

# ภาคผนวก ง

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ใบรับรองการสอบเทียบเครื่องมือ



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รายการเครื่องมือที่ใช้ในการวิเคราะห์ / ทดสอบ

Sample Name	Parameter	Equipment Name	ID No.	Calibrated Date	Next Cal	Freq. Calibrate (Months)
Stack	Oxides of Nitrogen	Console Control Unit	BKK_F51093	3-Jul-22	3-Jan-23	6
Stack	Oxides of Nitrogen	Vacuum Gauge	BKK_F50422	9-May-22	7-Nov-23	18
Stack	Oxides of Nitrogen	Spectrophotometer	BKK_EN0018	15-Oct-21	15-Oct-22	12
Stack	Sulfur Dioxide	Console Control Unit	BKK_F51093	3-Jul-22	3-Jan-23	6
Stack	Sulfur Dioxide	Dry Gas	BKK_F50554	3-Jul-22	3-Jan-23	6
Stack	Total Suspended Particulate	Console Control Unit	BKK_F51093	3-Jul-22	3-Jan-23	6
Stack	Total Suspended Particulate	Digital Balance	BKK_EN0309	16-Dec-21	16-Dec-22	12
Stack	Carbon Monoxide	Console Control Unit	BKK_F51093	3-Jul-22	3-Jan-23	6
Stack	Carbon Monoxide	CO Analyzer	BKK_EN0073	18-Oct-21	18-Apr-23	18
Ambient	Nitrogen Dioxide	NO <sub>2</sub> Analyzer	BKK_F50728	1-Jul-22	1-Jan-23	6
Ambient	Nitrogen Dioxide	NO <sub>2</sub> Analyzer	BKK_F51092	1-Jul-22	1-Jan-23	6
Ambient	Nitrogen Dioxide	NO <sub>2</sub> Analyzer	BKK_F50785	1-Jul-22	1-Jan-23	6
Ambient	Total Suspended Particulate	High Volume	BKK_F50366	-	-	On site Calibration
Ambient	Total Suspended Particulate	High Volume	BKK_F51057	-	-	On site Calibration
Ambient	Total Suspended Particulate	High Volume	BKK_F50370	-	-	On site Calibration
Ambient	Total Suspended Particulate	Digital Balance	BKK_EN0004	25-Feb-22	25-Feb-23	12
Ambient	Particulate Matter (PM-10)	High Volume	BKK_F50386	-	-	On site Calibration
Ambient	Particulate Matter (PM-10)	High Volume	BKK_F51061	-	-	On site Calibration
Ambient	Particulate Matter (PM-10)	High Volume	BKK_F50375	-	-	On site Calibration
Ambient	Particulate Matter (PM-10)	Digital Balance	BKK_EN0004	25-Feb-22	25-Feb-23	12
Ambient	Sulfur Dioxide	SO <sub>2</sub> Analyzer	BKK_F50727	1-Jul-22	1-Jan-23	6
Ambient	Sulfur Dioxide	SO <sub>2</sub> Analyzer	BKK_F51091	1-Jul-22	1-Jan-23	6
Ambient	Sulfur Dioxide	SO <sub>2</sub> Analyzer	BKK_F50799	1-Jul-22	1-Jan-23	6
Ambient	Wind Speed / Wind Direction	Wind Speed / Wind Direction	BKK_F50887	30-May-22	28-Nov-23	18
Ambient	Wind Speed / Wind Direction	Wind Speed / Wind Direction	BKK_F50910	6-May-21	4-Nov-22	18
Ambient	Wind Speed / Wind Direction	Wind Speed / Wind Direction	BKK_F50888	30-May-22	28-Nov-23	18
Ambient	Wind Speed / Wind Direction	Wind Speed / Wind Direction	BKK_F50159	31-Mar-21	29-Sep-22	18
Water Lab	pH at 25 °C	pH meter	BKK_EN0072	26-Mar-21	24-Sep-22	18
Water Lab	pH at 25 °C	pH meter	BKK_EN0072	12-Sep-22	12-Mar-24	18
Water Lab	BOD (5 days at 20°C)	DO Meter	BKK_EN0205	19-Jan-21	20-Jul-22	18
Water Lab	BOD (5 days at 20°C)	DO Meter	BKK_EN0017	24-May-22	24-Nov-23	18
Water Lab	BOD (5 days at 20°C)	Incubator	BKK_EN0005	4-Oct-21	4-Apr-23	18
Water Lab	COD	Hot Block	BKK_EN0222	7-Apr-21	7-Apr-22	12
Water Lab	COD	Hot Block	BKK_EN0222	21-Mar-22	21-Mar-23	12
Water Lab	COD	Spectrophotometer	BKK_EN0018	15-Oct-21	15-Oct-22	12
Water Lab	COD	Spectrophotometer	BKK_EN0018	16-Sep-22	16-Sep-23	12
Water Lab	Dissolved Oxygen	Burette	BKK_EN0171	30-Mar-21	28-Sep-22	18
Water Lab	Acidity	Burette	BKK_EN0171	30-Aug-22	1-Mar-24	18
Water Lab	Dissolved Oxygen	Chamber (Cold Room)	BKK_EN0167	18-May-21	16-Nov-22	18
Water Lab	Dissolved Oxygen	Chamber (Cold Room)	BKK_EN0167	30-Jun-22	30-Dec-23	18
Water Lab	Total Suspended Solids	Electronic Top-Loading Balance	BKK_EN0003	3-Sep-21	3-Sep-22	12
Water Lab	Total Suspended Solids	Electronic Top-Loading Balance	BKK_EN0002	25-Feb-22	25-Feb-23	12
Water Lab	Total Suspended Solids	Oven	BKK_EN0007	1-Dec-21	1-Jan-23	18
Water Lab	Total Dissolved Solids 180°C	Electronic Top-Loading Balance	BKK_EN0003	3-Sep-21	3-Sep-22	12
Water Lab	Total Dissolved Solids 180°C	Electronic Top-Loading Balance	BKK_EN0002	25-Feb-22	25-Feb-23	12
Water Lab	Total Dissolved Solids 180°C	Oven	BKK_EN0007	1-Dec-21	1-Jan-23	18
Water Lab	Oil & Grease (Soxhlet)	Electronic Top-Loading Balance	BKK_EN0003	3-Sep-21	3-Sep-22	12
Water Lab	Oil & Grease (Soxhlet)	Electronic Top-Loading Balance	BKK_EN0002	25-Feb-22	25-Feb-23	12
Water Lab	Oil & Grease (Soxhlet)	Water Bath	BKK_EN0148	31-Jan-22	1-Aug-23	18
Water Lab	Residual Free Chlorine	Chlorine Meter	BKK_L60018	20-Sep-21	20-Sep-22	12
Water Lab	Residual Free Chlorine	Chlorine Meter	BKK_L60018	31-Aug-22	31-Aug-23	12
Noise	Leq 24 hrs	Sound Calibrator	BKK_F50630	26-Apr-22	26-Apr-23	12
Noise	Leq 24 hrs	Sound Level Meter	BKK_F50100	11-Jul-21	11-Jul-22	12
Noise	Leq 24 hrs	Sound Level Meter	BKK_F50930	12-Jan-22	12-Jan-23	12
Noise	Leq 24 hrs	Sound Level Meter	BKK_F50929	28-Oct-21	28-Oct-22	12
Noise	Leq 8 hrs	Sound Calibrator	BKK_F50630	26-Apr-22	26-Apr-23	12
Noise	Leq 8 hrs	Sound Level Meter	BKK_F50109	14-Dec-21	14-Dec-22	12
Noise	Leq 8 hrs	Sound Level Meter	BKK_F50110	14-Dec-21	14-Dec-22	12
Noise	Leq 8 hrs	Sound Level Meter	BKK_F50111	14-Dec-21	14-Dec-22	12
Noise	Leq 8 hrs	Sound Level Meter	BKK_F50113	12-Jan-22	12-Jan-23	12

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Sample Name	Parameter	Equipment Name	ID No.	Calibrated Date	Next Cal	Freq. Calibrate (Months)
Noise	Leq 8 hrs	Sound Calibrator	BKK_F50633	14-Jan-22	14-Jan-23	12
Noise	Leq 8 hrs	Sound Level Meter	BKK_F50922	12-Jan-22	12-Jan-23	12
Noise	Leq 8 hrs	Sound Level Meter	BKK_F50108	12-Jan-22	12-Jan-23	12
Noise	Leq 8 hrs	Sound Level Meter	BKK_F50030	12-Jan-22	12-Jan-23	12
Noise	Leq 8 hrs	Sound Level Meter	BKK_F50109	14-Dec-21	14-Dec-22	12
Heat	Heat Stress	Heat Stress Monitor	BKK_F50642	18-Feb-22	18-Feb-23	12
Heat	Heat Stress	Heat Stress Monitor	BKK_F50676	2-Nov-21	2-Nov-22	12

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CONSOLE CONTROL UNIT CALIBRATION TEST REPORT



Calibration of Date : 3 Jul 22

Next Cal Date : 3 Jan 23

Barometric Pressure (mm Hg) : 756

Relative Humidity (%) : 54.0

Temperature : 31.0

Reference Dry Gas Meter Data

Reference Dry Gas Meter ID : BKK\_F51122

Serial No. : A2003240

Correction Factor (Y) : 1.0160

Next Calibration Date : 27 May 23

Console Control Meter Data

Calibration No. : C-030722-BKK\_F51093

Dry Gas Meter No. : BKK\_F51093

Serial No. : 1706090

Model No. : XC-572-V

ΔH (mm.H <sub>2</sub> O)	Θ Minutes	Reference Dry Gas Meter Calibration					Console Control Drygas Meter					Dry Gas Meter Correction Factor (Y)	Office Calibration Factor (Y)	ΔH <sub>g</sub>
		Vr (Liters)			Tr (°C)	Vm (Liters)			Ti (°C)	To (°C)	Avg Tm (°C)			
		Final	Initial	Total		Final	Initial	Total						
15	12.21	150.00	0.00	150.00	29.0	148478.2	148478.2	153.20	30.0	30.0	31.0	0.9968	46.4475	
25	9.25	150.00	0.00	150.00	31.0	148466.2	148466.2	153.20	31.0	31.0	31.0	0.9924	44.0016	
50	6.55	150.00	0.00	150.00	32.0	148651.2	148652.0	153.20	32.0	32.0	32.0	0.9900	44.2714	
80	5.10	150.00	0.00	150.00	32.0	149256.6	149105.0	153.60	33.0	33.0	33.0	0.9876	42.8035	
120	4.18	150.00	0.00	150.00	32.0	149427.1	149271.0	153.00	36.0	35.5	35.5	0.9969	42.8603	
											Avg	0.9925	43.6949	

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

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

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

Approved by : (Mr. Prasant Surakhan) Field Scientist (3)

Calibrated by : (Mr. Prasant Surakhan) Specialist (1)



DIGITAL TEMPERATURE CALIBRATION DATA SHEET

Calibration Date		3 Jul 22	Ambient Temperature (°C)		31
Calibration sheet No. : C-030722-BKK_FS1093			Relative Humidity (%) :		62
Digital Temperature ID BKK_FS1093			Reference Temperature ID BKK_FS0609		
Console Serial No. : 1706090			Serial No. : 7688004		
Console Model : XC-572-V			Model : FLUKE714		
			Last Calibrate : 26 Jul 23		
Location	Reference Temperature °C	Digital Temperature °C	Error °C	Remark	
Stack	0	0	0		
	25	25	0		
	50	50	0		
	100	100	0		
	150	150	0		
	200	200	0		
	250	250	0		
	300	300	0		
	500	501	1		
	1000	1001	1		
Probe	1200	1201	1		
	100	100	0		
	125	126	1		
Oven	150	151	1		
	100	101	1		
	125	125	0		
Filter	150	150	0		
	100	100	0		
	125	125	0		
Exit	150	151	1		
	0	0	0		
	10	10	0		
Meter	20	20	0		
	0	0	0		
	25	25	0		
AUX	50	50	0		
	0	0	0		
	25	25	0		
	50	50	0		

Calibrated by :

(Mr. Prasant Surakhan)  
Field Scientist (3)

Approved by :

(Mr. Prasant Surakhan)  
Specialist (1)

FORM NO. F-10-007-REVISION 01-01-2021



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THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)  
Mechanical Engineering Standards Laboratory Sol 1, Bangpoo Industrial Estate, Muang, Samutprakan 10280, Thailand.

Request No. 23-65/0316-01

MTC.No. 23-65/0316-01

Number of Pages(S) 2

## CALIBRATION CERTIFICATE

Nomenclature : "Dwyer" DIGITAL PRESSURE GAUGE

Manufactured by DWYER INSTRUMENTS, INC. U.S.A.

Model : DVG-00

Serial No. : DVG02 ID. BKK\_FS0422

Range : -30 in Hg to 0 in Hg

Resolution : 0.01 in Hg

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

104 Phatthanakan 40, Phatthanakan Rd.,

Khwaeng Phatthanakan, Khet Suan Luang, Bangkok 10250, Thailand.

Calibration method : Normal

Received date : 17 March 2022

Calibration date : 9 May 2022

Standard : Reference Pressure Monitor, Serial 1950, Certificate no. 23-64/0581-01

Due Date 3 August 2022

The Standard used for the measurement is traceable to SI Unit through  
National Institute of Metrology (THAILAND).

CALIBRATED BY :

( Mr. Uthai Chaiyapat )

APPROVED BY :

( Ms. Kirana Luanghinan )

Director  
Mechanical Engineering Standards Laboratory

Ref. 2013265031701244001

Issued Date : 12 May 2022

The results relate only to the items tested/calibrated or value assigned.

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Office  
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FM.BLMTC.002 Rev.4



THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)  
Mechanical Engineering Standards Laboratory Sol 1, Bangpoo Industrial Estate, Muang, Samutprakan 10280, Thailand.

Request 23-65/0316-01

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MTC.No. 23-65/0316-01

Calibration range : -27 in Hg to 0 in Hg

Calibration method : The Digital Pressure Gauge Under Calibration (UUC) was calibrated by  
comparison method followed DAKKS-DKD-R 6-1: Calibration of Pressure  
Gauge, edition 03/2014

Calibration condition : Temperature (  $23.1 \pm 2$  ) °C , Relative Humidity (  $62 \pm 10$  ) %

Atmospheric pressure (  $1006 \pm 10$  ) hPa,

Local gravity (  $9.783003 \pm 0.000050$  ) m/s<sup>2</sup>

Measurement Data :

Gauge position : Vertical

Medium : Air

Reference level : Gauge inlet

Unit : In Hg

UUC Reading	Gauge Pressure	Error	(±) Uncertainty
0.00	0.000	0.000	0.090
-10.00	-9.914	-0.086	0.090
-20.00	-19.820	-0.180	0.090
-26.00	-25.759	-0.241	0.090
-27.00	-26.659	-0.341	0.095
-28.00	-27.748	-0.252	0.090

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

The End of Calibration Certificate

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FM.BLMTC.002 Rev.4



Bara Scientific Co., Ltd.  
958 U Chu Liang Building Floor 7 Rama4 Road  
Silom Bangkok Bangkok Thailand 10500  
Tel: 02-6324300 Fax: 02-6375496-7  
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## Certificate of Calibration

Number of Page(s) 1 of 3

Certificate No. BSCC-UV-290/21  
Equipment UV-Vis Spectrophotometer  
Model UV-1800  
Manufacturer Shimadzu  
Serial No. A11454908533CD  
ID No. BKK\_EN0018  
Date of receipt 15 October 2021  
Date of calibration 15 October 2021  
Date of issue 25 October 2021

Customer name ALS Laboratory Group (Thailand) Co., Ltd.

Address 104 Soi Phatthanakan 40 Phatthanakan Road, Phatthanakan, Suan Luang, Bangkok 10250

Temperature (25.0 - 26.4) °C (On site)  
Humidity (49.5 - 53.4) %RH (On site)

Equipment condition Good Operation

Calibration Location Organic Prep

Calibration Procedure In-house method WI-UV-702-01 based on ASTM E275-01

Traceability Wavelength Accuracy is traceable to certificate No. 87839 and 87844  
Photometric Accuracy is traceable to certificate No. 87845 and 87877  
Stray Light is traceable to certificate No. 87825  
The above certificate are traceable to SI unit through Starna Scientific Ltd.  
(UKAS accredited calibration laboratory NO. 0559)

Calibrated by Mr Wanchana Janloey

Approved by  
  
Mr. Kanchit Choothep  
Technical Manager

The above results are valid exclusively for the calibrated items as mentioned in this report / certificate.  
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FM-UV-708-02 Rev 01 (23/11/23)



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## Certificate of Calibration

Certificate No. BSCC-UV-290/21

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	333.80	-0.22	0.18
418.53	418.40	-0.13	0.18
572.99	572.85	-0.14	0.18
879.41	879.15	-0.26	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
	0.7174	0.7198	0.0024	0.0075
257	0.0000	-0.0001	-0.0001	0.0075
	0.8362	0.8377	0.0015	0.0075
313	0.0000	0.0000	0.0000	0.0075
	0.2778	0.2803	0.0025	0.0075
350	0.0000	-0.0001	-0.0001	0.0075
	0.6202	0.6221	0.0019	0.0075

\*CNR = Customer not request

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FM-UV-708-02 Rev 01 (23/11/23)





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## Certificate of Calibration

Certificate No. BSCC-UV-290/21

Number of Pages: 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
	0.5631	0.5570	-0.0061	0.0042
	0.7390	0.7334	-0.0056	0.0042
	1.0863	1.0816	-0.0047	0.0042
	0.0000	0.0000	0.0000	0.0042
440.0	0.5524	0.5489	-0.0035	0.0042
	0.7217	0.7186	-0.0031	0.0042
	1.0606	1.0570	-0.0036	0.0042
	0.0000	0.0000	0.0000	0.0042
	0.5018	0.4966	-0.0052	0.0042
465.0	0.6657	0.6610	-0.0047	0.0042
	0.9775	0.9740	-0.0035	0.0042
	0.0000	0.0000	0.0000	0.0042
	0.5147	0.5113	-0.0034	0.0042
	0.6743	0.6705	-0.0038	0.0042
546.1	0.9909	0.9890	-0.0019	0.0042
	0.0000	0.0000	0.0000	0.0042
	0.5427	0.5394	-0.0033	0.0042
	0.7037	0.7001	-0.0036	0.0042
	1.0338	1.0323	-0.0015	0.0042
590.0	0.0000	0.0000	0.0000	0.0042
	0.5268	0.5235	-0.0033	0.0042
	0.6720	0.6685	-0.0035	0.0042
	0.9864	0.9847	-0.0017	0.0042
	0.0000	0.0000	0.0000	0.0042

\*CNR = Customer not request

### 4. Stray Light\*

Standard cut-off wavelength (nm)	Unit Under Calibration(UUC)
200 91±0.11nm	Wavelength (nm) Transmission (%T) Absorbance (A)
	200.31 0.9399 2.0274

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 based on a standard uncertainty multiplied by a coverage factor k=2 providing a level of confidence of approximately 95%  
\*\*\*End of Certificate\*\*\*

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FM-UV-708-02 Rev.01 (23/01/03)



## DIGITAL TEMPERATURE CALIBRATION DATA SHEET

Calibration Date :	3 Jul 22	Ambient Temperature (°C)	31
Calibration sheet No. :	C-030722-BKK_FS0554	Relative Humidity (%) :	62
Digital Temperature ID :	BKK_FS0554	Reference Temperature ID	BKK_FS1144
Console Serial No.	1606012	Serial No. :	201090006013
Model :	XC-62CV	Model :	Digicon-CC-VT-MS
		Next Calibrate :	31 Jan 23

Location	Reference Temperature °C	Digital Temperature °C	Error °C	Remark
Stack	0	0	0	
	25	25	0	
	50	50	0	
	100	101	1	
	150	151	1	
	200	201	1	
	250	252	2	
Probe	300	302	2	
	500	502	2	
	1000	1002	2	
	1200	1202	2	
	100	101	1	
	125	126	1	
	150	152	2	
Filter	100	100	0	
	125	126	1	
	150	152	2	
Exit	0	1	1	
	10	11	1	
	20	21	1	
Meter	0	0	0	
	25	26	1	
	50	51	1	
AUX	0	0	0	
	25	25	0	
	50	50	0	

Calibrated by

Mr. Prasert Surakhnan  
Field Scientist (3)

Approved by

Mr. Samart Roo-ngan  
Specialist (1)

FORM NO. F-04-167 REV.01-12-13-14-15-16-17-18-19-20-21-22-23-24-25-26-27-28-29-30-31-32-33-34-35-36-37-38-39-40-41-42-43-44-45-46-47-48-49-50-51-52-53-54-55-56-57-58-59-60-61-62-63-64-65-66-67-68-69-70-71-72-73-74-75-76-77-78-79-80-81-82-83-84-85-86-87-88-89-90-91-92-93-94-95-96-97-98-99-100-101-102-103-104-105-106-107-108-109-110-111-112-113-114-115-116-117-118-119-120-121-122-123-124-125-126-127-128-129-130-131-132-133-134-135-136-137-138-139-140-141-142-143-144-145-146-147-148-149-150-151-152-153-154-155-156-157-158-159-160-161-162-163-164-165-166-167-168-169-170-171-172-173-174-175-176-177-178-179-180-181-182-183-184-185-186-187-188-189-190-191-192-193-194-195-196-197-198-199-200-201-202-203-204-205-206-207-208-209-210-211-212-213-214-215-216-217-218-219-220-221-222-223-224-225-226-227-228-229-230-231-232-233-234-235-236-237-238-239-240-241-242-243-244-245-246-247-248-249-250-251-252-253-254-255-256-257-258-259-260-261-262-263-264-265-266-267-268-269-270-271-272-273-274-275-276-277-278-279-280-281-282-283-284-285-286-287-288-289-290-291-292-293-294-295-296-297-298-299-300-301-302-303-304-305-306-307-308-309-310-311-312-313-314-315-316-317-318-319-320-321-322-323-324-325-326-327-328-329-330-331-332-333-334-335-336-337-338-339-340-341-342-343-344-345-346-347-348-349-350-351-352-353-354-355-356-357-358-359-360-361-362-363-364-365-366-367-368-369-370-371-372-373-374-375-376-377-378-379-380-381-382-383-384-385-386-387-388-389-390-391-392-393-394-395-396-397-398-399-400-401-402-403-404-405-406-407-408-409-410-411-412-413-414-415-416-417-418-419-420-421-422-423-424-425-426-427-428-429-430-431-432-433-434-435-436-437-438-439-440-441-442-443-444-445-446-447-448-449-450-451-452-453-454-455-456-457-458-459-460-461-462-463-464-465-466-467-468-469-470-471-472-473-474-475-476-477-478-479-480-481-482-483-484-485-486-487-488-489-490-491-492-493-494-495-496-497-498-499-500-501-502-503-504-505-506-507-508-509-510-511-512-513-514-515-516-517-518-519-520-521-522-523-524-525-526-527-528-529-530-531-532-533-534-535-536-537-538-539-540-541-542-543-544-545-546-547-548-549-550-551-552-553-554-555-556-557-558-559-560-561-562-563-564-565-566-567-568-569-570-571-572-573-574-575-576-577-578-579-580-581-582-583-584-585-586-587-588-589-590-591-592-593-594-595-596-597-598-599-600-601-602-603-604-605-606-607-608-609-610-611-612-613-614-615-616-617-618-619-620-621-622-623-624-625-626-627-628-629-630-631-632-633-634-635-636-637-638-639-640-641-642-643-644-645-646-647-648-649-650-651-652-653-654-655-656-657-658-659-660-661-662-663-664-665-666-667-668-669-670-671-672-673-674-675-676-677-678-679-680-681-682-683-684-685-686-687-688-689-690-691-692-693-694-695-696-697-698-699-700-701-702-703-704-705-706-707-708-709-710-711-712-713-714-715-716-717-718-719-720-721-722-723-724-725-726-727-728-729-730-731-732-733-734-735-736-737-738-739-740-741-742-743-744-745-746-747-748-749-750-751-752-753-754-755-756-757-758-759-760-761-762-763-764-765-766-767-768-769-770-771-772-773-774-775-776-777-778-779-780-781-782-783-784-785-786-787-788-789-790-791-792-793-794-795-796-797-798-799-800-801-802-803-804-805-806-807-808-809-810-811-812-813-814-815-816-817-818-819-820-821-822-823-824-825-826-827-828-829-830-831-832-833-834-835-836-837-838-839-840-841-842-843-844-845-846-847-848-849-850-851-852-853-854-855-856-857-858-859-860-861-862-863-864-865-866-867-868-869-870-871-872-873-874-875-876-877-878-879-880-881-882-883-884-885-886-887-888-889-890-891-892-893-894-895-896-897-898-899-900-901-902-903-904-905-906-907-908-909-910-911-912-913-914-915-916-917-918-919-920-921-922-923-924-925-926-927-928-929-930-931-932-933-934-935-936-937-938-939-940-941-942-943-944-945-946-947-948-949-950-951-952-953-954-955-956-957-958-959-960-961-962-963-964-965-966-967-968-969-970-971-972-973-974-975-976-977-978-979-980-981-982-983-984-985-986-987-988-989-990-991-992-993-994-995-996-997-998-999-1000-1001-1002-1003-1004-1005-1006-1007-1008-1009-1010-1011-1012-1013-1014-1015-1016-1017-1018-1019-1020-1021-1022-1023-1024-1025-1026-1027-1028-1029-1030-1031-1032-1033-1034-1035-1036-1037-1038-1039-1040-1041-1042-1043-1044-1045-1046-1047-1048-1049-1050-1051-1052-1053-1054-1055-1056-1057-1058-1059-1060-1061-1062-1063-1064-1065-1066-1067-1068-1069-1070-1071-1072-1073-1074-1075-1076-1077-1078-1079-1080-1081-1082-1083-1084-1085-1086-1087-1088-1089-1090-1091-1092-1093-1094-1095-1096-1097-1098-1099-1100-1101-1102-1103-1104-1105-1106-1107-1108-1109-1110-1111-1112-1113-1114-1115-1116-1117-1118-1119-1120-1121-1122-1123-1124-1125-1126-1127-1128-1129-1130-1131-1132-1133-1134-1135-1136-1137-1138-1139-1140-1141-1142-1143-1144-1145-1146-1147-1148-1149-1150-1151-1152-1153-1154-1155-1156-1157-1158-1159-1160-1161-1162-1163-1164-1165-1166-1167-1168-1169-1170-1171-1172-1173-1174-1175-1176-1177-1178-1179-1180-1181-1182-1183-1184-1185-1186-1187-1188-1189-1190-1191-1192-1193-1194-1195-1196-1197-1198-1199-1200-1201-1202-1203-1204-1205-1206-1207-1208-1209-1210-1211-1212-1213-1214-1215-1216-1217-1218-1219-1220-1221-1222-1223-1224-1225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## Certificate of Calibration

Represent to Certificate of Calibration ,PTC/07/21161

Certificate No.: PTC/07/21161 Page: 1 of 2  
Equipment: Digital Balance Condition: Normal  
Manufacturer: Sartorius Serial No: 38304165  
Model: SECURA224-1S ID No: BKK-EN0309  
Type of Balance: Single interval



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

Environment Condition: Temperature 23.8 °C ± 0.4 °C  
Humidity 58.1 %RH ± 0.7 %RH  
Air density 1.18 kg/m<sup>3</sup>

Calibration Place: ALS Laboratory Group ( Thailand ) Co.,Ltd.  
104 Phatthanakarn 40, Phatthanakarn Rd.,  
Khwaeng Phatthanakarn, Khet Suan Luang, Bangkok 10250.

The Method used: In house method, PTC-WI-07, base on Euramet cg 16

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

Date Received: December 16, 2021

Calibration Date: December 16, 2021

Issued Date: December 20, 2021

Calibration By: Mr. Keattisak Kerdto

REVIEW BY: Sarayuth M  
APPROVED BY: K. Kerdto  
NEXT CAL. DATE: 10/12/22



Approved By: ( Mr. Keattisak Kerdto )  
Laboratory Manager

Reviewed by: ( Mr. Kriangsak Kalasri )  
Reviewed by

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 recognised national standard laboratories.

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

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

PTC-FWC-07-02: 2 Feb 2020

Represent to Certificate of Calibration ,PTC/07/21161

Certificate No.: PTC/07/21161

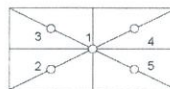
Page: 2 of 2

Measurement Results:

Without Adjustment:

Function Calibration: Internal Calibration

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



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

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

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

Nominal test value (g)	Standard Deviation
200	0.00004

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

Nominal Value (g)	Conventional Mass (g)	Indication (g)	Correction of Balance (g)	Uncertainty (g)	k
0	0.00000	0.0000	0.0000	0.00013	2.37
0.01	0.01000	0.0100	0.0000	0.00028	2.00
0.1	0.10000	0.1000	0.0000	0.00015	2.12
1	1.00000	1.0000	0.0000	0.00014	2.18
2	2.00000	2.0000	0.0000	0.00014	2.20
5	5.00001	5.0000	0.0000	0.00014	2.20
10	10.00000	10.0000	0.0000	0.00014	2.20
20	20.00003	20.0000	0.0000	0.00014	2.18
50	50.00004	50.0000	0.0000	0.00015	2.11
100	100.00004	100.0000	0.0000	0.00016	2.05
200	200.00011	200.0000	0.0001	0.00025	2.00

Note: Weight of adjust (g)

The End of Certificate

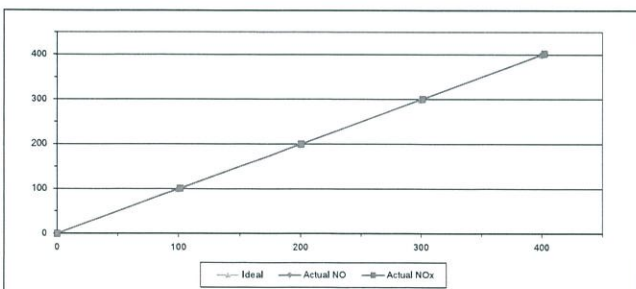
PTC-FWC-07-02: 2 Feb 2020



## MULTIPOINT CALIBRATION REPORT

Calibration Date: 1-Jul-22 Equipment Name: NOx Analyzer  
Manufacturer: Teledyne API Model: T200  
Serial No.: 1993 Equipment ID: BKK\_FS0728  
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

CALIBRATION RESULTS							
Point	Ideal	Actual NO	Error NO	%Error NO	Actual NOx	Error NOx	%Error NOx
ZERO	0.00	0.10	0.10	0.10	0.10	0.10	0.10
1	100.00	100.10	0.10	0.10	101.10	1.10	1.10
2	200.00	199.40	-0.60	-0.30	200.40	0.40	0.20
3	300.00	299.60	-0.40	-0.13	301.00	1.00	0.33
4	400.00	400.30	0.30	0.08	402.20	2.20	0.55
AVERAGE (%)				-0.03			0.46



Calibrated By

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

Approved By

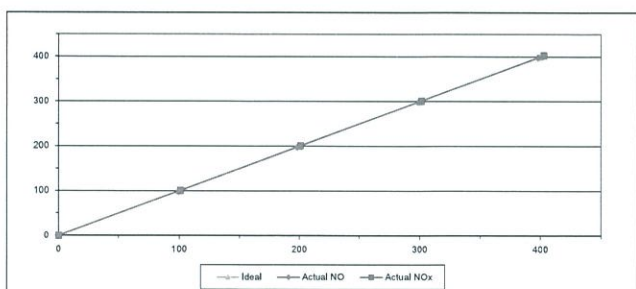
( Mr. Sarayuth Jitranont )  
Assistant General Manager



## MULTIPOINT CALIBRATION REPORT

Calibration Date: 1-Jul-22 Equipment Name: NOx Analyzer  
Manufacturer: HORIBA Model: APNA-370  
Serial No.: XLTWRBSJ Equipment ID: BKK\_FS1062  
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

CALIBRATION RESULTS							
Point	Ideal	Actual NO	Error NO	%Error NO	Actual NOx	Error NOx	%Error NOx
ZERO	0.00	0.10	0.10	0.10	0.10	0.10	0.10
1	100.00	99.70	-0.30	-0.30	101.00	1.00	1.00
2	200.00	198.10	-1.90	-0.95	201.00	1.00	0.50
3	300.00	299.10	-0.90	-0.30	301.40	1.40	0.47
4	400.00	398.20	-1.80	-0.45	402.80	2.80	0.70
AVERAGE (%)				-0.38			0.55



Calibrated By

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

Approved By

( Mr. Sarayuth Jitranont )  
Assistant General Manager

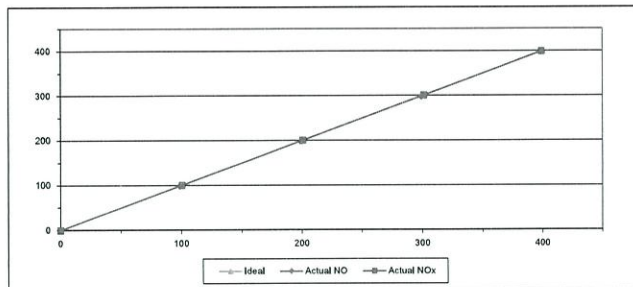




### MULTIPOINT CALIBRATION REPORT

Calibration Date: 1-Jul-22 Equipment Name: NOx Analyzer  
 Manufacturer: HORIBA Model: APNA-370  
 Serial No.: TLTATGQW Equipment ID: BKK\_FS0785  
 Calibrator Manufacturer: Teledyne API Model: 700  
 Serial No.: 947  
 Std. Gas Concentration (PPM): 55.88 Cylinder No.: GN0027222  
 Cylinder Pressure (psi): 1800 Certified By: Airgas Inc.  
 Certified Date: 9-Feb-22 Expired Date: 9-Feb-30

Point	CALIBRATION RESULTS						
	Ideal	Actual NO	Error NO	%Error NO	Actual NOx	Error NOx	%Error NOx
ZERO	0.00	0.10	0.10	0.10	0.10	0.10	0.10
1	100.00	99.00	-1.00	-1.00	100.50	0.50	0.50
2	200.00	199.50	-0.50	-0.25	200.70	0.70	0.35
3	300.00	299.00	-1.00	-0.33	301.10	1.10	0.37
4	400.00	398.70	-1.30	-0.33	399.00	-1.00	-0.25
AVERAGE (%)				-0.36			0.21



Calibrated By

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

Approved By

(Mr. Sarayuth Jitranont)  
Assistant General Manager

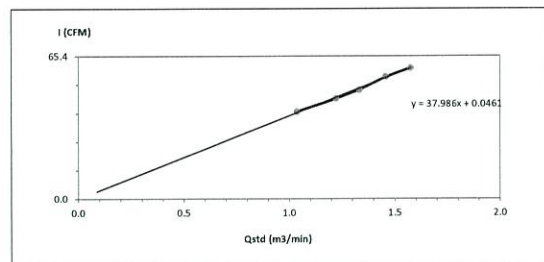
ALS Laboratory Group  
FORM NO.: F 06-056 REVISION NO.: - ISSUE DATE: 02/04/12



### High Volume Air Sampler Calibration Worksheet

Project Site: B Grimm BIP Power 1 Limited Barometric Pressure (mm Hg): 757  
 Calibrate Location: บริษัท เจริญรุ่งเรือง Temperature (°C): 34  
 Calibrate Date: 1-Sep-22 High Volume ID: BKK\_FS0366  
 Calibration Sheet No.: C-010922-BKK\_FS0366 High Volume Model: TE-5009X  
 Calibrator ID: BKK\_FS0625 High Volume S/N: 4156  
 Calibrator Model: TE-5028A Calibrator Slope: 1.67326  
 Calibrator S/N: 2585 Calibrator Intercept: -0.01954

Test No.	Delta H <sub>2</sub> O (Inch)	Q <sub>std</sub> (m³/min)	I: Chart (CFM)	Linear Regression
1	3.0	1.0374	40	Slope: 37.9856 Intercept: 0.0461 Correlation Coefficient: 0.9972
2	4.2	1.2239	46	
3	5.0	1.3336	50	
4	6.0	1.4590	56	
5	7.0	1.5743	60	



Calibrated by

(Mr. Prommee Sripatmet)  
Field Scientist (2)

Approved by:

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

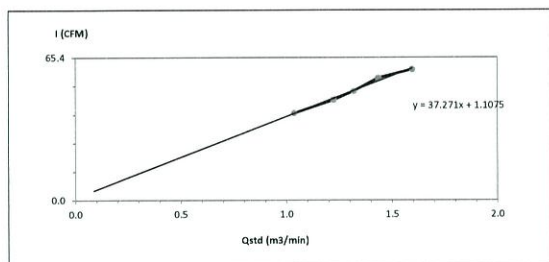
FORM NO.: F 06-073 REVISION NO.: - ISSUE DATE: 14/03/16



### High Volume Air Sampler Calibration Worksheet

Project Site: B Grimm BIP Power 1 Limited Barometric Pressure (mm Hg): 757  
 Calibrate Location: บริษัท เจริญรุ่งเรือง Temperature (°C): 34  
 Calibrate Date: 1-Sep-22 High Volume ID: BKK\_FS1057  
 Calibration Sheet No.: C-010922-BKK\_FS1057 High Volume Model: TE-5009X  
 Calibrator ID: BKK\_FS0625 High Volume S/N: 5500  
 Calibrator Model: TE-5028A Calibrator Slope: 1.67326  
 Calibrator S/N: 2585 Calibrator Intercept: -0.01954

Test No.	Delta H <sub>2</sub> O (Inch)	Q <sub>std</sub> (m³/min)	I: Chart (CFM)	Linear Regression
1	3.0	1.0374	40	Slope: 37.2712 Intercept: 1.1075 Correlation Coefficient: 0.9939
2	4.2	1.2239	46	
3	4.9	1.3203	50	
4	5.8	1.4348	56	
5	7.2	1.5964	60	



Calibrated by

(Mr. Prommee Sripatmet)  
Field Scientist (2)

Approved by:

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

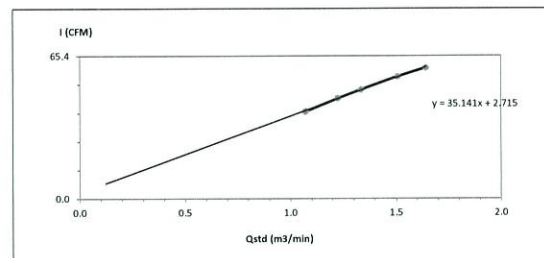
FORM NO.: F 06-073 REVISION NO.: - ISSUE DATE: 14/03/16



### High Volume Air Sampler Calibration Worksheet

Project Site: B Grimm BIP Power 1 Limited Barometric Pressure (mm Hg): 757  
 Calibrate Location: บริษัท เจริญรุ่งเรือง Temperature (°C): 33  
 Calibrate Date: 1-Sep-22 High Volume ID: BKK\_FS0370  
 Calibration Sheet No.: C-010922-BKK\_FS0370 High Volume Model: TE-5009X  
 Calibrator ID: BKK\_FS0625 High Volume S/N: 4798  
 Calibrator Model: TE-5028A Calibrator Slope: 1.67326  
 Calibrator S/N: 2585 Calibrator Intercept: -0.01954

Test No.	Delta H <sub>2</sub> O (Inch)	Q <sub>std</sub> (m³/min)	I: Chart (CFM)	Linear Regression
1	3.2	1.0725	40	Slope: 35.1411 Intercept: 2.7150 Correlation Coefficient: 0.9988
2	4.2	1.2258	46	
3	5.0	1.3357	50	
4	6.4	1.5086	56	
5	7.6	1.6422	60	



Calibrated by

(Mr. Prommee Sripatmet)  
Field Scientist (2)

Approved by:

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

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

## Certificate of Calibration

Represent to Certificate of Calibration ,PTC/07/22072

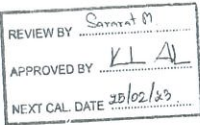
Certificate No.: PTC/07/22072 Page: 1 of 3  
Equipment: Digital Balance Condition: Normal  
Manufacturer: METTLER TOLEDO Serial No: 1123091894  
Model: XP105 ID No: BKK\_EN0004  
Type of Balance: Multi interval

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

Environment Condition: Temperature 21.0 °C ± 0.4 °C  
Humidity 62.8 %RH ± 3.7 %RH  
Air density 1.20 kg/m<sup>3</sup>

Calibration Place: ALS Laboratory Group (Thailand) Co.,Ltd.  
104 Phatthanakarn 40 Phatthanakarn Rd.,  
khwaeng Phatthanakarn, Khet Suan Luang, Bangkok 10250.

