

## ภาคผนวกที่ 5

### เอกสารสอบเทียบความถูกต้องของเครื่องมือ

- เอกสาร 5-1 เอกสารสอบเทียบเครื่องมือการตรวจวิเคราะห์คุณภาพน้ำผิวดิน  
เอกสาร 5-2 เอกสารสอบเทียบเครื่องมือการตรวจวัดคุณภาพอากาศ

**ตารางสรุปการสอบเทียบเครื่องมือการตรวจวิเคราะห์**

รายการตรวจวัด	เครื่องมือเก็บตัวอย่าง	เครื่องมือตรวจวิเคราะห์
<b>คุณภาพน้ำผิวดิน</b>		
- Temperature	-	- Thermometer
- Conductivity	-	- Conductivity Meter
- pH	-	- pH Meter
- Total Suspended Solids (TSS)	-	- Electronic Balance
- Dissolved Oxygen (DO)	-	- Electronic Balance
- BOD <sub>5</sub>	-	- BOD Analyzer
- Grease & Oil	-	- Electronic Balance
- Total Iron	-	- ICP
- Total Coliform Bacteria (TCB)	-	- Incubator
- Fecal Coliform Bacteria (FCB)	-	- Water Bath
- Lead (Pb)	-	- ICP
- Cadmium (Cd)	-	- ICP
<b>คุณภาพอากาศในบรรยากาศ</b>		
- TSP	- High Volume Air Sampler No. B37	- Electronic Balance
- PM-10	- High Volume PM-10 Air Sampler No. B34	- Electronic Balance
- CO	- CO Analyzer No. B13	- CO Analyzer No. B13
- NO <sub>2</sub>	- NO <sub>2</sub> Analyzer No. B21	- NO <sub>2</sub> Analyzer No. B21

## เอกสารที่ 5-1

เอกสารสอบเทียบเครื่องมือการตรวจวิเคราะห์คุณภาพน้ำผิวดิน

**QUALITY CALIBRATION CO.,LTD.**

235 Petchkasem 63/2 Road, Laksong, Bangkai, Bangkok 10160  
Tel (662) 421-5402, (662) 444-0152-3, Fax (662) 809-4584  
www.qcalibration.com



CERTIFICATE No : 22T0572  
REFERENCE No : 63773-4

PAGE : 1 OF 2

**Certificate of Calibration**

**EQUIPMENT** : LIQUID IN GLASS THERMOMETER  
**MANUFACTURER** : PRECISION  
**MODEL** : -10 °C TO 250 °C  
**SERIAL No** : 33696  
**ID No** : TM 24/59  
**RESOLUTION** : 1 °C  
**TYPE** : TOTAL IMMERSION  
**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** : CHARUKIT L.  
**CALIBRATION DATE** : 24-Jan-22  
**APPROVED BY** : PONGSAK J.  
**ISSUED DATE** : 24-Jan-22  
**RECEIVED DATE** : 19-Jan-22

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

**QUALITY CALIBRATION CO.,LTD.**

235 Petchkasem 63/2 Road, Laksong, Bangkai, Bangkok 10160  
Tel (662) 421-5402, (662) 444-0152-3, Fax (662) 809-4584  
www.qcalibration.com

CERTIFICATE No : 22T0572

PAGE : 2 OF 2

**Calibration Report**

**EQUIPMENT** : LIQUID IN GLASS THERMOMETER  
**MANUFACTURER** : PRECISION  
**MODEL** : -10 °C TO 250 °C  
**ID No** : TM 24/59  
**RESOLUTION** : 1 °C  
**RECEIVED DATE** : 19-Jan-22  
**AMBIENT TEMPERATURE** : 23 °C ± 3 °C  
**SERIAL NUMBER** : 33696  
**TYPE** : TOTAL IMMERSION  
**CALIBRATION DATE** : 24-Jan-22  
**RELATIVE HUMIDITY** : 50 %RH ± 20 %RH

**CONDITION OF THIS RESULTS OF CALIBRATION**

- THIS INSTRUMENT WAS CALIBRATED BASED ON ASTM E77:1992 BY COMPARISON WITH STANDARD PLATINUM RESISTANCE THERMOMETER (SPRT) INTO LIQUID BATH TEMPERATURE CONTROLLER. THE TEMPERATURE SCALE USED WAS BASED ON ITS-90.
- REFERENCE STANDARD INSTRUMENTS :-

INSTRUMENT	MODEL	SERIAL No	CERTIFICATE No	DUE DATE
1) STANDARD THERMOMETER	1502	77964	21T3033	08-Mar-22
2) SPRT PROBE	5614	636626	21T3033	08-Mar-22
3) PRECISION BATH	7320	A21105	21T12433	16-Dec-22
- THIS RESULT WAS FOUND ACCURATE AS SHOWN ON DATE AND PLACE OF CALIBRATION ONLY.
- THIS RESULT EXCLUDE LONG TERM STABILITY OF THE UNIT UNDER CALIBRATION.
- THIS CERTIFICATE IS TRACEABLE TO THE INTERNATIONAL SYSTEM OF UNIT MAINTAINED AT:-  
- NATIONAL INSTITUTE OF METROLOGY (THAILAND).

