

ภาคผนวกที่ 5

เอกสารสอบเทียบความถูกต้องของเครื่องมือ

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| เอกสารแนบ 5-1 | เอกสารสอบเทียบเครื่องมือการตรวจวัดคุณภาพอากาศในบรรยากาศ |
| เอกสารแนบ 5-2 | เอกสารสอบเทียบเครื่องมือการตรวจวัดคุณภาพอากาศจากปล่อง |
| เอกสารแนบ 5-3 | เอกสารสอบเทียบเครื่องมือการตรวจวัดระดับเสียงในบรรยากาศ |
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| เอกสารแนบ 5-9 | เอกสารสอบเทียบเครื่องมือการตรวจวัดระดับความร้อนในสถานประกอบการ |

ตารางสรุปรายการเอกสารการสอบเทียบความถูกต้องของเครื่องมือเก็บตัวอย่างและตรวจวิเคราะห์

รายการตรวจวัด	เครื่องมือเก็บตัวอย่าง	เครื่องมือตรวจวิเคราะห์
	ชื่อเครื่องมือ	ชื่อเครื่องมือ
คุณภาพอากาศในบรรยากาศ		
- TSP	- High Volume Air Sampler No. R05, R08, R09, R10, R11, R18	- Digital Balance
- PM ₁₀	High Volume PM ₁₀ Air Sampler No. R06, R11, R13, R09	- Digital Balance
- Acetaldehyde	- Mass Flow Meter	- GC/MS
- NO ₂	- NO Analyzer No. R03, R05, R07, R11	- NO Analyzer No. R03, R05, R07, R11
- SO ₂	- SO ₂ Analyzer No. R02, R03, R06, R07	- SO ₂ Analyzer No. R02, R03, R06, R07
คุณภาพอากาศจากปล่อง		
- TSP	- Console No. B05, R03, R04, R06 - Pitot Tube No. B24, B28, B45, B49	- Digital Balance
- PM10	- Console No. B05, R03, R06 - Pitot Tube No. B08, B24, B49	- Digital Balance
- PM2.5	- Console No. B05, R03, R06 - Pitot Tube No. B08, B24, B49	- Digital Balance
- NO _x	- Vacuum Gauge	- Spectrophotometer
- SO ₂	- Personal Pump SKC No. B41, R08, R10, R36 - Rotameter No. H-B08, R01	-
- Acetaldehyde	- Personal Pump SKC No. R24, R36 - Rotameter No. L-R01	- GC/FID
- Acetic Acid	- Personal Pump SKC No. R08 - Rotameter No. L-R01	- GC/FID
- Ethylene Glycol	- Personal Pump SKC No. R24, R36 - Rotameter No. H-R01	- GC/FID
ระดับเสียง		
- Leq 24 hr	- Acoustic Calibrator	-
- Lmax	- Sound Level Meter No. ACO-R21, R25	
- L90		
คุณภาพน้ำ		
- pH	-	- pH Meter
- BOD ₅	-	- DO Meter
- COD	-	- COD Reactor
- Total Suspended Solids	-	- Digital balances
- Total Dissolved Solids	-	- Digital balances
- Grease and Oil	-	- Digital balances
- Ethylene Glycol	-	- GC/FID
- Acetaldehyde	-	- GC/MS

ตารางสรุปรายการเอกสารการสอบเทียบความถูกต้องของเครื่องมือเก็บตัวอย่างและตรวจวิเคราะห์ (ต่อ)

รายการตรวจวัด	เครื่องมือเก็บตัวอย่าง	เครื่องมือตรวจวิเคราะห์
	ชื่อเครื่องมือ	ชื่อเครื่องมือ
คุณภาพอากาศในสถานประกอบการ		
- Acetaldehyde	- Personal Pump No. B44, B48, B50, B65, B66, B77, R19, R24, R33, R36, R37, R43 - Rotameter No. L-R02, R06	- GC/FID
- Ethylene Glycol	- Personal Pump No. B38, B66, B45, B66, B67, R24, R26, R33 R37, R40, R45 - Rotameter No. H- R02, R06	- GC/FID
- Total Dust	- Personal Pump No. B36. B65, B72, B71, R02, R13, R26, R37 - Rotameter No. H- R02, R06	- Digital Balance
- Respirable Dust	- Personal Pump No. B40, B44, B71, R25, R31, R32, R44 - Rotameter No. H- R02, R06	- Digital Balance
- Phosphoric Acid	- Personal Pump No. B65, R40 - Rotameter No. L-R02, R06	- IC
- Sodium Hydroxide	- Personal Pump No. B28, B45, B48, B50, B71, B72, R12 - Rotameter No. H- R02, R06	-
- Sodium Hypochlorite as Sodium	- Personal Pump No. B67, R06 - Rotameter No. H- R02, R06	- ICP
- Hydrogen Sulfide	- Personal Pump No. B77, R24 - Rotameter No. L-R02, R06	- IC
- Acetone	- Personal Pump No. B31, R08 - Rotameter No. L-R02, R06	- GC/FID
- Ethanol	- Personal Pump No. B31, R08 - Rotameter No. L-R02, R06	- GC/FID
- Chloroform	- Personal Pump No. B45, R36 - Rotameter No. L-R02, R06	- GC/FID
- Phenol	- Personal Pump No. B38, R44 - Rotameter No. L-R02, R06	- GC/FID
- Isopropyl Alcohol	- Personal Pump No. B44, R19 - Rotameter No. L-R02, R06	- GC/FID
- Sulfuric Acid	- Personal Pump No. B71, R37 - Rotameter No. L-R02, R06	- IC
- Hydrochloric Acid	- Personal Pump No. B65, R08 - Rotameter No. H-R02, R06	- IC
- Acetic Acid	- Personal Pump No. R33, R43 - Rotameter No. L-R02, R06	- GC/FID

ตารางสรุปรายการเอกสารการสอบเทียบความถูกต้องของเครื่องมือเก็บตัวอย่างและตรวจวิเคราะห์ (ต่อ)

รายการตรวจวัด	เครื่องมือเก็บตัวอย่าง	เครื่องมือตรวจวิเคราะห์
	ชื่อเครื่องมือ	ชื่อเครื่องมือ
ระดับความร้อนในสถานประกอบการ - WBGT	- Heat Stress WBGT Meter No. R04, R05, R06, R13, R14, R15, R16	-
ระดับความเข้มของแสงสว่างในสถานประกอบการ - Light Intensity	- Light Meter No. R07	-
ระดับเสียงในสถานประกอบการ - Leq 12 hr - Lmax	- Acoustic Calibrator	-
	- Sound Level Meter No. ACO-B18, B29, B33, B36, B41, B43, R40, R51, R52	-
ปริมาณเสียงสะสมติดตัวพนักงาน - Noise Dose	- Acoustic Calibrator	-
	- Noise Dosimeter No. NMD-B01, B02, B03, B04, B05, B08, B09, B10, R03	-

เอกสารแนบ 5-1

เอกสารสอบเทียบเครื่องมือการตรวจวัดคุณภาพอากาศในบรรยากาศ



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., Jomjol, Chulachak, 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 : 3611

Calibration Data

High Volume Air Sampler Data		Calibration Data		
Recorder No.	Blower No.	Date	Actual Flowrate (ft ³ /min)	R ²
B35	B35	01/02/2023	y = 1.194x-4.992	0.995
B36	B36	02/02/2023	y = 1.201x-3.946	0.997
B37	B37	02/02/2023	y = 1.284x-6.745	0.997
B38	B38	02/02/2023	y = 1.250x-6.733	0.998
B39	B39	01/02/2023	y = 1.268x-7.186	0.998
B40	B40	03/02/2023	y = 1.214x-4.324	0.998
B41	B41	03/02/2023	y = 1.176x-2.734	0.999
B42	B42	02/02/2023	y = 1.283x-8.167	0.997
B43	B43	02/02/2023	y = 1.197x-3.772	0.996
B44	B44	02/02/2023	y = 1.249x-7.038	0.995
R01	R01	01/02/2023	y = 1.287x-8.462	0.998
R02	R02	01/02/2023	y = 1.239x-6.678	0.998
R03	R03	03/02/2023	y = 1.254x-7.928	0.999
R04	R04	02/02/2023	y = 1.206x-3.694	0.999
R05	R05	02/02/2023	y = 1.237x-6.503	0.997
R06	R06	02/02/2023	y = 1.239x-4.541	0.995
R07	R07	03/02/2023	y = 1.060x+1.983	0.999
R08	R08	03/02/2023	y = 1.274x-8.050	0.998
R09	R09	02/02/2023	y = 1.280x-7.005	0.998
R10	R10	03/02/2023	y = 1.244x-5.980	1.000
R11	R11	03/02/2023	y = 1.097x-0.462	0.998
R12	R12	02/02/2023	y = 1.151x-2.727	0.995
R13	R13	02/02/2023	y = 1.134x-1.526	1.000
R14	R14	02/02/2023	y = 1.172x-2.510	0.999
R15	R15	01/02/2023	y = 1.131x-2.129	0.998
R16	R16	01/02/2023	y = 1.202x-5.830	0.998
R17	R17	01/02/2023	y = 1.182x-3.281	0.998
R18	R18	03/02/2023	y = 1.217x-5.060	0.999
R19	R19	03/02/2023	y = 1.228x-6.084	0.998
R20	R20	03/02/2023	y = 1.277x-9.434	0.997



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High Volume Air Sampler Calibration Report

Calibration Method : Multipoint Orifice Flow Transfer Standard

Model : TE 5025A

S/N : 3611

Calibration Data

High Volume Air Sampler Data		Calibration Data		
Recorder No.	Blower No.	Date	Actual Flowrate (ft ³ /min)	R ²
B35	B35	01/05/2023	y = 1.310x-9.363	0.996
B36	B36	02/05/2023	y = 1.201x-4.686	0.999
B37	B37	02/05/2023	y = 1.239x-4.586	0.998
B38	B38	02/05/2023	y = 1.304x-9.606	0.997
B39	B39	01/05/2023	y = 1.240x-5.469	0.998
B40	B40	03/05/2023	y = 1.196x-4.045	0.999
B41	B41	03/05/2023	y = 1.179x-2.611	0.999
B42	B42	02/05/2023	y = 1.246x-7.813	0.996
B43	B43	02/05/2023	y = 1.206x-3.694	0.999
B44	B44	02/05/2023	y = 1.302x-9.108	0.999
R01	R01	02/05/2023	y = 1.268x-7.113	0.995
R02	R02	01/05/2023	y = 1.235x-6.759	0.997
R03	R03	03/05/2023	y = 1.247x-7.848	0.996
R04	R04	02/05/2023	y = 1.161x-1.778	0.999
R05	R05	02/05/2023	y = 1.288x-9.494	0.999
R06	R06	02/05/2023	y = 1.277x-6.891	0.997
R07	R07	02/05/2023	y = 1.046x+2.772	1.000
R08	R08	02/05/2023	y = 1.206x-5.068	0.997
R09	R09	02/05/2023	y = 1.296x-8.463	0.999
R10	R10	02/05/2023	y = 1.244x-6.477	0.999
R11	R11	02/05/2023	y = 1.097x-0.462	0.998
R12	R12	02/05/2023	y = 1.210x-5.084	0.998
R13	R13	01/05/2023	y = 1.149x-1.965	1.000
R14	R14	01/05/2023	y = 1.189x-3.035	0.998
R15	R15	02/05/2023	y = 1.161x-3.437	0.998
R16	R16	01/05/2023	y = 1.158x-4.330	0.997
R17	R17	02/05/2023	y = 1.218x-5.356	0.998
R18	R18	02/05/2023	y = 1.234x-5.546	0.999
R19	R19	02/05/2023	y = 1.267x-7.058	0.999
R20	R20	01/05/2023	y = 1.284x-8.743	0.999



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High Volume PM-10 Air Sampler Calibration Report

Calibration Method : Multipoint Orifice Flow Transfer Standard

Model : TE 5025A

S/N : 3611

Calibration Data

High Volume PM-10 Data		Calibration Data		
Recorder No.	Blower No.	Date	Actual Flowrate (ft ³ /min)	R ²
R01	R01	01/02/2023	y = 1.253x-8.016	0.996
R02	R02	01/02/2023	y = 1.246x-5.052	0.998
R03	R03	02/02/2023	y = 1.239x-5.451	0.999
R04	R04	03/02/2023	y = 1.263x-8.320	0.999
R05	R05	03/02/2023	y = 1.193x-4.904	0.998
R06	R06	03/02/2023	y = 1.270x-7.534	0.995
R07	R07	03/02/2023	y = 1.244x-5.727	0.998
R08	R08	02/02/2023	y = 1.277x-7.820	0.998
R09	R09	02/02/2023	y = 1.183x-5.015	0.996
R10	R10	01/02/2023	y = 1.200x-4.576	0.999
R11	R11	01/02/2023	y = 1.225x-4.833	0.995
R12	R12	03/02/2023	y = 1.273x-8.109	0.998
R13	R13	01/02/2023	y = 1.281x-6.830	1.000
R14	R14	01/02/2023	y = 1.288x-7.622	0.999
R15	R15	02/02/2023	y = 1.282x-8.311	0.997
R16	R16	02/02/2023	y = 1.246x-5.817	0.995
R17	R17	03/02/2023	y = 1.263x-7.123	0.999
R18	R18	03/02/2023	y = 1.203x-5.483	0.999
R19	R19	01/02/2023	y = 1.204x-4.399	0.996
R20	R20	01/02/2023	y = 1.259x-8.655	0.997



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7 ซอยพหลโยธิน 24 ถนนพหลโยธิน แขวงจอมพล เขตจตุจักร กรุงเทพฯ 10900
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High Volume PM-10 Air Sampler Calibration Report

Calibration Method : Multipoint Orifice Flow Transfer Standard

Model : TE 5025A

S/N : 3611

Calibration Data

High Volume PM-10 Data		Calibration Data		
Recorder No.	Blower No.	Date	Actual Flowrate (ft ³ /min)	R ²
R01	R01	01/05/2023	y = 1.169x-4.728	0.996
R02	R02	01/05/2023	y = 1.265x-5.602	0.999
R03	R03	01/05/2023	y = 1.215x-5.146	0.997
R04	R04	01/05/2023	y = 1.226x-6.655	0.997
R05	R05	01/05/2023	y = 1.212x-5.960	1.000
R06	R06	04/05/2023	y = 1.238x-5.381	0.995
R07	R07	04/05/2023	y = 1.283x-7.908	0.998
R08	R08	04/05/2023	y = 1.281x-7.778	1.000
R09	R09	03/05/2023	y = 1.202x-6.317	0.999
R10	R10	02/05/2023	y = 1.169x-2.499	0.999
R11	R11	01/05/2023	y = 1.210x-4.423	0.996
R12	R12	01/05/2023	y = 1.176x-3.099	0.997
R13	R13	01/05/2023	y = 1.276x-6.852	0.997
R14	R14	03/05/2023	y = 1.207x-4.849	0.996
R15	R15	03/05/2023	y = 1.198x-4.617	0.997
R16	R16	04/05/2023	y = 1.199x-5.485	0.995
R17	R17	04/05/2023	y = 1.184x-4.669	0.998
R18	R18	04/05/2023	y = 1.167x-4.142	0.998
R19	R19	04/05/2023	y = 1.197x-5.308	0.997
R20	R20	02/05/2023	y = 1.244x-8.211	0.999

**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 : 22M2567

REFERENCE No : 64386-1

PAGE : 1 OF 2

Certificate of Calibration

EQUIPMENT : DIGITAL BALANCE

MANUFACTURER : METTLER TOLEDO

MODEL : XS 105DU

SERIAL No : 1126422905

ID No : BA 05/50

CONDITION AS RECEIVED : USED ITEM

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

CALIBRATED BY : TETNITHI W.

CALIBRATION DATE : 11-Mar-22

APPROVED BY :

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.