The Method used: In house method, PTC-WI-07, base on Euramet cg. 18  
Traceability: This certificate is traceable to the SI units through Thai Calibration Service Co.,Ltd.  
NSC-ONSC Accreditation No.: Calibration 0189  
Date Received: February 25, 2022  
Calibration Date: February 25, 2022  
Issued Date: March 01, 2022  
Calibration By: Mr. Rungroj Metakul



(Mr. Kiangsak Kalasin)  
Reviewed by

Approved By: (Mr. Keattisak Kerdto)  
Laboratory Manager

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

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

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

PTC-FMC-07-02 2 Feb 2020

Represent to Certificate of Calibration ,PTC/07/22072

Certificate No.: PTC/07/22072

Page: 2 of 3

### Measurement Results:

Without Adjustment:

Function Calibration: Non Adjustment

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

Eccentricity test 30 (g)				
Position (g)				
1	2	3	4	5
0.0000	0.0000	0.0000	0.0000	0.0000
Maximum deviation:				0.0000

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

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

Nominal test value (g)	Standard Deviation
100	0.00005

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

Nominal Value (g)	Conventional Mass (g)	Indication (g)	Correction of Balance (g)	Uncertainty (g)	k
40	40.00005	40.0000	0.0000	0.00016	2.11
50	50.00001	50.0000	0.0000	0.00015	2.13
60	60.00003	60.0000	0.0000	0.00016	2.08
70	70.00003	70.0000	0.0000	0.00017	2.07
80	80.00005	80.0001	-0.0001	0.00019	2.04
90	90.00006	90.0001	0.0000	0.00020	2.03
100	100.00002	99.9999	0.0001	0.00018	2.06

Note: Weight of adjust (g)

PTC-FMC-07-02 2 Feb 2020

Represent to Certificate of Calibration ,PTC/07/22072

Certificate No.: PTC/07/22072 Page: 3 of 3

### Measurement Results:

Without Adjustment:

Function Calibration: Non Adjustment

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

Eccentricity test 30 (g)				
Position (g)				
1	2	3	4	5
0.00000	-0.00001	-0.00002	0.00000	0.00000
Maximum deviation:				0.00002

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

Determination of the standard deviation of weighing balance., Readability 0.00001 (g)

Nominal test value (g)	Standard Deviation
20	0.000005

Error of indication: from nominal value., Readability 0.00001 (g)

Nominal Value (g)	Conventional Mass (g)	Indication (g)	Correction of Balance (g)	Uncertainty (g)	k
0	0.000000	0.00000	0.00000	0.000016	2.52
0.1	0.100000	0.10000	0.00000	0.000019	2.00
0.5	0.499999	0.50000	0.00000	0.000019	2.00
2	2.000010	1.99999	0.00002	0.000024	2.00
5	5.000005	5.00001	0.00000	0.000027	2.00
10	10.000015	10.00001	0.00000	0.000031	2.00
20	20.000019	20.00001	0.00001	0.000042	2.00
30	30.000034	30.00006	-0.00003	0.000069	2.00

Note: Weight of adjust (g)

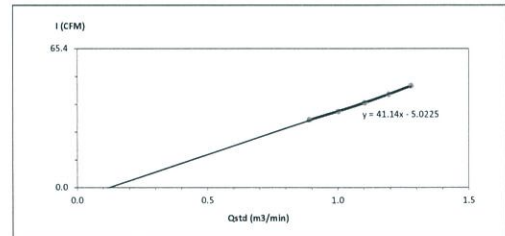
The End of Certificate

PTC-FMC-07-02 2 Feb 2020

### High Volume Air Sampler Calibration Worksheet

Project Site: B Grimm BHP Power 1 Limited Barometric Pressure (mm Hg): 757  
Calibrate Location: กรุงเทพมหานคร Temperature (°C): 34  
Calibrate Date: 1-Sep-22 High Volume ID: BKK-FS0386  
Calibration Sheet No.: C-010922-BKK-FS0386 High Volume Model: TE-5009X  
Calibrator ID: BKK-FS0625 High Volume S/N: 4790  
Calibrator Model: TE-5028A Calibrator Slope: 1.67326  
Calibrator S/N: 2585 Calibrator Intercept: -0.01954

Test No.	Delta H <sub>2</sub> O (inch)	Q <sub>vol</sub> (m <sup>3</sup> /min)	I: Chart (CFM)	Linear Regression
1	2.2	0.8912	32	Slope: 41.1402 Intercept: -5.0225 Correlation Coefficient: 0.9985
2	2.8	1.0029	36	
3	3.4	1.1031	40	
4	4.0	1.1948	44	
5	4.6	1.2799	48	



Calibrated by: (Mr. Prommee Sripanet)  
Field Scientist (2)

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

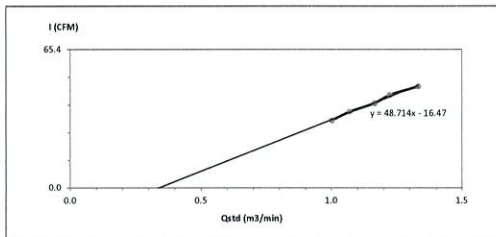




### High Volume Air Sampler Calibration Worksheet

Project Site: B Grimm BIP Power 1 Limited Barometric Pressure (mm Hg): 757  
 Calibrate Location: กรุงเทพมหานคร Temperature (°C): 34  
 Calibrate Date: 1-Sep-22 High Volume ID: BKK\_FS1061  
 Calibration Sheet No.: C-010922-BKK\_FS1061 High Volume Model: TE-5009X  
 Calibrator ID: BKK\_FS0625 High Volume S/N: 5504  
 Calibrator Model: TE-5028A Calibrator Slope: 1.67326  
 Calibrator S/N: 2585 Calibrator Intercept: -0.01954

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	1.0029	32	Slope: 48.7140 Intercept: -16.4700 Correlation Coefficient: 0.9960
2	3.2	1.0707	36	
3	3.8	1.1651	40	
4	4.2	1.2239	44	
5	5.0	1.3336	48	



Calibrated by: *Prom Sr*  
 (Mr. Prommee Sriprattet)  
 Field Scientist(2)

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

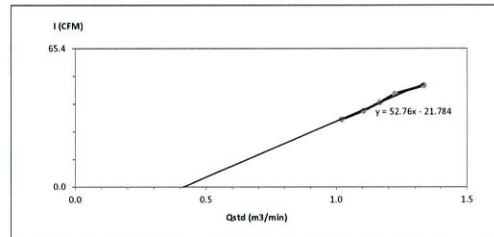
FORM NO.: F 06-074 REVISION NO.: - ISSUE DATE: 14/03/16



### High Volume Air Sampler Calibration Worksheet

Project Site: B Grimm BIP Power 1 Limited Barometric Pressure (mm Hg): 757  
 Calibrate Location: กรุงเทพมหานคร Temperature (°C): 33  
 Calibrate Date: 1-Sep-22 High Volume ID: BKK\_FS0375  
 Calibration Sheet No.: C-010922-BKK\_FS0375 High Volume Model: TE-5009X  
 Calibrator ID: BKK\_FS0625 High Volume S/N: 5196  
 Calibrator Model: TE-5028A Calibrator Slope: 1.67326  
 Calibrator S/N: 2585 Calibrator Intercept: -0.01954

Test No.	Delta H <sub>2</sub> O (inch)	Q <sub>std</sub> (m <sup>3</sup> /min)	I: Chart (CFM)	Linear Regression
1	2.9	1.0219	32	Slope: 52.7596 Intercept: -21.7837 Correlation Coefficient: 0.9936
2	3.4	1.1049	36	
3	3.8	1.1669	40	
4	4.2	1.2258	44	
5	5.0	1.3357	48	



Calibrated by: *Prom Sr*  
 (Mr. Prommee Sriprattet)  
 Field Scientist(2)

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

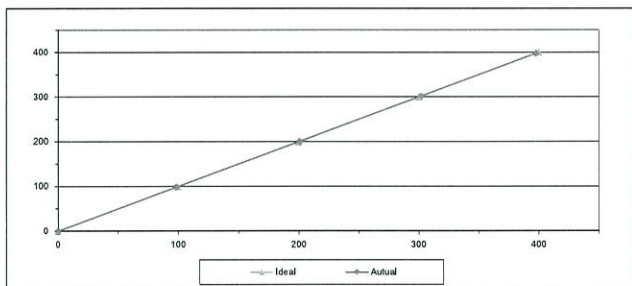
FORM NO.: F 06-074 REVISION NO.: - ISSUE DATE: 14/03/16



### MULTIPOINT CALIBRATION REPORT

Calibration Date: 1-Jul-22 Equipment Name: SO2 Analyzer  
 Manufacturer: Teledyne API Model: T100  
 Serial No.: 1808 Equipment ID: BKK\_FS0727  
 Calibrator Manufacturer: Teledyne API Model: 700  
 Serial No.: 947  
 Std. Gas Concentration (PPM): 56.3 Cylinder No.: GN0027222  
 Cylinder Pressure (psi): 1800 Certified By: Algas Inc.  
 Certified Date: 9-Feb-22 Expired Date: 9-Feb-30

Point	Ideal	Actual	Error	%Error
ZERO	0.00	0.10	0.10	0.10
1	100.00	98.10	-1.90	-1.90
2	200.00	200.80	0.80	0.40
3	300.00	302.00	2.00	0.67
4	400.00	397.70	-2.30	-0.58
AVERAGE (%)				-0.26



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

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

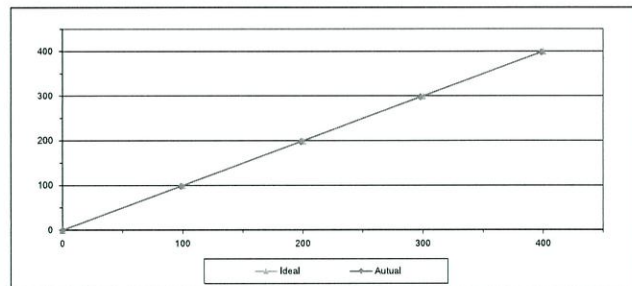
ALS Laboratory Group  
 FORM NO.: F 06-056 REVISION NO.: - ISSUE DATE: 02/04/12



### MULTIPOINT CALIBRATION REPORT

Calibration Date: 1-Jul-22 Equipment Name: SO2 Analyzer  
 Manufacturer: HORIBA Model: APSA-370  
 Serial No.: 8BVW9P1K Equipment ID: BKK\_FS1061  
 Calibrator Manufacturer: Teledyne API Model: 700  
 Serial No.: 947  
 Std. Gas Concentration (PPM): 56.3 Cylinder No.: GN0027222  
 Cylinder Pressure (psi): 1800 Certified By: Algas Inc.  
 Certified Date: 9-Feb-22 Expired Date: 9-Feb-30

Point	Ideal	Actual	Error	%Error
ZERO	0.00	0.10	0.10	0.10
1	100.00	98.50	-1.50	-1.50
2	200.00	198.30	-1.70	-0.85
3	300.00	297.90	-2.10	-0.70
4	400.00	398.50	-1.50	-0.38
AVERAGE (%)				-0.87



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

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

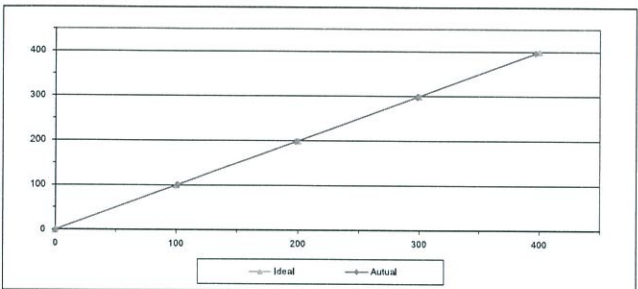
ALS Laboratory Group  
 FORM NO.: F 06-056 REVISION NO.: - ISSUE DATE: 02/04/12



## MULTIPOINT CALIBRATION REPORT

Calibration Date	1-Jul-22	Equipment Name	SO2 Analyzer
Manufacturer	HORIBA	Model	APSA-370
Serial No.	YU8BY9F9	Equipment ID	BKK_FS0799
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	101.30	1.30	1.30
2	200.00	198.10	-1.90	-0.95
3	300.00	298.50	-1.50	-0.50
4	400.00	397.00	-3.00	-0.75
AVERAGE (%)				-0.16



Calibrated By

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

Approved By

(Mr. Sarayuth Jitranont)  
Assistant General Manager

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



63/14-15,67/35-36, Soi Petchkasem 7,7/1, Petchkasem Rd,

Wathapra, Bangkokyai, Bangkok 10600 Thailand.

Tel: (66) 02-8680812#13 Fax: (66) 02-8680860 www.jiranatee.com



## CERTIFICATE OF CALIBRATION

Certificate No.: CL-076-65  
Page 1 of 2

Equipment Name: Data Logger with Temperature  
Sensor  
Manufacturer: Novalyx  
Model: 200-WS-25LB  
Serial No.: A5244  
ID No.: BKK\_FS0887

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

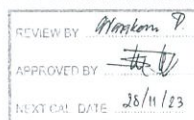
Received date: 23 May 2022  
Calibration date: 30 May 2022  
Issue date: 02 Jun 2022

Reference Used During Calibration  
1. Standard Temperature Probe Model: STS-100 A500, Serial No.: 667682-09, Due date: 23 Mar 2023  
2. Digital Temperature Indicator Model: DTI-1000 A MK II, Serial No.: 671407-00591 Due date: 04 June 2022

Calibration Condition  
Temperature: (23±3)°C  
Relative Humidity: (55±15)%

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

Traceability  
The measurement results are traceable to the international system of units (SI) through National Institute of Metrology Thailand (NIMT) Certificate number: TT-0034-22, Certificate number: ER-0032-21



Calibrated by  
☒ Mr. Sorawit Thachalad  
☐ Miss Jitraporn Lertsomphol



Approved Signatory:   
Mr. Panya Booncharoen  
Calibration Department Manager

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



63/14-15,67/35-36, Soi Petchkasem 7,7/1, Petchkasem Rd,

Wathapra, Bangkokyai, Bangkok 10600 Thailand.

Tel: (66) 02-8680812#13 Fax: (66) 02-8680860 www.jiranatee.com



Certificate No.: CL-076-65  
Page 2 of 2

Result of Calibration: ☒ Without Adjustment ☐ With Adjustment

Calibration Range: 20-40 °C

Function:

This equipment was connected with temperature sensor Model: HMP60 S/N: N0330782

Dimension: Diameter 12mm. Length 80 mm.

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
60	19.98	20.0	0.0	0.30
60	24.98	24.9	-0.1	0.30
60	30.02	29.8	-0.2	0.30
60	35.01	34.6	-0.4	0.30
60	40.01	39.5	-0.5	0.30

UUC\*: Unit Under Calibration

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

★ End of Certificate ★



63/14-15,67/35-36, Soi Petchkasem 7,7/1, Petchkasem Rd,

Wathapra, Bangkokyai, Bangkok 10600 Thailand.

Tel: (66) 02-8680812#13 Fax: (66) 02-8680860 www.jiranatee.com

## CALIBRATION REPORT

Calibration No.: RH-01062022  
Page 1 of 1 Pages

Measurement Item: Relative humidity with data logger  
Manufacturer: Novalyx  
Model/Type: 200-WS-25LB  
Serial Number: A5244  
ID No.: BKK\_FS0887  
Customer: ALS laboratory group (Thailand) Co., Ltd.  
104 Phatthakanan 40, Phatthakanan Rd, Khwaeng Suan Luang, Khet Suan Luang, Bangkok 10250 Thailand.

Environmental Condition:

The measurement was carried out in an ambient temperature of (25±3)°C and relative humidity of (50±15)%.

Measurement Method:

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

Traceability:

This instrument was calibrated using standard equipment whose accuracy is traceable through National Institute of Standards and Technology to the international system of units (SI) via MCS Calibration, Inc. Certificate number: 20314-101, Due date: Mar 14, 2023

Measurement Date: Jun 01, 2022  
Issued Date: Jun 02, 2022

Measurement Results:

This equipment was connected with indoor air quality probe and Displayed (RH) on display. Model: HMP60. Serial number: N0330782

Calibration was performed in the range of 20%RH to 80%RH

The results of calibration are reported in table below:

Determined (%RH)	Standard Reading (%RH)	UUC Reading (%RH)	Error (%RH)	Uncertainty ±(%RH)
20	20.02	18.9	-1.1	0.51
50	50.22	49.4	-0.8	0.51
80	80.55	79.3	-1.3	0.65

Performed by  
☒ Mr. Sorawit Thachalad  
☐ Miss Jitraporn Lertsomphol



Approved Signatory:   
Mr. Panya Booncharoen  
Calibration Department Manager

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



## CERTIFICATE OF CALIBRATION

Certificate No: WS-01062022  
Page 1 of 2 pages

**Measurement Item** : Cup anemometer with data logger

**Manufacturer** : Data logger: Novallux  
Cup anemometer: Novallux

**Model/Type** : Data logger: 200-WS-25LB  
Cup anemometer: WS-02P

**Serial Number** : Data logger: A5244  
Cup anemometer: -

**ID No** : Data logger: BKK FS08B7  
Cup anemometer: -

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

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

**Test Conditions** : Air temperature 24.7 ±0.6 °C  
Air pressure 1003.5 ±0.4 hPa  
Relative air humidity 51.1 ±3.5 %RH

**Calibration Procedure** : Calibration was carried out base on:  
ISO 6140-12-1 ED1: 2005-Power Performance Measurements of Electricity Producing Wind Turbines.  
MEASNET Anemometer Calibration Procedure - Version 2: 2005.

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

**Measurement Date** : Jun 01, 2022.  
**Issued Date** : Jun 02, 2022.

Calibrated by  
☒ Mr. Sorawit Thachalad  
☐ Miss Jitraporn Lertsomphol



Approved Signatory:   
Mr. Parniya 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.

Continuation of Certificate of Calibration Number

Certificate No: WS-01062022  
Page 2 of 2 Pages

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

V <sub>ref</sub> Reading m/s	V <sub>unc</sub> Reading m/s	Error (m/s)	Uncertainty (%)
2.086	2.0	-0.1	2.4
4.179	4.1	-0.1	1.2
6.01	6.0	0.0	0.95
8.00	8.1	0.1	0.66
10.00	10.1	0.1	0.66
12.00	12.1	0.1	0.69
13.99	14.2	0.2	0.69
15.98	16.3	0.3	0.43
16.00	16.3	0.3	0.43
12.99	13.1	0.1	0.52
11.01	11.1	0.1	0.48
9.03	9.0	0.0	0.64
7.03	7.0	0.0	0.81
5.184	5.2	0.0	0.83
3.019	3.1	0.1	1.4
1.050	0.9	-0.2	4.6

UUC\*: Unit Under Calibration

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

### Appendix 1: Instrumentations

NO	Sensor	Manufacturer	Model/Type	Calibration Date	Certificate Report Number	Range
1	Pitot static	TESTO INC.	06302145	Aug 07, 2021	MW-0034-21	5 – 30 m/s
2	Precision Differential Pressure Meter	Zorglab	DFM2500	Aug 07, 2021	MW-0034-21	5 – 30 m/s
3	Air velocity transducer (hot wire)	TSI INC	8455-12	Aug 08, 2021	MW-0035-21	0 – 5 m/s
4	Temperature	Zorglab	DGH-Tier	March 30, 2022	PH-03232022	-30 – 70 °C
5	Relative humidity	Zorglab	DGH-Tier	March 30, 2022	PH-03232022	0 – 100 %RH
6	Atmospheric pressure	Zorglab	DGH-Tier	March 30, 2022	PH-03232022	600 – 1100 hPa
7	Wind tunnel	CSROM	MP3300	-	-	0 – 60 Hz

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



## CERTIFICATE OF CALIBRATION

Certificate No: WD-01062022  
Page 1 of 2 pages

**Measurement Item** : Wind direction sensor with data logger

**Manufacturer** : Data logger: Novallux  
Wind direction sensor: Novallux

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

**Serial Number** : Data logger: A5244  
Wind direction sensor: -

**ID No** : Data logger: BKK FS08B7  
Wind direction sensor: -

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

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

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

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

**Traceability:**  
The measurement results are traceable to the international system of units (SI) through Certificate No: G21086014, Certificate No: KWS64/0025.

**Measurement Date** : Jun 01, 2022.  
**Issued Date** : Jun 02, 2022.

Calibrated by  
☒ Mr. Sorawit Thachalad  
☐ Miss Jitraporn Lertsomphol



Approved Signatory:   
Mr. Parniya Booncharoen  
Calibration Department Manager

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Continuation of Certificate of Calibration Number

Certificate No: WD-01062022  
Page 2 of 2 pages

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

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

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

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



## CERTIFICATE OF CALIBRATION

Certificate No: WS-02052021  
Page 1 of 2 pages

**Measurement Item:** Cup anemometer with data logger  
**Manufacturer:** Data logger: Novolyx  
Cup anemometer: Novolyx  
**Model/Type:** Data logger: 200-WS-251B  
Cup anemometer: WS-02F  
**Serial Number:** Data logger: A5263  
Cup anemometer:  
**ID No:** Data logger: BKH-F80910  
Cup anemometer:  
**Customer:** A.S. laboratory group (Thailand) co., Ltd.  
104 Phatthanarat 40, Phatthanarat Rd, Kwangwong San Luang, Khwaeng San Luang, Bangkok 10250 Thailand  
**Test Conditions:** Wind tunnel cross test section area: 900 cm<sup>2</sup>  
Anemometer installation area: 100 cm<sup>2</sup>  
Diameter of mounting plate: 80 mm  
Flowage ratio of test object: 0.111 [-]  
**Test Conditions:** Air temperature: 22.9 ±0.5 °C  
Air pressure: 1015.6 ±0.4 hPa  
Relative air humidity: 72.5 ±5.5 %RH  
**Calibration Procedure:** Calibration was carried out based on:  
ISO 9140-1P.1: 2015 Power Performance Measurements of Electrically Powered Wind Turbines  
MCA/NET Anemometer Calibration Procedure - Version 2: 2009  
**Traceability:** This calibration documents the traceability to national standard, which realize the unit of measurements according to the international system of units (SI) through National Institute of Metrology (Thailand) NIMT.  
**Measurement Date:** May 05, 2021  
**Issued Date:** May 11, 2021

REVIEW BY: *[Signature]*  
APPROVED BY: *[Signature]*  
NEXT CAL. DATE: 4/11/22

Calibrated by:  
☐ Mr. Sorawat Thaiduead  
☒ Mr. Rungroed Malinpong



Approved Signatory: *[Signature]*  
Mr. Panya Rongkhamen  
Technical Support  
and Calibration Manager

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Continuation of Certificate of Calibration Number

Certificate No: WS-02052021  
Page 2 of 2 Pages

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

V <sub>act</sub> Reading m/s	V <sub>ref</sub> Reading m/s	Error (m/s)	Uncertainty (%)
2.030	1.7	-0.3	2.6
4.035	3.9	-0.1	1.2
6.05	6.0	0.0	0.98
7.99	8.0	0.0	0.76
10.00	10.2	0.2	0.67
12.00	12.3	0.3	0.69
14.04	14.4	0.4	0.52
15.97	16.5	0.6	0.85
14.98	16.3	0.3	0.49
12.99	13.3	0.3	0.61
11.00	11.1	0.1	0.80
9.00	9.1	0.1	0.76
6.99	7.0	0.0	1.0
5.065	5.0	-0.1	1.2
2.969	2.8	-0.2	2.2
1.066	0.7	-0.4	6.9

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

### Appendix 1: Instrumentation

NO	Sensor	Manufacturer	Model/Type	Calibration Date	Certificate Report Number	Range
1	Hot wire	10910 INC	0332145	July 16, 2020	MA-0035-20	5 - 30 m/s
2	Precision Differential Pressure Meter	Zorgab	DPM500	July 16, 2020	MA-0035-20	5 - 30 m/s
3	Air velocity transducer (hot wire)	10 INC	8455-12	July 20, 2020	MA-0034A-20	0 - 8 m/s
4	Temperature	Zorgab	DSR-TMP	March 30, 2021	01-007-64	-30 - 70 °C
5	Relative humidity	Zorgab	DSR-TMP	March 30, 2021	RH-C0032021	0 - 100 %RH
6	Ambient pressure	Zorgab	DSR-TMP	March 30, 2021	BPC-0032021	650 - 1100 hPa
7	Wind tunnel	CISOM	M73300	-	-	0 - 60 Hz

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



## CERTIFICATE OF CALIBRATION

Certificate No: WD-01052021  
Page 1 of 2 pages

**Measurement Item:** Wind direction sensor with data logger  
**Manufacturer:** Data logger: Novolyx  
Wind direction sensor: Novolyx  
**Model/Type:** Data logger: 200-WS-251B  
Wind direction sensor: WS-02F  
**Serial Number:** Data logger: A5263  
Wind direction sensor:  
**ID No:** Data logger: BKH-F80910  
Cup anemometer:  
**Customer:** A.S. laboratory group (Thailand) Co., Ltd.  
104 Phatthanarat 40, Phatthanarat Rd, Kwangwong San Luang, Khwaeng San Luang, Bangkok 10250 Thailand  
**Environmental Condition:** The measurement was carried out in an ambient temperature of 22±0.1°C, and relative humidity of 60±10%  
**Measurement Method:** The wind direction sensor calibration according to the impeller method with reference and measurement electronic theodolite and the laser is used for axis control. The measurement were taken at 45° intervals in clockwise and counter-clockwise directions.  
**Note:** The UUC was warmed up for 1 hour prior to the calibration being performed.  
**Traceability:** The measurement results are traceable to the international system of units (SI) through Certificate No. 00563-07-0045, Certificate No. KW503/0044.  
**Measurement Date:** May 11, 2021  
**Issued Date:** May 12, 2021

Performed by:  
☐ Mr. Sorawat Thaiduead  
☒ Mr. Rungroed Malinpong



Approved Signatory: *[Signature]*  
Mr. Panya Rongkhamen  
Technical Support  
and Calibration Manager

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Continuation of Certificate of Calibration Number

Certificate No: WD-01052021  
Page 2 of 2 pages

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

NO	Turning Direction	Nominal Angle (°)	Standard Reading (°)	UUC* Reading (°)	Error (°)	Uncertainty x(°)
1	Clockwise	0/360	360	359	-1	3.0
2		45	45	41	-4	3.0
3		90	90	87	-3	3.0
4		135	135	134	-1	3.0
5		180	180	180	0	3.0
6		225	225	227	2	3.0
7		270	270	272	2	3.0
8		315	315	319	4	3.0
9	Counter Clockwise	0/360	360	359	-1	3.0
10		45	45	41	-4	3.0
11		90	90	87	-3	3.0
12		135	135	134	-1	3.0
13		180	180	180	0	3.0
14		225	225	227	2	3.0
15		270	270	272	2	3.0
16		315	315	319	4	3.0

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

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







63/14-15,67/35-36, Soi Petchkasem 7/71, Petchkasem Rd,  
Wathapra, Bangkokyai, Bangkok 10600 Thailand.  
Tel: (66) 02-8680812#13 Fax: (66) 02-8680860 www.jiranatee.com



## CERTIFICATE OF CALIBRATION

Certificate No.: CL-028-64  
Page 1 of 2

Equipment Name: Data Logger with Temperature  
Sensor

Manufacturer: Novalyx  
Model: 200-WS-25LB  
Serial No.: A5263  
ID No.: BKK\_FS0910

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

Received date: 30 Apr 2021  
Calibration date: 07 May 2021  
Issue date: 11 May 2021

Reference Used During Calibration  
1. Standard Temperature Probe Model: STS-100 A500,  
Serial No.: 667682-09, Due date: 25 Mar 2022  
2. Digital Temperature Indicator Model: DTI-1000-A MK  
II, Serial No.: 671407-00591 Due date: 20 May 2021

Calibration Condition  
Temperature: (23±3)°C  
Relative Humidity: (55±15)%

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

Traceability  
The measurement results are traceable to the  
international system of units (SI) through National  
Institute of Metrology Thailand (NIMT) Certificate  
number: TT-0036-21, Certificate number: ER-0071-  
20

Calibrated by  
☐ Mr. Sorawit Thachalad  
☒ Mr. Bongkroch Malithong



Approved Signatory:   
Mr. Parniya Booncharoen  
Technical Support  
And Calibration Manager



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Certificate No.: CL-028-64  
Page 2 of 2

Result of Calibration: ☒ Without Adjustment ☐ With Adjustment

Calibration Range: 20°C - 40°C

### Function:

This equipment was connected with temperature sensor Model: HMP60 S/N: N0330786

Dimension: Diameter 12mm, Length 80 mm.

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
60	20.045	19.6	-0.4	0.19
60	25.041	24.6	-0.4	0.19
60	30.035	29.5	-0.5	0.19
60	35.027	34.5	-0.5	0.19
60	40.020	39.4	-0.6	0.19

UUC\*: Unit Under Calibration

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

★ End of Certificate ★



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## CALIBRATION REPORT

Calibration No.: RH101052021  
Page 1 of 1 Pages

Measurement Item: Relative humidity with data logger

Manufacturer: Data logger: Novalyx  
Relative humidity sensor: Novalyx

Model/Type: Data logger: 200-WS-25LB  
Relative humidity sensor: HMP60

Serial Number: Data logger: A5263  
Relative humidity sensor: N0330786

ID No: Data logger: BKK\_FS0910  
Relative humidity sensor: -

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

Environmental Condition:  
The measurement was carried out in an ambient temperature of (23±3)°C, and relative humidity of (50±10)%.

Measurement Method:  
The Relative humidity with display, Unit Under Calibration (UUC) was calibrated by comparison method with the equivalent of  
standard salt solution (NaClO4, Potassium Acetate, Magnesium Nitrate, KCl, Potassium Chloride) to determine the errors

Measurement Date: May 07, 2021  
Issued Date: May 11, 2021

Measurement Results:  
The results of calibration are reported in table below:

Standard salt solution	Standard (RH%)	UUC Reading	Error
CH <sub>3</sub> COOK Potassium Acetate	29.51	29.6	0.0
Mg(NO <sub>3</sub> ) <sub>2</sub> Magnesium Nitrate	52.69	51.3	-1.4
KCl Potassium Chloride	84.54	81.8	-2.7

Performed by  
☐ Mr. Sorawit Thachalad  
☒ Mr. Bongkroch Malithong



Approved Signatory:   
Mr. Parniya Booncharoen  
Technical Support  
and Calibration Manager

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63/14-15,67/35-36, Soi Petchkasem 7/71, Petchkasem Rd,  
Wathapra, Bangkokyai, Bangkok 10600 Thailand.  
Tel: (66) 02-8680812#13 Fax: (66) 02-8680860 www.jiranatee.com



## CERTIFICATE OF CALIBRATION

Certificate No.: CL-077-65  
Page 1 of 2

Equipment Name: Data Logger with Temperature  
Sensor

Manufacturer: Novalyx  
Model: 200-WS-25LB  
Serial No.: A5261  
ID No.: BKK\_FS0888

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

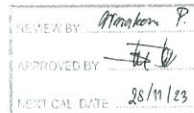
Received date: 23 May 2022  
Calibration date: 30 May 2022  
Issue date: 02 Jun 2022

Reference Used During Calibration  
1. Standard Temperature Probe Model: STS-100 A500,  
Serial No.: 667682-09, Due date: 23 Mar 2023  
2. Digital Temperature Indicator Model: DTI-1000-A MK  
II, Serial No.: 671407-00591 Due date: 04 June 2022

Calibration Condition  
Temperature: (23±3)°C  
Relative Humidity: (55±15)%

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

Traceability  
The measurement results are traceable to the  
international system of units (SI) through National  
Institute of Metrology Thailand (NIMT) Certificate  
number: TT-0034-22, Certificate number: ER-0032-  
21



Calibrated by  
☒ Mr. Sorawit Thachalad  
☐ Miss Jitraporn Lertsomphon



Approved Signatory:   
Mr. Parniya Booncharoen  
Calibration Department Manager

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OBTAINED IN WRITING FROM THE LABORATORY.

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

Function:  
This equipment was connected with temperature sensor Model : HMP60 S/N : N0330783  
Dimension : Diameter 12mm, Length 80 mm.