**RESULT OF CALIBRATION : WITHOUT ADJUSTMENT**

STANDARD READING (°C)	UUC* READING (°C)	IMMERSION DEPTH (mm)	CORRECTION (°C)	EMERGENT STEM TEMPERATURE (°C)	UNCERTAINTY OF MEASUREMENT (±°C)
112.023	115.0	150	-2.977	N/A	0.15
117.407	121.0	156	-3.593	N/A	0.15

UUC\* : UNIT UNDER CALIBRATION

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



**QUALITY CALIBRATION CO.,LTD.**

235 Petchkasem 63/2 Road, Laksong, Bangkac, Bangkok 10160  
Tel (662) 421-5402, (662) 444-0152-3, Fax (662) 809-4584



CERTIFICATE No : 21E3592  
REFERENCE No : 60760-1

PAGE : 1 OF 2

**Certificate of Calibration**

EQUIPMENT : CONDUCTIVITY METER  
MANUFACTURER : EUTECH  
MODEL : CON 150  
SERIAL No : 2746308  
ID No : CD 04/61  
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 : 02-Apr-21

APPROVED BY : PONGSAK J.

ISSUED DATE : 02-Apr-21

RECEIVED DATE : 31-Mar-21

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

F-G010 REV 02

**QUALITY CALIBRATION CO.,LTD.**

235 Petchkasem 63/2 Road, Laksong, Bangkac, Bangkok 10160  
Tel (662) 421-5402, (662) 444-0152-3, Fax (662) 809-4584

CERTIFICATE No : 21E3592

PAGE : 2 OF 2

**Calibration Report**

EQUIPMENT : CONDUCTIVITY METER  
MANUFACTURER : EUTECH  
SERIAL NUMBER : 2746308  
RECEIVED DATE : 31-Mar-21  
AMBIENT TEMPERATURE : 20 °C ± 1 °C  
MODEL : CON 150  
ID No : CD 04/61  
CALIBRATION DATE : 02-Apr-21  
RELATIVE HUMIDITY : 50 % RH ± 15% RH

**CONDITION OF THIS RESULTS OF CALIBRATION**

1. THIS INSTRUMENT WAS CALIBRATED BY DIRECT MEASUREMENT METHOD. THE DISPLAY AND ELECTROD WAS CALIBRATED BY USING STANDARD CONDUCTIVITY BUFFER SOLUTION IN CONTROLLED TEMPERATURE BATH.
2. REFERENCE STANDARD INSTRUMENTS :-

INSTRUMENT	MODEL	LOT No	CERTIFICATE No	DUE DATE
1) REFERENCE MATERIAL	00652-26	CC20562	4066-11793752	09-Dec-21
2) REFERENCE MATERIAL	00652-30	CC20458	4173-11692041	04-Nov-21
3) REFERENCE MATERIAL	00652-32	CC20466	4068-11695401	05-Nov-21
4) REFERENCE MATERIAL	00652-34	CC20523	4069-11762897	01-Dec-21
5) BATH	260014	1247 48074	20T9392	10-Sep-21
6) STANDARD THERMOMETER	421504	55000379	20T9616	10-Sep-21

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 :-
  - NATIONAL INSTITUTE OF STANDARDS AND TECHNOLOGY (NIST), USA.
  - NATIONAL INSTITUTE OF METROLOGY (THAILAND)

**RESULT OF CALIBRATION : WITHOUT ADJUSTMENT****1. DISPLAY UNIT WITH ELECTROD S/N CONSEN91W**

CONDUCTIVITY BUFFER SOLUTION	UUC READING	CORRECTION	VALUE BEFORE ADJUSTMENT	UNIT	UNCERTAINTY OF MEASUREMENT (±)	COVERAGE FACTOR k
99.0	99.4	-0.40	N/A	µS/cm	3.0	2.0
1413.0	1413	0.00	N/A	µS/cm	30	2.0
9.992	9.55	0.44	N/A	mS/cm	0.21	2.0
99.915	80.3	19.62	N/A	mS/cm	2.1	2.0

**2. DISPLAY UNIT WITH TEMPERATURE**

STANDARD READING (°C)	UUC READING (°C)	CORRECTION	VALUE BEFORE ADJUSTMENT	UNCERTAINTY OF MEASUREMENT (±°C)	COVERAGE FACTOR k
25.003	25.0	0.0	N/A	0.0085	2.0

UUC : UNIT UNDER CALIBRATION

THE REPORTED UNCERTAINTY OF MEASUREMENT WAS BASED ON A STANDARD UNCERTAINTY MULTIPLIED BY A COVERAGE FACTOR SHOWN IN THE TABLE, PROVIDING A LEVEL OF CONFIDENCE APPROXIMATELY 95%.

