

## ภาคผนวกที่ 4

เอกสารการสอบเทียบความถูกต้องของเครื่องมือ



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@spscs.com www.spscs.com

## 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 <sup>3</sup> /min)	R <sup>2</sup>
B01	B01	01/08/2023	y = 1.289x-5.689	0.999
B02	B02	02/08/2023	y = 1.106x+2.666	0.999
B03	B03	01/08/2023	y = 1.126x-0.852	0.997
B04	B04	01/08/2023	y = 1.294x-8.235	0.998
B05	B05	04/08/2023	y = 1.279x-7.416	0.996
B06	B06	01/08/2023	y = 1.280x-7.015	0.999
B07	B07	01/08/2023	y = 1.220x-6.249	0.998
B08	B08	01/08/2023	y = 1.268x-7.621	0.999
B09	B09	01/08/2023	y = 1.258x-5.982	1.000
B10	B10	04/08/2023	y = 1.142x+0.294	0.999
B11	B11	04/08/2023	y = 1.165x-3.050	0.998
B12	B12	04/08/2023	y = 1.227x-5.594	0.999
B13	B13	04/08/2023	y = 1.282x-7.522	0.998
B14	B14	04/08/2023	y = 1.298x-7.713	0.999
B15	B15	02/08/2023	y = 1.176x-3.322	0.997
B16	B16	02/08/2023	y = 1.316x-9.126	0.997
B17	B17	02/08/2023	y = 1.235x-5.694	1.000
B18	B18	02/08/2023	y = 1.323x-10.629	0.998
B19	B19	02/08/2023	y = 1.277x-8.109	0.997
B20	B20	02/08/2023	y = 1.297x-8.466	0.998
B21	B21	03/08/2023	y = 1.186x-3.582	1.000
B22	B22	03/08/2023	y = 1.274x-8.729	0.998
B23	B23	03/08/2023	y = 1.224x-5.880	0.995
B24	B24	03/08/2023	y = 1.185x-3.773	0.999
B25	B25	01/08/2023	y = 1.075x+1.295	0.998
B26	B26	01/08/2023	y = 1.282x-7.798	0.997
B27	B27	01/08/2023	y = 1.248x-7.408	0.997
B28	B28	01/08/2023	y = 1.279x-8.370	0.999
B29	B29	04/08/2023	y = 1.292x-7.541	0.999
B30	B30	04/08/2023	y = 1.270x-8.142	0.995
B31	B31	04/08/2023	y = 1.284x-8.212	0.999
B32	B32	04/08/2023	y = 1.294x-6.759	0.999
B33	B33	04/08/2023	y = 1.252x-5.024	0.999
B34	B34	04/08/2023	y = 1.262x-7.362	0.998

Calibrated by :



(Mr. Adul Dangklom)

Approved by :



(Mr. Peera Detudom)



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Model : TE 5025A

S/N : 3611

### Calibration Data

High Volume Air Sampler Data		Calibration Data		
Recorder No.	Blower No.	Date	Actual Flowrate (ft <sup>3</sup> /min)	R <sup>2</sup>
B35	B35	03/08/2023	y = 1.221x-4.116	0.995
B36	B36	03/08/2023	y = 1.247x-6.537	0.999
B37	B37	03/08/2023	y = 1.313x-8.352	0.997
B38	B38	03/08/2023	y = 1.279x-8.340	0.998
B39	B39	03/08/2023	y = 1.286x-6.520	0.999
B40	B40	03/08/2023	y = 1.241x-6.104	1.000
B41	B41	03/08/2023	y = 1.203x-4.249	0.999
B42	B42	03/08/2023	y = 1.296x-8.828	0.999
B43	B43	04/08/2023	y = 1.245x-5.710	0.997
B44	B44	04/08/2023	y = 1.262x-5.417	0.999
R01	R01	04/08/2023	y = 1.285x-8.953	0.999
R02	R02	04/08/2023	y = 1.268x-8.283	0.998
R03	R03	04/08/2023	y = 1.283x-9.563	0.999
R04	R04	04/08/2023	y = 1.234x-5.231	0.999
R05	R05	04/08/2023	y = 1.303x-10.505	0.999
R06	R06	04/08/2023	y = 1.287x-7.927	0.997
R07	R07	04/08/2023	y = 1.084x+0.577	0.999
R08	R08	04/08/2023	y = 1.304x-9.687	0.998
R09	R09	04/08/2023	y = 1.286x-8.387	0.998
R10	R10	03/08/2023	y = 1.241x-6.099	0.996
R11	R11	03/08/2023	y = 1.112x-1.473	0.998
R12	R12	03/08/2023	y = 1.250x-6.933	0.997
R13	R13	02/08/2023	y = 1.142x-2.480	0.998
R14	R14	02/08/2023	y = 1.205x-3.813	0.998
R15	R15	01/08/2023	y = 1.160x-3.518	0.999
R16	R16	01/08/2023	y = 1.229x-7.416	0.998
R17	R17	01/08/2023	y = 1.209x-4.808	0.998
R18	R18	01/08/2023	y = 1.257x-6.979	0.999
R19	R19	01/08/2023	y = 1.256x-7.676	0.998
R20	R20	01/08/2023	y = 1.279x-8.603	0.998

Calibrated by :

(Mr. Adul Dangklom)

Approved by :

(Mr. Peera Detudom)





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Calibration Method : Multipoint Orifice Flow Transfer Standard

Model : TE 5025A

S/N : 3611

#### Calibration Data

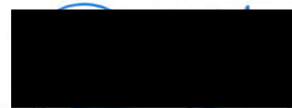
High Volume Air Sampler Data		Calibration Data		
Recorder No.	Blower No.	Date	Actual Flowrate (ft <sup>3</sup> /min)	R <sup>2</sup>
B35	B35	01/11/2023	y = 1.247x-5.373	0.999
B36	B36	02/11/2023	y = 1.190x-2.630	0.995
B37	B37	01/11/2023	y = 1.188x-2.249	0.999
B38	B38	01/11/2023	y = 1.191x-5.051	0.995
B39	B39	01/11/2023	y = 1.230x-3.335	0.995
B40	B40	02/11/2023	y = 1.172x-2.695	0.998
B41	B41	02/11/2023	y = 1.169x-2.206	0.998
B42	B42	02/11/2023	y = 1.212x-5.591	0.998
B43	B43	03/11/2023	y = 1.223x-3.058	0.997
B44	B44	01/11/2023	y = 1.194x-2.207	0.996
R01	R01	08/11/2023	y = 1.199x-4.374	0.998
R02	R02	06/11/2023	y = 1.229x-6.243	0.999
R03	R03	08/11/2023	y = 1.239x-7.264	0.998
R04	R04	09/11/2023	y = 1.182x-3.161	0.998
R05	R05	09/11/2023	y = 1.141x-2.095	0.997
R06	R06	03/11/2023	y = 1.155x-2.543	0.997
R07	R07	09/11/2023	y = 1.057x+1.380	0.999
R08	R08	02/11/2023	y = 1.230x-6.615	0.997
R09	R09	04/11/2023	y = 1.188x-1.331	0.997
R10	R10	04/11/2023	y = 1.213x-3.571	0.998
R11	R11	01/11/2023	y = 1.136x-2.259	0.999
R12	R12	01/11/2023	y = 1.145x-3.404	0.998
R13	R13	02/11/2023	y = 1.076x-0.153	0.999
R14	R14	02/11/2023	y = 1.166x+1.197	0.996
R15	R15	09/11/2023	y = 1.171x-4.139	0.997
R16	R16	09/11/2023	y = 1.142x-3.462	0.999
R17	R17	01/11/2023	y = 1.169x-3.932	0.998
R18	R18	01/11/2023	y = 1.192x-4.280	0.998
R19	R19	01/11/2023	y = 1.158x-4.004	0.996
R20	R20	02/11/2023	y = 1.191x-4.426	0.997

Calibrated by :



(Mr. Adul Dangklom)

Approved by :



(Mr. Peera Detudom)





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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 <sup>3</sup> /min)	R <sup>2</sup>
R01	R01	01/11/2023	y = 1.166x-2.827	0.999
R02	R02	01/11/2023	y = 1.140x+0.079	0.998
R03	R03	02/11/2023	y = 1.176x-2.983	0.999
R04	R04	01/11/2023	y = 1.155x-3.417	0.996
R05	R05	01/11/2023	y = 1.193x-5.553	0.998
R06	R06	08/11/2023	y = 1.173x-2.245	0.998
R07	R07	08/11/2023	y = 1.183x-3.521	0.999
R08	R08	06/11/2023	y = 1.195x-5.732	0.997
R09	R09	01/11/2023	y = 1.161x-3.857	0.995
R10	R10	09/11/2023	y = 1.181x-4.105	0.998
R11	R11	09/11/2023	y = 1.155x-0.430	0.996
R12	R12	09/11/2023	y = 1.196x-4.411	0.999
R13	R13	09/11/2023	y = 1.188x-3.031	0.996
R14	R14	01/11/2023	y = 1.167x-2.357	0.998
R15	R15	02/11/2023	y = 1.186x-3.860	0.998
R16	R16	02/11/2023	y = 1.187x-2.636	0.999
R17	R17	02/11/2023	y = 1.169x-3.318	0.996
R18	R18	03/11/2023	y = 1.190x-4.826	0.997
R19	R19	01/11/2023	y = 1.152x-2.131	0.996
R20	R20	01/11/2023	y = 1.183x-4.568	0.997

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](http://www.qcalibration.com)

CERTIFICATE No : 23M2441

REFERENCE No : 68471-1

PAGE : 1 OF 2

**Certificate of Calibration**

**EQUIPMENT** : DIGITAL BALANCE

**MANUFACTURER** : METTLER TOLEDO

**MODEL** : XS105DU

**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** : ATSAWIN Y.

**CALIBRATION DATE** : 10-Mar-23

**APPROVED BY** : [REDACTED]  
PONGSAK J.

**ISSUED DATE** : 16-Mar-23

**RECEIVED DATE** : 10-Mar-23

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





CERTIFICATE No : 23M2441

PAGE : 2 OF 2

## Calibration Report

EQUIPMENT : DIGITAL BALANCE MODEL : XS105DU  
MANUFACTURER : METTLER TOLEDO S/N : 1126422905  
ID No : BA 05/50 RECEIVED DATE : 10-Mar-23  
AIR PRESSURE : 1010mbar  $\pm$  1mbar CALIBRATION DATE : 10-Mar-23  
AMBIENT TEMPERATURE : 23°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	M2302013S	02-Feb-25
2) STANDARD WEIGHT	E2	15843	M2302014S	02-Feb-25

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 200 g WAS 0 g

4. DEPARTURE FROM NOMINAL VALUE/ LINEARITY

NOMINAL VALUE (g)	BALANCE READING (g)	CORRECTION (g)	UNCERTAINTY ( $\pm$ g)
0.00	0.00000	0.00000	0.000039
0.02	0.02000	0.00000	0.000039
0.10	0.10000	0.00000	0.000039
0.20	0.20001	-0.00001	0.000040
0.50	0.50001	-0.00001	0.000040
1.00	1.00000	0.00000	0.000041
2.00	2.00003	-0.00003	0.000042
5.00	5.00001	-0.00001	0.000046
10.00	10.00003	-0.00003	0.000053
20.00	20.00005	-0.00005	0.000067
50.00	50.00001	-0.00001	0.00011
100.00	100.00001	-0.00001	0.00019
200.00	200.00001	-0.00001	0.00032

5. OFF CENTER LOADING ERROR



POINT	READING (g)
1	50.0000
2	50.0001
3	50.0000
4	50.0000
5	49.9999
OFF-CENTER LOADING	0.0001

NOTE: THIS CALIBRATION WAS CARRIED OUT AT THE CUSTOMER'S PLACE AT LABORATORY 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





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## CALIBRATION REPORT

### SO<sub>2</sub> FLUORESCENT ANALYZER

DATE : 13 November 2023

BRAND : API

MODEL : 100E

NO. SO<sub>2</sub>-B06

SERIAL NO. 3430

#### Calibrator (Dilution System)

Brand : API

Model : 700

Last Cal. Date : 08 August 2023

Serial No. : 911

#### Reference Standard Gas

Standard Gas : Sulphur Dioxide (SO<sub>2</sub>)

Cylinder No. : A00814SK

Certified Date : 21 June 2021

Expired Date : 21 June 2029

Cylinder Conc. : 49.8 ppm

#### CALIBRATING CONDITION

Pressure 1011 mmbar

Temp. 24.5 °C

% RH 49

#### CALIBRATION SETTING

Span	Initial Reading (Before Adj.),PPB			Final Reading (After Adj.),PPB	
	Expected Concentration	Analyzer Response	%Dif	Analyzer Response	Slope
Zero	0	0.10	-	0	-
SO <sub>2</sub> Span	400.0	399.8	-0.050	400.0	1.007