F-G010 REV 02

**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

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CERTIFICATE No : 22M2567

PAGE : 2 OF 2

Calibration Report

EQUIPMENT : DIGITAL BALANCE MODEL : XS 105DU

MANUFACTURER : METTLER TOLEDO S/N : 1126422905

ID No : BA 05/50 RECEIVED DATE : 11-Mar-22

AIR PRESSURE : 1008mbar \pm 1mbar CALIBRATION DATE : 11-Mar-22

AMBIENT TEMPERATURE : 22° C \pm 1° C RELATIVE HUMIDITY : 49 %RH \pm 10 % RH

CONDITION OF THIS RESULTS OF CALIBRATION

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

2. REFERENCE STANDARD INSTRUMENTS :-

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

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

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

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

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

RESULT OF CALIBRATION :- WITHOUT ADJUSTMENT

1. ZERO SETTING FUNCTION : NORMAL

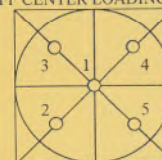
2. TARE FUNCTION : NORMAL

3. REPEATABILITY OF READING AT 20 g WAS 0.000004 g

4. REPEATABILITY OF READING AT 100 g WAS 0.000048 g

5. DEPARTURE FROM NOMINAL VALUE/ LINEARITY

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

6. OFF CENTER LOADING ERROR

POINT	READING (g)	
1	10.00001	50.0000
2	10.00002	50.0000
3	10.00001	50.0000
4	10.00001	50.0000
5	10.00002	50.0001
OFF-CENTER LOADING	0.00001	0.0001

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

END OF CALIBRATION REPORT



CERTIFICATE No : 23M2441
REFERENCE No : 68471-1

PAGE : 1 OF 2

Certificate of Calibration

EQUIPMENT : DIGITAL BALANCE
MANUFACTURER : METTLER TOLEDO
MODEL : XS105DU
SERIAL No : 1126422905
ID No : BA 05/50
CONDITION AS RECEIVED : USED ITEM
SUBMITTED BY : S.P.S. CONSULTING SERVICE CO., LTD.
7 SOI PHAHOLYOTHIN 24, PHAHOLYOTHIN RD.,
JOMPOL, CHATUCHAK, BANGKOK 10900

CALIBRATED BY : ATSAWIN Y.
CALIBRATION DATE :
APPROVED BY :
ISSUED DATE :
RECEIVED DATE : 10-Mar-23

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

F-G010 REV 02



CERTIFICATE No : 23M2441

PAGE : 2 OF 2

Calibration Report

EQUIPMENT : DIGITAL BALANCE MODEL : XS105DU
MANUFACTURER : METTLER TOLEDO S/N : 1126422905
ID No : BA 05/50 RECEIVED DATE : 10-Mar-23
AIR PRESSURE : 1010mbar \pm 1mbar CALIBRATION DATE : 10-Mar-23
AMBIENT TEMPERATURE : 23°C \pm 1°C RELATIVE HUMIDITY : 49%RH \pm 10% RH

CONDITION OF THIS RESULTS OF CALIBRATION

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

INSTRUMENT	MODEL	SERIAL No	CERTIFICATE No	DUE DATE
1) STANDARD WEIGHT SET	E2	QK-1-151	M2302013S	02-Feb-25
2) STANDARD WEIGHT	E2	15843	M2302014S	02-Feb-25
3. THIS RESULT WAS FOUND ACCURATE AS SHOWN ON DATE AND PLACE OF CALIBRATION ONLY.
4. THIS RESULT EXCLUDE LONG TERM STABILITY OF THE UNIT UNDER CALIBRATION.
5. THIS CERTIFICATE IS TRACEABLE TO THE INTERNATIONAL SYSTEM OF UNIT MAINTAINED AT:-
- NATIONAL INSTITUTE OF METROLOGY (THAILAND) THROUGH CENTRAL BUREAU OF WEIGHTS&MEASURES

RESULT OF CALIBRATION :- WITHOUT ADJUSTMENT

1. ZERO SETTING FUNCTION : NORMAL
2. TARE FUNCTION : NORMAL
3. REPEATABILITY OF READING AT 200 g WAS 0 g
4. DEPARTURE FROM NOMINAL VALUE/ LINEARITY

NOMINAL VALUE (g)	BALANCE READING (g)	CORRECTION (g)	UNCERTAINTY (\pm g)
0.00	0.00000	0.00000	0.000039
0.02	0.02000	0.00000	0.000039
0.10	0.10000	0.00000	0.000039
0.20	0.20001	-0.00001	0.000040
0.50	0.50001	-0.00001	0.000040
1.00	1.00000	0.00000	0.000041
2.00	2.00003	-0.00003	0.000042
5.00	5.00001	-0.00001	0.000046
10.00	10.00003	-0.00003	0.000053
20.00	20.00005	-0.00005	0.000067
50.00	50.0001	-0.0001	0.00011
100.00	100.0001	-0.0001	0.00019
200.00	200.0001	-0.0001	0.00032

5. OFF CENTER LOADING ERROR



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

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

END OF CALIBRATION REPORT



Certificate of Calibration

Certificate Number : SPR22050189-1 Page : 1 of 3

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

Equipment Name : Mass Flow Meter
Manufacturer : Dwyer
Model : GMF-2101
Serial Number : N/A
ID. Number : N/A

Environmental Conditions
Ambient Temperature : 23 °C ± 2 °C Received Date : 13 May 2022
Relative Humidity : 50 % ± 15 % Calibration Date : 14 May 2022
Location of Calibration : In-Lab Recommend Due Date : 14 May 2023
Calibration Procedure : In-House Method Date of Issue : 15 May 2022

Method of Calibration

This certifies that the above instrument was calibrated in compliance with the calibration system requirement of ISO/IEC 17025:2017 in accordance with reference procedure. Standards used to perform this calibration are certified by to NIST or equivalent, National metrology institute, Natural physical constants, consensus standards. The result reported herein apply only to the calibration of the item described above as received. Our decision rule is to contact the customer if the item pass and fail calibration when the results include the uncertainties and the customer must determine if the results meets their needs.

All calibrations are performed within manufacture's specifications. The calibration certificate shall not be reproduced except in full, without written approval of SP Metrology System (Thailand).

Calibrated by

Calibration Officer

Approved by :

Authorized Signatory



Calibration Report

Certificate Number : SPR22050189-1

Page : 2 of 3

Reference Standards

Equipment Name	Model	Serial No.	Certificate No.	Due. Date
Mass Flow Calibrator	AFC-COMLETE-10	12532	AD2107-244-0001	24 Jul 2022

Traceability

This certification is traceable to the International System of Unit maintained at :
MIT - Miracle International Technology Co.,Ltd.



Result of Calibration

Certificate No. : SPR22050189-1

Page : 3 of 3

Function : Air Flow Measurement

Unit : CFM

Calibration Point	UUC Reading	Standard Reading	UUC Error	K Factor Value	Uncertainty (±)
0.0	0.00	0.00	0.00	1.00000	0.12
3.3	3.32	3.53	-0.21	1.06325	0.26
7.3	7.40	7.74	-0.34	1.04595	0.26
13.5	13.25	14.22	-0.97	1.07321	0.26
17.0	17.00	17.58	-0.58	1.03412	0.26

Note:
The result of calibration was found accurate as show on date and place of calibration only.
This Certificate is not certified for any commercial transaction.

Measurement Uncertainty
The reported uncertainty of measurement is the expanded uncertainty obtained by multiplying the standard uncertainty with the coverage factor k = 2, providing a level of confidence approximately 95 %
- End of Certificate -

69/29 Moo 1 Klongsi Klongluang Pathumthani 12120 (Thailand) Tel: (662) 193-2220 5 ผู้ขาย www.souffeur.co.th

69/29 Moo 1 Klongsi Klonguang Pathumthani 12120 (Thailand) Tel: (662) 193-2220 5 6878 www.southernmetrology.com



Certificate of Calibration

Certificate Number : SPR23050422-1 Page : 1 of 3

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

Equipment Name : Mass Flow Meter
Manufacturer : Dwyer
Model : GMF-2101
Serial Number : N/A
ID. Number : MF01/51

Environmental Conditions
Ambient Temperature : 23 °C ± 2 °C Received Date : 26 May 2023
Relative Humidity : 50 % ± 15 % Calibration Date : 29 May 2023
Location of Calibration : In-Lab Recommend Due Date : 29 May 2024
Calibration Procedure : SP-CPM-04-13 Date of Issue : 30 May 2023

Method of Calibration

This certifies that the above instrument was calibrated in compliance with the calibration system requirement of ISO/IEC 17025:2017 in accordance with reference procedure. Standards used to perform this calibration are certified by to NIST or equivalent, National metrology institute, Natural physical constants, consensus standards. The result reported herein apply only to the calibration of the item described above as received. Our decision rule is to contact the customer if the item pass and fail calibration when the results include the uncertainties and the customer must determine if the results meets their needs. The calibration certificate shall not be reproduced except in full, without written approval of SP Metrology System (Thailand).

Calibrated by 
Calibration Officer

Approved by : 
Authorized Signatory

69/29 Moo 1 Klongsi Klonguang Pathumthani 12120 (Thailand) Tel: (662) 193-2220 5 6878 www.southernmetrology.com



Calibration Report

Certificate Number : SPR23050422-1 Page : 2 of 3

Reference Standards

Equipment Name	Model	Serial No.	Certificate No.	Due. Date
Mass Flow Calibrator	AFC-COMplete-10	12532	AD2207-177-0001	17 Jul 2023
Standard Flow Meter	520-H	200353	MW-0071-22	25 Aug 2023

Traceability

This certification is traceable to the International System of Unit maintained at :
MIT - Miracle International Technology Co.,Ltd.
MesaLabs - Mesa Laboratories, Inc.NVLEP Lab Code 200661-0 (ISO17025)

Turbomass/Clarus Mass/ SQ8 MS Preventive Maintenance (PM)			
Company Name:	S.P.S. Consulting Service Co.,Ltd		
Address (Instrument Location):	7 Soi Phaholyothin24 Phaholyothin Road, Jompol, Chatuchak, Bangkok, 10900.		
Serial Number:	648N4050804	PM Number:	1 of 2
Customer Name (if applicable):	Ms. Naruecha	Telephone Number:	NA
Service Engineer Name:	Monchai Kitcharoenkeat	Service Order Number:	WO-01852714
Date PM Performed: (DD-MMM-YYYY)	22-Feb-2023	Next PM Due Date: (DD-MMM-YYYY)	22-Aug-2023

Part Number	Release	Publication Date	
TH09370064	C	March 2013	

Scope

The purpose of this PM is to ensure the continued functionality of the Turbomass/Clarus MS SQ8 MS 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 or calibration, including a current back-up of system software and/or data files. The completed document should be signed by an authorized PerkinElmer and customer representative and left with the customer. Update the PM sticker and instrument logbook as required.

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Component List

Component / Specific Model	Serial #	Software Version	Configuration Notes
Clarus680	680S14042502	Totalchrom6.3	
Clarus SQ8	648N4050804	Turbomass 6.4	
Atom X	US14113002	Tekma AtomX	

Parts lists

Parts Included with the PM				
Part Number (if applicable)	Description	Quantity	Batch/Lot #	Expiration Date (MM/YY)
N/A				

Additional Tools Required for PM				
Part Number (if applicable)	Description	Quantity	Serial #	Calibration Due Date (MM/YY)
N/A				
Additional Reagents and Standards Required for PM				
Part Number (if applicable)	Description	Quantity	Batch/Lot #	Expiration Date (MM/YY)
N/A				



Procedure Checklist

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

General:

- ☒ Column type Elite 5ms
- ☒ Carrier gas flow rate 1 ml/min.
- ☒ Review the instrument performance with the customer and document any recent problems.
- ☒ Inspect the customer log book and make any appropriate PM entries.
- ☒ Check incoming AC line voltage for proper levels and grounding.

Mechanical:

- ☒ Inspect and clean all fans and filters.
- ☒ Check the level of FC-43 calibration compound in reference gas bulb and fill if necessary.
- ☒ Change the oil in the fore pump.
- ☒ Inspect cartridge in fore pump vacuum filter; replace adsorbent bead if necessary.
- ☒ Replace the exhaust vapor mist filter on the fore pump.
- ☒ Remove and clean the ion source assembly. Use the Insulator Replacement Kit and/or Optics Replacement Kit if necessary
- ☒ Replace the filament.
- ☒ Remove and clean the pre-quad rods.
- ☒ Observe Wide Range Gauge pressure; clean/adjust if required.
- ☒ Inspect and clean as needed all PC boards and bottom inside of MS chassis.

Electrical:

- ☒ Check head amp offset. Adjust if necessary for proper value (Service Manual).

Operational Tests:

- ☒ Vacuum pressure.
- ☒ Air/water leak check
- ☒ AutoTune and mass calibration.
- ☒ Make a Chromatographic injection to verify peak shape and integrity only (not meant for sensitivity test).



PC Maintenance:

- ☒ Delete all unnecessary temporary files.
- ☒ Empty deleted files from recycle bin.
- ☒ Perform hard drive defragmentation.

Review:

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

Additional Comments

Additional Comments Regarding the PM

Review

<i>The preventive maintenance checks and if applicable performance tests for Turbomass/ Clarus Mass/ SQ8 have been completed.</i>		
<i>This Turbomass/ClarusMS/SQ8 Pass the preventive maintenance.</i>		
Review of Preventive Maintenance:		
Authorized PerkinElmer Representative Monchai Kitcharoenkeat		Date: 22-Feb-2023 (DD-MMM-YYYY)
Authorized Customer Representative:		Date: 22-Feb-2023 (DD-MMM-YYYY)



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

CALIBRATION REPORT

CHEMILUMINESCENT NO / NO₂ / NO_x ANALYZER

DATE : 09 February 2023 BRAND : API MODEL : 200E
NO. NOX-R03 SERIAL NO. 4410

Calibrator (Dilution System)

Brand : API Model : 700
Last Cal. Date : 04 August 2022 Serial No. : 911

Reference Standard Gas

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

CALIBRATING CONDITION

Pressure 1011 mmbar Temp. 24.6 °C % RH 49

CALIBRATION SETTING

Span Set Point	Initial Reading (Before Adj.),PPB			Final Reading (After Adj.),PPB	
	Expected Concentration	Analyzer Response	%Dif	Analyzer Response	Slope
Zero	0	-0.10	-	0	-
NO Span	400	399.5	-0.125	400.0	1.002
NO _x Span	400	399.8	-0.050	400.0	1.005

Test Values	Observed Value	Units	Nominal Range
RANGE	500	PPB	500 standard
STABILITY (Zero Gas)	0.1	PPB	< 2 with zero air
SAMPLE FLOW	510	cc/min	500 ± 50
OZONE FLOW	79	cc/min	80 ± 15
PMT	103.2	mV	-20 - 150
AZERO	94.0	mV	-20 - 150
HVPS	673	V	420 - 900 constant
RCELL TEMP	50.4	°C	50 ± 1
BOX TEMP	29.2	°C	8 - 48
PMT TEMP	7.5	°C	7 ± 2
MOLY TEMP	315.1	°C	315 ± 5
RCELL PRESS	8.3	IN-Hg-A	2 - 10 constant
SAMPLE PRESS	28.5	IN-Hg-A	25 - 30 constant
NO Span Conc	400	PPB	20 - 20,000
NO _x Span Conc	400	PPB	20 - 20,000
NO Slope	1.002	-	1.0 ± 0.3
NO _x Slope	1.005	-	1.0 ± 0.3
NO Offset	1.0	mV	-20 to +150
NO _x Offset	0.6	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 :

Approved by :



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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 : 09 February 2023 BRAND : API MODEL : 200E
NO. NOX-R05 SERIAL NO. 4413

Calibrator (Dilution System)

Brand : API Model : 700
Last Cal. Date : 04 August 2022 Serial No. : 911

Reference Standard Gas

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

CALIBRATING CONDITION

Pressure 1011 mmbar Temp. 24.6 °C % RH 49

CALIBRATION SETTING

Span Set Point	Initial Reading (Before Adj.),PPB			Final Reading (After Adj.),PPB	
	Expected Concentration	Analyzer Response	%Dif	Analyzer Response	Slope
Zero	0	0.11	-	0	-
NO Span	400	400.2	0.050	400.0	1.010
NO _x Span	400	400.3	0.075	400.0	1.013

