

ภาคผนวกที่ 4

เอกสารสอบเทียบความถูกต้องของเครื่องมือตรวจวัดคุณภาพสิ่งแวดล้อม

**ตารางสรุปรายการเอกสารการสอบเทียบความถูกต้องของเครื่องมือเก็บตัวอย่าง
และเครื่องมือตรวจวิเคราะห์คุณภาพสิ่งแวดล้อม**

รายการตรวจวัด	เครื่องมือเก็บตัวอย่าง	เครื่องมือตรวจวิเคราะห์
	ชื่อเครื่องมือ	ชื่อเครื่องมือ
1. คุณภาพอากาศจากปล่อง Total Suspended Particulate	Console No. R05 Pitot Tube No. B14, B26, B42	Digital Balance
Oxides of Nitrogen (NO _x)	Vacuum Gauge	Spectrophotometer
2. คุณภาพอากาศในบรรยากาศ Total Suspended Particulate	High Volume Air Sampler Rec No. , Blow No. R02, R04	Digital Balance
PM ₁₀	High Volume PM-10 Air Sampler Rec No. , Blow No. R03, R05	Digital Balance
Nitrogen Dioxide	NO/NO ₂ /NO _x Analyzer No. R06, R10	NO/NO ₂ /NO _x Analyzer No. R06, R10
3. ระดับเสียง L _{eq} 24 hr, L ₉₀ , L _{max} และ L _{dn}	Acoustic Calibrator Sound Level Meter No. ACO-R22, R23, R27, R39	-
4. คุณภาพน้ำ pH	-	pH Meter
TSS	-	Digital Balance
COD	-	COD Reactor
Oil and Grease	-	Digital Balance
5. คุณภาพอากาศในสถานประกอบการ Total Dust	Personal Pump SKC No. R07, R16 Rotameter No. H-R01	Digital Balance
Respirable Dust	Personal Pump SKC No. R35 Rotameter No. H-R01	Digital Balance
Aluminium	Personal Pump SKC No. R19, R20 Rotameter No. H-R01	ICP
Hydrogen Fluoride	Personal Pump SKC No. R27 Rotameter No. L-R01	Ion Chromatography
Oil Mist	Personal Pump SKC No. R12 Rotameter No. L-R01	Ion Chromatography
6. ระดับเสียงในสถานประกอบการ L _{eq} 1 hr, L _{eq} 8 hr และ	Acoustic Calibrator Sound Level Meter ACO No. R20, R21, R23	-
Noise Dose	Acoustic Calibrator Sound Level Meter ACO No. R15, R19, R35	-
7. ระดับความร้อนใน สถานประกอบการ WBGT	Heat Stress WBGT Meter No. B17, B22, B34	-

คุณภาพอากาศจากปล่อง



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

Console Calibration Report

Calibration Method

Critical Orifices

Calibration Data

Console Data		Calibration Data		
No.	Serial No.	Date	y	$\Delta H_{@}$ (mmH ₂ O)
B01	1563	01/06/2021	0.997	49.36
B02	8002514	01/06/2021	1.007	50.08
B03	1503016	01/06/2021	0.996	49.87
B04	2883	02/06/2021	1.003	49.13
B05	1609067	02/06/2021	0.999	50.12
R01	1561	01/06/2021	0.997	49.34
R02	8002513	01/06/2021	0.998	50.46
R03	1570	02/03/2021	1.003	49.90
R04	8002519	01/06/2021	1.005	50.05
R05	1503015	01/06/2021	0.995	48.89

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

Accept Value of $\Delta H_{@}$ (test) is 46.7 ± 6.4 (mmH₂O)

Calibrated by :

Phakhinai Khongkomnerd
(Mr. Phakhinai Khongkomnerd)

Approved by :

Peera Detudom
(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

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
B03	S	0.99	13/05/2021	0.84	0.84
B04	S	0.99	13/05/2021	0.84	0.83
B05	S	0.99	05/05/2021	0.84	0.84
B07	S	0.99	05/05/2021	0.85	0.84
B08	S	0.99	05/05/2021	0.83	0.84
B09	S	0.99	05/05/2021	0.84	0.85
B11	S	0.99	05/05/2021	0.84	0.84
B16	S	0.99	06/05/2021	0.84	0.84
B18	S	0.99	06/05/2021	0.85	0.84
B19	S	0.99	06/05/2021	0.83	0.84
B21	S	0.99	17/05/2021	0.84	0.84
B24	S	0.99	06/05/2021	0.83	0.84
B27	S	0.99	07/05/2021	0.84	0.84
B30	S	0.99	07/05/2021	0.84	0.85
B31	S	0.99	07/05/2021	0.84	0.83
B33	S	0.99	07/05/2021	0.85	0.84
B35	S	0.99	05/05/2021	0.84	0.84

Remark : Accept value of Cp (test) is 0.84 ± 0.01

Calibrated by :

Phakhinai Khongkomnerd
(Mr. Phakhinai Khongkomnerd)

Approved by :

Peera Detudom
(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

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	07/05/2021	0.83	0.84
B37	S	0.99	07/05/2021	0.85	0.84
B38	S	0.99	07/05/2021	0.84	0.83
B39	S	0.99	05/05/2021	0.84	0.84
B40	S	0.99	05/05/2021	0.84	0.85
B41	S	0.99	05/05/2021	0.84	0.84
B44	S	0.99	06/05/2021	0.84	0.83
B45	S	0.99	06/05/2021	0.85	0.84
B46	S	0.99	13/05/2021	0.84	0.84
B47	S	0.99	05/05/2021	0.83	0.84
B48	S	0.99	05/05/2021	0.84	0.83
B49	S	0.99	05/05/2021	0.85	0.84
B54	S	0.99	06/05/2021	0.84	0.84
B56	S	0.99	06/05/2021	0.83	0.84
B57	S	0.99	06/05/2021	0.84	0.84
B58	S	0.99	06/05/2021	0.84	0.85

Remark : Accept value of Cp (test) is 0.84 ± 0.01

Calibrated by :

Phakhinai Khongkomnerd
(Mr. Phakhinai Khongkomnerd)

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.comNSC-TISI-TISI7025
CALIBRATION 0049

CERTIFICATE No : 21M3169

REFERENCE No : 60627-5

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 : 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.

**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 : 21M3169

PAGE : 2 OF 2

Calibration Report

EQUIPMENT : DIGITAL BALANCE MODEL : XS105DU
MANUFACTURER : METTLER TOLEDO S/N : 1126422905
ID No : BA 05/50 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-I-151	C02210415	09-Feb-23
2) STANDARD WEIGHT	E2	15843	C02210419	10-Feb-23
3) STANDARD WEIGHT	E2	QK-I-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&MEASURES

RESULT OF CALIBRATION :- WITHOUT ADJUSTMENT

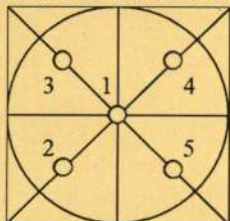
1. ZERO SETTING FUNCTION : NORMAL

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	0.01998	0.00002	0.000066
0.10	0.10001	-0.00001	0.000066
0.20	0.20001	-0.00001	0.000067
0.50	0.49996	0.00004	0.000065
1.00	0.99997	0.00003	0.000066
2.00	2.00000	0.00000	0.000067
5.00	5.00002	-0.00002	0.000068
10.00	10.00003	-0.00003	0.000070
20.00	20.00000	0.00000	0.000075
50.00	50.00000	0.00000	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

Lambda UV Preventive Maintenance (PM)

Company Name:	S.P.S. CONSULTING SERVICE CO., LTD.		
Address:	7 Phaholyothin 24 Chompol Chatujak Bangkok		
User Name:	เบญจวรรณ	WO Number:	WO-01090784
Telephone Number:	086-141-2523	PM Number:	5 of 6
Customer Support Engineer:	Kerkkiat Kerdasil	Certificate Number:	UV5005-2021
Date PM Performed: (DD-MMM-YYYY)	28-Jan-2021	Next PM Due Date: (DD-MMM-YYYY)	28-Jul-2021

Scope

The purpose of this PM is to ensure the continued functionality of the PerkinElmer Lambda UV/Vis Spectrophotometer by inspecting and replacing any worn or damaged parts. This service should only be performed by a trained representative of PerkinElmer. The customer should save their method before the PM begins.

General Instructions:

The customer must provide the engineer operational data to demonstrate recent instrument performance prior to starting the PM. Always check with the customer before making any changes that may affect the customer's analysis should be signed by an authorized PerkinElmer and customer representative and left with the customer. Update the PM sticker and instrument logbook as required.