#### API Model 100E SO<sub>2</sub> Analyzer Check list

Test Values	Observed Value	Units	Nominal Range
RANGE	500	PPB	0-500
SAMPLE PRESS	28.4	in-Hg	25-35
SAMPLE FLOW	659	cc/min	650 ± 10%
PMT	103.2	mV	-20-150 with Zero Air
UV LAMP	3027.1	mV	1000-4900
STR. LGT	61.5	PPB	<100
DRK PMT	63.0	mV	-50 - 200
DRK LMP	57.8	mV	-50 - 200
HVPS	674	V	550-900 constant
DCPS	2517	mV	2500 ± 200
RCELL TEMP	50.1	°C	50 ± 1
BOX TEMP	29.3	°C	5-40
PMT TEMP	7.4	°C	7 ± 2.0
SO <sub>2</sub> Span Conc	400	PPB	20-20,000
SO <sub>2</sub> Slope	1.007	-	1.0 ± 0.3
SO <sub>2</sub> Offset	22.2	mV	<250
Stability at Zero	0.1	PPB	<0.2
Stability at Span	0.2	PPB	0.5% of reading (above 50 ppb)

Calibrated by :

(Mr.Adul Dangklom)

Approved by :

(Mr.Peera Detudom)



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## CALIBRATION REPORT

### SO<sub>2</sub> FLUORESCENT ANALYZER

DATE : 13 November 2023

BRAND : Thermo

MODEL : 43C

NO. SO2-B09

SERIAL NO. 43C-59325-322

#### Calibrator (Dilution System)

Brand : API

Model : 700

Last Cal. Date : 08 August 2023

Serial No. : 911

#### Reference Standard Gas

Standard Gas : Sulphur Dioxide (SO<sub>2</sub>)

Cylinder No. : A00814SK

Certified Date : 21 June 2021

Expired Date : 21 June 2029

Cylinder Conc. : 49.8 ppm

#### CALIBRATING CONDITION

Pressure 1011 mmbar

Temp. 24.5 °C

% RH 49

#### CALIBRATION SETTING

Span	Initial Reading (Before Adj.),PPB			Final Reading (After Adj.),PPB
Set Point	Expected Concentration	Analyzer Response	%Dif	Analyzer Response
Zero	0	-0.10	-	0
SO <sub>2</sub> Span	400.0	399.7	-0.075	400.0

#### INSTRUMENT STATUS

CHAMBER TEMP

44.5 °C

FLOW

1.0 LPM

PRESSURE

728.6 mm Hg

Calibrated by :

(Mr.Adul Dangklom)

Approved by :

(Mr.Peera Detudom)



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## CALIBRATION REPORT

### SO<sub>2</sub> FLUORESCENT ANALYZER

DATE : 13 November 2023

BRAND : TELEDYNE

MODEL : 100E

NO. SO<sub>2</sub>-R10

SERIAL NO. TRS1065

#### Calibrator (Dilution System)

Brand : API Model : 700  
Last Cal. Date : 08 August 2023 Serial No. : 911

#### Reference Standard Gas

Standard Gas : Sulphur Dioxide (SO<sub>2</sub>) Cylinder No. : A00814SK  
Certified Date : 21 June 2021 Expired Date : 21 June 2029 Cylinder Conc. : 49.8 ppm

#### CALIBRATING CONDITION

Pressure 1011 mmbar Temp. 24.5 °C % RH 49

#### CALIBRATION SETTING

Span	Initial Reading (Before Adj.),PPB			Final Reading (After Adj.),PPB	
Set Point	Expected Concentration	Analyzer Response	%Dif	Analyzer Response	Slope
Zero	0	0.11	-	0	-
SO <sub>2</sub> Span	400.0	400.1	0.025	400.0	1.012

#### API Model 100E SO<sub>2</sub> Analyzer Check list

Test Values	Observed Value	Units	Nominal Range
RANGE	500	PPB	0-500
SAMPLE PRESS	28.7	in-Hg	25-35
SAMPLE FLOW	657	cc/min	650 ± 10%
PMT	103.0	mV	-20-150 with Zero Air
UV LAMP	3018.8	mV	1000-4900
STR. LGT	61.7	PPB	<100
DRK PMT	63.2	mV	-50 - 200
DRK LMP	58.1	mV	-50 - 200
HVPS	675	V	550-900 constant
DCPS	2521	mV	2500 ± 200
RCELL TEMP	50.2	°C	50 ± 1
BOX TEMP	29.1	°C	5-40
PMT TEMP	7.3	°C	7 ± 2.0
SO <sub>2</sub> Span Conc	400	PPB	20-20,000
SO <sub>2</sub> Slope	1.012	-	1.0 ± 0.3
SO <sub>2</sub> Offset	21.9	mV	<250
Stability at Zero	0.1	PPB	<0.2
Stability at Span	0.2	PPB	0.5% of reading (above 50 ppb)

Calibrated by :

(Mr.Adul Dangklom)

Approved by :

(Mr.Peera Detudom)





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## CALIBRATION REPORT

### CHEMILUMINESCENT NO / NO<sub>2</sub> / NO<sub>x</sub> ANALYZER

DATE : 13 November 2023

BRAND : API

MODEL : 200E

NO. NOX-B09

SERIAL NO. 4412

#### Calibrator (Dilution System)

Brand : API Model : 700  
Last Cal. Date : 08 August 2023 Serial No. : 911

#### Reference Standard Gas

Standard Gas : Nitric Oxide (NO) Cylinder No. : D636192  
Certified Date : 20 April 2022 Expired Date : 20 April 2024 Cylinder Conc. : 49.1 ppm

#### CALIBRATING CONDITION

Pressure 1011 mmbar Temp. 24.5 °C % RH 49

#### CALIBRATION SETTING

Span Set Point	Initial Reading (Before Adj.),PPB			Final Reading (After Adj.),PPB	
	Expected Concentration	Analyzer Response	%Dif	Analyzer Response	Slope
Zero	0	-0.10	-	0	-
NO Span	400	400.1	0.025	400.0	1.007
NO <sub>x</sub> Span	400	400.2	0.050	400.0	1.010

#### API Model 200E NO<sub>x</sub> Analyzer Check List

Test Values	Observed Value	Units	Nominal Range
RANGE	500	PPB	500 standard
STABILITY (Zero Gas)	0.1	PPB	< 2 with zero air
SAMPLE FLOW	505	cc/min	500 ± 50
OZONE FLOW	78	cc/min	80 ± 15
PMT	103.2	mV	-20 - 150
AZERO	93.9	mV	-20 - 150
HVPS	673	V	420 - 900 constant
RCELL TEMP	50.2	°C	50 ± 1
BOX TEMP	29.5	°C	8 - 48
PMT TEMP	7.1	°C	7 ± 2
MOLY TEMP	315.2	°C	315 ± 5
RCELL PRESS	8.4	IN-Hg-A	2 - 10 constant
SAMPLE PRESS	28.6	IN-Hg-A	25 - 30 constant
NO Span Conc	400	PPB	20 - 20,000
NO <sub>x</sub> Span Conc	400	PPB	20 - 20,000
NO Slope	1.007	-	1.0 ± 0.3
NO <sub>x</sub> Slope	1.010	-	1.0 ± 0.3
NO Offset	1.6	mV	-20 to +150
NO <sub>x</sub> Offset	1.0	mV	-20 to 150
Stability at Zero	0.1	PPB	< 0.2
Stability at Span	0.2	PPB	< 2 ppb @ 400 ppb span gas

Calibrated by :

(Mr.Adul Dangklom)

Approved by :

(Mr.Peera Detudom)



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## CALIBRATION REPORT

### CHEMILUMINESCENT NO / NO<sub>2</sub> / NO<sub>x</sub> ANALYZER

DATE : 13 November 2023

BRAND : API

MODEL : 200A

NO. NOX-B13

SERIAL NO. 1983

#### Calibrator (Dilution System)

Brand : API Model : 700

Last Cal. Date : 08 August 2023 Serial No. : 911

#### Reference Standard Gas

Standard Gas : Nitric Oxide (NO) Cylinder No. : D636192

Certified Date : 20 April 2022 Expired Date : 20 April 2024 Cylinder Conc. : 49.1 ppm

#### CALIBRATING CONDITION

Pressure 1011 mmbar Temp. 24.5 °C % RH 49

#### CALIBRATION SETTING

Span Set Point	Initial Reading (Before Adj.),PPB			Final Reading (After Adj.),PPB	
	Expected Concentration	Analyzer Response	%Dif	Analyzer Response	Slope
Zero	0	0.11	-	0	-
NO Span	400	399.8	-0.050	400.0	1.006
NO <sub>x</sub> Span	400	400.1	0.025	400.0	1.009

#### API Model 200E NO<sub>x</sub> Analyzer Check List

Test Values	Observed Value	Units	Nominal Range
RANGE	500	PPB	500 standard
STABILITY (Zero Gas)	0.1	PPB	< 2 with zero air
SAMPLE FLOW	511	cc/min	500 ± 50
OZONE FLOW	79	cc/min	80 ± 15
PMT	103.3	mV	-20 - 150
AZERO	94.1	mV	-20 - 150
HVPS	674	V	420 - 900 constant
RCELL TEMP	50.1	°C	50 ± 1
BOX TEMP	29.3	°C	8 - 48
PMT TEMP	7.0	°C	7 ± 2
MOLY TEMP	314.7	°C	315 ± 5
RCELL PRESS	8.3	IN-Hg-A	2 - 10 constant
SAMPLE PRESS	28.5	IN-Hg-A	25 - 30 constant
NO Span Conc	400	PPB	20 - 20,000
NO <sub>x</sub> Span Conc	400	PPB	20 - 20,000
NO Slope	1.006	-	1.0 ± 0.3
NO <sub>x</sub> Slope	1.009	-	1.0 ± 0.3
NO Offset	1.3	mV	-20 to +150
NO <sub>x</sub> Offset	0.9	mV	-20 to 150
Stability at Zero	0.1	PPB	< 0.2
Stability at Span	0.2	PPB	< 2 ppb @ 400 ppb span gas

Calibrated by :

(Mr.Adul Dangklom)

Approved by :

(Mr.Peera Detudom)





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

## CALIBRATION REPORT

### CHEMILUMINESCENT NO / NO<sub>2</sub> / NO<sub>x</sub> ANALYZER

DATE : 13 November 2023

BRAND : API

MODEL : 200E

NO. NOX-R08

SERIAL NO. 243

#### Calibrator (Dilution System)

Brand : API Model : 700

Last Cal. Date : 08 August 2023 Serial No. : 911

#### Reference Standard Gas

Standard Gas : Nitric Oxide (NO) Cylinder No. : D636192

Certified Date : 20 April 2022 Expired Date : 20 April 2024 Cylinder Conc. : 49.1 ppm

#### CALIBRATING CONDITION

Pressure 1011 mmbar Temp. 24.5 °C % RH 49

#### CALIBRATION SETTING

Span Set Point	Initial Reading (Before Adj.),PPB			Final Reading (After Adj.),PPB	
	Expected Concentration	Analyzer Response	%Dif	Analyzer Response	Slope
Zero	0	0.10	-	0	-
NO Span	400	399.7	-0.075	400.0	1.004
NO <sub>x</sub> Span	400	399.9	-0.025	400.0	1.008

#### API Model 200E NO<sub>x</sub> Analyzer Check List

Test Values	Observed Value	Units	Nominal Range
RANGE	500	PPB	500 standard
STABILITY (Zero Gas)	0.1	PPB	< 2 with zero air
SAMPLE FLOW	509	cc/min	500 ± 50
OZONE FLOW	78	cc/min	80 ± 15
PMT	103.0	mV	-20 - 150
AZERO	93.7	mV	-20 - 150
HVPS	669	V	420 - 900 constant
RCELL TEMP	50.3	°C	50 ± 1
BOX TEMP	29.1	°C	8 - 48
PMT TEMP	7.2	°C	7 ± 2
MOLY TEMP	315.3	°C	315 ± 5
RCELL PRESS	8.2	IN-Hg-A	2 - 10 constant
SAMPLE PRESS	28.4	IN-Hg-A	25 - 30 constant
NO Span Conc	400	PPB	20 - 20,000
NO <sub>x</sub> Span Conc	400	PPB	20 - 20,000
NO Slope	1.004	-	1.0 ± 0.3
NO <sub>x</sub> Slope	1.008	-	1.0 ± 0.3
NO Offset	1.2	mV	-20 to +150
NO <sub>x</sub> Offset	0.8	mV	-20 to 150
Stability at Zero	0.1	PPB	< 0.2
Stability at Span	0.2	PPB	< 2 ppb @ 400 ppb span gas