END OF CALIBRATION REPORT

F-G010 REV 02



**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



CERTIFICATE No : 21E3943  
REFERENCE No : 60857-1

PAGE : 1 OF 3

**Certificate of Calibration**

**EQUIPMENT** : pH METER  
**MANUFACTURER** : HANNA  
**MODEL** : HI 3512  
**SERIAL No** : TH118035  
**ID No** : PH 04/56  
**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** : 20-Apr-21

**APPROVED BY** : PONGSAK J.

**ISSUED DATE** : 20-Apr-21

**RECEIVED DATE** : 09-Apr-21

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

**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

CERTIFICATE No : 21E3943

PAGE : 2 OF 3

**Calibration Report**

**EQUIPMENT** : pH METER  
**MANUFACTURER** : HANNA  
**ID No** : PH 04/56  
**RECEIVED DATE** : 09-Apr-21  
**AMBIENT TEMPERATURE** : 20 ° C ± 1 ° C  
**MODEL** : HI 3512  
**SERIAL NUMBER** : TH118035  
**CALIBRATION DATE** : 20-Apr-21  
**RELATIVE HUMIDITY** : 50 % RH ± 10% RH

**CONDITION OF THIS RESULTS OF CALIBRATION**

1. THIS INSTRUMENT WAS CALIBRATED BY DIRECT MEASUREMENT METHOD BASED ON WI-TQ-062 AND WI-TQ-063. THE DISPLAY UNIT WAS TESTED BY GENERATING STANDARD VOLTAGE TO THE UNIT AND READ THE VALUE COMPARED WITH CALCULATED VALUE. THE DISPLAY AND ELECTRODE WAS CALIBRATED BY USING STANDARD pH BUFFER
2. REFERENCE STANDARD INSTRUMENTS :-

INSTRUMENT	MODEL	SERIAL No	CERTIFICATE No / LOT No	DUE DATE
1) pH STANDARD SOLUTION	00651-36	CC639097	4956-10686748	05-Sep-21
2) pH STANDARD SOLUTION	00651-38	CC646738	4957-10828986	25-Oct-21
3) pH STANDARD SOLUTION	00651-40	CC635214	4958-10640234	13-Aug-21
4) PROCESS CALIBRATOR	744	7514008	20E1318	10-May-21
5) BATH	260014	1247 48074	20T9392	10-Sep-21
6) THERMOMETER WITH PROBE	421504	55000379	20T9616	10-Sep-21

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 SI UNIT MAINTAINED AT :-
  - NATIONAL INSTITUTE OF STANDARD AND TECHNOLOGY, USA.
  - NATIONAL INSTITUTE OF METROLOGY (THAILAND)

**RESULT OF CALIBRATION : ADJUSTMENT****1. DISPLAY UNIT ONLY**

SLOPE FACTOR k = 2.303 RT/F = 59 mV/pH

mV APPLIED	UUC READING (mV)	CORRECTION (mV)	UUC READING (pH)	UNCERTAINTY OF MEASUREMENT (± mV)	COVERAGE FACTOR k
414.11	414.8	-0.69	-0.43	0.14	2.0
354.95	355.6	-0.65	0.62	0.14	2.0
295.80	296.4	-0.60	1.68	0.14	2.0
236.64	237.2	-0.56	2.73	0.14	2.0
177.48	177.9	-0.42	3.79	0.14	2.0
118.32	118.8	-0.48	4.84	0.14	2.0
59.16	59.6	-0.44	5.89	0.14	2.0
0.00	0.4	-0.40	6.95	0.14	2.0
-59.16	-58.8	-0.36	7.99	0.14	2.0
-118.32	-117.9	-0.42	9.03	0.14	2.0
-177.48	-177.1	-0.38	10.07	0.14	2.0
-236.64	-236.3	-0.34	11.08	0.14	2.0
-295.80	-295.5	-0.30	12.09	0.14	2.0
-354.95	-354.7	-0.25	13.10	0.14	2.0
-414.11	-413.9	-0.21	14.11	0.14	2.0

END OF CALIBRATION REPORT PAGE 2 OF 3



# QUALITY CALIBRATION CO.,LTD.

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

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

CERTIFICATE No : 21E3943

PAGE : 3 OF 3

## Calibration Report

### RESULT OF CALIBRATION (CONTINUE) :

#### 2. DISPLAY UNIT WITH pH ELECTRODE S/N: 061416CM

STANDARD pH BUFFER SOLUTION (pH)	UUC READING (pH)	CORRECTION (pH)	VALUE BEFORE ADJUSTMENT	UNCERTAINTY OF MEASUREMENT (± pH)	COVERAGE FACTOR k
4.007	4.008	-0.001	4.018	0.012	2.0
6.992	7.001	-0.009	6.888	0.012	2.0
10.016	10.011	0.005	10.027	0.014	2.0

#### 3. PERCENT SLOPE 90%

UUC : UNIT UNDER CALIBRATION

THE REPORTED UNCERTAINTY OF MEASUREMENT WAS BASED ON A STANDARD UNCERTAINTY MULTIPLIED BY A COVERAGE FACTOR k, PROVIDING A LEVEL OF CONFIDENCE APPROXIMATELY 95%.

