

ภาคผนวกที่ 5

เอกสารการสอบเทียบความถูกต้องของเครื่องมือ

- เอกสาร 5-1 เอกสารสอบเทียบเครื่องมือการตรวจวัดคุณภาพอากาศ
เอกสาร 5-2 เอกสารสอบเทียบเครื่องมือการตรวจวัดระดับเสียง

ตารางสรุปรายการเอกสารการสอบเทียบเครื่องมือตรวจวัดคุณภาพสิ่งแวดล้อม

รายการตรวจวัด	เครื่องมือเก็บตัวอย่าง	เครื่องมือตรวจวิเคราะห์
	ชื่อเครื่องมือ	ชื่อเครื่องมือ
คุณภาพอากาศ		
- TSP	- High Volume Air Sampler No. B05, B15	- Electronic Balance
- PM ₁₀	- High Volume PM-10 Air Sampler No. B25, B32	- Electronic Balance
- CO	- CO Analyzer No. B06, B07, B08	- CO Analyzer No. B06, B07, B08
ระดับเสียง		
- Leq 24 hr	- Acoustic Calibrator	-
- Lmax	- Sound Level Meter No. ACO-B05, B14, B24, B31	-

เอกสารที่ 5-1

เอกสารสอบเทียบเครื่องมือการตรวจวัดคุณภาพอากาศ



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S.P.S. CONSULTING SERVICE CO., LTD.

7 ซอยพหลโยธิน 24 ถนนพหลโยธิน แขวงจอมพล เขตจตุจักร กรุงเทพฯ 10900

7 Soi Phaholyothin 24, Phaholyothin Rd., Jompol, Chatuchak, Bangkok 10900

Tel : (662) 939-4370-72, Fax : (662) 513-4221, E-mail : sale@spscon.com, www.spscon.com

High Volume Air Sampler Calibration Report

Calibration Method : Multipoint Orifice Flow Transfer Standard

Model : TE 5025A

S/N : 3095

Calibration Data

High Volume Air Sampler Data		Calibration Data		
Recorder No.	Blower No.	Date	Actual Flowrate (ft ³ /min)	R ²
B01	B01	04/05/2022	$y = 1.313x - 9.642$	0.999
B02	B02	02/05/2022	$y = 1.062x + 2.593$	1.000
B03	B03	04/05/2022	$y = 1.045x + 0.757$	0.998
B04	B04	04/05/2022	$y = 1.161x - 3.677$	0.996
B05	B05	02/05/2022	$y = 1.218x - 6.416$	1.000
B06	B06	04/05/2022	$y = 1.235x - 6.768$	0.998
B07	B07	06/05/2022	$y = 1.178x - 5.564$	0.999
B08	B08	02/05/2022	$y = 1.222x - 6.991$	1.000
B09	B09	04/05/2022	$y = 1.240x - 6.649$	0.996
B10	B10	04/05/2022	$y = 1.091x + 0.142$	0.995
B11	B11	04/05/2022	$y = 1.120x - 2.107$	1.000
B12	B12	02/05/2022	$y = 1.102x - 1.916$	0.996
B13	B13	03/05/2022	$y = 1.187x - 5.240$	0.999
B14	B14	06/05/2022	$y = 1.290x - 9.276$	0.998
B15	B15	03/05/2022	$y = 1.093x - 0.919$	0.999
B16	B16	04/05/2022	$y = 1.223x - 6.745$	0.999
B17	B17	03/05/2022	$y = 1.172x - 3.414$	0.998
B18	B18	04/05/2022	$y = 1.259x - 8.700$	1.000
B19	B19	03/05/2022	$y = 1.307x - 10.268$	0.999
B20	B20	02/05/2022	$y = 1.232x - 7.260$	0.999
B21	B21	04/05/2022	$y = 1.209x - 7.461$	0.996
B22	B22	02/05/2022	$y = 1.239x - 7.827$	0.999
B23	B23	03/05/2022	$y = 1.227x - 6.159$	0.999
B24	B24	03/05/2022	$y = 1.075x - 0.925$	0.997
B25	B25	04/05/2022	$y = 0.997x + 2.795$	0.998
B26	B26	04/05/2022	$y = 1.185x - 5.015$	0.998
B27	B27	06/05/2022	$y = 1.148x - 5.099$	0.996
B28	B28	04/05/2022	$y = 1.221x - 6.454$	1.000
B29	B29	02/05/2022	$y = 1.181x - 5.705$	0.995
B30	B30	04/05/2022	$y = 1.136x - 3.406$	0.999
B31	B31	04/05/2022	$y = 1.114x - 1.568$	0.999
B32	B32	04/05/2022	$y = 1.249x - 6.749$	1.000
B33	B33	06/05/2022	$y = 1.195x - 4.397$	0.996
B34	B34	04/05/2022	$y = 1.222x - 7.759$	0.999



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High Volume Air Sampler Calibration Report