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	505	cc/min	500 ± 50
OZONE FLOW	78	cc/min	80 ± 15
PMT	103.4	mV	-20 - 150
AZERO	94.2	mV	-20 - 150
HVPS	670	V	420 - 900 constant
RCELL TEMP	50.3	°C	50 ± 1
BOX TEMP	29.5	°C	8 - 48
PMT TEMP	7.1	°C	7 ± 2
MOLY TEMP	314.9	°C	315 ± 5
RCELL PRESS	8.3	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	1.010	-	1.0 ± 0.3
NO _x Slope	1.013	-	1.0 ± 0.3
NO Offset	1.6	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 :

Approved by :



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CALIBRATION REPORT					
CHEMILUMINESCENT NO / NO ₂ / NO _x ANALYZER					
DATE :	09 February 2023	BRAND :	API	MODEL :	200E
NO.	NOX-R07	SERIAL NO.	4468		
Calibrator (Dilution System)					
Brand	: API		Model	: 700	
Last Cal. Date	: 04 August 2022		Serial No.	: 911	
Reference Standard Gas					
Standard Gas	: Nitric Oxide (NO)		Cylinder No.	: D636192	
Certified Date	: 20 April 2022		Expired Date	: 20 April 2024	
Cylinder Conc. : 49.1 ppm					
CALIBRATING CONDITION					
Pressure	1011	mmbar	Temp.	24.6	°C
% RH 49					
CALIBRATION SETTING					
Span	Initial Reading (Before Adj.),PPB			Final Reading (After Adj.),PPB	
Set Point	Expected Concentration	Analyzer Response	%Dif	Analyzer Response	Slope
Zero	0	-0.10	-	0	-
NO Span	400	400.1	0.025	400.0	1.008
NO _x Span	400	400.2	0.050	400.0	1.010
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	508	cc/min	500 ± 50		
OZONE FLOW	78	cc/min	80 ± 15		
PMT	103.0	mV	-20 - 150		
AZERO	93.7	mV	-20 - 150		
HVPS	672	V	420 - 900 constant		
RCELL TEMP	50.0	°C	50 ± 1		
BOX TEMP	29.4	°C	8 - 48		
PMT TEMP	7.2	°C	7 ± 2		
MOLY TEMP	315.2	°C	315 ± 5		
RCELL PRESS	8.5	IN-Hg-A	2 - 10 constant		
SAMPLE PRESS	28.7	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	1.010	-	1.0 ± 0.3		
NO Offset	1.4	mV	-20 to +150		
NO _x Offset	0.9	mV	-20 to 150		
Stability at Zero	0.1	PPB	< 0.2		
Stability at Span	0.2	PPB			

Calibrated by :

Approved by :



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CALIBRATION REPORT					
CHEMILUMINESCENT NO / NO ₂ / NO _x ANALYZER					
DATE :	09 February 2023	BRAND :	API	MODEL :	200E
NO.	NOX-R11	SERIAL NO.	2621		
Calibrator (Dilution System)					
Brand	: API		Model	: 700	
Last Cal. Date	: 04 August 2022		Serial No.	: 911	
Reference Standard Gas					
Standard Gas	: Nitric Oxide (NO)		Cylinder No.	: D636192	
Certified Date	: 20 April 2022		Expired Date	: 20 April 2024	
Cylinder Conc. : 49.1 ppm					
CALIBRATING CONDITION					
Pressure	1011	mmbar	Temp.	24.6	°C
% RH 49					
CALIBRATION SETTING					
Span	Initial Reading (Before Adj.),PPB			Final Reading (After Adj.),PPB	
Set Point	Expected Concentration	Analyzer Response	%Dif	Analyzer Response	Slope
Zero	0	-0.10	-	0	-
NO Span	400	399.7	-0.075	400.0	1.005
NO _x Span	400	400.1	0.025	400.0	1.008
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	511	cc/min	500 ± 50		
OZONE FLOW	79	cc/min	80 ± 15		
PMT	103.3	mV	-20 - 150		
AZERO	93.9	mV	-20 - 150		
HVPS	674	V	420 - 900 constant		
RCELL TEMP	50.2	°C	50 ± 1		
BOX TEMP	29.3	°C	8 - 48		
PMT TEMP	7.5	°C	7 ± 2		
MOLY TEMP	314.7	°C	315 ± 5		
RCELL PRESS	8.2	IN-Hg-A	2 - 10 constant		
SAMPLE PRESS	28.4	IN-Hg-A	25 - 30 constant		
NO Span Conc	400	PPB	20 - 20,000		
NO _x Span Conc	400	PPB	20 - 20,000		
NO Slope	1.005	-	1.0 ± 0.3		
NO _x Slope	1.008	-	1.0 ± 0.3		
NO Offset	1.1	mV	-20 to +150		
NO _x Offset	0.7	mV	-20 to 150		
Stability at Zero	0.1	PPB	< 0.2		
Stability at Span	0.2	PPB			

Calibrated by :

Approved by :



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					
SO ₂ FLUORESCENT ANALYZER					
DATE :	09 February 2023	BRAND :	API	MODEL :	100E
NO.	SO ₂ -R02	SERIAL NO.	3431		
Calibrator (Dilution System)					
Brand	: API		Model	: 700	
Last Cal. Date	: 04 August 2022		Serial No.	: 911	
Reference Standard Gas					
Standard Gas	: Sulphur Dioxide (SO ₂)		Cylinder No.	: A00814SK	
Certified Date	: 21 June 2021		Expired Date	: 21 June 2029	
Cylinder Conc.	: 50.0 ppm				
CALIBRATING CONDITION					
Pressure	1011	mmbar	Temp.	24.6	°C
% RH	49				
CALIBRATION SETTING					
Span	Initial Reading (Before Adj.),PPB			Final Reading (After Adj.),PPB	
Set Point	Expected Concentration	Analyzer Response	%Dif	Analyzer Response	Slope
Zero	0	0.10	-	0	-
SO ₂ Span	400.0	400.2	0.050	400.0	1.014
API Model 100E SO ₂ Analyzer Check list					
Test Values	Observed Value	Units	Nominal Range		
RANGE	500	PPB	0-500		
SAMPLE PRESS	28.6	in-Hg	25-35		
SAMPLE FLOW	654	cc/min	650 ± 10%		
PMT	103.3	mV	-20-150 with Zero Air		
UV LAMP	3024.8	mV	1000-4900		
STR. LGT	61.5	PPB	<100		
DRK PMT	63.0	mV	-50 - 200		
DRK LMP	57.6	mV	-50 - 200		
HVPS	672	V	550-900 constant		
DCPS	2524	mV	2500 ± 200		
RCELL TEMP	50.4	°C	50 ± 1		
BOX TEMP	29.2	°C	5-40		
PMT TEMP	7.5	°C	7 ± 2.0		
SO ₂ Span Conc	400	PPB	20-20,000		
SO ₂ Slope	1.014	-	1.0 ± 0.3		
SO ₂ Offset	21.7	mV	<250		
Stability at Zero	0.1	PPB	<0.2		
Stability at Span	0.2	PPB	0.5% of reading (above 50 ppb)		

Calibrated by

Approved by



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
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CALIBRATION REPORT					
SO ₂ FLUORESCENT ANALYZER					
DATE :	09 February 2023	BRAND :	API	MODEL :	100E
NO.	SO ₂ -R03	SERIAL NO.	3488		
Calibrator (Dilution System)					
Brand	: API		Model	: 700	
Last Cal. Date	: 04 August 2022		Serial No.	: 911	
Reference Standard Gas					
Standard Gas	: Sulphur Dioxide (SO ₂)		Cylinder No.	: A00814SK	
Certified Date	: 21 June 2021		Expired Date	: 21 June 2029	
Cylinder Conc.	: 50.0 ppm				
CALIBRATING CONDITION					
Pressure	1011	mmbar	Temp.	24.6	°C
% RH	49				
CALIBRATION SETTING					
Span	Initial Reading (Before Adj.),PPB			Final Reading (After Adj.),PPB	
Set Point	Expected Concentration	Analyzer Response	%Dif	Analyzer Response	Slope
Zero	0	-0.10	-	0	-
SO ₂ Span	400.0	399.7	-0.075	400.0	1.009
API Model 100E SO ₂ Analyzer Check list					
Test Values	Observed Value	Units	Nominal Range		
RANGE	500	PPB	0-500		
SAMPLE PRESS	28.4	in-Hg	25-35		
SAMPLE FLOW	659	cc/min	650 ± 10%		
PMT	103.0	mV	-20-150 with Zero Air		
UV LAMP	3019.5	mV	1000-4900		
STR. LGT	61.4	PPB	<100		
DRK PMT	63.1	mV	-50 - 200		
DRK LMP	57.8	mV	-50 - 200		
HVPS	670	V	550-900 constant		
DCPS	2518	mV	2500 ± 200		
RCELL TEMP	50.2	°C	50 ± 1		
BOX TEMP	29.1	°C	5-40		
PMT TEMP	7.0	°C	7 ± 2.0		
SO ₂ Span Conc	400	PPB	20-20,000		
SO ₂ Slope	1.009	-	1.0 ± 0.3		
SO ₂ Offset	22.1	mV	<250		
Stability at Zero	0.1	PPB	<0.2		
Stability at Span	0.2	PPB	0.5% of reading (above 50 ppb)		

Calibrated by

Approved by



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					
SO ₂ FLUORESCENT ANALYZER					
DATE :	09 February 2023	BRAND :	API	MODEL :	100E
NO.	SO ₂ -R06	SERIAL NO.	066		
Calibrator (Dilution System)					
Brand	: API		Model	: 700	
Last Cal. Date	: 04 August 2022		Serial No.	: 911	
Reference Standard Gas					
Standard Gas	: Sulphur Dioxide (SO ₂)		Cylinder No.	: A00814SK	
Certified Date	: 21 June 2021		Expired Date	: 21 June 2029	
Cylinder Conc.	: 50.0 ppm				
CALIBRATING CONDITION					
Pressure	1011	mmbar	Temp.	24.6	°C
% RH	49				
CALIBRATION SETTING					
Span	Initial Reading (Before Adj.),PPB			Final Reading (After Adj.),PPB	
Set Point	Expected Concentration	Analyzer Response	%Dif	Analyzer Response	Slope
Zero	0	-0.10	-	0	-
SO ₂ Span	400.0	400.1	0.025	400.0	1.010
API Model 100E SO ₂ Analyzer Check list					
Test Values	Observed Value	Units	Nominal Range		
RANGE	500	PPB	0-500		
SAMPLE PRESS	28.3	in-Hg	25-35		
SAMPLE FLOW	660	cc/min	650 ± 10%		
PMT	103.1	mV	-20-150 with Zero Air		
UV LAMP	3075.3	mV	1000-4900		
STR. LGT	31.8	PPB	<100		
DRK PMT	63.3	mV	-50 - 200		
DRK LMP	58.0	mV	-50 - 200		
HVPS	675	V	550-900 constant		
DCPS	2528	mV	2500 ± 200		
RCELL TEMP	50.5	°C	50 ± 1		
BOX TEMP	29.4	°C	5-40		
PMT TEMP	7.1	°C	7 ± 2.0		
SO ₂ Span Conc	400	PPB	20-20,000		
SO ₂ Slope	1.010	-	1.0 ± 0.3		
SO ₂ Offset	22.0	mV	<250		
Stability at Zero	0.1	PPB	<0.2		
Stability at Span	0.2	PPB	0.5% of reading (above 50 ppb)		

Calibrated by

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

CALIBRATION REPORT					
SO ₂ FLUORESCENT ANALYZER					
DATE :	09 February 2023	BRAND :	TELEDYNE	MODEL :	TML-60
NO.	SO ₂ -R07	SERIAL NO.	TRS1068		
Calibrator (Dilution System)					
Brand	: API		Model	: 700	
Last Cal. Date	: 04 August 2022		Serial No.	: 911	
Reference Standard Gas					
Standard Gas	: Sulphur Dioxide (SO ₂)		Cylinder No.	: A00814SK	
Certified Date	: 21 June 2021		Expired Date	: 21 June 2029	
Cylinder Conc.	: 50.0 ppm				
CALIBRATING CONDITION					
Pressure	1011	mmbar	Temp.	24.6	°C
% RH	49				
CALIBRATION SETTING					
Span	Initial Reading (Before Adj.),PPB			Final Reading (After Adj.),PPB	
Set Point	Expected Concentration	Analyzer Response	%Dif	Analyzer Response	Slope
Zero	0	0.11	-	0	-
SO ₂ Span	400.0	399.6	-0.100	400.0	1.007
API Model TML-60 SO ₂ Analyzer Check list					
Test Values	Observed Value	Units	Nominal Range		
RANGE	500	PPB	0-500		
SAMPLE PRESS	28.7	in-Hg	25-35		
SAMPLE FLOW	656	cc/min	650 ± 10%		
PMT	102.9	mV	-20-150 with Zero Air		
UV LAMP	3013.1	mV	1000-4900		
STR. LGT	61.3	PPB	<100		
DRK PMT	62.9	mV	-50 - 200		
DRK LMP	57.7	mV	-50 - 200		
HVPS	673	V	550-900 constant		
DCPS	2517	mV	2500 ± 200		
RCELL TEMP	50.3	°C	50 ± 1		
BOX TEMP	29.5	°C	5-40		
PMT TEMP	7.2	°C	7 ± 2.0		
SO ₂ Span Conc	400	PPB	20-20,000		
SO ₂ Slope	1.007	-	1.0 ± 0.3		
SO ₂ Offset	22.2	mV	<250		
Stability at Zero	0.1	PPB	<0.2		
Stability at Span	0.2	PPB	0.5% of reading (above 50 ppb)		

Calibrated by

Approved by

เอกสารแนบ 5-2

เอกสารสอบเทียบเครื่องมือการตรวจวัดคุณภาพอากาศจากปล่อง



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	DH _@ (mmH ₂ O)
B01	1563	02/03/2023	0.998	50.11
B02	8002514	03/03/2023	1.004	49.25
B03	1503016	03/03/2023	1.002	50.62
B04	00006659	02/03/2023	1.004	50.14
B05	00007428	03/03/2023	1.001	49.76
R01	1561	01/03/2023	0.997	49.86
R02	8002513	03/03/2023	0.996	49.93
R03	1570	02/03/2023	1.003	49.57
R04	8002519	01/03/2023	1.002	48.90
R05	1503015	01/03/2023	0.998	50.20

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

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



บริษัท เอส.พี.เอส. คอนซัลติ้ง เซอร์วิส จำกัด
S.P.S. CONSULTING SERVICE CO., LTD.
7 ซอยพหลโยธิน 24 ถนนพหลโยธิน แขวงจอมพล เขตจตุจักร กรุงเทพฯ 10900
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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	02/06/2023	1.002	50.06
B02	8002514	05/06/2023	0.998	49.11
B03	1503016	01/06/2023	1.004	50.26
B04	00006659	05/06/2023	0.996	49.89
B05	00007428	02/06/2023	0.997	49.51
R01	1561	01/06/2023	0.995	49.93
R02	8002513	02/06/2023	1.003	49.77
R03	1570	01/06/2023	0.996	49.70
R04	8002519	05/06/2023	0.995	49.44
R05	1503015	01/06/2023	0.997	50.37

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

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

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	02/02/2023	0.84	0.84
B04	S	0.99	01/02/2023	0.84	0.83
B05	S	0.99	02/02/2023	0.84	0.85
B07	S	0.99	02/02/2023	0.85	0.84
B08	S	0.99	01/02/2023	0.83	0.84
B09	S	0.99	01/02/2023	0.84	0.84
B11	S	0.99	01/02/2023	0.84	0.84
B16	S	0.99	01/02/2023	0.84	0.83
B18	S	0.99	02/02/2023	0.84	0.84
B19	S	0.99	02/02/2023	0.85	0.84
B21	S	0.99	03/02/2023	0.84	0.84
B24	S	0.99	03/02/2023	0.84	0.83
B27	S	0.99	02/02/2023	0.84	0.84
B30	S	0.99	01/02/2023	0.83	0.84
B31	S	0.99	02/02/2023	0.84	0.85
B33	S	0.99	03/02/2023	0.84	0.84
B35	S	0.99	02/02/2023	0.84	0.85