Copyright Information

This document contains proprietary information that is protected by copyright. All rights are reserved. No part of this publication may be reproduced in any form whatsoever or translated into any language without the prior, written permission of PerkinElmer, Inc. Copyright © 2009 PerkinElmer, Inc.

Trademarks

Registered names, trademarks, etc. used in this document, even when not specifically marked as such, are protected by law. PerkinElmer is a registered trademark of PerkinElmer, Inc. All other trademarks and registered trademarks not owned by PerkinElmer, Inc. or its subsidiaries that are depicted herein are the property of their respective owners. Except as specifically set forth in its terms and conditions of sale, PerkinElmer makes no Warranty of any kind with regard to this document, including, but not limited to, the implied warranties of merchantability and fitness for a particular purpose. PerkinElmer shall not be liable for incidental or consequential damages in connection with the furnishing or use of this document.

Component List

Component Specific Model	Serial #	Software Version		Configuration Notes
LAMBDA25	501S14123010	6.2.0.0741	STD	1.27
NA	NA	NA	NA	NA

Standard Lists

Part Number (If applicable)	Description	Quantity	Batch/Lot/SN#	Expiration Date (MM-YY)
B250 0999	Stray Light Standard			
	NaI	1	1705	Jun-21
	NaNO2	1	21060	
	KCl	1	31280	
	H2O	1	71015	
RM-1N2N3N	Secondary Standard for calibration of wavelength and photometric accuracy or use NBS/NIST 930 standards			
	Gray Glass G1	1	1882	Jun-21
	Gray Glass G2	1	1882	
	Gray Glass G3	1	1502	
	Holmium Oxide	1	1822	
	NA	NA	NA	
	NA	NA	NA	

Additional Parts Required for PM					
Part Number (if applicable)	Description	Quantity	Serial #		Remark
NA	NA	NA	NA		NA
NA	NA	NA	NA		NA
NA	NA	NA	NA		NA
Additional Reagents and Standards Required for PM					
Part Number (if applicable)	Description	Quantity	Batch/Lot #		Expiration Date (MM/YY)
NA	NA	NA	NA	NA	NA
NA	NA	NA	NA	NA	NA
NA	NA	NA	NA	NA	NA

Procedure Checklist

Use (✓) to check off those steps in the checklist that have been completed.

1. General:

- ☒ Review the instrument performance with the customer and document any recent problems.
- ☒ Inspect the customer log book and make any appropriate PM entries.
- ☒ Perform general inspection of system for cleanliness.

2. Optical checks:

- ☒ Lamp Alignment/Energy
- ☒ Sample Compartment Windows/Monochromator
- ☒ Mirror and Grating Alignment
- ☒ Cell Holder Alignment

3. Mechanical:

- ☒ Physical inspection – Please write any comments in the additional comments section.
- ☒ Grating Drive Mechanism.
- ☒ Lamp Change Mechanism.
- ☒ Slit Drive Manual Servo.

4. Performance Test:

- ☒ D2 Wavelength accuracy

	Actual Value	Specification
Accuracy at 656.1 nm	656.12	± 0.1

- ☒ Holmium Oxide wavelength accuracy. (Specification ± 0.5 nm.)

Filter ID #		1822	
Test	Calibration Value	Actual Value	Deviation
279.3 nm	279.3	279.41	0.11
360.8 nm	360.9	361.01	0.11
459.9 nm	460.0	460.17	0.17
536.4 nm	536.3	536.44	0.14

- ☒ Stay Light.

Test	Filter ID #	Result	Specification
NaI @ 220 nm	1705	0.0091	< 0.02 %T
NaNO ₂ @ 340 nm	21060	0.0121	< 0.02 %T
NaNO ₂ @ 370 nm	21060	0.0012	< 0.02 %T
KCl @ 200 nm	31280	2.8542	≥ 2 A

- ☒ Baseline Flatness.

Corrected Baseline	Specification
0.000253	± 0.001 A

- ☒ Noise Test @ 500 nm.

Actual Value	Specification
0.000014	± 0.00008 A

☒ Photometric Accuracy. (Specification ± 0.006 A.)

Filter 1 ID #		1882	
Test	Calibrated Value	Actual Value	Deviation
440 nm	0.3375	0.3378	0.0003
546.1 nm	0.3053	0.3059	0.0006
635 nm	0.3279	0.3285	0.0006
Filter 2 ID #		1882	
Test	Calibrated Value	Actual Value	Deviation
440 nm	0.9898	0.9902	0.0004
546.1 nm	0.9422	0.9431	0.0009
635 nm	0.9380	0.9384	0.0004
Filter 3 ID #		1502	
Test	Calibrated Value	Actual Value	Deviation
440 nm	0.4969	0.4978	0.0009
546.1 nm	0.4667	0.4676	0.0009
635 nm	0.4818	0.4825	0.0007

5. Accessory (where applicable):

- ☐ Integrating Sphere
- ☐ Reflecting Attachment
- ☐ Cell Changer
- ☐ Sipper
- ☐ Auto Sampler

6. Review:

- ☒ Review with the customer PM work performed.
- ☒ Review with the customer routine maintenance procedures.
- ☒ Discuss recommended customer-supplied materials to have on hand
- ☒ Attach PM sticker.

Additional Comments

Additional Comments Regarding the PM

Review

<p><i>The preventive maintenance checks and if applicable performance tests for Lambda UV have been completed.</i></p>	
<p><i>This Lambda UV Passes <input checked="" type="checkbox"/> Fails <input type="checkbox"/> the preventive maintenance.</i></p>	
<p align="center"><i>Review of Preventive Maintenance:</i></p>	
<p>Authorized PerkinElmer Representative:</p> <p align="center"><i>Kerkkiat</i></p>	<p>Date:</p> <p align="center">28-Jan-2021 (DD-MMM-YYYY)</p>
<p>Authorized Customer Representative:</p>	<p>Date:</p> <p align="center">(DD-MMM-YYYY)</p>

คุณภาพอากาศในบรรยากาศ



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., Jomput, Chatuchak, Bangkok 10900
Tel : (662) 939-4370-72, Fax : (662) 513-4221, E-mail : sale@spscon.com., www.spscon.com

High Volume Air Sampler Calibration Report

Calibration Method : Multipoint Orifice Flow Transfer Standard

Model : TE 5025A

S/N : 3095

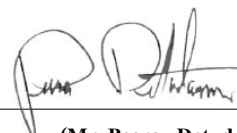
Calibration Data

High Volume Air Sampler Data		Calibration Data		
Recorder No.	Blower No.	Date	Actual Flowrate (ft ³ /min)	R ²
B35	B35	05/05/2021	y = 1.199x-4.960	1.000
B36	B36	05/05/2021	y = 1.154x-3.587	0.995
B37	B37	10/05/2021	y = 1.218x-6.760	0.996
B38	B38	10/05/2021	y = 1.184x-3.687	0.997
B39	B39	10/05/2021	y = 1.245x-5.680	1.000
B40	B40	10/05/2021	y = 1.216x-4.631	0.996
B41	B41	10/05/2021	y = 1.072x+0.857	0.997
B42	B42	05/05/2021	y = 1.078x+0.321	0.998
B43	B43	06/05/2021	y = 1.247x-6.394	0.999
B44	B44	05/05/2021	y = 1.302x-9.148	0.995
R01	R01	06/05/2021	y = 1.317x-10.213	0.998
R02	R02	06/05/2021	y = 1.221x-5.412	1.000
R03	R03	06/05/2021	y = 1.206x-6.047	0.997
R04	R04	05/05/2021	y = 1.162x-3.069	0.996
R05	R05	05/05/2021	y = 1.161x-3.912	0.998
R06	R06	07/05/2021	y = 1.301x-8.860	1.000
R07	R07	07/05/2021	y = 1.304x-9.049	0.999
R08	R08	07/05/2021	y = 1.300x-8.220	0.996
R09	R09	05/05/2021	y = 1.105x+0.378	0.998
R10	R10	05/05/2021	y = 1.110x-1.727	0.995
R11	R11	06/05/2021	y = 1.169x-3.766	0.997
R12	R12	06/05/2021	y = 1.108x-0.163	0.998
R13	R13	05/05/2021	y = 1.150x-1.989	0.996
R14	R14	05/05/2021	y = 1.091x+0.584	0.997
R15	R15	05/05/2021	y = 1.136x-1.190	0.999
R16	R16	07/05/2021	y = 1.115x-1.637	0.997
R17	R17	07/05/2021	y = 1.190x-6.003	1.000
R18	R18	07/05/2021	y = 1.177x-1.913	0.996
R19	R19	07/05/2021	y = 1.111x-0.625	0.997
R20	R20	07/05/2021	y = 1.045x+1.882	0.998