Calibrated by :

(Mr.Adul Dangklom)

Approved by :

(Mr.Peera Detudom)



THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-66/0413

MTC No. EEL. BP. 109/0366

## 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 :  $(23 \pm 3) ^\circ\text{C}$

Relative Humidity :  $(50 \pm 15) \%$

Ambient Pressure :  $(101.325 \pm 1.500) \text{ kPa}$

Standards used : 1. Digital Function Synthesizer NF Electronic DF-193A S/N 122037.  
2. Measuring Amplifier Bruel&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 Bruel&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 : 27 Mar. 2023

Date of Calibration : 29 Mar. 2023

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.BL.MTC.002 Rev.4

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THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-66/0413

MTC No. EEL. BP. 109/0366

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 $\mu$ Pa at 1000 Hz

Acoustic Output in dB re 20 $\mu$ Pa , 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 Bruel&Kjaer 4180	93.94	-0.06	$\pm 0.10$	$\pm 0.40$ dB

2. Frequency

Standard Microphone Type	Measured Frequency (Hz)	Deviated value (Hz)	Uncertainty (Hz)	Tolerance limit IEC60942:2003 Class 1
1/2 inch Bruel&Kjaer 4180	999.9	-0.1	$\pm 1.5$	$\pm 1.0\%$

3. Total distortion

Standard Microphone Type	Measured Total distortion (%)	Uncertainty (%)	Tolerance limit IEC60942:2003 Class 1
1/2 inch Bruel&Kjaer 4180	1.80	$\pm 0.50$	$\pm 3.0\%$

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 Kluaypa)

Director

Electrical and Electronic Standards Laboratory

Industrial Metrology and Testing Service Centre

Date of Calibration : 29 Mar. 2023

Date of Issue : 30 Mar. 2023

Ref : 2011266032701228001

End of Certificate

2 / 2

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

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Noise R\_740/23

## 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	29 March 2023
		Due Date	29 March 2024

### Calibration Data

Sound Level Meter Data				Calibration Data		
SLM No.	Brand	Model	Serial No.	Date	Actual Reading [dB]	
					Before Adjustment	After Adjustment
ACO-R44	ACO	6236	00192056	18 December 2023	94.0	94.0
Acoustic Certified Value : Thailand Institute of Scientific and Technological Research (TISTR)					93.94 ± 0.10 dB	

Calibrated by :

(Mr. Abdul Dangklom)

Approved by :

(Mr. Peera Detudom)





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## Console Calibration Report

Calibration Method

Critical Orifices

### Calibration Data

Console Data		Calibration Data		
No.	Serial No.	Date	y	DH <sub>g</sub> (mmH <sub>2</sub> O)
B01	1563	04/09/2023	0.997	50.11
B02	8002514	06/09/2023	1.002	49.25
B03	1503016	05/09/2023	0.998	50.44
B04	00006659	05/09/2023	1.004	49.37
B05	00007428	05/09/2023	0.996	49.77
R01	1561	06/09/2023	1.004	49.86
R02	8002513	08/09/2023	1.005	50.36
R03	1570	07/09/2023	0.997	49.55
R04	8002519	04/09/2023	1.004	49.69
R05	1503015	07/09/2023	0.999	50.08

Remark : Accept Value of y (test) is  $0.97 < y < 1.03$

Accept Value of DH<sub>g</sub> (test) is  $46.7 \pm 6.4$  (mmH<sub>2</sub>O)

Calibrated by :

(Mr. Adul Dangklom)

Approved by :

(Mr. Peera Detudom)



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

## Pitot Tube Calibration Report

Calibration Method

Standard Pitot Tube

### Calibration Data

Pitot Tube Data			Calibration Data		
No.	Type of Pitot	Coefficient of Standard Pitot	Date	Avg. of Cp (test)	
				Side A	Side B
B36	S	0.99	01/08/2023	0.85	0.84
B37	S	0.99	02/08/2023	0.84	0.84
B38	S	0.99	03/08/2023	0.84	0.83
B39	S	0.99	03/08/2023	0.84	0.84
B40	S	0.99	01/08/2023	0.85	0.84
B41	S	0.99	02/08/2023	0.84	0.85
B44	S	0.99	01/08/2023	0.84	0.84
B45	S	0.99	01/08/2023	0.85	0.84
B46	S	0.99	01/08/2023	0.84	0.85
B47	S	0.99	01/08/2023	0.84	0.84
B48	S	0.99	01/08/2023	0.84	0.85
B49	S	0.99	03/08/2023	0.85	0.84
B54	S	0.99	03/08/2023	0.83	0.84
B56	S	0.99	03/08/2023	0.84	0.85
B57	S	0.99	03/08/2023	0.84	0.83
B58	S	0.99	03/08/2023	0.85	0.84

Remark : Accept value of Cp (test) is  $0.84 \pm 0.01$

Calibrated by :

(Mr. Adul Dangklom)

Approved by :

(Mr. Peera Detudom)



## CERTIFICATE OF CALIBRATION FOR

NOMENCLATURE : VACUUM GAUGE  
MANUFACTURER : HI-LIGHT  
MODEL / TYPE : N/A  
SERIAL NO. : N/A[64-220066-3]  
CLID. NO. : 212201114  
JOB CONTROL NO. : 230725081569

CUSTOMER : S.P.S. CONSULTING SERVICE CO., LTD.  
7 SOI PHAHOLYOTHIN 24 ROAD., JOMPOL,  
CHATUCHAK, BANGKOK 10900

DATE OF RECEIVED : 25 July 2023

DATE OF ISSUED : 31 July 2023

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

Calibrated By : Sittipong Pimdee  
Calibration Engineer



Approved By : Mongkol Yotsoontorn  
Authorized Signatory  
31 July 2023



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

Certificate No. Q23081569

F3-011-04/01-12

page 1 of 3



@clccalibration

## REPORT OF CALIBRATION

### FOR

NOMENCLATURE	:	VACUUM GAUGE
MANUFACTURER	:	HI-LIGHT
MODEL / TYPE	:	N/A
SERIAL NO.	:	N/A[64-220066-3]
DATE OF CALIBRATION	:	26 July 2023
DUE DATE OF CALIBRATION	:	26 July 2024

---

#### ENVIRONMENT CONDITIONS :

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

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

#### PROCEDURE USED :

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

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

#### REFERENCE STANDARD USED :

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

#### TRACEABILITY :

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

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

#### UNCERTAINTY :

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

Certificate No. Q23081569

F3-011-04/01-12

page 2 of 3



@clccalibration





**CLC**  
Accredited  
ISO/IEC 17025

# CALIBRATION LABORATORY Co., LTD.

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



**CONDITION OF CALIBRATION ITEM : GOOD**

**MEASUREMENT RESULTS : ( X ) without adjustment ( ) adjustment**

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

## CALIBRATION DATA

### **CORRECTION OF PRESSURE**

DUC Test point ( inHg )	STD Reading ( kPa )		Conversion to inHg		Correction ( inHg )	
	Up	Down	Up	Down	Up	Down
0	0.00	0.00	0.0	0.0	0.0	0.0
-5	-16.66	-16.69	-4.9	-4.9	+0.1	+0.1
-10	-33.79	-33.79	-10.0	-10.0	0.0	0.0
-15	-50.76	-50.76	-15.0	-15.0	0.0	0.0
-20	-67.79	-67.82	-20.0	-20.0	0.0	0.0
-25	-84.68	-84.72	-25.0	-25.0	0.0	0.0
-30	-101.51	-101.51	-30.0	-30.0	0.0	0.0

Uncertainty of measurement  $\pm 0.2$  inHg

Transmitting fluid : Air.

Technical Note. Conversion factor 1 kPa ; 0.2953003 inHg

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

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

### End of Certificate ###

Certificate No. Q23081569

F3-011-04/01-12

page 3 of 3



@clccalibration



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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

### Personal Pump Calibration Report

Calibration Method : Dry Cal Primary Flowmeter

Model : Defender 510-H

S/N : 136164

#### Environmental Conditions

Temperature : 25  $\pm$  3  $^{\circ}$ C  
Pressure : 1010  $\pm$  15 mmbar

Personal Pump Data				Calibration Data								
No.	Brand	Model	Serial No.	Date	Flow Rate (ml/min)						Value From Calibration Curve	
					Setting			Actual (Q std.)			y	R <sup>2</sup>
					1	2	3	1	2	3		
R01	SKC	224-PCXR4	602467	02/10/2023	1,000	1,500	2,000	1,001	1,499	1,999	1.010x - 22.581	0.999
R02	SKC	224-PCXR4	626450	06/10/2023	1,000	2,000	3,000	996	1,493	1,986	0.992x + 3.742	1.000
R03	SKC	224-PCXR4	691592	06/10/2023	1,000	1,500	2,000	989	1,495	1,994	0.999x - 6.866	1.000
R04	SKC	224-PCXR4	691672	06/10/2023	1,000	1,500	2,000	998	1,491	1,989	0.991x + 5.421	1.000
R05	SKC	224-PCXR4	798470	06/10/2023	1,000	1,500	2,000	999	1,495	1,995	1.005x - 18.995	0.999
R06	SKC	224-PCXR4	798456	02/10/2023	1,000	1,500	2,000	1,000	1,488	1,987	0.986x + 13.398	1.000
R07	SKC	224-PCXR4	798480	02/10/2023	1,000	1,500	2,000	1,000	1,497	1,998	1.009x - 21.689	0.999
R08	SKC	224-PCXR4	883215	05/10/2023	1,000	1,500	2,000	994	1,500	1,990	0.995x + 3.109	1.000
R09	SKC	224-PCXR4	034650	05/10/2023	1,000	1,500	2,000	999	1,497	1,996	1.008x - 21.526	0.999
R10	SKC	224-PCXR4	091765	05/10/2023	1,000	1,500	2,000	996	1,493	1,994	1.000x - 6.596	1.000
R11	SKC	224-PCXR4	091763	04/10/2023	1,000	1,500	2,000	998	1,496	1,983	0.998x - 9.346	0.999
R12	SKC	224-PCXR4	091568	04/10/2023	1,000	1,500	2,000	1,000	1,497	1,999	1.009x - 21.948	0.999
R13	SKC	224-PCXR4	091638	02/10/2023	1,000	1,500	2,000	994	1,495	1,986	0.993x + 2.981	1.000
R14	SKC	224-PCXR4	091764	06/10/2023	1,000	1,500	2,000	998	1,498	2,000	1.012x - 26.788	0.999
R15	SKC	224-PCXR8	529457	06/10/2023	1,000	1,500	2,000	995	1,492	1,987	0.994x + 1.457	1.000
R16	SKC	224-PCXR8	529643	04/10/2023	1,000	1,500	2,000	1,000	1,498	1,997	1.007x - 17.908	0.999
R17	SKC	224-PCXR8	529645	07/10/2023	1,000	1,500	2,000	998	1,496	1,998	1.011x - 25.546	0.999
R18	SKC	224-PCXR8	566756	03/10/2023	1,000	1,500	2,000	994	1,490	1,989	0.995x - 1.759	1.000
R19	SKC	224-PCXR8	566802	02/10/2023	1,000	1,500	2,000	1,000	1,496	1,999	1.010x - 22.864	0.999
R20	SKC	224-PCXR8	529089	06/10/2023	1,000	1,500	2,000	992	1,506	1,996	1.008x - 22.151	0.999
R21	SKC	224-PCXR8	665728	02/10/2023	1,000	1,500	2,000	992	1,486	1,994	1.002x - 11.842	1.000
R22	SKC	224-PCXR8	707444	03/10/2023	1,000	1,500	2,000	1,001	1,500	1,999	1.007x - 18.171	0.999
R23	SKC	224-PCXR8	761067	06/10/2023	1,000	1,500	2,000	1,000	1,488	1,993	0.992x + 5.744	1.000
R24	SKC	224-PCXR8	707893	05/10/2023	1,000	1,500	2,000	994	1,505	1,996	1.005x - 15.010	0.999
R25	SKC	224-PCXR8	761052	06/10/2023	1,000	1,500	2,000	999	1,495	1,989	0.991x + 5.640	1.000
R26	SKC	224-PCXR8	707956	07/10/2023	1,000	1,500	2,000	1,010	1,497	2,002	0.999x - 2.874	0.999
R27	SKC	224-PCXR8	707398	07/10/2023	1,000	1,500	2,000	1,001	1,496	1,997	1.008x - 20.237	0.999
R28	SKC	224-PCXR8	707481	07/10/2023	1,000	1,500	2,000	993	1,506	1,995	1.002x - 10.719	1.000
R29	SKC	224-PCXR8	707402	04/10/2023	1,000	1,500	2,000	995	1,495	1,989	0.995x + 1.091	1.000
R30	SKC	224-PCXR8	093811	04/10/2023	1,000	1,500	2,000	998	1,495	1,992	0.997x - 0.693	1.000
R31	SKC	224-PCXR8	093183	06/10/2023	1,000	1,500	2,000	999	1,502	1,997	0.988x + 9.127	0.999
R32	SKC	224-PCXR8	671950	07/10/2023	1,000	1,500	2,000	998	1,495	1,994	0.998x - 3.451	1.000
R33	SKC	224-PCXR4	626254	07/10/2023	1,000	1,500	2,000	992	1,503	1,995	1.011x - 30.016	0.999
R34	SKC	224-PCXR4	626131	03/10/2023	1,000	1,500	2,000	990	1,499	1,997	1.014x - 32.986	0.999
R35	SKC	224-PCXR8	707460	07/10/2023	1,000	1,500	2,000	990	1,501	1,997	1.005x - 15.898	1.000
R36	SKC	224-PCXR8	707446	05/10/2023	1,000	1,500	2,000	1,000	1,497	1,997	1.002x - 7.547	1.000
R37	SKC	224-PCXR8	707432	02/10/2023	1,000	1,500	2,000	995	1,498	1,995	0.999x - 4.856	1.000
R38	SKC	224-PCXR8	707349	02/10/2023	1,000	1,500	2,000	991	1,496	1,992	1.000x - 7.364	1.000
R39	SKC	224-PCXR8	761095	06/10/2023	1,000	1,500	2,000	995	1,489	1,985	0.990x + 6.253	1.000