END OF CALIBRATION REPORT



CERTIFICATE No : 21M3165  
REFERENCE No : 60627-1

PAGE : 1 OF 2

## Certificate of Calibration

EQUIPMENT : DIGITAL BALANCE

MANUFACTURER : METTLER TOLEDO

MODEL : XSR 105DU

SERIAL No : B926859981

ID No : BA 10/62

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 : 19-Mar-21

APPROVED BY : PONGSAK J.

ISSUED DATE : 20-Mar-21

RECEIVED DATE : 19-Mar-21

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

CERTIFICATE No : 21M3165

PAGE : 2 OF 2

## Calibration Report

EQUIPMENT : DIGITAL BALANCE MODEL : XSR 105DU

MANUFACTURER : METTLER TOLEDO S/N : B926859981

ID No : BA 10/62 RECEIVED DATE : 19-Mar-21

AIR PRESSURE : 1009mbar  $\pm$  1mbar CALIBRATION DATE : 19-Mar-21

AMBIENT TEMPERATURE : 24°C  $\pm$  1°C RELATIVE HUMIDITY : 52%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 ADJUSTED USING WEIGHT OF QUALITY CALIBRATION TO ADJUST. 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-1-151	C02210415	09-Feb-23
2) STANDARD WEIGHT	E2	15843	C02210419	10-Feb-23
3) STANDARD WEIGHT	E2	QK-1-349	M2103235S	26-Mar-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&amp;MEASURES

## RESULT OF CALIBRATION :- WITHOUT ADJUSTMENT

1. ZERO SETTING FUNCTION : NORMAL
2. TARE FUNCTION : NORMAL
3. REPEATABILITY OF READING AT 100 g WAS 0.000055 g
4. DEPARTURE FROM NOMINAL VALUE/ LINEARITY

NOMINAL VALUE (g)	BALANCE READING (g)	CORRECTION (g)	UNCERTAINTY ( $\pm$ g)
0.00	0.00000	0.00000	0.000066
0.02	0.02002	-0.00002	0.000066
0.10	0.10002	-0.00002	0.000066
0.20	0.20003	-0.00003	0.000067
0.50	0.50002	-0.00002	0.000065
1.00	1.00000	0.00000	0.000066
2.00	1.99999	0.00001	0.000067
5.00	5.00000	0.00000	0.000068
10.00	10.00002	-0.00002	0.000070
20.00	20.0000	0.0001	0.000075
50.00	50.0000	0.0000	0.00013
100.00	100.0001	-0.0001	0.00019
120.00	120.0001	-0.0001	0.00022

## 5. OFF CENTER LOADING ERROR



POINT	READING (g)
1	50.0000
2	50.0000
3	50.0000
4	50.0000
5	50.0000
OFF-CENTER LOADING	0.0000

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





MIRACLE INTERNATIONAL TECHNOLOGY CO.,LTD

214 Bangwaek Rd. Bangpai Bangkae Bangkok 10160  
Tel.: 0-2865-4647-8 Fax: 0-2865-4649 http://www.mit.in.th



## CALIBRATION CERTIFICATE

Certificate No. : SS2110-013-0003

Date Issued : 04-Oct-21

**Customer & Calibrated Place** : S.P.S. CONSULTING SERVICE CO., LTD.  
7 Soi Phaholyothin 24 Phaholyothin Road., Jompol, Chatuchak, Bangkok 10900

**Equipment** : Incubator  
**Manufacturer** : BINDER  
**Model** : BD 115  
**Serial No.** : 12-16967  
**ID No./Tag No.** : IN 05/56  
**Date Received** : 01-Oct-21  
**Date Calibrated** : 01-Oct-21  
**Calibrated by** : Mr. Jame Khaothong

### Calibration Method or Calibration Procedure Used

Standard method : CP-05 TLAS G-20.

This certificate is traceable to national standards, which realize the units of measurement according to the International System of Units (SI).

### Result of Calibration

The reported uncertainty of measurement was based on standard uncertainty multiplied by a coverage factor  $k = 2$ , providing a level confidence approximately 95 percent.

This certificate may not be reproduced other than in full except with the prior written approval of the Miracle International Technology Company Limited.

Approved by :

*K. Nathapong*

(Mr. Nathapong Krudaum)



Page 1 of 2

Certificate No. : SS2110-013-0003

**Environment** : Ambient Temperature : Start record 26.0 °C, Stop record 25.7 °C  
Relative Humidity : Start record 56.5 %RH, Stop record 55.7 %RH

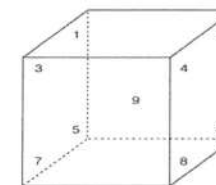
Calibration Temperature (°C)	Setting Temperature (°C)	Indicating Temperature (°C)	Measured Stability <sup>1</sup> (°C)	Measured Uniformity <sup>2</sup> (°C)	Overall Variation <sup>3</sup> (°C)
35	35.0	35.0	0.12	0.40	0.45
41.5	41.5	41.5	0.11	0.39	0.51