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

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	02/02/2023	0.85	0.84
B37	S	0.99	02/02/2023	0.84	0.85
B38	S	0.99	01/02/2023	0.84	0.84
B39	S	0.99	03/02/2023	0.85	0.84
B40	S	0.99	02/02/2023	0.84	0.84
B41	S	0.99	02/02/2023	0.84	0.85
B44	S	0.99	03/02/2023	0.84	0.84
B45	S	0.99	01/02/2023	0.84	0.85
B46	S	0.99	01/02/2023	0.84	0.83
B47	S	0.99	01/02/2023	0.84	0.84
B48	S	0.99	03/02/2023	0.84	0.83
B49	S	0.99	03/02/2023	0.83	0.84
B54	S	0.99	03/02/2023	0.85	0.84
B56	S	0.99	02/02/2023	0.84	0.83
B57	S	0.99	02/02/2023	0.84	0.84
B58	S	0.99	02/02/2023	0.84	0.84

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

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	02/05/2023	0.85	0.84
B04	S	0.99	02/05/2023	0.84	0.84
B05	S	0.99	02/05/2023	0.84	0.83
B07	S	0.99	02/05/2023	0.83	0.84
B08	S	0.99	03/05/2023	0.84	0.85
B09	S	0.99	04/05/2023	0.85	0.84
B11	S	0.99	04/05/2023	0.84	0.83
B16	S	0.99	04/05/2023	0.84	0.85
B18	S	0.99	02/05/2023	0.84	0.84
B19	S	0.99	02/05/2023	0.85	0.84
B21	S	0.99	03/05/2023	0.84	0.85
B24	S	0.99	03/05/2023	0.84	0.83
B27	S	0.99	02/05/2023	0.83	0.84
B30	S	0.99	04/05/2023	0.84	0.84
B31	S	0.99	02/05/2023	0.83	0.84
B33	S	0.99	03/05/2023	0.85	0.84
B35	S	0.99	02/05/2023	0.84	0.83

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

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	02/05/2023	0.84	0.84
B37	S	0.99	02/05/2023	0.83	0.84
B38	S	0.99	03/05/2023	0.85	0.84
B39	S	0.99	03/05/2023	0.84	0.83
B40	S	0.99	02/05/2023	0.84	0.83
B41	S	0.99	02/05/2023	0.84	0.84
B44	S	0.99	03/05/2023	0.85	0.84
B45	S	0.99	03/05/2023	0.85	0.84
B46	S	0.99	04/05/2023	0.84	0.83
B47	S	0.99	03/05/2023	0.84	0.85
B48	S	0.99	03/05/2023	0.83	0.84
B49	S	0.99	03/05/2023	0.85	0.84
B54	S	0.99	03/05/2023	0.83	0.84
B56	S	0.99	02/05/2023	0.84	0.85
B57	S	0.99	02/05/2023	0.84	0.83
B58	S	0.99	02/05/2023	0.85	0.84

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



CALIBRATION LABORATORY Co., LTD.

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



CALIBRATION LABORATORY Co., LTD.

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



CERTIFICATE OF CALIBRATION

FOR

NOMENCLATURE : VACUUM GAUGE
MANUFACTURER : HI-LIGHT
MODEL / TYPE : N/A
SERIAL NO. : N/A[64-220066-4]
CLID. NO. : 212201115
JOB CONTROL NO. : 220720073204

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

DATE OF RECEIVED : 20 July 2022

DATE OF ISSUED : 22 July 2022

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

Calibrated By :

Calibration Engineer

Approved By :

Authorized Signatory

22 July 2022



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. Q22073204

F3-011-04/01-12

page 1 of 3



@clccalibration

REPORT OF CALIBRATION

FOR

NOMENCLATURE : VACUUM GAUGE
MANUFACTURER : HI-LIGHT
MODEL / TYPE : N/A
SERIAL NO. : N/A[64-220066-4]
DATE OF CALIBRATION : 21 July 2022

ENVIRONMENT CONDITIONS :

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

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

PROCEDURE USED :

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

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

REFERENCE STANDARD USED :

Document Process Calibrator, Fluke Model 744 S/N. 9226007 with Pressure Module Model 700PV4 S/N. 19298401.

TRACEABILITY :

The measurements are traceable to International System of Units (SI), through National Institute of Metrology (Thailand).
Certificate No. MP-0196-21, Due Date 17 November 2022.

UNCERTAINTY :

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

Certificate No. Q22073204

F3-011-04/01-12

page 2 of 3



@clccalibration



CALIBRATION LABORATORY Co., LTD.

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



CONDITION OF CALIBRATION ITEM : GOOD

MEASUREMENT RESULTS : (X) without adjustment () adjustment

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

CALIBRATION DATA

CORRECTION OF PRESSURE

DUC Test point (inHg)	STD Reading (inHg)		Correction (inHg)	
	Up	Down	Up	Down
0	0.0	0.0	0.0	0.0
-5	-5.1	-5.1	-0.1	-0.1
-10	-10.0	-10.1	0.0	-0.1
-15	-15.0	-15.0	0.0	0.0
-20	-19.9	-20.0	+0.1	0.0
-25	-24.9	-24.9	+0.1	+0.1
-30	-29.9	-29.9	+0.1	+0.1

Uncertainty of measurement ± 0.2 inHg

Transmitting fluid : Air.

Technical Note. k factor 1 kPa = 0.2952998 inHg

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

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

End of Certificate

Certificate No. Q22073204

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@clccalibration

SITHIPORN ASSOCIATES CO.,LTD. CALIBRATION LABORATORY

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



NSC-TISI-TIS 17025
CALIBRATION 0394

Cert. No. : SP22018
Pages 1 of 3

Calibration Certificate

Equipment : UV-VIS SPECTROPHOTOMETER
Manufacturer : PERKINELMER
Model : LAMBDA 25
Serial No.: 501S14123010
ID No.: SP03/58
Calibration Mode : WAVELENGTH ACCURACY
PHOTOMETRIC ACCURACY

Condition As Found : GOOD

Customer : S.P.S. CONSULTING SERVICE CO., LTD.
7 SOI PHAHOLYOTHIN 24, PHAHOLYOTHIN ROAD,
CHOMPHON, CHATUCHAK,
BANGKOK 10900, THAILAND.

Location : ORGANIC LABORATORY IV

Ambient Temperature : (24.4 ± 5) °C

Relative Humidity : (60.1 ± 25) %

Received Date : 30 AUGUST 2022

Calibration Date : 30 AUGUST 2022

Date of Issue : 31 AUGUST 2022

Calibrated by :

Approved by :

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

SITHIPORN
associates

SITHIPORN ASSOCIATES CO.,LTD.
CALIBRATION LABORATORY

Continuation of Calibration Certificate

Cert. No. : SP22018
Job No. : VC65SP0008
Pages : 2 of 3

Calibration Method :

This instrument was calibrated by using on-site calibration procedure In-house method : CP-SP-01
The calibration procedure to direct measurement wavelength accuracy by using wavelength standard solution, Photometric accuracy by using absorbance standard filter and absorbance standard solution
The calibration procedure used was based on ASTM E275-01,ASTM E925-02

Condition of this result of calibration :

1. Certified reference materials

Material	Ref. type	Cell serial No.	Cert. No.	Due Date
Holmium liquid	RM-HL	29706	87569	13/10/2022
Didymium liquid	RM-DL	28912	87588	15/10/2022
Neutral density filter	RM-1N2N3N	13877	87600	15/10/2022
Potassium dichromate solutions	RM-0204060810	14204	87614	16/10/2022
Potassium Iodide solution	-	KI-0701-001	CI-0090-22	08/04/2024

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

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

- 3.1 The UK National Physical Laboratory (NPL)
- 3.2 The National Institute of Standards and Technology,NIST.

Result of calibration : Wavelength Accuracy

(Without adjustment)

Material	Certified Values of Reference Material (nm)	UUC* Reading (nm)	Error (nm)	Uncertainty ± (nm)	k Factor
RM-HL	278.13	278.3	0.17	0.16	2.00
	361.25	361.4	0.15	0.16	2.00
	467.82	467.8	-0.02	0.16	2.00
	536.56	536.5	-0.06	0.16	2.00
	640.50	640.5	0.00	0.16	2.00
RM-DL	740.09	740.0	-0.09	0.16	2.00
	864.94	865.2	0.26	0.16	2.00

UUC* = Unit Under Calibration

Continuation of Calibration Certificate

Cert. No. : SP22018
Job No. : VC65SP0008
Pages : 3 of 3

Result of calibration : Photometric Accuracy

(Without adjustment)

Material	Wavelength (nm)	Filter: S/N	Nominal Absorbance (A)	Certified Absorbance (A)	UUC* Reading Absorbance (A)	Error (A)	Uncertainty ± (A)	k Factor
Neutral Density glass filter	440.0	29360	1.0	1.0524	1.0539	0.0015	0.0028	2.00
		29914	0.7	0.7454	0.7459	0.0005	0.0029	2.00
		29381	0.5	0.5426	0.5426	0.0000	0.0028	2.00
	546.1	29360	1.0	0.9822	0.9810	-0.0012	0.0028	2.00
		29914	0.7	0.6962	0.6960	-0.0002	0.0028	2.00
		29381	0.5	0.5076	0.5070	-0.0006	0.0029	2.00
	590.0	29360	1.0	1.0221	1.0202	-0.0019	0.0028	2.00
		29914	0.7	0.7238	0.7230	-0.0008	0.0029	2.00
		29381	0.5	0.5364	0.5360	-0.0004	0.0031	2.00
	635.0	29360	1.0	0.9751	0.9732	-0.0019	0.0028	2.00
		29914	0.7	0.6912	0.6902	-0.0010	0.0029	2.00
		29381	0.5	0.5214	0.5210	-0.0004	0.0032	2.00
Material	Wavelength (nm)	Solution (mg/l)	Certified Absorbance (A)	UUC* Reading Absorbance (A)	Error (A)	Uncertainty ± (A)	k Factor	
RM-0204060810	235.0	20	0.2436	0.2419	-0.0017	0.0101	2.00	
		40	0.4905	0.4855	-0.0050	0.0115	2.00	
		60	0.7453	0.7388	-0.0065	0.0067	2.00	
		80	0.9920	0.9839	-0.0081	0.0071	2.00	
		100	1.2487	1.2414	-0.0073	0.0073	2.00	

UUC* = Unit Under Calibration

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

Resolution of Wavelength Mode 0.1 nm
Resolution of Photometric Mode 0.0001 A

Parameter Setting

Measurement Mode Wavelength, Absorbance

Wavelength Scan 1100 nm-190 nm

Scanning Speed 7.5 nm/min

Data Pitch 0.1 nm

Band width(Wavelength) 1.0 nm

Band width(Vis) 1.0 nm

Band width(Uv) 1.0 nm

Stray Light** UUC* Reading at 220 nm	
Transmission T(%)	Absorbance(A)
0.0107	3.9886

**Specific Acceptance :

Transmission ≤ 1.0 T(%), Absorbance ≥ 2.0 A

**Stray light not TISI Accredited

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

End of Calibration Certificate

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S.P.S. CONSULTING SERVICE CO., LTD.
7 ซอยพหลโยธิน 24 ถนนพหลโยธิน แขวงจตุจักร 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		± 3		°C						
Pressure		1010		± 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			
B41	SKC	224-PCXR4	612669	05/01/2023	1,000	1,500	2,000	998	1,497	1,990	0.997x + 0.718	1.000
B42	SKC	224-PCXR4	626041	05/01/2023	1,000	1,500	2,000	1,004	1,498	1,991	0.986x + 18.291	1.000
B43	SKC	224-PCXR4	034636	05/01/2023	1,000	1,500	2,000	1,000	1,501	1,992	0.991x + 11.882	1.000
B44	SKC	224-PCXR8	529341	06/01/2023	1,000	1,500	2,000	1,002	1,502	2,002	1.005x - 9.213	1.000
B45	SKC	224-PCXR8	529594	06/01/2023	1,000	1,500	2,000	999	1,501	1,989	0.991x + 11.184	1.000
B46	SKC	224-PCXR8	566743	06/01/2023	1,000	1,500	2,000	995	1,504	2,002	1.014x - 30.571	0.999
B47	SKC	224-PCXR8	566747	06/01/2023	1,000	1,500	2,000	1,002	1,502	2,004	1.013x - 24.601	0.999
B48	SKC	224-PCXR8	566753	04/01/2023	1,000	1,500	2,000	1,000	1,494	1,998	0.998x + 0.319	1.000
B49	SKC	224-PCXR8	566780	04/01/2023	1,000	1,500	2,000	1,003	1,502	2,006	1.013x - 23.982	0.999
B50	SKC	224-PCXR8	500400	04/01/2023	1,000	1,500	2,000	1,001	1,496	2,002	1.001x - 3.538	1.000
B51	SKC	224-PCXR8	500363	04/01/2023	1,000	1,500	2,000	996	1,504	1,999	1.011x - 25.031	0.999
B52	SKC	224-PCXR8	093186	04/01/2023	1,000	1,500	2,000	995	1,496	1,994	0.997x - 0.602	1.000
B53	SKC	224-PCXR8	707670	03/01/2023	1,000	1,500	2,000	1,002	1,500	2,002	1.008x - 15.403	0.999
B54	SKC	224-PCXR3	509821	03/01/2023	1,000	1,500	2,000	993	1,502	2,001	1.017x - 34.237	0.999
B55	SKC	224-PCXR3	510710	03/01/2023	1,000	1,500	2,000	999	1,494	1,994	0.997x - 0.989	1.000
B56	SKC	224-PCXR3	511450	03/01/2023	1,000	1,500	2,000	1,002	1,500	2,001	1.004x - 8.081	1.000
B57	SKC	224-PCXR3	510798	06/01/2023	1,000	1,500	2,000	997	1,492	1,998	1.000x - 2.680	1.000
B58	SKC	224-PCXR3	509852	06/01/2023	1,000	1,500	2,000	1,000	1,498	1,999	1.007x - 18.953	0.999
B59	SKC	224-PCXR3	509862	06/01/2023	1,000	1,500	2,000	996	1,503	1,994	0.997x + 3.235	1.000
B60	SKC	224-PCXR3	512655	06/01/2023	1,000	1,500	2,000	1,002	1,500	2,003	1.006x - 11.407	1.000
B61	SKC	224-PCXR3	503915	06/01/2023	1,000	1,500	2,000	994	1,489	1,998	1.004x - 12.623	1.000
B62	SKC	224-PCXR3	505975	06/01/2023	1,000	1,500	2,000	999	1,494	1,996	0.997x + 0.343	1.000
B63	SKC	224-PCXR3	511432	03/01/2023	1,000	1,500	2,000	991	1,501	1,999	1.016x - 34.624	0.999
B64	SKC	224-PCXR3	508302	03/01/2023	1,000	1,500	2,000	997	1,492	1,989	0.992x + 6.226	1.000
B65	SKC	224-PCXR3	508310	03/01/2023	1,000	1,500	2,000	1,002	1,500	2,003	1.007x - 13.936	1.000
B66	SKC	224-PCXR3	509861	03/01/2023	1,000	1,500	2,000	1,002	1,491	1,991	0.987x + 14.183	1.000
B67	SKC	224-PCXR3	506295	04/01/2023	1,000	1,500	2,000	993	1,508	2,004	1.009x - 15.555	1.000
B68	SKC	224-PCXR3	505872	04/01/2023	1,000	1,500	2,000	1,002	1,490	1,997	0.995x + 3.841	1.000
B69	SKC	224-PCXR3	508375	04/01/2023	1,000	1,500	2,000	1,002	1,499	2,000	1.010x - 20.772	0.999
B70	SKC	224-PCXR3	510623	05/01/2023	1,000	1,500	2,000	992	1,503	1,997	1.002x - 5.855	1.000
B71	SKC	224-PCXR3	508367	05/01/2023	1,000	1,500	2,000	992	1,506	2,002	1.017x - 34.791	0.999
B72	SKC	224-PCXR3	505977	05/01/2023	1,000	1,500	2,000	1,001	1,498	1,993	0.991x + 8.962	1.000
B73	SKC	224-PCXR3	512606	05/01/2023	1,000	1,500	2,000	1,002	1,501	2,005	1.009x - 14.785	1.000
B74	SKC	224-PCXR3	505993	05/01/2023	1,000	1,500	2,000	996	1,495	1,994	1.000x - 6.916	1.000
B75	SKC	224-PCXR3	509820	04/01/2023	1,000	1,500	2,000	995	1,498	1,990	0.996x + 1.791	1.000
B76	SKC	224-PCXR3	509811	04/01/2023	1,000	1,500	2,000	993	1,498	1,998	1.006x - 14.322	1.000
B77	SKC	224-PCXR3	508301	04/01/2023	1,000	1,500	2,000	1,000	1,501	2,003	1.014x - 26.603	0.999
B78	SKC	224-PCXR3	510677	04/01/2023	1,000	1,500	2,000	995	1,503	1,999	1.013x - 28.158	0.999
B79	SKC	224-PCXR3	510920	03/01/2023	1,000	1,500	2,000	994	1,493	1,994	0.999x - 4.184	1.000
Calibrated by :					Approved by :							