Calibration Method : Multipoint Orifice Flow Transfer Standard

Model : TE 5025A

S/N : 3611

Calibration Data

High Volume Air Sampler Data		Calibration Data		
Recorder No.	Blower No.	Date	Actual Flowrate (ft ³ /min)	R ²
B01	B01	01/08/2022	$y = 1.310x - 7.517$	0.998
B02	B02	01/08/2022	$y = 1.098x + 2.659$	0.997
B03	B03	01/08/2022	$y = 1.089x + 0.857$	0.998
B04	B04	01/08/2022	$y = 1.206x - 3.858$	0.995
B05	B05	01/08/2022	$y = 1.285x - 7.595$	0.997
B06	B06	01/08/2022	$y = 1.287x - 6.981$	0.998
B07	B07	01/08/2022	$y = 1.197x - 4.681$	0.998
B08	B08	01/08/2022	$y = 1.224x - 5.592$	0.999
B09	B09	01/08/2022	$y = 1.275x - 6.394$	0.997
B10	B10	01/08/2022	$y = 1.121x + 1.091$	0.995
B11	B11	04/08/2022	$y = 1.165x - 2.766$	0.998
B12	B12	04/08/2022	$y = 1.230x - 4.896$	0.998
B13	B13	01/08/2022	$y = 1.249x - 6.430$	0.996
B14	B14	02/08/2022	$y = 1.232x - 4.320$	0.996
B15	B15	02/08/2022	$y = 1.134x - 0.926$	0.997
B16	B16	02/08/2022	$y = 1.261x - 6.890$	0.998
B17	B17	02/08/2022	$y = 1.175x - 2.039$	0.997
B18	B18	02/08/2022	$y = 1.290x - 7.805$	0.999
B19	B19	02/08/2022	$y = 1.375x - 11.753$	0.995
B20	B20	02/08/2022	$y = 1.262x - 7.100$	0.999
B21	B21	03/08/2022	$y = 1.142x - 1.809$	0.999
B22	B22	02/08/2022	$y = 1.289x - 8.540$	0.997
B23	B23	02/08/2022	$y = 1.216x - 4.912$	0.999
B24	B24	01/08/2022	$y = 1.147x - 1.299$	1.000
B25	B25	02/08/2022	$y = 1.025x + 3.341$	0.997
B26	B26	02/08/2022	$y = 1.184x - 3.486$	0.995
B27	B27	03/08/2022	$y = 1.237x - 6.825$	0.996
B28	B28	02/08/2022	$y = 1.284x - 7.704$	0.998
B29	B29	02/08/2022	$y = 1.305x - 8.854$	0.996
B30	B30	03/08/2022	$y = 1.227x - 5.387$	0.996
B31	B31	03/08/2022	$y = 1.215x - 4.628$	0.995
B32	B32	03/08/2022	$y = 1.313x - 8.558$	0.995
B33	B33	03/08/2022	$y = 1.330x - 7.545$	1.000
B34	B34	03/08/2022	$y = 1.287x - 8.617$	0.999



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High Volume PM-10 Air Sampler Calibration Report

Calibration Method : Multipoint Orifice Flow Transfer Standard

Model : TE 5025A

S/N : 3095

Calibration Data

High Volume PM-10 Data		Calibration Data		
Recorder No.	Blower No.	Date	Actual Flowrate (ft ³ /min)	R ²
B01	B01	02/05/2022	$y = 1.171x - 0.211$	0.997
B02	B02	02/05/2022	$y = 0.960x + 5.104$	0.998
B03	B03	04/05/2022	$y = 1.214x - 5.211$	0.996
B04	B04	02/05/2022	$y = 1.310x - 9.479$	0.999
B05	B05	03/05/2022	$y = 1.202x - 5.734$	0.999
B06	B06	04/05/2022	$y = 1.241x - 7.631$	0.998
B07	B07	04/05/2022	$y = 1.186x - 4.480$	0.999
B08	B08	03/05/2022	$y = 1.322x - 8.634$	0.999
B09	B09	04/05/2022	$y = 1.219x - 5.756$	0.998
B10	B10	03/05/2022	$y = 1.234x - 7.417$	1.000
B11	B11	02/05/2022	$y = 1.260x - 7.479$	0.999
B12	B12	02/05/2022	$y = 1.225x - 5.900$	0.998
B13	B13	04/05/2022	$y = 1.326x - 10.711$	0.999
B14	B14	07/05/2022	$y = 1.197x - 3.534$	0.999
B15	B15	04/05/2022	$y = 1.096x - 0.244$	0.998
B16	B16	04/05/2022	$y = 1.209x - 1.612$	1.000
B17	B17	03/05/2022	$y = 1.198x - 3.075$	0.999
B18	B18	07/05/2022	$y = 1.159x - 2.421$	0.999
B19	B19	03/05/2022	$y = 1.053x + 1.562$	0.999
B20	B20	03/05/2022	$y = 1.206x - 6.147$	1.000
B21	B21	04/05/2022	$y = 1.156x - 0.999$	0.998
B22	B22	04/05/2022	$y = 1.293x - 8.368$	0.998
B23	B23	07/05/2022	$y = 1.149x - 2.644$	1.000
B24	B24	02/05/2022	$y = 1.250x - 7.392$	1.000
B25	B25	03/05/2022	$y = 1.131x - 2.476$	0.999
B26	B26	07/05/2022	$y = 1.154x + 1.978$	1.000
B27	B27	02/05/2022	$y = 1.278x - 8.984$	0.998
B28	B28	04/05/2022	$y = 1.093x - 0.217$	0.999
B29	B29	04/05/2022	$y = 1.280x - 9.168$	0.999
B30	B30	03/05/2022	$y = 1.290x - 8.822$	0.997
B31	B31	03/05/2022	$y = 1.116x - 0.814$	0.997
B32	B32	05/05/2022	$y = 1.156x - 3.473$	0.999
B33	B33	06/05/2022	$y = 1.254x - 8.880$	0.998
B34	B34	03/05/2022	$y = 1.157x - 1.629$	0.999