Without adjustment

Calibration Temperature (°C)	STD No. 1 (°C)	STD No. 2 (°C)	STD No. 3 (°C)	STD No. 4 (°C)	STD No. 5 (°C)	STD No. 6 (°C)	STD No. 7 (°C)	STD No. 8 (°C)	STD No. 9 (°C)	Uncertainty <sup>4</sup> ±°C
35	35.01	35.11	34.95	35.00	34.99	34.95	35.07	35.07	35.23	0.23
41.5	41.47	41.47	41.40	41.49	41.37	41.33	41.43	41.51	41.62	0.22

Note : Probe No. 9 is Reference Probe

Setting Air Fresh No. 0



### Measurement Standards Used & Traceability :

The International System of Units (SI) through

MIT Certificate No. AD2107-034-0001 for Digital Thermometer with Probe (Agilent) Module 1 (245) Serial No. US37005130, Due 04-Feb-22

Notes : 1. The temperature stability is the one-half of greatest maximum difference of measured temperatures at any one probe.

2. The temperature uniformity is the maximum difference of measured temperatures between of any probes and the measured temperature at the reference location which are observed at same time.

3. Overall variation is the difference of maximum and minimum measured temperatures throughout observation time.

4. The uncertainty of measurement is included temperature stability.

5. The temperature uniformity, stability, overall variation and indicating temperature is applicable to all air or gas filled temperature controlled enclosures at atmospheric pressure.

End of Certificate

Page 2 of 2



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)  
CORPORATE SERVICES 3 : EQUIPMENT CALIBRATION AND TESTING SERVICES

534/4 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG BANGKOK 10250

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

Cert.No.: 21TW92

Page.: 1 of 2

## Certificate of Testing

Equipment : DO Meter  
Manufacturer : YSI  
Model : 5100  
Serial No. : 01H1079 AB  
ID No. : -  
Received Date : 19 April 2021  
Test Date : 21 April 2021  
Reference : 2104-0372WN-1  
Submitted by : S.P.S. Consulting Service Co.,Ltd.  
7 Soi Phaholyothin 24, Phaholyothin Rd.,  
Jompol, Chatuchak, Bangkok 10900  
Laboratory Condition : Temperature ( 25 ± 5 ) °C  
Humidity (50 ± 20) %  
Test Procedure : In - house method : CP-CH9  
by Comparison Technique with Azide Modification Method  
Tested by : Walalak Sirithean

Approved by : Warakorn.  
Approved Signatory

- ( ) Malee Butkruea  
( ) Saithip Meangmai  
( ✓ ) Warakorn Lernagtrakul

Issue Date : 26 April 2021

B 0259252



Cert.No.: 21TW92

Page.: 2 of 2

Result : Dissolved Oxygen Meter Adjustment With Air 100 %

Dissolved Oxygen Probe No.: 14J100195

Titration Method (Azide Modification Method) (mg/L)	DO Meter Reading (mg/L)	Standard Deviation (mg/L)
8.00	7.99	0.0055

This report was certified only for the instrument we tested. It is allowable to use for study the system efficiency. The environmental impact control and present to organization it may concerned. Intend to use for advertising and referral purpose is prohibited. This report may not be reproduced other in full, without written approval of the laboratory

-o0o-

Warakorn

a 1052037





WO-01513756/2022

**MAINTENANCE AND TEST CERTIFICATE MODEL**  
**OPTIMA 5300DV**

<b>Customer :</b> S.P.S.Consulting Service Co.,Ltd	<b>Date Tested:</b> January 12, 2022
<b>Address :</b> 7 Soi Phaholyothin 24	<b>Recommendation Recertification</b>
Paholyothin Road	Period 6 Months
Jompol Chatuchak, Bangkok 1090	Recertification Due: July 12, 2022
<b>User Name:</b> K.Phenpha Vipasthawat	Date Last Certified: July 14, 2021
<b>Phone:</b> 083-9269252	Visit Number: 2 of 2
<b>Fax:</b> 02-513-4221	PerkinElmer Phone: 02-719-6420 ext 206
	PerkinElmer Fax: 02-318-5597

CONFIGURATION TESTED		ACCESSORIES/COMPONENT NOT INCLUDED
<b>MODEL</b>	<b>SERIAL NUMBER</b>	
OPTIMA 5300DV	077C7042401	
<b>TESTED EQUIPMENT</b>	<b>CALIBRATION NUMBER</b>	<b>EXPIRATION</b>
IPV Methods		
<b>TEST STANDARD USED</b>	<b>PART NUMBER</b>	<b>EXPIRATION DATE</b>
Multielement Standard	N069-1579	August 30, 2022
Wavecal Solution	N058-2152	January 30, 2022
VIS Wavecal solution	N930-2946	June 30, 2022
Instrument Cal. STD4	N930-0221	August 30, 2022
<b>CUSTOMER SUPPLIED</b>	<b>COMMENTS</b>	<b>CUSTOMER INITIALS</b>
2 % HNO3		
10 % HNO3		