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7 ซอยพหลโยธิน 24 ถนนพหลโยธิน แขวงจอมพล เขตจตุจักร กรุงเทพฯ 10900
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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	R²
B80	SKC	224-PCXR3	504569	03/01/2023	1,000	1,500	2,000	1,002	1,499	2,002	1.012x - 24.026	0.999
B81	SKC	224-PCXR3	503480	03/01/2023	1,000	1,500	2,000	996	1,499	2,000	1.014x - 30.524	0.999
B82	SKC	224-PCXR3	505673	06/01/2023	1,000	1,500	2,000	994	1,498	1,996	1.001x - 5.943	1.000
B83	SKC	224-PCXR3	510785	06/01/2023	1,000	1,500	2,000	1,010	1,499	2,002	1.004x - 10.466	0.999
B84	SKC	224-PCXR3	508333	06/01/2023	1,000	1,500	2,000	997	1,495	1,991	0.996x + 1.260	1.000
B85	SKC	224-PCXR3	505757	06/01/2023	1,000	1,500	2,000	994	1,502	1,998	1.005x - 13.844	1.000
B86	SKC	224-PCXR3	512625	03/01/2023	1,000	1,500	2,000	1,013	1,503	2,004	1.001x - 0.726	0.999
B87	SKC	224-PCXR3	504324	03/01/2023	1,000	1,500	2,000	998	1,496	2,000	1.000x - 1.109	1.000
B88	SKC	224-PCXR3	508307	03/01/2023	1,000	1,500	2,000	996	1,498	1,994	0.996x + 1.532	1.000
B89	SKC	224-PCXR3	509860	04/01/2023	1,000	1,500	2,000	1,000	1,499	2,003	1.008x - 15.156	1.000
B90	SKC	224-PCXR3	508366	04/01/2023	1,000	1,500	2,000	993	1,508	1,999	1.006x - 12.512	1.000
B91	SKC	224-PCXR3	510919	04/01/2023	1,000	1,500	2,000	1,000	1,498	1,996	0.990x + 8.719	1.000
B92	SKC	224-PCXR3	510987	04/01/2023	1,000	1,500	2,000	1,002	1,501	1,999	1.000x + 0.299	1.000
B93	SKC	224-PCXR3	509845	04/01/2023	1,000	1,500	2,000	995	1,496	2,004	1.009x - 16.979	1.000
B94	SKC	224-PCXR8	A127871	03/01/2023	1,000	1,500	2,000	1,000	1,500	2,002	1.007x - 19.105	0.999
B95	SKC	224-PCXR8	A127921	03/01/2023	1,000	1,500	2,000	993	1,502	2,001	1.015x - 30.898	0.999
B96	SKC	224-PCXR8	A127942	03/01/2023	1,000	1,500	2,000	998	1,498	1,995	0.998x - 1.485	1.000
B97	SKC	224-PCXR8	A127955	03/01/2023	1,000	1,500	2,000	1,003	1,501	2,003	1.011x - 20.356	0.999
B98	SKC	224-PCXR8	A127956	03/01/2023	1,000	1,500	2,000	996	1,498	1,997	1.003x - 7.473	1.000

Calibrated by :

Approved by :



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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	R²
R01	SKC	224-PCXR4	602467	03/01/2023	1,000	1,500	2,000	993	1,508	2,004	1.008x - 13.936	0.999
R02	SKC	224-PCXR4	626450	06/01/2023	1,000	2,000	3,000	998	1,499	1,990	0.989x + 12.268	1.000
R03	SKC	224-PCXR4	691592	06/01/2023	1,000	1,500	2,000	1,003	1,500	2,004	1.011x - 21.761	0.999
R04	SKC	224-PCXR4	691672	06/01/2023	1,000	1,500	2,000	996	1,493	1,995	0.997x - 1.563	1.000
R05	SKC	224-PCXR4	798470	06/01/2023	1,000	1,500	2,000	993	1,505	1,999	1.014x - 31.752	0.999
R06	SKC	224-PCXR4	798456	06/01/2023	1,000	1,500	2,000	993	1,498	1,994	1.003x - 8.555	1.000
R07	SKC	224-PCXR4	798480	04/01/2023	1,000	1,500	2,000	994	1,490	1,999	1.007x - 16.073	1.000
R08	SKC	224-PCXR4	883215	04/01/2023	1,000	1,500	2,000	1,011	1,501	2,005	0.999x + 3.207	1.000
R09	SKC	224-PCXR4	034650	04/01/2023	1,000	1,500	2,000	991	1,504	2,002	1.018x - 35.900	0.999
R10	SKC	224-PCXR4	091765	04/01/2023	1,000	1,500	2,000	997	1,512	1,994	0.999x + 0.977	1.000
R11	SKC	224-PCXR4	091763	03/01/2023	1,000	1,500	2,000	1,000	1,499	2,002	1.013x - 25.119	0.999
R12	SKC	224-PCXR4	091568	03/01/2023	1,000	1,500	2,000	997	1,501	1,999	1.001x - 4.906	1.000
R13	SKC	224-PCXR4	091638	03/01/2023	1,000	1,500	2,000	1,002	1,499	1,994	0.992x + 9.636	1.000
R14	SKC	224-PCXR4	091764	03/01/2023	1,000	1,500	2,000	994	1,502	1,999	1.014x - 30.212	0.999
R15	SKC	224-PCXR8	529457	03/01/2023	1,000	1,500	2,000	1,001	1,500	2,004	1.006x - 11.941	1.000
R16	SKC	224-PCXR8	529643	05/01/2023	1,000	1,500	2,000	998	1,497	1,994	1.000x - 4.686	1.000
R17	SKC	224-PCXR8	529645	05/01/2023	1,000	1,500	2,000	994	1,509	2,000	1.015x - 30.731	0.999
R18	SKC	224-PCXR8	566756	05/01/2023	1,000	1,500	2,000	991	1,498	1,998	1.001x - 6.840	1.000
R19	SKC	224-PCXR8	566802	05/01/2023	1,000	1,500	2,000	1,002	1,499	2,000	1.010x - 21.027	0.999
R20	SKC	224-PCXR8	529089	03/01/2023	1,000	1,500	2,000	991	1,501	2,003	1.020x - 39.916	0.999
R21	SKC	224-PCXR8	665728	03/01/2023	1,000	1,500	2,000	998	1,493	1,999	1.000x - 5.404	1.000
R22	SKC	224-PCXR8	707444	03/01/2023	1,000	1,500	2,000	1,002	1,500	2,002	1.004x - 7.135	1.000
R23	SKC	224-PCXR8	761067	03/01/2023	1,000	1,500	2,000	998	1,494	1,991	0.993x + 4.132	1.000
R24	SKC	224-PCXR8	707893	04/01/2023	1,000	1,500	2,000	996	1,505	2,000	1.008x - 17.553	0.999
R25	SKC	224-PCXR8	761052	04/01/2023	1,000	1,500	2,000	1,010	1,499	1,993	0.984x + 23.464	1.000
R26	SKC	224-PCXR8	707956	04/01/2023	1,000	1,500	2,000	1,002	1,500	2,004	1.009x - 15.842	1.000
R27	SKC	224-PCXR8	707398	04/01/2023	1,000	1,500	2,000	996	1,503	2,001	1.006x - 13.449	1.000
R28	SKC	224-PCXR8	707481	04/01/2023	1,000	1,500	2,000	1,004	1,500	2,002	1.010x - 19.288	0.999
R29	SKC	224-PCXR8	707402	03/01/2023	1,000	1,500	2,000	1,004	1,493	1,991	0.986x + 14.167	1.000
R30	SKC	224-PCXR8	093811	03/01/2023	1,000	1,500	2,000	1,000	1,495	1,994	0.996x + 1.922	1.000
R31	SKC	224-PCXR8	093163	03/01/2023	1,000	1,500	2,000	1,001	1,501	2,001	1.002x - 3.618	1.000
R32	SKC	224-PCXR8	671950	03/01/2023	1,000	1,500	2,000	998	1,498	1,994	0.995x + 4.970	1.000
R33	SKC	224-PCXR4	626254	03/01/2023	1,000	1,500	2,000	995	1,502	1,999	1.014x - 31.070	0.999
R34	SKC	224-PCXR4	626131	03/01/2023	1,000	1,500	2,000	1,002	1,498	2,004	1.006x - 11.510	1.000
R35	SKC	224-PCXR8	707460	03/01/2023	1,000	1,500	2,000	999	1,498	1,995	0.994x + 6.669	1.000
R36	SKC	224-PCXR8	707446	03/01/2023	1,000	1,500	2,000	1,004	1,499	2,001	1.009x - 18.036	0.999
R37	SKC	224-PCXR8	707432	03/01/2023	1,000	1,500	2,000	996	1,499	1,998	1.000x - 2.070	1.000
R38	SKC	224-PCXR8	707349	03/01/2023	1,000	1,500	2,000	996	1,500	2,001	1.004x - 9.345	1.000
R39	SKC	224-PCXR8	761095	03/01/2023	1,000	1,500	2,000	1,001	1,496	1,994	0.997x + 2.373	1.000

Calibrated by :

Approved by :



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, Chaluchak, Bangkok 10900
Tel : (662) 939-4370-72, Fax : (662) 513-4221, E-mail : sale@spscn.com, www.spscn.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
R40	SKC	224-PCXR4	612753	05/01/2023	1,000	1,500	2,000	1,001	1,502	2,003	1.012x - 23.564	0.999
R41	SKC	224-PCXR4	626140	05/01/2023	1,000	1,500	2,000	992	1,509	2,001	1.017x - 32.442	0.999
R42	SKC	224-PCXR4	626463	05/01/2023	1,000	1,500	2,000	998	1,493	1,999	1.001x - 2.963	1.000
R43	SKC	224-PCXR4	626129	05/01/2023	1,000	1,500	2,000	1,003	1,501	2,003	1.010x - 18.945	0.999
R44	SKC	224-PCXR4	602753	05/01/2023	1,000	1,500	2,000	1,002	1,496	1,993	0.995x + 2.529	1.000
R45	SKC	224-PCXR4	626137	05/01/2023	1,000	1,500	2,000	992	1,505	2,002	1.019x - 37.408	0.999

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บริษัท เอส.พี.เอส. คอนซัลติ้ง เซอร์วิส จำกัด
S.P.S. CONSULTING SERVICE CO., LTD.
7 ซอยพหลโยธิน 24 ถนนพหลโยธิน แขวงจอมพล เขตจตุจักร กรุงเทพฯ 10900
7 Soi Phaholyothin 24, Phaholyothin Rd., Jompol, Chaluchak, Bangkok 10900
Tel : (662) 939-4370-72, Fax : (662) 513-4221, E-mail : sale@spscn.com, www.spscn.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
B41	SKC	224-PCXR4	612669	07/04/2023	1,000	1,500	2,000	997	1,496	1,991	0.998x - 1.396	1.000
B42	SKC	224-PCXR4	626041	10/04/2023	1,000	1,500	2,000	1,006	1,496	1,992	0.988x + 14.223	1.000
B43	SKC	224-PCXR4	034636	07/04/2023	1,000	1,500	2,000	1,001	1,503	1,993	0.992x + 8.810	1.000
B44	SKC	224-PCXR8	529341	10/04/2023	1,000	1,500	2,000	1,000	1,499	2,005	1.008x - 14.358	1.000
B45	SKC	224-PCXR8	529594	10/04/2023	1,000	1,500	2,000	998	1,506	1,987	0.990x + 12.580	1.000
B46	SKC	224-PCXR8	566743	05/04/2023	1,000	1,500	2,000	996	1,502	2,000	1.012x - 26.902	0.999
B47	SKC	224-PCXR8	566747	07/04/2023	1,000	1,500	2,000	998	1,501	2,002	1.014x - 27.552	0.999
B48	SKC	224-PCXR8	566753	10/04/2023	1,000	1,500	2,000	998	1,493	1,996	0.997x - 0.359	1.000
B49	SKC	224-PCXR8	566780	05/04/2023	1,000	1,500	2,000	1,007	1,501	2,007	1.011x - 19.156	0.999
B50	SKC	224-PCXR8	500400	07/04/2023	1,000	1,500	2,000	1,004	1,495	2,004	1.000x - 1.663	1.000
B51	SKC	224-PCXR8	500363	04/04/2023	1,000	1,500	2,000	997	1,502	1,998	1.008x - 21.322	0.999
B52	SKC	224-PCXR8	093186	05/04/2023	1,000	1,500	2,000	993	1,493	1,995	1.000x - 6.106	1.000
B53	SKC	224-PCXR8	707670	05/04/2023	1,000	1,500	2,000	1,000	1,498	2,002	1.009x - 18.883	0.999
B54	SKC	224-PCXR3	509821	05/04/2023	1,000	1,500	2,000	995	1,500	2,001	1.016x - 32.482	0.999
B55	SKC	224-PCXR3	510710	10/04/2023	1,000	1,500	2,000	998	1,497	1,992	0.996x - 0.191	1.000
B56	SKC	224-PCXR3	511450	05/04/2023	1,000	1,500	2,000	1,003	1,501	2,003	1.005x - 8.081	1.000
B57	SKC	224-PCXR3	510798	05/04/2023	1,000	1,500	2,000	999	1,490	2,000	1.001x - 2.920	1.000
B58	SKC	224-PCXR3	509852	10/04/2023	1,000	1,500	2,000	1,002	1,496	1,998	1.004x - 15.922	0.999
B59	SKC	224-PCXR3	509862	10/04/2023	1,000	1,500	2,000	998	1,501	1,996	0.996x + 4.471	1.000
B60	SKC	224-PCXR3	512655	07/04/2023	1,000	1,500	2,000	1,003	1,499	2,004	1.005x - 9.971	1.000
B61	SKC	224-PCXR3	503915	10/04/2023	1,000	1,500	2,000	993	1,488	1,999	1.007x - 15.934	1.000
B62	SKC	224-PCXR3	505975	10/04/2023	1,000	1,500	2,000	1,001	1,495	1,997	1.000x - 4.802	1.000
B63	SKC	224-PCXR3	511432	07/04/2023	1,000	1,500	2,000	993	1,500	2,000	1.015x - 32.709	0.999
B64	SKC	224-PCXR3	508302	05/04/2023	1,000	1,500	2,000	998	1,491	1,987	0.989x + 9.855	1.000
B65	SKC	224-PCXR3	508310	10/04/2023	1,000	1,500	2,000	998	1,502	2,005	1.012x - 20.596	1.000
B66	SKC	224-PCXR3	509861	10/04/2023	1,000	1,500	2,000	1,000	1,492	1,992	0.990x + 10.912	1.000
B67	SKC	224-PCXR3	506295	07/04/2023	1,000	1,500	2,000	993	1,506	2,002	1.007x - 13.999	1.000
B68	SKC	224-PCXR3	505872	05/04/2023	1,000	1,500	2,000	998	1,488	1,997	0.998x - 1.743	1.000
B69	SKC	224-PCXR3	508375	04/04/2023	1,000	1,500	2,000	1,004	1,502	2,002	1.009x - 18.897	0.999
B70	SKC	224-PCXR3	510623	05/04/2023	1,000	1,500	2,000	994	1,505	1,998	1.004x - 8.846	1.000
B71	SKC	224-PCXR3	508307	10/04/2023	1,000	1,500	2,000	994	1,503	2,003	1.011x - 23.544	0.999
B72	SKC	224-PCXR3	505977	10/04/2023	1,000	1,500	2,000	1,005	1,493	1,992	0.988x + 13.309	1.000
B73	SKC	224-PCXR3	512606	05/04/2023	1,000	1,500	2,000	1,000	1,504	2,004	1.008x - 14.506	1.000
B74	SKC	224-PCXR3	505993	05/04/2023	1,000	1,500	2,000	997	1,497	1,996	1.001x - 7.514	1.000
B75	SKC	224-PCXR3	509820	07/04/2023	1,000	1,500	2,000	997	1,496	1,992	0.997x + 0.195	1.000
B76	SKC	224-PCXR3	509811	05/04/2023	1,000	1,500	2,000	995	1,498	1,999	1.004x - 11.212	1.000
B77	SKC	224-PCXR3	508301	10/04/2023	1,000	1,500	2,000	1,003	1,502	2,004	1.013x - 23.811	0.999
B78	SKC	224-PCXR3	510677	04/04/2023	1,000	1,500	2,000	997	1,505	2,000	1.007x - 16.113	0.999
B79	SKC	224-PCXR3	510920	10/04/2023	1,000	1,500	2,000	996	1,495	1,993	0.998x - 1.232	1.000