Calibrated by :

(Mr. Adul Dangklom)

Approved by :

(Mr. Peera Detudom)





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Rotameter Calibration Report (For Personal Pump Low Flow Adjust)

Calibration Method : Dry Cal Primary Flowmeter

Model : Defender 510-H

S/N : 136164

Calibration Data

Rotameter Data			Calibration Data								
No.	Brand	Model	Date	Flow Rate (mL/min)						Value From Calibration Curve	
				Flow Rate (Reading)			Actual (Q std.)				
				1	2	3	1	2	3	y	R <sup>2</sup>
L-R01	Dwyer	VFA-21	02/10/2023	50	100	200	50.4	98.3	200.4	0.989x + 0.553	1.000
L-R02	Dwyer	VFA-21	06/10/2023	50	100	200	49.3	100.6	199.3	1.002x - 1.123	0.999
L-R03	Dwyer	VFA-21	04/10/2023	50	100	200	50.1	99.3	200.7	1.001x - 0.261	1.000
L-R04	Dwyer	VFA-21	02/10/2023	50	100	200	50.1	100.7	200.6	1.006x - 1.002	0.999
L-R05	Dwyer	VFA-21	03/10/2023	50	100	200	49.8	101.4	200.7	0.995x + 1.282	1.000
L-R06	Dwyer	VFA-21	05/10/2023	50	100	200	50.3	101.1	199.7	1.004x - 0.716	0.999

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](http://www.qcalibration.com)

CERTIFICATE No : 23M2441

REFERENCE No : 68471-1

PAGE : 1 OF 2

**Certificate of Calibration**

**EQUIPMENT** : DIGITAL BALANCE

**MANUFACTURER** : METTLER TOLEDO

**MODEL** : XS105DU

**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** : ATSAWIN Y.

**CALIBRATION DATE** : 10-Mar-23

**APPROVED BY** : [REDACTED]  
PONGSAK J.

**ISSUED DATE** : 16-Mar-23

**RECEIVED DATE** : 10-Mar-23

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





CERTIFICATE No : 23M2441

PAGE : 2 OF 2

## Calibration Report

EQUIPMENT : DIGITAL BALANCE MODEL : XS105DU  
MANUFACTURER : METTLER TOLEDO S/N : 1126422905  
ID No : BA 05/50 RECEIVED DATE : 10-Mar-23  
AIR PRESSURE : 1010mbar  $\pm$  1mbar CALIBRATION DATE : 10-Mar-23  
AMBIENT TEMPERATURE : 23° 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	M2302013S	02-Feb-25
2) STANDARD WEIGHT	E2	15843	M2302014S	02-Feb-25

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 200 g WAS 0 g

4. DEPARTURE FROM NOMINAL VALUE/ LINEARITY

NOMINAL VALUE (g)	BALANCE READING (g)	CORRECTION (g)	UNCERTAINTY ( $\pm$ g)
0.00	0.00000	0.00000	0.000039
0.02	0.02000	0.00000	0.000039
0.10	0.10000	0.00000	0.000039
0.20	0.20001	-0.00001	0.000040
0.50	0.50001	-0.00001	0.000040
1.00	1.00000	0.00000	0.000041
2.00	2.00003	-0.00003	0.000042
5.00	5.00001	-0.00001	0.000046
10.00	10.00003	-0.00003	0.000053
20.00	20.00005	-0.00005	0.000067
50.00	50.00001	-0.00001	0.00011
100.00	100.00001	-0.00001	0.00019
200.00	200.00001	-0.00001	0.00032

5. OFF CENTER LOADING ERROR



POINT	READING (g)
1	50.0000
2	50.0001
3	50.0000
4	50.0000
5	49.9999
OFF-CENTER LOADING	0.0001

NOTE: THIS CALIBRATION WAS CARRIED OUT AT THE CUSTOMER'S PLACE AT LABORATORY 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



# SITHIPHORN ASSOCIATES CO.,LTD. CALIBRATION LABORATORY



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

NSC-TISI-TIS 17025  
CALIBRATION 0394

Cert. No. : SP23016

Pages : 1 of 3

## Calibration Certificate

**Equipment :** UV-VIS SPECTROPHOTOMETER  
**Manufacturer :** PERKINELMER  
**Model :** LAMBDA 25  
**Serial No.:** 501S14123010  
**ID No.:** SP03/58  
**Calibration Mode :** WAVELENGTH ACCURACY  
PHOTOMETRIC ACCURACY  
**Condition As Found :** GOOD  
**Customer :** S.P.S. CONSULTING SERVICE CO., LTD.  
7 SOI PHAHOLYOTHIN 24, PHAHOLYOTHIN ROAD,  
CHOMPHON, CHATUCHAK,  
BANGKOK 10900, THAILAND.  
**Location :** ORGANIC LABORATORY IV  
**Ambient Temperature :** ( 25.0 ± 5 ) °C  
**Relative Humidity :** ( 48.4 ± 25 ) %  
**Received Date :** 30 AUGUST 2023  
**Calibration Date :** 30 AUGUST 2023  
**Date of Issue :** 31 AUGUST 2023

**Calibrated by :**

Nathakorn Pisutpaisan

**Approved by :**

( Thanakul Petchurai )

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



## Continuation of Calibration Certificate

Cert. No. : SP23016

Job No. : VC66SP0014

Pages : 2 of 3

**Calibration Method :**

This instrument was calibrated by using on-site calibration procedure In-house method : CP-SP-01

The calibration procedure to direct measurement wavelength accuracy by using wavelength standard solution, Photometric accuracy by using absorbance standard filter and absorbance standard solution

The calibration procedure used was based on ASTM E275-01,ASTM E925-02

**Condition of this result of calibration :**

## 1. Certified reference materials

<u>Material</u>	<u>Ref. type</u>	<u>Cell serial No.</u>	<u>Cert. No.</u>	<u>Due Date</u>
Holmium liquid	RM-HL	29706	106864	01/11/2024
Didymium liquid	RM-DL	28912	106905	02/11/2024
Neutral density filter	RM-1N2N3N	13877	106918	03/11/2024
Potassium dichromate solutions	RM-0204060810	14204	106902	02/11/2024
Potassium Iodide solution	-	KI-0701-001	CI-0090-22	08/04/2024

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

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

3.1 The UK National Physical Laboratory (NPL)

3.2 The National Institute of Standards and Technology, NIST.

**Result of calibration : Wavelength Accuracy**

(Without adjustment)

<u>Material</u>	<u>Certified Values of Reference Material (nm)</u>	<u>UUC* Reading (nm)</u>	<u>Error (nm)</u>	<u>Uncertainty ± (nm)</u>	<u>k Factor</u>
RM-HL	278.13	278.3	0.17	0.16	2.00
	361.25	361.3	0.05	0.16	2.00
	467.82	468.0	0.18	0.16	2.00
	536.56	536.6	0.04	0.16	2.00
	640.50	640.4	-0.10	0.16	2.00
RM-DL	740.09	740.0	-0.09	0.16	2.00
	864.94	865.0	0.06	0.16	2.00

UUC\* = Unit Under Calibration



Continuation of Calibration Certificate

**Cert. No. : SP23016**  
**Job No. : VC66SP0014**  
**Pages : 3 of 3**

**Result of calibration : Photometric Accuracy**

(Without adjustment)

Material	Wavelength (nm)	Filter S/N	Nominal Absorbance (A)	Certified Absorbance (A)	UUC* Reading Absorbance (A)	Error (A)	Uncertainty ± (A)	k Factor
Neutral Density glass filter	440.0	29360	1.0	1.0517	1.0564	0.0047	0.0031	2.00
		29914	0.7	0.7445	0.7460	0.0015	0.0032	2.00
		29381	0.5	0.5416	0.5429	0.0013	0.0032	2.00
	546.1	29360	1.0	0.9821	0.9849	0.0028	0.0030	2.00
		29914	0.7	0.6961	0.6961	0.0000	0.0030	2.00
		29381	0.5	0.5073	0.5073	0.0000	0.0030	2.00
	590.0	29360	1.0	1.0222	1.0244	0.0022	0.0030	2.00
		29914	0.7	0.7237	0.7234	-0.0003	0.0030	2.00
		29381	0.5	0.5361	0.5360	-0.0001	0.0031	2.00
	635.0	29360	1.0	0.9753	0.9775	0.0022	0.0030	2.00
		29914	0.7	0.6910	0.6910	0.0000	0.0030	2.00
		29381	0.5	0.5211	0.5210	-0.0001	0.0032	2.00
Material	Wavelength (nm)	Solution (mg/l)	Certified Absorbance (A)	UUC* Reading Absorbance (A)	Error (A)	Uncertainty ± (A)	k Factor	
RM-0204060810	235.0	20	0.2422	0.2462	0.0040	0.0101	2.00	
		40	0.4866	0.4900	0.0034	0.0115	2.00	
		60	0.7414	0.7390	-0.0024	0.0068	2.00	
		80	0.9858	0.9871	0.0013	0.0093	2.00	
		100	1.2442	1.2480	0.0038	0.0087	2.00	

UUC\* = Unit Under Calibration

**Condition of this result of calibration : Spectrophotometer PERKINELMER Model Lambda 25 S/N 501S141230**

Resolution of Wavelength Mode 0.1 nm  
Resolution of Photometric Mode 0.0001 A  
Parameter Setting  
Measurement Mode Wavelength, Absorbance  
Wavelength Scan 1100 nm-190 nm  
Scanning Speed 7.5 nm/min  
Data Pitch 0.1 nm  
Band width(Wavelength) 1.0 nm  
Band width(Vis) 1.0 nm  
Band width(Uv) 1.0 nm

Stray Light** UUC* Reading at 220 nm	
Transmission T(%)	Absorbance(A)
0.0111	3.9564

\*\*Specific Acceptance :

Transmission  $\leq$  1.0 T(%), Absorbance  $\geq$  2.0 A

\*\*Stray light not TISI Accredited

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

**End of Calibration Certificate**





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

Calibration Report					
Non-Dispersive Infrared CO Analyzer					
Date :	09 November 2023	Brand :	API	Model :	300E
No.	CO-B02			Serial No.	965
Calibrator (Dilution System)					
Brand : API			Model : 700		
Last Cal. Date : 08 August 2023			Serial No. : 911		
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	48	
Calibration Setting					
Span	Initial Reading (Before Adj.), PPM			Final Reading (After Adj.), PPM	
Set Point	Expected Concentration	Analyzer Response	%Dif	Analyzer Response	
Zero	0	-0.10	-	0	
CO Span	40.00	40.04	0.100	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	4016.5	mV	2500-4800 mV		
CO Reference	3949.8	mV	2500-4800 mV		
Measure/Reference Ratio	1.180	-	1.1-1.3 W/Zero Air		
Sample Pressure	28.5	In-Hg-A	~2" < Ambient Absolute Pressure		
Sample Flow	806	CC/Min	800 ± 10%		
Sample Temperature	48.5	°C	48 ± 4		
Bench Temperature	48.2	°C	48 ± 2		
Wheel Temperature	68.3	°C	68 ± 2		
Box Temperature	30.6	°C	Ambient Temp + 7 ± 10		
Photo-Drive	3035.3	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)

## CALIBRATION REPORT

Calibration No: WQM-01102023

Page 1 of 2 pages

MEASUREMENT ITEM : Multi parameter Water Quality Meter  
MANUFACTURER : HORIBA  
MODEL/TYPE : Display: U-5000G  
: Probe: U-53  
SERIAL NUMBER : Display: RAAGSEN3  
: Probe: V39CGM6U  
ID No. : -  
CUSTOMER : IRPC Public Company Limited  
555/2, Energy Complex, Building B, 10th Floor,  
Vibhavadi Rangsit Road, Chatuchak, Bangkok 10900

MEASUREMENT DATE : Oct 25, 2023  
ISSUED DATE : Oct 25, 2023

### ENVIRONMENTAL CONDITIONS:

The measurement was carried out in an ambient temperature of  $(25 \pm 3)$  °C, relative humidity of  $(50 \pm 15)$  %, and atmospheric pressure of  $(1008.8 \pm 0.5)$  hPa.