Page 1 of 4



WO-01513756/2022

**MAINTENANCE AND TEST CERTIFICATE MODEL**  
**OPTIMA 5300DV**

<b>SERIAL NUMBER</b> 077C7042401	<b>DATE TESTED</b> January 12, 2022
<b>1. MECHANICAL CHECKS</b>	
A. Inspect and clean all fans and filters.	<input type="checkbox"/>
B. Inspect and replace as necessary, all torch components including the RF coil.	<input type="checkbox"/>
C. Inspect all tubing for sign of clacking or leaking.	<input type="checkbox"/>
D. Adjust water and gas pressure regulator settings.	<input type="checkbox"/>
E. Inspect and leak check pneumatics drawers.	<input type="checkbox"/>
F. Clean the exterior of the instrument.	<input type="checkbox"/>
<b>2. OPTICAL CHECKS</b>	
A. Inspect and clean all optical components.	<input type="checkbox"/>
B. As required, check and replace all purgefilters.	<input type="checkbox"/>
C. Recheck optical alignment.	<input type="checkbox"/>
<b>3. COOLING SYSTEM CHECKS</b>	
A. Perform preventive maintenance on chiller.	<input type="checkbox"/>
B. Flush out the chiller every year.	<input type="checkbox"/>
<b>4. PERFORMANCE CHECKS</b>	
A. Torch View Alignment.	<input type="checkbox"/>
B. Wavelength Calibration.	<input type="checkbox"/>

Page 2 of 4

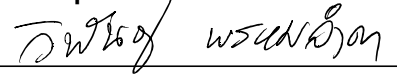


**MAINTENANCE AND TEST CERTIFICATE MODEL**  
**OPTIMA 5300DV**

SERIAL NUMBER : 077C7042401		DATE TESTED : January 12, 2022	
PARAMETER	SPECIFICATION		FINAL VALUE
Spectral Resolution : UV	As 193.696 nm	≤ 0.007	0.00554
	Ni 231.604 nm	≤ 0.008	0.00725
	Ni 341.476 nm	≤ 0.012	0.00752
Spectral Resolution : VIS	La 408.672 nm	≤ 0.020	0.01616
	Ba 455.403 nm	≤ 0.025	0.02416
Precision	As 193.656 nm	% RSD < 1.0	0.34 %
	Zn 213.856 nm	% RSD < 1.0	0.27 %
	Mn 257.610 nm	% RSD < 1.0	0.41 %
	La 379.478 nm	% RSD < 1.0	0.57 %
	Ba 455.403 nm	% RSD < 1.0	0.33 %
	Ba 493.408 nm	% RSD < 1.0	0.26 %
Detection Limits : Axial	Tl 190.080 nm	3(sd)	5.51 ppb
	As 193.696 nm	3(sd)	8.59 ppb
	Pb 220.353 nm	3(sd)	0.50 ppb
Detection Limits : Radial	As 193.696 nm	3(sd)	21.00 ppb
	Zn 213.856 nm	3(sd)	0.32 ppb
	Mn 257.610 nm	3(sd)	0.18 ppb
	La 379.478 nm	3(sd)	0.44 ppb
	Ba 455.403 nm	3(sd)	0.17 ppb
	Ba 493.408 nm	3(sd)	0.12 ppb
BEC : Axial (IB X 500)/(IS-IB)	Cd 226.502 nm	≤ 150 ppb	12.46
BEC : Radial (IB X 1000)/(IS-IB)	Mn 257.610 nm	≤ 45 ppb	30.82



**MAINTENANCE AND TEST CERTIFICATE MODEL**  
**OPTIMA 5300DV**

SERIAL NUMBER	077C7042401	DATE TESTED	January 12, 2022
Remarks :			
Commissioning follow as commissioning performance sheets.			
This is to certify that the above tests have been performed and the configuration tested			
<input checked="" type="checkbox"/> meets		<input type="checkbox"/> does not meet	
the PerkinElmer Specifications listed on this certificate.			
This certificate does not modify PerkinElmer's standard terms and condition of sale, including warranty terms.			
<b>Service Department PerkinElmer Ltd.</b>			
Authorized Representative:			
		( Mr. Wiphan Promlumda )	
		Service Engineer	



**QUALITY CALIBRATION CO.,LTD.**

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

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

www.qcalibration.com



CERTIFICATE No : 20T2746

REFERENCE No : 56382-4

PAGE : 1 OF 2

**Certificate of Calibration**

EQUIPMENT : WATER BATH  
MANUFACTURER : MEMMERT  
MODEL : WNE45  
SERIAL No : L715.0400  
ID No : WB06/58  
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 : CHAICHARN CH.

CALIBRATION DATE : 20-Mar-20

APPROVED BY : PONGSAK J.