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
60	19.98	20.0	0.1	0.30
60	24.98	24.7	0.3	0.30
60	30.02	29.6	-0.4	0.30
60	35.01	34.5	-0.5	0.30
60	40.01	39.3	-0.7	0.30

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

★ End of Certificate ★



## CALIBRATION REPORT

Calibration No.: RH-02062022  
Page 1 of 1 Pages

Measurement Item : Relative humidity with data logger  
Manufacturer : Novolyx  
Model/Type : 200-WS-25LB  
Serial Number : A5261  
ID No. : BKK\_F50888  
Customer : ALS laboratory group (Thailand) Co., Ltd.  
104 Phatthanakan 40, Phatthanakan Rd, Khwaeng Suan Luang, Khet Suan Luang, Bangkok 10260 Thailand.

Environmental Condition:  
The measurement was carried out in an ambient temperature of (25±3)°C, and relative humidity of (60±15)%.

Measurement Method:  
Unit Under Calibration (UUC) was calibrated by comparison method with standard thermo hygrometer in the humidity generator chamber to determine the errors.

Traceability:  
This instrument was calibrated using standard equipment whose accuracy is traceability through National Institute of Standards and Technology to the international system of units (SI) via MCS Calibration, Inc. Certificate number: 20314-101. Due date: Mar 14, 2023.

Measurement Date : Jun 01, 2022  
Issued Date : Jun 02, 2022

Measurement Results:  
This equipment was connected with indoor air quality probe and Displayed (URI) on display. Model: HMP60, Serial number: N0330783

Calibration was performed in the range of 20%RH to 80%RH  
The results of calibration are reported in table below.

Determined (%RH)	Standard (Reading) (%RH)	UUC (Reading) (%RH)	Error (%RH)	Uncertainty (%RH)
20	20.02	18.8	-1.2	0.61
50	50.22	49.4	-0.8	0.57
80	80.56	79.3	-1.3	0.69

Performed by  
☒ Mr. Sorawit Thachad  
☐ Miss Jitaporn Lertsomphol



Approved Signatory:   
Mr. Pailiya Booncharoen  
Calibration Department Manager

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## CERTIFICATE OF CALIBRATION

Certificate No.: WS-02062022  
Page 1 of 2 pages

Measurement Item : Cup anemometer with data logger

Manufacturer : Data logger: Novolyx  
Cup anemometer: Novolyx

Model/Type : Data logger: 200 WS 25LB  
Cup anemometer: WS 02P

Serial Number : Data logger: A5261  
Cup anemometer: -

ID No : Data logger: BKK\_F50888  
Cup anemometer: -

Customer : ALS laboratory group (Thailand) co., Ltd.  
104 Phatthanakan 40, Phatthanakan Rd, Khwaeng Suan Luang, Khet Suan Luang, Bangkok 10260 Thailand

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

Test Conditions : Air temperature : 24.7 ±0.8 °C  
Air pressure : 1005.2 ±0.4 hPa  
Relative air humidity : 48.1 ±3.5 %RH

Calibration Procedure : Calibration was carried out base on:  
ISO 6140-12-1 Ed.1: 2005 Power Performance Measurements of Electricity Producing Wind Turbines.  
IEC61400-12-1 Ed.1: 2005 Power Performance Measurements of Electricity Producing Wind Turbines.  
IEC61400-12-1 Ed.1: 2005 Power Performance Measurements of Electricity Producing Wind Turbines.  
IEC61400-12-1 Ed.1: 2005 Power Performance Measurements of Electricity Producing Wind Turbines.

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

Measurement Date : Jun 01, 2022  
Issued Date : Jun 02, 2022

Calculated by:  
☒ Mr. Sorawit Thachad  
☐ Miss Jitaporn Lertsomphol



Approved Signatory:   
Mr. Pailiya Booncharoen  
Calibration Department Manager

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Continuation of Certificate of Calibration Number

Certificate No.: WS-02062022  
Page 2 of 2 Pages

Result of calibration: ☒ Without adjustment ☐ With adjustment  
Calibration is in the range of 1 - 16 m/s at a calibration interval of 1 m/s.

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

V <sub>ref</sub> Reading m/s	V <sub>unc</sub> Reading m/s	Error (m/s)	Uncertainty (%)
2.087	2.0	0.1	2.4
4.140	4.2	0.1	1.0
6.02	6.0	0.0	0.88
8.00	8.0	0.0	0.74
10.00	10.0	0.0	0.59
11.99	12.1	0.1	0.55
14.02	14.3	0.3	0.42
16.00	16.4	0.4	0.63
15.01	15.4	0.4	0.39
12.97	13.1	0.1	0.69
11.00	11.0	0.0	0.62
9.01	9.0	0.0	0.66
7.01	7.0	0.0	0.65
5.186	5.2	0.0	0.96
3.003	3.1	0.1	1.5
1.053	0.8	-0.3	4.8

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

### Appendix 1: Instrumentations

NO	Sensor	Manufacturer	Model/Type	Calibration Date	Certificate Report Number	Range
1	Humidity	TECSTO INC	56352145	Aug 07, 2022	MR-0034-21	5 - 95 %RH
2	Pressure Differential Pressure Meter	Zuglitz	DPN2500	Aug 07, 2021	MR-0034-21	5 - 30 m/s
3	Air velocity transducer (hot wire)	TS INC	8455-12	Aug 08, 2021	MR-0035-21	0 - 5 m/s
4	Temperature	Zuglitz	DSH-TMP	March 30, 2022	CL-027-65	-50 - 70 °C
5	Relative humidity	Zuglitz	DSH-TMP	March 30, 2022	PH-03032022	0 - 100 %RH
6	Atmospheric pressure	Zuglitz	DSH-TMP	March 30, 2022	PH-03032022	500 - 1100 mPa
7	Wind tunnel	CSM	MP3300			0 - 50 m/s

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





## CERTIFICATE OF CALIBRATION

Certificate No: WD-02062022  
Page 1 of 2 pages

**Measurement Item** : Wind direction sensor with data logger,  
**Manufacturer** : Data logger: Novallux  
: Wind direction sensor: Novallux  
**Model/Type** : Data logger: 200-WS-25LB  
: Wind direction sensor: WS-02P  
**Serial Number** : Data logger: A5261  
: Wind direction sensor :  
**ID No** : Data logger: BKK\_F08088  
: Wind direction sensor :  
**Customer** : ALS laboratory group (Thailand) co., Ltd.  
: 104 Phatthanakan 40, Phatthanakan Rd, Khwaeng Suan Luang, Khet Suan Luang, Bangkok 10250 Thailand.

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

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

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

**Traceability:**  
The measurement results are traceable to the international system of units (SI) through Certificate No. Q21080014. Certificate No: HWS64/0026.

**Measurement Date** : Jun 01, 2022  
**Issued Date** : Jun 02, 2022

Calibrated by  
☒ Mr. Sorawit Thachalad  
☐ Miss Jitraporn Lertsomphol



Approved Signatory:   
Mr. Parinya Booncharoen  
Calibration Department Manager

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Continuation of Certificate of Calibration Number

Certificate No: WD-02062022  
Pages 2 of 2 pages

Result of calibration: ☐ Without adjustment ☒ With adjustment.  
Calibration in the range of 0 - 360 ° at a calibration interval of 45°.

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

NO	Turning Direction	Nominal Angle (°)	Standard Reading (°)	UUC* Reading (°)	Error (°)	Uncertainty ±(°)
1	Clockwise	0/360	360	359	-1	3.0
2		45	45	41	-4	3.0
3		90	90	87	-3	3.0
4		135	135	133	-2	3.0
5		180	180	181	1	3.0
6		225	225	229	4	3.0
7		270	270	274	4	3.0
8		315	315	319	4	3.0
9	Counter Clockwise	0/360	360	359	-1	3.0
10		45	45	41	-4	3.0
11		90	90	87	-3	3.0
12		135	135	133	-2	3.0
13		180	180	181	1	3.0
14		225	225	229	4	3.0
15		270	270	274	4	3.0
16		315	315	319	4	3.0

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

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



Accredited calibration laboratory  
ISO/IEC 17025:2017  
No: 158-15/1025  
CALIBRATION 0367

Air speed measurement laboratory  
Calibration services department.

REVIEW BY:   
APPROVED BY:   
NEXT CAL DATE: 23/9/24

Certificate Number

CL 007-65

## CERTIFICATE OF CALIBRATION

Page 1 of 2 Pages

**MEASUREMENT ITEM** : Cup anemometer  
**MANUFACTURER** : Novallux  
**MODEL/TYPE** : Sensor: WS-02P  
: Data logger: 200-WS-25LB  
**SERIAL NUMBER** : Sensor: -  
: Data logger: A4903  
**ID NUMBER** : BKK\_F50159  
**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** : 09 Nov 2022  
**MEASUREMENT DATE** : 23 Nov 2022  
**ISSUE DATE** : 25 Nov 2022

### ENVIRONMENTAL CONDITIONS:

Ambient condition in the laboratory are as follow:  
Temperature : 23.0 ± 3.0 °C  
Relative Humidity : 55.0 ± 15.0 %RH  
Atmospheric Pressure : 1010.10 hPa

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

**CALIBRATION 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> : -  
Blockage ratio of test object<sup>4</sup> : 0.111 [-]

**Preconditioning** : 24 hours at ambient conditions.  
**Measurement Condition** : The average values during measurement are (24.2) °C, (45.0) %RH and (1007.2) hPa.

### TABULATION OF RESULTS:

The table on next page give the measured values.



Approved signatory:   
Mr. Parinya Booncharoen  
Calibration Department Manager

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

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Certificate Number

CL-007-65

Page 2 of 2 Pages

### MEASUREMENT RESULTS<sup>5</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 <sub>ref</sub> (m/s)	Temp. wind tunnel (°C)	Temp. room (°C)	V <sub>UUC</sub> (m/s)	Error (m/s)	U (k=2) (m/s)
0.993	24.10	24.15	0.8	-0.2	0.16
2.054	24.24	24.15	1.9	-0.2	0.16
3.028	24.10	24.15	2.9	-0.1	0.22
4.220	24.14	24.15	3.9	-0.4	0.20
5.05	23.98	24.15	4.9	-0.2	0.17
6.04	24.30	24.15	5.9	-0.2	0.18
7.14	23.90	24.15	6.9	-0.2	0.19
8.27	24.24	24.15	8.0	-0.3	0.19
9.21	23.92	24.15	9.0	-0.2	0.23
10.20	24.10	24.15	9.9	-0.3	0.22
11.28	24.00	24.15	11.0	-0.2	0.20
12.27	24.00	24.15	12.0	-0.2	0.24
13.34	23.96	24.15	13.1	-0.3	0.23
14.41	23.94	24.15	14.1	0.3	0.22
15.40	23.94	24.15	15.1	0.3	0.23
16.48	24.00	24.15	16.1	-0.4	0.24

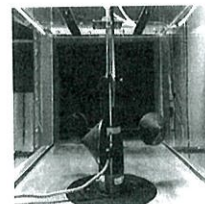
### Remark:

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

<sup>5</sup> Velocity of standard

<sup>5</sup> Velocity of Unit Under Calibration

### PHOTO OF CALIBRATION SET-UP



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



Certificate Number
CL 007-65

## CERTIFICATE OF CALIBRATION

Page 1 of 2 Pages

**MEASUREMENT ITEM** : Wind Direction Sensor  
**MANUFACTURER** : Novayn  
**MODEL/TYPE** : Sensor: WS-02F  
Data logger: 200 WS-25LB  
**SERIAL NUMBER** :  
**ID NUMBER** : Data logger: A4903  
BKK\_150159  
**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** : 15 Nov 2022  
**MEASUREMENT DATE** : 23 Nov 2022  
**ISSUE DATE** : 25 Nov 2022

### ENVIRONMENTAL CONDITIONS:

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

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

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

**Preconditioning** : 24 hours at ambient conditions.  
**Measurement Condition** : The average values during measurement are (24.5)°C, (44.6) %RH and (1009.5) hPa.

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

Calibrated by:  
P. Mr. Soravit Thakulal  
J. Miss Jitraporn Lertsomphol



Approved signatory:  
Mr. Paranya 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 "to"

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Page 2 of 2 Pages

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

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

Air speed	D <sub>cal</sub>	D <sub>ref</sub>	Error	U (k=2)
m/s	Degree (°)	Degree (°)	Degree (°)	Degree (°)
	0.001	0	0	0.58
	45.000	43	-2	0.76
	90.000	88	-2	0.74
	135.000	133	-3	0.76
5.05	180.000	179	-1	0.68
	225.001	226	1	0.68
	270.000	271	1	0.74
	315.000	318	3	0.58

### Remark:

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

<sup>1</sup> Direction of standard

<sup>2</sup> Direction of Unit Under Calibration

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



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)  
CORPORATE SERVICES & EQUIPMENT CALIBRATION AND TESTING SERVICES  
531/44 PATHANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG BANGKOK 10250  
TEL: 0-2717-9000-21 FAX: 0-2719-9484



Cert.No.: 21CH452  
Page.: 1 of 3

## Certificate of Calibration

**Equipment :** pH Meter  
**Manufacturer :** Mettler Toledo  
**Model :** SevenCompact S220  
**Serial No. :** B520948426  
**ID No. :** BKK\_EN0072  
**Condition As-Received:** Used item  
**Received Date :** 24 March 2021  
**Calibration Date :** 26 March 2021  
**Reference :** 2103-1008DSC-1  
**Submitted by :** ALS Laboratory Group (Thailand) Co., Ltd.  
104 Phatthanakan 40, Phatthanakan Rd.,  
Khwaeng Phatthanakan, Khet Suan Luang,  
Bangkok 10250 Thailand  
**Ambient Temperature :** (25 ± 2.5) °C  
**Relative Humidity :** (50 ± 15) %  
**Calibration Procedure :** In-house method :  
- CP-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 Lernagatrakul

**Approved by :** Malee Butkruea  
Approved Signatory

(✓) Malee Butkruea  
( ) Sathip Meangmai  
( ) Warakorn Lernagatrakul

**Issue Date :** 31 March 2021

The Uncertainties are for a confidence probability of approximately 95%

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Approval of the head of Corporate Services & Equipment Calibration and Testing Services

A 0026590



### Condition of this calibration result

1. Reference Standard Instrument : -

Instrument	Serial No.	ID No.	Cert. No.	Due Date
1) Document Process Calibrator	1385032	130RC022	20E4213	24 Nov 2021
2) Ref. Standard Thermometer	4982054	110RC044	20I1233	15 Oct 2021

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

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

Buffer Solution	Manufacturer	Lot No.	Exp. date
pH 4.008	CPA chem	706694	06 Sep 2022
pH 6.985	CPA chem	722285	19 Dec 2021
pH 10.012	CPA chem	722287	19 Dec 2021

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	(±mV)	k
pH Meter	4.000	177.48	177.4	0.058	2.00
S/N.: B520948426	7.000	0.00	-0.1	0.058	2.00
	10.000	-177.48	-177.5	0.058	2.00

Malee

a 1048959





Cert.No.: 21CH452  
Page.: 3 of 3

#### Calibration Results

Function : pH Measurement

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

Unit Under Calibration	Standard pH Buffer Solution	Actual pH Reading	Actual mV Reading (mV)	Uncertainty of pH measurement ( $\pm$ )	Coverage factor $k$
pH Electrode S/N.: 9265091	4.008	4.010	150.3	0.0048	2.05
	6.985	6.989	-22.5	0.0077	2.00
	10.012	10.011	-193.7	0.013	2.00

Function : Temperature Measurement

(\*) Without adjustment

This equipment was connected with Temperature Probe;

- Model : InLab Expert Pro-ISM  
- Serial No. : 9265091  
Dimension of probe;  
- Length : 120 mm.  
- Diameter : 12 mm.  
- Immersion Depth : 100 mm.

Calibration Point ( $^{\circ}\text{C}$ )	Standard Temperature ( $^{\circ}\text{C}$ )	UUC* Reading ( $^{\circ}\text{C}$ )	Error ( $^{\circ}\text{C}$ )	Uncertainty of measurement ( $\pm$ $^{\circ}\text{C}$ )	Coverage factor $k$
25.0	25.003	25.2	0.197	0.20	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 %.

-o0o-

Malu.

a 1048958



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



Cert.No.: 22CH1222  
Page.: 1 of 2

## Certificate of Calibration

Equipment : pH Meter  
Manufacturer : Mettler Toledo  
Model : Seven Compact S220  
Serial No. : B520948426  
ID No. : BKK\_EN0072  
Condition As-Received: Used Item  
Received Date : 09 September 2022  
Calibration Date : 12 September 2022  
Reference : 2209-0312DSC-1  
Submitted by : ALS Laboratory Group (Thailand) Co.,Ltd.  
104 Phatthanakan 40, Phatthanakan Rd.,  
Khwaeng Phatthanakan, Khet Suan Luang,  
Bangkok 10250 Thailand

Ambient Temperature : (25  $\pm$  2.5)  $^{\circ}\text{C}$   
Relative Humidity : (50  $\pm$  15) %  
In - house method :  
- CP-CH5 by direct measurement with standard voltage calibrator and direct measurement with certified reference material (CRM)

Calibrated by : Warakorn Lernagatrakul

Approved by :   
Approved Signatory

( ) Malee Bulkruea  
( ) Sathip Meangmai  
( ) Warakorn Lernagatrakul

Issue Date : 15 September 2022

The Uncertainties are for a confidence probability of approximately 95%

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Cert. No.: 22CH1222  
Page.: 2 of 2

#### Condition of this calibration result

1. Reference Standard Instrument : -

Instrument	Serial No.	ID No.	Cert. No.	Due Date
1) Document Process Calibrator	54030049	130RC116	22E2769	24 Aug 2023

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

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

Buffer Solution	Manufacturer	Lot No.	Exp. date
pH 4.008	CPA chem	823320	20 June 2024
pH 6.985	CPA chem	794122	14 Feb 2023
pH 10.008	CPA chem	823323	20 June 2023

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

#### Calibration Results

Function : mV Measurement

Performing standard curve by Fluke at pH (4,7,10)

Unit Under Calibration	Nominal Value		Standard Voltage Input		Actual Reading		Uncertainty of Measurement ( $\pm$ mV)	Coverage factor $k$
	pH	mV	mV	pH	mV	pH		
pH Meter S/N.: B520948426	4.000	177.48	177.4	4.000	0.058	0.058	2.00	2.00
	7.000	0.00	0.0	7.000	0.058	0.058	2.00	2.00
	10.000	-177.48	-177.5	10.000	0.058	0.058	2.00	2.00

Function : pH Measurement

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

Unit Under Calibration	Standard pH Buffer Solution	Actual pH Reading	Actual mV Reading (mV)	Uncertainty of pH measurement ( $\pm$ )	Coverage factor $k$
pH Electrode S/N.: PCE-86-EX1001	4.008	3.999	153.9	0.0055	2.09
	6.985	7.017	-13.7	0.0084	2.00
	10.008	9.996	-179.0	0.0078	2.06

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

-o0o-

Malu.

a 1126274



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

Cert.No.: 21TW6  
Page.: 1 of 2

## Certificate of Testing

Equipment : DO Meter  
Manufacturer : YSI  
Model : 5100  
Serial No. : 15L103204  
ID No. : BKK\_EN0205  
Received Date : 15 January 2021  
Test Date : 19 January 2021  
Reference : 2101-0428WSC-5  
Submitted by : ALS Laboratory Group (Thailand) Co.,Ltd.  
104 Phatthanakan 40, Phatthanakan Rd.,  
Khwaeng Phatthanakan, Khet Suan Luang,  
Bangkok 10250 Thailand

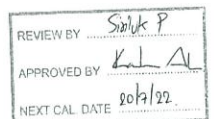
Laboratory Condition : Temperature (25  $\pm$  5)  $^{\circ}\text{C}$   
Humidity (50  $\pm$  20) %  
In - house method : CP-CH9  
by Comparison Technique with Azide Modification Method

Calibrated by : Walaiak Sirirathan

Approved by :   
Approved Signatory

( ) Malee Bulkruea  
( ) Sathip Meangmai  
( ) Warakorn Lernagatrakul

Issue Date : 25 January 2021



B 0251901



Cert.No.: 21TW6  
Page.: 2 of 2

**Result :** Dissolved Oxygen Meter Adjustment With Air 100 %  
Dissolved Oxygen Probe No.: 18C100772

Titration Method (Azide Modification Method) (mg/L)	DO Meter Reading (mg/L)	Standard Deviation (mg/L)
8.10	8.10	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.

-o0o-

*Malu*

a 1037070



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Cert. No.: 21TM166  
Page.: 1 of 2

## Certificate of Calibration

**Equipment :** DO Meter with Sensor  
**Manufacturer :** YSI  
**Model :** 5100  
**Serial No. :** 15L103204  
**ID No. :** BKK\_EN0205  
**Submitted by :** ALS Laboratory Group (Thailand) Co., Ltd.  
104 Phatthanakan 40, Phatthanakan Rd.,  
Khwaeng Phatthanakan, Khet Suan Luang,  
Bangkok 10250 Thailand  
**Location :** TPA On Site Calibration Laboratory  
**Received Order :** 15 January 2021  
**Calibrated Date :** 21 January 2021  
**Ambient Temperature :** ( 26 ± 10 ) °C  
**Relative Humidity :** ( 50 ± 30 ) %  
**AC Line Voltage :** ( 220 ± 22 ) V  
**Calibrated by :** Kritsada Chairong  
**Approved by :** *Malu*  
( ) Pornthipha Tameyakul  
( ) Maloe Bulkruea  
( ) Suwit Imjai  
**Issue Date :** 28 January 2021

The Uncertainties are for a confidence probability of approximately 95%

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Approval of the head of Corporate Services 3 - Equipment Calibration and Testing Services

A 0023875



**Equipment :** DO Meter with Sensor  
**Condition As-Received :** Used Item  
**Reference :** 2101-0428WSC-6  
**Procedure Used :-**

Calibration were conducted using in-house calibration procedure CP-OT01 according to comparison with Industrial Platinum Resistance Thermometer ( IPRT ) into Temperature Bath.

The temperature scale used was based on ITS-90.

### Condition of this result of calibration

1. Reference standard instrument:-

Instrument	Model	Serial No.	Cert. No.	Due Date
1) Digital Thermometer	1523	2188080	2011389	20 Nov 2021

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

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

**Result of Calibration :-** ( \* ) Without Adjustment

**Function :** Temperature measurement.

This instrument was connected with temperature sensor, S/N.: 18C100772

Calibration Point ( °C )	Immersion Depth ( mm )	Standard Temperature ( °C )	UUC* Reading ( °C )	Error ( °C )	Uncertainty ( ± °C )	Coverage Factor k
20.00	60	20.002	19.94	-0.062	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 %.

-o0o-

*Malu*

a 1038215



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

Cert.No.: 22TW122  
Page.: 1 of 2

## Certificate of Testing

**Equipment :** DO Meter  
**Manufacturer :** YSI  
**Model :** 5000-230V  
**Serial No. :** 09J101147  
**ID No. :** BKK\_EN0017  
**Received Date :** 20 May 2022  
**Test Date :** 24 May 2022  
**Reference :** 2205-0638DSC-8  
**Submitted by :** ALS Laboratory Group (Thailand) Co., Ltd.  
104 Phatthanakan 40, Phatthanakan Rd.,  
Khwaeng Phatthanakan, Khet Suan Luang,  
Bangkok 10250 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 :** Warakorn Lemgagtrakul  
**Approved by :** *Malu*  
( ) Maloe Butkruea  
( ) Sathip Meangmai  
( ) Warakorn Lemgagtrakul  
**Issue Date :** 31 May 2022

REVIEW BY	<i>Sinluk P.</i>
APPROVED BY	<i>K. An</i>
NEXT CAL. DATE	24/11/23

B 0285244





Cert.No.: 22TW122  
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	21CG1389	25 Mar 2023
2) Balance	1126143764	140RC004	21MM430	21 Sep 2022

##### 2. Standard Material :-

Material	Manufacturer	Lot.No.	Assay
Sodium Thiosulfate pentahydrate	Merck	AM1763315	100.2%

**Result :** Dissolved Oxygen Meter Adjustment With Air 100 %

Dissolved Oxygen Probe No.: 16K100498

Titration Method (Azide Modification Method) (mg/L)	DO Meter Reading (mg/L)	Standard Deviation (mg/L)
8.12	8.13	0.015

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-

Malu.

a 1110482



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)  
CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES  
5344 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG BANGKOK 10250  
TEL: 0 2717 3000-27 FAX: 0 2719 9484



Cert. No.: 22LM83  
Page.: 1 of 2

## Certificate of Calibration

**Equipment :** DO Meter with Sensor  
**Manufacturer :** YSI  
**Model :** 5000-230V  
**Serial No. :** 09J 101147  
**ID No. :** BKK\_EN0017  
**Submitted by :** ALS Laboratory Group (Thailand) Co., Ltd.  
104 Phatthanakan 40, Phatthanakan Rd.,  
Khaeng Phatthanakan, Khet Suan Luang,  
Bangkok 10250 Thailand  
**Location :** TPA On Site Calibration Laboratory  
**Received Order :** 20 May 2022  
**Calibrated Date :** 30 May 2022  
**Ambient Temperature :** (28 ± 10) °C  
**Relative Humidity :** (50 ± 30) %  
**AC Line Voltage :** (220 ± 22) V  
**Calibrated by :** Tawatchai Pama  
**Approved by :**   
Approved Signatory  
( ) Pornthippa Tameyakul  
(x) Malee Butkruea  
( ) Suwit Imjai  
**Issue Date :** 31 May 2022

The Uncertainties are for a confidence probability of approximately 95%

This certificate may not be reproduced other than in full, except with the prior written approval of the head of Corporate Services 3: Equipment Calibration and Testing Services.

A 0039957



**Equipment :** DO Meter with Sensor  
**Condition As-Received :** Used Item  
**Reference :** 2205-0638DSC-10  
**Procedure Used :-**

Cert. No.: 22LM83  
Page.: 2 of 2

Calibration were conducted using in-house calibration procedure CP-OT01 according to comparison with Industrial Platinum Resistance Thermometer (IPRT) into Temperature Bath.  
The temperature scale used was based on ITS-90.

#### Condition of this result of calibration

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

Instrument	Model	Serial No.	Cert. No.	Due Date
1) Digital Thermometer	1502A	A09204	2218	04 Jan 2023

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

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

**Result of Calibration :-** ( ° ) Without Adjustment

**Function :** Temperature measurement.

This instrument was connected with thermistor sensor, ID No.: 16K100498

Calibration Point (°C)	Immersion Depth (mm)	Standard Temperature (°C)	UUC* Reading (°C)	Error (°C)	Uncertainty (± °C)	Coverage Factor k
20.00	60	20.003	20.01	0.007	0.15	2.00

UUC\*: Unit Under Calibration

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

-000-

Malu.

a 1090806



## Metrological Center

SCI ECO Services Company Limited

33/2 Moo 3, T. Banpa, A. Kaengkhoi, Saraburi 18110, Thailand

Saraburi Tel : +66 3627 3096 Fax : +66 3627 3100

Bangkok Tel : +668 9205 6851 , +668 8247 2360

Website : www.scieco.co.th E-Mail : calibrate@scg.co.th

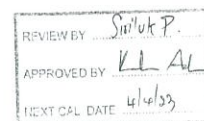


Certificate No. T212123

Page 1 of 3

## Certificate of Calibration

**Equipment :** Chamber ( Incubator )  
**Manufacturer :** SHEL LAB  
**Model :** 2020-2E  
**Serial No. :** 802899  
**Customer Code :** BKK\_EN0005  
**ID No. :** T7499A0  
**Customer :** ALS Laboratory Group (Thailand) Co., Ltd.  
104 Phatthanakan 40, Phatthanakan Rd., Khaeng Phatthanakan,  
Khet Suan Luang, Bangkok 10250  
**Customer Location :** Wet Chemistry Lab2  
**Date of Receipt :** 1 October 2021  
**Calibrated By :** Sujjar Naknakred ( Site Calibration Manager )  
**Approved By :** /Boonchai Suriyawong (Site Calibration Manager)  
**Date of Issue :** 07 OCT 2021



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

This Certificate is issued in accordance with the conditions of accreditation granted by the Thai Laboratory Accreditation Scheme which has assessed the measurement capability of the laboratory and its traceability to recognized national standards and to the units of measurement realized at the corresponding national standard laboratory. This certificate may not be reproduced other than in full except with the prior written approval of the Metrological Center.

FM-L14 117 01-02-64



Certificate No. T212123

Page 2 of 3

## Calibration Report

Equipment : Chamber ( Incubator )  
Date of Calibration : 4-5 October 2021  
Environment : Temperature : 23.8-24.9 °C  
Line Voltage : 227.5-231.1 V  
Relative Humidity : 55 - 65 %RH

### Condition of this results of calibration :

- This equipment was calibrated by insert nine resistance thermometer detectors into its chamber , the other one resistance thermometer detector use for ambient temperature measurement . The calibration was done in according to WI-T20 ( based on ASTM E145-94 ( Reapproved 2001 ) and AS2853-1986 ).  
All data show below were final values and the initial data from customer request . The temperature scale used was based on ITS - 90 .
- Reference Standard Instrument :

Instrument	Model	Instrument No.	Certificate No.	Due Date
RTD	100 ohm	29-(CH1-10)	T210118	2 February 2022
DATA LOGGER	34970A	T47	T210118	2 February 2022
- This certificate is traceable to :  
National Institute of Metrology ( Thailand ) through Metrological Center ( NSC-TISI-TIS 17025 CALIBRATION 0244.)
- Condition of calibrated item : good  
Equipment Description :  
Time Constant : 2 Hour 20 Minute At 20 °C  
Fresh Air Damper : ☐ Open ☐ Min ☐ Medium ☐ Max  
☐ Close  
☒ Not Available
- Adjustment :  
( ) without adjustment ( X ) after adjustment

Approved By:

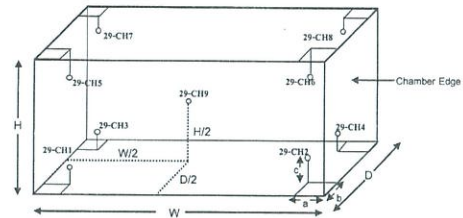
FM-L15 117 15-05-63



Certificate No. T212123

Page 3 of 3

## Calibration Report



### Remark :

Internal Dimensions of Chamber : W (Width) = 70 cm. , H (Height) = 130 cm. and D (Depth) = 55 cm.  
Size of Installed Standard sensor number 29-CH1 to number 29-CH8 : a = 5 cm. , b = 5 cm. and c = 5 cm.  
Size of Installed Standard sensor number 29-CH9 : W/2 = 70 cm./2, H/2 = 130 cm./2 and D/2 = 55 cm./2

### Measurement Results

Calibration Point	Average Standard Reading at each position (°C)							
	29-CH1	29-CH2	29-CH3	29-CH4	29-CH5	29-CH6	29-CH7	29-CH8
20	20.04	20.06	20.19	19.86	19.68	20.08	20.12	19.80
25	24.99	25.06	25.18	24.89	24.74	25.12	25.16	24.80

Setting (°C)	Chamber ( Incubator )			Temperature Distribution			
	Reading (°C)			Stability (± °C)	Uniformity (°C)	Uncertainty (± °C)	Coverage Factor k
	Min	Max	Average				
20.0	-	-	20.0	0.05	1.01	0.38	2.00
25.0	-	-	25.0	0.07	0.96	0.38	2.00

\* The quoted uncertainty exclude "uniformity"

The calibration result apply only the above calibrated item.

The result of test was found accurate as shown on date and place of test only.

The reported expanded uncertainty is based on a standard uncertainty multiplied by a coverage factor k which for a t-distribution, providing a level of confidence of approximately 95 %.

Approved By:

FM-L15 117 15-05-63

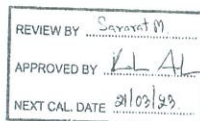


Certificate No. T220630

Page 1 of 5

## Certificate of Calibration

Equipment : HOT BLOCK  
Manufacturer : Environmental Express  
Model : B3000- 240  
Serial No. : 2017CODW116  
Customer Code : BKK\_EN0222  
ID No. : T6769A4  
Customer : ALS Laboratory Group (Thailand) Co.,Ltd.  
104 Phatthanakan 40, Phatthanakan Rd., Khwaeng Phatthanakan,  
Khet Suan Luang, Bangkok 10250  
Customer Location : Wet Chemistry Lab2  
Date of Receipt : 21 March 2022  
Calibrated By : Watcharapon Sangtong (Technician )  
Approved By : / Sujjar Naknakred ( Site Calibration Manager )  
Date of Issue : 03 APR 2022



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

This Certificate is issued in accordance with the conditions of accreditation granted by the Thai Laboratory Accreditation Scheme which has assessed the measurement capability of the laboratory and its traceability to recognized national standards and to the units of measurement realized at the corresponding national standard laboratory. This certificate may not be reproduced other than in full except with the prior written approval of the Metrological Center.

FM-L12 109 30-05-57



Certificate No. T220630

Page 2 of 5

## Calibration Report

Equipment : HOT BLOCK  
Date of Calibration : 21 March 2022  
Environment : Temperature : 21.8-23.1 °C  
Line Voltage : 221.6-226.3 V  
Relative Humidity : 55 - 65 %RH

### Condition of this results of calibration :

- This equipment was calibrated by insert nine standard thermocouples type T into its chamber , the other one standard thermocouples type T use for ambient temperature measurement . The calibration was done in according to WI-T20.  
All data show below were final values and the initial data from customer request . The temperature scale used was based on ITS - 90 .
- Reference Standard Instrument :

Instrument	Model	Instrument No.	Certificate No.	Due Date
TC	TYPE T	TN51-TN60	T220275	28 February 2023
TC	TYPE T	TN61-TN70	T220275	28 February 2023
DATA LOGGER	34970A	T47	T220275	28 February 2023
- This certificate is traceable to :  
National Institute of Metrology ( Thailand ) through Metrological Center ( NSC-TISI-TIS 17025 CALIBRATION 0244.)
- Condition of calibrated item : good  
Equipment Description :  
Time Constant : 1 Hour - Minute At 150 °C  
Fresh Air Damper : ☐ Open ☐ Min ☐ Medium ☐ Max  
☐ Close  
☒ Not Available
- Adjustment :  
( ) without adjustment ( X ) after adjustment

Approved By:

FM-L13 108 30-05-57





## Metrological Center

SCI ECO Services Company Limited

33/2 Moo 3, T.Banpa, A.Kaengkhoh, Saraburi 18110

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Certificate No. T220630

Page 3 of 5

### Calibration Report

R7	49	50	51	52	53	54	55	56
R6	41	42	43	44	45	46	47	48
R5	33	34	35	36	37	38	39	40
R4	25	26	27	28	29	30	31	32
R3	17	18	19	20	21	22	23	24
R2	9	10	11	12	13	14	15	16
R1	1	2	3	4	5	6	7	8

Controller

○ STANDARD THERMOCOUPLE TYPE T

No.1 = TN51	No.13 = TN63	No.25 = TN55	No.37 = TN67	No.49 = TN59
No.2 = TN52	No.14 = TN64	No.26 = TN56	No.38 = TN68	No.50 = TN60
No.3 = TN53	No.15 = TN65	No.27 = TN57	No.39 = TN69	No.51 = TN61
No.4 = TN54	No.16 = TN66	No.28 = TN58	No.40 = TN70	No.52 = TN62
No.5 = TN55	No.17 = TN67	No.29 = TN59	No.41 = TN51	No.53 = TN63
No.6 = TN56	No.18 = TN68	No.30 = TN60	No.42 = TN52	No.54 = TN64
No.7 = TN57	No.19 = TN69	No.31 = TN61	No.43 = TN53	No.55 = TN65
No.8 = TN58	No.20 = TN70	No.32 = TN62	No.44 = TN54	No.56 = TN66
No.9 = TN59	No.21 = TN51	No.33 = TN63	No.45 = TN55	
No.10 = TN60	No.22 = TN52	No.34 = TN64	No.46 = TN56	
No.11 = TN61	No.23 = TN53	No.35 = TN65	No.47 = TN57	
No.12 = TN62	No.24 = TN54	No.36 = TN66	No.48 = TN58	

Approved By.