Calibrated by :

Approved by :



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
B80	SKC	224-PCXR3	504569	05/04/2023	1,000	1,500	2,000	1,003	1,498	2,003	1.011x - 22.431	0.999
B81	SKC	224-PCXR3	503480	05/04/2023	1,000	1,500	2,000	995	1,500	2,001	1.016x - 32.797	0.999
B82	SKC	224-PCXR3	505673	05/04/2023	1,000	1,500	2,000	995	1,496	1,997	1.003x - 7.259	1.000
B83	SKC	224-PCXR3	510785	05/04/2023	1,000	1,500	2,000	1,007	1,498	2,001	1.006x - 13.816	0.999
B84	SKC	224-PCXR3	508333	10/04/2023	1,000	1,500	2,000	995	1,498	1,993	0.998x - 1.970	1.000
B85	SKC	224-PCXR3	505757	10/04/2023	1,000	1,500	2,000	996	1,500	2,000	1.004x - 12.009	1.000
B86	SKC	224-PCXR3	512625	05/04/2023	1,000	1,500	2,000	1,011	1,501	2,005	1.002x - 3.877	0.999
B87	SKC	224-PCXR3	504324	05/04/2023	1,000	1,500	2,000	999	1,495	1,998	0.999x + 0.606	1.000
B88	SKC	224-PCXR3	508307	05/04/2023	1,000	1,500	2,000	997	1,497	1,992	0.994x + 4.682	1.000
B89	SKC	224-PCXR3	509860	05/04/2023	1,000	1,500	2,000	1,001	1,498	2,002	1.007x - 13.92	1.000
B90	SKC	224-PCXR3	508366	05/04/2023	1,000	1,500	2,000	995	1,507	1,998	1.004x - 9.640	1.000
B91	SKC	224-PCXR3	510919	04/04/2023	1,000	1,500	2,000	1,003	1,500	1,995	0.988x + 13.505	1.000
B92	SKC	224-PCXR3	510987	05/04/2023	1,000	1,500	2,000	1,003	1,503	1,998	0.997x + 5.125	1.000
B93	SKC	224-PCXR3	509845	10/04/2023	1,000	1,500	2,000	996	1,498	2,003	1.007x - 13.628	1.000
B94	SKC	224-PCXR8	A127871	04/04/2023	1,000	1,500	2,000	1,001	1,495	2,003	1.006x - 18.746	0.999
B95	SKC	224-PCXR8	A127921	03/04/2023	1,000	1,500	2,000	995	1,504	2,001	1.013x - 26.112	0.999
B96	SKC	224-PCXR8	A127942	07/04/2023	1,000	1,500	2,000	999	1,499	1,997	1.000x - 2.010	1.000
B97	SKC	224-PCXR8	A127955	07/04/2023	1,000	1,500	2,000	1,006	1,503	2,005	1.011x - 18.638	0.999
B98	SKC	224-PCXR8	A127956	07/04/2023	1,000	1,500	2,000	994	1,497	1,998	1.005x - 11.436	1.000

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Approved by :



บริษัท เอส.พี.เอส. คอนซัลติ้ง เซอร์วิส จำกัด
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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	R²
R01	SKC	224-PCXR4	602467	10/04/2023	1,000	1,500	2,000	992	1,507	2,005	1.009x - 15.491	1.000
R02	SKC	224-PCXR4	626450	10/04/2023	1,000	2,000	3,000	997	1,497	1,989	0.990x + 10.155	1.000
R03	SKC	224-PCXR4	691592	10/04/2023	1,000	1,500	2,000	1,005	1,498	2,003	1.010x - 19.567	0.999
R04	SKC	224-PCXR4	691672	04/04/2023	1,000	1,500	2,000	998	1,491	1,997	0.998x - 1.962	1.000
R05	SKC	224-PCXR4	798470	10/04/2023	1,000	1,500	2,000	994	1,506	1,998	1.012x - 28.038	0.999
R06	SKC	224-PCXR4	798456	05/04/2023	1,000	1,500	2,000	993	1,497	1,995	1.004x - 10.749	1.000
R07	SKC	224-PCXR4	798480	10/04/2023	1,000	1,500	2,000	996	1,492	1,998	1.005x - 11.766	1.000
R08	SKC	224-PCXR4	883215	10/04/2023	1,000	1,500	2,000	1,010	1,503	2,003	0.998x + 3.526	1.000
R09	SKC	224-PCXR4	034650	04/04/2023	1,000	1,500	2,000	994	1,505	2,003	1.017x - 33.985	0.999
R10	SKC	224-PCXR4	091765	07/04/2023	1,000	1,500	2,000	998	1,492	1,996	1.000x - 3.929	1.000
R11	SKC	224-PCXR4	091763	04/04/2023	1,000	1,500	2,000	1,002	1,497	2,003	1.012x - 23.883	0.999
R12	SKC	224-PCXR4	091568	10/04/2023	1,000	1,500	2,000	995	1,503	1,998	1.002x - 7.698	1.000
R13	SKC	224-PCXR4	091638	10/04/2023	1,000	1,500	2,000	1,005	1,497	1,993	0.989x + 13.679	1.000
R14	SKC	224-PCXR4	091764	10/04/2023	1,000	1,500	2,000	992	1,503	1,998	1.015x - 32.167	0.999
R15	SKC	224-PCXR8	529457	10/04/2023	1,000	1,500	2,000	1,003	1,501	2,005	1.005x - 9.429	1.000
R16	SKC	224-PCXR8	529643	04/04/2023	1,000	1,500	2,000	999	1,496	1,995	0.999x - 3.290	1.000
R17	SKC	224-PCXR8	529645	05/04/2023	1,000	1,500	2,000	995	1,511	2,001	1.012x - 23.233	0.999
R18	SKC	224-PCXR8	566756	07/04/2023	1,000	1,500	2,000	992	1,497	1,999	1.002x - 7.359	1.000
R19	SKC	224-PCXR8	568602	07/04/2023	1,000	1,500	2,000	1,002	1,498	1,999	1.009x - 19.671	0.999
R20	SKC	224-PCXR8	529089	07/04/2023	1,000	1,500	2,000	992	1,501	2,004	1.015x - 28.270	1.000
R21	SKC	224-PCXR8	665728	10/04/2023	1,000	1,500	2,000	997	1,494	1,997	1.001x - 7.797	1.000
R22	SKC	224-PCXR8	707444	05/04/2023	1,000	1,500	2,000	1,003	1,501	2,003	1.003x - 6.218	1.000
R23	SKC	224-PCXR8	761067	10/04/2023	1,000	1,500	2,000	996	1,495	1,993	0.995x + 0.263	1.000
R24	SKC	224-PCXR8	707893	10/04/2023	1,000	1,500	2,000	997	1,506	2,002	1.009x - 17.713	0.999
R25	SKC	224-PCXR8	761052	10/04/2023	1,000	1,500	2,000	1,009	1,497	1,992	0.983x + 22.945	1.000
R26	SKC	224-PCXR8	707956	10/04/2023	1,000	1,500	2,000	1,004	1,502	2,005	1.008x - 14.326	0.999
R27	SKC	224-PCXR8	707398	07/04/2023	1,000	1,500	2,000	995	1,502	2,002	1.007x - 16.361	1.000
R28	SKC	224-PCXR8	707481	10/04/2023	1,000	1,500	2,000	1,006	1,501	2,003	1.009x - 18.291	0.999
R29	SKC	224-PCXR8	707402	07/04/2023	1,000	1,500	2,000	1,002	1,494	1,989	0.987x + 14.566	1.000
R30	SKC	224-PCXR8	093811	04/04/2023	1,000	1,500	2,000	1,001	1,494	1,996	0.997x + 0.646	1.000
R31	SKC	224-PCXR8	093183	10/04/2023	1,000	1,500	2,000	1,001	1,502	2,004	1.004x - 5.552	1.000
R32	SKC	224-PCXR8	671950	05/04/2023	1,000	1,500	2,000	999	1,501	1,993	0.994x + 7.163	1.000
R33	SKC	224-PCXR4	626254	10/04/2023	1,000	1,500	2,000	996	1,504	2,001	1.015x - 30.192	0.999
R34	SKC	224-PCXR4	626131	04/04/2023	1,000	1,500	2,000	1,003	1,498	2,004	1.004x - 9.377	1.000
R35	SKC	224-PCXR8	707460	10/04/2023	1,000	1,500	2,000	998	1,496	1,996	0.996x + 3.677	1.000
R36	SKC	224-PCXR8	707446	10/04/2023	1,000	1,500	2,000	1,003	1,498	2,002	1.010x - 20.668	0.999
R37	SKC	224-PCXR8	707432	10/04/2023	1,000	1,500	2,000	998	1,496	2,000	0.999x - 0.873	1.000
R38	SKC	224-PCXR8	707349	07/04/2023	1,000	1,500	2,000	997	1,497	2,001	1.003x - 8.747	1.000
R39	SKC	224-PCXR8	761095	10/04/2023	1,000	1,500	2,000	1,001	1,497	1,997	0.999x + 0.140	1.000

Calibrated by :

Approved by :



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

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	10/04/2023	1,000	1,500	2,000	1,001	1,503	2,004	1.014x - 25.279	0.999
R41	SKC	224-PCXR4	626140	07/04/2023	1,000	1,500	2,000	993	1,511	2,002	1.016x - 31.245	0.999
R42	SKC	224-PCXR4	626463	10/04/2023	1,000	1,500	2,000	999	1,495	2,001	1.003x - 5.636	1.000
R43	SKC	224-PCXR4	626129	10/04/2023	1,000	1,500	2,000	1,006	1,503	2,005	1.008x - 15.834	0.999
R44	SKC	224-PCXR4	602753	10/04/2023	1,000	1,500	2,000	1,000	1,496	1,994	0.997x - 0.383	1.000
R45	SKC	224-PCXR4	626137	10/04/2023	1,000	1,500	2,000	994	1,505	2,004	1.015x - 29.231	0.999

Calibrated by :

Approved by :



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-B01	Dwyer	VFB-65	05/01/2023	500	1,000	2,000	506.1	989.5	1973.5	0.990x + 8.311	1.000
H-B02	Dwyer	VFB-65	05/01/2023	500	1,000	2,000	494.9	998.2	1995.3	0.993x + 4.772	1.000
H-B03	Dwyer	VFB-65	05/01/2023	500	1,000	2,000	498.3	987.5	2010.6	1.005x - 15.690	0.999
H-B04	Dwyer	VFB-65	03/01/2023	500	1,000	2,000	500.4	999.5	2008.7	0.998x - 2.369	1.000
H-B05	Dwyer	VFB-65	03/01/2023	500	1,000	2,000	499.0	997.8	1972.3	0.981x + 20.957	0.999
H-B06	Dwyer	VFB-65	03/01/2023	500	1,000	2,000	503.6	995.0	1981.4	1.005x - 8.788	0.999
H-B07	Dwyer	VFB-65	04/01/2023	500	1,000	2,000	504.1	989.0	2018.7	1.002x - 2.144	1.000
H-B08	Dwyer	VFB-65	06/01/2023	500	1,000	2,000	499.8	999.2	1976.8	0.996x + 3.270	0.999
H-B09	Dwyer	VFB-65	06/01/2023	500	1,000	2,000	503.7	1006.6	2014.3	0.994x + 14.202	1.000
H-B10	Dwyer	VFB-65	06/01/2023	500	1,000	2,000	496.1	998.6	2012.4	0.997x + 2.443	1.000

Calibrated by :

Approved by :

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	05/01/2023	500	1,000	2,000	503.3	992.4	1978.7	0.999x - 3.199	0.999
H-R02	Dwyer	VFB-65	04/01/2023	500	1,000	2,000	501.2	995.3	1985.7	1.002x - 5.186	1.000
H-R03	Dwyer	VFB-65	04/01/2023	500	1,000	2,000	501.7	987.7	1996.9	0.994x + 1.679	1.000
H-R04	Dwyer	VFB-65	04/01/2023	500	1,000	2,000	496.4	989.6	2019.5	1.008x - 13.614	1.000
H-R05	Dwyer	VFB-65	06/01/2023	500	1,000	2,000	497.2	987.7	1988.1	1.004x - 9.360	1.000
H-R06	Dwyer	VFB-65	06/01/2023	500	1,000	2,000	505.2	992.4	1979.8	0.999x - 2.816	0.999
Calibrated by :				Approved by :							

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	04/01/2023	50	100	200	50.6	100.6	203.9	0.982x + 2.803	1.000
L-R02	Dwyer	VFA-21	04/01/2023	50	100	200	49.7	101.3	200.1	1.008x - 1.204	0.999
L-R03	Dwyer	VFA-21	04/01/2023	50	100	200	50.5	99.8	202.3	1.017x - 0.913	1.000
L-R04	Dwyer	VFA-21	03/01/2023	50	100	200	49.8	100.5	201.0	1.010x - 1.439	0.999
L-R05	Dwyer	VFA-21	03/01/2023	50	100	200	50.6	100.0	203.4	0.991x + 1.807	1.000
L-R06	Dwyer	VFA-21	03/01/2023	50	100	200	50.6	99.1	201.9	1.003x - 0.031	1.000
Calibrated by :				Approved by :							

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-B01	Dwyer	VFB-65	05/04/2023	500	1,000	2,000	506.9	990.3	1974.3	0.989x + 9.271	1.000
H-B02	Dwyer	VFB-65	04/04/2023	500	1,000	2,000	495.3	999.1	1996.1	0.994x + 4.127	1.000
H-B03	Dwyer	VFB-65	07/04/2023	500	1,000	2,000	497.5	988.1	2009.6	1.003x - 14.485	0.999
H-B04	Dwyer	VFB-65	07/04/2023	500	1,000	2,000	501.2	1000.3	2006.5	0.997x - 1.216	1.000
H-B05	Dwyer	VFB-65	07/04/2023	500	1,000	2,000	500.2	999.6	1974.3	0.980x + 21.307	0.999
H-B06	Dwyer	VFB-65	07/04/2023	500	1,000	2,000	504.3	996.2	1984.0	1.004x - 6.770	1.000
H-B07	Dwyer	VFB-65	04/04/2023	500	1,000	2,000	502.3	990.7	2016.7	1.001x - 1.154	1.000
H-B08	Dwyer	VFB-65	05/04/2023	500	1,000	2,000	500.2	1000.6	1979.8	0.995x + 5.040	0.999
H-B09	Dwyer	VFB-65	07/04/2023	500	1,000	2,000	504.4	1007.4	2010.7	0.993x + 15.376	1.000
H-B10	Dwyer	VFB-65	10/04/2023	500	1,000	2,000	495.7	1001.6	2009.2	0.996x + 3.966	1.000

Calibrated by :

Approved by :

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	05/04/2023	50	100	200	50.2	101.0	204.3	0.981x + 2.956	0.999
L-R02	Dwyer	VFA-21	10/04/2023	50	100	200	50.1	102.0	201.0	1.007x - 0.506	0.999
L-R03	Dwyer	VFA-21	07/04/2023	50	100	200	50.1	100.2	202.7	1.015x - 0.825	1.000
L-R04	Dwyer	VFA-21	10/04/2023	50	100	200	50.2	100.9	200.6	1.005x - 0.751	0.999
L-R05	Dwyer	VFA-21	05/04/2023	50	100	200	50.2	101.0	202.6	0.994x + 1.409	1.000
L-R06	Dwyer	VFA-21	10/04/2023	50	100	200	50.8	100.2	202.3	1.001x + 0.717	1.000

Calibrated by :

Approved by :

**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

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CALIBRATION 6048

CERTIFICATE No : 22M2567

REFERENCE No : 64386-1

PAGE : 1 OF 2

Certificate of Calibration

EQUIPMENT : DIGITAL BALANCE

MANUFACTURER : METTLER TOLEDO

MODEL : XS 105DU

SERIAL No : 1126422905

ID No : BA 05/50

CONDITION AS RECEIVED : USED ITEM

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

CALIBRATED BY : TETNITHI W.