Calibrated by :

Phakhinai Khongkomnerd
(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@spscn.com, www.spscn.com

High Volume PM-10 Air Sampler Calibration Report

Calibration Method : Multipoint Orifice Flow Transfer Standard

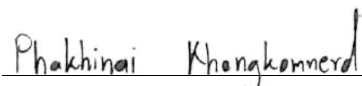
Model : TE 5025A

S/N : 3095


Calibration Data

High Volume PM-10 Data		Calibration Data		
Recorder No.	Blower No.	Date	Actual Flowrate (ft ³ /min)	R ²
R01	R01	06/05/2021	$y = 1.237x - 7.328$	0.998
R02	R02	07/05/2021	$y = 1.075x + 0.610$	0.997
R03	R03	05/05/2021	$y = 1.089x + 0.423$	0.999
R04	R04	05/05/2021	$y = 1.267x - 7.431$	1.000
R05	R05	06/05/2021	$y = 1.096x - 0.147$	0.996
R06	R06	06/05/2021	$y = 1.161x - 2.360$	0.999
R07	R07	06/05/2021	$y = 1.119x - 1.304$	0.997
R08	R08	07/05/2021	$y = 1.087x - 0.664$	0.995
R09	R09	07/05/2021	$y = 1.232x - 6.935$	1.000
R10	R10	07/05/2021	$y = 1.267x - 7.345$	0.999
R11	R11	07/05/2021	$y = 1.185x - 4.047$	0.997
R12	R12	06/05/2021	$y = 1.041x + 2.616$	0.997
R13	R13	06/05/2021	$y = 1.164x - 2.004$	0.995
R14	R14	05/05/2021	$y = 1.051x + 1.715$	1.000
R15	R15	05/05/2021	$y = 1.260x - 7.640$	0.999
R16	R16	05/05/2021	$y = 1.198x - 4.118$	0.995
R17	R17	05/05/2021	$y = 1.123x - 0.021$	0.998
R18	R18	05/05/2021	$y = 1.262x - 6.287$	0.999
R19	R19	05/05/2021	$y = 1.230x - 7.037$	0.996
R20	R20	05/05/2021	$y = 1.217x - 6.471$	0.995

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 แขวงจตุจักร 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 / NO₂ / NO_x ANALYZER

DATE : 16 June 2021

BRAND : API

MODEL : 200E

NO. NOX-R06

SERIAL NO. 4466

Calibrator (Dilution System)

Brand : API

Model : 700

Last Cal. Date : 07 August 2020

Serial No. : 911

Reference Standard Gas

Standard Gas : Nitric Oxide (NO)

Cylinder No. : A00771SK

Certified Date : 19 July 2019

Expired Date : 18 July 2021

Cylinder Conc. : 48.6 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	0.11	-	0	-
NO Span	400	399.5	-0.125	400.0	0.999
NO _x Span	400	399.8	-0.050	400.0	1.004

API Model 200E NO_x 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	507	cc/min	500 ± 50
OZONE FLOW	78	cc/min	80 ± 15
PMT	103.3	mV	-20 - 150
AZERO	94.0	mV	-20 - 150
HVPS	673	V	420 - 900 constant
RCELL TEMP	50.4	°C	50 ± 1
BOX TEMP	29.1	°C	8 - 48
PMT TEMP	7.0	°C	7 ± 2
MOLY TEMP	315.3	°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 _x Span Conc	400	PPB	20 - 20,000
NO Slope	0.999	-	1.0 ± 0.3
NO _x Slope	1.004	-	1.0 ± 0.3
NO Offset	1.0	mV	-20 to +150
NO _x Offset	0.5	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 :

Phakhinai Khongkomnerd
(Mr.Phakhinai Khongkomnerd)

Approved by :

Peera Detudom
(Mr.Peera Detudom)



บริษัท เอส.พี.เอส. คอนซัลติ้ง เซอร์วิส จำกัด
S.P.S. CONSULTING SERVICE CO., LTD.
7 ซอยพหลโยธิน 24 ถนนพหลโยธิน แขวงจตุจักร 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 / NO₂ / NO_x ANALYZER

DATE : 16 June 2021

BRAND : API

MODEL : 200E

NO. NOX-R10

SERIAL NO. 1991

Calibrator (Dilution System)

Brand : API

Model : 700

Last Cal. Date : 07 August 2020

Serial No. : 911

Reference Standard Gas

Standard Gas : Nitric Oxide (NO)

Cylinder No. : A00771SK

Certified Date : 19 July 2019

Expired Date : 18 July 2021

Cylinder Conc. : 48.6 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	400.2	0.050	400.0	1.008
NO _x Span	400	400.4	0.100	400.0	1.014

API Model 200E NO_x 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	103.1	mV	-20 - 150
AZERO	93.7	mV	-20 - 150
HVPS	670	V	420 - 900 constant
RCELL TEMP	50.5	°C	50 ± 1
BOX TEMP	29.3	°C	8 - 48
PMT TEMP	7.2	°C	7 ± 2
MOLY TEMP	315.4	°C	315 ± 5
RCELL PRESS	8.3	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 _x Span Conc	400	PPB	20 - 20,000
NO Slope	1.008	-	1.0 ± 0.3
NO _x Slope	1.014	-	1.0 ± 0.3
NO Offset	1.7	mV	-20 to +150
NO _x 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 :

Phakhinai Khongkomnerd
(Mr. Phakhinai Khongkomnerd)

Approved by :

Mr. Peera Detudom
(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.comNSC-TISI-TISI7025
CALIBRATION 0049

CERTIFICATE No : 21M3169

REFERENCE No : 60627-5

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 : 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.

**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 : 21M3169

PAGE : 2 OF 2

Calibration Report

EQUIPMENT : DIGITAL BALANCE MODEL : XS105DU
MANUFACTURER : METTLER TOLEDO S/N : 1126422905
ID No : BA 05/50 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-I-151	C02210415	09-Feb-23
2) STANDARD WEIGHT	E2	15843	C02210419	10-Feb-23
3) STANDARD WEIGHT	E2	QK-I-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&MEASURES

RESULT OF CALIBRATION :- WITHOUT ADJUSTMENT

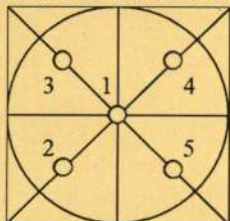
1. ZERO SETTING FUNCTION : NORMAL

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	0.01998	0.00002	0.000066
0.10	0.10001	-0.00001	0.000066
0.20	0.20001	-0.00001	0.000067
0.50	0.49996	0.00004	0.000065
1.00	0.99997	0.00003	0.000066
2.00	2.00000	0.00000	0.000067
5.00	5.00002	-0.00002	0.000068
10.00	10.00003	-0.00003	0.000070
20.00	20.00000	0.00000	0.000075
50.00	50.00000	0.00000	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

ระดับเสียงทั่วไป

THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-64/0528

MTC No. EEL. BP. 17/0564

CALIBRATION CERTIFICATE

Submitted by : S.P.S. Consulting Services 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 generated by sound calibrator under test shall be measured by standard microphone using an insert voltage technique.

