	1) Waste Extraction, Digestion, Inductively Coupled Plasma Method <sup>(1,6,16)</sup> 2) Waste Extraction, Digestion, Inductively Coupled Plasma/Mass Spectrometric Method <sup>(1,6,17)</sup> 3) Digestion, Inductively Coupled Plasma Method <sup>(7,16)</sup> 4) Digestion, Inductively Coupled Plasma/Mass Spectrometric Method <sup>(7,17)</sup>
35	Zinc	1) Waste Extraction, Digestion, Inductively Coupled Plasma Method <sup>(1,6,16)</sup> 2) Waste Extraction, Digestion, Inductively Coupled Plasma/Mass Spectrometric Method <sup>(1,6,17)</sup> 3) Digestion, Inductively Coupled Plasma Method <sup>(7,16)</sup> 4) Digestion, Inductively Coupled Plasma/Mass Spectrometric Method <sup>(7,17)</sup>

31...

สืบ จำนวน 125 รายการ

ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
1	Acenaphthene	1) Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(10,26)</sup> 2) Automated Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(11,26)</sup>
2	Acetone	1) Purge and Trap, Gas Chromatographic/Mass Spectrometric Method <sup>(15,25)</sup> 2) Equilibrium Headspace, Gas Chromatographic/Mass Spectrometric Method <sup>(13,23)</sup>
3	Aldrin	1) Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(10,26)</sup> 2) Automated Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(11,26)</sup>
4	Anthracene	1) Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(10,26)</sup> 2) Automated Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(11,26)</sup>
5	Antimony	1) Digestion, Inductively Coupled Plasma Method <sup>(7,16)</sup> 2) Digestion, Inductively Coupled Plasma/Mass Spectrometric Method <sup>(7,17)</sup>
6	Arsenic	1) Digestion, Inductively Coupled Plasma Method <sup>(7,16)</sup> 2) Digestion, Inductively Coupled Plasma/Mass Spectrometric Method <sup>(7,17)</sup>
7	Atrazine	1) Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(10,26)</sup> 2) Automated Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(11,26)</sup>
8	Barium	1) Digestion, Inductively Coupled Plasma Method <sup>(7,16)</sup> 2) Digestion, Inductively Coupled Plasma/Mass Spectrometric Method <sup>(7,17)</sup>
9	Benz(a)anthracene	1) Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(10,26)</sup> 2) Automated Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(11,26)</sup>
10	Benzene	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method <sup>(15,25)</sup>

11 Benzol(b)fluoranthene

ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
11	Benzol(b)fluoranthene	1) Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(10,26)</sup> 2) Automated Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(11,26)</sup>
12	Benzol(k)fluoranthene	1) Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(10,26)</sup> 2) Automated Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(11,26)</sup>
13	Benzoic acid	1) Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(10,26)</sup> 2) Automated Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(11,26)</sup>
14	Benzol(a)pyrene	1) Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(10,26)</sup> 2) Automated Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(11,26)</sup>
15	Benzol(g,h)perylene	1) Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(10,26)</sup> 2) Automated Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(11,26)</sup>
16	Beryllium	1) Digestion, Inductively Coupled Plasma Method <sup>(7,16)</sup> 2) Digestion, Inductively Coupled Plasma/Mass Spectrometric Method <sup>(7,17)</sup>
17	Bis(2-chloroethyl)ether	1) Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(10,26)</sup> 2) Automated Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(11,26)</sup>
18	Bis(2-ethylhexyl)phthalate	1) Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(10,26)</sup> 2) Automated Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(11,26)</sup>
19	Bromodichloromethane	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method <sup>(15,25)</sup>
20	Bromoform	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method <sup>(15,25)</sup>
21	Butanol	Equilibrium Headspace, Gas Chromatographic/Mass Spectrometric Method <sup>(13,23)</sup>
22	Butyl Benzyl Phthalate	1) Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(10,26)</sup> 2) Automated Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(11,26)</sup>

23 Cadmium...



ลำดับที่	สารเคมี	วิธีวิเคราะห์
23	Cadmium	1) Digestion, Inductively Coupled Plasma Method <sup>(7,14)</sup> 2) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method <sup>(7,17)</sup>
24	Carbazole	1) Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(10,26)</sup> 2) Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(11,26)</sup>
25	Carbon Disulfide	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(15,23)</sup>
26	Carbon tetrachloride	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(15,23)</sup>
27	Chlordane	1) Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(10,26)</sup> 2) Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(11,26)</sup>
28	p-Chloroaniline	1) Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(10,26)</sup> 2) Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(11,26)</sup>
29	Chlorobenzene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(15,23)</sup>
30	Chlorodibromomethane	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(15,23)</sup>
31	Chloroform	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(15,23)</sup>
32	2-Chlorophenol	1) Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(10,26)</sup> 2) Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(11,26)</sup>
33	Chromium	1) Digestion, Inductively Coupled Plasma Method <sup>(7,14)</sup> 2) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method <sup>(7,17)</sup>
34	Chromium (III)	1) Digestion, Inductively Coupled Plasma Method; Alkaline Digestion, Colorimetric Method; Calculation Method <sup>(7,8,16,19)</sup> 2) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method; Alkaline Digestion, Colorimetric Method; Calculation Method <sup>(7,8,17,19)</sup>
35	Chromium (VI)	Alkaline Digestion, Colorimetric Method <sup>(8,19)</sup>

36 Chrysene...

ลำดับที่	สารเคมี	วิธีวิเคราะห์
36	Chrysene	1) Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(10,26)</sup> 2) Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(11,26)</sup>
37	Cyanide	Extraction, Distillation, Colorimetric Method <sup>(27,28,29)</sup>
38	2,4-D	1) Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(10,26)</sup> 2) Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(11,26)</sup>
39	DDD	1) Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(10,26)</sup> 2) Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(11,26)</sup>
40	DDE	1) Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(10,26)</sup> 2) Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(11,26)</sup>
41	DDT	1) Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(10,26)</sup> 2) Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(11,26)</sup>
42	Dibenz(a,h)anthracene	1) Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(10,26)</sup> 2) Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(11,26)</sup>
43	Di-n-Butyl Phthalate	1) Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(10,26)</sup> 2) Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(11,26)</sup>
44	1,2-Dichlorobenzene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(15,23)</sup>
45	1,3-Dichlorobenzene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(15,23)</sup>
46	1,4-Dichlorobenzene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(15,23)</sup>
47	3,3-Dichlorobenzidine	1) Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(10,26)</sup> 2) Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(11,26)</sup>
48	1,1-Dichloroethane	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(15,23)</sup>

49 1,2-Dichloroethane...