CALIBRATION DATE : 11-Mar-22

APPROVED BY :

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.

F-G010 REV 02

**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

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CERTIFICATE No : 22M2567

PAGE : 2 OF 2

Calibration Report

EQUIPMENT : DIGITAL BALANCE MODEL : XS 105DU

MANUFACTURER : METTLER TOLEDO S/N : 1126422905

ID No : BA 05/50 RECEIVED DATE : 11-Mar-22

AIR PRESSURE : 1008mbar \pm 1mbar CALIBRATION DATE : 11-Mar-22

AMBIENT TEMPERATURE : 22° C \pm 1° C RELATIVE HUMIDITY : 49 %RH \pm 10 % RH

CONDITION OF THIS RESULTS OF CALIBRATION

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

2. REFERENCE STANDARD INSTRUMENTS :-

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

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

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

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

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

RESULT OF CALIBRATION :- WITHOUT ADJUSTMENT

1. ZERO SETTING FUNCTION : NORMAL

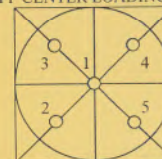
2. TARE FUNCTION : NORMAL

3. REPEATABILITY OF READING AT 20 g WAS 0.000004 g

4. REPEATABILITY OF READING AT 100 g WAS 0.000048 g

5. DEPARTURE FROM NOMINAL VALUE/ LINEARITY

NOMINAL VALUE (g)	BALANCE READING (g)	CORRECTION (g)	UNCERTAINTY (\pm g)
0.00	0.00000	0.00000	0.000058
0.02	0.01999	0.00001	0.000058
0.10	0.09999	0.00001	0.000059
0.20	0.19999	0.00001	0.000059
0.50	0.50001	-0.00001	0.000058
1.00	1.00001	-0.00001	0.000059
2.00	2.00000	0.00000	0.000059
5.00	5.00001	-0.00001	0.000061
10.00	10.00005	-0.00005	0.000063
20.00	20.00006	-0.00006	0.000069
50.00	50.00000	0.00000	0.00011
100.00	100.0001	-0.0001	0.00019
120.00	120.0001	-0.0001	0.00022

6. OFF CENTER LOADING ERROR

POINT	READING (g)	
1	10.00001	50.0000
2	10.00002	50.0000
3	10.00001	50.0000
4	10.00001	50.0000
5	10.00002	50.0001
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
COVERAGE FACTOR K = 2, PROVIDING A LEVEL OF CONFIDENCE APPROXIMATELY 95%

END OF CALIBRATION REPORT



CERTIFICATE No : 23M2441
REFERENCE No : 68471-1

PAGE : 1 OF 2

Certificate of Calibration

EQUIPMENT : DIGITAL BALANCE
MANUFACTURER : METTLER TOLEDO
MODEL : XS105DU
SERIAL No : 1126422905
ID No : BA 05/50
CONDITION AS RECEIVED : USED ITEM
SUBMITTED BY : S.P.S. CONSULTING SERVICE CO., LTD.
7 SOI PHAHOLYOTHIN 24, PHAHOLYOTHIN RD.,
JOMPOL, CHATUCHAK, BANGKOK 10900

CALIBRATED BY : ATSAWIN Y.
CALIBRATION DATE : 10-Mar-23
APPROVED BY :
ISSUED DATE : 16-Mar-23
RECEIVED DATE : 10-Mar-23

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



CERTIFICATE No : 23M2441

PAGE : 2 OF 2

Calibration Report

EQUIPMENT : DIGITAL BALANCE MODEL : XS105DU
MANUFACTURER : METTLER TOLEDO S/N : 1126422905
ID No : BA 05/50 RECEIVED DATE : 10-Mar-23
AIR PRESSURE : 1010mbar \pm 1mbar CALIBRATION DATE : 10-Mar-23
AMBIENT TEMPERATURE : 23°C \pm 1°C RELATIVE HUMIDITY : 49%RH \pm 10% RH

CONDITION OF THIS RESULTS OF CALIBRATION

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

INSTRUMENT	MODEL	SERIAL No	CERTIFICATE No	DUE DATE
1) STANDARD WEIGHT SET	E2	QK-1-151	M2302013S	02-Feb-25
2) STANDARD WEIGHT	E2	15843	M2302014S	02-Feb-25
3. THIS RESULT WAS FOUND ACCURATE AS SHOWN ON DATE AND PLACE OF CALIBRATION ONLY.
4. THIS RESULT EXCLUDE LONG TERM STABILITY OF THE UNIT UNDER CALIBRATION.
5. THIS CERTIFICATE IS TRACEABLE TO THE INTERNATIONAL SYSTEM OF UNIT MAINTAINED AT:-
- NATIONAL INSTITUTE OF METROLOGY (THAILAND) THROUGH CENTRAL BUREAU OF WEIGHTS&MEASURES

RESULT OF CALIBRATION :- WITHOUT ADJUSTMENT

1. ZERO SETTING FUNCTION : NORMAL
2. TARE FUNCTION : NORMAL
3. REPEATABILITY OF READING AT 200 g WAS 0 g
4. DEPARTURE FROM NOMINAL VALUE/ LINEARITY

NOMINAL VALUE (g)	BALANCE READING (g)	CORRECTION (g)	UNCERTAINTY (\pm g)
0.00	0.00000	0.00000	0.000039
0.02	0.02000	0.00000	0.000039
0.10	0.10000	0.00000	0.000039
0.20	0.20001	-0.00001	0.000040
0.50	0.50001	-0.00001	0.000040
1.00	1.00000	0.00000	0.000041
2.00	2.00003	-0.00003	0.000042
5.00	5.00001	-0.00001	0.000046
10.00	10.00003	-0.00003	0.000053
20.00	20.00005	-0.00005	0.000067
50.00	50.0001	-0.0001	0.00011
100.00	100.0001	-0.0001	0.00019
200.00	200.0001	-0.0001	0.00032

5. OFF CENTER LOADING ERROR



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

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

END OF CALIBRATION REPORT



บริษัท ไทยยูนิค จำกัด

THAI UNIQUE CO., LTD.

80-82 ถนนประชาธิปไตย แขวงบางขุนพรหม เขตพระนคร กรุงเทพฯ 10200

80-82 Prachathipatai Rd., Bangkhunphrom, Pranakorn, Bangkok 10200

Tel. 0-2629-0191-6, 0-2280-1787, Fax. 0-2280-1788, E-mail : thawatt@thaiunique.com, Website : www.thaiunique.com

GAS CHROMATOGRAPH TEST CERTIFICATION

Certificate No. : SV0822/20530

Instrument Type : GC

Model : CP-3800

Serial Number : 00734

Organization : S.P.S. Consulting Service Co., Ltd.

Address : 7 Phahonyothin Soi 24 Phahonyothin Rd. Ladyao Chatuchak Bangkok 10900

Date : 10/08/2022

ELECTRONIC TEST

CPU	<input checked="" type="checkbox"/> PASS	<input type="checkbox"/> FAIL
LCD TEST	<input checked="" type="checkbox"/> PASS	<input type="checkbox"/> FAIL
VENT TEST	<input checked="" type="checkbox"/> PASS	<input type="checkbox"/> FAIL
KEY ECHO TEST	<input checked="" type="checkbox"/> PASS	<input type="checkbox"/> FAIL
DESTRUCTION RAM TEST	<input checked="" type="checkbox"/> PASS	<input type="checkbox"/> FAIL

RUN CHROMATOGRAM TEST

DETECTOR : Flame Ionization Detector (FID Channel Front)

INJECTOR : Capillary Injector Model 1079

GC CONDITION:

Column	80 °C hold 1 min., rate 20 °C/min. to 200 °C hold 1min.
Injector	220 °C
Detector	300 °C
Column flow	5 mL/min
Makeup flow	25 mL/min
Air flow	300 mL/min
Hydrogen flow	30 mL/min

Column: Capillary Column CP sil 5 CB 0.25 ID x 15 M

Sample: 1 µL Injection FID Test Sample 0.218 g/L C14, C15, C16 in hexane

SENSITIVITY TEST: C15. (Area count) = 118,103 Counts.



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Detector Sensitivity (FID)

Detector Response	Result	Specification
Baseline Noise (µV)	2.94	≤ 50
Baseline Drift (%)	0.18	≤ 1
Sensitivity (S/N for C15)	4,000	≥ 1,024

Temperature Specification

Temperature	Set	Result	Specification
Column Oven (° C)	80	80	± 5
Injector (° C)	220	220	± 5
Detector (° C)	300	300	± 5
Incubator (° C)	60	N/A	± 5

Relative Standard Deviation % (% RSD)

Checkout Procedure	Result	Specification
Area C15 (%)	1.68	≤ 5
Retention Time C15(%)	0.01	≤ 0.5

APPROVAL :

Signature: Suwarot.

Engineer : Suwarot Trikanut

Date : 10/08/2022



VARIAN

1/2

SERVICE DEPARTMENT

FR-SV-029 Rev. 04



VARIAN

2/2

SERVICE DEPARTMENT

FR-SV-029 Rev. 04



บริษัท ไทยยูนิค จำกัด

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Tel. 0-2629-0191-6, 0-2280-1787, Fax. 0-2280-1788, E-mail : thawatt@thaiunique.com, Website : www.thaiunique.com

Results Integrated System Testing

Checkout Procedure	FID
Detector Position	Front
Inlet Type	1079 Injector
C15 Area 1	117,172
C15 Area 2	119,182
C15 Area 3	117,982
C15 Area 4	118,589
C15 Area 5	117,592
C15 Area Average	118,103
* % RSD (< 5 %)	1.68

* The precision specification should be less than 2.0 % RSD ** (Relative Standard Deviation) for an Auto sampler injection and less than 5 % for Manual injections. To calculate the %RSD, select the C15 peak area for each of the five (5) samples.

** (Relative Standard Deviation is determined by dividing the standard deviation by the average and multiplying by 100.)

$$\% \text{ RSD} = (\text{std.dev} / \text{avg}) * 100$$



บริษัท ไทยยูนิค จำกัด

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Tel. 0-2629-0191-6, 0-2280-1787, Fax. 0-2280-1788, E-mail : thawatt@thaiunique.com, Website : www.thaiunique.com

Results Integrated System Testing

Checkout Procedure	FID
Detector Position	Front
Inlet Type	1079 Injector
C15 RT 1	4.048
C15 RT 2	4.048
C15 RT 3	4.048
C15 RT 4	4.048
C15 RT 5	4.048
C15 RT Average	4.000
* % RSD (< 0.5 %)	0.01

* The precision specification should be less than 0.5 % RSD ** (Relative Standard Deviation) for an Auto sampler injection and less than 0.5 % for Manual injections. To calculate the %RSD, select the RT C15 peak for each of the five (5) samples.

** (Relative Standard Deviation is determined by dividing the standard deviation by the average and multiplying by 100.)



เอกสารแนบ 5-3

เอกสารสอบเทียบเครื่องมือการตรวจวัดระดับเสียงในบรรยากาศ



THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-65/0455

MTC No. EEL. BP. 41/0465

CALIBRATION CERTIFICATE

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

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

Calibrated at : Electrical and Electronic Standards Laboratory, Industrial Metrology and Testing Service Centre.
: Soi 1C, Bangpoo Industrial Estate, Sukhumvit Rd., Muang, Samutprakan 10280.

Instrument Calibrated :

Description : Sound Calibrator

Manufacturer : ACO

Model : 2127

Serial No. : 130006

Ambient Environment

Temperature : (23 ± 3) °C

Relative Humidity : (50 ± 15) %

Ambient Pressure : (101.325 ± 1.500) kPa

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

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

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

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

5. Pressure Transmitter Vaisala PTB202AD S/N T0650001.

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

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

Calibration Procedure: CP-102-04 based on IEC 60942-2003. The sound pressure level of instrument was measured by standard microphone using an insert voltage technique.

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

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

Date of Receipt : 22 Apr. 2022

Date of Calibration : 28 Apr. 2022

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

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

FM.BLMTC.002 Rev.4



THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-65/0455

MTC No. EEL. BP. 41/0465

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

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

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

1. Sound Pressure Level

Standard Microphone Type	Measured Sound Pressure Level (dB)	Deviated value (dB)	Uncertainty (dB)	Tolerance limit IEC60942:2003 Class 1
1/2 inch Bruel&Kjaer 4180	93.93	-0.07	± 0.10	± 0.40 dB

2. Frequency

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

3. Total Distortion

Standard Microphone Type	Measured Total Distortion (%)	Uncertainty (%)	Tolerance limit IEC60942:2003 Class 1
1/2 inch Bruel&Kjaer 4180	1.44	± 0.50	± 3.0%

Note : 1. No adjustment.

2. The calibrator pressure correction was not included.

3. The microphone volume correction was not included.

Calibrated by :

Approved :

Date of Calibration : 28 Apr. 2022

Date of Issue : 28 Apr. 2022

Electrical and Electronic Standards Laboratory
Industrial Metrology and Testing Service Centre

Ref : 2011265042601787001

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End of Certificate

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

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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

Head Office
35 Mu 3 Tambon Khlong Ha, Amphoe Khlong Luang,
Changwat Pathumthani 12120, Thailand
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THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-66/0413

MTC No. EEL. BP. 109/0366

CALIBRATION CERTIFICATE

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

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

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

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

Instrument Calibrated :

Description : Sound Calibrator

Manufacturer : ACO

Model : 2127

Serial No. : 130006

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.

Ambient Environment

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

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

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

Calibration Procedure: CP-102-04 based on IEC 60942-2003. The sound pressure level of instrument was measured by standard microphone using an insert voltage technique.