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

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

Date of Receipt : 6 May 2021

Date of Calibration : 15 May 2021

1 / 2 ✓

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

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

FM.BL.MTC.002 Rev.4

Head Office

35 Mu 3 Tambon Khlone Ha, Amphoe Khlong Luang,
Changwat Pathumthani 12120, Thailand

Tel. (66) 0 2577 9000

Fax. (66) 0 2577 9009

E-mail : rumpai@tistr.or.th Website:www.tistr.or.th

Office/Laboratory

Soi 1C, Bangpoo Industrial Estate, Sukhumvit Road,
Amphoe Muang, Changwat Samutprakan 10280, Thailand

Tel. (66) 0 2323 1672-80 ext. 115, 116

Fax. (66) 0 2323 9165

E-mail : mtc@tistr.or.th

Office

196 Phahonyothin Road, Chatuchak, Bangkok 10900,
Thailand

Tel. (66) 0 2579 1121-30 ext. 5219, 5225, 5217

Fax. (66) 0 2579 8592

E-mail : sumalee@tistr.or.th

THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-64/0528

MTC No. EEL. BP. 17/0564

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 μ Pa at 1000 Hz

Acoustic Output in dB re 20 μ 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	93.96	-0.04	± 0.10	± 0.40 dB

2. Frequency

Standard Microphone Type	Measured Frequency (Hz)	Deviated value (Hz)	Uncertainty (Hz)	Tolerance limit IEC60942:2003 Class 1
1/2 inch Bruel&Kjaer 4180	999.9	-0.1	± 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	1.26	± 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)
Acting Director

Electrical and Electronic Standards Laboratory
Industrial Metrology and Testing Service Centre

Date of Calibration : 15 May 2021

Date of Issue : 18 May 2021

Ref : 2011264050601894002

End of Certificate

2 / 2

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

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

FM.BLMTC.002 Rev.4

Head Office

35 Mu 3 Tambon Khlong Ha, Amphoe Khlong Luang,
Changwat Pathumthani 12120, Thailand
Tel. (66) 0 2577 9000
Fax. (66) 0 2577 9009
E-mail : rumpai@tistr.or.th Website:www.tistr.or.th

Office/Laboratory

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

Office

196 Phahonyothin Road, Chatuchak, Bangkok 10900,
Thailand
Tel. (66) 0 2579 1121-30 ext. 5219, 5225, 5217
Fax. (66) 0 2579 8592
E-mail : sumalee@tistr.or.th



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

Noise R_290/21

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	15 May 2021
		Due Date	15 May 2022

Calibration Data

Sound Level Meter Data				Calibration Data		
SLM No.	Brand	Model	Serial No.	Date	Actual Reading [dB]	
					Before Adjustment	After Adjustment
ACO-R22	ACO	6236	00182010	16 June 2021	94.0	94.0
ACO-R23	ACO	6236	00192035	16 June 2021	94.0	94.0
ACO-R27	ACO	6236	00192039	16 June 2021	94.0	94.0
ACO-R39	ACO	6236	00192051	16 June 2021	94.0	94.0
Acoustic Certified Value : Thailand Institute of Scientific and Technological Research (TISTR)					93.96 ± 0.40 dB	

Calibrated by :

Phakhinai Khongkomnerd
(Mr. Phakhinai Khongkomnerd)

Approved by :

Peera Detudom
(Mr. Peera Detudom)

คุณภาพน้ำ

**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 ELECTROD WAS CALIBRATED BY USING STANDARD pH BUFFER
2. REFERENCE STANDARD INSTRUMENTS :-

<u>INSTRUMENT</u>	<u>MODEL</u>	<u>SERIAL No</u>	<u>CERTIFICATE No</u> <u>/ LOT No</u>	<u>DUE DATE</u>
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 $k = 2.303 RT/F = 59 \text{ mV/pH}$

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, Bangkac, 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 (\pm 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 : 21M3167
REFERENCE No : 60627-3

PAGE : 1 OF 2

Certificate of Calibration

EQUIPMENT : DIGITAL BALANCE

MANUFACTURER : SARTORIUS

MODEL : BSA224S-CW

SERIAL No : 36591843

ID No : BA 09/61

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 : 19-Mar-21

APPROVED BY : 
PONGSAK J.

ISSUED DATE : 20-Mar-21

RECEIVED DATE : 19-Mar-21



CERTIFICATE No : 21M3167

PAGE : 2 OF 2

Calibration Report

EQUIPMENT : DIGITAL BALANCE MODEL : BSA224S-CW
MANUFACTURER : SARTORIUS S/N : 36591843
ID No : BA 09/61 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-I-151	C02210415	09-Feb-23
2) STANDARD WEIGHT	E2	15843	C02210419	10-Feb-23
3) STANDARD WEIGHT	E2	QK-I-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&MEASURES

RESULT OF CALIBRATION :- WITHOUT ADJUSTMENT

1. ZERO SETTING FUNCTION : NORMAL

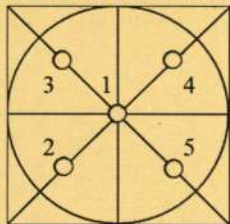
2. TARE FUNCTION : NORMAL

3. REPEATABILITY OF READING AT 200 g WAS 0.000045 g

4. DEPARTURE FROM NOMINAL VALUE/ LINEARITY

NOMINAL VALUE (g)	BALANCE READING (g)	CORRECTION (g)	UNCERTAINTY (\pm g)
0.0	0.0000	0.0000	0.000075
0.1	0.1000	0.0000	0.000075
0.2	0.2000	0.0000	0.000076
0.5	0.5000	0.0000	0.000076
1.0	1.0000	0.0000	0.000077
2.0	2.0000	0.0000	0.000077
5.0	5.0000	0.0000	0.000079
10.0	10.0000	0.0000	0.000082
20.0	20.0000	0.0000	0.000086
50.0	50.0000	0.0000	0.00013
100.0	100.0001	-0.0001	0.00019
200.0	199.9997	0.0003	0.00032

5. OFF CENTER LOADING ERROR



POINT	READING (g)
1	100.0000
2	100.0000
3	100.0001
4	100.0000
5	99.9999
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



QUALITY CALIBRATION CO.,LTD.

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

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

www.qcalibration.com

CERTIFICATE No : 21T0599

REFERENCE No : 59852-1

PAGE : 1 OF 2

Certificate of Calibration

EQUIPMENT : COD REACTOR

MANUFACTURER : HACH

MODEL : DRB 200

SERIAL No : 15110C0235

ID No : DRB 02/59

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 : 21-Jan-21

APPROVED BY : 
PONGSAK J.

ISSUED DATE : 25-Jan-21

RECEIVED DATE : 20-Jan-21



CERTIFICATE No : 21T0599

PAGE : 2 OF 2

Calibration Report

EQUIPMENT : COD REACTOR
MANUFACTURER : HACH
ID NUMBER : DRB 02/59
RECEIVED DATE : 20-Jan-21
AMBIENT TEMPERATURE : 23° C ± 1° C

MODEL : DRB 200
SERIAL NUMBER : 15110C0235
CALIBRATION DATE : 21-Jan-21
RELATIVE HUMIDITY : 52 %RH ± 10 % RH

CONDITION OF THIS RESULTS OF CALIBRATION

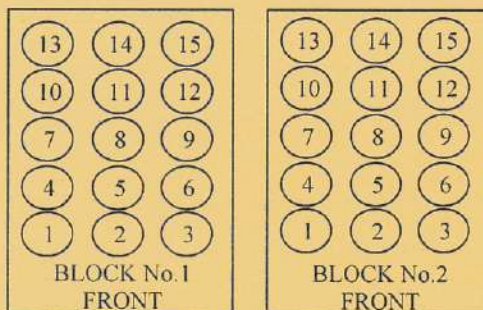
1. THIS INSTRUMENT WAS CALIBRATED ACCORDING TO TLAS G-20 BY COMPARISON WITH CALIBRATED THERMOCOUPLE TYPE K UNDER NO LOAD CONDITION. THE THERMOCOUPLES WERE PLACED ON 19 POINTS AND LOCATED AS THE PICTURE BELOW AND WAS AWAY FROM THE EACH WALL OF 5 cm TO 10 cm. AND PLACED THE TENTH THERMOCOUPLE WITHIN 2.5 cm. OF THE GEOMETRIC CENTER OF THE CHAMBER. THE UNIFORMITY WAS MEASURED BETWEEN REFERENCE PROBE AND OTHER PROBES AT THE SAME TIME.

2. REFERENCE STANDARD INSTRUMENTS :-

INSTRUMENT	MODEL	SERIAL No	CERTIFICATE No	DUE DATE
1) DATA LOGGER WITH TC TYPE K	HYDRA 2635A	8009008	20T7223	11-Jul-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 THE INTERNATIONAL SYSTEM OF UNIT MAINTAINED AT:-
- NATIONAL INSTITUTE OF METROLOGY (THAILAND) THROUGH QUALITY CALIBRATION CO.,LTD.