FM-L13 108/30-05-57



## Metrological Center

SCI ECO Services Company Limited

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Certificate No. T220630

Page 4 of 5

### Calibration Report

#### Measurement Results

Calibration Point		Average Standard Reading at each position (°C)							
R1		TN51	TN52	TN53	TN54	TN55	TN56	TN57	TN58
CAL POINT	Max	149.42	150.39	149.10	149.91	150.93	150.58	151.54	150.13
	Min	149.27	150.15	148.51	149.65	150.72	150.39	151.43	149.97
	Average	149.35	150.27	148.81	149.78	150.83	150.48	151.49	150.05
R2		TN59	TN60	TN61	TN62	TN63	TN64	TN65	TN66
Max	150.66	150.45	151.00	151.76	150.66	150.67	150.73	149.65	
	Min	150.46	150.16	150.74	151.51	150.48	150.56	149.40	
	Average	150.56	150.31	150.87	151.63	150.57	150.58	150.65	149.52
R3		TN67	TN68	TN69	TN70	TN51	TN52	TN53	TN54
Max	150.90	151.18	151.10	151.05	150.16	150.55	149.86	150.39	
	Min	150.68	151.00	150.84	150.75	149.36	149.17	148.95	149.17
	Average	150.79	151.09	150.97	150.90	149.76	149.86	149.41	149.78
R4		TN55	TN56	TN57	TN58	TN59	TN60	TN61	TN62
Max	150.82	150.07	151.63	150.72	150.35	149.78	150.24	150.04	
	Min	149.53	149.71	149.57	148.67	148.46	148.36	149.55	148.81
	Average	150.17	149.89	150.60	149.70	149.41	149.32	149.90	149.42
R5		TN63	TN64	TN65	TN66	TN67	TN68	TN69	TN70
Max	150.00	149.68	150.31	149.66	150.34	150.48	150.09	149.51	
	Min	149.81	149.58	149.49	149.42	149.20	149.00	149.69	149.38
	Average	149.90	149.63	149.90	149.54	149.77	150.04	149.89	149.44
R6		TN51	TN52	TN53	TN54	TN55	TN56	TN57	TN58
Max	149.25	150.37	148.53	149.06	150.91	150.04	151.13	149.83	
	Min	149.07	150.18	148.28	148.78	150.69	149.83	150.95	149.65
	Average	149.16	150.28	148.41	148.92	150.80	149.94	151.04	149.74
R7		TN59	TN60	TN61	TN62	TN63	TN64	TN65	TN66
Max	149.38	149.24	149.88	150.17	149.72	149.45	149.63	149.51	
	Min	149.22	149.05	149.68	149.99	149.61	149.34	149.48	149.36
	Average	149.30	149.15	149.78	150.08	149.67	149.40	149.56	149.43

Approved By.

FM-L13 108/30-05-57



## Metrological Center

SCI ECO Services Company Limited

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Certificate No. T220630

Page 5 of 5

### Calibration Report

#### Measurement Results:

HOT BLOCK			Temperature Distribution	
Setting (°C)	Reading (°C)		Stability (± °C)	Uncertainty (± °C)
	Min , Max	Average		
150.0	149.9 , 150.1	150.0	1.04	1.44

\* The quoted uncertainty exclude " uniformity "

The calibration result apply only the above calibrated item.

The result of test was found accurate as shown on date and place of test only

The reported expanded uncertainty is based on a standard uncertainty multiplied by a coverage factor k which for a t-distribution, providing a level of confidence of approximately 95 % .

Approved By.

FM-L13 108/30-05-57



## Metrological Center

SCI ECO Services Company Limited

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Telephone : +66 2 586 5792-4 Fax : +66 2 586 5109

Website : www.scieco.co.th E-Mail : calibrate@scg.co.th

Certificate No. T210717

Page 1 of 5

### Certificate of Calibration

Equipment : HOT BLOCK

Manufacturer : Environmental Express

Model : B300 240

Serial No. : 2017CODW116

Customer Code : BKK\_EN0222

ID No. : T6769A4

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

104 Phatthanakan 40, Phatthanakan Rd., Khwaeng Phatthanakan, Khet Suan Luang, Bangkok 10250

Customer Location : Environmental Control & IP Room

Date of Receipt : 1 April 2021

Calibrated By : Atiphong Rongrat ( Technician )

Approved By : Boonchai Suriyawong (Site Calibration Manager)

Date of Issue : 22 Apr 2021

REVIEW BY	Silok P.
APPROVED BY	KL AI
NEXT CAL. DATE	21/4/22

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

This Certificate is issued in accordance with the conditions of accreditation granted by the Thai Laboratory Accreditation Scheme which has assessed the measurement capability of the laboratory and its traceability to recognized national standards and to the units of measurement realized at the corresponding national standard laboratory. This certificate may not be reproduced other than in full except with the prior written approval of the Metrological Center.

FM-L12 109/30-05-57



## Metrological Center

SCI ECO Services Company Limited

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Telephone : +66 2 586 5792-4 Fax : +66 2 586 5109

Website : www.scieco.co.th E-Mail : calibrate@scg.co.th

Certificate No. T210717

Page 2 of 5

### Calibration Report

Equipment : HOT BLOCK  
Date of Calibration : 7 April 2021  
Environment : Temperature : 16.4-17.9 °C  
Line Voltage : 222.7-227.8 V  
Relative Humidity : 55 - 65 %RH

#### Condition of this results of calibration :

- This equipment was calibrated by insert 20 standard thermocouples type T into its chamber, the other one standard thermocouples type T use for ambient temperature measurement. The calibration was done in according to WI-T20. All data show below were final values and the initial data from customer request.  
The temperature scale used was based on ITS - 90.
- Reference Standard Instrument :

Instrument	Model	Instrument No.	Certificate No.	Due Date
TC	TYPE T	TN91-TN100	T202053	24 September 2021
TC	TYPE T	TN101-TN110	T202053	24 September 2021
DATA LOGGER	34970A	T121	T202053	24 September 2021
- This certificate is traceable to :  
National Institute of Metrology ( Thailand ) through Metrological Center ( NSC-TISI-TIS 17025 CALIBRATION 0244.)
- Condition of calibrated item : good  
Equipment Description :  
Time Constant : - Hour 40 Minute At 150 °C  
Fresh Air Damper : ☐ Open ☐ Min ☐ Medium ☐ Max  
☒ Close  
☒ Not Available
- Adjustment :  
( X ) without adjustment ( ) after adjustment

Approved By

FM-L13 108/30-05-57



## Metrological Center

SCI ECO Services Company Limited

33/2 Moo 3, T.Banpa, A.Kaengkhoi, Saraburi 18110

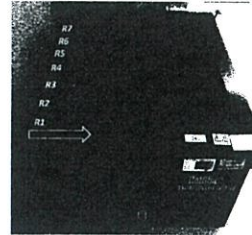
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Certificate No. T210717

Page 3 of 5

### Calibration Report



Row	Hole							
R7	H49	H50	H51	H52	H53	H54	H55	H56
R6	H41	H42	H43	H44	H45	H46	H47	H48
R5	H33	H34	H35	H36	H37	H38	H39	H40
R4	H25	H26	H27	H28	H29	H30	H31	H32
R3	H17	H18	H19	H20	H21	H22	H23	H24
R2	H9	H10	H11	H12	H13	H14	H15	H16
R1	H1	H2	H3	H4	H5	H6	H7	H8

#### H: STANDARD THERMOCOUPLE TYPE T

H1 = TN91	H9 = TN99	H17 = TN107	H25 = TN95	H33 = TN103	H41 = TN91	H49 = TN99
H2 = TN92	H10 = TN100	H18 = TN108	H26 = TN96	H34 = TN104	H42 = TN92	H50 = TN100
H3 = TN93	H11 = TN101	H19 = TN109	H27 = TN97	H35 = TN105	H43 = TN93	H51 = TN101
H4 = TN94	H12 = TN102	H20 = TN110	H28 = TN98	H36 = TN106	H44 = TN94	H52 = TN102
H5 = TN95	H13 = TN103	H21 = TN91	H29 = TN99	H37 = TN107	H45 = TN95	H53 = TN103
H6 = TN96	H14 = TN104	H22 = TN92	H30 = TN100	H38 = TN108	H46 = TN96	H54 = TN104
H7 = TN97	H15 = TN105	H23 = TN93	H31 = TN101	H39 = TN109	H47 = TN97	H55 = TN105
H8 = TN98	H16 = TN106	H24 = TN94	H32 = TN102	H40 = TN110	H48 = TN98	H56 = TN106

Approved By

FM-L13 108/30-05-57



## Metrological Center

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Certificate No. T210717

Page 4 of 5

### Calibration Report

#### Measurement Results

Calibration Point		Average Standard Reading at each position (°C)									
		TN91	TN92	TN93	TN94	TN95	TN96	TN97	TN98	TN99	TN100
150	Setting	Max	150.72	150.68	150.86	150.83	150.66	150.66	149.34	149.71	150.37
		Min	150.54	150.47	150.66	150.68	150.54	150.57	149.25	149.54	149.44
	Average	150.65	150.61	150.77	150.77	150.61	150.61	149.30	149.62	150.30	149.55
150	Setting	Max	150.25	150.40	150.40	150.73	150.41	150.80	150.55	150.63	149.48
		Min	150.10	150.30	150.25	150.63	150.33	150.72	150.47	150.50	149.27
	Average	150.18	150.35	150.31	150.69	150.37	150.75	150.51	150.57	149.38	150.69
150	Setting	Max	151.05	150.70	150.59	150.14	150.87	150.71	150.73	149.62	150.77
		Min	150.90	150.53	150.40	150.01	150.74	150.56	150.63	149.53	150.60
	Average	150.96	150.61	150.50	150.08	150.80	150.62	150.68	149.57	150.68	149.98
150	Setting	Max	149.78	149.65	149.81	150.14	150.71	150.90	150.21	150.82	149.21
		Min	149.64	149.57	149.68	150.01	150.59	150.79	150.07	150.71	149.10
	Average	149.69	149.61	149.74	150.08	150.65	150.83	150.15	150.76	149.16	150.98
150	Setting	Max	150.94	150.28	150.68	150.74	150.36	150.29	150.35	150.18	149.27
		Min	150.67	150.13	150.50	150.57	150.24	150.11	150.20	150.09	149.18
	Average	150.83	150.22	150.59	150.65	150.31	150.22	150.30	150.14	149.22	149.67
150	Setting	Max	149.29	150.12	150.25	150.39	150.91	150.36			
		Min	149.07	149.94	150.16	150.21	150.73	150.27			
	Average	149.20	150.06	150.20	150.30	150.83	150.32				

Approved By

FM-L13 108/30-05-57



## Metrological Center

SCI ECO Services Company Limited

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Website : www.scieco.co.th E-Mail : calibrate@scg.co.th

Certificate No. T210717

Page 5 of 5

### Calibration Report

#### Measurement Results

HOT BLOCK			Temperature Distribution		
Setting (°C)	Reading (°C)		Average (°C)	Stability (±°C)	Uncertainty (±°C)
	Min	Max			
149.6	149.5	149.7	149.6	150.37	0.20

The calibration result apply only the above calibrated item.  
The result of test was found accurate as shown on date and place of test only.  
The reported expanded uncertainty is based on a standard uncertainty multiplied by a coverage factor k=2, providing a level of confidence of approximately 95 %.

Approved By

FM-L13 108/30-05-57





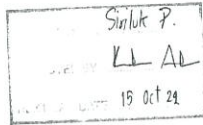
Bara Scientific Co., Ltd.  
968 U Chu Liang Building Floor7 Rama4 Road  
Siam Bangkok Bangkok Thailand 10500  
Tel: 02-6324300 Fax: 02-6375496-7  
www.barascientific.com



## Certificate of Calibration

Number of Page(s) 1 of 3

Certificate No. BSCC-UV-290/21  
Equipment UV/Vis Spectrophotometer  
Model UV-1800  
Manufacturer Shimadzu  
Serial No. A11454908533CD  
ID No. BKK\_EN0018  
Date of receipt 15 October 2021  
Date of calibration 15 October 2021  
Date of issue 25 October 2021



Customer name ALS Laboratory Group (Thailand) Co., Ltd.  
Address 104 Soi Phatthanakan 40, Phatthanakan Road, Phatthanakan, Suan Luang, Bangkok 10250

Temperature (25.0 - 26.4) °C (On site)  
Humidity (49.5 - 53.4) %RH (On site)

Equipment condition Good Operation

Calibration Location Organic Prep

Calibration Procedure In-house method WI-UV-702-01 based on ASTM E275-01

Traceability Wavelength Accuracy is traceable to certificate No. 87639 and 87644  
Photometric Accuracy is traceable to certificate No. 87646 and 87677  
Stray Light is traceable to certificate No. 87625  
The above certificate are traceable to SI unit through Starra Scientific Ltd.  
(UKAS accredited calibration laboratory NO. 0659)

Calibrated by Mr. Wanchana Janloey

Approved by

Mr. Kanchit Choothep  
Technical Manager

The above results are valid exclusively for the calibrated item(s) as mention in this report / certificate.  
Advertising the report / Certificate and publicity of the results are prohibited and also shall not be reproduced  
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FM-UV-708-02 Rev 01 (23/01/63)



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Siam Bangkok Bangkok Thailand 10500  
Tel: 02-6324300 Fax: 02-6375496-7  
www.barascientific.com



## Certificate of Calibration

Certificate No. BSCC-UV-290/21

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	333.80	-0.22	0.18
418.53	418.40	-0.13	0.18
572.59	572.85	-0.14	0.18
878.41	879.15	-0.26	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
	0.7174	0.7198	0.0024	0.0075
257	0.0000	-0.0001	-0.0001	0.0075
	0.8362	0.8377	0.0015	0.0075
313	0.0000	0.0000	0.0000	0.0075
	0.2778	0.2803	0.0025	0.0075
350	0.0000	-0.0001	-0.0001	0.0075
	0.6202	0.6221	0.0019	0.0075

\*CNR = Customer not request

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FM-UV-708-02 Rev 01 (23/01/63)



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-290/21

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
	0.5631	0.5570	-0.0061	0.0042
	0.7390	0.7334	-0.0056	0.0042
	1.0863	1.0816	-0.0047	0.0042
440.0	0.0000	0.0000	0.0000	0.0042
	0.5524	0.5469	-0.0055	0.0042
	0.7217	0.7186	-0.0031	0.0042
	1.0605	1.0570	-0.0036	0.0042
465.0	0.0000	0.0000	0.0000	0.0042
	0.5018	0.4966	-0.0052	0.0042
	0.6657	0.6610	-0.0047	0.0042
	0.9775	0.9740	-0.0035	0.0042
546.1	0.0000	0.0000	0.0000	0.0042
	0.5147	0.5113	-0.0034	0.0042
	0.6743	0.6705	-0.0038	0.0042
	0.9909	0.9890	-0.0019	0.0042
590.0	0.0000	0.0000	0.0000	0.0042
	0.5427	0.5394	-0.0033	0.0042
	0.7037	0.7001	-0.0036	0.0042
	1.0338	1.0323	-0.0015	0.0042
635.0	0.0000	0.0000	0.0000	0.0042
	0.5268	0.5235	-0.0033	0.0042
	0.6720	0.6685	-0.0035	0.0042
	0.9864	0.9847	-0.0017	0.0042

\*CNR = Customer not request

#### 4. Stray Light\*

Standard cut-off wavelength (nm)	Unit Under Calibration(UUC) Wavelength (nm)	Transmission (%)	Absorbance (A)
200.91±0.11nm	200.31	0.9399	2.0274

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 based 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  
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FM-UV-708-02 Rev 01 (23/01/63)

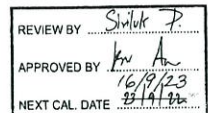


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968 U Chu Liang Building Floor7 Rama4 Road  
Siam Bangkok Bangkok Thailand 10500  
Tel: 02-6324300 Fax: 02-6375496-7  
www.barascientific.com



## Certificate of Calibration

Certificate No. BSCC-UV-307/22  
Equipment UV/Vis Spectrophotometer  
Model UV-1800  
Manufacturer Shimadzu  
Serial No. A11454908533CD  
ID No. BKK\_EN0018  
Date of receipt 16 September 2022  
Date of calibration 16 September 2022  
Date of issue 23 September 2022



Customer name ALS Laboratory Group (Thailand) Co., Ltd.  
Address 104 Soi Phatthanakan 40, Phatthanakan Road, Phatthanakan, Suan Luang, Bangkok 10250

Temperature (22.1-23.3) °C (On site)  
Humidity (58.8-63.2) %RH (On site)

Equipment condition Good Operation

Calibration Location Organic Prep

Calibration Procedure In-house method WI-UV-702-01 based on ASTM E275-01

Traceability Wavelength Accuracy is traceable to certificate No. 95917 and 95918  
Photometric Accuracy is traceable to certificate No. 95924 and 95937  
Stray Light is traceable to certificate No. 95908  
The above certificate are traceable to SI unit through Starra Scientific Ltd.  
(UKAS accredited calibration laboratory NO. 0659)

Calibrated by Mr. Wanchit Janphung

Approved by

Mr. Kanchit Choothep  
Technical Manager

The above results are valid exclusively for the calibrated item(s) as mention in this report / certificate.  
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FM-UV-708-02 Rev 01 (23/01/63)



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Tel : 02-6324300 Fax : 02-6375496-7  
www.barscientific.com



## Certificate of Calibration

Certificate No. BSCC-UV-307/22

Number of Page(s)

2 of 3

### Calibration Results:

#### 1. Wavelength Accuracy

Certified Wavelength (nm)	UUC (nm)	Error (nm)	Uncertainty (nm)
241.70	241.65	-0.05	0.18
334.02	333.92	-0.10	0.18
418.53	418.46	-0.07	0.18
572.99	572.96	-0.03	0.18
879.41	879.17	-0.24	0.18

#### 2. Photometric Accuracy (UV)

Wavelength (nm)	Certified Absorbance (A)	UUC (A)	Error (A)	Uncertainty (±A)
235	0.0000	0.0000	0.0000	0.0075
	0.7467	0.7461	-0.0006	0.0075
257	0.0000	0.0000	0.0000	0.0075
	0.8662	0.8647	-0.0015	0.0075
313	0.0000	0.0000	0.0000	0.0075
	0.2904	0.2911	0.0007	0.0075
350	0.0000	0.0000	0.0000	0.0075
	0.6429	0.6426	-0.0003	0.0075

\*CNR = Customer not request

The above results are valid exclusively for the calibrated item(s) as mention in this report / certificate.  
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FM-UV-708-02 Rev.01 (2301/63)



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.barscientific.com



## Certificate of Calibration

Certificate No. BSCC-UV-307/22

Number of Page(s)

3 of 3

### Calibration Results:

#### 3. Photometric Accuracy (Visible)

Wavelength (nm)	Certified Absorbance (A)	UUC (A)	Error (A)	Uncertainty (±A)
420.0	0.0000	0.0000	0.0000	0.0042
	0.5783	0.5777	-0.0006	0.0042
	0.7628	0.7635	0.0007	0.0046
	1.0206	1.0230	0.0024	0.0042
440.0	0.0000	0.0000	0.0000	0.0042
	0.5621	0.5618	-0.0003	0.0042
	0.7455	0.7460	0.0005	0.0048
	0.9985	1.0005	0.0020	0.0042
465.0	0.0000	0.0000	0.0000	0.0042
	0.5227	0.5219	-0.0008	0.0042
	0.6880	0.6884	0.0004	0.0051
	0.9487	0.9503	0.0016	0.0042
546.1	0.0000	0.0000	0.0000	0.0042
	0.5207	0.5199	-0.0008	0.0042
	0.6973	0.6971	-0.0002	0.0049
	0.9959	0.9964	0.0005	0.0042
590.0	0.0000	0.0000	0.0000	0.0042
	0.5544	0.5534	-0.0010	0.0042
	0.7253	0.7242	-0.0011	0.0050
	1.0942	1.0943	0.0001	0.0042
635.0	0.0000	0.0000	0.0000	0.0042
	0.5616	0.5606	-0.0010	0.0042
	0.6927	0.6921	-0.0006	0.0053
	1.0881	1.0885	0.0004	0.0042

\*CNR = Customer not request

#### 4. Stray Light\*

Standard cut-off wavelength (nm)	Unit Under Calibration(UUC) Wavelength (nm)	Transmission (%T)	Absorbance (A)
200.96±0.11nm	200.30	0.9505	2.0229

The Stray light transmission reference is less than 1.0%T and Stray light absorbance reference is greater than 2.00A  
\*Stray Light not NSC-ONSC Accredited.

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

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

The above results are valid exclusively for the calibrated item(s) as mention in this report / certificate.  
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FM-UV-708-02 Rev.01 (2301/63)



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)  
CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES  
534-4 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG BANGKOK 10250  
TEL: 0-2717-3000-27 FAX: 0-2719-9184



Cert.No.: 21CG1446  
Page: 1 of 2

## Certificate of Calibration

Equipment : Burette  
Capacity : 50 mL  
Serial No. : -  
ID. No. : BKK\_EN0171

Manufacturer : Witeg  
Made in : Germany  
Submitted by : ALS Laboratory Group (Thailand) Co., Ltd.  
104 Phatthanakan 40, Phatthanakan Rd.  
Khaeng Phatthanakan, Khet Suan Luang  
Bangkok 10250 Thailand

Ambient Temperature : (20 ± 2.5) °C  
Relative Humidity : (50 ± 10) %  
Barometric Pressure : 755 mmHg  
Calibration Procedure : ASTM E 542 - 01

Calibrated by : Sa-ngeunkam Wongsu

Approved by : Melu  
Approved Signatory

( ) Pornthipha Tameyakul  
( ) Malee Bulkruea  
( ) Ponpan Palpim  
( ) Srisuda Khamitha

Issue Date : 31 March 2021

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 0026589



Equipment : Burette  
Received Date : 24 March 2021  
Condition As-Received : Used Item  
Calibration Date : 30 March 2021  
Reference : 2103-1008DSC-5

Cert.No.: 21CG1446  
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	21MM181	NIMT	02 Mar 2022
2) Thermo-Hygograph	TH 803	09153022	140EC004	20H1434	NIST,NIMT	19 June 2021
3) Thermometer		1594592	140EC010	20I1191	NIMT	08 Oct 2021

This certificate 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
50	50.0041	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-

Melu

a 1048960





TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)  
CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES  
534/4 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG BANGKOK 10250  
TEL: 0-2717-3000-27 FAX: 0-2719-9484



Cert.No.: 22CG3154  
Page.: 1 of 2

## Certificate of Calibration

Equipment : Burette  
Capacity : 50 mL  
Serial No. :  
ID. No. : BKK\_EN0171

Manufacturer : Witeg  
Made in : Germany  
Submitted by : ALS Laboratory Group (Thailand) Co., Ltd.  
104 Phatthanakan 40, Phatthanakan Rd.  
Khwaeng Phatthanakan, Khet Suan Luang  
Bangkok 10250 Thailand

Ambient Temperature : (20 ± 2.5) °C  
Relative Humidity : (50 ± 10) %  
Barometric Pressure : 759 mmHg  
Calibration Procedure : ASTM E 542 - 01

Calibrated by : Panward Pramklam

Approved by :

( ) Pornthippa Tameyakul  
( ) Malee Butkruea  
(X) Ponpan Paipim  
( ) Srisuda Khamtha

Issue Date : 31 August 2022

The Uncertainties are for a confidence probability of approximately 95%

This certificate may not be reproduced other than in full, except with the prior written  
Approval of the head of Corporate Services 3: Equipment Calibration and Testing Services.

A 0044607



Equipment : Burette  
Received Date : 26 August 2022  
Condition As-Received : Used Item  
Calibration Date : 30 August 2022  
Reference : 2208-0918DSC-2

Cert.No.: 22CG3154  
Page.: 2 of 2

### Condition of this result of calibration

- Reference Standard Instruments :

Instruments	Model	Serial No.	ID. No.	Certificate No.	Traceability	Due date
1) Balance	AE200S	N03679	140RC001	21MM429	NIMT	22 Sep 2022
2) Thermo-Hygrograph	THDX-CE	00016540	140EC001	22H1243	NIST,NIMT	09 June 2023
3) Thermometer	-	1594592	140EC010	221181	NIMT	10 Feb 2023

This certification is traceable to SI Unit
- The certificate is valid only to the item calibrated on date and place of calibration.
- 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
50	49.9959	0.010	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-

a 1123908



## Metrological Center SCI ECO Services Company Limited

33/2 Moo 3, T.Banpa, A.Kaengkhoi, Saraburi 18110, Thailand.  
Saraburi Tel : +66 3627 3096 Fax : +66 3627 3100  
Bangkok Tel : +668 9205 6851 , +669 8247 2360  
Website : www.scieco.co.th E-Mail : calibrate@scg.co.th



Certificate No.T211009

Page 1 of 4

## Certificate of Calibration

Equipment : Chamber (Cold Room)

Manufacturer : KOLDTECH

Model : KM 320

Serial No. : TBN-1012061/05

Customer Code : BKK\_EN0167

ID No. : T2463A3

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

104 Phatthanakan 40, Phatthanakan Rd., Khwaeng Phatthanakan,  
Khet Suan Luang, Bangkok 10250

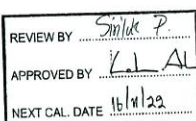
Customer Location : Laboratory

Date of Receipt : 6 May 2021

Calibrated By : Watcharapon Songthong (Technician)

Approved By : Boonchai Suriyawong (Site Calibration Manager)

Date of Issue : 20 MAY 2021



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

This Certificate is issued in accordance with the conditions of accreditation granted by the Thai Laboratory Accreditation Scheme which has assessed the measurement capability of the laboratory and its traceability to recognized national standards and to the units of measurement realized at the corresponding national standard laboratory. This certificate may not be reproduced other than in full except with the prior written approval of the Metrological Center.

FM-L14 117/01-02-64



## Metrological Center SCI ECO Services Company Limited

33/2 Moo 3, T.Banpa, A.Kaengkhoi, Saraburi 18110, Thailand.



Certificate No.T211009

Page 2 of 4

## Calibration Report

Equipment : Chamber (Cold Room)  
Date of Calibration : 18 May 2021  
Environment : Temperature : 23.4-24.9 °C  
Line Voltage : 221.4-230.2 V  
Relative Humidity : 55 - 65 %RH

### Condition of this results of calibration :

- This equipment was calibrated by insert 16 standard thermocouples type T into its chamber, the other one standard thermocouples type T use for ambient temperature measurement. The calibration was done in according to WI-T20 (based on ASTM E145-94 (Reapproved 2001) and AS2853-1986). All data show below were final values and the initial data from customer request. The temperature scale used was based on ITS - 90.

Instrument	Model	Instrument No.	Certificate No.	Due Date
TC	TYPE T	TN161-TN170	T210009	8 January 2022
TC	TYPE T	TN171-TN180	T210009	8 January 2022
DATA LOGGER	34970A	T149	T210009	8 January 2022

- This certificate is traceable to : National Institute of Metrology (Thailand) through Metrological Center (NSC-TISI-TIS 17025 CALIBRATION 0244).
- Condition of calibrated item : good

### Equipment Description :

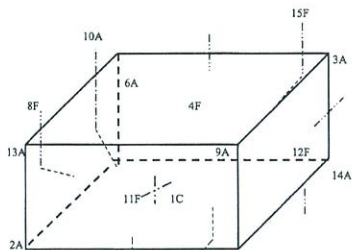
Time Constant : 1 Hour - Minute At 3 °C  
Fresh Air Damper : ☐ Open ☐ Min ☐ Medium ☐ Max  
☐ Close  
☒ Not Available

- Adjustment :  
( X ) without adjustment ( ) after adjustment

Approved By : Boonchai Suriyawong

FM-L15 117/15-05-63

## Calibration Report



C = Centre, F = Centre of Face, A = Corner, E = Centre of Edge

1C = TN161	12F = TN172
2A = TN162	13A = TN173
3A = TN163	14A = TN174
4F = TN164	15F = TN175
5A = TN165	16E = TN176
6A = TN166	
7F = TN167	
8F = TN168	
9A = TN169	
10A = TN170	
11F = TN171	

Approved By:

FM-L15 117/15-05-63

## Calibration Report

### Measurement Results

Calibration Point	Average Standard Reading at each position (°C)								
	TN161	TN162	TN163	TN164	TN165	TN166	TN167	TN168	TN169
3	3.23	3.38	3.23	3.41	3.36	3.52	3.51	3.11	3.29
	TN171	TN172	TN173	TN174	TN175	TN176			
	3.36	3.18	3.52	3.22	3.28	3.31			

Chamber (Cold Room)			Temperature Distribution				
Setting (°C)	Reading (°C)		Average (°C)	Stability (± °C)	Uniformity (°C)	Uncertainty (± °C)	Coverage Factor k
	Min	Max					
3.0	2.7	3.4	3.0	3.34	1.00	1.10	1.46

\* The Acuated uncertainty exclude "uniformity"

The calibration result apply only the above calibrated item.

The result of test was found accurate as shown on date and place of test only.

The reported expanded uncertainty is based on a standard uncertainty multiplied by a coverage factor  $k$  which for a t-distribution, providing a level of confidence of approximately 95 %.

Approved By:

FM-L15 117/15-05-63

## Certificate of Calibration

**Equipment** : Chamber ( Cold Room )  
**Manufacturer** : KOLDTECH  
**Model** : KM 320  
**Serial No.** : TBN-1012061/05  
**Customer Code** : BKK\_EN0167  
**ID No.** : T2463A3  
**Customer** : ALS Laboratory Group (Thailand) Co.,Ltd.  
104 Phatthanakan 40, Phatthanakan Rd., Khwaeng Phatthanakan,  
Khet Suan Luang, Bangkok 10250  
**Customer Location** : Environmental Laboratory  
**Date of Receipt** : 27 June 2022  
**Calibrated By** : Sujjar Naknakred ( Site Calibration Manager )  
**Approved By** : / Boonchai Suriyawong (Site Calibration Manager)  
**Date of Issue** : 04 JUL 2022

REVIEW BY	
APPROVED BY	
NEXT CAL. DATE	30/12/23

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

This Certificate is issued in accordance with the conditions of accreditation granted by the Thai Laboratory Accreditation Scheme which has assessed the measurement capability of the laboratory and its traceability to recognized national standards and to the units of measurement realized at the corresponding national standard laboratory. This certificate may not be reproduced other than in full except with the prior written approval of the Metrological Center.

FM-L14 117/01-02-64

## Calibration Report

**Equipment** : Chamber ( Cold Room )  
**Date of Calibration** : 30 June - 1 July 2022  
**Environment** : Temperature : 18.9-23.7 °C  
Line Voltage : 222.9-226.5 V  
Relative Humidity : 55 - 65 %RH

### Condition of this results of calibration :

1. This equipment was calibrated by insert nine standard thermocouples type T into its chamber , the other one standard thermocouples type T use for ambient temperature measurement . The calibration was done in according to WI-T20 ( based on ASTM E145-94 ( Reapproved 2001 ) and AS2853-1986 ).

All data show below were final values and the initial data from customer request . The temperature scale used was based on ITS - 90 .

### 2. Reference Standard Instrument :

Instrument	Model	Instrument No.	Certificate No.	Due Date
TC	TYPE T	TN161-TN170	T210009	30 July 2022
TC	TYPE T	TN171-TN180	T210009	30 July 2022
DATA LOGGER	34970A	T149	T210009	30 July 2022

### 3. This certificate is traceable to :

National Institute of Metrology ( Thailand ) through Metrological Center ( NSC-TISI-TIS 17025 CALIBRATION 0244 ).

### 4. Condition of calibrated item : good

#### Equipment Description :

Time Constant : 3 Hour - Minute At 3 °C  
Fresh Air Damper : ☐ Open ☐ Min ☐ Medium ☐ Max  
☐ Close  
☒ Not Available

### 5. Adjustment :

( ) without adjustment ( X ) after adjustment

Approved By:

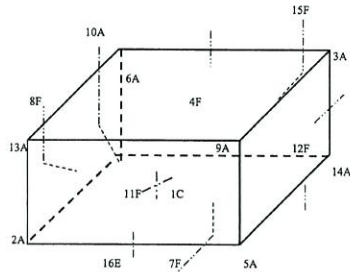
FM-L15 117/15-05-63



Certificate No. T221644

Page 3 of 4

## Calibration Report



C = Centre, F = Centre of Face, A = Corner, E = Centre of Edge

1C = TN161	11F = TN171
2A = TN162	12F = TN172
3A = TN163	13A = TN173
4F = TN164	14A = TN174
5A = TN165	15F = TN175
6A = TN166	16E = TN176
7F = TN167	
8F = TN168	
9A = TN169	
10A = TN170	

Approved By:

FM-L15 117/15-05-63

Certificate No. T221644

Page 4 of 4

## Calibration Report

## Measurement Results:

Calibration Point	Average Standard Reading at each position (°C)									
	TN161	TN162	TN163	TN164	TN165	TN166	TN167	TN168	TN169	TN170
3	2.71	2.82	2.75	2.89	2.95	3.68	3.02	2.96	3.03	2.85
	TN171	TN172	TN173	TN174	TN175	TN176				
	2.97	3.02	2.89	3.04	2.97	3.33				

Chamber ( Cold Room )			Temperature Distribution				
Setting (°C)	Reading (°C)		Average (°C)	Stability (± °C)	Uniformity (°C)	Uncertainty (± °C)	Coverage
	Min , Max	Average					Factor k
3.0	2.9 , 4.0	3.2	2.99	1.05	1.30	1.66	2.00

\* The quoted uncertainty exclude " uniformity "

The calibration result apply only the above calibrated item.

The result of test was found accurate as shown on date and place of test only.

The reported expanded uncertainty is based on a standard uncertainty multiplied by a coverage factor k which for a t-distribution, providing a level of confidence of approximately 95 % .

Approved By:

FM-L15 117/15-05-63

## Certificate of Calibration

Model Number : MSU2245-000-DA  
Description : Analytical Balance  
Serial Number : 27405555 # BKK\_EN0003  
Manufacturer : Sartorius

Certificate No. : 218C10263  
Issued Date : Monday, September 06, 2021  
Reference No. : 502052  
Page No. : 1 of 2

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

Calibrated Place : Lab Room

Calibrated By : Mr. Chonchai Inthana  
Calibration Date : Friday, September 03, 2021

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

## Metrological data :

Capacity : 220 g Readability : 0.0001 g

## Ambients Conditions :

Temperature : 23.5 °C ± 5.0 °C  
Humidity : 59.1 % RH ± 10.0 % RH  
Pressure : ±

## Reasons for calibration

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

## Equipment Condition :

☒ Good Operate ☐ Fair

## Measurement Method UKAS Publication Ref : Lab 14

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

## Traceability:

Model Number	Description	Traceability	Certificate No.	Due Date
YCS011-522-00	Sartorius weight set 1mg - 200g E2,YCS011-522-00	Sartorius	119934 D-K-19398-01-00	10-Sep-2021
MHB-382SD	Humidity/Barometer/Temp. Lutron MHB-382SD	SPCC	KSPR2111869	31-Aug-2022

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.

ISO 17025-RF-22 26/03/2020 R2

Mr Chonchai Inthana(Technical Manager)



## Certificate of Calibration

Model Number : MSU2245-000-DA  
Description : Analytical Balance  
Serial Number : 27405555 # BKK\_EN0003  
Manufacturer : Sartorius

Certificate No. : 218C10263  
Issued Date : Monday, September 06, 2021  
Reference No. : 502052  
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 readouts under constant test conditions when the same load within a measurement series is placed repeatedly on the weighing pan in the same manner. The standard deviation is used to express repeatability quantitatively.			The off-center loading error is yielded by the difference between the readout of the load, i.e. 1/2 or 1/4 of maximum capacity, placed in the middle of the weighing pan and between each of four additional measurement points (positions defined according to OIML R110).		
Nominal Value : (Low Load)	20.0000	200.0001	Nominal value:	50	g
20 g	20.0001	200.0000	Tolerance	0.0004	g
Tolerance	20.0000	200.0001			
0.0001 g	20.0000	200.0001			
	20.0001	200.0001			
Nominal Value : (High Load)	20.0000	200.0001			
200 g	20.0001	200.0000			
Tolerance	20.0000	200.0001			
0.0001 g	20.0000	200.0000			
	20.0000	200.0001			
Standard Deviation	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
1	1.0000	1.0000	0.0000	0.00013
2	2.0000	2.0000	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	50.0001	50.0002	0.0001	0.00014
100	100.0001	100.0002	0.0001	0.00018
200	200.0001	200.0001	0.0000	0.00029

End of Report

ISO 17025-RF-22 26/03/2020 R2

## Certificate of Calibration

Represent to Certificate of Calibration /PTC/07/22071

Certificate No.: PTC/07/22071 Page: 1 of 2  
Equipment: Digital Balance Condition: Normal  
Manufacturer: Sartorius Serial No: 26207042  
Model: MSE224-100-DU ID No: BKK\_EN0002  
Type of Balance: Single interval

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

Environment Condition: Temperature 21.5 °C ± 0.7 °C  
Humidity 61.8 %RH ± 4.7 %RH  
Air density 1.19 kg/m<sup>3</sup>

Calibration Place: ALS Laboratory Group (Thailand) Co., Ltd.  
104 Phatthanakarn 40 Phatthanakarn Rd.,  
khwaeng Phatthanakarn, Khet Suan Luang, Bangkok 10250.