ลำดับที่	สารเคมี	วิธีวิเคราะห์
49	1,2-Dichloroethane	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(15,23)</sup>
50	1,1-Dichloroethylene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(15,23)</sup>
51	cis-1,2-Dichloroethylene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(15,23)</sup>
52	trans-1,2-Dichloroethylene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(15,23)</sup>
53	2,4-Dichlorophenol	1) Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(10,26)</sup> 2) Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(11,26)</sup>
54	1,2-Dichloropropane	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(15,23)</sup>
55	1,3-Dichloropropane	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(15,23)</sup>
56	1,3-Dichloropropene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(15,23)</sup>
57	Dieldrin	1) Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(10,26)</sup> 2) Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(11,26)</sup>
58	Diethyl Phthalate	1) Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(10,26)</sup> 2) Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(11,26)</sup>
59	2,4-Dimethylphenol	1) Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(10,26)</sup> 2) Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(11,26)</sup>
60	2,4-Dinitrophenol	1) Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(10,26)</sup> 2) Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(11,26)</sup>
61	2,4-Dinitrotoluene	1) Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(10,26)</sup> 2) Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(11,26)</sup>
62	2,6-Dinitrotoluene	1) Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(10,26)</sup> 2) Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(11,26)</sup>

63 Di-n-Octyl Phthalate...

ลำดับที่	สารเคมี	วิธีวิเคราะห์
63	Di-n-Octyl Phthalate	1) Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(10,26)</sup> 2) Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(11,26)</sup>
64	Endosulfan	1) Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(10,26)</sup> 2) Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(11,26)</sup>
65	Endrin	1) Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(10,26)</sup> 2) Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(11,26)</sup>
66	Ethylbenzene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(15,23)</sup>
67	Fluoranthene	1) Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(10,26)</sup> 2) Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(11,26)</sup>
68	Fluorene	1) Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(10,26)</sup> 2) Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(11,26)</sup>
69	Heptachlor	1) Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(10,26)</sup> 2) Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(11,26)</sup>
70	Heptachlor epoxide	1) Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(10,26)</sup> 2) Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(11,26)</sup>
71	Hexachlorobenzene	1) Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(10,26)</sup> 2) Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(11,26)</sup>
72	Hexachloro-1,3-butadiene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(15,23)</sup>
73	n-Hexane	1) Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(15,23)</sup> 2) Equilibrium Headspace, Gas Chromatographic/ Mass Spectrometric Method <sup>(13)</sup>

73 n-Hexane...



ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
74	$\alpha$ -HCH	1) Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(10,26)</sup> 2) Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(11,26)</sup>
75	$\beta$ -HCH	1) Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(10,26)</sup> 2) Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(11,26)</sup>
76	$\gamma$ -HCH	1) Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(10,26)</sup> 2) Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(11,26)</sup>
77	Hexachlorocyclopentadiene	1) Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(10,26)</sup> 2) Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(11,26)</sup>
78	Hexachloroethane	1) Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(10,26)</sup> 2) Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(11,26)</sup>
79	Indeno(1,2,3-cd)pyrene	1) Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(10,26)</sup> 2) Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(11,26)</sup>
80	Isophorone	1) Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(10,26)</sup> 2) Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(11,26)</sup>
81	Lead	1) Digestion, Inductively Coupled Plasma Method <sup>(7,16)</sup> 2) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method <sup>(7,17)</sup>
82	Manganese	1) Digestion, Inductively Coupled Plasma Method <sup>(7,16)</sup> 2) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method <sup>(7,17)</sup>
83	Mercury	1) Digestion, Cold-Vapor Atomic Absorption Spectrometric Method <sup>(20)</sup> 2) Thermal Decomposition, Amalgamation, and Atomic Absorption Spectrophotometry <sup>(21)</sup> 3) Digestion, Cold-Vapor Atomic Fluorescence Spectrometric Method <sup>(20)</sup>

85 Methanol...

ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
84	Methanol	1) Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(11,23)</sup> 2) Equilibrium Headspace, Gas Chromatographic/ Mass Spectrometric Method <sup>(11,23)</sup>
85	Methoxychlor	1) Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(10,26)</sup> 2) Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(11,26)</sup>
86	Methyl Bromide	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(11,23)</sup>
87	Methylene Chloride	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(11,23)</sup>
88	2-methylphenol	1) Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(10,26)</sup> 2) Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(11,26)</sup>
89	2-Methylnaphthalene	1) Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(10,26)</sup> 2) Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(11,26)</sup>
90	Methyl tert-Butyl Ether	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(11,23)</sup>
91	Naphthalene	1) Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(10,26)</sup> 2) Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(11,26)</sup>
92	Nickel	1) Digestion, Inductively Coupled Plasma Method <sup>(7,16)</sup> 2) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method <sup>(7,17)</sup>
93	Nitrobenzene	1) Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(10,26)</sup> 2) Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(11,26)</sup>
94	N-Nitrosodiphenylamine	1) Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(10,26)</sup> 2) Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(11,26)</sup>
95	N-Nitrosodi-n-propylamine	1) Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(10,26)</sup> 2) Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(11,26)</sup>

96 Polychlorinated biphenyls (PCBs)

ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
96	Polychlorinated biphenyls (PCBs) - Aroclor 1016 - Aroclor 1221 - Aroclor 1232 - Aroclor 1242 - Aroclor 1248 - Aroclor 1254 - Aroclor 1260 - 2-Chlorobiphenyl - 2,2',3,5'-Tetrachlorobiphenyl - 2,2',5,5'-Tetrachlorobiphenyl - 2,3',4,4'-Tetrachlorobiphenyl - 2,2',3,4,5'-Pentachlorobiphenyl - 2,2',4,5,5'-Pentachlorobiphenyl - 2,3,3',4,6-Pentachlorobiphenyl - 2,2',3,4,4',5'-Hexachlorobiphenyl - 2,2',3,4,5,5'-Hexachlorobiphenyl - 2,2',3,5,5',6'-Hexachlorobiphenyl - 2,2',4,4',5,5'-Hexachlorobiphenyl - 2,2',3,3',4,4',5'-Heptachlorobiphenyl - 2,2',3,4,4',5,5'-Heptachlorobiphenyl - 2,2',3,4',5,5',6'-Heptachlorobiphenyl - 2,2',3,3',4,4',5,5',6'-Nonachlorobiphenyl	1) Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(10,26)</sup> 2) Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(11,26)</sup>
97	Pentachlorophenol	1) Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(10,26)</sup> 2) Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(11,26)</sup>
98	Phenanthrene	1) Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(10,26)</sup> 2) Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(11,26)</sup>

99 Phenol...

ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
99	Phenol	1) Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(10,26)</sup> 2) Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(11,26)</sup>
100	Pyrene	1) Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(10,26)</sup> 2) Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(11,26)</sup>
101	Selenium	1) Digestion, Inductively Coupled Plasma Method <sup>(7,16)</sup> 2) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method <sup>(7,17)</sup>
102	Silver	1) Digestion, Inductively Coupled Plasma Method <sup>(7,16)</sup> 2) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method <sup>(7,17)</sup>
103	Styrene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(11,23)</sup>
104	1,1,2,2-Tetrachloroethane	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(11,23)</sup>
105	Tetrachloroethylene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(11,23)</sup>
106	Toluene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(11,23)</sup>
107	Toxaphene	1) Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(10,26)</sup> 2) Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(11,26)</sup>
108	TPH (C <sub>5</sub> -C <sub>8</sub> )	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(11,23)</sup>
109	TPH (C <sub>8</sub> -C <sub>15</sub> )	1) Automate Extraction, Gas Chromatographic Method <sup>(11,22)</sup> 2) Solvent Extraction, Gas Chromatographic Method <sup>(12,22)</sup> 3) Ultrasonic Extraction, Gas Chromatographic Method <sup>(22,3)</sup>
110	TPH (C <sub>15</sub> -C <sub>35</sub> )	1) Automate Extraction, Gas Chromatographic Method <sup>(11,22)</sup> 2) Solvent Extraction, Gas Chromatographic Method <sup>(12,22)</sup> 3) Ultrasonic Extraction, Gas Chromatographic Method <sup>(22,3)</sup>
111	1,2,4-Trichlorobenzene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(11,23)</sup>
112	1,1,1-Trichloroethane	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(11,23)</sup>
113	1,1,2-Trichloroethane	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(11,23)</sup>
114	Trichloroethylene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(11,23)</sup>

115 2,4,5-Trichlorophenol...