RESULT OF CALIBRATION :- WITHOUT ADJUSTMENT



TEMPERATURE MEASUREMENT ACCURACY TEST

Block No.	1	2
Controller temperature (°C)	150	150
Indicating Temperature	150	150
Measured Temperature (°C) at Spread Locations	1	150.4
	2	150.8
	3	150.7
	4	151.1
	5	151.0
	6	150.8
	7	150.9
	8	151.2
	9	150.9
	10	150.6
	11	150.4
	12	149.6
	13	149.3
	14	149.4
	15	149.9
Uncertainty of Measurement(± °C)	0.86	0.86

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

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

คุณภาพอากาศในการทำงาน



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

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.)				
					1	2	3	1	2	3	y	R ²
R01	SKC	224-PCXR4	602467	12/04/2021	1,000	1,500	2,000	1,000	1,502	2,003	1.013x - 24.844	0.999
R02	SKC	224-PCXR4	626450	12/04/2021	1,000	2,000	3,000	997	1,498	1,997	1.001x - 4.906	1.000
R03	SKC	224-PCXR4	691592	01/04/2021	1,000	1,500	2,000	1,003	1,499	1,992	0.994x + 6.150	1.000
R04	SKC	224-PCXR4	691672	01/04/2021	1,000	1,500	2,000	1,001	1,501	2,003	1.013x - 24.617	0.999
R05	SKC	224-PCXR4	798470	01/04/2021	1,000	1,500	2,000	995	1,505	2,001	1.015x - 30.280	0.999
R06	SKC	224-PCXR4	798456	01/04/2021	1,000	1,500	2,000	998	1,494	1,992	0.992x + 6.126	1.000
R07	SKC	224-PCXR4	798480	01/04/2021	1,000	1,500	2,000	994	1,505	2,004	1.017x - 33.507	0.999
R08	SKC	224-PCXR4	883215	01/04/2021	1,000	1,500	2,000	993	1,496	1,989	0.997x - 0.977	1.000
R09	SKC	224-PCXR4	034650	12/04/2021	1,000	1,500	2,000	1,002	1,500	2,003	1.012x - 22.738	0.999
R10	SKC	224-PCXR4	091765	01/04/2021	1,000	1,500	2,000	999	1,497	1,989	0.992x + 7.103	1.000
R11	SKC	224-PCXR4	091763	12/04/2021	1,000	1,500	2,000	996	1,501	2,002	1.016x - 31.648	0.999
R12	SKC	224-PCXR4	091568	12/04/2021	1,000	1,500	2,000	1,004	1,499	2,002	1.010x - 20.768	0.999
R13	SKC	224-PCXR4	091638	01/04/2021	1,000	1,500	2,000	1,001	1,493	1,997	0.994x + 5.025	1.000
R14	SKC	224-PCXR4	091764	12/04/2021	1,000	1,500	2,000	991	1,505	1,999	1.015x - 31.704	0.999
R15	SKC	224-PCXR8	529457	12/04/2021	1,000	1,500	2,000	998	1,492	1,992	0.996x + 0.271	1.000
R16	SKC	224-PCXR8	529643	02/04/2021	1,000	1,500	2,000	1,001	1,501	2,000	1.012x - 22.774	0.999
R17	SKC	224-PCXR8	529645	12/04/2021	1,000	1,500	2,000	995	1,504	2,001	1.015x - 31.214	0.999
R18	SKC	224-PCXR8	566756	02/04/2021	1,000	1,500	2,000	1,003	1,500	2,003	1.012x - 22.830	0.999
R19	SKC	224-PCXR8	566802	02/04/2021	1,000	1,500	2,000	996	1,493	1,994	0.999x - 4.830	1.000
R20	SKC	224-PCXR8	529089	02/04/2021	1,000	1,500	2,000	996	1,497	2,001	1.001x - 3.757	1.000
R21	SKC	224-PCXR8	665728	02/04/2021	1,000	1,500	2,000	1,003	1,500	2,004	1.013x - 23.651	0.999
R22	SKC	224-PCXR8	707444	12/04/2021	1,000	1,500	2,000	994	1,505	2,001	1.015x - 31.784	0.999
R23	SKC	224-PCXR8	761067	12/04/2021	1,000	1,500	2,000	998	1,498	1,995	0.995x + 3.653	1.000
R24	SKC	224-PCXR8	707893	05/04/2021	1,000	1,500	2,000	992	1,505	1,998	1.013x - 29.275	0.999
R25	SKC	224-PCXR8	761052	05/04/2021	1,000	1,500	2,000	1,003	1,501	2,002	1.011x - 21.099	0.999
R26	SKC	224-PCXR8	707956	12/04/2021	1,000	1,500	2,000	994	1,504	2,000	1.014x - 29.574	0.999
R27	SKC	224-PCXR8	707398	05/04/2021	1,000	1,500	2,000	1,001	1,498	2,000	0.997x + 2.309	1.000
R28	SKC	224-PCXR8	707481	12/04/2021	1,000	1,500	2,000	998	1,497	1,994	0.993x + 6.728	1.000
R29	SKC	224-PCXR8	707402	12/04/2021	1,000	1,500	2,000	1,002	1,500	2,003	1.013x - 23.707	0.999
R30	SKC	224-PCXR8	093811	05/04/2021	1,000	1,500	2,000	997	1,505	2,001	1.012x - 26.451	0.999
R31	SKC	224-PCXR8	093183	12/04/2021	1,000	1,500	2,000	1,000	1,498	1,991	0.990x + 11.774	1.000
R32	SKC	224-PCXR8	671950	05/04/2021	1,000	1,500	2,000	1,004	1,500	2,004	1.012x - 22.144	0.999
R33	SKC	224-PCXR4	626254	12/04/2021	1,000	1,500	2,000	999	1,500	1,994	0.994x + 5.173	1.000
R34	SKC	224-PCXR4	626131	12/04/2021	1,000	1,500	2,000	994	1,504	1,999	1.013x - 29.088	0.999
R35	SKC	224-PCXR8	707460	05/04/2021	1,000	1,500	2,000	997	1,496	1,994	0.997x + 1.141	1.000
R36	SKC	224-PCXR8	707446	12/04/2021	1,000	1,500	2,000	1,003	1,500	2,004	1.015x - 26.128	0.999
R37	SKC	224-PCXR8	707432	12/04/2021	1,000	1,500	2,000	992	1,504	2,001	1.017x - 34.097	0.999
R38	SKC	224-PCXR8	707349	05/04/2021	1,000	1,500	2,000	995	1,491	1,996	0.998x - 3.622	1.000
R39	SKC	224-PCXR8	761095	05/04/2021	1,000	1,500	2,000	994	1,497	1,999	1.004x - 9.122	1.000

Calibrated by :

Phakhinai Khongkounerd
(Mr. Phakhinai Khongkounerd)

Approved by :

Peera Detudom
(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

Personal Pump Calibration Report

Calibration Method : Dry Cal Primary Flowmeter

Model : Defender 510-H

S/N : 136164

Environmental Conditions

Temperature : 25 \pm 3 °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.)				
					1	2	3	1	2	3	y	R ²
R40	SKC	224-PCXR4	612753	12/04/2021	1,000	1,500	2,000	1,001	1,501	2,003	1.013x - 24.246	0.999
R41	SKC	224-PCXR4	626140	12/04/2021	1,000	1,500	2,000	996	1,492	1,994	0.995x + 1.472	1.000
R42	SKC	224-PCXR4	626463	05/04/2021	1,000	1,500	2,000	993	1,503	1,999	1.015x - 31.297	0.999
R43	SKC	224-PCXR4	626129	12/04/2021	1,000	1,500	2,000	993	1,494	1,991	0.999x - 4.084	1.000
R44	SKC	224-PCXR4	602753	05/04/2021	1,000	1,500	2,000	996	1,504	1,998	1.009x - 23.292	0.999
R45	SKC	224-PCXR4	626137	05/04/2021	1,000	1,500	2,000	1,001	1,503	2,003	1.012x - 23.624	0.999

Calibrated by :

Phakhinai Khongkomnerd
(Mr. Phakhinai Khongkomnerd)

Approved by :

Peera Detudom
(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

Rotameter Calibration Report (For Personal Pump High 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 ²
H-R01	Dwyer	VFB-65	09/04/2021	500	1,000	2,000	500.3	995.9	1989.0	0.993x + 6.712	1.000
H-R02	Dwyer	VFB-65	09/04/2021	500	1,000	2,000	500.2	994.6	1989.5	1.003x – 7.642	1.000
H-R03	Dwyer	VFB-65	09/04/2021	500	1,000	2,000	502.9	997.1	1990.7	0.994x + 3.626	1.000
H-R04	Dwyer	VFB-65	01/04/2021	500	1,000	2,000	497.9	991.9	2000.9	1.002x – 8.757	1.000
H-R05	Dwyer	VFB-65	02/04/2021	500	1,000	2,000	497.1	997.2	1986.7	1.001x – 4.130	1.000
H-R06	Dwyer	VFB-65	02/04/2021	500	1,000	2,000	495.4	999.3	1998.2	1.004x – 6.634	1.000