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

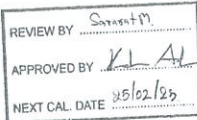
Traceability: This certificate is traceable to the SI Units through Thai Calibration Service Co., Ltd.  
, NSC-ONSC Accreditation No.: Calibration 0189

Date Received: February 25, 2022

Calibration Date: February 25, 2022

Issued Date: March 01, 2022

Calibration By: Mr. Rungroje Metakul



Approved By: (Mr. Kriangsak Kalasin)  
Reviewed by

Approved By: (Mr. Keattisak Kerdto)  
Laboratory Manager

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

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

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

PTC-FMC-BI-02: 2 Feb. 2020

Represent to Certificate of Calibration /PTC/07/22071

Certificate No.: PTC/07/22071

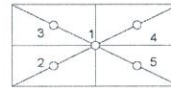
Page: 2 of 2

Measurement Results:

Without Adjustment:

Function Calibration: Non Adjustment

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



Eccentricity test 100 (g)				
Position (g)				
1	2	3	4	5
0.0000	-0.0002	-0.0001	0.0001	-0.0001
Maximum deviation: 0.0002				

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

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

Nominal test value (g)	Standard Deviation
200	0.00005

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

Nominal Value (g)	Conventional Mass (g)	Indication (g)	Correction of Balance (g)	Uncertainty (g)	k
0	0.00000	0.0000	0.0000	0.00016	2.52
0.1	0.10000	0.1000	0.0000	0.00017	2.20
0.5	0.50000	0.5000	0.0000	0.00016	2.28
1	1.00001	1.0000	0.0000	0.00016	2.28
2	2.00001	2.0000	0.0000	0.00016	2.28
5	5.00001	5.0000	0.0000	0.00016	2.28
10	10.00002	10.0000	0.0000	0.00016	2.28
20	20.00002	20.0000	0.0000	0.00016	2.23
50	50.00001	50.0000	0.0000	0.00017	2.15
100	100.00002	99.9999	0.0001	0.00020	2.06
120	120.00004	120.0000	0.0000	0.00023	2.03
150	150.00003	150.0000	0.0000	0.00026	2.00
200	200.00003	199.9999	0.0001	0.00030	2.00

Note: Weight of adjust (g)

The End of Certificate

PTC-FMC-BI-02: 2 Feb. 2020



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)  
CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES  
5344 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG BANGKOK 10250  
TEL: 0-2717-3000-27 FAX: 0-2719-9484



Cert. No.: 21TM2189

Page: 1 of 3

## Certificate of Calibration

Equipment: Hot Air Oven

Manufacturer: Memmert

Model: UFE 500

Serial No.: GS11.1574

ID No.: BKK\_EN0007

Submitted by: ALS Laboratory Group (Thailand) Co., Ltd.  
104 Phatthanakarn 40, Phatthanakarn Rd.,  
Khwaeng Phatthanakarn, Khet Suan Luang,  
Bangkok 10250 Thailand

Location: Oven Room

Received Order: 1 December 2021

Calibration Date: 1 December 2021

Ambient Temperature: (26 ± 10) °C

Relative Humidity: (50 ± 30) %

Calibrated by: Khit Rutanaprapachai

Approved by: (Signature)  
Approved Signatory

( ) Ponthippa Tameyakul  
( ) Malee Butkruea  
( ) Suwit Imjai

Issue Date: 7 December 2021

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 0032815



Equipment: Hot Air Oven  
Condition As-Received: Used Item  
Reference: 2112-0002OC-1

Cert. No.: 21TM2189  
Page: 2 of 3

Procedure Used :-

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

The temperature scale used was based on ITS-90.

Condition of this result of calibration

1. Reference standard instrument:-

Instrument	Model	Serial No.	Cert. No.	Due Date
1) Data Acquisition	34970A	MY44060450	21LM4/1	06 Mar 2022

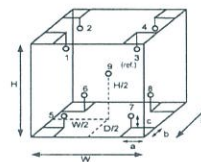
2. This certificate is valid only to the item calibrated on date and place of calibration.

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

Result of Calibration :- ( ) Without Adjustment

Function of UUC: Temperature Source

Fresh air setting: Close



Probe Installation Details:		Dimension of Chamber:	
a =	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)	25	25
REL.Humid. (%)	51	53
AC Supply (Volt)	221	222

Ref. Std. ID No.: @ Calibration Point		
Position:	(104) °C	(121,175,180) °C
1	19-14RTD-01	19-14TC-01
2	19-14RTD-02	19-14TC-02
3	19-14RTD-03	19-14TC-03
4	19-14RTD-04	19-14TC-04
5	19-14RTD-05	19-14TC-05
6	19-14RTD-06	19-14TC-06
7	21-14RTD-07	19-14TC-07
8	19-14RTD-08	19-14TC-08
9 (ref.)	19-14RTD-09	19-14TC-09

a 1085618





Equipment : Hot Air Oven  
 Condition As-Received : Used Item  
 Reference : 2112-0002OC-1  
 Result of Calibration : ( " ) Without Adjustment  
 Function of UUC\* : Temperature Source  
 Fresh air setting : Close

Cert. No.: 21TM2189  
 Page.: 3 of 3

Calibration Point (°C)	UUC* Setting (°C)	UUC* Reading (°C)	Temperature stability (± °C)	Temperature uniformity (°C)	Overall Variation (°C)	Uncertainty (± °C)	Coverage Factor k
104.0	104.0	104.0	0.059	0.52	0.59	0.45	2
121.0	121.0	121.0	0.11	0.75	1.2	1.1	2
175.0	175.0	175.0	0.13	0.90	1.6	1.1	2
180.0	180.0	180.0	0.13	0.93	1.6	1.1	2

Calibration Point (°C)	Measured Temperature (°C)								
	Position								
	1	2	3	4	5	6	7	8	9 (ref.)
104.0	104.265	104.229	104.080	103.922	104.390	104.304	104.284	103.994	103.909
121.0	120.838	120.519	120.661	120.524	121.162	120.855	120.703	120.126	120.726
175.0	175.021	174.603	174.848	174.652	175.830	175.321	175.411	174.440	175.222
180.0	179.792	179.374	179.575	179.376	180.643	180.081	180.174	179.217	180.014

Average\*: The average of 30 values in each position.  
 Temperature stability: One-half of the greatest maximum difference of measured temperature at any one sensor.  
 Temperature uniformity: The maximum difference of measured temperatures at any sensors and the measured temperature at the reference location which are observed at the same time or at as close an observation time as possible to determine the temperature pattern or homogeneity within the chamber under steady-state conditions.  
 Overall Variation: The Difference of the maximum and minimum measured temperatures throughout observation.  
 UUC\*: Unit Under Calibration  
 Note: The reported uncertainty of measurement was included stability and excluded uniformity.

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

-000-

a 1085617



## Metrological Center

SCI ECO Services Company Limited

33/2 Moo 3, T.Banpa, A.Kaengkhoi, Saraburi 18110, Thailand.  
 Saraburi Tel: +66 3627 3096 Fax: +66 3627 3100  
 Bangkok Tel: +668 9205 6851, +669 8247 2360  
 Website: www.scieco.co.th E-Mail: calibrate@scg.co.th



Certificate No. T220139

Page 1 of 3

## Certificate of Calibration

Equipment : Liquid Bath ( Water )

Manufacturer : MEMMERT

Model : WNB29

Serial No. : L611.0135

Customer Code : BKK\_EN0148

ID No. : T6455A4

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

104 Phatthanakan 40, Phatthanakan Rd., Khwaeng Phatthanakan,

Khet Suan Luang, Bangkok 10250

Customer Location : ORGANIC PREPARATION LAB

Date of Receipt : 26 January 2022

Calibrated By : Watcharapon Sangtong (Technician)

Approved By :  / Sujjar Naknakred (Site Calibration Manager)

Date of Issue : 08 FEB 2022

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

This Certificate is issued in accordance with the conditions of accreditation granted by the Thai Laboratory Accreditation Scheme which has assessed the measurement capability of the laboratory and its traceability to recognized national standards and to the units of measurement realized at the corresponding national standard laboratory. This certificate may not be reproduced other than in full except with the prior written approval of the Metrological Center.

FM-L14 117-01-02-64



## Metrological Center

SCI ECO Services Company Limited

33/2 Moo 3, T.Banpa, A.Kaengkhoi, Saraburi 18110, Thailand.



Certificate No. T220139

Page 2 of 3

## Calibration Report

Equipment : Liquid Bath ( Water )  
 Date of Calibration : 31 January 2022  
 Environment : Temperature : 22.4-23.9 °C  
 Line Voltage : 221.4-225.4 V  
 Relative Humidity : 55 - 65 %RH

### Condition of this results of calibration :

1. This equipment was calibrated by insert five resistance thermometer detectors into its water bath, the other one thermocouple type T use for ambient temperature measurement. The calibration was done in according to WI-T36 ( based on ASTM E715-80 ( Reapproved 2001 ) ).  
 All data show below were final values and the initial data from customer request. The temperature scale used was based on ITS - 90.

### 2. Reference Standard Instrument :

Instrument	Model	Instrument No.	Certificate No.	Due Date
RTD	100 OHM	M34 (CH1-CH5)	T210115	2 February 2022
DATA LOGGER	34970A	T47	T210115	2 February 2022

### 3. This certificate is traceable to :

National Institute of Metrology ( Thailand ) through Metrological Center ( NSC-TISI-TIS 17025 CALIBRATION 0244 )

### 4. Condition of calibrated item : good

### Equipment Description :

Time Constant : 1 Hour - Minute At 60 °C

### 5. Adjustment :

( X ) without adjustment ( ) after adjustment

Approved By: 

FM-L15 117-15-05-63



## Metrological Center

SCI ECO Services Company Limited

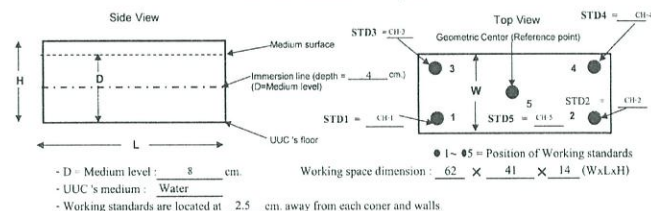
33/2 Moo 3, T.Banpa, A.Kaengkhoi, Saraburi 18110, Thailand.



Certificate No. T220139

Page 3 of 3

## Calibration Report



### Measurement Results:

Calibration Point	Average Standard Reading at each position (°C)				
	CH-1	CH-2	CH-3	CH-4	CH-5
60	59.95	60.04	60.12	60.01	59.89
85	85.17	84.89	85.34	84.78	84.93
95	93.46	93.14	93.81	93.05	93.28

Setting (°C)	Reading (°C)		Stability (± °C)	Uniformity (± °C)	Uncertainty (± °C)	Coverage Factor k
	Min.	Max.				
61.0	60.9	61	0.10	0.19	0.25	2.00
86.0	85.9	86.1	0.12	0.39	0.32	2.06
95.0	94.8	95.1	0.14	0.51	0.38	2.11

\* The quoted uncertainty exclude "uniformity"

The calibration result apply only the above calibrated item.

The result of test was found accurate as shown on date and place of test only.

The reported expanded uncertainty is based on a standard uncertainty multiplied by a coverage factor k which for a t-distribution, providing a level of confidence of approximately 95 %.

Approved By: 

FM-L15 117-15-05-63

LABX 2102202

### Test Report

Customers	ALS Laboratory Group (Thailand) Co., Ltd.		
Equipment	Chlorine Meter	Manufacturer	HACH
Controller Model	Pocket II C12	Sensor Model	-
Controller Serial No.	13060E225094	Sensor Serial No.	BKK_LG0018
Date of test	20/09/2021	Period	1 Year
Environment temperature	25.0 °C	Humidity	60.0 %RH

### Results

#### Instrument Checked

Item	Characteristic	Before	After	Remark
1	Visual Inspect	<input checked="" type="checkbox"/> Pass <input type="checkbox"/> Fail	<input checked="" type="checkbox"/> Pass <input type="checkbox"/> Fail	
2	Power Supply (4.5 – 6.5 VDC)	6.0 VDC	6.0 VDC	
3	Display Check	<input checked="" type="checkbox"/> Pass <input type="checkbox"/> Fail	<input checked="" type="checkbox"/> Pass <input type="checkbox"/> Fail	
4	Keyboard Check	<input checked="" type="checkbox"/> Pass <input type="checkbox"/> Fail	<input checked="" type="checkbox"/> Pass <input type="checkbox"/> Fail	
5	Function System Program	<input checked="" type="checkbox"/> Pass <input type="checkbox"/> Fail	<input checked="" type="checkbox"/> Pass <input type="checkbox"/> Fail	

#### Warning and Error Checked

Item	Event	Before	After
6	Error test	<input checked="" type="checkbox"/> None <input type="checkbox"/> Appear	<input checked="" type="checkbox"/> None <input type="checkbox"/> Appear

#### Check with Standard

Item	Characteristic	Before	After	Remark
DPD-CHLORINE-LR				
7	Blank (0.00 mg/l)	0.00 mg/l	0.00 mg/l	
8	Standard C2 No. 1 (0.22 ± 0.09 mg/l)	0.21 mg/l	0.20 mg/l	
9	Standard C2 No. 2 (0.91 ± 0.10 mg/l)	0.91 mg/l	0.90 mg/l	
10	Standard C2 No. 3 (1.66 ± 0.14 mg/l)	1.67 mg/l	1.57 mg/l	
DPD-CHLORINE-HR				
11	Blank (0.0 mg/l)	0.0 mg/l	0.0 mg/l	
12	Standard C2 No. 1 (2.2 ± 0.2 mg/l)	2.2 mg/l	2.2 mg/l	
13	Standard C2 No. 2 (3.9 ± 0.3 mg/l)	4.0 mg/l	3.9 mg/l	
14	Standard C2 No. 3 (6.6 ± 0.6 mg/l)	7.0 mg/l	6.9 mg/l	

REVIEW BY *Chayathorn P.*  
APPROVED BY *Thak*  
NEXT CAL DATE 2019/02



LABX 2102202

### Summary of checked

- ☒ The instrument can work normally and efficiently. (เครื่องมือวัดสามารถทำงานได้ปกติและมีประสิทธิภาพ)  
☐ The instrument can work but it's requiring to maintenance. (เครื่องมือวัดสามารถทำงานได้แต่ต้องบำรุงรักษา)  
☐ The instrument could not work it's requiring to repair. (เครื่องมือวัดไม่สามารถทำงานได้และต้องทำการซ่อมบำรุง)

### Remark:

### Standard Equipment Used

Equipment	Equipment ID
Standard Chlorine DPD-CHLORINE-LR	Lot No. A1059 Exp. date Feb-23
Standard Chlorine DPD-CHLORINE-HR	Lot No. A1019 Exp. date Jan-23
Digital multi meter	S/N 2330582 Due date Aug-22
Thermo hygrometer	S/N 41413945 Due date Aug-22

Test By : *WILAIK S.*  
(Miss Wilailak Sawangpun)  
Service Engineer

Approved by : *SAB*  
(Mr. Suanun Saryangkool)  
Assistant Service Division Manager



BKK\_LG0018

LABX 2202138

### Test Report

Customers	ALS LABORATORY GROUP (THAILAND) CO. LTD		
Equipment	Chlorine Meter	Manufacturer	HACH
Controller Model	Pocket II C12	Sensor Model	-
Controller Serial No.	13060E225094	Sensor Serial No.	-
Date of test	31/08/2022	Period	1 Year
Environment temperature	24.0 °C	Humidity	60.0 %RH

### Results

#### Instrument Checked

Item	Characteristic	Before	After	Remark
1	Visual Inspect	<input checked="" type="checkbox"/> Pass <input type="checkbox"/> Fail	<input checked="" type="checkbox"/> Pass <input type="checkbox"/> Fail	
2	Power Supply (4.5 – 6.0 VDC)	5.7 VDC	5.3 VDC	
3	Display Check	<input checked="" type="checkbox"/> Pass <input type="checkbox"/> Fail	<input checked="" type="checkbox"/> Pass <input type="checkbox"/> Fail	
4	Keyboard Check	<input checked="" type="checkbox"/> Pass <input type="checkbox"/> Fail	<input checked="" type="checkbox"/> Pass <input type="checkbox"/> Fail	
5	Function System Program	<input checked="" type="checkbox"/> Pass <input type="checkbox"/> Fail	<input checked="" type="checkbox"/> Pass <input type="checkbox"/> Fail	

#### Warning and Error Checked

Item	Event	Before	After
6	Error test	<input checked="" type="checkbox"/> None <input type="checkbox"/> Appear	<input checked="" type="checkbox"/> None <input type="checkbox"/> Appear

#### Check with Standard

Item	Characteristic	Before	After	Remark
DPD-CHLORINE-LR				
7	Blank (0.00 mg/l)	0.00 mg/l	0.00 mg/l	
8	Standard C2 No. 1 (0.23 ± 0.09 mg/l)	0.22 mg/l	0.23 mg/l	
9	Standard C2 No. 2 (0.89 ± 0.10 mg/l)	0.87 mg/l	0.89 mg/l	
10	Standard C2 No. 3 (1.64 ± 0.14 mg/l)	1.71 mg/l	1.64 mg/l	
DPD-CHLORINE-HR				
11	Blank (0.0 mg/l)	0.0 mg/l	0.0 mg/l	
12	Standard C2 No. 1 (2.1 ± 0.2 mg/l)	2.0 mg/l	2.2 mg/l	
13	Standard C2 No. 2 (3.9 ± 0.3 mg/l)	3.7 mg/l	3.9 mg/l	
14	Standard C2 No. 3 (6.6 ± 0.6 mg/l)	6.7 mg/l	6.8 mg/l	

REVIEW BY *Chayathorn P.*  
APPROVED BY *Thak*  
NEXT CAL DATE 31/08/2023



LABX 2202138

### Summary of checked

- ☒ The instrument can work normally and efficiently. (เครื่องมือวัดสามารถทำงานได้ปกติและมีประสิทธิภาพ)  
☐ The instrument can work but it's requiring to maintenance. (เครื่องมือวัดสามารถทำงานได้แต่ต้องบำรุงรักษา)  
☐ The instrument could not work it's requiring to repair. (เครื่องมือวัดไม่สามารถทำงานได้และต้องทำการซ่อมบำรุง)

### Remark:

### Standard Equipment Used

Equipment	Equipment ID
Standard Chlorine DPD-CHLORINE-LR	Lot No. A2131 Exp. date May-24
Standard Chlorine DPD-CHLORINE-HR	Lot No. A2104 Exp. date Apr-24
Digital multi meter	S/N 97270010 Due date 23-Jun-23
Thermo hygrometer	S/N 41413945 Due date 17-Aug-23

Test By : *WILAIK S.*  
(Miss Wilailak Sawangpun)  
Service Engineer

Approved by : *SAB*  
(Mr. Suanun Saryangkool)  
Assistant Service Division Manager





# SITHIPORN ASSOCIATES CO.,LTD. CALIBRATION LABORATORY

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



Cert. No. : ACC22012  
Pages : 1 of 3

## Calibration Certificate

Equipment : SOUND CALIBRATOR  
Manufacturer : RION  
Model : NC-74  
Serial No.: 34178117  
ID No.: BKK\_FS0630

Condition As Found : GOOD

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

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

Received Date : 22 APRIL 2022  
Calibration Date : 26 APRIL 2022  
Date of Issue : 29 APRIL 2022

Calibrated by : Nathakorn Pisutpaisan

Approved by :

*T. Petchur*  
( Thanakul Petchur )

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QF-TS12-04-04-020664

# SITHIPORN ASSOCIATES CO.,LTD. CALIBRATION LABORATORY

Continuation of Calibration Certificate

Cert. No. : ACC22012  
Job No. : VC65AC0055  
Pages : 2 of 3

Calibration Procedure : CP-AC-03

## Calibration Method :

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

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

## Condition of this result of calibration :

### 1. Reference Standard Instruments :

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

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

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

3.1 National Institute of Metrology (Thailand).

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

QF-TS12-04-04-020664

# SITHIPORN ASSOCIATES CO.,LTD. CALIBRATION LABORATORY

Continuation of Calibration Certificate

Cert. No. : ACC22012  
Job No. : VC65AC0055  
Pages : 3 of 3

## Result of calibration :

### 1. Sound pressure level

Specified sound pressure level (dB)	Measured value (dB)	Deviated value (dB)	Uncertainty (dB)	Tolerance limit (dB)
94	94.13	0.13	0.14	0.40

### 2. Frequency

Specified Frequency (Hz)	Measured value (Hz)	Deviated value (%)	Uncertainty (%)	Tolerance limit (%)
1000	1001.7	0.2	0.1	1.0

### 3. Total distortion

Measured value (%)	Uncertainty (%)	Tolerance limit (%)
1.73	0.10	3.0

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

End of Calibration Certificate

QF-TS12-04-04-020664

# SITHIPORN ASSOCIATES CO.,LTD. CALIBRATION LABORATORY

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

## Calibration Certificate

Equipment : SOUND LEVEL METER  
Manufacturer : RION  
Model : NL-42/ Microphone UC-52 / Pre-amplifier NH-24  
Serial No.: 00658243 / 157783 / 48098  
ID No.: BKK\_FS0100

Condition As Found : GOOD

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

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

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

Calibrated by : Nathakorn Pisutpaisan

Approved by :

*T. Petchur*  
( Thanakul Petchur )

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QF-TS12-04-04-020664

## Continuation of Calibration Certificate

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

Calibration Procedure : CP-AC-01

## Calibration Method :

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

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

## Condition of this result of calibration :

## 1. Reference Standard Instruments :

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

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

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

3.1 National Institute of Metrology (Thailand).

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

QF-TS12-04-04-020664

T. R. H.

## Continuation of Calibration Certificate

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

## Summary of Measurement Result :

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

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T. R. H.

## Continuation of Calibration Certificate

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

## Result of calibration :

## 1. Absolute sensitivity

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

## 2. Self-generated noise

## 2.1 Normal test

Measured Value (dB)
15.7

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

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

## 3. Acoustical signal tests of frequency weightings

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

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

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T. R. H.

## Continuation of Calibration Certificate

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

## 4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

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

## 5. Frequency and time weightings at 1 kHz

## 5.1 Frequency weightings at 1 kHz

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

## 5.2 Time weighting at 1 kHz

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

## 6. Long - term stability

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

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T. R. H.



## Continuation of Calibration Certificate

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

## 7. Level linearity on the reference level range

Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
137.0	137.0	0.0	±1.1
136.0	136.0	0.0	±1.1
135.0	135.0	0.0	±1.1
134.0	134.0	0.0	±1.1
133.0	132.9	-0.1	±1.1
132.0	131.9	-0.1	±1.1
131.0	130.9	-0.1	±1.1
129.0	128.9	-0.1	±1.1
124.0	124.0	0.0	±1.1
119.0	119.0	0.0	±1.1
114.0	114.0	0.0	±1.1
109.0	109.0	0.0	±1.1
104.0	104.0	0.0	±1.1
99.0	99.0	0.0	±1.1
94.0	94.0	0.0	±1.1
89.0	89.0	0.0	±1.1
84.0	84.0	0.0	±1.1
79.0	79.0	0.0	±1.1
74.0	74.0	0.0	±1.1
69.0	69.0	0.0	±1.1
64.0	64.0	0.0	±1.1
59.0	59.0	0.0	±1.1
54.0	54.0	0.0	±1.1
49.0	49.0	0.0	±1.1
44.0	44.0	0.0	±1.1
39.0	39.0	0.0	±1.1
34.0	34.0	0.0	±1.1
30.0	30.1	0.1	±1.1
29.0	29.1	0.1	±1.1
28.0	28.0	0.0	±1.1
27.0	27.1	0.1	±1.1
26.0	26.2	0.2	±1.1
25.0	25.2	0.2	±1.1

QF-TS12-04-04-020664

T. Petchur

## Continuation of Calibration Certificate

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

## 8. Level linearity including the level range control

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

## 9. Tone burst response

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

## 10. Peak C sound level

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

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

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T. Petchur

## Continuation of Calibration Certificate

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

## 11. Overload indication

Measured value (dB)		Deviated Value (dB)	Acceptance Limits (dB)
Positive one-half cycle	Negative one-half cycle		
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 Srinithorn 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. : ACL22043  
Pages : 1 of 8

## Calibration Certificate

Equipment : SOUND LEVEL METER  
Manufacturer : RION  
Model : NL-42/ Microphone UC-52 / Preamplifier NH-24  
Serial No.: 00873053 / 171587 / 73329  
ID No.: BKK\_FS0930

Condition As Found : GOOD

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

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

Received Date : 05 JANUARY 2022  
Calibration Date : 12-14 JANUARY 2022  
Date of Issue : 17 JANUARY 2022

Calibrated by : Nakhorn Pisutpaisan

Approved by :

T. Petchur  
( Thanakul Petchurai )

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Continuation of Calibration Certificate

Cert. No. : ACL22043  
Job No. : VC65AC0041  
Pages : 2 of 8

Calibration Procedure : CP-AC-01

Calibration Method :

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

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

Condition of this result of calibration :

1. Reference Standard Instruments :

Instrument	Model	Serial No.	Cert. No.	Due Date
Waveform Generator	33210A	MY48017076	EF-0012-21	10-Feb-22
Waveform Generator	33511B	MY52302742	EF-0011-21	10-Feb-22
Digital Multimeter	33461A	MY53220104	EEL_BP_05-0264	10-Feb-22
Digital Multimeter	33461A	MY53220076	EEL_BP_03-0264	08-Feb-22
Digital Multimeter	34461A	MY60024273	1-15180225251-1	15-Sep-22
Programmable Attenuator	MAT-1070	62100114	1500-07774E	08-Mar-22
Condenser Microphone	4180	2977900	AA-1008-21	05-Feb-22
Measuring Amplifier	NA-42KA1	34560495	AA-3003-21	16-Feb-22

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

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

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

QF-TS12-04-04-020664

Continuation of Calibration Certificate

Cert. No. : ACL22043  
Job No. : VC65AC0041  
Pages : 3 of 8

Summary of Measurement Result :

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

QF-TS12-04-04-020664

Continuation of Calibration Certificate

Cert. No. : ACL22043  
Job No. : VC65AC0041  
Pages : 4 of 8

Result of calibration :

1. Absolute sensitivity

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

2. Self-generated noise

2.1 Normal test

Measured Value (dB)
14.6

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

Frequency Weighting	Measured value (dB)
A - weight	13.1
C - weight	19.4
Flat	24.7

3. Acoustical signal tests of frequency weightings

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

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

QF-TS12-04-04-020664

Continuation of Calibration Certificate

Cert. No. : ACL22043  
Job No. : VC65AC0041  
Pages : 5 of 8

4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

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

5. Frequency and time weightings at 1 kHz

5.1 Frequency weightings at 1 kHz

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

5.2 Time weighting at 1 kHz

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

6. Long - term stability

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

QF-TS12-04-04-020664



## Continuation of Calibration Certificate

Cert. No. : ACL22043  
Job No. : VC65AC0041  
Pages : 6 of 8

## 7. Level linearity on the reference level range

Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
137.0	137.0	0.0	± 1.1
136.0	136.0	0.0	± 1.1
135.0	135.0	0.0	± 1.1
134.0	134.0	0.0	± 1.1
133.0	133.0	0.0	± 1.1
132.0	132.0	0.0	± 1.1
131.0	131.0	0.0	± 1.1
129.0	129.0	0.0	± 1.1
124.0	124.0	0.0	± 1.1
119.0	119.0	0.0	± 1.1
114.0	114.0	0.0	± 1.1
109.0	109.0	0.0	± 1.1
104.0	104.0	0.0	± 1.1
99.0	99.0	0.0	± 1.1
94.0	94.0	0.0	± 1.1
89.0	89.0	0.0	± 1.1
84.0	84.1	0.1	± 1.1
79.0	79.0	0.0	± 1.1
74.0	74.1	0.1	± 1.1
69.0	69.1	0.1	± 1.1
64.0	64.0	0.0	± 1.1
59.0	59.1	0.1	± 1.1
54.0	54.0	0.0	± 1.1
49.0	49.0	0.0	± 1.1
44.0	44.0	0.0	± 1.1
39.0	39.0	0.0	± 1.1
34.0	34.0	0.0	± 1.1
30.0	30.0	0.0	± 1.1
29.0	29.0	0.0	± 1.1
28.0	28.0	0.0	± 1.1
27.0	27.0	0.0	± 1.1
26.0	25.9	-0.1	± 1.1
25.0	25.0	0.0	± 1.1

QF-TS12-04-04-020664

T. Petchur

## Continuation of Calibration Certificate

Cert. No. : ACL22043  
Job No. : VC65AC0041  
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	93.9	-0.1	± 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, Lepeak (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.0	0.0	-
One	136.4	136.3	-0.1	± 3.0

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

QF-TS12-04-04-020664

T. Petchur

## Continuation of Calibration Certificate

Cert. No. : ACL22043  
Job No. : VC65AC0041  
Pages : 8 of 8

## 11. Overload indication

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

## 12. High level stability

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

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

End of Calibration Certificate

QF-TS12-04-04-020664

T. Petchur

451-451/1 Sirinthorn Rd., Bangumru, Bangplud Bangkok 10700 THAILAND  
Tel: 0-2435-8800 Fax: 0-2433-1679 e-mail: cal-center@sithiporn.com http://www.sithiporn.comCert. No. : ACL21138  
Pages : 1 of 8

## Calibration Certificate

Equipment : SOUND LEVEL METER  
Manufacturer : RION  
Model : NL-42/ Microphone UC-52 / Preamplifier NH-24  
Serial No.: 00672789 / 170666 / 73129  
ID No.: BKK FS0929

Condition As Found : GOOD

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

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

Received Date : 21 OCTOBER 2021  
Calibration Date : 28-29 OCTOBER 2021  
Date of Issue : 01 NOVEMBER 2021

Calibrated by : Nathakorn Pisutpaisan

Approved by :

( Thanakul Petchurai )

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

QF-TS12-04-04-020664

## Continuation of Calibration Certificate

Cert. No. : ACL21138  
Job No. : VC65AC0008  
Pages : 2 of 8

Calibration Procedure : CP-AC-01

## Calibration Method :

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

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

## Condition of this result of calibration :

## 1. Reference Standard Instruments :

Instrument	Model	Serial No.	Cert. No.	Due Date
Waveform Generator	33210A	MY48017076	EF-0012-21	10-Feb-22
Waveform Generator	33511B	MY52302742	EF-0011-21	10-Feb-22
Digital Multimeter	33461A	MY53220104	EEL-BP. 05/0264	10-Feb-22
Digital Multimeter	33461A	MY53220076	EEL-BP. 03/0264	08-Feb-22
Digital Multimeter	8846A	1997025	EEL-BP. 06/0264	05-Feb-22
Programmable Attenuator	MAT-1070	62100114	1500-07774E	08-Mar-22
Condenser Microphone	4180	2977900	AA-1008-21	05-Feb-22
Measuring Amplifier	NA-42KA1	34560495	AA-3003-21	16-Feb-22

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

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

3.1 National Institute of Metrology (Thailand).

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

QF-TS12-04-04-020664

## Continuation of Calibration Certificate

Cert. No. : ACL21138  
Job No. : VC65AC0008  
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	0.35
10. Peak C sound level	✓	-	0.2	0.25
11. Overload indication	✓	-	0.1	0.1
12. High level stability	✓	-	0.1	0.1

QF-TS12-04-04-020664

## Continuation of Calibration Certificate

Cert. No. : ACL21138  
Job No. : VC65AC0008  
Pages : 4 of 8

## Result of calibration :

## 1. Absolute sensitivity

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

## 2. Self-generated noise

## 2.1 Normal test

Measured Value (dB)
15.4

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

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

## 3. Acoustical signal tests of frequency weightings

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

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

QF-TS12-04-04-020664

## Continuation of Calibration Certificate

Cert. No. : ACL21138  
Job No. : VC65AC0008  
Pages : 5 of 8

## 4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

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

## 5. Frequency and time weightings at 1 kHz

## 5.1 Frequency weightings at 1 kHz

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

## 5.2 Time weighting at 1 kHz

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

## 6. Long - term stability

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

QF-TS12-04-04-020664



## Continuation of Calibration Certificate

Cert. No. : ACL21138  
Job No. : VC65AC0008  
Pages : 6 of 8

## 7. Level linearity on the reference level range

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

QF-TS12-04-04-020664

## Continuation of Calibration Certificate

Cert. No. : ACL21138  
Job No. : VC65AC0008  
Pages : 7 of 8

## 8. Level linearity including the level range control

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

## 9. Tone burst response

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

## 10. Peak C sound level

Number of cycle in test signal	Anticipated Value (dB)	Measured Value, L <sub>peak</sub> (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.0	0.0	-
One	136.4	136.3	-0.1	±3.0

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

QF-TS12-04-04-020664

## Continuation of Calibration Certificate

Cert. No. : ACL21138  
Job No. : VC65AC0008  
Pages : 8 of 8

## 11. Overload indication

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

## 12. High level stability

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

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

End of Calibration Certificate

QF-TS12-04-04-020664

451-451/1 Sirinithorn Rd., Bangumru, Bangplud Bangkok 10700 THAILAND  
Tel: 0-2435-8800 Fax: 0-2433-1679 e-mail: cal-center@sithiporn.com http://www.sithiporn.comCert. No. : ACL21168  
Pages : 1 of 8

## Calibration Certificate

Equipment : SOUND LEVEL METER  
Manufacturer : RION  
Model : NL-42/ Microphone UC-52 / Preamplifier NH-24  
Serial No. : 00858519 / 158770 / 58771  
ID No. : BKK\_FS0109

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 : 09 DECEMBER 2021  
Calibration Date : 14-15 DECEMBER 2021  
Date of Issue : 16 DECEMBER 2021



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. : ACL21168  
Job No. : VC65AC0033  
Pages : 2 of 8

Calibration Procedure : CP-AC-01

## Calibration Method :

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

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

## Condition of this result of calibration :

## 1. Reference Standard Instruments :

Instrument	Model	Serial No.	Cert. No.	Due Date
Waveform Generator	33210A	MY48017076	EF-0012-21	10-Feb-22
Waveform Generator	33511B	MY52302742	EF-0011-21	10-Feb-22
Digital Multimeter	33461A	MY53220104	EEL.BP. 05/0264	10-Feb-22
Digital Multimeter	33461A	MY53220076	EEL.BP. 03/0264	08-Feb-22
Digital Multimeter	8846A	1997025	EEL.BP. 06/0264	05-Feb-22
Programmable Attenuator	MAT-1070	62100114	1500-07774E	08-Mar-22
Condenser Microphone	4180	2977900	AA-1008-21	05-Feb-22
Measuring Amplifier	NA-42KA1	34560495	AA-3003-21	16-Feb-22

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

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

3.1 National Institute of Metrology (Thailand).

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

QF-TS12-04-04-020664

## Continuation of Calibration Certificate

Cert. No. : ACL21168  
Job No. : VC65AC0033  
Pages : 3 of 8

## Summary of Measurement Result :

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

QF-TS12-04-04-020664

## Continuation of Calibration Certificate

Cert. No. : ACL21168  
Job No. : VC65AC0033  
Pages : 4 of 8

## Result of calibration :

## 1. Absolute sensitivity

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

## 2. Self-generated noise

## 2.1 Normal test

Measured Value (dB)
16.3

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

Frequency Weighting	Measured value (dB)
A - weight	13.1
C - weight	19.6
Flat	25.0

## 3. Acoustical signal tests of frequency weightings

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

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)			
	Flat	C-weight	A-weight	Acceptance Limits
125	0.4	0.4	0.5	± 1.5
1000	0.0	0.0	0.0	± 1.0
8000	-1.0	-1.1	-0.9	±5.0

QF-TS12-04-04-020664

## Continuation of Calibration Certificate

Cert. No. : ACL21168  
Job No. : VC65AC0033  
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	-0.1	0.0	-0.1	±1.5
250	0.0	0.0	-0.1	±1.5
500	0.0	0.0	-0.1	±1.5
1000	0.0	0.0	0.0	±1.0
2000	0.0	0.0	0.0	±2.0
4000	0.0	0.0	0.0	±3.0
8000	0.0	0.1	0.1	±5.0