### MEASUREMENT METHOD:

1. The Water Quality meter, Unit Under Calibration (UUC) was calibrated by automatic calibration mode for Conductivity, Turbidity and Dissolved Oxygen (DO) by comparison method with pH 4.01 standard buffer solution.
2. Manual calibration mode was used for calibrated a multi-point pH by comparison with standard buffer solution pH 4.01, 7.00, 10.01. Temperature was calibrated by comparison method with standard digital thermometer in temperature source.

### REFERENCE STANDARD EQUIPMENT:

Equipment:	Model	Serial/Lot No.	Due date.
1. pH 4.01 standard buffer solution	500-4	S0323/01	Jan 16, 2025
2. pH 7.00 standard buffer solution	500-7	S5022/01	Dec 03, 2024
3. pH 10.01 standard buffer solution	500-10	S5022/01	Dec 16, 2024
4. Standard Temperature Probe	STS-100 A500	667682-09	Mar 28, 2024
5. Digital Temperature Indicator	DTI-1000-A MK II	671407-00591	July 22, 2023
6. Refrigerated calibration bath	PD15RCAL-A12E	1B1670656	Jan 17, 2024

### Calibrated by

- ☐ Mr. Sorawit Thachalad  
☐ Miss Jitraporn Lertsomphol  
☒ Miss Ruangrumpai Phoommit



Approved Signatory: \_\_\_\_\_

Mr. Parinya Booncharoen  
Calibration Department Manager



Continuation of Calibration Report Number

Calibration No: WQM-01102023

Page 2 of 2 pages

MEASUREMENT RESULTS: ☒ With Adjustment ☐ Without Adjustment

Table 1: Results of automatic calibration of Conductivity, Turbidity and DO by pH 4.01 standard buffer solution are reported in the table below.

Expected Conductivity (mS/cm)	UUC* <sub>Reading</sub> (before) (mS/cm)	UUC* <sub>Reading</sub> (after) (mS/cm)	Error (mS/cm)
4.49	5.13	4.54	0.05

Expected Turbidity (NTU)	UUC* <sub>Reading</sub> (before) (NTU)	UUC* <sub>Reading</sub> (after) (NTU)	Error (NTU)
0.0	0.00	0.00	0.00

Expected DO concentration (mg/L)	UUC* <sub>Reading</sub> (before) (mg/L)	UUC* <sub>Reading</sub> (after) (mg/L)	Error (mg/L)
8.92	10.38	8.74	-0.18

Table 2: Results of Manual calibration of pH and Temperature are reported in the table below.

Standard buffer solution (pH)	UUC* <sub>Reading</sub> (before) (pH)	UUC* <sub>Reading</sub> (after) (pH)	Error (pH)
4.01	3.61	3.97	-0.04
7.00	7.38	7.15	0.15
10.01	9.52	10.18	0.17

Standard Temperature Reading (°C)	UUC* <sub>Reading</sub> (before) (°C)	UUC* <sub>Reading</sub> (after) (°C)	Error (°C)
25.043	22.78	24.99	-0.05

UUC\* Unit Under Calibration

Noted: 1. The Unit under calibration was warmed up for 30 minute prior to the calibration being performed.  
2. The report is valid only to the item calibrated on date and place of calibration.

\*\*\*End of Calibration Report\*\*\*



Certificate No.: CP20230386EA

Operation No.: CP2023100007

## Certificate of Calibration

Equipment: Sound Level Meter

Manufacturer: RION

Model/Type: NL-42 (Meter), UC-52 (Microphone), NH-24 (Preamplifier)

Serial No.: 00546401 (Meter), 152917 (Microphone), 46612 (Preamplifier)

ID No.: -

Customer: IRPC Public Company Limited.

Address: 299 Moo 5, Sukhumvit Rd., Tumbon Chungnern,  
Amphor Muang, Rayong 21000


Received Date: 24 October 2023

Calibrated Date: 6 - 8 November 2023

Issued Date: 9 November 2023

Calibrated by: Ms. Juntaporn Kunhakom

Approved by:



( Mr. Sittichai Swaksuriyawong )  
Group Manager

This report was prepared electronically using applicable electronic signature. Printing or copy of file are considered as a copy of the document.

The reported uncertainty of measurement was based on standard uncertainty multiplied by a coverage factor ( $k$ ) providing a level of confidence of approximately 95%. This certificate may not be reproduced other than in full except with the prior written approval of the Electrical and Electronics Institute, Foundation for Industrial Development.



Certificate No.: CP20230386EA

## Calibration Report

Equipment: Sound Level Meter  
 Manufacturer: RION  
 Model/Type: NL-42 (Meter), UC-52 (Microphone), NH-24 (Preamplifier)  
 Serial No.: 00546401 (Meter), 152917 (Microphone), 46612 (Preamplifier)  
 ID No.: -  
 Ambient Temperature: ( 23 ± 2 ) °C  
 Relative Humidity: ( 50 ± 15 ) %  
 Pressure: (101.3 ± 1.5) kPa  
 Method of Calibration :-  
 IEC 61672-3:2013.

### Condition of this result of calibration

1. Reference standards instrument :-

Instrument	Model	Serial No.	Cert. No.	Due Date
1) Standard microphone	4180	2661000	AA-1006-23	7 June 2024
2) Arbitrary Function Generator	AFG2021	C010063	CK20230040EA	26 June 2024
3) Programmable Attenuator	PA5	2755	EF-0040-23	1 October 2024
4) 6.5 Digit precision multimeter	8846A	9610014	CB20220223EA	14 November 2023
5) Pressure humidity and Temperature Transmitter	PTU301	F0640002	CL1-P230024 CD20230196EA	20 March 2024 23 July 2024
6) Pressure humidity and Temperature Transmitter	PTU301	F0640003	CL1-P230032 CD20230197EA	4 April 2024 23 July 2024
7) Performance Audio Analyzer	U8903B	MY56510003	CB20230038EA CK20230072EA	14 February 2024 13 September 2024

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

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

Reference standards instrument for Acoustic function

- National Institute of Metrology (Thailand)

Reference standards instrument for Electrical function

- National Institute of Metrology (Thailand)

- Electrical and Electronics Institute; NSC Accredited Calibration No.0119

### Result of Calibration:-

Function : 1. Indication at the calibration check frequency

Reference Acoustic Signal (dB)	Measured value (dB)	Deviation (dB)	Acceptance limits (dB)
94.1	94.1	0.0	±1.0

Note : Absolute sensitivity was established by the use of the Sound Calibrator RION Type NC-74 S/N : 34904949.

Certificate No.: CP20230386EA

## Calibration Report

Function : 2. Self-generated Noise

### 2.1 Microphone Installed

Measured value (dB)
14.5

### 2.2 Microphone replaced by the electrical input signal device

Frequency Weighting	Measured value (dB)
A-weighting	9.9
C-weighting	15.9
Z-weighting	21.9

Function : 3. Acoustical signal tests of frequency weightings (Without Windscreen)

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

Frequency (Hz)	Deviation from various Frequency Weighting Response Curve			
	C-Weighting (dB)	A-Weighting (dB)	Z-Weighting (dB)	Acceptance limits (dB)
125	0.3	0.2	0.4	±1.5
1000	0.0	0.0	0.0	±1.0
8000	-3.3	-3.4	-3.4	±5.0

Function : 4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

Frequency (Hz)	Deviation from various Frequency Weighting Response Curve			
	C-Weighting (dB)	A-Weighting (dB)	Z-Weighting (dB)	Acceptance limits (dB)
63	-0.1	-0.1	0.0	±2.0
125	0.0	-0.1	0.0	±1.5
250	-0.1	-0.1	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	0.1	0.1	0.0	±5.0

Function : 5. Frequency and time weighting at 1 kHz

### 5.1 Frequency weighting at 1 kHz

Frequency Weighting	Measured value (dB)	Deviated value (dB)	Acceptance limits (dB)
C-weighting	94.0	0.0	±0.2
A-weighting	94.0	0.0	±0.2
Z-weighting	94.0	0.0	±0.2



Certificate No.: CP20230386EA

## Calibration Report

### 5.2 Time weighting at 1 kHz

Time Weighting	Measured value (dB)	Deviated value (dB)	Acceptance limits (dB)
Fast	94.0	0.0	±0.1
Slow	94.0	0.0	±0.1
LAeq	94.0	0.0	±0.1

### Function : 6. Long-Term Stability

Long-term stability over 30 minutes, with steady 1 kHz signal at reference level.

Time Period to Apply Signal (min)	Reference SPL (dB)	Record SPL at Conclusion of Time Period (dB)	Deviated value (dB)	Acceptance limits (dB)
30	94.0	94.0	0.0	±0.3

### Function : 7. Level Linearity on the reference level range

#### 7.1 Level Linearity on the reference level range, Upper

Anticipated Value (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limits (dB)
94.0	94.0	0.0	±1.1
99.0	99.0	0.0	±1.1
104.0	104.0	0.0	±1.1
109.0	109.0	0.0	±1.1
114.0	114.0	0.0	±1.1
119.0	119.0	0.0	±1.1
124.0	124.0	0.0	±1.1
129.0	129.0	0.0	±1.1
130.0	130.0	0.0	±1.1
131.0	131.0	0.0	±1.1
132.0	132.0	0.0	±1.1
133.0	133.0	0.0	±1.1
134.0	134.0	0.0	±1.1
135.0	135.0	0.0	±1.1
136.0	136.0	0.0	±1.1
137.0	137.0	0.0	±1.1

#### 7.2 Level Linearity on the reference level range, Lower

Anticipated Value (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limits (dB)
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

Certificate No.: CP20230386EA

### Calibration Report

#### 7.2 Level Linearity on the reference level range, Lower (Cont.)

Anticipated Value (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limits (dB)
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
29.0	28.9	-0.1	±1.1

#### Function : 8. Tone burst response

Time Weighting	Tone burst duration, Tb (ms)	Measured value (dB)	Deviated value (dB)	Acceptance limits (dB)
Fast	200	126.0	0.0	±1.0
	2	109.0	0.0	+1.0 ; -2.5
	0.25	99.9	-0.1	+1.5 ; -5.0
Slow	200	119.6	0.0	±1.0
	2	100.0	0.0	+1.0 ; -5.0
LAE	200	120.0	0.0	±1.0
	2	100.0	0.0	+1.0 ; -2.5
	0.25	90.9	-0.1	+1.5 ; -5.0

#### Function : 9. Peak C sound level

Number of cycles in test signal	Anticipated Value (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limits (dB)
Complete cycle	125.4	125.2	-0.2	±3.0
Positive half cycle	124.4	124.1	-0.3	±2.0
Negative half cycle	124.4	124.1	-0.3	±2.0

#### Function : 10. Overload indication

Measured value (dB)		Deviated value (dB)	Acceptance limits (dB)
Positive one-half cycle	Negative one-half cycle		
139.5	139.5	0.0	±1.5



Certificate No.: CP20230386EA

### Calibration Report

Function : 11. High-Level Stability

High-level stability over 5 minutes, with steady 1 kHz signal, 1 dB below upper boundary.