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High Volume PM-10 Air Sampler Calibration Report

Calibration Method : Multipoint Orifice Flow Transfer Standard

Model : TE 5025A

S/N : 3611

Calibration Data

High Volume PM-10 Data		Calibration Data		
Recorder No.	Blower No.	Date	Actual Flowrate (ft ³ /min)	R ²
B01	B01	02/08/2022	$y = 1.258x - 2.366$	0.998
B02	B02	02/08/2022	$y = 0.987x + 5.729$	0.999
B03	B03	02/08/2022	$y = 1.247x - 5.106$	0.999
B04	B04	01/08/2022	$y = 1.242x - 4.634$	0.997
B05	B05	01/08/2022	$y = 1.245x - 5.869$	0.997
B06	B06	01/08/2022	$y = 1.360x - 10.516$	0.999
B07	B07	01/08/2022	$y = 1.290x - 6.671$	0.999
B08	B08	01/08/2022	$y = 1.353x - 8.231$	0.999
B09	B09	04/08/2022	$y = 1.289x - 6.478$	0.999
B10	B10	04/08/2022	$y = 1.317x - 9.553$	0.998
B11	B11	04/08/2022	$y = 1.331x - 8.248$	0.999
B12	B12	04/08/2022	$y = 1.317x - 9.553$	0.998
B13	B13	01/08/2022	$y = 1.338x - 9.806$	0.999
B14	B14	01/08/2022	$y = 1.230x - 3.665$	0.998
B15	B15	01/08/2022	$y = 1.169x - 2.069$	0.998
B16	B16	01/08/2022	$y = 1.240x - 1.078$	0.998
B17	B17	01/08/2022	$y = 1.241x - 3.121$	0.997
B18	B18	01/08/2022	$y = 1.190x - 1.997$	0.998
B19	B19	02/08/2022	$y = 1.108x + 0.786$	0.999
B20	B20	02/08/2022	$y = 1.251x - 6.369$	0.997
B21	B21	02/08/2022	$y = 1.176x - 0.519$	0.999
B22	B22	02/08/2022	$y = 1.291x - 7.071$	0.999
B23	B23	02/08/2022	$y = 1.177x - 2.290$	0.998
B24	B24	03/08/2022	$y = 1.367x - 11.212$	0.997
B25	B25	03/08/2022	$y = 1.178x - 3.689$	0.999
B26	B26	03/08/2022	$y = 1.204x - 3.755$	0.999
B27	B27	03/08/2022	$y = 1.331x - 10.619$	0.998
B28	B28	03/08/2022	$y = 1.139x - 1.295$	0.999
B29	B29	03/08/2022	$y = 1.333x - 10.813$	0.999
B30	B30	01/08/2022	$y = 1.344x - 10.463$	0.997
B31	B31	01/08/2022	$y = 1.162x + 0.382$	0.997
B32	B32	01/08/2022	$y = 1.204x - 2.345$	0.999
B33	B33	01/08/2022	$y = 1.349x - 10.216$	0.999
B34	B34	01/08/2022	$y = 1.289x - 4.593$	1.000



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CALIBRATION REPORT

NON-DISPERSIVE INFRARED CO ANALYZER

DATE : 13 July 2022

BRAND : Thermo

MODEL : 48C

NO. CO-B07

SERIAL NO. 0335203746

Calibrator (Dilution System)

Brand : API

Model : 700

Last Cal. Date : 20 September 2021

Serial No. : 421

Reference Standard Gas

Standard Gas : Carbon Monoxide (CO)

Cylinder No. : D196045

Certified Date : 16 April 2022

Expired Date : 15 April 2024

Cylinder Conc. : 4,570 PPM

CALIBRATING CONDITION

Pressure 1011 mmbar

Temp. 24.5 °C

% RH 49

CALIBRATION SETTING

Span Set Point	Initial Reading (Before Adj.),PPM			Final Reading (After Adj.),PPM
	Expected Concentration	Analyzer Response	%Dif	Analyzer Response
Zero	0	0.10	-	0
CO Span	40.00	40.08	0.200	40.00

INSTRUMENT STATUS

CHAMBER TEMP

47.4 °C

FLOW

1.5 LPM

PRESSURE

730.7 mm Hg

MOTOR SPEED

100.00%

Calibrated by :

(Mr.Phakhinai Khongkomnerd)

Approved by :

(Mr.Peera Detudom)



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CALIBRATION REPORT						
NON-DISPERSIVE INFRARED CO ANALYZER						
DATE :	18 October 2022	BRAND :	Thermo	MODEL :	48C	
NO.	CO-B08	SERIAL NO.	0508011067			
Calibrator (Dilution System)						
Brand	: API			Model	: 700	
Last Cal. Date	: 06 September 2022			Serial No.	: 421	
Reference Standard Gas						
Standard Gas	: Carbon Monoxide (CO)			Cylinder No.	: D196045	
Certified Date	: 16 April 2022	Expired Date	: 15 April 2024	Cylinder Conc.	: 4,570 PPM	
CALIBRATING CONDITION						
Pressure	1011	mmbar	Temp.	24.5	°C	
% RH						49
CALIBRATION SETTING						
Span	Initial Reading (Before Adj.),PPM			Final Reading (After Adj.),PPM		
Set Point	Expected Concentration	Analyzer Response		%Dif	Analyzer Response	
Zero	0	0.11		-	0	
CO Span	40.00	39.95		-0.125	40.00	
INSTRUMENT STATUS						
CHAMBER TEMP	47.6 °C		FLOW	1.5 LPM		
PRESSURE	730.7 mm Hg		MOTOR SPEED	100.00%		