Calibrated by :

Phakhinai Khongkomnerd
(Mr. Phakhinai Khongkomnerd)

Approved by :

Peera Detudom
(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

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 ²
L-R01	Dwyer	VFA-21	09/04/2021	50	100	200	50.2	99.9	200.4	1.007x - 0.819	1.000
L-R02	Dwyer	VFA-21	09/04/2021	50	100	200	49.6	100.7	200.8	0.999x + 0.130	1.000
L-R03	Dwyer	VFA-21	09/04/2021	50	100	200	49.5	99.1	199.2	0.997x - 0.450	1.000
L-R04	Dwyer	VFA-21	01/04/2021	50	100	200	49.8	99.4	198.9	1.002x - 1.085	1.000
L-R05	Dwyer	VFA-21	02/04/2021	50	100	200	49.2	100.2	200.2	0.994x + 0.448	1.000
L-R06	Dwyer	VFA-21	02/04/2021	50	100	200	50.1	99.2	201.7	1.006x - 0.657	1.000

Calibrated by :

Phakhinai Khongkomnerd
(Mr. Phakhinai Khongkomnerd)

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.comNSC-TISI-TISI7025
CALIBRATION 0049

CERTIFICATE No : 21M3169

REFERENCE No : 60627-5

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 : 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.

**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 : 21M3169

PAGE : 2 OF 2

Calibration Report

EQUIPMENT : DIGITAL BALANCE MODEL : XS105DU
MANUFACTURER : METTLER TOLEDO S/N : 1126422905
ID No : BA 05/50 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-I-151	C02210415	09-Feb-23
2) STANDARD WEIGHT	E2	15843	C02210419	10-Feb-23
3) STANDARD WEIGHT	E2	QK-I-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&MEASURES

RESULT OF CALIBRATION :- WITHOUT ADJUSTMENT

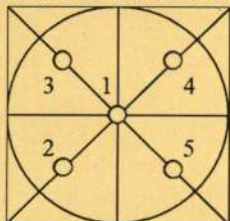
1. ZERO SETTING FUNCTION : NORMAL

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	0.01998	0.00002	0.000066
0.10	0.10001	-0.00001	0.000066
0.20	0.20001	-0.00001	0.000067
0.50	0.49996	0.00004	0.000065
1.00	0.99997	0.00003	0.000066
2.00	2.00000	0.00000	0.000067
5.00	5.00002	-0.00002	0.000068
10.00	10.00003	-0.00003	0.000070
20.00	20.00000	0.00000	0.000075
50.00	50.00000	0.00000	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

ระดับเสียงในการทำงาน

THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-64/0528

MTC No. EEL. BP. 17/0564

CALIBRATION CERTIFICATE

Submitted by : S.P.S. Consulting Services 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 generated by sound calibrator under test shall be measured by standard microphone using an insert voltage technique.

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

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

Date of Receipt : 6 May 2021

Date of Calibration : 15 May 2021

1 / 2 ✓

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

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

FM.BL.MTC.002 Rev.4

Head Office

35 Mu 3 Tambon Khlone Ha, Amphoe Khlong Luang,
Changwat Pathumthani 12120, Thailand

Tel. (66) 0 2577 9000

Fax. (66) 0 2577 9009

E-mail : rumpai@tistr.or.th Website:www.tistr.or.th

Office/Laboratory

Soi 1C, Bangpoo Industrial Estate, Sukhumvit Road,
Amphoe Muang, Changwat Samutprakan 10280, Thailand
Tel. (66) 0 2323 1672-80 ext. 115, 116

Fax. (66) 0 2323 9165

E-mail : mtc@tistr.or.th

Office

196 Phahonyothin Road, Chatuchak, Bangkok 10900,
Thailand

Tel. (66) 0 2579 1121-30 ext. 5219, 5225, 5217

Fax. (66) 0 2579 8592

E-mail : sumalee@tistr.or.th

THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-64/0528

MTC No. EEL. BP. 17/0564

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 μ Pa at 1000 Hz

Acoustic Output in dB re 20 μ 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 Brüel&Kjaer 4180	93.96	-0.04	± 0.10	± 0.40 dB

2. Frequency

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

3. Total Distortion

Standard Microphone Type	Measured Total Distortion (%)	Uncertainty (%)	Tolerance limit IEC60942:2003 Class 1
1/2 inch Brüel&Kjaer 4180	1.26	± 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)
Acting Director

Electrical and Electronic Standards Laboratory
Industrial Metrology and Testing Service Centre

Date of Calibration : 15 May 2021

Date of Issue : 18 May 2021

Ref : 2011264050601894002

End of Certificate

2 / 2

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

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

FM.BLMTC.002 Rev.4

Head Office

35 Mu 3 Tambon Khlong Ha, Amphoe Khlong Luang,
Changwat Pathumthani 12120, Thailand
Tel. (66) 0 2577 9000
Fax. (66) 0 2577 9009
E-mail : rumpai@tistr.or.th Website:www.tistr.or.th

Office/Laboratory

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

Office

196 Phahonyothin Road, Chatuchak, Bangkok 10900,
Thailand
Tel. (66) 0 2579 1121-30 ext. 5219, 5225, 5217
Fax. (66) 0 2579 8592
E-mail : sumalee@tistr.or.th



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

Noise R_154/21

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	15 June 2020
		Due Date	15 June 2021

Calibration Data

Sound Level Meter Data				Calibration Data		
SLM No.	Brand	Model	Serial No.	Date	Actual Reading [dB]	
					Before Adjustment	After Adjustment
ACO-R20	ACO	6236	00182003	05 April 2021	94.1	94.0
ACO-R21	ACO	6236	00182004	05 April 2021	94.1	94.0
ACO-R23	ACO	6236	00192035	05 April 2021	94.0	94.0
Acoustic Certified Value : Electrical and Electronics Institute Foundation for Industrial Development					93.92 ± 0.25 dB	

Calibrated by :

Phakhinai Khongkomnerd
(Mr. Phakhinai Khongkomnerd)

Approved by :

Peera Detudom
(Mr. Peera Detudom)

ปริมาณเสียงสะสมแบบติดตัวบุคคล



CALIBRATION CERTIFICATE

Date of issue: 2019-07-08

Certificate No: 14012891-2

Page: 1/3

OBJECT OF CALIBRATION

Manufacturer: **Svante**

Model: **SV34**

Serial No.: 33142

Description: Acoustical Calibrator accuracy class 2 with nominal level
 $L_{p, \text{nom1}} = 114 \text{ dB}$, and nominal frequency $f_{n1} = 1000 \text{ Hz}$.

ENVIRONMENTAL CONDITIONS

Temperature: 23.2 °C

Humidity: 47.3 %

Pressure: 101.16 hPa

DATE OF CALIBRATION 2019-07-08

APPROVED BY B. Hunt

AcSoft
sound & vibration

AcSoft Calibration | Bedford Technology Park
Thurleigh | Bedford | MK44 2YA

+44 (0) 1234 639550

www.acsoft.co.uk

Date of issue: 2019-07-08**Certificate No:** 14012891-2**Page:** 2/3**CALIBRATION RESULTS**

The calibrator submitted for testing has successfully completed the IEC 60942:2003 (BS EN 60942:2003), for the environmental conditions under which the tests were performed.

The results are presented on page 3 of this certificate (including measurement uncertainty).

UNCERTAINTY OF MEASUREMENTS

Level:	0.15	dB
Frequency:	0.1	Hz
Distortion:	0.1	%

NOTES

1. The information appearing on this certificate has been compiled specifically for this instrument. This calibration certificate is produced with traceable and advanced equipment which permit comprehensive quality assurance verification of all data supplied herein.
2. The measurements in this document are traceable to GUM (Central Office of Measures), Poland
3. This calibration certificate shall not be reproduced except in full, without written permission from Svantek UK Ltd.