Time Period to Apply Signal (min)	Reference SPL (dB)	Record SPL at Conclusion of Time Period (dB)	Deviated value (dB)	Acceptance limits (dB)
5	129.0	129.0	0.0	±0.3

#### Uncertainty of measurement

Function	Uncertainty (dB)	Maximum-permitted uncertainty of measurement (dB)
1) Indication at the calibration check frequency	0.30	Not applicable
2) Self-generated Noise	0.10	Not applicable
3) Acoustical signal tests of frequency weightings - Free-field sound pressure response level	0.30	0.60 (10Hz to 4kHz) 0.70 (>4kHz to 10kHz)
4) Electrical signal tests of frequency weightings	0.20	0.20
5) Frequency and time weighting at 1 kHz	0.20	0.20
6) Long-Term Stability	0.10	0.10
7) Level Linearity on the reference level range	0.30	0.30
8) Tone burst response	0.20	0.30
9) Peak C sound level	0.20	0.35
10) Overload indication	0.20	0.25
11) High-Level Stability	0.10	0.10

Remarks: 1. The acceptance limit is for the deviated value.  
2. Acceptance limits was IEC61672-3:2013 Class 2.  
3. The coverage factor  $k = 2.00$

-- End of Report --

Certificate No.: CP20230387EA

Operation No.: CP2023100008

## Certificate of Calibration

Equipment: Sound Level Meter

Manufacturer: RION

Model/Type: NL-52 (Meter), UC-59 (Microphone), NH-25 (Preamplifier)

Serial No.: 00632063 (Meter), 05230 (Microphone), 32091 (Preamplifier)

ID No.: -

Customer: IRPC Public Company Limited.

Address: 299 Moo 5, Sukhumvit Rd., Tumbon Chungnern,  
Amphor Muang, Rayong 21000

Received Date: 24 October 2023

Calibrated Date: 6 - 8 November 2023

Issued Date: 9 November 2023

Calibrated by: Ms. Juntaporn Kunhakom

Approved by: 

( Mr. Sittichai Swaksuriyawong )  
Group Manager

This report was prepared electronically using applicable electronic signature. Printing or copy of file are considered as a copy of the document.

The reported uncertainty of measurement was based on standard uncertainty multiplied by a coverage factor ( $k$ ) providing a level of confidence of approximately 95%. This certificate may not be reproduced other than in full except with the prior written approval of the Electrical and Electronics Institute, Foundation for Industrial Development.



Certificate No.: CP20230387EA

## Calibration Report

Equipment: Sound Level Meter  
 Manufacturer: RION  
 Model/Type: NL-52 (Meter), UC-59 (Microphone), NH-25 (Preamplifier)  
 Serial No.: 00632063 (Meter), 05230 (Microphone), 32091 (Preamplifier)  
 ID No.: -  
 Ambient Temperature: ( 23 ± 2 ) °C  
 Relative Humidity: ( 50 ± 15 ) %  
 Pressure: (101.3 ± 1.5) kPa  
 Method of Calibration :-  
 IEC 61672-3:2013.

### Condition of this result of calibration

#### 1. Reference standards instrument :-

	Instrument	Model	Serial No.	Cert. No.	Due Date
1)	Standard microphone	4180	2661000	AA-1006-23	7 June 2024
2)	Arbitrary Function Generator	AFG2021	C010063	CK20230040EA	26 June 2024
3)	Programmable Attenuator	PA5	2755	EF-0040-23	1 October 2024
4)	6.5 Digit precision multimeter	8846A	9610014	CB20220223EA	14 November 2023
5)	Pressure humidity and Temperature Transmitter	PTU301	F0640002	CL1-P230024 CD20230196EA	20 March 2024 23 July 2024
6)	Pressure humidity and Temperature Transmitter	PTU301	F0640003	CL1-P230032 CD20230197EA	4 April 2024 23 July 2024
7)	Performance Audio Analyzer	U8903B	MY56510003	CB20230038EA CK20230072EA	14 February 2024 13 September 2024

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

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

Reference standards instrument for Acoustic function

- National Institute of Metrology (Thailand)

Reference standards instrument for Electrical function

- National Institute of Metrology (Thailand)

- Electrical and Electronics Institute; NSC Accredited Calibration No.0119

### Result of Calibration:-

Function : 1. Indication at the calibration check frequency

Reference Acoustic Signal (dB)	Measured value (dB)	Deviation (dB)	Acceptance limits (dB)
94.1	94.1	0.0	±0.7

Note : Absolute sensitivity was established by the use of the Sound Calibrator RION Type NC-74 S/N : 34904949.

Certificate No.: CP20230387EA

## Calibration Report

Function : 2. Self-generated Noise

### 2.1 Microphone Installed

Measured value (dB)
15.7

### 2.2 Microphone replaced by the electrical input signal device

Frequency Weighting	Measured value (dB)
A-weighting	10.4
C-weighting	15.7
Z-weighting	20.4

Function : 3. Acoustical signal tests of frequency weightings (Without Windscreen)

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

Frequency (Hz)	Deviation from various Frequency Weighting Response Curve			
	C-Weighting (dB)	A-Weighting (dB)	Z-Weighting (dB)	Acceptance limits (dB)
125	0.3	0.2	0.3	±1.0
1000	0.0	0.0	0.0	±0.7
8000	-0.6	-0.6	-0.7	+1.5; -2.5

Function : 4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

Frequency (Hz)	Deviation from various Frequency Weighting Response Curve			
	C-Weighting (dB)	A-Weighting (dB)	Z-Weighting (dB)	Acceptance limits (dB)
63	0.0	0.0	0.0	±1.0
125	0.0	-0.1	0.0	±1.0
250	0.0	0.0	-0.1	±1.0
500	0.0	0.0	-0.1	±1.0
1000	0.0	0.0	0.0	±0.7
2000	0.0	0.1	0.0	±1.0
4000	0.0	0.0	0.0	±1.0
8000	0.0	0.1	0.0	+1.5; -2.5
16000	-1.4	-1.3	0.0	+2.5; -16.0



Certificate No.: CP20230387EA

### Calibration Report

Function : 5. Frequency and time weighting at 1 kHz

#### 5.1 Frequency weighting at 1 kHz

Frequency Weighting	Measured value (dB)	Deviated value (dB)	Acceptance limits (dB)
C-weighting	94.0	0.0	±0.2
A-weighting	94.0	0.0	±0.2
Z-weighting	94.0	0.0	±0.2

#### 5.2 Time weighting at 1 kHz

Time Weighting	Measured value (dB)	Deviated value (dB)	Acceptance limits (dB)
Fast	94.0	0.0	±0.1
Slow	94.0	0.0	±0.1
LAeq	94.0	0.0	±0.1

Function : 6. Long-Term Stability

Long-term stability over 30 minutes, with steady 1 kHz signal at reference level.

Time Period to Apply Signal (min)	Reference SPL (dB)	Record SPL at Conclusion of Time Period (dB)	Deviated value (dB)	Acceptance limits (dB)
30	94.0	94.0	0.0	±0.1

Function : 7. Level Linearity on the reference level range

#### 7.1 Level Linearity on the reference level range, Upper

Anticipated Value (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limits (dB)
94.0	94.0	0.0	±0.8
99.0	99.0	0.0	±0.8
104.0	104.0	0.0	±0.8
109.0	109.0	0.0	±0.8
114.0	114.0	0.0	±0.8
119.0	119.0	0.0	±0.8
124.0	124.0	0.0	±0.8
129.0	129.0	0.0	±0.8
130.0	130.0	0.0	±0.8
131.0	131.0	0.0	±0.8
132.0	132.0	0.0	±0.8
133.0	133.0	0.0	±0.8
134.0	134.0	0.0	±0.8
135.0	135.0	0.0	±0.8
136.0	136.0	0.0	±0.8
137.0	137.0	0.0	±0.8

Certificate No.: CP20230387EA

### Calibration Report

#### 7.2 Level Linearity on the reference level range, Lower

Anticipated Value (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limits (dB)
94.0	94.0	0.0	±0.8
89.0	89.0	0.0	±0.8
84.0	84.0	0.0	±0.8
79.0	79.0	0.0	±0.8
74.0	74.0	0.0	±0.8
69.0	69.0	0.0	±0.8
64.0	64.0	0.0	±0.8
59.0	59.0	0.0	±0.8
54.0	54.0	0.0	±0.8
49.0	49.0	0.0	±0.8
44.0	44.0	0.0	±0.8
39.0	39.0	0.0	±0.8
34.0	33.9	-0.1	±0.8
29.0	28.9	-0.1	±0.8

#### Function : 8. Tone burst response

Time Weighting	Tone burst duration, Tb (ms)	Measured value (dB)	Deviated value (dB)	Acceptance limits (dB)
Fast	200	126.0	0.0	±0.5
	2	109.0	0.0	+1.0 ; -1.5
	0.25	99.9	-0.1	+1.0 ; -3.0
Slow	200	119.6	0.0	±0.5
	2	100.0	0.0	+1.0 ; -3.0
	0.25	90.9	-0.1	+1.0 ; -3.0
LAE	200	120.0	0.0	±0.5
	2	100.0	0.0	+1.0 ; -1.5
	0.25	90.9	-0.1	+1.0 ; -3.0

#### Function : 9. Peak C sound level

Number of cycles in test signal	Anticipated Value (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limits (dB)
Complete cycle	125.4	125.2	-0.2	±2.0
Positive half cycle	124.4	124.1	-0.3	±1.0
Negative half cycle	124.4	124.1	-0.3	±1.0



Certificate No.: CP20230387EA

### Calibration Report

Function : 10. Overload indication

Measured value (dB)		Deviated value (dB)	Acceptance limits (dB)
Positive one-half cycle	Negative one-half cycle		
139.5	139.5	0.0	±1.5

Function : 11. High-Level Stability

High-level stability over 5 minutes, with steady 1 kHz signal, 1 dB below upper boundary.

Time Period to Apply Signal (min)	Reference SPL (dB)	Record SPL at Conclusion of Time Period (dB)	Deviated value (dB)	Acceptance limits (dB)
5	129.0	129.0	0.0	±0.1

### Uncertainty of measurement

Function	Uncertainty (dB)	Maximum-permitted uncertainty of measurement (dB)
1) Indication at the calibration check frequency	0.30	Not applicable
2) Self-generated Noise	0.10	Not applicable
3) Acoustical signal tests of frequency weightings - Free-field sound pressure response level	0.30	0.60 (10Hz to 4kHz) 0.70 (>4kHz to 10kHz)
4) Electrical signal tests of frequency weightings	0.20	0.20
5) Frequency and time weighting at 1 kHz	0.20	0.20
6) Long-Term Stability	0.10	0.10
7) Level Linearity on the reference level range	0.30	0.30
8) Tone burst response	0.20	0.30
9) Peak C sound level	0.20	0.35
10) Overload indication	0.20	0.25
11) High-Level Stability	0.10	0.10

Remarks: 1. The acceptance limit is for the deviated value.  
2. Acceptance limits was IEC61672-3:2013 Class 1.  
3. The coverage factor  $k = 2.00$

- - End of Report - -

Certificate No.: CP20230383EA

Operation No.: CP2023100010

## Certificate of Calibration

Equipment: Sound Calibrator

Manufacturer: RION

Model/Type: NC-74

Serial No.: 34536115

ID No.: -

Customer: IRPC Public Company Limited.

Address: 299 Moo 5, Sukhumvit Rd., Tumbon Chungnern,  
Amphor Muang, Rayong 21000

Received Date: 24 October 2023

Calibrated Date: 30 October 2023

Issued Date: 31 October 2023

Calibrated by: Ms. Juntaporn Kunhakom

Approved by: 

( Mr. Sittichai Swaksuriyawong )

Group Manager

This report was prepared electronically using applicable electronic signature. Printing or copy of file are considered as a copy of the document.

The reported uncertainty of measurement was based on standard uncertainty multiplied by a coverage factor ( $k$ ) providing a level of confidence of approximately 95%. This certificate may not be reproduced other than in full except with the prior written approval of the Electrical and Electronics Institute, Foundation for Industrial Development.