ISSUED DATE : 21-Mar-20

RECEIVED DATE : 20-Mar-20

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

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

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

www.qcalibration.com

CERTIFICATE No : 20T2746

PAGE : 2 OF 2

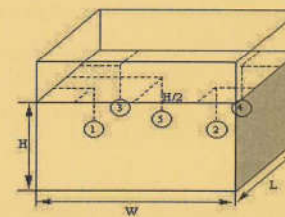
**Calibration Report**

EQUIPMENT : WATER BATH  
MANUFACTURER : MEMMERT  
ID NUMBER : WB06/58  
RECEIVED DATE : 20-Mar-20  
AMBIENT TEMPERATURE : 23 °C ± 1 °C  
MODEL : WNE45  
SERIAL NUMBER : L715.0400  
CALIBRATION DATE : 20-Mar-20  
RELATIVE HUMIDITY : 48 %RH ± 10 % RH

**CONDITION OF THIS RESULTS OF CALIBRATION**

1. THIS INSTRUMENT WAS CALIBRATED ACCORDING TO ASTM E715-80 (REAPPROVED 2001) BY COMPARISON WITH CALIBRATED RTD. THE PROBES WERE PLACED ON FIVE POINTS AND LOCATED ONE PROBE IN EACH OF THE FOUR CORNERS OF THE BATH AND PLACED THE FIFTH RTD WITHIN 2.5 cm. OF THE GEOMETRIC CENTER OF THE WATER VOLUME (REFERENCE LOCATION) UNDER NO LOAD CONDITION.
2. REFERENCE STANDARD INSTRUMENTS :-

INSTRUMENT	MODEL	SERIAL No	CERTIFICATE No	DUE DATE
1) DATA LOGGER WITH RTD	2635A	7286308	19T6777	27-Jul-20
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 QUALITY CALIBRATION CO.,LTD.				

**RESULT OF CALIBRATION :- WITHOUT ADJUSTMENT**PROBE INSTALLATION  
POSITION IN THE BATH**GENERAL INFORMATION**

Overall Variation of Ambient Temperature around the Bath (°C) : 0.7
Overall Variation of Line Voltage (V) : 3
Instrument Condition : Normal

**BATH PERFORMANCE**

Controller Temperature (°C)	Indicating Temperature (°C)	Temperature Stability (±°C)	Temperature Uniformity (°C)	Overall Variation (°C)
44.7	44.7	0.02	0.02	0.05

**TEMPERATURE MEASUREMENT ACCURACY TEST**

Controller Temp (°C)	Indicating Temp (°C)	Measured Temperature (°C) at Spread Locations					Uncertainty (± °C)
		#1	#2	#3	#4	Ref. 5	
44.7	44.7	44.53	44.54	44.53	44.53	44.53	0.14

NOTE 1 : THE UNCERTAINTY OF MEASUREMENT EXCLUDED TEMPERATURE UNIFORMITY OF THE BATH.

NOTE 2 : 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

## เอกสารที่ 5-2

เอกสารสอบเทียบเครื่องมือการตรวจวัดคุณภาพอากาศ





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

## 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 <sup>3</sup> /min)	R <sup>2</sup>
B35	B35	02/05/2022	$y = 1.345x - 12.323$	0.999
B36	B36	03/05/2022	$y = 1.154x - 4.565$	0.999
B37	B37	04/05/2022	$y = 1.139x - 2.122$	0.996
B38	B38	06/05/2022	$y = 1.126x - 2.401$	0.999
B39	B39	02/05/2022	$y = 1.188x - 5.455$	0.998
B40	B40	06/05/2022	$y = 1.156x - 3.823$	0.995
B41	B41	06/05/2022	$y = 1.187x - 6.052$	0.997
B42	B42	04/05/2022	$y = 1.063x + 0.537$	0.998
B43	B43	04/05/2022	$y = 1.258x - 9.645$	0.998
B44	B44	03/05/2022	$y = 1.252x - 9.964$	0.999
R01	R01	02/05/2022	$y = 1.220x - 6.992$	0.999
R02	R02	10/05/2022	$y = 1.121x - 3.616$	0.997
R03	R03	02/05/2022	$y = 1.161x - 5.046$	0.999
R04	R04	06/05/2022	$y = 1.115x - 1.773$	0.999
R05	R05	06/05/2022	$y = 1.217x - 7.663$	0.998
R06	R06	04/05/2022	$y = 1.245x - 8.155$	0.996
R07	R07	06/05/2022	$y = 1.042x + 1.155$	0.995
R08	R08	04/05/2022	$y = 1.220x - 6.674$	0.998
R09	R09	04/05/2022	$y = 1.192x - 5.710$	0.997
R10	R10	10/05/2022	$y = 1.209x - 6.199$	0.999
R11	R11	02/05/2022	$y = 1.101x - 2.414$	0.999
R12	R12	10/05/2022	$y = 1.209x - 6.618$	0.995
R13	R13	10/05/2022	$y = 1.158x - 3.923$	0.999
R14	R14	06/05/2022	$y = 1.128x - 2.065$	0.999
R15	R15	04/05/2022	$y = 1.014x + 2.496$	0.998
R16	R16	04/05/2022	$y = 1.159x - 5.442$	0.997
R17	R17	10/05/2022	$y = 1.203x - 5.717$	0.999
R18	R18	02/05/2022	$y = 1.325x - 12.252$	0.997
R19	R19	03/05/2022	$y = 1.246x - 7.147$	0.998
R20	R20	04/05/2022	$y = 1.230x - 7.354$	0.999

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

## 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 <sup>3</sup> /min)	R <sup>2</sup>
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

Calibrated by :