ลำดับที่	สารเคมี	วิธีการตรวจ
115	2,4,5-Trichlorophenol	1) Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(16,20)</sup> 2) Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(11,20)</sup>
116	2,4,6-Trichlorophenol	1) Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(10,20)</sup> 2) Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(11,24)</sup>
117	1,3,5-Trimethylbenzene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(15,23)</sup>
118	Vanadium	1) Digestion, Inductively Coupled Plasma Method <sup>(7,88)</sup> 2) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method <sup>(7,17)</sup>
119	Vinyl Acetate	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(15,23)</sup>
120	Vinyl Chloride	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(15,23)</sup>
121	m-Xylene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(15,23)</sup>
122	o-Xylene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(15,23)</sup>
123	p-Xylene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(15,23)</sup>
124	Xylene (Total)	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(15,23)</sup>
125	Zinc	1) Digestion, Inductively Coupled Plasma Method <sup>(7,14)</sup> 2) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method <sup>(7,17)</sup>

## เอกสารอ้างอิง

1. กระทรวงอุตสาหกรรม, ประกาศกระทรวงอุตสาหกรรม, พ.ศ. 2566 เรื่อง การจัดการสิ่งปฏิกูลหรือวัสดุที่ไม่ได้ใช้, ราชกิจจานุเบกษา, 31 ตุลาคม 2566, เล่มที่ 140 ตอนพิเศษ 126 ง.
2. กระทรวงสาธารณสุข, ประกาศกระทรวงสาธารณสุข, พ.ศ. 2549 เรื่อง กำหนดค่าปริมาณค่าปนเปื้อนที่เจือปนในอากาศที่ระบายนอกจากปล่องของหม้อไอน์โรงใช้ฟิวส์ที่ผลิตเป็นเชื้อเพลิง, ราชกิจจานุเบกษา, 4 ธันวาคม 2549, เล่มที่ 123 ตอนพิเศษ 125.
3. สมาคมการวิเคราะห์สิ่งแวดล้อมแห่งประเทศไทย, คู่มือวิเคราะห์น้ำเสีย, พิมพ์ครั้งที่ 4, กรุงเทพฯ: เรือนแก้วการพิมพ์, 2547.
4. APHA, AWWA, WEF. Standard Methods for the Examination of Water and Wastewater, 24<sup>th</sup> ed. Washington, DC: APHA, 2023.

5. United States..

5. United States Environmental Protection Agency. *Standards of Performance for New Stationary Sources*. 40 CFR 60, Appendix A, 2023.
6. United States Environmental Protection Agency. *Test Methods for Evaluating Solid Waste Physical/Chemical Methods*. SW-846, 2014.
7. United States Environmental Protection Agency. *Test Methods for Evaluating 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 Evaluating Solid Waste Physical/Chemical Methods. Alkaline Digestion for Hexavalent Chromium*. SW-846 Method 3060A, 1996.
9. United States Environmental Protection Agency. *Test Methods for Evaluating Solid Waste Physical/Chemical Methods. Separatory Funnel Liquid-Liquid Extraction*. SW-846 Method 3510C, 1996.
10. United States Environmental Protection Agency. *Test Methods for Evaluating Solid Waste Physical/Chemical Methods. Soxhlet Extraction*. SW-846 Method 3540C, 1996.
11. United States Environmental Protection Agency. *Test Methods for Evaluating Solid Waste Physical/Chemical Methods. Automated Soxhlet Extraction*. SW-846 Method 3541, 1994.
12. United States Environmental Protection Agency. *Test Methods for Evaluating Solid Waste Physical/Chemical Methods. Microscale Solvent Extraction (MSE)*. SW-846 Method 3570, 2002.
13. United States Environmental Protection Agency. *Test Methods for Evaluating Solid Waste Physical/Chemical Methods. Volatile Organic Compounds (VOCs) in Various Sample Matrices Using Equilibrium Headspace Analysis*. SW-846 Method 5021A, 2014.
14. United States Environmental Protection Agency. *Test Methods for Evaluating Solid Waste Physical/Chemical Methods. Purge-and-Trap for Aqueous Samples*. SW-846 Method 5030B, 1996.
15. United States Environmental Protection Agency. *Test Methods for Evaluating 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.
16. United States Environmental Protection Agency. *Test Methods for Evaluating Solid Waste Physical/Chemical Methods. Inductively Coupled Plasma-Atomic Emission Spectrometry*. SW-846 Method 6010B, 1996.
17. United States Environmental Protection Agency. *Test Methods for Evaluating Solid Waste Physical/Chemical Methods. Inductively Coupled Plasma-Mass Spectrometry*. SW-846 Method 6020A, 2007.
18. United States Environmental Protection Agency. *Test Methods for Evaluating Solid Waste Physical/Chemical Methods. Antimony and Arsenic (Atomic Absorption, Borohydride Reduction)*. SW-846 Method 7062, 1994.
19. United States Environmental Protection Agency. *Test Methods for Evaluating Solid Waste Physical/Chemical Methods. Chromium, Hexavalent (Colorimetric)*. SW-846 Method 7195A, 1992.

20. United States...

20, United States.