Calibrated by :



(Mr.Adul Dangklom)

Approved by :



(Mr.Peera Detudom)



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CALIBRATION REPORT					
NON-DISPERSIVE INFRARED CO ANALYZER					
DATE :	14 November 2022	BRAND :	Thermo	MODEL :	48C
NO.	CO-B08	SERIAL NO.	0508011067		
Calibrator (Dilution System)					
Brand : API			Model : 700		
Last Cal. Date : 06 September 2022			Serial No. : 421		
Reference Standard Gas					
Standard Gas : Carbon Monoxide (CO)			Cylinder No. : D196045		
Certified Date : 16 April 2022		Expired Date : 15 April 2024		Cylinder Conc. : 4,570 PPM	
CALIBRATING CONDITION					
Pressure	1011	mmbar	Temp.	24.5	°C
% RH 49					
CALIBRATION SETTING					
Span	Initial Reading (Before Adj.),PPM			Final Reading (After Adj.),PPM	
Set Point	Expected Concentration	Analyzer Response		%Dif	
Zero	0	-0.10		-	
CO Span	40.00	40.07		0.175	
INSTRUMENT STATUS					
CHAMBER TEMP	47.6 °C		FLOW	1.5 LPM	
PRESSURE	730.7 mm Hg		MOTOR SPEED	100.00%	

Calibrated by :

(Mr.Adul Dangklom)

Approved by :

(Mr.Peera Detudom)



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CALIBRATION REPORT

NON-DISPERSIVE INFRARED CO ANALYZER

DATE : 20 Decmber 2022

BRAND : API

MODEL : 300E

NO. CO-B06

SERIAL NO. 3117

Calibrator (Dilution System)

Brand : API

Model : 700

Last Cal. Date : 06 September 2022

Serial No. : 421

Reference Standard Gas

Standard Gas : Carbon Monoxide (CO)

Cylinder No. : D196045

Certified Date : 16 April 2022

Expired Date : 15 April 2024

Cylinder Conc. : 4,570 PPM

CALIBRATING CONDITION

Pressure 1011 mmbar

Temp. 24.5 °C

% RH 49

CALIBRATION SETTING

Span Set Point	Initial Reading (Before Adj.),PPM			Final Reading (After Adj.),PPM
	Expected Concentration	Analyzer Response	%Dif	Analyzer Response
Zero	0	0.11	-	0
CO Span	40.00	40.10	0.250	40.00

API Model 300E CO Analyzer Check list

Parameter	Observed Value	Units	Nominal Range
RANGE	50	PPM	0-1000 ppm
STABILITY	0.10	PPM	< 1 ppm with zero air
CO MEASURE	4014.1	mV	2500-4800 mV
CO REFERENCE	3948.9	mV	2500-4800 mV
MEASURE/REFERENCE RATIO	1.179	-	1.1-1.3 w/zero air
SAMPLE PRESSURE	28.6	In-Hg-A	~2" < ambient absolute pressure
SAMPLE FLOW	805	cc/min	800 ± 10%
SAMPLE TEMPERATURE	48.4	°C	48 ± 4
BENCH TEMPERATURE	48.1	°C	48 ± 2
WHEEL TEMPERATURE	68.3	°C	68 ± 2
BOX TEMPERATURE	30.7	°C	Ambient temp + 7 ± 10
PHOTO-DRIVE	3023.9	mV	250 mV to 4750 mV
SLOPE	1.017	-	1.0 ± 0.3
OFFSET	0.2	-	0 ± 0.3

Calibrated by :

(Mr.Adul Dangklom)

Approved by :

(Mr.Peera Detudom)

**QUALITY CALIBRATION CO.,LTD.**

235 Petchkasem 63/2 Road, Laksong, Bangkae, Bangkok 10160

Tel (662) 421-5402, (662) 444-0152-3, Fax (662) 809-4584

www.qcalibration.com

CERTIFICATE No : 22M2567

REFERENCE No : 64386-1

PAGE : 1 OF 2

Certificate of Calibration

EQUIPMENT : DIGITAL BALANCE

MANUFACTURER : METTLER TOLEDO

MODEL : XS 105DU

SERIAL No : 1126422905


ID No : BA 05/50

CONDITION AS RECEIVED : USED ITEM

SUBMITTED BY : S.P.S. CONSULTING SERVICE CO., LTD.
7 SOI PHAHOLYOTHIN 24, PHAHOLYOTHIN RD.,
JOMPOL, CHATUCHAK, BANGKOK 10900

CALIBRATED BY : TETNITHI W.

CALIBRATION DATE : 11-Mar-22

APPROVED BY : 
PONGSAK J.

ISSUED DATE : 17-Mar-22

RECEIVED DATE : 11-Mar-22

THIS CERTIFICATE MAY NOT BE REPRODUCED OTHER THAN IN FULL EXCEPT WITH THE PRIOR WRITTEN APPROVAL OF
QUALITY CALIBRATION CO., LTD.