Phakhinai Khongkomnerd  
(Mr. Phakhinai Khongkomnerd)

Approved by :

Mr. Peera Detudom  
(Mr. Peera Detudom)





CERTIFICATE No : 22M2570  
REFERENCE No : 64386-4

PAGE : 1 OF 2

## Certificate of Calibration

EQUIPMENT : DIGITAL BALANCE  
MANUFACTURER : METTLER TOLEDO  
MODEL : XSR 105DU  
SERIAL No : B926859981  
ID No : BA 10/62  
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 : TEJNITHI 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 : 22M2570

PAGE : 2 OF 2

## Calibration Report

EQUIPMENT : DIGITAL BALANCE  
MANUFACTURER : METTLER TOLEDO  
ID No : BA 10/62  
AIR PRESSURE : 1008mbar  $\pm$  1mbar  
AMBIENT TEMPERATURE : 22°C  $\pm$  1°C  
MODEL : XSR 105DU  
S/N : B926859981  
RECEIVED DATE : 11-Mar-22  
CALIBRATION DATE : 11-Mar-22  
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-1-151 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

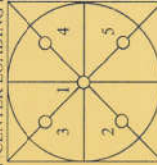
3. REPEATABILITY OF READING AT 20 g WAS 0.000014 g

4. REPEATABILITY OF READING AT 100 g WAS 0.000042 g

5. DEPARTURE FROM NOMINAL VALUE/ LINEARITY

NOMINAL VALUE (g)	BALANCE READING (g)	CORRECTION (g)	UNCERTAINTY ( $\pm$ g)
0.00	0.00000	0.00000	0.000051
0.02	0.01999	0.00001	0.000051
0.10	0.10000	0.00000	0.000052
0.20	0.20001	-0.00001	0.000050
0.50	0.50002	-0.00002	0.000051
1.00	1.00002	-0.00002	0.000052
2.00	2.00002	-0.00002	0.000054
5.00	5.00003	-0.00003	0.000058
10.00	10.00007	-0.00007	0.000067
20.00	20.00007	-0.00007	0.000111
50.00	50.00000	-0.00001	0.00019
100.00	100.00001	-0.00001	0.00022
120.00	120.00001	-0.00001	0.00022

6. OFF CENTER LOADING ERROR



POINT	READING (g)
1	10.00003
2	10.00003
3	10.00004
4	10.00003
5	10.00003
OFF-CENTER LOADING	0.00001

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





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

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

DATE : 25 May 2022

BRAND : API

MODEL : TML-41M

NO. NOX-B21

SERIAL NO. N02374

#### Calibrator (Dilution System)

Brand : API

Model : 700

Last Cal. Date : 05 August 2021

Serial No. : 911

#### Reference Standard Gas

Standard Gas : Nitric Oxide (NO)

Cylinder No. : A00681SK

Certified Date : 24 August 2020

Expired Date : 24 August 2022

Cylinder Conc. : 51.0 ppm

#### CALIBRATING CONDITION

Pressure 1011 mmbar

Temp. 24.5 °C

% RH 48

#### 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	-
NO Span	400	400.1	0.025	400.0	1.006
NO <sub>x</sub> Span	400	400.2	0.050	400.0	1.010

#### API Model TML-41M 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	103.1	mV	-20 - 150
AZERO	93.9	mV	-20 - 150
HVPS	674	V	420 - 900 constant
RCELL TEMP	50.1	°C	50 ± 1
BOX TEMP	29.2	°C	8 - 48
PMT TEMP	7.3	°C	7 ± 2
MOLY TEMP	315.1	°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	1.006	-	1.0 ± 0.3
NO <sub>x</sub> Slope	1.010	-	1.0 ± 0.3
NO Offset	1.5	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 : Phakthinai Khongkomnerd  
(Mr.Phakthinai 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

## CALIBRATION REPORT

### NON-DISPERSIVE INFRARED CO ANALYZER

DATE : 25 May 2022 BRAND : API MODEL : 300E  
NO. CO-B13 SERIAL NO. 176

#### 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 48

#### 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	40.04	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	4015.2	mV	2500-4800 mV
CO REFERENCE	3949.5	mV	2500-4800 mV
MEASURE/REFERENCE RATIO	1.179	-	1.1-1.3 w/zero air
SAMPLE PRESSURE	28.5	In-Hg-A	~2" < ambient absolute pressure
SAMPLE FLOW	809	cc/min	800 ± 10%
SAMPLE TEMPERATURE	48.2	°C	48 ± 4
BENCH TEMPERATURE	48.0	°C	48 ± 2
WHEEL TEMPERATURE	68.3	°C	68 ± 2
BOX TEMPERATURE	30.7	°C	Ambient temp + 7 ± 10
PHOTO-DRIVE	3007.4	mV	250 mV to 4750 mV
SLOPE	1.017	-	1.0 ± 0.3
OFFSET	0.2	-	0 ± 0.3

Calibrated by : Phakhinai Khongkomnerd  
(Mr.Phakhinai Khongkomnerd)

Approved by : (Mr.Peera Detudom)