20. United States Environmental Protection Agency. Test Methods for Evaluating Solid Waste Physical/Chemical Methods. Mercury in Solid or Semisolid Waste (Manual Cold-Vapor Technique). SW-846 Method 7471B, 2007.
21. United States Environmental Protection Agency. Test Methods for Evaluating Solid Waste Physical/Chemical Methods. Mercury in Solids and Solutions by Thermal Decomposition, Annalargation, and Atomic Absorption Spectrophotometry. SW-846 Method 7473, 2007.
22. United States Environmental Protection Agency. Test Methods for Evaluating Solid Waste Physical/Chemical Methods. Nonhalogenated Organics by Gas Chromatography. SW-846 Method 8015C, 2007.
23. United States Environmental Protection Agency. Test Methods for Evaluating Solid Waste Physical/Chemical Methods. pH Electrometric Measurement. SW-846 Method 9040C, 2004.
24. United States Environmental Protection Agency. Test Methods for Evaluating Solid Waste Physical/Chemical Methods. Soil and Waste pH. SW-846 Method 9045D, 2004.
25. United States Environmental Protection Agency. Test Methods for Evaluating Solid Waste Physical/Chemical Methods. Volatile Organic Compounds by Gas Chromatography/Mass Spectrometry (GC/MS). SW-846 Method 8260D, 2018.
26. United States Environmental Protection Agency. Test Methods for Evaluating Solid Waste Physical/Chemical Methods. Semivolatile Organic Compounds by Gas Chromatography/Mass Spectrometry (GC/MS). SW-846 Method 8270E, 2018.
27. United States Environmental Protection Agency. Test Methods for Evaluating Solid Waste Physical/Chemical Methods. Total and Amenable Cyanide: Distillation SW-846 Method 9010B, 1996.
28. United States Environmental Protection Agency. Test Methods for Evaluating Solid Waste Physical/Chemical Methods. Cyanide Extraction Procedure for Solids and Oil. SW-846 Method 9013A, 1996.
29. United States Environmental Protection Agency. Test Methods for Evaluating Solid Waste Physical/Chemical Methods. Cyanide in Waters and Extracts Using Titrimetric and Manual Spectrophotometric Procedures. SW-846 Method 9014, 2014.
30. United States Environmental Protection Agency. Test Methods for Evaluating Solid Waste Physical/Chemical Methods. Mercury in Sediment and Tissue Samples by Atomic Fluorescence Spectrometry. SW-846 Method 7474, 2007.
31. United States Environmental Protection Agency. Test Methods for Evaluating Solid Waste Physical/Chemical Methods. Ultrasonic Extraction. SW-846 Method 3550C, 2007.

7. signed



ମି. ପ୍ର. ଗଣକ(କ)/ ୧୧୭୯

กรมโรงงานอุตสาหกรรม  
ถนนพระรามที่ ๖ แขวงทุ่งพญาไท  
เขตราชเทวี กรุงเทพฯ ๑๐๔๐๐

២៥ មេសា ២៥៦៧

เรื่อง เปลี่ยนแปลงบุคลากรของห้องปฏิบัติการวิเคราะห์

เรียน กรรมการผู้จัดการ บริษัท เอแอลเอส แลบบอราทอรี กรุป (ประเทศไทย) จำกัด

อ้างถึง คำขอขึ้นทะเบียน/ต่ออายุ/เปลี่ยนแปลงบุคลากร และชนิดสารมลพิษของห้องปฏิบัติการวิเคราะห์เอกชน  
ลงวันที่ ๒๕ มีนาคม ๒๕๖๗

ความท้าทายที่อ้างถึง บริษัท แอแอลเอส แล็บอราทอรี กรุ๊ป (ประเทศไทย) จำกัด หวังปฏิบัติการ  
วิเคราะห์เอกชน เลขทะเบียน ๖-๒๐๐๔ สังกัดที่ตั้งเลขที่ ๑๐๔ ซอยพัฒนาการ ๔๐ ถนนพัฒนาการ แขวงพัฒนาการ  
เขตสวนหลวง กรุงเทพมหานคร ขอเปลี่ยนแปลงบุคลากร ความละเอียดแจ้งแล้ว นั้น

กรมโรงงานอุตสาหกรรมพิจารณาแล้ว มีความเห็นดังนี้

- |   |                            |
|---|----------------------------|
| ๓. ให้ยกเลิกเจ้าหน้าที่ประจำห้องปฏิบัติการวิเคราะห์ จำนวน ๓ ราย   |                            |
| ๑) นางสาวพรรณิศา หุ่นงั้น   | ทะเบียนเลขที่ ๖-๒๐๔-๖-๐๐๖๕ |
| ๒) นายก๊อซ สุธะระ   | ทะเบียนเลขที่ ๖-๒๐๔-๖-๐๑๒๑ |
| ๓) นางสาวศุภรดา ปิ่นมธุรา   | ทะเบียนเลขที่ ๖-๒๐๔-๖-๐๑๓๘ |
| ๔. ให้เพิ่มเจ้าหน้าที่ห้องปฏิบัติการวิเคราะห์เภสัชกร จำนวน ๑๒ ราย |                            |
| ๑) นางสาวฐิติตา กลิ่นเขียว  | ทะเบียนเลขที่ ๖-๒๐๔-๖-๐๑๑๒ |
| ๒) นางสาวกาญจน์ภัทรา สายคำ  | ทะเบียนเลขที่ ๖-๒๐๔-๖-๐๑๔๗ |
| ๓) นางสาวณัฏฐิณี กัทธวงค์   | ทะเบียนเลขที่ ๖-๒๐๔-๖-๐๑๔๔ |
| ๔) นายธนากร วาจาเคน   | ทะเบียนเลขที่ ๖-๒๐๔-๖-๐๑๔๕ |
| ๕) นายฤทธพล ปัญญาวงศ์   | ทะเบียนเลขที่ ๖-๒๐๔-๖-๐๑๔๖ |
| ๖) นายสมชาย หารธา   | ทะเบียนเลขที่ ๖-๒๐๔-๖-๐๑๔๗ |
| ๗) นายวิจิตร ฝั่งสาสมาน   | ทะเบียนเลขที่ ๖-๒๐๔-๖-๐๑๔๘ |
| ๘) นายณัฐพงศ์ โสภา  | ทะเบียนเลขที่ ๖-๒๐๔-๖-๐๑๔๙ |
| ๙) นายกัณธิรณ ปานเพ็ง   | ทะเบียนเลขที่ ๖-๒๐๔-๖-๐๑๕๐ |
| ๑๐) นายณัฐพล ชุ่มเงิน   | ทะเบียนเลขที่ ๖-๒๐๔-๖-๐๑๕๑ |
| ๑๑) นายธนา สุพานันธุ์   | ทะเบียนเลขที่ ๖-๒๐๔-๖-๐๑๕๒ |
| ๑๒) นายวรากร แก้วพวงษา  | ทะเบียนเลขที่ ๖-๒๐๔-๖-๐๑๕๓ |

อนึ่ง หนังสือฉบับนี้



อนึ่ง หนังสือฉบับนี้จะหมดอายุพร้อมหนังสือต่ออายุรับขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์เอกชน  
ในวันที่ ๒ กันยายน ๒๕๖๔

จึงเรียนมาเพื่อทราบ

ขอแสดงความนับถือ



กองวิจัยและเตือนภัยมลพิษโรงงาน  
กลุ่มมาตรฐานวิธีการวิเคราะห์ทดสอบมลพิษและทะเบียนห้องปฏิบัติการ  
โทร. ๐ ๒๕๓๐ ๖๓๑๒ ต่อ ๒๑๐๓-๕  
โทรสาร ๐ ๒๕๓๐ ๖๓๑๒ ต่อ ๒๑๐๔๔  
ไปรษณีย์อิเล็กทรอนิกส์ sarabang@div.mail.go.th



"อุตสาหกรรมก้าวไกล ประเทศไทยก้าวหน้า ร่วมกันพัฒนา อุตสาหกรรมสีเขียว"