## 5. Frequency and time weightings at 1 kHz

## 5.1 Frequency weightings at 1 kHz

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

## 5.2 Time weighting at 1 kHz

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

## 6. Long - term stability

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

QF-TS12-04-04-020664



## Continuation of Calibration Certificate

Cert. No. : ACL21168  
Job No. : VC65AC0033  
Pages : 6 of 8

## 7. Level linearity on the reference level range

Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
137.0	137.0	0.0	±1.1
136.0	136.0	0.0	±1.1
135.0	135.0	0.0	±1.1
134.0	134.0	0.0	±1.1
133.0	133.0	0.0	±1.1
132.0	132.0	0.0	±1.1
131.0	131.0	0.0	±1.1
129.0	129.0	0.0	±1.1
124.0	124.0	0.0	±1.1
119.0	119.0	0.0	±1.1
114.0	114.0	0.0	±1.1
109.0	109.0	0.0	±1.1
104.0	104.0	0.0	±1.1
99.0	99.0	0.0	±1.1
94.0	94.0	0.0	±1.1
89.0	89.0	0.0	±1.1
84.0	84.1	0.1	±1.1
79.0	79.0	0.0	±1.1
74.0	74.1	0.1	±1.1
69.0	69.0	0.0	±1.1
64.0	64.0	0.0	±1.1
59.0	59.0	0.0	±1.1
54.0	54.0	0.0	±1.1
49.0	49.0	0.0	±1.1
44.0	44.0	0.0	±1.1
39.0	39.0	0.0	±1.1
34.0	34.0	0.0	±1.1
30.0	30.0	0.0	±1.1
29.0	28.9	-0.1	±1.1
28.0	28.0	0.0	±1.1
27.0	26.9	-0.1	±1.1
26.0	25.9	-0.1	±1.1
25.0	24.9	-0.1	±1.1

QF-TS12-04-04-020664

## Continuation of Calibration Certificate

Cert. No. : ACL21168  
Job No. : VC65AC0033  
Pages : 7 of 8

## 8. Level linearity including the level range control

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

## 9. Tone burst response

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

## 10. Peak C sound level

Number of cycle in test signal	Anticipated Value (dB)	Measured Value, L <sub>peak</sub> (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.0	0.0	-
One	136.4	136.0	-0.4	±3.0

Number of cycle in test signal	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.1	0.1	-
Positive half cycle	135.4	135.2	-0.2	±2.0
Negative half cycle	135.4	135.3	-0.1	±2.0

QF-TS12-04-04-020664

## Continuation of Calibration Certificate

Cert. No. : ACL21168  
Job No. : VC65AC0033  
Pages : 8 of 8

## 11. Overload indication

Measured value (dB)		Deviated Value (dB)	Acceptance Limits (dB)
Positive one-half cycle	Negative one-half cycle	0.3	±1.5
89.5	89.8		

## 12. High level stability

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

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

End of Calibration Certificate

QF-TS12-04-04-020664

451-451/1 Sirinthon Rd, Bangumru, Bangplud Bangkok 10700 THAILAND  
Tel:0-2435-8800 Fax:0-2433-1679 e-mail:cal-center@sithiporn.com http://www.sithiporn.comCert. No. : ACL21169  
Pages : 1 of 8

## Calibration Certificate

Equipment : SOUND LEVEL METER  
Manufacturer : RION  
Model : NL-42/ Microphone UC-52 / Preamplifier NH-24  
Serial No. : 00858520 / 158771 / 58772  
ID No. : BKK FS0110

Condition As Found : GOOD

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

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

Received Date : 09 DECEMBER 2021  
Calibration Date : 14-15 DECEMBER 2021  
Date of Issue : 16 DECEMBER 2021

Calibrated by : Nathakorn Pisutpaisan

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

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

QF-TS12-04-04-020664

## Continuation of Calibration Certificate

Cert. No. : ACL21169  
Job No. : VC65AC0033  
Pages : 2 of 8

Calibration Procedure : CP-AC-01

## Calibration Method :

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

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

## Condition of this result of calibration :

## 1. Reference Standard Instruments :

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

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

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

3.1 National Institute of Metrology (Thailand).

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

QF-TS12-04-04-020664

## Continuation of Calibration Certificate

Cert. No. : ACL21169  
Job No. : VC65AC0033  
Pages : 3 of 8

## Summary of Measurement Result :

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

QF-TS12-04-04-020664

## Continuation of Calibration Certificate

Cert. No. : ACL21169  
Job No. : VC65AC0033  
Pages : 4 of 8

## Result of calibration :

## 1. Absolute sensitivity

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

## 2. Self-generated noise

## 2.1 Normal test

Measured Value ( dB )
16.6

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

Frequency Weighting	Measured value ( dB )
A - weight	10.8
C - weight	16.9
Flat	22.6

## 3. Acoustical signal tests of frequency weightings

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

Frequency ( Hz )	Deviation from various frequency weighting response curve (dB)			
	Flat	C-weight	A-weight	Acceptance Limits
125	0.4	0.4	0.5	± 1.5
1000	0.0	0.0	0.0	± 1.0
8000	-1.3	-1.2	-1.2	± 5.0

QF-TS12-04-04-020664

## Continuation of Calibration Certificate

Cert. No. : ACL21169  
Job No. : VC65AC0033  
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	0.1	0.0	±2.0
4000	0.0	0.0	0.0	±3.0
8000	0.0	0.1	0.1	±5.0

## 5. Frequency and time weightings at 1 kHz

## 5.1 Frequency weightings at 1 kHz

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

## 5.2 Time weighting at 1 kHz

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

## 6. Long - term stability

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

QF-TS12-04-04-020664



## Continuation of Calibration Certificate

Cert. No. : ACL21169  
Job No. : VC65AC0033  
Pages : 6 of 8

## 7. Level linearity on the reference level range

Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
137.0	137.0	0.0	± 1.1
136.0	136.0	0.0	± 1.1
135.0	135.0	0.0	± 1.1
134.0	134.0	0.0	± 1.1
133.0	133.0	0.0	± 1.1
132.0	132.0	0.0	± 1.1
131.0	131.0	0.0	± 1.1
129.0	129.0	0.0	± 1.1
124.0	124.0	0.0	± 1.1
119.0	119.0	0.0	± 1.1
114.0	114.0	0.0	± 1.1
109.0	109.0	0.0	± 1.1
104.0	104.0	0.0	± 1.1
99.0	99.0	0.0	± 1.1
94.0	94.0	0.0	± 1.1
89.0	89.0	0.0	± 1.1
84.0	84.0	0.0	± 1.1
79.0	79.0	0.0	± 1.1
74.0	74.0	0.0	± 1.1
69.0	69.0	0.0	± 1.1
64.0	64.0	0.0	± 1.1
59.0	59.0	0.0	± 1.1
54.0	54.0	0.0	± 1.1
49.0	49.0	0.0	± 1.1
44.0	44.0	0.0	± 1.1
39.0	39.0	0.0	± 1.1
34.0	33.9	-0.1	± 1.1
30.0	29.9	-0.1	± 1.1
29.0	29.0	0.0	± 1.1
28.0	27.9	-0.1	± 1.1
27.0	26.9	-0.1	± 1.1
26.0	25.9	-0.1	± 1.1
25.0	24.9	-0.1	± 1.1

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T. Petchur

## Continuation of Calibration Certificate

Cert. No. : ACL21169  
Job No. : VC65AC0033  
Pages : 7 of 8

## 8. Level linearity including the level range control

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

## 9. Tone burst response

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

## 10. Peak C sound level

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

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

QF-TS12-04-04-020664

T. Petchur

## Continuation of Calibration Certificate

Cert. No. : ACL21169  
Job No. : VC65AC0033  
Pages : 8 of 8

## 11. Overload indication

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

## 12. High level stability

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

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

End of Calibration Certificate

QF-TS12-04-04-020664

T. Petchur

451-451/1 Sirinthorn Rd., Bangbunmu, Bangplud Bangkok 10700 THAILAND  
Tel: 0-2435-8800 Fax: 0-2433-1679 e-mail: cal-center@sithiphorn.com http://www.sithiphorn.comCert. No. : ACL21170  
Pages : 1 of 8

## Calibration Certificate

Equipment : SOUND LEVEL METER  
Manufacturer : RION  
Model : NL-42/ Microphone UC-52 / Preamplifier NH-24  
Serial No. : 00858521 / 158765 / 58767  
ID No. : BKK FS0111

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 : 09 DECEMBER 2021  
Calibration Date : 14-15 DECEMBER 2021  
Date of Issue : 16 DECEMBER 2021

Calibrated by : Nathakorn Pisutpaissan

Approved by :

T. Petchur  
( Thanakul Petchurui )

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QF-TS12-04-04-020664

## Continuation of Calibration Certificate

Cert. No. : ACL21170  
Job No. : VC65AC0033  
Pages : 2 of 8

Calibration Procedure : CP-AC-01

## Calibration Method :

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

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

## Condition of this result of calibration :

## 1. Reference Standard Instruments :

Instrument	Model	Serial No.	Cert. No.	Due Date
Waveform Generator	33210A	MY48017076	EF-0012-21	10-Feb-22
Waveform Generator	33511B	MY52302742	EF-0011-21	10-Feb-22
Digital Multimeter	33461A	MY53220104	EEL.BP. 05/0264	10-Feb-22
Digital Multimeter	33461A	MY53220076	EEL.BP. 03/0264	08-Feb-22
Digital Multimeter	8846A	1997025	EEL.BP. 06/0264	05-Feb-22
Programmable Attenuator	MAT-1070	62100114	1500-07774E	08-Mar-22
Condenser Microphone	4180	2977900	AA-1008-21	05-Feb-22
Measuring Amplifier	NA-42KA1	34560495	AA-3003-21	16-Feb-22

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

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

3.1 National Institute of Metrology (Thailand).

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

QF-TS12-04-04-020664

## Continuation of Calibration Certificate

Cert. No. : ACL21170  
Job No. : VC65AC0033  
Pages : 3 of 8

## Summary of Measurement Result :

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

QF-TS12-04-04-020664

## Continuation of Calibration Certificate

Cert. No. : ACL21170  
Job No. : VC65AC0033  
Pages : 4 of 8

## Result of calibration :

## 1. Absolute sensitivity

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

## 2. Self-generated noise

## 2.1 Normal test

Measured Value (dB)
14.8

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

Frequency Weighting	Measured value (dB)
A - weight	10.8
C - weight	17.3
Flat	23.1

## 3. Acoustical signal tests of frequency weightings

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

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)			
	Flat	C-weight	A-weight	Acceptance Limits
125	0.5	0.5	0.5	± 1.5
1000	0.0	0.0	0.0	± 1.0
8000	-2.6	-2.5	-2.5	±5.0

QF-TS12-04-04-020664

## Continuation of Calibration Certificate

Cert. No. : ACL21170  
Job No. : VC65AC0033  
Pages : 5 of 8

## 4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

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

## 5. Frequency and time weightings at 1 kHz

## 5.1 Frequency weightings at 1 kHz

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

## 5.2 Time weighting at 1 kHz

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

## 6. Long - term stability

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

QF-TS12-04-04-020664



## Continuation of Calibration Certificate

Cert. No. : ACL21170  
Job No. : VC65AC0033  
Pages : 6 of 8

## 7. Level linearity on the reference level range

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

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T. P. R.

## Continuation of Calibration Certificate

Cert. No. : ACL21170  
Job No. : VC65AC0033  
Pages : 7 of 8

## 8. Level linearity including the level range control

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

## 9. Tone burst response

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

## 10. Peak C sound level

Number of cycle in test signal	Anticipated Value (dB)	Measured Value, Lepeak (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.0	0.0	-
One	136.4	135.9	-0.5	±3.0

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

QF-TS12-04-04-020664

T. P. R.

## Continuation of Calibration Certificate

Cert. No. : ACL21170  
Job No. : VC65AC0033  
Pages : 8 of 8

## 11. Overload indication

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

## 12. High level stability

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

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

End of Calibration Certificate

QF-TS12-04-04-020664

T. P. R.

451-451/1 Sirinthorn Rd, Bangbunmu, Bangplud Bangkok 10700 THAILAND  
Tel:0-2435-8800 Fax:0-2433-1679 e-mail:cal-center@sithiporn.com http://www.sithiporn.comCert. No. : ACL22042  
Pages : 1 of 8

## Calibration Certificate

Equipment : SOUND LEVEL METER  
Manufacturer : RION  
Model : NL-42/ Microphone UC-52 / Preamplifier NH-24  
Serial No.: 00858523 / 158774 / 58775  
ID No.: BKK FS0113

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 : 05 JANUARY 2022  
Calibration Date : 12-14 JANUARY 2022  
Date of Issue : 17 JANUARY 2022

Calibrated by : Nathakorn Pisutpaisan

Approved by :

T. P. R.  
( 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. : ACL22042  
Job No. : VC65AC0041  
Pages : 2 of 8

Calibration Procedure : CP-AC-01

## Calibration Method :

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

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

## Condition of this result of calibration :

## 1. Reference Standard Instruments :

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

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

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

3.1 National Institute of Metrology (Thailand).

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

QF-TS12-04-04-020664

T. Ratan.

## Continuation of Calibration Certificate

Cert. No. : ACL22042  
Job No. : VC65AC0041  
Pages : 3 of 8

## Summary of Measurement Result :

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

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T. Ratan.

## Continuation of Calibration Certificate

Cert. No. : ACL22042  
Job No. : VC65AC0041  
Pages : 4 of 8

## Result of calibration :

## 1. Absolute sensitivity

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

## 2. Self-generated noise

## 2.1 Normal test

Measured Value (dB)
14.2

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

Frequency Weighting	Measured value (dB)
A - weight	12.0
C - weight	18.7
Flat	24.2

## 3. Acoustical signal tests of frequency weightings

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

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)			
	Flat	C-weight	A-weight	Acceptance Limits
125	0.4	0.5	0.5	± 1.5
1000	0.0	0.0	0.0	± 1.0
8000	-1.3	-1.3	-1.3	±5.0

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## Continuation of Calibration Certificate

Cert. No. : ACL22042  
Job No. : VC65AC0041  
Pages : 5 of 8

## 4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz

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

## 5. Frequency and time weightings at 1 kHz

## 5.1 Frequency weightings at 1 kHz

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

## 5.2 Time weighting at 1 kHz

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

## 6. Long - term stability

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

QF-TS12-04-04-020664

T. Ratan.



## Continuation of Calibration Certificate

Cert. No. : ACL22042  
Job No. : VC65AC0041  
Pages : 6 of 8

## 7. Level linearity on the reference level range

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

QF-TS12-04-04-020664

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## Continuation of Calibration Certificate

Cert. No. : ACL22042  
Job No. : VC65AC0041  
Pages : 7 of 8

## 8. Level linearity including the level range control

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

## 9. Tone burst response

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

## 10. Peak C sound level

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

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

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## Continuation of Calibration Certificate

Cert. No. : ACL22042  
Job No. : VC65AC0041  
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## 11. Overload indication

Measured value (dB)		Deviated Value (dB)	Acceptance Limits (dB)
Positive one-half cycle	Negative one-half cycle		
89.7	89.7	0.0	± 1.5

## 12. High level stability

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

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

End of Calibration Certificate

QF-TS12-04-04-020664

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451-451/1 Sirinthorn Rd., Bangbunru, Bangpuad Bangkok 10700 THAILAND.  
Tel: 0-2435-8800 Fax: 0-2433-1679 e-mail: cal-center@sithiporn.com http://www.sithiporn.comCert. No. : ACC22004  
Pages : 1 of 3

## Calibration Certificate

Equipment : SOUND CALIBRATOR  
Manufacturer : RION  
Model : NC-74  
Serial No. : 34178120  
ID No. : BKK\_FS0633

Condition As Found : GOOD

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

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

Received Date : 05 JANUARY 2022  
Calibration Date : 14 JANUARY 2022  
Date of Issue : 17 JANUARY 2022

Calibrated by :

Nathakorn Pisutpaisan

Approved by :

T. Bth.  
( Thanakul Petchurai )

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Continuation of Calibration Certificate

Cert. No. : ACC22004  
Job No. : VC65AC0041  
Pages : 2 of 3

Calibration Procedure : CP-AC-03

Calibration Method :

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

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

Condition of this result of calibration :

1. Reference Standard Instruments :

Instrument	Model	Serial No.	Cert. No.	Due Date
Waveform Generator	33511B	MY52302742	EF-0011-21	10-Feb-22
Digital Multimeter	33461A	MY53220104	EEL.BP. 05-0264	10-Feb-22
Digital Multimeter	33461A	MY53220076	EEL.BP. 03-0264	08-Feb-22
Digital Multimeter	33461A	MY60024273	1-15180725251-1	15-Sep-22
Programmable Attenuator	MAT-1070	62100114	1500-07774E	08-Mar-22
Condenser Microphone	4180	2977900	AA-1008-21	05-Feb-22
Measuring Amplifier	NA-42KA1	34560495	AA-3003-21	16-Feb-22
Audio Analyzer	AVR-3360A	V744B6069	EF-0010-21	10-Feb-22

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

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

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

QF-TS12-04-04-020664

T. Petchur

Continuation of Calibration Certificate

Cert. No. : ACC22004  
Job No. : VC65AC0041  
Pages : 3 of 3

Result of calibration :

1. Sound pressure level

Specified sound pressure level (dB)	Measured value (dB)	Deviated value (dB)	Uncertainty (dB)	Tolerance limit (dB)
94	94.06	0.06	0.14	0.40

2. Frequency

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

3. Total distortion

Measured value ( % )	Uncertainty ( % )	Tolerance limit ( % )
1.19	0.10	3.0

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

End of Calibration Certificate

QF-TS12-04-04-020664

T. Petchur

SITHIPORN ASSOCIATES CO.,LTD.  
CALIBRATION LABORATORY

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



Cert. No. : ACL22039  
Pages : 1 of 8

Calibration Certificate

Equipment : SOUND LEVEL METER  
Manufacturer : RION  
Model : NL-42/ Microphone UC-52 / Preamplifier NH-24  
Serial No. : 00572452 / 171618 / 72790  
ID No. : BKK\_FS0922

Condition As Found : GOOD

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

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

Received Date : 05 JANUARY 2022  
Calibration Date : 12-14 JANUARY 2022  
Date of Issue : 17 JANUARY 2022

Calibrated by : Nathakorn Pisutpaisan

Approved by :

T. Petchur  
( Thanakul Petchurai )

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Continuation of Calibration Certificate

Cert. No. : ACL22039  
Job No. : VC65AC0041  
Pages : 2 of 8

Calibration Procedure : CP-AC-01

Calibration Method :

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

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

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

Condition of this result of calibration :

1. Reference Standard Instruments :

Instrument	Model	Serial No.	Cert. No.	Due Date
Waveform Generator	33210A	MY48017076	EF-0012-21	10-Feb-22
Waveform Generator	33511B	MY52302742	EF-0011-21	10-Feb-22
Digital Multimeter	33461A	MY53220104	EEL.BP. 05-0264	10-Feb-22
Digital Multimeter	33461A	MY53220076	EEL.BP. 03-0264	08-Feb-22
Digital Multimeter	34461A	MY60024273	1-15180725251-1	15-Sep-22
Programmable Attenuator	MAT-1070	62100114	1500-07774E	08-Mar-22
Condenser Microphone	4180	2977900	AA-1008-21	05-Feb-22
Measuring Amplifier	NA-42KA1	34560495	AA-3003-21	16-Feb-22

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

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

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

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## Continuation of Calibration Certificate

Cert. No. : ACL22039  
Job No. : VC65AC0041  
Pages : 3 of 8

## Summary of Measurement Result :

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

QF-TS12-04-04-020664

T. Petch.

## Continuation of Calibration Certificate

Cert. No. : ACL22039  
Job No. : VC65AC0041  
Pages : 4 of 8

## Result of calibration :

## 1. Absolute sensitivity

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

## 2. Self-generated noise

## 2.1 Normal test

Measured Value (dB)
14.6

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

Frequency Weighting	Measured value (dB)
A - weight	12.0
C - weight	18.8
Flat	24.4

## 3. Acoustical signal tests of frequency weightings

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

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)			Acceptance Limits
	Flat	C-weight	A-weight	
125	0.2	0.2	0.2	± 1.5
1000	-0.1	-0.1	-0.1	± 1.0
8000	-0.5	-0.5	-0.4	± 5.0

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T. Petch.

## Continuation of Calibration Certificate

Cert. No. : ACL22039  
Job No. : VC65AC0041  
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	-0.1	±1.5
500	0.0	0.0	0.0	±1.5
1000	0.0	0.0	0.0	±1.0
2000	0.0	0.0	0.0	±2.0
4000	0.0	0.0	0.0	±3.0
8000	0.0	0.1	0.1	±5.0

## 5. Frequency and time weightings at 1 kHz

## 5.1 Frequency weightings at 1 kHz

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

## 5.2 Time weighting at 1 kHz

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

## 6. Long - term stability

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

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## Continuation of Calibration Certificate

Cert. No. : ACL22039  
Job No. : VC65AC0041  
Pages : 6 of 8

## 7. Level linearity on the reference level range

Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
137.0	137.0	0.0	± 1.1
136.0	136.0	0.0	± 1.1
135.0	135.0	0.0	± 1.1
134.0	134.0	0.0	± 1.1
133.0	133.0	0.0	± 1.1
132.0	132.0	0.0	± 1.1
131.0	131.0	0.0	± 1.1
129.0	129.0	0.0	± 1.1
124.0	124.0	0.0	± 1.1
119.0	119.0	0.0	± 1.1
114.0	114.0	0.0	± 1.1
109.0	109.0	0.0	± 1.1
104.0	104.0	0.0	± 1.1
99.0	99.0	0.0	± 1.1
94.0	94.0	0.0	± 1.1
89.0	89.0	0.0	± 1.1
84.0	84.0	0.0	± 1.1
79.0	79.0	0.0	± 1.1
74.0	74.0	0.0	± 1.1
69.0	69.0	0.0	± 1.1
64.0	64.0	0.0	± 1.1
59.0	59.0	0.0	± 1.1
54.0	53.9	-0.1	± 1.1
49.0	49.0	0.0	± 1.1
44.0	43.9	-0.1	± 1.1
39.0	38.9	-0.1	± 1.1
34.0	33.9	-0.1	± 1.1
30.0	29.9	-0.1	± 1.1
29.0	28.9	-0.1	± 1.1
28.0	27.9	-0.1	± 1.1
27.0	26.9	-0.1	± 1.1
26.0	25.9	-0.1	± 1.1
25.0	24.8	-0.2	± 1.1

QF-TS12-04-04-020664

T. Petch.

Continuation of Calibration Certificate

Cert. No. : ACL22039  
Job No. : VC65AC0041  
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
	200	800	128.0	128.0	0.0	±1.0

10. Peak C sound level

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

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

QI-TS12-04-04-020664

T. Petchuraj

Continuation of Calibration Certificate

Cert. No. : ACL22039  
Job No. : VC65AC0041  
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11. Overload indication

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

12. High level stability

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

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

End of Calibration Certificate

QI-TS12-04-04-020664

T. Petchuraj

SITHIPORN ASSOCIATES CO.,LTD.  
CALIBRATION LABORATORY

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



Cert. No. : ACL22041  
Pages : 1 of 8

Calibration Certificate

Equipment : SOUND LEVEL METER  
Manufacturer : RION  
Model : NL-42/ Microphone UC-52 / Preamplifier NH-24  
Serial No.: 00858518 / 158769 / 58770  
ID No.: BKK FS0108

Condition As Found : GOOD

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

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

Received Date : 05 JANUARY 2022  
Calibration Date : 12-14 JANUARY 2022  
Date of Issue : 17 JANUARY 2022

Calibrated by : Nathakorn Pisutpaisan

Approved by : T. Petchuraj  
( Thanakul Petchuraj )

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

QI-TS12-04-04-020664

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

Continuation of Calibration Certificate

Cert. No. : ACL22041  
Job No. : VC65AC0041  
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 item were made by observation of each Instruments display and also with SLM's display.

Condition of this result of calibration :

1. Reference Standard Instruments :

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

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

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

3.1 National Institute of Metrology (Thailand).

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

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T. Petchuraj



## Continuation of Calibration Certificate

Cert. No. : ACL22041  
Job No. : VC65AC0041  
Pages : 3 of 8

## Summary of Measurement Result :

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

QF-TS12-04-04-020664

T. Retch.

## Continuation of Calibration Certificate

Cert. No. : ACL22041  
Job No. : VC65AC0041  
Pages : 4 of 8

## Result of calibration :

## 1. Absolute sensitivity

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

## 2. Self-generated noise

## 2.1 Normal test

Measured Value (dB)
16.7

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

Frequency Weighting	Measured value (dB)
A-weight	15.9
C-weight	22.3
Flat	27.7

## 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)			Acceptance Limits
	Flat	C-weight	A-weight	
125	0.3	0.3	0.3	± 1.5
1000	0.0	0.0	0.0	± 1.0
8000	-1.1	-1.0	-1.0	± 5.0

QF-TS12-04-04-020664

T. Retch.

## Continuation of Calibration Certificate

Cert. No. : ACL22041  
Job No. : VC65AC0041  
Pages : 5 of 8

## 4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

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

## 5. Frequency and time weightings at 1 kHz

## 5.1 Frequency weightings at 1 kHz

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

## 5.2 Time weighting at 1 kHz

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

## 6. Long-term stability

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

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T. Retch.

## Continuation of Calibration Certificate

Cert. No. : ACL22041  
Job No. : VC65AC0041  
Pages : 6 of 8

## 7. Level linearity on the reference level range

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

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T. Retch.

Continuation of Calibration Certificate

Cert. No. : ACL22041  
Job No. : VC65AC0041  
Pages : 7 of 8

8. Level linearity including the level range control

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

9. Tone burst response

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

10. Peak C sound level

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

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

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T. Retch.

Continuation of Calibration Certificate

Cert. No. : ACL22041  
Job No. : VC65AC0041  
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. Retch.

SITHIPORN ASSOCIATES CO.,LTD.  
CALIBRATION LABORATORY

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Cert. No. : ACL22044  
Pages : 1 of 8

Calibration Certificate

Equipment : SOUND LEVEL METER  
Manufacturer : RION  
Model : NL-42 / Microphone UC-52 / Preamplifier NH-24  
Serial No. : 01022261 / 180399 / 88169  
ID No. : BKK\_FS0030

Condition As Found : GOOD

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

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

Received Date : 05 JANUARY 2022  
Calibration Date : 12-14 JANUARY 2022  
Date of Issue : 17 JANUARY 2022

Calibrated by : Nathakorn Pisutpaisan

Approved by : T. Retch.  
( Thanakul Petchurai )

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QF-TS12-04-04-020664

Continuation of Calibration Certificate

Cert. No. : ACL22044  
Job No. : VC65AC0041  
Pages : 2 of 8

Calibration Procedure : CP-AC-01

Calibration Method :

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

Condition of this result of calibration :

1. Reference Standard Instruments :

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

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

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

3.1 National Institute of Metrology (Thailand).

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

QF-TS12-04-04-020664

T. Retch.



## Continuation of Calibration Certificate

Cert. No. : ACL22044  
Job No. : VC65AC0041  
Pages : 3 of 8

## Summary of Measurement Result :

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

QF-TS12-04-04-020664

P.T.1

## Continuation of Calibration Certificate

Cert. No. : ACL22044  
Job No. : VC65AC0041  
Pages : 4 of 8

## Result of calibration :

## 1. Absolute sensitivity

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

## 2. Self-generated noise

## 2.1 Normal test

Measured Value (dB)
16.5

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

Frequency Weighting	Measured value (dB)
A - weight	13.4
C - weight	19.9
Flat	25.4

## 3. Acoustical signal tests of frequency weightings

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

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

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P.T.1

## Continuation of Calibration Certificate

Cert. No. : ACL22044  
Job No. : VC65AC0041  
Pages : 5 of 8

## 4. Electrical signal tests of frequency weightings

Weighing network response with relative to 1 kHz.

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

## 5. Frequency and time weightings at 1 kHz

## 5.1 Frequency weightings at 1 kHz

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

## 5.2 Time weighting at 1 kHz

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

## 6. Long - term stability

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

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P.T.1

## Continuation of Calibration Certificate

Cert. No. : ACL22044  
Job No. : VC65AC0041  
Pages : 6 of 8

## 7. Level linearity on the reference level range

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

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P.T.1

Cert. No. : ACL22044  
Job No. : VC65AC0041  
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8. Level linearity including the level range control

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

9. Tone burst response

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

10. Peak C sound level

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

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

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Cert. No. : ACL22044  
Job No. : VC65AC0041  
Pages : 8 of 8

11. Overload indication

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

12. High level stability

Frequency Weighting	SLM Display at initial (dB)	SLM Display at final (dB)	Deviated Value (dB)	Acceptance Limits (dB)
A-weight	137.0	137.1	-0.1	±0.3

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

End of Calibration Certificate

QF-TS12-04-04-020664

SITHIPORN ASSOCIATES CO.,LTD.  
CALIBRATION LABORATORY

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



Cert. No. : ACL21168  
Pages : 1 of 8

Calibration Certificate

Equipment : SOUND LEVEL METER  
Manufacturer : RION  
Model : NL-42/ Microphone UC-52 / Preamplifier NH-24  
Serial No.: 00858519 / 158770 / 58771  
ID No.: BKK FS0109

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 : 09 DECEMBER 2021  
Calibration Date : 14-15 DECEMBER 2021  
Date of Issue : 16 DECEMBER 2021

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.

QI-TS12-04-04-020664

SITHIPORN / SITHIPORN ASSOCIATES CO.,LTD.  
CALIBRATION LABORATORY

Cert. No. : ACL21168  
Job No. : VC65AC0033  
Pages : 2 of 8

Calibration Procedure : CP-AC-01

Calibration Method :

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

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

Condition of this result of calibration :

1. Reference Standard Instruments :

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

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

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

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

QF-TS12-04-04-020664



## Continuation of Calibration Certificate

Cert. No. : ACL21168  
Job No. : VC65AC0033  
Pages : 3 of 8

## Summary of Measurement Result :

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

QF-TS12-04-04-020664

## Continuation of Calibration Certificate

Cert. No. : ACL21168  
Job No. : VC65AC0033  
Pages : 4 of 8

## Result of calibration :

## 1. Absolute sensitivity

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

## 2. Self-generated noise

## 2.1 Normal test

Measured Value (dB)
16.3

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

Frequency Weighting	Measured value (dB)
A - weight	13.1
C - weight	19.6
Flat	25.0

## 3. Acoustical signal tests of frequency weightings

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

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)			
	Flat	C-weight	A-weight	Acceptance Limits
125	0.4	0.4	0.5	± 1.5
1000	0.0	0.0	0.0	± 1.0
8000	-1.0	-1.1	-0.9	±5.0

QF-TS12-04-04-020664

## Continuation of Calibration Certificate

Cert. No. : ACL21168  
Job No. : VC65AC0033  
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	-0.1	0.0	-0.1	±1.5
250	0.0	0.0	-0.1	±1.5
500	0.0	0.0	-0.1	±1.5
1000	0.0	0.0	0.0	±1.0
2000	0.0	0.0	0.0	±2.0
4000	0.0	0.0	0.0	±3.0
8000	0.0	0.1	0.1	±5.0

## 5. Frequency and time weightings at 1 kHz

## 5.1 Frequency weightings at 1 kHz

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

## 5.2 Time weighting at 1 kHz

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

## 6. Long - term stability

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

QF-TS12-04-04-020664

## Continuation of Calibration Certificate

Cert. No. : ACL21168  
Job No. : VC65AC0033  
Pages : 6 of 8

## 7. Level linearity on the reference level range

Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
137.0	137.0	0.0	± 1.1
136.0	136.0	0.0	± 1.1
135.0	135.0	0.0	± 1.1
134.0	134.0	0.0	± 1.1
133.0	133.0	0.0	± 1.1
132.0	132.0	0.0	± 1.1
131.0	131.0	0.0	± 1.1
129.0	129.0	0.0	± 1.1
124.0	124.0	0.0	± 1.1
119.0	119.0	0.0	± 1.1
114.0	114.0	0.0	± 1.1
109.0	109.0	0.0	± 1.1
104.0	104.0	0.0	± 1.1
99.0	99.0	0.0	± 1.1
94.0	94.0	0.0	± 1.1
89.0	89.0	0.0	± 1.1
84.0	84.1	0.1	± 1.1
79.0	79.0	0.0	± 1.1
74.0	74.1	0.1	± 1.1
69.0	69.0	0.0	± 1.1
64.0	64.0	0.0	± 1.1
59.0	59.0	0.0	± 1.1
54.0	54.0	0.0	± 1.1
49.0	49.0	0.0	± 1.1
44.0	44.0	0.0	± 1.1
39.0	39.0	0.0	± 1.1
34.0	34.0	0.0	± 1.1
30.0	30.0	0.0	± 1.1
29.0	28.9	-0.1	± 1.1
28.0	28.0	0.0	± 1.1
27.0	26.9	-0.1	± 1.1
26.0	25.9	-0.1	± 1.1
25.0	24.9	-0.1	± 1.1

QF-TS12-04-04-020664

Continuation of Calibration Certificate

Cert. No. : ACL21168  
Job No. : VC65AC0033  
Pages : 7 of 8

8. Level linearity including the level range control

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

9. Tone burst response

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

10. Peak C sound level

Number of cycle in test signal	Anticipated Value (dB)	Measured Value, L <sub>peak</sub> (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.0	0.0	-
One	136.4	136.0	-0.4	±3.0

Number of cycle in test signal	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.1	0.1	-
Positive half cycle	135.4	135.2	-0.2	±2.0
Negative half cycle	135.4	135.3	-0.1	±2.0

QF-TS12-04-04-020664

T. Pth.

Continuation of Calibration Certificate

Cert. No. : ACL21168  
Job No. : VC65AC0033  
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

QF-TS12-04-04-020664

T. Pth.



63/14-15,67/35-36, Soi Petchkasem 7/71, Petchkasem Rd,  
Walthapa, Bangkoknoi, Bangkok 10600 Thailand.  
Tel: (66) 02-8680812#13 Fax: (66) 02-8680860 www.jiranatee.com



CERTIFICATE OF CALIBRATION

Certificate No. : CL 012 65  
Page 1 of 2

Equipment Name: Heat Stress Monitor with Sensor  
Manufacturer: DeltaOHM  
Model: HD32.2  
Serial No: 13074797  
ID No: BKK\_FS0642

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

Received date: 10 JAN 2022  
Calibration date: 14 FEB 2022  
Issue date: 17 FEB 2022

Reference Used During Calibration  
1 Standard Temperature Probe Model: STS 100 A500.  
Serial No: 867652 09. Due date: 25 Mar 2022  
2 Digital Temperature Indicator Model: DTI 1000-A-MK  
II. Serial No: 671407 00591 Due date: 04 June 2022

Calibration Condition  
Temperature: (23±3)°C  
Relative Humidity: (55±15)%

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

Traceability  
The measurement results are traceable to the  
international system of units (SI) through National  
Institute of Metrology Thailand (NIMT) Certificate  
number: TT-0036 21. Certificate number: ER 0032.  
21

REVIEW BY *[Signature]*  
APPROVED BY *[Signature]*  
NEXT CAL DATE 14/2/23

Calibrated by  
☐ Mr. Sorawit Thachalad  
☐ Miss Orathai Wiwatwattaya



Approved Signatory: *[Signature]*  
Mr. Pannya Booncharoen  
Calibration Department Manager



63/14-15,67/35-36, Soi Petchkasem 7/71, Petchkasem Rd,  
Walthapa, Bangkoknoi, Bangkok 10600 Thailand.  
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Certificate No. : CL 012 65  
Page 2 of 2

Result of Calibration: ☒ Without Adjustment ☐ With Adjustment

Calibration Range: 20 - 40 °C

Function:

Table 1: This equipment was connected with wet bulb probe Model: HP3201.2 S/N: 13035038.  
Dimension: Diameter 14 mm. Length 170 mm.

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
30	20.055	20.0	0.1	0.099
30	25.037	25.0	0.0	0.099
30	30.019	30.0	0.0	0.099
30	35.006	35.0	0.0	0.099
30	40.002	40.0	0.0	0.099

Table 2: This equipment was connected with temperature probe Model: TP3207.2 S/N: 13033291.  
Dimension: Diameter 14 mm. Length 150 mm.