REFERENCE EQUIPMENT

Description	Manufacturer	Model	Serial Number
Pistonphone	GRAS	42AP	236167
Acoustical Calibrator	Svantek	SV30A	44775
Sound & Vibration Analyser	Svantek	SV912AE	15940
Digital Multimeter	Keithley	2015THD	1065133
Reference Microphone	GRAS	40AF	207373
Thermo-Barometer	LAB-EL	LB-706B	912

Date of issue: 2019-07-08

Certificate No: 14012891-2

Page: 3/3

CALIBRATION RESULTS

Calibration results are as follows:

SPL

L_{pn}	ΔL_p	$U(L_p)$	$\Delta L_{p,dop}$, dB	
dB	dB	dB	class 1	class 2
113.59	-0.41	0.15	$\pm 0,4$	$\pm 0,6$

Frequency

f_n	δf	$U(f)$	δf_{dop} , w %	
Hz	Hz	Hz	class 1	class 2
999.96	-0.04	0.1	$\pm 1,0$ ($\pm 10\text{Hz}$)	$\pm 2,0$ ($\pm 20\text{Hz}$)

THD – 1kHz

h_n	$U(h)$	δh_{dop} , %	
%	%	class 1	class 2
0.25	0.1	3,0	4,0



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

Noise Dose R_155/21

Noise Dose Meter Calibration Report

Acoustic Calibrator Data

Brand	SVANTEK	Number	SV 02/60
Model	SV34	Serial No.	33142
Calibration Range	114 dB, 1000 Hz	Last Calibration	14 October 2020
		Due Date	14 October 2021

Calibration Data

Sound Level Meter Data				Calibration Data		
SLM No.	Brand	Model	Serial No.	Date	Actual Reading [dB]	
					Before Adjustment	After Adjustment
NMD-R15	SVANTEK	SV-104IS	63440	05 April 2021	113.6	113.5
NMD-R19	SVANTEK	SV-104IS	70030	05 April 2021	113.6	113.5
NMD-R35	SVANTEK	SV-104IS	80873	05 April 2021	113.5	113.5
Acoustic Certified Value : Thailand Institute of Scientific And Technological Research (TISTR)					113.54 ± 0.75 dB	

Calibrated by :

Phakhinai Khongkornerd
(Mr. Phakhinai Khongkornerd)

Approved by :

Peera Detudom
(Mr. Peera Detudom)

ระดับความร้อนในการทำงาน

CERTIFICATE OF CALIBRATION

FOR

NOMENCLATURE : DIGITAL THERMOHYGRO METER
[THERMAL ENVIRONMENT MONITOR]
MANUFACTURER : 3M
MODEL / TYPE : QUESTemp° 34
SERIAL NO. : TEF050029
CLID. NO. : 231802269
JOB CONTROL NO. : 201111100103

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

DATE OF RECEIVED : 11 November 2020

DATE OF ISSUED : 13 November 2020

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

Calibrated By : Oranut Kamchatphai
Calibration Engineer



Approved By : Mongkol Yotsoontorn
Authorized Signatory
13 November 2020



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. Q20100103

F3-011-04/01-12

page 1 of 3



@clccalibration



CALIBRATION LABORATORY CO., LTD.

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



REPORT OF CALIBRATION

FOR

NOMENCLATURE : **DIGITAL THERMOHYGRO METER**
[THERMAL ENVIRONMENT MONITOR]

MANUFACTURER : **3M**

MODEL / TYPE : **QUESTemp° 34**

SERIAL NO. : **TEF050029**

DATE OF CALIBRATION : **12 November 2020**

ENVIRONMENT CONDITIONS :

Temperature : **(23 ± 2) °C**

Relative Humidity : **(55 ± 10) %RH**

PROCEDURE USED :

This instrument was calibrated under procedure No. **WI-305-74** as calibration guidelines.

The calibration was performed by using Chilled Mirror Hygrometer and Temperature & Humidity Chamber which maintained by the Calibration Laboratory Co., Ltd.

REFERENCE STANDARD USED :

Chilled Mirror Hygrometer, Edgetech Model Dew Master S/N. 36151.

Temperature & Humidity Chamber, PGC Model 9141-5114 S/N.0802282.

TRACEABILITY :

The measurements are traceable to International System of Units (SI) , through Thunder Scientific Corporation.

Certificate No. 18263, Due Date 29 April 2021.

UNCERTAINTY :

The reported expanded uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor $k = 2,00$ which for a normal distribution corresponds to a coverage probability of approximately 95 %.

It has been evaluated according to the "Evaluation of the Uncertainty of Measurement in Calibration (EA-4/02 M:2013)"

Certificate No. Q20100103

F3-011-04/01-12

page 2 of 3



@clccalibration

CONDITION OF CALIBRATION ITEM : GOOD

MEASUREMENT RESULTS : (X) without adjustment () adjustment

The table in the following gives the calibration results and associated measurement uncertainties of the measuring digital thermohygro meter [thermal environment monitor].

CALIBRATION DATA

1. CORRECTION OF TEMPERATURE : WET

Test point (° C)	Actual Temperature (° C)	DUC Reading (° C)	Correction (° C)	Uncertainty ± (° C)
30.0	30.06	29.9	+0.16	0.40
35.0	34.98	34.9	+0.08	
40.0	40.04	40.0	+0.04	

2. CORRECTION OF TEMPERATURE : DRY

Test point (° C)	Actual Temperature (° C)	DUC Reading (° C)	Correction (° C)	Uncertainty ± (° C)
30.0	30.06	30.0	+0.06	0.40
35.0	34.98	35.1	-0.12	
40.0	40.04	40.1	-0.06	

3. CORRECTION OF TEMPERATURE : GLOBE

Test point (° C)	Actual Temperature (° C)	DUC Reading (° C)	Correction (° C)	Uncertainty ± (° C)
30.0	30.06	29.8	+0.26	0.40
35.0	34.98	34.9	+0.08	
40.0	40.04	39.9	+0.14	

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

End of Certificate

Certificate No. Q20100103

F3-011-04/01-12

page 3 of 3



@clccalibration



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

Heat B076_1/21

Heat Stress WBGT Meter Verification Report

Verification Data

Heat Stress WBGT Meter No.	: B17	Verification Date	: 29 April 2021
Brand	: 3M	Ambient Temp.	: 24.5 °C
Model	: QUESTemp ^o 34	Barometric Pressure	: 1011 mmbar
Serial No.	: TEF050029	Relative Humidity	: 49 %

Verification Module (Electronic Sensor Check) :

Verification Module No. : 21 WB = 12.5 °C , DB = 47.1 °C , G = 69.3 °C

Result of Verification : Without Adjustment

Wet Probe Temperature Measurement

Verification Module Reading (°C)	UUC* Reading (°C)	Correction (°C)	Tolerance Limit (°C)
12.5	12.6	-0.1	± 0.5

Dry Probe Temperature Measurement

Verification Module Reading (°C)	UUC* Reading (°C)	Correction (°C)	Tolerance Limit (°C)
47.1	47.0	0.1	± 0.5

Globe Probe Temperature Measurement

Verification Module Reading (°C)	UUC* Reading (°C)	Correction (°C)	Tolerance Limit (°C)
69.3	69.2	0.1	± 0.5

UUC* = UNIT UNDER CALIBRATION

Verified by : Phakhinai Khongkomnerd
(Mr. Phakhinai Khongkomnerd)

Approved by : Peera Detudom
(Mr. Peera Detudom)



CALIBRATION LABORATORY CO., LTD.

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



CERTIFICATE OF CALIBRATION

FOR

NOMENCLATURE : DIGITAL THERMOHYGRO METER
(THERMAL ENVIRONMENT MONITOR)
MANUFACTURER : 3M
MODEL / TYPE : QUESTemp° 32
SERIAL NO. : TPK040059
CLID. NO. : 231802519
JOB CONTROL NO. : 201103097040

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

DATE OF RECEIVED : 03 November 2020

DATE OF ISSUED : 05 November 2020

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

Calibrated By : Oranut Kamchatphai
Calibration Engineer

Approved By : Mongkol Yotsoontorn
Authorized Signatory
05 November 2020



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. Q20097040

F3-011-04/01-12

page 1 of 3



@clccalibration



CALIBRATION LABORATORY CO., LTD.

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



REPORT OF CALIBRATION

FOR

NOMENCLATURE : **DIGITAL THERMOHYGRO METER**
(THERMAL ENVIRONMENT MONITOR)

MANUFACTURER : **3M**

MODEL / TYPE : **QUESTemp° 32**

SERIAL NO. : **TPK040059**

DATE OF CALIBRATION : **04 November 2020**

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. **WI-305-74** as calibration guidelines.

The calibration was performed by using Chilled Mirror Hygrometer and Temperature & Humidity Chamber which maintained by the Calibration Laboratory Co., Ltd.

REFERENCE STANDARD USED :

Chilled Mirror Hygrometer, Edgetech Model Dew Master S/N. 36151.

Temperature & Humidity Chamber, PGC Model 9141-5114 S/N.0802282.