ที่ ๑๓ ๐๓๑๐(๑)/ ๑๒๓๖ ๘

กรมโรงงานอุตสาหกรรม  
ถนนพระรามที่ ๖ แขวงทุ่งพญาไท  
เขตราชเทวี กรุงเทพฯ ๑๐๔๐๐

๑๔ ธันวาคม ๒๕๖๓

เรื่อง ยกเลิกบุคลากรของห้องปฏิบัติการวิเคราะห์

เรียน กรรมการผู้จัดการ บริษัท เอแอลเอส แลบบอราทอรี กรุ๊ป (ประเทศไทย) จำกัด

อ้างถึง คำขอขึ้นทะเบียน/ต่ออายุ/เปลี่ยนแปลงบุคลากร และชนิดสารมลพิษของห้องปฏิบัติการวิเคราะห์เอกชน  
ลงวันที่ ๒ ธันวาคม ๒๕๖๓

ตามคำขอที่ยังถึง บริษัท เอแอลเอส แลบบอราทอรี กรุ๊ป (ประเทศไทย) จำกัด ห้องปฏิบัติการ  
วิเคราะห์เอกชน เลขทะเบียน ๖-๒๐๔ สถานที่ตั้งเลขที่ ๑๐๔ ซอยพัฒนาการ ๕๐ ถนนพัฒนาการ แขวงพัฒนาการ  
เขตสวนหลวง กรุงเทพมหานคร ขอยกเลิกบุคลากร ความละเอียดแจ้งแล้ว นั้น

กรมโรงงานอุตสาหกรรมพิจารณาแล้ว ให้ออกเลิกเจ้าหน้าที่ประจำห้องปฏิบัติการวิเคราะห์  
จำนวน ๘ ราย ได้แก่

๑) นายประจักษ์ วรรณชัชชัย	ทะเบียนเลขที่ ๖-๒๐๔-จ-๐๐๖๐
๒) นายจิรณัฐ ขาวละออ	ทะเบียนเลขที่ ๖-๒๐๔-จ-๐๐๗๒
๓) นายพีรพัฒน์ คำคำ	ทะเบียนเลขที่ ๖-๒๐๔-จ-๐๑๐๘
๔) นางสาวอรุณ คำคณัง	ทะเบียนเลขที่ ๖-๒๐๔-จ-๐๑๓๔
๕) นายกิตติพงศ์ แซ่ลี	ทะเบียนเลขที่ ๖-๒๐๔-จ-๐๑๔๔
๖) นายจิรเมธ ประเสริฐศิริพงศ์	ทะเบียนเลขที่ ๖-๒๐๔-จ-๐๑๖๐
๗) นายภัทรพงษ์ มนศาหาทอง	ทะเบียนเลขที่ ๖-๒๐๔-จ-๐๑๖๗
๘) นางสาวจางวรรณ กระจำพันธุ์	ทะเบียนเลขที่ ๖-๒๐๔-จ-๐๑๘๑

จึงเรียนมาเพื่อทราบ

ขอแสดงความนับถือ

(นายธีรวัฒน์ อิศรางกูร ณ อยุธยา)  
รองอธิบดี ปฏิบัติราชการแทน  
อธิบดีกรมโรงงานอุตสาหกรรม

กองวิจัยและเตือนภัยมลพิษโรงงาน

กลุ่มมาตรฐานวิธีการวิเคราะห์ทดสอบมลพิษและทะเบียนห้องปฏิบัติการ

โทร. ๐ ๒๕๓๐ ๖๓๑๒ ต่อ ๒๑๐๓-๕

โทรสาร ๐ ๒๕๓๐ ๖๓๑๒ ต่อ ๒๑๐๔๔

ไปรษณีย์อิเล็กทรอนิกส์ sarabang@div.mail.go.th



"อุตสาหกรรมก้าวไกล ประเทศไทยก้าวหน้า ร่วมกันพัฒนา อุตสาหกรรมสีเขียว"



ที่ ๑๓ ๐๓๑๐/ ๑๔๓๘

กรมโรงงานอุตสาหกรรม  
ถนนพระรามที่ ๖ แขวงทุ่งพญาไท  
เขตราชเทวี กรุงเทพฯ ๑๐๔๐๐

๑๔ สิงหาคม ๒๕๖๓

เรื่อง ต่ออายุหนังสือรับขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์เอกชน

เรียน กรรมการผู้จัดการ บริษัท เอแอลเอส แลบบอราทอรี กรุ๊ป (ประเทศไทย) จำกัด

อ้างถึง คำขอขึ้นทะเบียน/ต่ออายุ/เปลี่ยนแปลงบุคลากร และชนิดสารมลพิษของห้องปฏิบัติการวิเคราะห์  
เอกชน ลงวันที่ ๒๗ พฤษภาคม ๒๕๖๓

สิ่งที่ส่งมาด้วย เอกสารแนบท้ายหนังสือต่ออายุรับขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์เอกชน  
บริษัท เอแอลเอส แลบบอราทอรี กรุ๊ป (ประเทศไทย) จำกัด จำนวน ๓ แผ่น

ตามคำขอที่ยังถึง บริษัท เอแอลเอส แลบบอราทอรี กรุ๊ป (ประเทศไทย) จำกัด ขอต่ออายุ  
หนังสือรับขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์เอกชน เลขทะเบียน ๖-๓๒๓ สถานที่ตั้งเลขที่ ๒๑๖/๓๐ หมู่ที่ ๕  
ตำบลแม่ไม้คู่ อำเภอบลวกแฉะ จังหวัดระยอง ต่อกรมโรงงานอุตสาหกรรม นั้น

กรมโรงงานอุตสาหกรรมพิจารณาแล้ว ให้ออกให้บริษัท เอแอลเอส แลบบอราทอรี กรุ๊ป (ประเทศไทย)  
จำกัด ต่ออายุหนังสือรับขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์เอกชน โดยมีองค์ประกอบดังนี้

ก. ผู้ควบคุมห้องปฏิบัติการวิเคราะห์เอกชน

๑) นายเดช ช้างชน	ทะเบียนเลขที่ ๖-๓๒๓-ท-๐๐๐๑
๒) นางวิลาวัลย์ บริรักษ์	ทะเบียนเลขที่ ๖-๓๒๓-ท-๐๐๐๒
๓) นายสุพจน์ สดามเตือ	ทะเบียนเลขที่ ๖-๓๒๓-ท-๐๐๐๓