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
70	20.051	20.0	0.1	0.099
70	24.990	24.7	0.3	0.099
70	29.917	29.5	0.4	0.099
70	34.873	34.4	0.5	0.099
70	39.864	39.4	0.5	0.099

Table 3: This equipment was connected with Globe thermometer probe Model: TP3276.2 S/N: 13042466.  
Dimension: Diameter 8 mm. Length 170 mm.

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
110	20.053	20.1	0.0	0.099
110	25.035	25.1	0.1	0.099
110	30.026	30.1	0.1	0.099
110	35.020	35.0	0.0	0.099
110	40.009	40.0	0.0	0.099

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

★ End of Certificate ★







63/14-15,67/35-36, Soi Petchkasem 7/71, Petchkasem Rd,  
Wattapra, Bangkokyal, Bangkok 10600 Thailand.

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## CERTIFICATE OF CALIBRATION

Certificate No.: CL-09164  
Page 1 of 2

Equipment Name: Heat Stress Monitor with Sensor  
Manufacturer: DeltaOHM  
Model: HD32.2  
Serial No: 15036016  
ID No: BKK\_FS0676

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

Received date: 30 OCT 2021  
Calibration date: 2 NOV 2021  
Issue date: 3 NOV 2021

Reference Used During Calibration  
1. Standard Temperature Probe Model: STS 100 A500,  
Serial No.: 667682-09, Due date: 25 Mar 2022  
2. Digital Temperature Indicator Model: DTI 1000 A MK  
II, Serial No.: 671407-00591 Due date: 04 June 2022

Calibration Condition  
Temperature: (23±3) °C  
Relative Humidity: (55±15)%

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

Traceability  
The measurement results are traceable to the  
international system of units (SI) through National  
Institute of Metrology Thailand (NIMT) Certificate  
number: TT-0036-21. Certificate number: ER-0032-  
21

REVIEW BY	<i>Hankon P</i>
APPROVED BY	<i>Mr. P. Booncharoen</i>
NEXT CAL. DATE	2/11/22

Calibrated by  
☐ Mr. Sorawit Thachalad  
☒ Miss Orathai Wiwatwattaya



Approved Signatory: *Mr. P. Booncharoen*  
Mr. Panyia Booncharoen  
Technical Support  
and Calibration Manager

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



63/14-15,67/35-36, Soi Petchkasem 7/71, Petchkasem Rd,  
Wattapra, Bangkokyal, Bangkok 10600 Thailand.

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Certificate No.: CL-09164  
Page 2 of 2

Result of Calibration: ☒ Without Adjustment ☐ With Adjustment

Calibration Range: 20 - 40 °C

Function:

Table 1: This equipment was connected with wet bulb probe Model: HP3201.2 S/N: 20030504.  
Dimension: Diameter 14 mm. Length 170 mm.

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
30	20.062	20.1	0.0	0.099
30	25.047	25.1	0.1	0.099
30	30.036	30.1	0.1	0.099
30	35.030	35.1	0.1	0.099
30	40.023	40.1	0.1	0.099

Table 2: This equipment was connected with temperature probe Model: TP3207.2 S/N: 16009383.  
Dimension: Diameter 14 mm. Length 150 mm.

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
70	20.063	20.2	0.1	0.099
70	24.886	24.9	0.0	0.099
70	29.818	29.7	-0.1	0.099
70	34.757	34.6	-0.2	0.099
70	39.723	39.5	-0.2	0.099

Table 3: This equipment was connected with Globe thermometer probe Model: TP3276.2 S/N: 20008276.  
Dimension: Diameter 8 mm. Length 170 mm.

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
110	20.062	20.1	0.0	0.099
110	25.047	25.1	0.1	0.099
110	30.036	30.1	0.1	0.099
110	35.031	35.1	0.1	0.099
110	40.023	40.1	0.1	0.099

UUC\*: Unit Under Calibration

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

★ End of Certificate ★



# ภาคผนวก จ

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สำเนาใบอนุญาตขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์เอกชน



ที่ อก ๐๓๑๐(๑)/ ๑๐๖๕



กรมโรงงานอุตสาหกรรม  
ถนนพระรามที่ ๖ เขตราชเทวี  
กรุงเทพมหานคร ๑๐๕๐๐

๒๘ มกราคม ๒๕๖๕

เรื่อง คัดสรรหนังสือรับขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์เอกชน

เรียน กรรมการผู้จัดการ บริษัท เอแอลเอส แลบบอราทอรี กรุ๊ป (ประเทศไทย) จำกัด

อ้างถึง คำขอขึ้นทะเบียน/ต่ออายุ/เปลี่ยนแปลงบุคลากร และชนิดสารเคมีของห้องปฏิบัติการวิเคราะห์เอกชน  
ลงวันที่ ๓๐ กรกฎาคม ๒๕๖๓

- สิ่งที่ส่งมาด้วย ๑. รายชื่อผู้ควบคุมดูแลห้องปฏิบัติการวิเคราะห์ จำนวน ๑ แผ่น  
๒. รายชื่อเจ้าหน้าที่ประจำห้องปฏิบัติการวิเคราะห์ จำนวน ๕ แผ่น  
๓. ขอบข่ายสารเคมีที่ได้รับขึ้นทะเบียนจากกรมโรงงานอุตสาหกรรม จำนวน ๓๑ แผ่น

ตามหนังสือที่อ้างถึง บริษัท เอแอลเอส แลบบอราทอรี กรุ๊ป (ประเทศไทย) จำกัด ขอต่ออายุ  
หนังสือรับขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์เอกชน เลขทะเบียน ๖-๒๐๔-๙-๔๙๐๓ สดวันที่ตั้งเลขที่ ๑๐๔  
ขอพัฒนาการ ๔๐ ถนนพัฒนาการ แขวงพัฒนาการ เขตสวนหลวง กรุงเทพมหานคร  
ต่อกรมโรงงานอุตสาหกรรม นั้น

กรมโรงงานอุตสาหกรรมพิจารณาแล้ว ให้บริษัท เอแอลเอส แลบบอราทอรี กรุ๊ป (ประเทศไทย)  
จำกัด ต่ออายุหนังสือรับขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์เอกชน โดยมีองค์ประกอบดังนี้  
ก. ผู้ควบคุมดูแลห้องปฏิบัติการวิเคราะห์ จำนวน ๖ ราย ตามสิ่งที่ส่งมาด้วย ๑  
ข. เจ้าหน้าที่ประจำห้องปฏิบัติการวิเคราะห์ จำนวน ๑๖๒ ราย ตามสิ่งที่ส่งมาด้วย ๒  
ค. ขอบข่ายสารเคมีที่ได้รับขึ้นทะเบียนให้วิเคราะห์ในน้ำเสีย จำนวน ๕๙ รายการ น้ำเสีย  
จำนวน ๑๒๖ รายการ อากาศเสีย ๑๖ รายการ สิ่งปฏิกูลหรือวัสดุที่ไม่ใช้แล้ว จำนวน ๓๕ รายการ และดิน  
จำนวน ๑๒๕ รายการ รวมทั้งสิ้นจำนวน ๓๑๖ รายการ ตามสิ่งที่ส่งมาด้วย ๓

หนังสือฉบับนี้จะมีผลต่ออายุในวันที่ ๒ กันยายน ๒๕๖๖ หากประสงค์จะต่ออายุหนังสือ  
รับขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์เอกชน ให้ยื่นคำขอต่ออายุพร้อมเอกสารประกอบคำขอ  
ต่อกรมโรงงานอุตสาหกรรม ภายใน ๓๐ วัน ก่อนวันสิ้นสุดอายุของหนังสือรับขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์  
เอกชน ซึ่งคำขอต่ออายุดังกล่าวจะได้รับได้ที่กรมโรงงานอุตสาหกรรม

จึงเรียนมาเพื่อทราบ

ขอแสดงความนับถือ

๒๒๒

(นายศิระ จันทร์เกิด)

อธิบดีกรมโรงงานอุตสาหกรรม  
ผู้อำนวยการกองวิจัยและพัฒนาผลิตภัณฑ์โรงงาน  
ปฏิบัติราชการแทนอธิบดีกรมโรงงานอุตสาหกรรม

กองวิจัยและพัฒนาผลิตภัณฑ์โรงงาน

กลุ่มมาตรฐานวิธีการวิเคราะห์ทดสอบผลิตภัณฑ์และห้องปฏิบัติการ

โทร. ๐ ๒๒๐๒ ๔๓๕๖ ๐ ๒๒๐๒ ๔๐๐๒

โทรสาร ๐ ๒๒๕๔ ๓๒๐๘ ๐ ๒๒๕๔ ๓๔๓๕

เอกสารแนบท้ายหนังสือรับขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์เอกชน

บริษัท เอแอลเอส แลบบอราทอรี กรุ๊ป (ประเทศไทย) จำกัด

เลขทะเบียน ๖-๒๐๔

ที่ อก ๐๓๑๐(๑)/ ๑๐๖๕

ลงวันที่ ๒๘ มกราคม ๒๕๖๕

ข. เจ้าหน้าที่ประจำห้องปฏิบัติการวิเคราะห์ จำนวน ๑๖๒ ราย

- ๑) นางสาวจินดา ใจอุตรธรรม ทะเบียนเลขที่ ๖-๒๐๔-๙-๔๙๐๔  
๒) นางสาวสิริ น้อยเสงี่ยม ทะเบียนเลขที่ ๖-๒๐๔-๙-๔๙๐๔  
๓) นางสาวศุภกาญจน์ อิมขม ทะเบียนเลขที่ ๖-๒๐๔-๙-๔๙๐๐  
๔) นางสาววันวิมล สายสิงห์ ทะเบียนเลขที่ ๖-๒๐๔-๙-๔๙๐๕  
๕) นางสาวนันทิณี สมบูรณ์ ทะเบียนเลขที่ ๖-๒๐๔-๙-๔๙๐๖  
๖) นางสาวศรีนยา เถลิงสร้างศรี ทะเบียนเลขที่ ๖-๒๐๔-๙-๔๙๐๗  
๗) นางสาวสิริวิมล มงคลจิระวุฒิ ทะเบียนเลขที่ ๖-๒๐๔-๙-๔๙๐๘  
๘) นางสาวศิริลักษณ์ พึ่งเพง ทะเบียนเลขที่ ๖-๒๐๔-๙-๔๙๐๙  
๙) นายณพพงศ์ จันทพินธุ์ ทะเบียนเลขที่ ๖-๒๐๔-๙-๕๐๐๘  
๑๐) นายนครเศรษฐ์ โภมาลัย ทะเบียนเลขที่ ๖-๒๐๔-๙-๕๐๑๑  
๑๑) นายธินา จริยา ทะเบียนเลขที่ ๖-๒๐๔-๙-๕๐๑๔  
๑๒) นางสาวภาวรินทร์ แก้วมัน ทะเบียนเลขที่ ๖-๒๐๔-๙-๕๐๑๖  
๑๓) นางสาวสุวิมล ชัยเรืองวุฒิ ทะเบียนเลขที่ ๖-๒๐๔-๙-๕๐๑๗  
๑๔) นางสาวสุชาดา ธรรมถาวร ทะเบียนเลขที่ ๖-๒๐๔-๙-๕๐๑๘  
๑๕) นางสาวเปมิกา ชื่นเดชอนกุล ทะเบียนเลขที่ ๖-๒๐๔-๙-๕๐๑๙  
๑๖) นางสาวศศิธร หนูสวัสดิ์ ทะเบียนเลขที่ ๖-๒๐๔-๙-๕๐๒๔  
๑๗) นางสาวเสาวลักษณ์ ภูมิกายัพ ทะเบียนเลขที่ ๖-๒๐๔-๙-๕๐๒๕  
๑๘) นายอภิสิทธิ์ สิงหา ทะเบียนเลขที่ ๖-๒๐๔-๙-๕๐๒๖  
๑๙) นายศักดิ์สิทธิ์ ไพศาลพิสุทธิ์ ทะเบียนเลขที่ ๖-๒๐๔-๙-๕๐๒๗  
๒๐) ว่าที่ร้อยตรีหญิง พรนิภา ช่างเจริญ ทะเบียนเลขที่ ๖-๒๐๔-๙-๕๐๒๘  
๒๑) นางจิตติ คำแก้ว ทะเบียนเลขที่ ๖-๒๐๔-๙-๕๐๓๑  
๒๒) นางสาวอรรณพ รักษะ ทะเบียนเลขที่ ๖-๒๐๔-๙-๖๑๑๕  
๒๓) นางสาวพรพรรณ แยมกรานต์ ทะเบียนเลขที่ ๖-๒๐๔-๙-๖๑๑๘  
๒๔) นายจุลเดช วารินทร์ ทะเบียนเลขที่ ๖-๒๐๔-๙-๖๑๑๙  
๒๕) นางสาวศุภรัตน์ รุ่งคำ ทะเบียนเลขที่ ๖-๒๐๔-๙-๖๑๒๑  
๒๖) นายนคร สุขเจริญ ทะเบียนเลขที่ ๖-๒๐๔-๙-๖๑๒๒  
๒๗) นายปัญชา นามเขตต์ ทะเบียนเลขที่ ๖-๒๐๔-๙-๖๑๒๓  
๒๘) นายพนม ศรีปิตินคร ทะเบียนเลขที่ ๖-๒๐๔-๙-๖๑๒๕  
๒๙) นายอุทิศ อุ่นสิน ทะเบียนเลขที่ ๖-๒๐๔-๙-๖๑๒๖  
๓๐) ว่าที่ร้อยตรี เติมเกียรติ อมรศรีเสริม ทะเบียนเลขที่ ๖-๒๐๔-๙-๖๑๒๘  
๓๑) นางสาววริยา สร้างมา ทะเบียนเลขที่ ๖-๒๐๔-๙-๖๑๒๙  
๓๒) นายอนุพงศ์ รัตนศรีประเสริฐ ทะเบียนเลขที่ ๖-๒๐๔-๙-๖๑๓๐  
๓๓) นางสาวจุฑาวิมล ไอนันท์เย็น ทะเบียนเลขที่ ๖-๒๐๔-๙-๖๑๔๒  
๓๔) นางสาวจางวรรณ พิมพ์อุทัยกุล ทะเบียนเลขที่ ๖-๒๐๔-๙-๗๐๓๖

(นายศิระ จันทร์เกิด)

อธิบดีกรมโรงงานอุตสาหกรรม  
ผู้อำนวยการกองวิจัยและพัฒนาผลิตภัณฑ์โรงงาน  
ปฏิบัติราชการแทนอธิบดีกรมโรงงานอุตสาหกรรม

๓๕) นางสาวปรารถนา พิทย...

เอกสารแนบท้ายหนังสือรับขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์เอกชน

บริษัท เอแอลเอส แลบบอราทอรี กรุ๊ป (ประเทศไทย) จำกัด

เลขทะเบียน ๖-๒๐๔

ที่ อก ๐๓๑๐(๑)/

ลงวันที่ ๒๘ มกราคม ๒๕๖๕

ก. ผู้ควบคุมดูแลห้องปฏิบัติการวิเคราะห์ จำนวน ๖ ราย

- ๑) นางสาวยุพพร จันทร์ปลั่ง ทะเบียนเลขที่ ๖-๒๐๔-๙-๔๙๐๐  
๒) นางสาวชัชชนา โภมากรกุล ณ นคร ทะเบียนเลขที่ ๖-๒๐๔-๙-๔๙๐๑  
๓) นายศราวุธ จิตราพันธ์ ทะเบียนเลขที่ ๖-๒๐๔-๙-๔๙๐๒  
๔) นางสาวกนกกร เอนก ทะเบียนเลขที่ ๖-๒๐๔-๙-๖๑๑๑  
๕) นายสุริยา สอนแก้ว ทะเบียนเลขที่ ๖-๒๐๔-๙-๖๑๑๒  
๖) นายวิชาญ ชุนทรดี ทะเบียนเลขที่ ๖-๒๐๔-๙-๖๑๑๓

๒๒๒

(นายศิระ จันทร์เกิด)

อธิบดีกรมโรงงานอุตสาหกรรม  
ผู้อำนวยการกองวิจัยและพัฒนาผลิตภัณฑ์โรงงาน  
ปฏิบัติราชการแทนอธิบดีกรมโรงงานอุตสาหกรรม

- ๒ -

- ๓๕) นางสาวปรารถนา พิทย กิจไพศาลศักดิ์ ทะเบียนเลขที่ ๖-๒๐๔-๙-๗๐๓๕  
๓๖) นางสาวเดือนใจ ทางกลาง ทะเบียนเลขที่ ๖-๒๐๔-๙-๗๐๓๖  
๓๗) นางสาวจิราพร ศิริเวช ทะเบียนเลขที่ ๖-๒๐๔-๙-๗๐๓๗  
๓๘) นายวรารณ ภูริรักษ์ ทะเบียนเลขที่ ๖-๒๐๔-๙-๗๐๓๘  
๓๙) นายทนง วีริยะสกิจ ทะเบียนเลขที่ ๖-๒๐๔-๙-๗๐๓๙  
๔๐) นายอนันต์ เจริญภะ ทะเบียนเลขที่ ๖-๒๐๔-๙-๗๐๔๐  
๔๑) นายณิศกร จำเพียร ทะเบียนเลขที่ ๖-๒๐๔-๙-๗๐๔๑  
๔๒) นายอรรถพล นิยมวิทย์พิน ทะเบียนเลขที่ ๖-๒๐๔-๙-๗๐๔๒  
๔๓) นายอวิช พรหมสะอาด ทะเบียนเลขที่ ๖-๒๐๔-๙-๗๐๔๓  
๔๔) นายอนันต์ ภาคพิพัฒน์ ทะเบียนเลขที่ ๖-๒๐๔-๙-๗๐๔๔  
๔๕) นายชวฤทธิ์ วงษ์จันทร์ ทะเบียนเลขที่ ๖-๒๐๔-๙-๗๐๔๕  
๔๖) นายอาทิตย์ ศรีสน ทะเบียนเลขที่ ๖-๒๐๔-๙-๗๐๔๖  
๔๗) นายเจษฎาพร คงศักดิ์ไทย ทะเบียนเลขที่ ๖-๒๐๔-๙-๗๐๔๗  
๔๘) นายจรัส ภูมิคุ้ม ทะเบียนเลขที่ ๖-๒๐๔-๙-๗๐๔๘  
๔๙) นายอนันต์ เอนก ทะเบียนเลขที่ ๖-๒๐๔-๙-๗๐๔๙  
๕๐) นายอภิวัฒน์ ทุมมา ทะเบียนเลขที่ ๖-๒๐๔-๙-๗๐๕๐  
๕๑) นางสาวสุภาวัญญา มาก ทะเบียนเลขที่ ๖-๒๐๔-๙-๗๐๕๑  
๕๒) นางสาวทิพร ขวาลสมบุญ ทะเบียนเลขที่ ๖-๒๐๔-๙-๗๐๕๒  
๕๓) นางสาวอติมา บุญเพ็ง ทะเบียนเลขที่ ๖-๒๐๔-๙-๗๐๕๓  
๕๔) นางสาวกนกกร เข้มเพียร ทะเบียนเลขที่ ๖-๒๐๔-๙-๗๐๕๔  
๕๕) นางสาวพัชรียา หงษ์มณี ทะเบียนเลขที่ ๖-๒๐๔-๙-๗๐๕๕  
๕๖) นางสาวกานดา สุวรรณศรีกุล ทะเบียนเลขที่ ๖-๒๐๔-๙-๗๐๕๖  
๕๗) นางสาวกนกกร นามวัฒน์ ทะเบียนเลขที่ ๖-๒๐๔-๙-๗๐๕๗  
๕๘) นางสาวอุไรรัตน์ พึ่งสร้างแป้น ทะเบียนเลขที่ ๖-๒๐๔-๙-๗๐๕๘  
๕๙) นายธีรวัฒน์ ปางสุข ทะเบียนเลขที่ ๖-๒๐๔-๙-๗๐๕๙  
๖๐) นายอิทธิพล ยะโส ทะเบียนเลขที่ ๖-๒๐๔-๙-๗๐๖๐  
๖๑) นายประจักษ์ วรรณสุขัย ทะเบียนเลขที่ ๖-๒๐๔-๙-๗๐๖๑  
๖๒) นายชยธร พงษ์ทิพย์ ทะเบียนเลขที่ ๖-๒๐๔-๙-๗๐๖๒  
๖๓) นางสาวกนกวรรณ จันทร์บาล ทะเบียนเลขที่ ๖-๒๐๔-๙-๗๐๖๓  
๖๔) นางสาวณิชา หลีกบุญ ทะเบียนเลขที่ ๖-๒๐๔-๙-๗๐๖๔  
๖๕) นายสิทธิโชค ธงเงิน ทะเบียนเลขที่ ๖-๒๐๔-๙-๗๐๖๕  
๖๖) นายสิริวรรณ ใจบุญ ทะเบียนเลขที่ ๖-๒๐๔-๙-๗๐๖๖  
๖๗) นางสาวพรรณธิดา พุ่มอง ทะเบียนเลขที่ ๖-๒๐๔-๙-๗๐๖๗  
๖๘) นางสาวศรณีย์ ยี่งิต ทะเบียนเลขที่ ๖-๒๐๔-๙-๗๐๖๘  
๖๙) นายณภัทร ศรีวิริยะ ทะเบียนเลขที่ ๖-๒๐๔-๙-๗๐๖๙  
๗๐) นายสุวิทย์ ทองอ่อน ทะเบียนเลขที่ ๖-๒๐๔-๙-๗๐๗๐  
๗๑) นายวิญญู บุญตะนิย ทะเบียนเลขที่ ๖-๒๐๔-๙-๗๐๗๑

(นายศิระ จันทร์เกิด)

อธิบดีกรมโรงงานอุตสาหกรรม  
ผู้อำนวยการกองวิจัยและพัฒนาผลิตภัณฑ์โรงงาน  
ปฏิบัติราชการแทนอธิบดีกรมโรงงานอุตสาหกรรม

๓๖) นายสมบุญ...







ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
19	Copper	1) Digestion, Inductively Coupled Plasma Method <sup>(4)</sup> 2) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method <sup>(4)</sup>
20	Cyanide	Distillation, Colorimetric Method <sup>(4)</sup>
21	2,4'-DDD	Liquid-Liquid Extraction, Gas Chromatographic Method <sup>(4)</sup>
22	4,4'-DDD	Liquid-Liquid Extraction, Gas Chromatographic Method <sup>(4)</sup>
23	2,4'-DDE	Liquid-Liquid Extraction, Gas Chromatographic Method <sup>(4)</sup>
24	4,4'-DDE	Liquid-Liquid Extraction, Gas Chromatographic Method <sup>(4)</sup>
25	2,4'-DDT	Liquid-Liquid Extraction, Gas Chromatographic Method <sup>(4)</sup>
26	4,4'-DDT	Liquid-Liquid Extraction, Gas Chromatographic Method <sup>(4)</sup>
27	Dieldrin	Liquid-Liquid Extraction, Gas Chromatographic Method <sup>(4)</sup>
28	Endosulfan Sulfate	Liquid-Liquid Extraction, Gas Chromatographic Method <sup>(4)</sup>
29	Endosulfan I	Liquid-Liquid Extraction, Gas Chromatographic Method <sup>(4)</sup>
30	Endosulfan II	Liquid-Liquid Extraction, Gas Chromatographic Method <sup>(4)</sup>
31	Endrin	Liquid-Liquid Extraction, Gas Chromatographic Method <sup>(4)</sup>
32	Endrin Aldehyde	Liquid-Liquid Extraction, Gas Chromatographic Method <sup>(4)</sup>
33	Formaldehyde	Distillation, Colorimetric Method <sup>(3)</sup>
34	Free Chlorine	1) DPD Ferrous Titrimetric Method <sup>(4)</sup> 2) Iodometric Method <sup>(4)</sup>
35	Heptachlor	Liquid-Liquid Extraction, Gas Chromatographic Method <sup>(4)</sup>
36	Heptachlor epoxide	Liquid-Liquid Extraction, Gas Chromatographic Method <sup>(4)</sup>
37	Hexavalent Chromium	Filtration, Colorimetric Method <sup>(4)</sup>
38	3-Hydroxycarbofuran	High-Performance Liquid Chromatographic Method <sup>(4)</sup>
39	Lead	1) Digestion, Inductively Coupled Plasma Method <sup>(4)</sup> 2) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method <sup>(4)</sup>
40	Manganese	1) Digestion, Inductively Coupled Plasma Method <sup>(4)</sup> 2) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method <sup>(4)</sup>
41	Mercury	1) Digestion, Cold-Vapor Atomic Absorption Spectrometric Method <sup>(4)</sup> 2) Digestion, Inductively Coupled Plasma/Mass spectrometric Method <sup>(4)</sup>
42	Methiocarb	High-Performance Liquid Chromatographic Method <sup>(4)</sup>
43	Methoxychlor	Liquid-Liquid Extraction, Gas Chromatographic Method <sup>(4)</sup>

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44 Methomyl...

ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
44	Methomyl	High-Performance Liquid Chromatographic Method <sup>(4)</sup>
45	Nickel	1) Digestion, Inductively Coupled Plasma Method <sup>(4)</sup> 2) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method <sup>(4)</sup>
46	Oil & Grease	1) Liquid-Liquid, Partition-Gravimetric Method <sup>(4)</sup> 2) Soxhlet Extraction Method <sup>(4)</sup>
47	Oxamyl	High-Performance Liquid Chromatographic Method <sup>(4)</sup>
48	Propoxur	High-Performance Liquid Chromatographic Method <sup>(4)</sup>
49	pH	Electrometric Method <sup>(4)</sup>
50	Phenols	1) Distillation, Chloroform Extraction Method <sup>(4)</sup> 2) Distillation, Direct Photometric Method <sup>(4)</sup>
51	Selenium	1) Digestion, Inductively Coupled Plasma Method <sup>(4)</sup> 2) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method <sup>(4)</sup>
52	Sulfide	Iodometric Method <sup>(4)</sup>
53	Temperature	Laboratory and Field Methods <sup>(4)</sup>
54	Total Dissolved Solids	Dried at 180 °C <sup>(4)</sup>
55	Total Kjeldahl Nitrogen	Semi-Micro Kjeldahl Method <sup>(4)</sup>
56	Total Suspended Solids	Dried at 103-105 °C <sup>(4)</sup>
57	Toxaphene	Liquid-Liquid Extraction, Gas Chromatographic Method <sup>(4)</sup>
58	Trivalent Chromium	1) Digestion, Inductively Coupled Plasma Method; Colorimetric Method; Calculation <sup>(4)</sup> 2) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method; Colorimetric Method; Calculation <sup>(4)</sup>
59	Zinc	1) Digestion, Inductively Coupled Plasma Method <sup>(4)</sup> 2) Digestion, Inductively Coupled Plasma/Mass Spectrometric Method <sup>(4)</sup>

ไม่ได้คิด 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>

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3 Aldrin...

ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
3	Aldrin	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
4	Anthracene	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
5	Antimony	1) Digestion, Inductively Coupled Plasma Method <sup>(4)</sup> 2) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method <sup>(4)</sup>
6	Arsenic	1) Digestion, Inductively Coupled Plasma Method <sup>(4)</sup> 2) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method <sup>(4)</sup>
7	Atrazine	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
8	Barium	1) Digestion, Inductively Coupled Plasma Method <sup>(4)</sup> 2) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method <sup>(4)</sup>
9	Benz(a)anthracene	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
10	Benzene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
11	Benzo(b)fluoranthene	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
12	Benzo(k)fluoranthene	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
13	Benzoic Acid	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
14	Benzo(a)pyrene	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
15	Benzo(g,h,i)perylene	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
16	Beryllium	1) Digestion, Inductively Coupled Plasma Method <sup>(4)</sup> 2) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method <sup>(4)</sup>
17	Bis(2-chloroethyl)ether	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>

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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>

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34 Chromium (III)...



ลำดับที่	สารเคมี	วิธีวิเคราะห์
34	Chromium (III)	1) Digestion, Inductively Coupled Plasma Method; Colorimetric Method; Calculation <sup>(4)</sup> 2) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method; Colorimetric Method; Calculation <sup>(4)</sup>
35	Chromium (VI)	Colorimetric Method <sup>(4)</sup>
36	Chrysene	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
37	Cyanide	Distillation, Colorimetric Method <sup>(4)</sup>
38	2,4-D	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
39	DDD	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
40	DDE	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
41	DDT	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
42	Dibenz(a,h)anthracene	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
43	Di-n-Butyl Phthalate	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
44	1,2-Dichlorobenzene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
45	1,3-Dichlorobenzene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
46	1,4-Dichlorobenzene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
47	3,3-Dichlorobenzidine	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
48	1,1-Dichloroethane	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
49	1,2-Dichloroethane	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
50	1,1-Dichloroethylene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>

  
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
51 cis-1,2-Dichloroethylene...

ลำดับที่	สารเคมี	วิธีวิเคราะห์
51	cis-1,2-Dichloroethylene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
52	trans-1,2-Dichloroethylene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
53	2,4-Dichlorophenol	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
54	1,2-Dichloropropane	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
55	1,3-Dichloropropane	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
56	1,3-Dichloropropene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
57	Dieldrin	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
58	Diethyl Phthalate	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
59	2,4-Dimethylphenol	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
60	2,4-Dinitrophenol	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
61	2,4-Dinitrotoluene	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
62	2,6-Dinitrotoluene	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
63	Di-n-Octyl Phthalate	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
64	Endosulfan	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
65	Endrin	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
66	Ethylbenzene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
67	Fluoranthene	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>

  
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68 Fluorene...

ลำดับที่	สารเคมี	วิธีวิเคราะห์
68	Fluorene	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
69	Heptachlor	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
70	Heptachlor epoxide	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
71	Hexachlorobenzene	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
72	Hexachloro-1,3-butadiene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
73	n-Hexane	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
74	α-HCH	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
75	β-HCH	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
76	γ-HCH	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
77	Hexachlorocyclopentadiene	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
78	Hexachloroethane	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
79	Indeno(1,2,3-cd)pyrene	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
80	Isophorone	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
81	Lead	1) Digestion, Inductively Coupled Plasma Method <sup>(4)</sup> 2) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method <sup>(4)</sup>
82	Manganese	1) Digestion, Inductively Coupled Plasma Method <sup>(4)</sup> 2) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method <sup>(4)</sup>
83	Mercury	1) Cold Vapor Atomic Absorption Spectrometric Method <sup>(4)</sup> 2) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method <sup>(4)</sup>

  
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84 Methanol...

ลำดับที่	สารเคมี	วิธีวิเคราะห์
84	Methanol	1) Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup> 2) Equilibrium Headspace, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
85	Methoxychlor	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
86	Methyl Bromide	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
87	Methylene Chloride	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
88	2-Methylphenol	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
89	2-Methylnaphthalene	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
90	Methyl tert-Butyl Ether	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
91	Naphthalene	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
92	Nickel	1) Digestion, Inductively Coupled Plasma Method <sup>(4)</sup> 2) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method <sup>(4)</sup>
93	Nitrobenzene	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
94	N-Nitrosodiphenylamine	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
95	N-Nitrosodi-n-Propylamine	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
96	Polychlorinated Biphenyls - PCB 1016 - PCB 1221 - PCB 1232 - PCB 1242 - PCB 1248 - PCB 1254 - PCB 1260	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>

  
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97 Pentachlorophenol...



ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
97	Pentachlorophenol	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
98	pH	Electrometric Method <sup>(4)</sup>
99	Phenanthrene	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
100	Phenol	1) Distillation, Direct Photometric Method <sup>(4)</sup> 2) Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
101	Pyrene	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
102	Selenium	1) Digestion, Inductively Coupled Plasma Method <sup>(4)</sup> 2) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method <sup>(4)</sup>
103	Silver	1) Digestion, Inductively Coupled Plasma Method <sup>(4)</sup> 2) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method <sup>(4)</sup>
104	Styrene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
105	1,1,2,2-Tetrachloroethane	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
106	Tetrachloroethylene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
107	Toluene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
108	Toxaphene	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
109	TPH (C <sub>5</sub> -C <sub>6</sub> )	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(13,24)</sup>
110	TPH (C <sub>8</sub> -C <sub>16</sub> )	Solvent Extraction, Gas Chromatographic Method <sup>(9,21)</sup>
111	TPH (C <sub>16</sub> -C <sub>35</sub> )	Solvent Extraction, Gas Chromatographic Method <sup>(9,21)</sup>
112	1,2,4-Trichlorobenzene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
113	1,1,1-Trichloroethane	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>

114 1,1,2-Trichloroethane...

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และประเมินภัยต่อสุขภาพ

ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
114	1,1,2-Trichloroethane	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
115	Trichloroethylene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
116	2,4,5-Trichlorophenol	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
117	2,4,6-Trichlorophenol	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
118	1,3,5-Trimethylbenzene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
119	Vanadium	1) Digestion, Inductively Coupled Plasma Method <sup>(4)</sup> 2) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method <sup>(4)</sup>
120	Vinyl Acetate	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
121	Vinyl Chloride	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
122	m-Xylene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
123	o-Xylene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
124	p-Xylene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
125	Xylene (Total)	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(4)</sup>
126	Zinc	1) Digestion, Inductively Coupled Plasma Method <sup>(4)</sup> 2) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method <sup>(4)</sup>

อากาศเสีย (ปฏิกิริยา) จำนวน 16 รายการ

ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
1	Antimony	Isokinetic, Digestion, Inductively Coupled Plasma Method <sup>(5)</sup>
2	Arsenic	Isokinetic, Digestion, Inductively Coupled Plasma Method <sup>(5)</sup>

3 Carbon Monoxide...

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ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
3	Carbon Monoxide	1) Sampling Bag Non-Dispersive Infrared Method <sup>(5)</sup> 2) Non-Dispersive Infrared Method <sup>(5)</sup> 3) Instrumental Analyzer Method <sup>(5)</sup>
4	Chlorine	1) Absorption Sampling, Ion Chromatographic Method <sup>(5)</sup> 2) Isokinetic Sampling, Ion Chromatographic Method <sup>(5)</sup>
5	Copper	Isokinetic, Digestion, Inductively Coupled Plasma Method <sup>(5)</sup>
6	Dioxins	Isokinetic Sampling, Analysis by ISO/IEC 17025 Accredited Laboratory or Analysis by Department of Industrial Works Registered Laboratory (Dioxins/Furans Analysis Approved) <sup>(5)</sup>
7	Hydrogen Chloride	1) Absorption Sampling, Ion Chromatographic Method <sup>(5)</sup> 2) Isokinetic Sampling, Ion Chromatographic Method <sup>(5)</sup>
8	Hydrogen Sulfide	Absorption Sampling, Iodometric Method <sup>(5)</sup>
9	Lead	Isokinetic, Digestion, Inductively Coupled Plasma Method <sup>(5)</sup>
10	Mercury	1) Isokinetic Sampling, Digestion, Cold-Vapor Atomic Absorption Spectrometric Method <sup>(5)</sup> 2) Isokinetic, Digestion, Inductively Coupled Plasma Method <sup>(5)</sup>
11	Opacity	Ringelmann's Method <sup>(2)</sup>
12	Oxides of Nitrogen	1) Absorption Sampling, Phenoldisulfonic Acid Method <sup>(5)</sup> 2) Chemiluminescence Method <sup>(5)</sup> 3) Instrumental Analyzer Method <sup>(5)</sup>
13	Sulfur Dioxide	1) Absorption Sampling, Barium-Thorin Titrimetric Method <sup>(5)</sup> 2) UV Fluorescence Method <sup>(5)</sup> 3) Instrumental Analyzer Method <sup>(5)</sup>
14	Sulfuric Acid	Isokinetic Sampling, Barium-Thorin Titrimetric Method <sup>(5)</sup>
15	Total Suspended Particulate	Isokinetic Sampling, Gravimetric Method <sup>(5)</sup>
16	Xylene	Absorption Sampling, Gas Chromatographic Method <sup>(5)</sup>

สิ่งปฏิกูล...