Certificate No.: CP20230383EA

## Calibration Report

Equipment: Sound Calibrator  
Manufacturer: RION  
Model/Type: NC-74  
Serial No.: 34536115  
ID No.: -  
Ambient Temperature: ( 23 ± 2 ) °C  
Relative Humidity: ( 50 ± 15 ) %  
Pressure: (101.3 ± 1.5) kPa

Method of Calibration :-

IEC 60942:2017

### Condition of this result of calibration

1. Reference standards instrument :-

Instrument	Model	Serial No.	Cert. No.	Due Date
1) Standard microphone	4180	2787490	AA-1024-22	6 November 2023
2) Waveform Generator	33511B	MY52302264	CK20230039EA	27 June 2024
3) Audio Analyzing DMM	2015-P	000136E	E1U225466	2 December 2023
4) Pressure humidity and Temperature Transmitter	PTU301	F0640002	CL1-P230024 CD20230196EA	20 March 2024 23 July 2024

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

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

Reference standards instrument for Acoustic function

- National Institute of Metrology (Thailand)

Reference standards instrument for Electrical function

- Electrical and Electronics Institute; NSC Accredited Calibration No.0119

### Result of Calibration:-

1. Function : Sound pressure level

Norminal Frequency (Hz)	Specified Sound Pressure level (dB)	Measured value (dB)	Deviated value <sup>[1]</sup> (dB)	Acceptance limit <sup>[3]</sup> (dB)
1000	94	94.10	0.10	±0.25

2. Function : Frequency

Norminal Sound Pressure level (dB)	Specified Frequency (Hz)	Measured value (Hz)	Deviated value <sup>[2]</sup> (%)	Acceptance limit <sup>[3]</sup> (%)
94	1000	1002.76	0.28	±0.70

Certificate No.: CP20230383EA

### Calibration Report

#### 3. Function : Total distortion + noise

Norminal Sound Pressure level (dB)	Norminal Frequency (Hz)	Measured value <sup>[4]</sup> (%)	Acceptance limit <sup>[5]</sup> (%)
94	1000	1.40	2.50

#### Uncertainty of measurement

Function	Uncertainty	Maximum-permitted uncertainty of measurement
Sound pressure level	0.10 dB	0.15 dB
Frequency	0.10 %	0.20 %
Total distortion + noise	0.40 %	0.50 %

- Note:
- [1] The deviated value is the absolute value of the difference between the measured value and the corresponding specified sound pressure level.
  - [2] The deviated value is the absolute value of the difference in percent between the measured value and the corresponding specified frequency.
  - [3] The acceptance limit is for the deviated value.
  - [4] The measured value is the total distortion + noise, measured over the frequency range from 20 Hz to 20 kHz.
  - [5] The acceptance limit is for the Measured value.

- Remarks:
- 1. Using the 1/2-inch microphone adaptor NC-74-002.
  - 2. Acceptance limit was IEC 60942:2017 Class 1.
  - 3. Maximum-permitted uncertainty of measurement was IEC 60942:2017 Class 1.
  - 4. The coverage factor  $k = 2.00$

- - End of Report - -



Certificate No.: CP20230382EA

Operation No.: CP2023100009

## Certificate of Calibration

Equipment: Sound Calibrator

Manufacturer: RION

Model/Type: NC-74

Serial No.: 34904949

ID No.: -

Customer: IRPC Public Company Limited.

Address: 299 Moo 5, Sukhumvit Rd., Tumbon Chungnern,  
Amphor Muang, Rayong 21000

Received Date: 24 October 2023

Calibrated Date: 30 October 2023

Issued Date: 31 October 2023

Calibrated by: Ms. Juntaporn Kunhakom

Approved by: \_\_\_\_\_

( Mr. Sittichai Swaksuriyawong )  
Group Manager

This report was prepared electronically using applicable electronic signature. Printing or copy of file are considered as a copy of the document.

The reported uncertainty of measurement was based on standard uncertainty multiplied by a coverage factor ( $k$ ) providing a level of confidence of approximately 95%. This certificate may not be reproduced other than in full except with the prior written approval of the Electrical and Electronics Institute, Foundation for Industrial Development.

Certificate No.: CP20230382EA

## Calibration Report

Equipment: Sound Calibrator  
Manufacturer: RION  
Model/Type: NC-74  
Serial No.: 34904949  
ID No.: -  
Ambient Temperature: ( 23 ± 2 ) °C  
Relative Humidity: ( 50 ± 15 ) %  
Pressure: (101.3 ± 1.5) kPa

Method of Calibration :-

IEC 60942:2017

### Condition of this result of calibration

1. Reference standards instrument :-

Instrument	Model	Serial No.	Cert. No.	Due Date
1) Standard microphone	4180	2787490	AA-1024-22	6 November 2023
2) Waveform Generator	33511B	MY52302264	CK20230039EA	27 June 2024
3) Audio Analyzing DMM	2015-P	000136E	E1U225466	2 December 2023
4) Pressure humidity and Temperature Transmitter	PTU301	F0640002	CL1-P230024 CD20230196EA	20 March 2024 23 July 2024

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

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

Reference standards instrument for Acoustic function

- National Institute of Metrology (Thailand)

Reference standards instrument for Electrical function

- Electrical and Electronics Institute; NSC Accredited Calibration No.0119

### Result of Calibration:-

1. Function : Sound pressure level

Norminal Frequency (Hz)	Specified Sound Pressure level (dB)	Measured value (dB)	Deviated value <sup>[1]</sup> (dB)	Acceptance limit <sup>[3]</sup> (dB)
1000	94	94.11	0.11	±0.25

2. Function : Frequency

Norminal Sound Pressure level (dB)	Specified Frequency (Hz)	Measured value (Hz)	Deviated value <sup>[2]</sup> (%)	Acceptance limit <sup>[3]</sup> (%)
94	1000	1002.52	0.25	±0.70



Certificate No.: CP20230382EA

### Calibration Report

#### 3. Function : Total distortion + noise

Norminal Sound Pressure level (dB)	Norminal Frequency (Hz)	Measured value <sup>[4]</sup> (%)	Acceptance limit <sup>[5]</sup> (%)
94	1000	1.45	2.50

#### Uncertainty of measurement

Function	Uncertainty	Maximum-permitted uncertainty of measurement
Sound pressure level	0.10 dB	0.15 dB
Frequency	0.10 %	0.20 %
Total distortion + noise	0.40 %	0.50 %

- Note:
- [1] The deviated value is the absolute value of the difference between the measured value and the corresponding specified sound pressure level.
  - [2] The deviated value is the absolute value of the difference in percent between the measured value and the corresponding specified frequency.
  - [3] The acceptance limit is for the deviated value.
  - [4] The measured value is the total distortion + noise, measured over the frequency range from 20 Hz to 20 kHz.
  - [5] The acceptance limit is for the Measured value.

- Remarks:
- 1. Using the 1/2-inch microphone adaptor NC-74-002.
  - 2. Acceptance limit was IEC 60942:2017 Class 1.
  - 3. Maximum-permitted uncertainty of measurement was IEC 60942:2017 Class 1.
  - 4. The coverage factor  $k = 2.00$

-- End of Report --

Certificate No.: CP20230373EA

Operation No.: CP2023090019

## Certificate of Calibration

Equipment: Sound Level Meter

Manufacturer: 01dB (Meter), G.R.A.S. (Microphone), 01dB (Preamplifier)

Model/Type: CUBE (Meter), 40CD (Microphone), PRE22 (Preamplifier)

Serial No.: 11442 (Meter), 330591 (Microphone), 1707308 (Preamplifier)

ID No.: 11442 (Extension cable)

Customer: IRPC Public Company Limited.

Address: 299 Moo 5, Sukhumvit Rd., Tumbon Chungnern,  
Amphor Muang, Rayong 21000

Received Date: 22 September 2023

Calibrated Date: 18 - 19 October 2023

Issued Date: 20 October 2023

Calibrated by: Ms. Juntaporn Kunhakom

Approved by:

( Mr. Sittichai Swaksuriyawong )  
Group Manager

This report was prepared electronically using applicable electronic signature. Printing or copy of file are considered as a copy of the document.

The reported uncertainty of measurement was based on standard uncertainty multiplied by a coverage factor ( $k$ ) providing a level of confidence of approximately 95%. This certificate may not be reproduced other than in full except with the prior written approval of the Electrical and Electronics Institute, Foundation for Industrial Development.



Certificate No.: CP20230373EA

### Calibration Report

Equipment: Sound Level Meter  
 Manufacturer: 01dB (Meter), G.R.A.S. (Microphone), 01dB (Preamplifier)  
 Model/Type: CUBE (Meter), 40CD (Microphone), PRE22 (Preamplifier)  
 Serial No.: 11442 (Meter), 330591 (Microphone), 1707308 (Preamplifier)  
 ID No.: 11442 (Extension cable)  
 Ambient Temperature: ( 23 ± 2 ) °C  
 Relative Humidity: ( 50 ± 15 ) %  
 Pressure: (101.3 ± 1.5) kPa  
 Method of Calibration :-  
 IEC 61672-3:2013.

#### Condition of this result of calibration

1. Reference standards instrument :-

	Instrument	Model	Serial No.	Cert. No.	Due Date
1)	Standard microphone	4180	2787490	AA-1024-22	6 November 2023
2)	Arbitrary Function Generator	AFG2021	C010063	CK20230040EA	26 June 2024
3)	Programmable Attenuator	PA5	2755	EF-0034-22	30 October 2023
4)	6.5 Digit precision multimeter	8846A	9610014	CB20220223EA	14 November 2023
5)	Pressure humidity and Temperature Transmitter	PTU301	F0640002	CL1-P230024 CD20230196EA	20 March 2024 23 July 2024
6)	Pressure humidity and Temperature Transmitter	PTU301	F0640003	CL1-P230032 CD20230197EA	4 April 2024 23 July 2024
7)	Performance Audio Analyzer	U8903B	MY56510003	CB20230038EA CK20230072EA	14 February 2024 13 September 2024

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

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

- Reference standards instrument for Acoustic function
  - National Institute of Metrology (Thailand)
- Reference standards instrument for Electrical function
  - National Institute of Metrology (Thailand)
  - Electrical and Electronics Institute; NSC Accredited Calibration No.0119

#### Result of Calibration:-

Function : 1. Indication at the calibration check frequency

Reference Acoustic Signal (dB)	Correction for Microphone Model 40CD (dB)	Effective Calibration Level (dB)	Measured value (dB)	Deviation (dB)	Acceptance limits (dB)
-	-	-	-	-	-

Certificate No.: CP20230373EA

## Calibration Report

Function : 2. Self-generated Noise

### 2.1 Microphone Installed

Measured value (dB)
16.8

### 2.2 Microphone replaced by the electrical input signal device

Frequency Weighting	Measured value (dB)
A-weighting	10.1
C-weighting	10.0
Z-weighting	18.1

Function : 3. Acoustical signal tests of frequency weightings (With Windscreen)

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

Frequency (Hz)	Deviation from various Frequency Weighting Response Curve			
	C-Weighting (dB)	A-Weighting (dB)	Z-Weighting (dB)	Acceptance limits (dB)
125	0.0	-0.2	-0.1	±1.0
1000	0.2	0.2	0.2	±0.7
8000	-0.9	-0.9	-0.4	+1.5; -2.5

Function : 4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

Frequency (Hz)	Deviation from various Frequency Weighting Response Curve			
	C-Weighting (dB)	A-Weighting (dB)	Z-Weighting (dB)	Acceptance limits (dB)
63	-0.1	-0.1	0.0	±1.0
125	0.2	-0.1	0.2	±1.0
250	0.1	0.1	0.2	±1.0
500	0.2	0.2	0.2	±1.0
1000	0.2	0.2	0.2	±0.7
2000	0.2	0.1	0.1	±1.0
4000	0.9	0.8	0.9	±1.0
8000	-0.1	0.0	0.4	+1.5; -2.5
16000	-9.8	-9.6	-4.3	+2.5; -16.0



Certificate No.: CP20230373EA

### Calibration Report

Function : 5. Frequency and time weighting at 1 kHz

#### 5.1 Frequency weighting at 1 kHz

Frequency Weighting	Measured value (dB)	Deviated value (dB)	Acceptance limits (dB)
C-weighting	94.0	0.0	±0.2
A-weighting	94.0	0.0	±0.2
Z-weighting	94.0	0.0	±0.2

#### 5.2 Time weighting at 1 kHz

Time Weighting	Measured value (dB)	Deviated value (dB)	Acceptance limits (dB)
Fast	94.0	0.0	±0.1
Slow	94.0	0.0	±0.1
LAeq	94.0	0.0	±0.1

Function : 6. Long-Term Stability

Long-term stability over 30 minutes, with steady 1 kHz signal at reference level.