ข. เจ้าหน้าที่ห้องปฏิบัติการวิเคราะห์เอกชน

๑) นายณัฐพงษ์ เพ็ญชวนา	ทะเบียนเลขที่ ๖-๓๒๓-จ-๐๐๐๑
๒) นางสาวกัญจพรพรคน รักดี	ทะเบียนเลขที่ ๖-๓๒๓-จ-๐๐๐๒
๓) นางสาวจุฑาทิพย์ สัตทองหลาง	ทะเบียนเลขที่ ๖-๓๒๓-จ-๐๐๐๓
๔) นางสาวจิตติภา พรเรืองสุข	ทะเบียนเลขที่ ๖-๓๒๓-จ-๐๐๐๔
๕) นายสรวิชัย คุ้มกุลสุข	ทะเบียนเลขที่ ๖-๓๒๓-จ-๐๐๐๕
๖) นายณัฐพล ออมพรวรรณ	ทะเบียนเลขที่ ๖-๓๒๓-จ-๐๐๐๖
๗) นายจิตรกร สีวันสา	ทะเบียนเลขที่ ๖-๓๒๓-จ-๐๐๐๗
๘) นายสิทธิพรชัย สุวรรณรัตน์	ทะเบียนเลขที่ ๖-๓๒๓-จ-๐๐๐๘
๙) นายสิทธิพันธ์ แสนาชิว	ทะเบียนเลขที่ ๖-๓๒๓-จ-๐๐๐๙
๑๐) นายอนุรัตน์ เฒ่า	ทะเบียนเลขที่ ๖-๓๒๓-จ-๐๐๑๐
๑๑) นายสุวิทย์ นวาทพงษ์	ทะเบียนเลขที่ ๖-๓๒๓-จ-๐๐๑๑
๑๒) นายณัฐพล เจริญวิวงศ์	ทะเบียนเลขที่ ๖-๓๒๓-จ-๐๐๑๒
๑๓) นายชานนท์ บุญชื่น	ทะเบียนเลขที่ ๖-๓๒๓-จ-๐๐๑๓
๑๔) นายณัฐกานต์ วงศ์อินทร์อยู่	ทะเบียนเลขที่ ๖-๓๒๓-จ-๐๐๑๔
๑๕) นายอานนท์ โพธิ์พระทอง	ทะเบียนเลขที่ ๖-๓๒๓-จ-๐๐๑๕

๑๖) นายณัฐพล...	ทะเบียนเลขที่ ๖-๓๒๓-จ-๐๐๑๖
-----------------	----------------------------

๑๖) นายณัฐพล...

- ๒ -

๑๖) นายณัฐพล...	ทะเบียนเลขที่ ๖-๓๒๓-จ-๐๐๑๖
๑๗) นายศุภณัฐ ศิริสัมพันธ์	ทะเบียนเลขที่ ๖-๓๒๓-จ-๐๐๑๗
๑๘) นายณัฐพล ศิริสัมพันธ์	ทะเบียนเลขที่ ๖-๓๒๓-จ-๐๐๑๘
๑๙) นายณัฐพล ศิริสัมพันธ์	ทะเบียนเลขที่ ๖-๓๒๓-จ-๐๐๑๙
๒๐) นายศุภณัฐ ศุภณัฐสัมพันธ์	ทะเบียนเลขที่ ๖-๓๒๓-จ-๐๐๒๐
๒๑) นายณัฐพล ศิริสัมพันธ์	ทะเบียนเลขที่ ๖-๓๒๓-จ-๐๐๒๑
๒๒) นายณัฐพล ศิริสัมพันธ์	ทะเบียนเลขที่ ๖-๓๒๓-จ-๐๐๒๒
๒๓) นายณัฐพล ศิริสัมพันธ์	ทะเบียนเลขที่ ๖-๓๒๓-จ-๐๐๒๓
๒๔) นางสาวณัฐพล ศิริสัมพันธ์	ทะเบียนเลขที่ ๖-๓๒๓-จ-๐๐๒๔
๒๕) นายณัฐพล ศิริสัมพันธ์	ทะเบียนเลขที่ ๖-๓๒๓-จ-๐๐๒๕
๒๖) นางสาวณัฐพล ศิริสัมพันธ์	ทะเบียนเลขที่ ๖-๓๒๓-จ-๐๐๒๖
๒๗) นางสาวณัฐพล ศิริสัมพันธ์	ทะเบียนเลขที่ ๖-๓๒๓-จ-๐๐๒๗
๒๘) นางสาวณัฐพล ศิริสัมพันธ์	ทะเบียนเลขที่ ๖-๓๒๓-จ-๐๐๒๘
๒๙) นางสาวณัฐพล ศิริสัมพันธ์	ทะเบียนเลขที่ ๖-๓๒๓-จ-๐๐๒๙
๓๐) นางสาวณัฐพล ศิริสัมพันธ์	ทะเบียนเลขที่ ๖-๓๒๓-จ-๐๐๓๐
๓๑) นางสาวณัฐพล ศิริสัมพันธ์	ทะเบียนเลขที่ ๖-๓๒๓-จ-๐๐๓๑
๓๒) นางสาวณัฐพล ศิริสัมพันธ์	ทะเบียนเลขที่ ๖-๓๒๓-จ-๐๐๓๒
๓๓) นางสาวณัฐพล ศิริสัมพันธ์	ทะเบียนเลขที่ ๖-๓๒๓-จ-๐๐๓๓
๓๔) นางสาวณัฐพล ศิริสัมพันธ์	ทะเบียนเลขที่ ๖-๓๒๓-จ-๐๐๓๔
๓๕) นางสาวณัฐพล ศิริสัมพันธ์	ทะเบียนเลขที่ ๖-๓๒๓-จ-๐๐๓๕
๓๖) นางสาวณัฐพล ศิริสัมพันธ์	ทะเบียนเลขที่ ๖-๓๒๓-จ-๐๐๓๖
๓๗) นางสาวณัฐพล ศิริสัมพันธ์	ทะเบียนเลขที่ ๖-๓๒๓-จ-๐๐๓๗
๓๘) นางสาวณัฐพล ศิริสัมพันธ์	ทะเบียนเลขที่ ๖-๓๒๓-จ-๐๐๓๘
๓๙) นางสาวณัฐพล ศิริสัมพันธ์	ทะเบียนเลขที่ ๖-๓๒๓-จ-๐๐๓๙
๔๐) นางสาวณัฐพล ศิริสัมพันธ์	ทะเบียนเลขที่ ๖-๓๒๓-จ-๐๐๔๐
๔๑) นางสาวณัฐพล ศิริสัมพันธ์	ทะเบียนเลขที่ ๖-๓๒๓-จ-๐๐๔๑
๔๒) นางสาวณัฐพล ศิริสัมพันธ์	ทะเบียนเลขที่ ๖-๓๒๓-จ-๐๐๔๒
๔๓) นางสาวณัฐพล ศิริสัมพันธ์	ทะเบียนเลขที่ ๖-๓๒๓-จ-๐๐๔๓
๔๔) นางสาวณัฐพล ศิริสัมพันธ์	ทะเบียนเลขที่ ๖-๓๒๓-จ-๐๐๔๔
๔๕) นางสาวณัฐพล ศิริสัมพันธ์	ทะเบียนเลขที่ ๖-๓๒๓-จ-๐๐๔๕
๔๖) นางสาวณัฐพล ศิริสัมพันธ์	ทะเบียนเลขที่ ๖-๓๒๓-จ-๐๐๔๖
๔๗) นางสาวณัฐพล ศิริสัมพันธ์	ทะเบียนเลขที่ ๖-๓๒๓-จ-๐๐๔๗
๔๘) นางสาวณัฐพล ศิริสัมพันธ์	ทะเบียนเลขที่ ๖-๓๒๓-จ-๐๐๔๘
๔๙) นางสาวณัฐพล ศิริสัมพันธ์	ทะเบียนเลขที่ ๖-๓๒๓-จ-๐๐๔๙
๕๐) นางสาวณัฐพล ศิริสัมพันธ์	ทะเบียนเลขที่ ๖-๓๒๓-จ-๐๐๕๐
๕๑) นางสาวณัฐพล ศิริสัมพันธ์	ทะเบียนเลขที่ ๖-๓๒๓-จ-๐๐๕๑
๕๒) นางสาวณัฐพล ศิริสัมพันธ์	ทะเบียนเลขที่ ๖-๓๒๓-จ-๐๐๕๒
๕๓) นางสาวณัฐพล ศิริสัมพันธ์	ทะเบียนเลขที่ ๖-๓๒๓-จ-๐๐๕๓
๕๔) นางสาวณัฐพล ศิริสัมพันธ์	ทะเบียนเลขที่ ๖-๓๒๓-จ-๐๐๕๔
๕๕) นางสาวณัฐพล ศิริสัมพันธ์	ทะเบียนเลขที่ ๖-๓๒๓-จ-๐๐๕๕
๕๖) นางสาวณัฐพล ศิริสัมพันธ์	ทะเบียนเลขที่ ๖-๓๒๓-จ-๐๐๕๖
๕๗) นางสาวณัฐพล ศิริสัมพันธ์	ทะเบียนเลขที่ ๖-๓๒๓-จ-๐๐๕๗
๕๘) นางสาวณัฐพล ศิริสัมพันธ์	ทะเบียนเลขที่ ๖-๓๒๓-จ-๐๐๕๘
๕๙) นางสาวณัฐพล ศิริสัมพันธ์	ทะเบียนเลขที่ ๖-๓๒๓-จ-๐๐๕๙
๖๐) นางสาวณัฐพล ศิริสัมพันธ์	ทะเบียนเลขที่ ๖-๓๒๓-จ-๐๐๖๐