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และประเมินภัยต่อสุขภาพ

สิ่งปฏิกูลหรือวัสดุที่ไม่ใช้แล้ว จำนวน 35 รายการ

ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
1	Aldrin	1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(1,9,25)</sup> 2) Soxhlet Extraction, Gas Chromatographic Method <sup>(10,22)</sup> 3) Automated Soxhlet Extraction, Gas Chromatographic Method <sup>(22,31)</sup>
2	Antimony	1) Waste Extraction, Digestion, Inductively Coupled Plasma Method <sup>(1,6,15)</sup> 2) Waste Extraction, Digestion, Inductively Coupled Plasma/Mass Spectrometric Method <sup>(1,6,16)</sup> 3) Digestion, Inductively Coupled Plasma Method <sup>(7,15)</sup> 4) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method <sup>(7,16)</sup>
3	Arsenic	1) Waste Extraction, Digestion, Inductively Coupled Plasma Method <sup>(1,6,15)</sup> 2) Waste Extraction, Digestion, Inductively Coupled Plasma/Mass Spectrometric Method <sup>(1,6,16)</sup> 3) Digestion, Inductively Coupled Plasma Method <sup>(7,15)</sup> 4) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method <sup>(7,16)</sup>
4	Barium	1) Waste Extraction, Digestion, Inductively Coupled Plasma Method <sup>(1,6,15)</sup> 2) Waste Extraction, Digestion, Inductively Coupled Plasma/Mass Spectrometric Method <sup>(1,6,16)</sup> 3) Digestion, Inductively Coupled Plasma Method <sup>(7,15)</sup> 4) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method <sup>(7,16)</sup>
5	Beryllium	1) Waste Extraction, Digestion, Inductively Coupled Plasma Method <sup>(1,6,15)</sup> 2) Waste Extraction, Digestion, Inductively Coupled Plasma/Mass Spectrometric Method <sup>(1,6,16)</sup> 3) Digestion, Inductively Coupled Plasma Method <sup>(7,15)</sup> 4) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method <sup>(7,16)</sup>

6 Cadmium...

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และประเมินภัยต่อสุขภาพ



ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
6	Cadmium	1) Waste Extraction, Digestion, Inductively Coupled Plasma Method <sup>(1.6.15)</sup> 2) Waste Extraction, Digestion, Inductively Coupled Plasma/Mass Spectrometric Method <sup>(1.6.16)</sup> 3) Digestion, Inductively Coupled Plasma Method <sup>(7.15)</sup> 4) Digestion, Inductively Coupled Plasma/Mass Spectrometric Method <sup>(7.14)</sup>
7	Chlordane	1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(1.9.25)</sup> 2) Soxhlet Extraction, Gas Chromatographic Method <sup>(10.22)</sup> 3) Automated Soxhlet Extraction, Gas Chromatographic Method <sup>(22.31)</sup>
8	Chromium	1) Waste Extraction, Digestion, Inductively Coupled Plasma Method <sup>(1.6.15)</sup> 2) Waste Extraction, Digestion, Inductively Coupled Plasma/Mass Spectrometric Method <sup>(1.6.16)</sup> 3) Digestion, Inductively Coupled Plasma Method <sup>(7.15)</sup> 4) Digestion, Inductively Coupled Plasma/Mass Spectrometric Method <sup>(7.14)</sup>
9	Chromium (III)	1) Waste Extraction, Digestion, Inductively Coupled Plasma Method; Waste Extraction, Colorimetric Method; Calculation Method <sup>(1.6.15.17)</sup> 2) Waste Extraction, Digestion, Inductively Coupled Plasma/Mass Spectrometric Method; Waste Extraction, Colorimetric Method; Calculation Method <sup>(1.6.16.17)</sup> 3) Digestion, Inductively Coupled Plasma Method; Alkaline Digestion, Colorimetric Method; Calculation Method <sup>(7.8.15.17)</sup> 4) Digestion, Inductively Coupled Plasma/Mass Spectrometric Method; Alkaline Digestion, Colorimetric Method; Calculation Method <sup>(7.8.16.17)</sup>
10	Chromium (VI)	1) Waste Extraction, Colorimetric Method <sup>(1.6.17)</sup> 2) Alkaline Digestion, Colorimetric Method <sup>(8.17)</sup>

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กรมควบคุมมลพิษ

11 Cobalt...

ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
11	Cobalt	1) Waste Extraction, Digestion, Inductively Coupled Plasma Method <sup>(1.6.15)</sup> 2) Waste Extraction, Digestion, Inductively Coupled Plasma/Mass Spectrometric Method <sup>(1.6.16)</sup> 3) Digestion, Inductively Coupled Plasma Method <sup>(7.15)</sup> 4) Digestion, Inductively Coupled Plasma/Mass Spectrometric Method <sup>(7.14)</sup>
12	Copper	1) Waste Extraction, Digestion, Inductively Coupled Plasma Method <sup>(1.6.15)</sup> 2) Waste Extraction, Digestion, Inductively Coupled Plasma/Mass Spectrometric Method <sup>(1.6.16)</sup> 3) Digestion, Inductively Coupled Plasma Method <sup>(7.15)</sup> 4) Digestion, Inductively Coupled Plasma/Mass Spectrometric Method <sup>(7.14)</sup>
13	2,4-D	1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(1.9.25)</sup> 2) Soxhlet Extraction, Gas Chromatographic Method <sup>(10.22)</sup> 3) Automated Soxhlet Extraction, Gas Chromatographic Method <sup>(22.31)</sup>
14	DDD	1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(1.9.25)</sup> 2) Soxhlet Extraction, Gas Chromatographic Method <sup>(10.22)</sup> 3) Automated Soxhlet Extraction, Gas Chromatographic Method <sup>(22.31)</sup>
15	DDE	1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(1.9.25)</sup> 2) Soxhlet Extraction, Gas Chromatographic Method <sup>(10.22)</sup> 3) Automated Soxhlet Extraction, Gas Chromatographic Method <sup>(22.31)</sup>
16	DDT	1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(1.9.25)</sup>

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2) Soxhlet...

ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
17	Dieldrin	2) Soxhlet Extraction, Gas Chromatographic Method <sup>(10.22)</sup> 3) Automated Soxhlet Extraction, Gas Chromatographic Method <sup>(22.31)</sup>
18	Endrin	1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(1.9.25)</sup> 2) Soxhlet Extraction, Gas Chromatographic Method <sup>(10.22)</sup> 3) Automated Soxhlet Extraction, Gas Chromatographic Method <sup>(22.31)</sup>
19	Heptachlor	1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(1.9.25)</sup> 2) Soxhlet Extraction, Gas Chromatographic Method <sup>(10.22)</sup> 3) Automated Soxhlet Extraction, Gas Chromatographic Method <sup>(22.31)</sup>
20	Lead	1) Waste Extraction, Digestion, Inductively Coupled Plasma Method <sup>(1.6.15)</sup> 2) Waste Extraction, Digestion, Inductively Coupled Plasma/Mass Spectrometric Method <sup>(1.6.16)</sup> 3) Digestion, Inductively Coupled Plasma Method <sup>(7.15)</sup> 4) Digestion, Inductively Coupled Plasma/Mass Spectrometric Method <sup>(7.14)</sup>
21	Lindane	1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(1.9.25)</sup> 2) Soxhlet Extraction, Gas Chromatographic Method <sup>(10.22)</sup> 3) Automated Soxhlet Extraction, Gas Chromatographic Method <sup>(22.31)</sup>
22	Mercury	1) Waste Extraction, Digestion, Cold-Vapor Atomic Absorption Spectrometric Method <sup>(1.6.18)</sup>

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2) Waste Extraction...

ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
23	Methoxychlor	2) Waste Extraction, Thermal Decomposition Amalgamation and Atomic Absorption Spectrometric Method <sup>(1.6.19)</sup> 3) Waste Extraction, Digestion, Cold-Vapor Atomic Fluorescence Spectrometric Method <sup>(1.6.20)</sup> 4) Digestion, Cold-Vapor Atomic Absorption Spectrometric Method <sup>(1.8)</sup> 5) Thermal Decomposition Amalgamation and Atomic Absorption Spectrometric Method <sup>(1.9)</sup> 6) Digestion, Cold-Vapor Atomic Fluorescence Spectrometric Method <sup>(20)</sup>
24	Mirex	1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(1.9.25)</sup> 2) Soxhlet Extraction, Gas Chromatographic Method <sup>(10.22)</sup> 3) Automated Soxhlet Extraction, Gas Chromatographic Method <sup>(22.31)</sup>
25	Molybdenum	1) Waste Extraction, Digestion, Inductively Coupled Plasma Method <sup>(1.6.15)</sup> 2) Waste Extraction, Digestion, Inductively Coupled Plasma/Mass Spectrometric Method <sup>(1.6.16)</sup> 3) Digestion, Inductively Coupled Plasma Method <sup>(7.15)</sup> 4) Digestion, Inductively Coupled Plasma/Mass Spectrometric Method <sup>(7.14)</sup>
26	Nickel	1) Waste Extraction, Digestion, Inductively Coupled Plasma Method <sup>(1.6.15)</sup> 2) Waste Extraction, Digestion, Inductively Coupled Plasma/Mass Spectrometric Method <sup>(1.6.16)</sup> 3) Digestion, Inductively Coupled Plasma Method <sup>(7.15)</sup> 4) Digestion, Inductively Coupled Plasma/Mass Spectrometric Method <sup>(7.14)</sup>

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27 Polychlorinated...



ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
27	Polychlorinated biphenyls (PCBs) - Aroclor 1016 - Aroclor 1221 - Aroclor 1232 - Aroclor 1242 - Aroclor 1248 - Aroclor 1254 - Aroclor 1260 - 2-Chlorobiphenyl - 2,3-Dichlorobiphenyl - 2,2',5-Trichlorobiphenyl - 2,4',5-Trichlorobiphenyl - 2,2',3,5'-Tetrachlorobiphenyl - 2,2',5,5'-Tetrachlorobiphenyl - 2,3',4,4'-Tetrachlorobiphenyl - 2,2',3,4,5'-Pentachlorobiphenyl - 2,2',4,5,5'-Pentachlorobiphenyl - 2,3,3',4'-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',3,4,4',5,5',6'-Heptachlorobiphenyl - 2,2',3,3',4,4',5,5',6'-Nonachlorobiphenyl	1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic Method <sup>(1,9,23)</sup> 2) Soxhlet Extraction, Gas Chromatographic Method <sup>(10,23)</sup> 3) Automated Soxhlet Extraction, Gas Chromatographic Method <sup>(22,31)</sup>

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28 Pentachlorophenol...

ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
28	Pentachlorophenol	1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(1,9,23)</sup> 2) Soxhlet Extraction, Gas Chromatographic Method <sup>(10,22)</sup> 3) Automated Soxhlet Extraction, Gas Chromatographic Method <sup>(22,31)</sup>
29	pH	Electrometric Method <sup>(29,30)</sup>
30	Selenium	1) Waste Extraction, Digestion, Inductively Coupled Plasma Method <sup>(1,6,15)</sup> 2) Waste Extraction, Digestion, Inductively Coupled Plasma/Mass Spectrometric Method <sup>(1,6,16)</sup> 3) Digestion, Inductively Coupled Plasma Method <sup>(7,15)</sup> 4) Digestion, Inductively Coupled Plasma/Mass Spectrometric Method <sup>(7,16)</sup>
31	Silver	1) Waste Extraction, Digestion, Inductively Coupled Plasma Method <sup>(1,6,15)</sup> 2) Waste Extraction, Digestion, Inductively Coupled Plasma/Mass Spectrometric Method <sup>(1,6,16)</sup>
32	Thallium	1) Waste Extraction, Digestion, Inductively Coupled Plasma Method <sup>(1,6,15)</sup> 2) Waste Extraction, Digestion, Inductively Coupled Plasma/Mass Spectrometric Method <sup>(1,6,16)</sup> 3) Digestion, Inductively Coupled Plasma Method <sup>(7,15)</sup> 4) Digestion, Inductively Coupled Plasma/Mass Spectrometric Method <sup>(7,16)</sup>
33	Toxaphene	1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(1,9,23)</sup> 2) Soxhlet Extraction, Gas Chromatographic Method <sup>(10,22)</sup> 3) Automated Soxhlet Extraction, Gas Chromatographic Method <sup>(22,31)</sup>
34	Vanadium	1) Waste Extraction, Digestion, Inductively Coupled Plasma Method <sup>(1,6,15)</sup> 2) Waste Extraction, Digestion, Inductively Coupled Plasma/Mass Spectrometric Method <sup>(1,6,16)</sup> 3) Digestion, Inductively Coupled Plasma Method <sup>(7,15)</sup>

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4) Digestion...

ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
35	Zinc	4) Digestion, Inductively Coupled Plasma/Mass Spectrometric Method <sup>(7,16)</sup> 1) Waste Extraction, Digestion, Inductively Coupled Plasma Method <sup>(1,6,15)</sup> 2) Waste Extraction, Digestion, Inductively Coupled Plasma/Mass Spectrometric Method <sup>(1,6,16)</sup> 3) Digestion, Inductively Coupled Plasma Method <sup>(7,15)</sup> 4) Digestion, Inductively Coupled Plasma/Mass Spectrometric Method <sup>(7,16)</sup>

ดิน จำนวน 125 รายการ

ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
1	Acenaphthene	Automated Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(25,31)</sup>
2	Acetone	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method <sup>(14,24)</sup>
3	Aldrin	1) Soxhlet Extraction, Gas Chromatographic Method <sup>(10,22)</sup> 2) Automated Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(25,31)</sup>
4	Anthracene	Automated Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(25,31)</sup>
5	Antimony	1) Digestion, Inductively Coupled Plasma Method <sup>(7,15)</sup> 2) Digestion, Inductively Coupled Plasma/Mass Spectrometric Method <sup>(7,16)</sup>
6	Arsenic	1) Digestion, Inductively Coupled Plasma Method <sup>(7,15)</sup> 2) Digestion, Inductively Coupled Plasma/Mass Spectrometric Method <sup>(7,16)</sup>
7	Atrazine	1) Soxhlet Extraction, Gas Chromatographic Method <sup>(10,22)</sup> 2) Automated Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(25,31)</sup>
8	Barium	1) Digestion, Inductively Coupled Plasma Method <sup>(7,15)</sup> 2) Digestion, Inductively Coupled Plasma/Mass Spectrometric Method <sup>(7,16)</sup>

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9 Benz(a)anthracene...


ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
9	Benz(a)anthracene	Automated Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(25,31)</sup>
10	Benzene	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method <sup>(14,24)</sup>
11	Benzo(b)fluoranthene	Automated Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(25,31)</sup>
12	Benzo(k)fluoranthene	Automated Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(25,31)</sup>
13	Benzoic acid	Automated Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(25,31)</sup>
14	Benzo(a)pyrene	Automated Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(25,31)</sup>
15	Benzo(g,h,i)perylene	Automated Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(25,31)</sup>
16	Beryllium	1) Digestion, Inductively Coupled Plasma Method <sup>(7,15)</sup> 2) Digestion, Inductively Coupled Plasma/Mass Spectrometric Method <sup>(7,16)</sup>
17	Bis(2-chloroethyl)ether	Automated Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(25,31)</sup>
18	Bis(2-ethylhexyl)phthalate	Automated Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(25,31)</sup>
19	Bromodichloromethane	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method <sup>(14,24)</sup>
20	Bromoform	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method <sup>(14,24)</sup>
21	Butanol	Equilibrium Headspace, Gas Chromatographic/Mass Spectrometric Method <sup>(12,24)</sup>
22	Butyl Benzyl Phthalate	Automated Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(25,31)</sup>
23	Cadmium	1) Digestion, Inductively Coupled Plasma Method <sup>(7,15)</sup> 2) Digestion, Inductively Coupled Plasma/Mass Spectrometric Method <sup>(7,16)</sup>
24	Carbazole	Automated Soxhlet Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(25,31)</sup>
25	Carbon Disulfide	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method <sup>(14,24)</sup>

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26 Carbon tetrachloride...




ลำดับที่	สารเคมี	วิธีวิเคราะห์
26	Carbon tetrachloride	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(14,24)</sup>
27	Chlordane	1) Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(10,22)</sup> 2) Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(25,31)</sup>
28	p-Chloroaniline	Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(25,31)</sup>
29	Chlorobenzene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(14,24)</sup>
30	Chlorodibromomethane	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(14,24)</sup>
31	Chloroform	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(14,24)</sup>
32	2-Chlorophenol	Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(25,31)</sup>
33	Chromium	1) Digestion, Inductively Coupled Plasma Method <sup>(7,15)</sup> 2) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method <sup>(7,16)</sup>
34	Chromium (III)	1) Digestion, Inductively Coupled Plasma Method; Alkaline Digestion, Colorimetric Method; Calculation Method <sup>(7,8,15,17)</sup> 2) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method; Alkaline Digestion, Colorimetric Method; Calculation Method <sup>(7,8,16,17)</sup>
35	Chromium (VI)	Alkaline Digestion, Colorimetric Method <sup>(8,17)</sup>
36	Chrysene	Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(25,31)</sup>
37	Cyanide	Extraction, Distillation, Colorimetric Method <sup>(26,27,28)</sup>
38	2,4-D	1) Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(10,22)</sup> 2) Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(25,31)</sup>
39	DDD	1) Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(10,22)</sup> 2) Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(25,31)</sup>

  
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
40 DDE...

ลำดับที่	สารเคมี	วิธีวิเคราะห์
40	DDE	1) Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(10,22)</sup>
41	DDT	2) Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(25,31)</sup> 1) Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(10,22)</sup>
42	Dibenz(a,h)anthracene	2) Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(25,31)</sup> Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(25,31)</sup>
43	Di-n-Butyl Phthalate	Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(25,31)</sup>
44	1,2-Dichlorobenzene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(14,24)</sup>
45	1,3-Dichlorobenzene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(14,24)</sup>
46	1,4-Dichlorobenzene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(14,24)</sup>
47	3,3-Dichlorobenzidine	Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(25,31)</sup>
48	1,1-Dichloroethane	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(14,24)</sup>
49	1,2-Dichloroethane	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(14,24)</sup>
50	1,1-Dichloroethylene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(14,24)</sup>
51	cis-1,2-Dichloroethylene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(14,24)</sup>
52	trans-1,2-Dichloroethylene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(14,24)</sup>
53	2,4-Dichlorophenol	Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(25,31)</sup>
54	1,2-Dichloropropane	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(14,24)</sup>
55	1,3-Dichloropropane	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(14,24)</sup>
56	1,3-Dichloropropene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(14,24)</sup>

  
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
57 Dieldrin...

ลำดับที่	สารเคมี	วิธีวิเคราะห์
57	Dieldrin	1) Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(10,22)</sup> 2) Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(25,31)</sup>
58	Diethyl Phthalate	Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(25,31)</sup>
59	2,4-Dimethylphenol	Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(25,31)</sup>
60	2,4-Dinitrophenol	Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(25,31)</sup>
61	2,4-Dinitrotoluene	Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(25,31)</sup>
62	2,6-Dinitrotoluene	Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(25,31)</sup>
63	Di-n-Octyl Phthalate	Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(25,31)</sup>
64	Endosulfan	1) Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(10,22)</sup> 2) Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(25,31)</sup>
65	Endrin	1) Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(10,22)</sup> 2) Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(25,31)</sup>
66	Ethylbenzene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(14,24)</sup>
67	Fluoranthene	Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(25,31)</sup>
68	Fluorene	Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(25,31)</sup>
69	Heptachlor	1) Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(10,22)</sup> 2) Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(25,31)</sup>
70	Heptachlor Epoxide	1) Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(10,22)</sup> 2) Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(25,31)</sup>

  
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71 Hexachlorobenzene...

ลำดับที่	สารเคมี	วิธีวิเคราะห์
71	Hexachlorobenzene	1) Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(10,22)</sup> 2) Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(25,31)</sup>
72	Hexachloro-1,3-butadiene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(14,24)</sup>
73	n-Hexane	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(14,24)</sup>
74	α-HCH	1) Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(10,22)</sup> 2) Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(25,31)</sup>
75	β-HCH	1) Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(10,22)</sup> 2) Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(25,31)</sup>
76	γ-HCH	1) Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(10,22)</sup> 2) Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(25,31)</sup>
77	Hexachlorocyclopentadiene	Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(25,31)</sup>
78	Hexachloroethane	Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(25,31)</sup>
79	Indeno(1,2,3-cd)pyrene	Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(25,31)</sup>
80	Isophorone	Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(25,31)</sup>
81	Lead	1) Digestion, Inductively Coupled Plasma Method <sup>(7,15)</sup> 2) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method <sup>(7,16)</sup>
82	Manganese	1) Digestion, Inductively Coupled Plasma Method <sup>(7,15)</sup> 2) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method <sup>(7,16)</sup>
83	Mercury	1) Digestion, Cold-Vapor Atomic Absorption Spectrometric Method <sup>(18)</sup>

  
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2) Thermal...



ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
84	Methanol	2) Thermal Decomposition, Amalgamation, and Atomic Absorption Spectrophotometry <sup>(19)</sup> 3) Digestion, Cold-Vapor Atomic Fluorescence Spectrometric Method <sup>(20)</sup> Equilibrium Headspace, Gas Chromatographic/ Mass Spectrometric Method <sup>(12,24)</sup>
85	Methoxychlor	1) Soxhlet Extraction, Gas Chromatographic Method <sup>(10,22)</sup> 2) Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(23,31)</sup>
86	Methyl Bromide	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(14,24)</sup>
87	Methylene Chloride	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(14,24)</sup>
88	2-methylphenol	Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(23,31)</sup>
89	2-Methylnaphthalene	Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(23,31)</sup>
90	Methyl tert-Butyl Ether	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(14,24)</sup>
91	Naphthalene	Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(23,31)</sup>
92	Nickel	1) Digestion, Inductively Coupled Plasma Method <sup>(7,15)</sup> 2) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method <sup>(7,14)</sup>
93	Nitrobenzene	Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(23,31)</sup>
94	N-Nitrosodiphenylamine	Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(23,31)</sup>
95	N-Nitrosodi-n-propylamine	Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(23,31)</sup>
96	Polychlorinated biphenyls (PCBs) - Aroclor 1016 - Aroclor 1221 - Aroclor 1232	1) Soxhlet Extraction, Gas Chromatographic Method <sup>(10,23)</sup> 2) Automated Soxhlet Extraction, Gas Chromatographic Method <sup>(23,32)</sup>

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- Aroclor 1242...

ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
	- Aroclor 1242 - Aroclor 1248 - Aroclor 1254 - Aroclor 1260 - 2-Chlorobiphenyl - 2,2',3,5'-Tetrachlorobiphenyl - 2,2',5,5'-Tetrachlorobiphenyl - 2,3',4,4'-Tetrachlorobiphenyl - 2,2',3,4,5'-Pentachlorobiphenyl - 2,2',4,5,5'-Pentachlorobiphenyl - 2,3,3',4,6-Pentachlorobiphenyl - 2,2',3,4,4',5'-Hexachlorobiphenyl - 2,2',3,4,5,5'-Hexachlorobiphenyl - 2,2',3,5,5',6'-Hexachlorobiphenyl - 2,2',4,4',5,5'-Hexachlorobiphenyl - 2,2',3,3',4,4',5'-Heptachlorobiphenyl - 2,2',3,4,4',5,5'-Heptachlorobiphenyl - 2,2',3,4,4',5,6'-Heptachlorobiphenyl - 2,2',3,4',5,5',6'-Heptachlorobiphenyl - 2,2',3,3',4,4',5,6'-Nonachlorobiphenyl - Pentachlorophenol	Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(23,31)</sup> Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(23,31)</sup> Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(23,31)</sup> Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(23,31)</sup> Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(23,31)</sup>
97	Phenanthrene	Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(23,31)</sup>
98	Phenol	Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(23,31)</sup>
99	Pyrene	Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(23,31)</sup>
100		

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101 Selenium...

ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
101	Selenium	1) Digestion, Inductively Coupled Plasma Method <sup>(7,15)</sup> 2) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method <sup>(7,16)</sup>
102	Silver	1) Digestion, Inductively Coupled Plasma Method <sup>(7,15)</sup> 2) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method <sup>(7,16)</sup>
103	Styrene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(14,24)</sup>
104	1,1,2,2-Tetrachloroethane	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(14,24)</sup>
105	Tetrachloroethylene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(14,24)</sup>
106	Toluene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(14,24)</sup>
107	Toxaphene	1) Soxhlet Extraction, Gas Chromatographic Method <sup>(10,22)</sup> 2) Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(23,31)</sup>
108	TPH (C <sub>3</sub> -C <sub>6</sub> )	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(14,24)</sup>
109	TPH (C <sub>9</sub> -C <sub>16</sub> )	1) Solvent Extraction, Gas Chromatographic Method <sup>(11,21)</sup> 2) Automated Soxhlet Extraction, Gas Chromatographic Method <sup>(23,31)</sup>
110	TPH (C <sub>18</sub> -C <sub>33</sub> )	1) Solvent Extraction, Gas Chromatographic Method <sup>(11,21)</sup> 2) Automated Soxhlet Extraction, Gas Chromatographic Method <sup>(23,31)</sup>
111	1,2,4-Trichlorobenzene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(14,24)</sup>
112	1,1,1-Trichloroethane	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(14,24)</sup>
113	1,1,2-Trichloroethane	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(14,24)</sup>
114	Trichloroethylene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(14,24)</sup>
115	2,4,5-Trichlorophenol	Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(23,31)</sup>

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116 2,4,6-Trichlorophenol...

ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
116	2,4,6-Trichlorophenol	Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method <sup>(23,31)</sup>
117	1,3,5-Trimethylbenzene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(14,24)</sup>
118	Vanadium	1) Digestion, Inductively Coupled Plasma Method <sup>(7,15)</sup> 2) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method <sup>(7,16)</sup>
119	Vinyl Acetate	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(14,24)</sup>
120	Vinyl Chloride	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(14,24)</sup>
121	m-Xylene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(14,24)</sup>
122	o-Xylene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(14,24)</sup>
123	p-Xylene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(14,24)</sup>
124	Xylene (Total)	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(14,24)</sup>
125	Zinc	1) Digestion, Inductively Coupled Plasma Method <sup>(7,15)</sup> 2) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method <sup>(7,16)</sup>

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กรมโรงงานอุตสาหกรรม

ศูนย์มาตรฐานวิธีการวิเคราะห์ทดสอบผลิตภัณฑ์และทะเบียนของปฏิบัติการ การวิจัยและพัฒนายุทธศาสตร์โรงงาน กรมโรงงานอุตสาหกรรม โทร. ๐ ๒๖๔๒ ๔๐๐๖, ๔๔๔๖



ที่ อก ๐๓๐๓(๓)/ ๖๔๗๐

กรมโรงงานอุตสาหกรรม  
ถนนพระรามที่ ๖ แขวงทุ่งพญาไท  
เขตราชเทวี กรุงเทพฯ ๑๐๔๐๐

๒๔ มิถุนายน ๒๕๖๕

เรื่อง ขันทะเบียนของปฏิบัติการวิเคราะห์เอกชน

เรียน กรรมการผู้จัดการ บริษัท เอลเอส แลบบอราทอรี กรุ๊ป (ประเทศไทย) จำกัด

อ้างถึง คำขอขึ้นทะเบียน/เปลี่ยนแม่แบบบุคลากร และชนิดสารเคมีของห้องปฏิบัติการวิเคราะห์เอกชน ลงวันที่ ๒๔ เมษายน ๒๕๖๔

สิ่งที่ส่งมาด้วย เอกสารแบบคำขอขึ้นทะเบียนของปฏิบัติการวิเคราะห์เอกชน บริษัท เอลเอส แลบบอราทอรี กรุ๊ป (ประเทศไทย) จำกัด จำนวน ๒ แผ่น

ตามหนังสือที่อ้างถึง บริษัท เอลเอส แลบบอราทอรี กรุ๊ป (ประเทศไทย) จำกัด ขอขึ้นทะเบียนของปฏิบัติการวิเคราะห์เอกชน พร้อมรายชื่อผู้ควบคุมดูแลห้องปฏิบัติการวิเคราะห์ เจ้าหน้าที่ประจำห้องปฏิบัติการวิเคราะห์ และรายการสารเคมีที่จะทำการวิเคราะห์ ต่อกรมโรงงานอุตสาหกรรม นั้น

กรมโรงงานอุตสาหกรรมพิจารณาแล้ว ให้บริษัท เอลเอส แลบบอราทอรี กรุ๊ป (ประเทศไทย) จำกัด ขันทะเบียนของปฏิบัติการวิเคราะห์เอกชน มีเลขทะเบียน ๖-๓๒๒ สถานที่ตั้งเลขที่ ๖๓๖/๓๐ หมู่ที่ ๕ ตำบลแม่แก้ว อำเภอลำลูกเกด จังหวัดระยอง โดยมีองค์ประกอบดังนี้

ก. ผู้ควบคุมดูแลห้องปฏิบัติการวิเคราะห์

- |                          |                            |
|--------------------------|----------------------------|
| ๑) นายเดช ช้างชน         | ทะเบียนเลขที่ ๖-๓๒๒-๖-๔๔๔๖ |
| ๒) นางวิไลรัตน์ บริรักษ์ | ทะเบียนเลขที่ ๖-๓๒๒-๖-๔๔๔๓ |
| ๓) นายสุพจน์ สลามเต๊ะ    | ทะเบียนเลขที่ ๖-๓๒๒-๖-๔๔๔๔ |

ข. เจ้าหน้าที่ประจำห้องปฏิบัติการวิเคราะห์

- |                                 |                            |
|---------------------------------|----------------------------|
| ๑) นางสาวณกุล บรรจงกิจ          | ทะเบียนเลขที่ ๖-๓๒๒-๖-๔๔๔๕ |
| ๒) นางพจนา สีดา                 | ทะเบียนเลขที่ ๖-๓๒๒-๖-๔๔๔๖ |
| ๓) นางสาวอนิศา กุลสุริวงศ์      | ทะเบียนเลขที่ ๖-๓๒๒-๖-๔๔๔๗ |
| ๔) นายพิทยา ทองแดง              | ทะเบียนเลขที่ ๖-๓๒๒-๖-๔๔๔๘ |
| ๕) นางชลธิชา สุนทรข             | ทะเบียนเลขที่ ๖-๓๒๒-๖-๔๔๔๙ |
| ๖) วาที่ ร.ค.ธนชัย ม่วงมา       | ทะเบียนเลขที่ ๖-๓๒๒-๖-๔๔๕๐ |
| ๗) นายวรวิทย์ ทัพพา             | ทะเบียนเลขที่ ๖-๓๒๒-๖-๔๔๕๑ |
| ๘) นายคณินันท์ จรัสกลาย         | ทะเบียนเลขที่ ๖-๓๒๒-๖-๔๔๕๒ |
| ๙) นายสุรศักดิ์ ลาชัน           | ทะเบียนเลขที่ ๖-๓๒๒-๖-๔๔๕๓ |
| ๑๐) นางสาวเพชรคุณ ภาวตานนท์     | ทะเบียนเลขที่ ๖-๓๒๒-๖-๔๔๕๔ |
| ๑๑) นายสราวุธ ภาแก้ว            | ทะเบียนเลขที่ ๖-๓๒๒-๖-๔๔๕๕ |
| ๑๒) นายสุวิทย์ดำรง โชคปิตินันท์ | ทะเบียนเลขที่ ๖-๓๒๒-๖-๔๔๕๖ |

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| ๑๓) นายวัลลภ ทัชไชยนาร           | ทะเบียนเลขที่ ๖-๓๒๒-๖-๔๔๕๗ |
| ๑๔) นางสาววชิรา ทรัพย์เจริญ      | ทะเบียนเลขที่ ๖-๓๒๒-๖-๔๔๕๘ |
| ๑๕) นายธนธรณ์ วงศ์ไชโย           | ทะเบียนเลขที่ ๖-๓๒๒-๖-๔๔๕๙ |
| ๑๖) นายชัยนรินทร์ เลิศนันทกุลชัย | ทะเบียนเลขที่ ๖-๓๒๒-๖-๔๔๖๐ |
| ๑๗) นายสิริจาง เพ็ชรแสง          | ทะเบียนเลขที่ ๖-๓๒๒-๖-๔๔๖๑ |
| ๑๘) นายกันตภณ มณีสัมพันธ์        | ทะเบียนเลขที่ ๖-๓๒๒-๖-๔๔๖๒ |
| ๑๙) นางสาวจันทิพย์ โกเมนชนะ      | ทะเบียนเลขที่ ๖-๓๒๒-๖-๔๔๖๓ |
| ๒๐) นายอริยวัชร อธิจินดา         | ทะเบียนเลขที่ ๖-๓๒๒-๖-๔๔๖๔ |
| ๒๑) นายคุณัฐ พิสิสัยพันธ์        | ทะเบียนเลขที่ ๖-๓๒๒-๖-๔๔๖๕ |
| ๒๒) นายศุภชัย วงศ์สุริยฉาย       | ทะเบียนเลขที่ ๖-๓๒๒-๖-๔๔๖๖ |
| ๒๓) นายปฐมพงศ์ กรสวัสดิ์         | ทะเบียนเลขที่ ๖-๓๒๒-๖-๔๔๖๗ |
| ๒๔) นายโสภณ คณโพธิ์              | ทะเบียนเลขที่ ๖-๓๒๒-๖-๔๔๖๘ |
| ๒๕) นางสาวกิตติยา สัตยาธิราชวรณ  | ทะเบียนเลขที่ ๖-๓๒๒-๖-๔๔๖๙ |
| ๒๖) นางสาวเจษฎาพร ศรีบุญเรือง    | ทะเบียนเลขที่ ๖-๓๒๒-๖-๔๔๗๐ |
| ๒๗) นางสาวมธุรีนาถ สิงห์เงา      | ทะเบียนเลขที่ ๖-๓๒๒-๖-๔๔๗๑ |
| ๒๘) นางสาวศิริรัตน์ ศิริมงคลโร   | ทะเบียนเลขที่ ๖-๓๒๒-๖-๔๔๗๒ |
| ๒๙) นายพิพัฒน์ นิพัทธ์เศรษฐ์     | ทะเบียนเลขที่ ๖-๓๒๒-๖-๔๔๗๓ |
| ๓๐) นายศิริวิทย์ เรืองสม         | ทะเบียนเลขที่ ๖-๓๒๒-๖-๔๔๗๔ |
| ๓๑) นายปารเมศ สัตยาคุณ           | ทะเบียนเลขที่ ๖-๓๒๒-๖-๔๔๗๕ |
| ๓๒) นายณพนา ธรรมะโร              | ทะเบียนเลขที่ ๖-๓๒๒-๖-๔๔๗๖ |
| ๓๓) นางสาวศุภกวีรัตน์ โสจันทร์   | ทะเบียนเลขที่ ๖-๓๒๒-๖-๔๔๗๗ |
| ๓๔) นายพชรกร อินทรเสนา           | ทะเบียนเลขที่ ๖-๓๒๒-๖-๔๔๗๘ |
| ๓๕) นายทิภากร เชื้อมาก           | ทะเบียนเลขที่ ๖-๓๒๒-๖-๔๔๗๙ |
| ๓๖) นายอนุวัชร ทองขจรศักดิ์      | ทะเบียนเลขที่ ๖-๓๒๒-๖-๔๔๘๐ |
| ๓๗) นายอภิชาติ วิลาศ             | ทะเบียนเลขที่ ๖-๓๒๒-๖-๔๔๘๑ |
| ๓๘) นายจรัสสรณ์ ศรีรักษา         | ทะเบียนเลขที่ ๖-๓๒๒-๖-๔๔๘๒ |
| ๓๙) นายประสาธิต เจริญเพชร        | ทะเบียนเลขที่ ๖-๓๒๒-๖-๔๔๘๓ |
| ๔๐) นายภาณุวัฒน์ วัชรบ           | ทะเบียนเลขที่ ๖-๓๒๒-๖-๔๔๘๔ |
| ๔๑) นายสันติ ชัยชนะ              | ทะเบียนเลขที่ ๖-๓๒๒-๖-๔๔๘๕ |
| ๔๒) นายสิทธิชัย แก้วภาค          | ทะเบียนเลขที่ ๖-๓๒๒-๖-๔๔๘๖ |
| ๔๓) นายทิมกร กุลชาติ             | ทะเบียนเลขที่ ๖-๓๒๒-๖-๔๔๘๗ |

ค. ขอบข่ายสารเคมีที่ได้รับขึ้นทะเบียนไว้วิเคราะห์ในน้ำเสีย จำนวน ๑๔ รายการ  
อากาศเสีย (ปล่อยระบาย) จำนวน ๗ รายการ และน้ำใต้ดิน จำนวน ๓ รายการ รวมทั้งสิ้นจำนวน ๒๔ รายการ  
ตามสิ่งที่ส่งมาด้วย



ศูนย์วิจัยและเตือนภัยมลพิษโรงงานภาคตะวันออก กองวิจัยและเตือนภัยมลพิษโรงงาน กรมโรงงานอุตสาหกรรม โทร. ๐ ๓๘๐๕ ๕๖๖๑-๓



บริษัท เอแอลเอส แล็บอราทอรี กรุ๊ป (ประเทศไทย) จำกัด (สำนักงานใหญ่)  
104 ซอยพัฒนาการ 40 ถนนพัฒนาการ  
แขวงพัฒนาการ เขตสวนหลวง กรุงเทพฯ 10250



ติดต่อเรา