CERTIFICATE No : 22M2567

PAGE : 2 OF 2

Calibration Report

EQUIPMENT	:	DIGITAL BALANCE	MODEL	:	XS 105DU
MANUFACTURER	:	METTLER TOLEDO	S/N	:	1126422905
ID No	:	BA 05/50	RECEIVED DATE	:	11-Mar-22
AIR PRESSURE	:	1008mbar \pm 1mbar	CALIBRATION DATE	:	11-Mar-22
AMBIENT TEMPERATURE	:	22° C \pm 1° C	RELATIVE HUMIDITY	:	49 %RH \pm 10 % RH

CONDITION OF THIS RESULTS OF CALIBRATION

1. THIS INSTRUMENT WAS CALIBRATED BY ACCORDING TO UKAS LAB 14 EDITION 6:2019 BY USING KNOWN WEIGHT STANDARD WEIGHT. THE BALANCE WAS NOT ADJUSTED BEFORE CALIBRATION. THE BALANCE HAS NO ZERO TRACKING FUNCTION. REPEATABILITY WAS MEASURED BY USING 10 REPEATED MEASUREMENTS. LINEARITY WAS MEASURED COVERING 10 POINTS, EVENLY SPREAD OVER THE RANGE. THE INSTRUMENT WAS SET ZERO BEFORE PERFORMING THE LINEARITY TEST. OFF-CENTER LOADING WAS MEASURED BY USING STANDARD WEIGHTS PLACED ON THE PAN AND MOVED TO VARIOUS POSITIONS ON THE PAN.

2. REFERENCE STANDARD INSTRUMENTS :-

INSTRUMENT	MODEL	SERIAL No	CERTIFICATE No	DUE DATE
1) STANDARD WEIGHT SET	E2	QK-I-151	C02210415	09-Feb-23

3. THIS RESULT WAS FOUND ACCURATE AS SHOWN ON DATE AND PLACE OF CALIBRATION ONLY.

4. THIS RESULT EXCLUDE LONG TERM STABILITY OF THE UNIT UNDER CALIBRATION.

5. THIS CERTIFICATE IS TRACEABLE TO THE INTERNATIONAL SYSTEM OF UNIT MAINTAINED AT:-

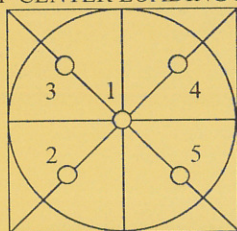
- NATIONAL INSTITUTE OF METROLOGY (THAILAND) THROUGH CENTRAL BUREAU OF WEIGHTS&MEASURES

RESULT OF CALIBRATION :- WITHOUT ADJUSTMENT

1. ZERO SETTING FUNCTION : NORMAL
2. TARE FUNCTION : NORMAL
3. REPEATABILITY OF READING AT 20 g WAS 0.000004 g
4. REPEATABILITY OF READING AT 100 g WAS 0.000048 g
5. DEPARTURE FROM NOMINAL VALUE/ LINEARITY

NOMINAL VALUE (g)	BALANCE READING (g)	CORRECTION (g)	UNCERTAINTY (\pm g)
0.00	0.00000	0.00000	0.000058
0.02	0.01999	0.00001	0.000058
0.10	0.09999	0.00001	0.000059
0.20	0.19999	0.00001	0.000059
0.50	0.50001	-0.00001	0.000058
1.00	1.00001	-0.00001	0.000059
2.00	2.00000	0.00000	0.000059
5.00	5.00001	-0.00001	0.000061
10.00	10.00005	-0.00005	0.000063
20.00	20.00006	-0.00006	0.000069
50.00	50.00000	0.00000	0.00011
100.00	100.00001	-0.00001	0.00019
120.00	120.00001	-0.00001	0.00022

6. OFF CENTER LOADING ERROR



POINT	READING (g)	
1	10.00001	50.0000
2	10.00002	50.0000
3	10.00001	50.0000
4	10.00001	50.0000
5	10.00002	50.0000
OFF-CENTER LOADING	0.00001	0.0001

NOTE: THIS CALIBRATION WAS CARRIED OUT AT THE CUSTOMER'S PLACE AT PRODUCTION AREA
THE REPORTED UNCERTAINTY OF MEASUREMENT WAS BASED ON A STANDARD UNCERTAINTY MULTIPLIED BY A COVERAGE FACTOR $k=2$, PROVIDING A LEVEL OF CONFIDENCE APPROXIMATELY 95%.

END OF CALIBRATION REPORT

เอกสารที่ 5-2

เอกสารสอบเทียบเครื่องมือการตรวจวัดระดับเสียง

Request No. 21-65/0374

MTC No. EEL. BP. 47/0365

CALIBRATION CERTIFICATE

Submitted by : S.P.S. Consulting Service Co., Ltd.
Address : 7 Soi Phaholyothin 24, Phaholyothin Road, Jompol, Chatuchak, Bangkok 10900.
Calibrated at : Electrical and Electronic Standards Laboratory, Industrial Metrology and Testing Service Centre.
 : Soi 1C, Bangpoo Industrial Estate, Sukhumvit Rd., Muang, Samutprakan 10280.
Instrument Calibrated :
 Description : Sound Calibrator
 Manufacturer : Cirrus
 Model : CR-515
 Serial No. : 92002
Ambient Environment
 Temperature : (23 ± 3) °C
 Relative Humidity : (50 ± 15) %
 Ambient Pressure : (101.325 ± 1.500) kPa

Standards used : 1. Digital Function Synthesizer NF Electronic DF-193A S/N 122037.
 2. Measuring Amplifier Brüel&Kjaer 2636 S/N 1537484.
 3. Programmable Attenuator Tamagawa TPA-303A S/N OF 2214.
 4. Digital Multimeter Agilent 34401A S/N MY44005560.
 5. Pressure Transmitter Vaisala PTB202AD S/N T0650001.
 6. Audio Analyzer Keithley 2015-P S/N 4106495.
 7. Condenser Microphone Brüel&Kjaer 4180 S/N 2889871.