๕๒) นายพชร...

(๕๒) นายพรกร เจ็งเจริญ  
(๕๓) นายวิภากร เขื่อนมาก  
(๕๔) นายอนุรักษ์ ทองขจรศักดิ์  
(๕๕) นายอภิชาติ วิลาศ  
(๕๖) นายจรัสศรี ศรีรักษา  
(๕๗) นายประสาธน์ มั่นเอนเพชร  
(๕๘) นายภาณุวัฒน์ วัชร  
(๖๐) นายสันติ ชัยชนะ  
(๖๑) นายทินกร กุลชาติ

ทะเบียนเลขที่ ว-๑๒๓-จ-๐๐๕๔  
ทะเบียนเลขที่ ว-๑๒๓-จ-๐๐๕๕  
ทะเบียนเลขที่ ว-๑๒๓-จ-๐๐๕๖  
ทะเบียนเลขที่ ว-๑๒๓-จ-๐๐๕๗  
ทะเบียนเลขที่ ว-๑๒๓-จ-๐๐๕๘  
ทะเบียนเลขที่ ว-๑๒๓-จ-๐๐๕๙  
ทะเบียนเลขที่ ว-๑๒๓-จ-๐๐๖๐  
ทะเบียนเลขที่ ว-๑๒๓-จ-๐๐๖๑  
ทะเบียนเลขที่ ว-๑๒๓-จ-๐๐๖๒

ค. ขอบข่ายชนิดสารมลพิษที่ได้รับขึ้นทะเบียนให้วิเคราะห์ในน้ำเสีย น้ำใต้ดิน อากาศเสีย ตามสิ่งที่ส่งมาด้วย

หนังสือฉบับนี้จะหมดอายุในวันที่ ๒๘ มิถุนายน ๒๕๖๓ หากประสงค์จะต่ออายุหนังสือ รับขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์เอกชน ให้ยื่นคำขอต่ออายุพร้อมเอกสารประกอบคำขอต่อกรมโรงงานอุตสาหกรรมภายใน ๖๐ วัน ก่อนวันสิ้นอายุของหนังสือรับขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์เอกชน

จึงเรียนมาเพื่อทราบ

ขอแสดงความนับถือ

  
(นายพรกร กิ่งกรทอง)  
รองเลขาธิการ  
สำนักงานโรงงานอุตสาหกรรม

ศูนย์วิจัยและเคมียกย่องพิษโรงงานภาคตะวันออก  
โทร. ๐ ๓๓๓๓ ๖๐๕๙ ต่อ ๕๐๐๑-๒  
ไปรษณีย์อิเล็กทรอนิกส์ [eww@dw.mae.go.th](mailto:eww@dw.mae.go.th)



"อุตสาหกรรมก้าวไกล ประเทศไทยก้าวทันฯ ร่วมกันพัฒนา อุตสาหกรรมสีเขียว"



เอกสารแนบท้ายหนังสือเปลี่ยนแปลงสารมลพิษของห้องปฏิบัติการวิเคราะห์เอกชน  
บริษัท เอแอลเอส แล็บอราทอรี กรุ๊ป (ประเทศไทย) จำกัด เลขทะเบียน ว-๑๒๓  
ที่ กก ๐๓๒๐/ ๗๕๓๘ ลงวันที่ ๐๔ สิงหาคม ๒๕๖๗

ขอขยายสารมลพิษที่ได้รับขึ้นทะเบียนจากกรมโรงงานอุตสาหกรรม จำนวน ๒๔ รายการ  
น้ำเสีย จำนวน ๑๔ รายการ

ลำดับ ที่	สารมลพิษ	วิธีวิเคราะห์
1	Biochemical Oxygen Demand	1) 5-Day BOD Test, Membrane Electrode Method <sup>[2]</sup> 2) 5-Day BOD Test, Azide Modification Method <sup>[2]</sup>
2	Chemical Oxygen Demand	1) Open Reflux, Titrimetric Method <sup>[2]</sup> 2) Closed Reflux, Colorimetric Method <sup>[2]</sup> 3) Closed Reflux, Titrimetric Method <sup>[2]</sup>
3	Color	ADMI Weighted-Ordinate Spectrophotometric Method <sup>[2]</sup>
4	Cyanide	Distillation, Colorimetric Method <sup>[2]</sup>
5	Formaldehyde	Distillation, Colorimetric Method <sup>[1]</sup>
6	Free Chlorine	DPD Ferrous Titrimetric Method <sup>[2]</sup>
7	Oil and Grease	Liquid-Liquid, Partition-Gravimetric Method <sup>[2]</sup>
8	pH	Electrometric Method <sup>[2]</sup>
9	Phenols	1) Distillation, Chloroform Extraction Method <sup>[2]</sup> 2) Distillation, Direct Photometric Method <sup>[2]</sup>
10	Sulfide	ZnS Precipitation, Iodometric Method <sup>[2]</sup>
11	Temperature	Field Method <sup>[2]</sup>
12	Total Dissolved Solids	Dried at 180 °C <sup>[2]</sup>
13	Total Kjeldahl Nitrogen	Semi-Macro Kjeldahl Method <sup>[2]</sup>
14	Total Suspended Solids	Dried at 103-105 °C <sup>[2]</sup>

น้ำใต้ดิน จำนวน ๓ รายการ

ลำดับ ที่	สารมลพิษ	วิธีวิเคราะห์
1	Cyanide	Distillation, Colorimetric Method <sup>[2]</sup>
2	pH	Electrometric Method <sup>[2]</sup>
3	Phenols	Distillation, Direct Photometric Method <sup>[2]</sup>

อากาศเสีย...