TRACEABILITY :

The measurements are traceable to International System of Units (SI) , through Thunder Scientific Corporation.

Certificate No. 18263, Due Date 29 April 2021.

UNCERTAINTY :

The reported expanded uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor $k = 2,00$ which for a normal distribution corresponds to a coverage probability of approximately 95 %.

It has been evaluated according to the "Evaluation of the Uncertainty of Measurement in Calibration (EA-4/02 M:2013)"

Certificate No. Q20097040

F3-011-04/01-12

page 2 of 3



@clccalibration

CONDITION OF CALIBRATION ITEM : GOOD

MEASUREMENT RESULTS : (X) without adjustment () adjustment

The table in the following gives the calibration results and associated measurement uncertainties of the measuring digital thermohygro meter (thermal environment monitor).

CALIBRATION DATA

1. CORRECTION OF TEMPERATURE : WET

Test point (° C)	Actual Temperature (° C)	DUC Reading (° C)	Correction (° C)	Uncertainty ± (° C)
30.0	29.95	30.2	-0.25	0.40
35.0	34.92	35.1	-0.18	
40.0	39.90	40.0	-0.10	

2. CORRECTION OF TEMPERATURE : DRY

Test point (° C)	Actual Temperature (° C)	DUC Reading (° C)	Correction (° C)	Uncertainty ± (° C)
30.0	29.95	30.3	-0.35	0.40
35.0	34.92	35.3	-0.38	
40.0	39.90	40.1	-0.20	

3. CORRECTION OF TEMPERATURE : GLOBE BULB

Test point (° C)	Actual Temperature (° C)	DUC Reading (° C)	Correction (° C)	Uncertainty ± (° C)
30.0	29.95	30.3	-0.35	0.40
35.0	34.92	35.1	-0.18	
40.0	39.90	39.9	0.00	

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

End of Certificate

Certificate No. Q20097040

F3-011-04/01-12

page 3 of 3





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

Heat B076_2/21

Heat Stress WBGT Meter Verification Report

Verification Data

Heat Stress WBGT Meter No.	: B22	Verification Date	: 29 April 2021
Brand	: 3M	Ambient Temp.	: 24.5 °C
Model	: QUESTemp ^o 32	Barometric Pressure	: 1011 mmbar
Serial No.	: TPK040059	Relative Humidity	: 49 %

Verification Module (Electronic Sensor Check) :

Verification Module No. : 21 WB = 12.5 °C , DB = 47.1 °C , G = 69.3 °C

Result of Verification : Without Adjustment

Wet Probe Temperature Measurement

Verification Module Reading (°C)	UUC* Reading (°C)	Correction (°C)	Tolerance Limit (°C)
12.5	12.3	0.2	± 0.5

Dry Probe Temperature Measurement

Verification Module Reading (°C)	UUC* Reading (°C)	Correction (°C)	Tolerance Limit (°C)
47.1	47.0	0.1	± 0.5

Globe Probe Temperature Measurement

Verification Module Reading (°C)	UUC* Reading (°C)	Correction (°C)	Tolerance Limit (°C)
69.3	69.4	-0.1	± 0.5

UUC* = UNIT UNDER CALIBRATION

Verified by :

Phakhinai Khongkomnerd
(Mr. Phakhinai Khongkomnerd)

Approved by :

Peera Detudom
(Mr. Peera Detudom)



CALIBRATION LABORATORY CO., LTD.

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



CERTIFICATE OF CALIBRATION

FOR

NOMENCLATURE : DIGITAL THERMOHYGRO METER
(THERMAL ENVIRONMENT MONITOR)
MANUFACTURER : 3M
MODEL / TYPE : QUESTemp[®]TM32
SERIAL NO. : TPK120034
CLID. NO. : 231801948
JOB CONTROL NO. : 200929086089

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

DATE OF RECEIVED : 29 September 2020

DATE OF ISSUED : 02 October 2020

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

Calibrated By : Oranut Kamchatphai
Calibration Engineer

Approved By : Mongkol Yotsoontorn
Authorized Signatory
02 October 2020



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. Q20086089

F3-011-04/01-12

page 1 of 3



@clccalibration



CALIBRATION LABORATORY Co., LTD.

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



REPORT OF CALIBRATION

FOR

NOMENCLATURE : **DIGITAL THERMOHYGRO METER**
(THERMAL ENVIRONMENT MONITOR)

MANUFACTURER : **3M**

MODEL / TYPE : **QUESTempTM32**

SERIAL NO. : **TPK120034**

DATE OF CALIBRATION : **30 September 2020**

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. **WI-305-74** as calibration guidelines.

The calibration was performed by using Chilled Mirror Hygrometer and Temperature & Humidity Chamber which maintained by the Calibration Laboratory Co., Ltd.

REFERENCE STANDARD USED :

Chilled Mirror Hygrometer, Edgetech Model Dew Master S/N. 44602.

Temperature & Humidity Chamber, PGC Model 9141-5116 S/N. 1304261.

TRACEABILITY :

The measurements are traceable to International System of Units (SI) , through Thunder Scientific Corporation.

Certificate No.17723, Due Date 24 October 2020.

UNCERTAINTY :

The reported expanded uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor $k = 2,00$ which for a normal distribution corresponds to a coverage probability of approximately 95 %.

It has been evaluated according to the "Evaluation of the Uncertainty of Measurement in Calibration (EA-4/02 M:2013)"

Certificate No. **Q20086089**

F3-011-04/01-12

page 2 of 3



@clc calibration

CONDITION OF CALIBRATION ITEM : GOOD

MEASUREMENT RESULTS : (X) without adjustment () adjustment

The table in the following gives the calibration results and associated measurement uncertainties of the measuring digital thermohygro meter (thermal environment monitor).

CALIBRATION DATA

1. CORRECTION OF TEMPERATURE : WET

Test point (° C)	Actual Temperature (° C)	DUC Reading (° C)	Correction (° C)	Uncertainty ± (° C)
30.0	30.06	30.2	-0.14	0.40
35.0	34.90	35.0	-0.10	
40.0	40.06	39.9	+0.16	

2. CORRECTION OF TEMPERATURE : DRY

Test point (° C)	Actual Temperature (° C)	DUC Reading (° C)	Correction (° C)	Uncertainty ± (° C)
30.0	30.06	30.4	-0.34	0.40
35.0	34.90	35.2	-0.30	
40.0	40.06	40.2	-0.14	

3. CORRECTION OF TEMPERATURE : GLOBE BULB

Test point (° C)	Actual Temperature (° C)	DUC Reading (° C)	Correction (° C)	Uncertainty ± (° C)
30.0	30.06	30.1	-0.04	0.40
35.0	34.90	34.8	+0.10	
40.0	40.06	39.7	+0.36	

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

End of Certificate

Certificate No. Q20086089

F3-011-04/01-12

page 3 of 3



@clccalibration



บริษัท เอส.พี.เอส. คอนซัลติ้ง เซอร์วิส จำกัด
S.P.S. CONSULTING SERVICE CO., LTD.
7 ซอยพหลโยธิน 24 ถนนพหลโยธิน แขวงจตุจักร 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

Heat B076_3/21

Heat Stress WBGT Meter Verification Report

Verification Data

Heat Stress WBGT Meter No.	: B34	Verification Date	: 29 April 2021
Brand	: QUEST TECHNOLOGIES	Ambient Temp.	: 24.5 °C
Model	: QUESTemp ^o 46	Barometric Pressure	: 1011 mmbar
Serial No.	: TSJ060005	Relative Humidity	: 49 %

Verification Module (Electronic Sensor Check) :

Verification Module No. : 21 WB = 12.5 °C , DB = 47.1 °C , G = 69.3 °C

Result of Verification : Without Adjustment

Wet Probe Temperature Measurement

Verification Module Reading (°C)	UUC* Reading (°C)	Correction (°C)	Tolerance Limit (°C)
12.5	12.4	0.1	± 0.5

Dry Probe Temperature Measurement

Verification Module Reading (°C)	UUC* Reading (°C)	Correction (°C)	Tolerance Limit (°C)
47.1	47.1	0.0	± 0.5

Globe Probe Temperature Measurement

Verification Module Reading (°C)	UUC* Reading (°C)	Correction (°C)	Tolerance Limit (°C)
69.3	69.5	-0.2	± 0.5

UUC* = UNIT UNDER CALIBRATION

Verified by :

Phakhinai Whongkomnerd
(Mr. Phakhinai Khongkomnerd)

Approved by :

Peera Detudom
(Mr. Peera Detudom)