Calibration Procedure: CP-102-04 based on IEC 60942:2003; The sound pressure level generated by sound calibrator under test shall be measured by standard microphone using an insert volume technique.

This instrument has been calibrated against standards maintained at Electrical and Electronic Standards Laboratory (EEL), which are traceable to the International System of Units through the National Institute of Metrology (Thailand).

The information on actual reading is attached herewith and the uncertainty limits quoted refer to the measured values only.

Date of Receipt : 14 Mar. 2022

Date of Calibration : 19 Mar. 2022

1 / 2

The results relate only to the items tested/calibrated or value assigned.
 Advertising the Report/Certificate and publicity of the results except in full are prohibited unless written permission is obtained from the governor of TISTR.

Head Office 35 Mu 3 Tambon Khlong Ha, Amphoe Khlong Luang, Changwat Pathumthani 12120, Thailand
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 Fax. (66) 0 2577 9009
 E-mail : rumpai@tistr.or.th Website: www.tistr.or.th

Office/Laboratory Soi 1C, Bangpoo Industrial Estate, Sukhumvit Road, Amphoe Muang, Changwat Samutprakan 10280, Thailand
 Tel. (66) 0 2323 1672-80 ext. 115, 116
 Fax. (66) 0 2323 9165
 E-mail : mtc@tistr.or.th

FM.BL.MTC.002 Rev.4

Request No. 21-65/0374

MTC No. EEL. BP. 47/0365

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

Nominal Output of Unit Under Test = 94 dB re 20 µPa at 1000 Hz

Acoustic Output in dB re 20 µPa, Corrected to Reference Conditions: 101.325 kPa, 23.0 °C and 50 % RH.

1. Sound Pressure Level

Standard Microphone Type	Measured Sound Pressure Level (dB)	Deviated value (dB)	Uncertainty (dB)	Tolerance limit IEC60942:2003 Class 1
1/2 inch Brüel&Kjaer 4180	93.99	-0.01	± 0.10	± 0.40 dB

2. Frequency

Standard Microphone Type	Measured Frequency (Hz)	Deviated value (Hz)	Uncertainty (Hz)	Tolerance limit IEC60942:2003 Class 1
1/2 inch Brüel&Kjaer 4180	1000.3	0.3	± 1.5	± 1.0%

3. Total Distortion

Standard Microphone Type	Measured Total Distortion (%)	Uncertainty (%)	Tolerance limit IEC60942:2003 Class 1
1/2 inch Brüel&Kjaer 4180	1.00	± 0.50	± 3.0%

Note : 1. No adjustment.

2. The calibrator pressure correction was not included.

3. The microphone volume correction was not included.

Calibrated by :

(Mr. Weerachai Deechaiyae)

Approved by :

(Mr. Prawate Khuyapn) Director

Electrical and Electronic Standards Laboratory

Industrial Metrology and Testing Service Centre

Date of Calibration : 19 Mar. 2022

Date of Issue : 22 Mar. 2022

Ref : 2011265031401103001

End of Certificate

2 / 2

The results relate only to the items tested/calibrated or value assigned.
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Office/Laboratory Soi 1C, Bangpoo Industrial Estate, Sukhumvit Road, Amphoe Muang, Changwat Samutprakan 10280, Thailand
 Tel. (66) 0 2323 1672-80 ext. 115, 116
 Fax. (66) 0 2323 9165
 E-mail : mtc@tistr.or.th

FM.BL.MTC.002 Rev.4



THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-65/0455

MTC No. EEL. BP. 41/0465

CALIBRATION CERTIFICATE

Submitted by : S.P.S. Consulting Service Co.,Ltd.

Address : 7 Soi Phaholyothin 24, Phaholyothin Road, Jompol, Chatuchak, Bangkok 10900.

Calibrated at : Electrical and Electronic Standards Laboratory, Industrial Metrology and Testing Service Centre.

: Soi 1C, Bangpoo Industrial Estate, Sukhumvit Rd., Muang, Samutprakan 10280.

Instrument Calibrated :

Description : Sound Calibrator

Manufacturer : ACO

Model : 2127

Serial No. : 130006

Ambient Environment

Temperature : (23 ± 3) °C

Relative Humidity : (50 ± 15) %

Ambient Pressure : (101.325 ± 1.500) kPa

Standards used : 1. Digital Function Synthesizer NF Electronic DF-193A S/N 122037.

2. Measuring Amplifier Brüel&Kjaer 2636 S/N 1537484.

3. Programmable Attenuator Tamagawa TPA-303A S/N OF 2214.

4. Digital Multimeter Agilent 34401A S/N MY4005560.

5. Pressure Transmitter Vaisala PTB202AD S/N T0650001.

6. Audio Analyzer Keithley 2015-P S/N 4106495.

7. Condenser Microphone Brüel&Kjaer 4180 S/N 2889871.

Calibration Procedure: CP-102-04 based on IEC 60942:2003. The sound pressure level of instrument was

measured by standard microphone using an insert voltage technique.

This instrument has been calibrated against standards maintained at Electrical and Electronic Standards Laboratory (EEL), which are traceable to the International System of Units through the National Institute of Metrology (Thailand).

The information on actual reading is attached herewith and the uncertainty limits quoted refer to the measured values only.