อากาศเสีย (ปล่อยระบาย) จำนวน 7 รายการ

ลำดับ ที่	สารมลพิษ	วิธีวิเคราะห์
1	Carbon Monoxide	1) Sampling Bag, Non-Dispersive Infrared Method <sup>[3]</sup> 2) Instrumental Analyzer Method <sup>[2]</sup>
2	Hydrogen Sulfide	Absorption Sampling, Iodometric Method <sup>[2]</sup>
3	Opacity	Ringelmann's Method <sup>[4]</sup>
4	Oxide of Nitrogen	1) Absorption Sampling, Phenoldisulfonic Acid Method <sup>[4]</sup> 2) Instrumental Analyzer Method <sup>[10]</sup>
5	Sulfur Dioxide	1) Absorption Sampling, Barium-Thorin Titrimetric Acid Method <sup>[9]</sup> 2) Instrumental Analyzer Method <sup>[11]</sup>
6	Sulfuric Acid	Isokinetic Sampling, Barium - Titrimetric Method <sup>[6]</sup>
7	Total Suspended Particulate	Isokinetic Sampling, Gravimetric Method <sup>[7]</sup>

เอกสารอ้างอิง

๑. ธงชัย พรณสวัสดิ์ และวิบูลย์ลักษณ์ วิสุทติกิต์, บรรณาธิการ, (2547) คู่มือวิเคราะห์ น้ำเสีย, พิมพ์ครั้งที่ 4, กรุงเทพฯ: สมาคมวิศวกรรมสิ่งแวดล้อมแห่งประเทศไทย
2. APHA, AWWA, WEF, Standard Methods for the Examination of Water and Wastewater, 24<sup>th</sup> ed, Washington, DC : APHA, 2023
3. กระทรวงอุตสาหกรรม, ประกาศกระทรวงอุตสาหกรรม, พ.ศ. 2549, เรื่อง กำหนดค่าปริมาณ หมายความว่าเจือปนในอากาศที่ระบายออกจากปล่องของหม้อน้ำโรงสีข้าวที่ใช้แก๊สเป็นเชื้อเพลิง, ราชกิจจานุเบกษา, 4 ธันวาคม 2549, เล่มที่ 123 ตอนพิเศษ 1254
4. กระทรวงอุตสาหกรรม, ประกาศกระทรวงอุตสาหกรรม, พ.ศ. 2549, เรื่อง กำหนดค่าปริมาณ หมายความว่าเจือปนในอากาศที่ระบายออกจากปล่องของหม้อน้ำของโรงงาน, ราชกิจจานุเบกษา, 4 ธันวาคม 2549, เล่มที่ 123 ตอนพิเศษ 1254
5. United States Environmental Protection Agency, Standards of Performance for New Stationary Sources, 40 CFR 60, Appendix A, 2017.
6. United States Environmental Protection Agency, Standards of Performance for New Stationary Sources, 40 CFR 60, Appendix A, 2019.

7. United States...

7. United States Environmental Protection Agency, Standards of Performance for New Stationary Sources, 40 CFR 60, Appendix A, 2020.
8. United States Environmental Protection Agency, Standards of Performance for New Stationary Sources, 40 CFR 60, Appendix A, 2023.
9. United States Environmental Protection Agency, Determination of Carbon Monoxide Emission from Stationary Sources; Instrumental Analyzer Procedure, 40 CFR 60, Appendix A Method 10, 2017.
10. United States Environmental Protection Agency, Determination of Oxide of Nitrogen Emission from Stationary Sources; Instrumental Analyzer Procedure, 40 CFR 60, Appendix A Method 7E, 2023.
11. United States Environmental Protection Agency, Determination of Sulfur dioxide Emission from Stationary Sources; Instrumental Analyzer Procedure, 40 CFR 60, Appendix A Method 6C, 2017.





๐๙ ตุลาคม ๒๕๖๗

เรื่อง แก้ไขรายชื่อเจ้าหน้าที่ห้องปฏิบัติการวิเคราะห์เอกชน

เรียน กรรมการผู้จัดการ บริษัท เอแอลเอส แลบบอราทอรี กรุ๊ป (ประเทศไทย) จำกัด

อ้างถึง หนังสือ บริษัท เอแอลเอส แลบบอราทอรี กรุ๊ป (ประเทศไทย) จำกัด เลขที่ Env.2024/005  
ลงวันที่ ๓๐ สิงหาคม ๒๕๖๗

ตามหนังสือที่อ้างถึง บริษัท เอแอลเอส แลบบอราทอรี กรุ๊ป (ประเทศไทย) จำกัด ห้องปฏิบัติการ  
วิเคราะห์เอกชน เลขทะเบียน ว-๓๒๓ สถานที่ตั้งเลขที่ ๖๑๖/๑๐ หมู่ที่ ๕ ตำบลแม่ไม้ อำเภอลวกแดง  
จังหวัดระยอง ขอแก้ไขชื่อเจ้าหน้าที่ห้องปฏิบัติการวิเคราะห์เอกชน เนื่องจากมีความคลาดเคลื่อน ความละเอียด  
แจ้งแล้ว นั้น

กรมโรงงานอุตสาหกรรม ได้รับทราบและดำเนินการแก้ไขรายชื่อเจ้าหน้าที่ห้องปฏิบัติการ  
วิเคราะห์เอกชน จำนวน ๕ ราย ตามที่แจ้งเรียบร้อยแล้ว เป็นดังนี้

- ลำดับที่ ๒๗ นางพจนา สีดา
- ลำดับที่ ๒๘ นางสาวธนิศา กุลสุริวงศ์
- ลำดับที่ ๓๐ นางชลธิชา สิบงกช
- ลำดับที่ ๓๖ นายสุทธิศักดิ์ โชคปิตินันท์
- ลำดับที่ ๔๒ นายกันตณณ มณีสัมพันธ์

จึงเรียนมาเพื่อทราบ

ขอแสดงความนับถือ

  
(นายพรยศ กลิ่นกรอง)  
รองอธิบดี ปฏิบัติราชการแทน  
อธิบดีกรมโรงงานอุตสาหกรรม

ศูนย์วิจัยและเตือนภัยมลพิษโรงงานภาคตะวันออก  
โทร. ๐ ๓๓๓๓ ๖๐๕๔ ต่อ ๕๐๐๑-๒  
ไปรษณีย์อิเล็กทรอนิกส์ eirw@dlw.mail.go.th