Time Period to Apply Signal (min)	Reference SPL (dB)	Record SPL at Conclusion of Time Period (dB)	Deviated value (dB)	Acceptance limits (dB)
30	94.0	94.0	0.0	±0.1

Function : 7. Level Linearity on the reference level range

#### 7.1 Level Linearity on the reference level range, Upper

Anticipated Value (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limits (dB)
94.0	94.0	0.0	±0.8
99.0	99.0	0.0	±0.8
104.0	104.0	0.0	±0.8
109.0	108.8	-0.2	±0.8
114.0	113.8	-0.2	±0.8
119.0	118.8	-0.2	±0.8
124.0	123.8	-0.2	±0.8
129.0	128.8	-0.2	±0.8

Certificate No.: CP20230373EA

### Calibration Report

#### 7.2 Level Linearity on the reference level range, Lower

Anticipated Value (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limits (dB)
94.0	94.0	0.0	±0.8
89.0	89.0	0.0	±0.8
84.0	84.0	0.0	±0.8
79.0	79.0	0.0	±0.8
74.0	74.0	0.0	±0.8
69.0	69.0	0.0	±0.8
64.0	64.0	0.0	±0.8
59.0	59.0	0.0	±0.8
54.0	54.0	0.0	±0.8
49.0	49.0	0.0	±0.8
44.0	44.0	0.0	±0.8
39.0	39.0	0.0	±0.8
34.0	33.8	-0.2	±0.8
29.0	28.8	-0.2	±0.8
24.0	24.0	0.0	±0.8

#### Function : 8. Tone burst response

Time Weighting	Tone burst duration, Tb (ms)	Measured value (dB)	Deviated value (dB)	Acceptance limits (dB)
Fast	200	134.0	0.0	±0.5
	2	116.9	-0.1	+1.0 ; -1.5
	0.25	107.8	-0.2	+1.0 ; -3.0
Slow	200	127.6	0.0	±0.5
	2	108.0	0.0	+1.0 ; -3.0
LAE	200	128.0	0.0	±0.5
	2	108.0	0.0	+1.0 ; -1.5
	0.25	98.8	-0.2	+1.0 ; -3.0

#### Function : 9. Peak C sound level

Number of cycles in test signal	Anticipated Value (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limits (dB)
Complete cycle	133.4	134.9	1.5	±2.0
Positive half cycle	132.4	131.6	-0.8	±1.0
Negative half cycle	132.4	131.6	-0.8	±1.0

#### Function : 10. Overload indication

Measured value (dB)		Deviated value (dB)	Acceptance limits (dB)
Positive one-half cycle	Negative one-half cycle		
138.4	139.0	0.6	±1.5



Certificate No.: CP20230373EA

### Calibration Report

Function : 11. High-Level Stability

High-level stability over 5 minutes, with steady 1 kHz signal, 1 dB below upper boundary.

Time Period to Apply Signal (min)	Reference SPL (dB)	Record SPL at Conclusion of Time Period (dB)	Deviated value (dB)	Acceptance limits (dB)
5	137.0	137.0	0.0	±0.1

### Uncertainty of measurement

Function	Uncertainty (dB)	Maximum-permitted uncertainty of measurement (dB)
1) Indication at the calibration check frequency	0.30	Not applicable
2) Self-generated Noise	0.10	Not applicable
3) Acoustical signal tests of frequency weightings - Free-field sound pressure response level	0.30	0.60 (10Hz to 4kHz) 0.70 (>4kHz to 10kHz)
4) Electrical signal tests of frequency weightings	0.20	0.20
5) Frequency and time weighting at 1 kHz	0.20	0.20
6) Long-Term Stability	0.10	0.10
7) Level Linearity on the reference level range	0.30	0.30
8) Tone burst response	0.20	0.30
9) Peak C sound level	0.20	0.35
10) Overload indication	0.20	0.25
11) High-Level Stability	0.10	0.10

Remarks:

1. Indication at the calibration check frequency can not measured because customer does not provide a sound calibrator.
2. The acceptance limit is for the deviated value.
3. Acceptance limits was IEC61672-3:2013 Class 1.
4. The coverage factor  $k = 2.00$

-- End of Report --

Certificate No.: CP20230372EA

Operation No.: CP2023090018

## Certificate of Calibration

Equipment: Sound Level Meter

Manufacturer: 01dB (Meter), G.R.A.S. (Microphone), 01dB (Preamplifier)

Model/Type: CUBE (Meter), 40CD (Microphone), PRE22 (Preamplifier)

Serial No.: 14257 (Meter), 494247 (Microphone), 2138114 (Preamplifier)

ID No.: 14257 (Extension cable)

Customer: IRPC Public Company Limited.

Address: 299 Moo 5, Sukhumvit Rd., Tumbon Chungnern,  
Amphor Muang, Rayong 21000

Received Date: 22 September 2023

Calibrated Date: 18 - 19 October 2023

Issued Date: 20 October 2023

Calibrated by: Ms. Juntaporn Kunhakom

Approved by: 

( Mr. Sittichai Swaksuriyawong )  
Group Manager

This report was prepared electronically using applicable electronic signature. Printing or copy of file are considered as a copy of the document.

The reported uncertainty of measurement was based on standard uncertainty multiplied by a coverage factor ( $k$ ) providing a level of confidence of approximately 95%. This certificate may not be reproduced other than in full except with the prior written approval of the Electrical and Electronics Institute, Foundation for Industrial Development.



Certificate No.: CP20230372EA

### Calibration Report

Equipment: Sound Level Meter  
 Manufacturer: 01dB (Meter), G.R.A.S. (Microphone), 01dB (Preamplifier)  
 Model/Type: CUBE (Meter), 40CD (Microphone), PRE22 (Preamplifier)  
 Serial No.: 14257 (Meter), 494247 (Microphone), 2138114 (Preamplifier)  
 ID No.: 14257 (Extension cable)  
 Ambient Temperature: ( 23 ± 2 ) °C  
 Relative Humidity: ( 50 ± 15 ) %  
 Pressure: (101.3 ± 1.5) kPa

Method of Calibration :-

IEC 61672-3:2013.

#### Condition of this result of calibration

1. Reference standards instrument :-

Instrument	Model	Serial No.	Cert. No.	Due Date
1) Standard microphone	4180	2787490	AA-1024-22	6 November 2023
2) Arbitrary Function Generator	AFG2021	C010063	CK20230040EA	26 June 2024
3) Programmable Attenuator	PA5	2755	EF-0034-22	30 October 2023
4) 6.5 Digit precision multimeter	8846A	9610014	CB20220223EA	14 November 2023
5) Pressure humidity and Temperature Transmitter	PTU301	F0640002	CL1-P230024 CD20230196EA	20 March 2024 23 July 2024
6) Pressure humidity and Temperature Transmitter	PTU301	F0640003	CL1-P230032 CD20230197EA	4 April 2024 23 July 2024
7) Performance Audio Analyzer	U8903B	MY56510003	CB20230038EA CK20230072EA	14 February 2024 13 September 2024

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

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

Reference standards instrument for Acoustic function

- National Institute of Metrology (Thailand)

Reference standards instrument for Electrical function

- National Institute of Metrology (Thailand)

- Electrical and Electronics Institute; NSC Accredited Calibration No.0119

#### Result of Calibration:-

Function : 1. Indication at the calibration check frequency

Reference Acoustic Signal (dB)	Correction for Microphone Model 40CD (dB)	Effective Calibration Level (dB)	Measured value (dB)	Deviation (dB)	Acceptance limits (dB)
-	-	-	-	-	-

Certificate No.: CP20230372EA

## Calibration Report

Function : 2. Self-generated Noise

### 2.1 Microphone Installed

Measured value (dB)
17.5

### 2.2 Microphone replaced by the electrical input signal device

Frequency Weighting	Measured value (dB)
A-weighting	11.7
C-weighting	11.5
Z-weighting	19.3

Function : 3. Acoustical signal tests of frequency weightings (With Windscreen)

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

Frequency (Hz)	Deviation from various Frequency Weighting Response Curve			
	C-Weighting (dB)	A-Weighting (dB)	Z-Weighting (dB)	Acceptance limits (dB)
125	0.0	-0.1	0.0	±1.0
1000	0.1	0.1	0.1	±0.7
8000	-1.2	-1.2	-0.7	+1.5; -2.5

Function : 4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

Frequency (Hz)	Deviation from various Frequency Weighting Response Curve			
	C-Weighting (dB)	A-Weighting (dB)	Z-Weighting (dB)	Acceptance limits (dB)
63	0.0	-0.2	0.1	±1.0
125	0.2	-0.1	0.0	±1.0
250	0.2	0.1	0.1	±1.0
500	0.3	0.1	0.2	±1.0
1000	0.2	0.2	0.2	±0.7
2000	0.2	0.1	0.1	±1.0
4000	0.8	0.8	0.8	±1.0
8000	0.0	-0.1	0.4	+1.5; -2.5
16000	-9.8	-9.7	-4.3	+2.5; -16.0



Certificate No.: CP20230372EA

### Calibration Report

Function : 5. Frequency and time weighting at 1 kHz

#### 5.1 Frequency weighting at 1 kHz

Frequency Weighting	Measured value (dB)	Deviated value (dB)	Acceptance limits (dB)
C-weighting	94.0	0.0	±0.2
A-weighting	94.0	0.0	±0.2
Z-weighting	94.0	0.0	±0.2

#### 5.2 Time weighting at 1 kHz

Time Weighting	Measured value (dB)	Deviated value (dB)	Acceptance limits (dB)
Fast	94.0	0.0	±0.1
Slow	94.0	0.0	±0.1
LAeq	94.0	0.0	±0.1

Function : 6. Long-Term Stability

Long-term stability over 30 minutes, with steady 1 kHz signal at reference level.

Time Period to Apply Signal (min)	Reference SPL (dB)	Record SPL at Conclusion of Time Period (dB)	Deviated value (dB)	Acceptance limits (dB)
30	94.0	94.0	0.0	±0.1

Function : 7. Level Linearity on the reference level range

#### 7.1 Level Linearity on the reference level range, Upper

Anticipated Value (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limits (dB)
94.0	94.0	0.0	±0.8
99.0	99.0	0.0	±0.8
104.0	104.0	0.0	±0.8
109.0	108.9	-0.1	±0.8
114.0	113.8	-0.2	±0.8
119.0	118.8	-0.2	±0.8
124.0	123.8	-0.2	±0.8
129.0	128.8	-0.2	±0.8

Certificate No.: CP20230372EA

### Calibration Report

#### 7.2 Level Linearity on the reference level range, Lower

Anticipated Value (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limits (dB)
94.0	94.0	0.0	±0.8
89.0	89.0	0.0	±0.8
84.0	84.0	0.0	±0.8
79.0	79.0	0.0	±0.8
74.0	74.0	0.0	±0.8
69.0	69.0	0.0	±0.8
64.0	64.0	0.0	±0.8
59.0	59.0	0.0	±0.8
54.0	54.0	0.0	±0.8
49.0	49.0	0.0	±0.8
44.0	44.0	0.0	±0.8
39.0	39.0	0.0	±0.8
34.0	33.8	-0.2	±0.8
29.0	28.8	-0.2	±0.8
24.0	24.0	0.0	±0.8

#### Function : 8. Tone burst response

Time Weighting	Tone burst duration, Tb (ms)	Measured value (dB)	Deviated value (dB)	Acceptance limits (dB)
Fast	200	134.0	0.0	±0.5
	2	117.0	0.0	+1.0 ; -1.5
	0.25	107.8	-0.2	+1.0 ; -3.0
Slow	200	127.6	0.0	±0.5
	2	108.0	0.0	+1.0 ; -3.0
LAE	200	128.0	0.0	±0.5
	2	108.0	0.0	+1.0 ; -1.5
	0.25	99.0	0.0	+1.0 ; -3.0

#### Function : 9. Peak C sound level

Number of cycles in test signal	Anticipated Value (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limits (dB)
Complete cycle	133.4	134.6	1.2	±2.0
Positive half cycle	132.4	131.5	-0.9	±1.0
Negative half cycle	132.4	131.5	-0.9	±1.0

#### Function : 10. Overload indication

Measured value (dB)		Deviated value (dB)	Acceptance limits (dB)
Positive one-half cycle	Negative one-half cycle		
139.2	139.6	0.4	±1.5



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Function : 11. High-Level Stability

High-level stability over 5 minutes, with steady 1 kHz signal, 1 dB below upper boundary.

Time Period to Apply Signal (min)	Reference SPL (dB)	Record SPL at Conclusion of Time Period (dB)	Deviated value (dB)	Acceptance limits (dB)
5	137.0	137.0	0.0	±0.1

### Uncertainty of measurement

Function	Uncertainty (dB)	Maximum-permitted uncertainty of measurement (dB)
1) Indication at the calibration check frequency	0.30	Not applicable
2) Self-generated Noise	0.10	Not applicable
3) Acoustical signal tests of frequency weightings - Free-field sound pressure response level	0.30	0.60 (10Hz to 4kHz) 0.70 (>4kHz to 10kHz)
4) Electrical signal tests of frequency weightings	0.20	0.20
5) Frequency and time weighting at 1 kHz	0.20	0.20
6) Long-Term Stability	0.10	0.10
7) Level Linearity on the reference level range	0.30	0.30
8) Tone burst response	0.20	0.30
9) Peak C sound level	0.20	0.35
10) Overload indication	0.20	0.25
11) High-Level Stability	0.10	0.10

Remarks:

1. Indication at the calibration check frequency can not measured because customer does not provide a sound calibrator.
2. The acceptance limit is for the deviated value.
3. Acceptance limits was IEC61672-3:2013 Class 1.
4. The coverage factor  $k = 2.00$

-- End of Report --