Date of Receipt : 22 Apr. 2022

Date of Calibration : 28 Apr. 2022

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

Advertising the Report/Certificate and publicity of the results except in full are prohibited unless written permission is obtained from the governor of TISTR.

Head Office

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Office/Laboratory

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Amphoe Muang, Changwat Samutprakan 10280, Thailand
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FM.BLMTC.002 Rev.4

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THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-65/0455

MTC No. EEL. BP. 41/0465

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

Nominal Output of Unit Under Test = 94 dB re 20μPa at 1000 Hz

Acoustic Output in dB re 20μPa, Corrected to Reference Conditions: 101.325 kPa, 23.0 °C and 50 %RH.

1. Sound Pressure Level

Standard Microphone Type	Measured Sound Pressure Level (dB)	Deviated value (dB)	Uncertainty (dB)	Tolerance limit IEC 60942:2003 Class 1
1/2 inch Brüel&Kjaer 4180	93.93	-0.07	± 0.10	± 0.40 dB

2. Frequency

Standard Microphone Type	Measured Frequency (Hz)	Deviated value (Hz)	Uncertainty (Hz)	Tolerance limit IEC 60942:2003 Class 1
1/2 inch Brüel&Kjaer 4180	999.9	-0.1	± 1.5	± 1.0%

3. Total Distortion

Standard Microphone Type	Measured Total Distortion (%)	Uncertainty (%)	Tolerance limit IEC 60942:2003 Class 1
1/2 inch Brüel&Kjaer 4180	1.44	± 0.50	± 3.0%

Note : 1. No adjustment.

2. The calibrator pressure correction was not included.

3. The microphone volume correction was not included.

Calibrated by :

N. N. P.
(Mr. Nuttapong Nitjruvannit)

Approved by :

Prayut Klayyapa
(Mr. Prayut Klayyapa)
Director

(Mr. Tawikiat Iamsamran)

Date of Calibration : 28 Apr. 2022

Date of Issue : 28 Apr. 2022

End of Certificate

Ref : 2011265042601787001

2 / 2

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

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Head Office

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Fax. (66) 0 2579 8592
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FM.BLMTC.002 Rev.4

THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-64/0776

MTC No. EEL. BP. 44/0864

CALIBRATION CERTIFICATE

Submitted by : S.P.S. Consulting Service Co.,Ltd.

Address : 7 Soi Phaholyothin 24, Phaholyothin Road, Jompol, Chatuchak, Bangkok 10900.

Calibrated at : Electrical and Electronic Standards Laboratory, Industrial Metrology and Testing Service Centre.

: Soi 1C, Bangpoo Industrial Estate, Sukhumvit Rd., Muang, Samutprakan 10280.

Instrument Calibrated :

Description : Sound Calibrator

Manufacturer : Rion

Model : NC-73

Serial No. : 10727909

Ambient Environment

Temperature : (23 ± 3) °C

Relative Humidity : (50 ± 15) %

Ambient Pressure : (101.325 ± 1.500) kPa

Standards used : 1. Digital Function Synthesizer NF Electronic DF-193A S/N 122037.

2. Measuring Amplifier Brüel&Kjaer 2636 S/N 1537484.

3. Programmable Attenuator Tamagawa TPA-303A S/N OF 2214.

4. Digital Multimeter Agilent 34401A S/N MY44005560.

5. Pressure Transmitter Vaisala PTB202AD S/N T0650001.

6. Audio Analyzer Panasonic VP-7722A S/N 041477D122.

7. Condenser Microphone B&K 4180 S/N 2633526.

Calibration Procedure: CP-102-04 based on IEC 60942-2003; The sound pressure level generated by sound

calibrator under test shall be measured by standard microphone using an insert voltage technique.

This instrument has been calibrated against standards maintained at Electrical and Electronic Standards

Laboratory (EEL), which are traceable to the International System of Units through the National Institute of

Metrology (Thailand).

The information on actual reading is attached herewith and the uncertainty limits quoted refer to the measured values only.

Date of Receipt : 16 Aug. 2021

Date of Calibration : 18 Aug. 2021

1/2

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

Advertising the Report/Certificate and publicity of the results except in full are prohibited unless written permission is obtained from the governor of TISTR.

FM.BLMTC.002 Rev.4

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THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-64/0776

MTC No. EEL. BP. 44/0864

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

Nominal Output of Unit Under Test = 94 dB re 20µPa at 1000 Hz

Acoustic Output in dB re 20µPa, Corrected to Reference Conditions: 101.325 kPa, 23.0 °C and 50 %RH.

1. Sound Pressure Level

Standard Microphone Type	Measured Sound Pressure Level (dB)	Deviated value (dB)	Uncertainty (dB)	Tolerance limit
1/2 inch Brüel&Kjaer 4180	93.88	-0.12	± 0.10	±0.40 dB

2. Frequency

Standard Microphone Type	Measured Frequency (Hz)	Deviated value (Hz)	Uncertainty (Hz)	Tolerance limit
1/2 inch Brüel&Kjaer 4180	980.9	-19.1	± 1.5	±1.0%

3. Total Distortion

Standard Microphone Type	Measured Total Distortion (%)	Uncertainty (%)	Tolerance limit
1/2 inch Brüel&Kjaer 4180	1.56	± 0.50	±3.0%

Note : 1. No adjustment.

2. The calibrator pressure correction was not included.

3. The microphone volume correction was not included.

Calibrated by :

(Mr. Weerachai Dechaiyae)

Approved by :

(Mr. Prawate Klauyapa)
Acting Director

Electrical and Electronic Standards Laboratory

Industrial Metrology and Testing Service Centre

Ref : 2011264081603374001

End of Certificate

2 / 2

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

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FM.BLMTC.002 Rev.4

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บริษัท เอส.พี.เอส. คอนซัลติ้ง เซอร์วิส จำกัด
S.P.S. CONSULTING SERVICE CO., LTD.
7 ซอยพหลโยธิน 24 ถนนพหลโยธิน แขวงจอมพล เขตจตุจักร กรุงเทพฯ 10900
7 Soi Phaholyothin 24, Phaholyothin Rd., Jompol, Chatuchak, Bangkok 10900
Tel : (662) 939-4370-72, Fax : (662) 513-4221, E-mail : sale@spscon.com, www.spscon.com

Noise B_410/22

Sound Level Meter Calibration Report

Acoustic Calibrator Data

Brand	ACO	Number	AC 03/56
Model	2127	Serial No.	130006
Calibration Range	94 dB, 1000 Hz	Last Calibration	28 April 2022
		Due Date	28 April 2023

Calibration Data

Sound Level Meter Data				Calibration Data		
SLM No.	Brand	Model	Serial No.	Date	Actual Reading [dB]	
					Before Adjustment	After Adjustment
ACO-B05	ACO	6236	00142002	13 July 2022	93.9	94.0
Acoustic Certified Value : Thailand Institute of Scientific and Technological Research (TISTR)					93.93 ± 0.10 dB	

Calibrated by :

(Mr. Phakhinai Khongkomnerd)

Approved by :

(Mr. Peera Detudom)



บริษัท เอส.พี.เอส. คอนซัลติ้ง เซอร์วิส จำกัด
S.P.S. CONSULTING SERVICE CO., LTD.
7 ซอยพหลโยธิน 24 ถนนพหลโยธิน แขวงจอมพล เขตจตุจักร กรุงเทพฯ 10900
7 Soi Phaholyothin 24, Phaholyothin Rd., Jompol, Chatuchak, Bangkok 10900
Tel : (662) 939-4370-72, Fax : (662) 513-4221, E-mail : sale@spscon.com., www.spscon.com

Noise B_573/22

Sound Level Meter Calibration Report

Acoustic Calibrator Data

Brand	ACO	Number	AC 03/56
Model	2127	Serial No.	130006
Calibration Range	94 dB, 1000 Hz	Last Calibration	28 April 2022
		Due Date	28 April 2023

Calibration Data

Sound Level Meter Data				Calibration Data		
SLM No.	Brand	Model	Serial No.	Date	Actual Reading [dB]	
					Before Adjustment	After Adjustment
ACO-B24	ACO	6236	00182005	18 October 2022	93.9	94.0
Acoustic Certified Value : Thailand Institute of Scientific and Technological Research (TISTR)					93.93 ± 0.10 dB	

Calibrated by :

(Mr. Adul Dangklom)

Approved by :

(Mr. Peera Detudom)



บริษัท เอส.พี.เอส. คอนซัลติ้ง เซอร์วิส จำกัด
S.P.S. CONSULTING SERVICE CO., LTD.
7 ซอยพหลโยธิน 24 ถนนพหลโยธิน แขวงจอมพล เขตจตุจักร กรุงเทพฯ 10900
7 Soi Phaholyothin 24, Phaholyothin Rd., Jompol, Chatuchak, Bangkok 10900
Tel : (662) 939-4370-72, Fax : (662) 513-4221, E-mail : sale@spscon.com., www.spscon.com

Noise B_613/22

Sound Level Meter Calibration Report

Acoustic Calibrator Data

Brand	ACO	Number	AC 03/56
Model	2127	Serial No.	130006
Calibration Range	94 dB, 1000 Hz	Last Calibration	28 April 2022
		Due Date	28 April 2023

Calibration Data

Sound Level Meter Data				Calibration Data		
SLM No.	Brand	Model	Serial No.	Date	Actual Reading [dB]	
					Before Adjustment	After Adjustment
ACO-B14	ACO	6236	00172034	14 November 2022	93.9	94.0
Acoustic Certified Value : Thailand Institute of Scientific and Technological Research (TISTR)					93.93 ± 0.10 dB	

Calibrated by :

(Mr. Adul Dangklom)

Approved by :

(Mr. Peera Detudom)



บริษัท เอส.พี.เอส. คอนซัลติ้ง เซอร์วิส จำกัด

S.P.S. CONSULTING SERVICE CO., LTD.

7 ซอยพหลโยธิน 24 ถนนพหลโยธิน แขวงจอมพล เขตจตุจักร กรุงเทพฯ 10900

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Noise B_674/22

Sound Level Meter Calibration Report

Acoustic Calibrator Data

Brand	ACO	Number	AC 03/56
Model	2127	Serial No.	130006
Calibration Range	94 dB, 1000 Hz	Last Calibration	28 April 2022
		Due Date	28 April 2023

Calibration Data

Sound Level Meter Data				Calibration Data		
SLM No.	Brand	Model	Serial No.	Date	Actual Reading [dB]	
					Before Adjustment	After Adjustment
ACO-B31	ACO	6236	00182013	20 December 2022	93.9	94.0
Acoustic Certified Value : Thailand Institute of Scientific and Technological Research (TISTR)					93.93 ± 0.10 dB	

Calibrated by :

(Mr. Adul Dangklom)

Approved by :

(Mr. Peera Detudom)