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

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

Date of Receipt : 27 Mar. 2023

Date of Calibration : 29 Mar. 2023

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

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FM.BLMTC.002 Rev.4



THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-66/0413

MTC No. EEL. BP. 109/0366

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

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

Acoustic Output in dB re 20 μ Pa, Corrected to Reference Conditions : 101.325 kPa, 23.0 $^\circ\text{C}$ and 50 %RH

1. Sound Pressure Level

Standard Microphone Type	Measured Sound Pressure Level (dB)	Deviated value (dB)	Uncertainty (dB)	Tolerance limit IEC60942:2003 Class 1
1/2 inch Bruel&Kjaer 4180	93.94	-0.06	± 0.10	$\pm 0.40 \text{ dB}$

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	1.80	± 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 :

Approved by :

Date of Calibration : 29 Mar. 2023

Date of Issue : 30 Mar. 2023

Electrical and Electronic Standards Laboratory

Industrial Metrology and Testing Service Centre

Ref : 2011266032701228001

End of Certificate

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

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FM.BLMTC.002 Rev.4

Head Office
35 Mu 3 Tambon Khlong Ha, Amphoe Khlong Luang,
Changwat Pathumthani 12120, Thailand
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Office/Laboratory
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Fax. (66) 0 2579 8592
E-mail : sumalee@tistr.or.th

Noise R_088/23

Sound Level Meter Calibration Report

Acoustic Calibrator Data

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

Calibration Data

Sound Level Meter Data				Calibration Data		
SLM No.	Brand	Model	Serial No.	Date	Actual Reading [dB]	
					Before Adjustment	After Adjustment
ACO-R21	ACO	6236	00182004	09 February 2023	94.1	94.0
ACO-R25	ACO	6236	00192037	09 February 2023	94.0	94.0
Acoustic Certified Value : Thailand Institute of Scientific and Technological Research (TISTR)					93.93 ± 0.10 dB	

Calibrated by :

Approved by :

Noise R_288/23

Sound Level Meter Calibration Report

Acoustic Calibrator Data

Brand	ACO	Number	AC 03/56
Model	2127	Serial No.	130006
Calibration Range	94 dB, 1000 Hz	Last Calibration	29 March 2023
		Due Date	29 March 2024

Calibration Data

Sound Level Meter Data				Calibration Data		
SLM No.	Brand	Model	Serial No.	Date	Actual Reading [dB]	
					Before Adjustment	After Adjustment
ACO-R06	ACO	6236	00152005	01 June 2023	94.1	94.0
ACO-R48	ACO	6236	00192060	01 June 2023	94.0	94.0
Acoustic Certified Value : Thailand Institute of Scientific and Technological Research (TISTR)					93.94 ± 0.10 dB	

Calibrated by :

Approved by :

เอกสารแนบ 5-4

เอกสารสอบเทียบเครื่องมือการตรวจวิเคราะห์คุณภาพน้ำทิ้ง



CERTIFICATE No : 22E9693
REFERENCE No : 66476-1

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 : 15-Sep-22
APPROVED BY :
ISSUED DATE : 15-Sep-22
RECEIVED DATE : 14-Sep-22



CERTIFICATE No : 22E9693

PAGE : 2 OF 3

Calibration Report

EQUIPMENT : pH METER
MANUFACTURER : HANNA
ID No : pH 04/56
RECEIVED DATE : 14-Sep-22
AMBIENT TEMPERATURE : 20 °C ± 1 °C
MODEL : HI 3512
SERIAL NUMBER : TH118035
CALIBRATION DATE : 15-Sep-22
RELATIVE HUMIDITY : 50 % RH ± 10% RH

CONDITION OF THIS RESULTS OF CALIBRATION

- 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
- REFERENCE STANDARD INSTRUMENTS :-

INSTRUMENT	MODEL	SERIAL No/ LOT No	CERTIFICATE No	DUE DATE
1) pH STANDARD SOLUTION	00651-06	CC719181	4880-12119147	05-Apr-23
2) pH STANDARD SOLUTION	00651-08	CC718727	4881-12110709	31-Mar-23
3) pH STANDARD SOLUTION	00651-10	CC717045	4882-12065386	17-Mar-23
4) PROCESS CALIBRATOR	CA150	91S6079	22E1145	31-Mar-23
5) BATH	260014	1247 48074	22T9870	13-Sep-23
6) THERMOMETER WITH PROBE	421504	55000379	22T9904	13-Sep-23

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

RESULT OF CALIBRATION : ADJUSTMENT

- DISPLAY UNIT ONLY

SLOPE FACTOR $k = 2.303 \text{ RT/F} = 59 \text{ mV/pH}$

mV APPLIED	UUC READING (mV)	CORRECTION (mV)	UUC READING (pH)	UNCERTAINTY OF MEASUREMENT (± mV)	COVERAGE FACTOR k
414.11	414.8	-0.69	-0.171	0.14	2.0
354.95	355.6	-0.65	0.860	0.14	2.0
295.80	296.4	-0.60	1.892	0.14	2.0
236.64	237.2	-0.56	2.922	0.14	2.0
177.48	178.0	-0.52	3.954	0.14	2.0
118.32	118.8	-0.48	4.985	0.14	2.0
59.16	59.7	-0.54	6.016	0.14	2.0
0.00	0.5	-0.50	7.049	0.14	2.0
-59.16	-58.8	-0.36	8.136	0.14	2.0
-118.32	-117.9	-0.42	9.223	0.14	2.0
-177.48	-177.1	-0.38	10.311	0.14	2.0
-236.64	-236.3	-0.34	11.399	0.14	2.0
-295.80	-295.5	-0.30	12.487	0.14	2.0
-354.95	-354.7	-0.25	13.575	0.14	2.0
-414.11	-413.9	-0.21	14.662	0.14	2.0



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 : 22E9693

PAGE : 3 OF 3

Calibration Report

RESULT OF CALIBRATION (CONTINUE) :

2. DISPLAY UNIT WITH pH ELECTRODE S/N: 09081C6M

STANDARD pH BUFFER SOLUTION (pH)	UUC READING (pH)	CORRECTION (pH)	VALUE BEFORE ADJUSTMENT	UNCERTAINTY OF MEASUREMENT (\pm pH)	COVERAGE FACTOR k
4.007	4.007	0.000	3.996	0.012	2.0
7.004	7.006	-0.002	6.944	0.012	2.0
10.016	10.012	0.004	10.194	0.014	2.0

3. DISPLAY UNIT WITH TEMPERATURE

STANDARD READING ($^{\circ}$ C)	UUC READING ($^{\circ}$ C)	CORRECTION ($^{\circ}$ C)	VALUE BEFORE ADJUSTMENT	UNCERTAINTY OF MEASUREMENT (\pm $^{\circ}$ C)	COVERAGE FACTOR k
25.003	25.0	0.003	---	0.0085	2.0

4. PERCENT SLOPE 100%

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



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.: 22TW98
Page.: 1 of 2

Certificate of Testing

Equipment : DO Meter
Manufacturer : YSI
Model : 5000-230V
Serial No. : 15B100751
ID No. : -
Received Date : 20 April 2022
Test Date : 21 April 2022
Reference : 2204-0429WC-1
Submitted by : S.P.S. Consulting Service Co.,Ltd.
7 Phaholyothin 24, Phaholyothin Road.,
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 : 
Approved by : 
(/) Malee Butkruea
() Saithip Meangmai
() Warakorn Lerngagtrakul
Issue Date : 25 April 2022

B 0286555



Cert.No.: 22TW98
Page.: 2 of 2

Condition of this result of calibration

1. Reference Standard Instruments :

This certification is traceable to the International System of Unit through the reference standards laboratory of Industrial Calibration Center, Technology Promotion Association (Thailand-Japan).

Instruments	Serial No.	ID No.	Certificate No.	Due Date
1) Burette	-	130BU10	21CG1389	25 Mar 2023
2) Balance	1126143764	140RC004	21MM430	21 Sep 2022

2. Standard Material :-

Material	Manufacturer	Lot.No.	Assay
Sodium Thiosulfate pentahydrate	Merck	AM1763316	100.2%

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)
8.12	8.14	0.0084

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-

a 1105753

CERT.No.: HS-U017D

Calibration Date : 3 Apr 23
 Submitted by : S.P.S CONSULTING SERVICE CO.,LTD
 7 Soi Phaholyothin 24, Phaholyothin Rd., Jompol,
 Chatuchak, Bangkok, Thailand 10900

Avg Room Temp : 20 °C
 Avg Water Temp : 20 °C
 Air Pressure : 760.00 mmHg
 Salinity : 0 ppt

Model : YSI 5000
 S/N : 15B100751
 Probe : YSI 5010
 S/N : 22D100097
 ID NO. : -
 Air Temp ref : S/N. E00522
 Barometric ref : S/N. E00522
 Water Temp ref : S/N. 11431
 Technician : Kittipong M.

Calibration Details

Calibration Point	100% air sat. (@20 °C, DO = 9.09 mg/l)	(status)	(status)
Measurement 1 (mg/l)	9.08	(PASS)	-
Measurement 2 (mg/l)	9.08	(PASS)	-
Measurement 3 (mg/l)	9.08	(PASS)	-
Measurement 4 (mg/l)	9.08	(PASS)	-
Measurement 5 (mg/l)	9.08	(PASS)	-
Measurement 6 (mg/l)	9.08	(PASS)	-
Measurement 7 (mg/l)	9.08	(PASS)	-
Measurement 8 (mg/l)	9.08	(PASS)	-
Measurement 9 (mg/l)	9.08	(PASS)	-
Measurement 10 (mg/l)	9.08	(PASS)	-
Mean Measurement	9.08	mg/l	-
Inaccuracy	0.01	mg/l	-
Overall Status	(PASS)		

Manufacturer Specification

Accuracy = +/- 0.02 mg/l

- 1) This certificate is issued based on the result that are found as shown on date and place of test only.
- 2) The calibration procedure followed in accordance with Harikul Science Co., Ltd.
- 3) This result shall not be used for advertising purpose.

**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.comCERTIFICATE No : 22T10972
REFERENCE No : 66837-1

PAGE : 1 OF 3

Certificate of Calibration

EQUIPMENT : COD REACTOR
MANUFACTURER : HACH
MODEL : DRB 200
SERIAL No : 15110C0497
ID No : DRB 04/59
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** : 20-Dec-22**APPROVED BY** :**ISSUED DATE** : 20-Dec-22**RECEIVED DATE** : 20-Dec-22THIS 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, Bangkai, Bangkok 10160

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

CERTIFICATE No : 22T10972

PAGE : 2 OF 2

Calibration Report

EQUIPMENT : COD REACTOR
MANUFACTURER : HACH
ID NUMBER : DRB 04/59
RECEIVED DATE : 20-Dec-22
AMBIENT TEMPERATURE : 23° C ± 1° C

MODEL : DRB 200
SERIAL NUMBER : 15110C0497
CALIBRATION DATE : 20-Dec-22
RELATIVE HUMIDITY : 52 %RH ± 10 % RH

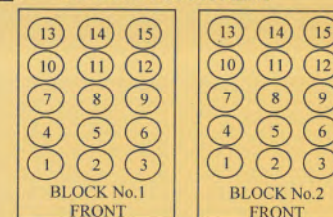
CONDITION OF THIS RESULTS OF CALIBRATION

1. THIS INSTRUMENT WAS CALIBRATED BY DIRECT MEASUREMENT TEMPERATURE RECORDER WITH THERMOCOUPLE TYPE K UNDER NO LOAD CONDITION. THE THERMOCOUPLES WERE PLACED ON 15 POINTS AND LOCATED ONE THERMOCOUPLE IN EACH OF THE FOUR CORNERS OF THE REACTOR AND PLACED THE EIGHTH THERMOCOUPLE AT THE CENTER OF THE REACTOR.

2. REFERENCE STANDARD INSTRUMENTS :-

INSTRUMENT	MODEL	SERIAL No	CERTIFICATE No	DUE DATE
1) DATA LOGGER WITH TC TYPE K	HYDRA 2635A	8009008	22T7511	10-Jul-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 QUALITY CALIBRATION CO.,LTD.

RESULT OF CALIBRATION :- WITHOUT ADJUSTMENT**TEMPERATURE MEASUREMENT ACCURACY TEST**

Block No.	1	2
Controller temperature (°C)	145	145
Indicating Temperature	145	145
Measured Temperature (°C) at Spread Locations	1	149.8
	2	149.6
	3	149.7
	4	149.8
	5	149.9
	6	149.8
	7	149.8
	8	149.8
	9	149.9
	10	149.8
	11	149.9
	12	149.7
	13	149.9
	14	149.9
	15	149.7
Uncertainty of Measurement(± °C)	0.86	0.86

NOTE 1 : THE UNCERTAINTY OF MEASUREMENT EXCLUDED TEMPERATURE UNIFORMITY OF THE CHA
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
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, Bangkai, Bangkok 10160

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

www.qcalibration.com

CERTIFICATE No : 22M2569

REFERENCE No : 64386-3

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 : TETNITHI W.

CALIBRATION DATE : 11-Mar-22

APPROVED BY :

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.

F-G010 REV 02

**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 : 22M2569

PAGE : 2 OF 2

Calibration Report

EQUIPMENT : DIGITAL BALANCE MODEL : BSA224S-CW

MANUFACTURER : SARTORIUS S/N : 36591843

ID No : BA 09/61 RECEIVED DATE : 11-Mar-22

AIR PRESSURE : 1008mbar \pm 1mbar CALIBRATION DATE : 11-Mar-22

AMBIENT TEMPERATURE : 22°C \pm 1°C RELATIVE HUMIDITY : 51 %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

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 0.000048 g

4. DEPARTURE FROM NOMINAL VALUE/ LINEARITY

NOMINAL VALUE (g)	BALANCE READING (g)	CORRECTION (g)	UNCERTAINTY (\pm g)
0.00	0.0000	0.0000	0.000078
0.10	0.1000	0.0000	0.000078
0.20	0.2000	0.0000	0.000078
0.50	0.5000	0.0000	0.000079
1.00	1.0000	0.0000	0.000079
2.00	2.0000	0.0000	0.000080
5.00	5.0000	0.0000	0.000081
10.00	10.0000	0.0000	0.000084
20.00	20.0000	0.0000	0.000089
50.00	50.0000	0.0000	0.00011
100.00	100.0000	0.0000	0.00019
200.00	199.9999	0.0001	0.00032

5. OFF CENTER LOADING ERROR

POINT	READING (g)
1	99.9999
2	99.9999
3	100.0000
4	99.9999
5	99.9998
OFF-CENTER LOADING	0.0001

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

END OF CALIBRATION REPORT

F-G



GAS CHROMATOGRAPH TEST CERTIFICATION

Certificate No. : SV0822/20530

Instrument Type : GC

Model : CP-3800

Serial Number : 00734

Organization : S.P.S. Consulting Service Co., Ltd.

Address : 7 Phahonyothin Soi 24 Phahonyothin Rd. Ladyao Chatuchak Bangkok 10900

Date : 10/08/2022

ELECTRONIC TEST

CPU	<input checked="" type="checkbox"/> PASS	<input type="checkbox"/> FAIL
LCD TEST	<input checked="" type="checkbox"/> PASS	<input type="checkbox"/> FAIL
VENT TEST	<input checked="" type="checkbox"/> PASS	<input type="checkbox"/> FAIL
KEY ECHO TEST	<input checked="" type="checkbox"/> PASS	<input type="checkbox"/> FAIL
DESTRUCTION RAM TEST	<input checked="" type="checkbox"/> PASS	<input type="checkbox"/> FAIL

RUN CHROMATOGRAM TEST

DETECTOR : Flame Ionization Detector (FID Channel Front)

INJECTOR : Capillary Injector Model 1079

GC CONDITION:

Column	80 °C hold 1 min., rate 20 °C/min. to 200 °C hold 1min.
Injector	220 °C
Detector	300 °C
Column flow	5 mL/min
Makeup flow	25 mL/min
Air flow	300 mL/min
Hydrogen flow	30 mL/min

Column: Capillary Column CP sil 5 CB 0.25 ID x 15 M

Sample: 1 µL Injection FID Test Sample 0.218 g/L C14, C15, C16 in hexane

SENSITIVITY TEST: C15. (Area count) = 118,103 Counts.



Detector Sensitivity (FID)

Detector Response	Result	Specification
Baseline Noise (µV)	2.94	≤ 50
Baseline Drift (%)	0.18	≤ 1
Sensitivity (S/N for C15)	4,000	≥ 1,024

Temperature Specification

Temperature	Set	Result	Specification
Column Oven (° C)	80	80	± 5
Injector (° C)	220	220	± 5
Detector (° C)	300	300	± 5
Incubator (° C)	60	N/A	± 5

Relative Standard Deviation % (% RSD)

Checkout Procedure	Result	Specification
Area C15 (%)	1.68	≤ 5
Retention Time C15(%)	0.01	≤ 0.5

APPROVAL :

Signature:

Engineer

Date : 10/08/2022



VARIAN

1/2

SERVICE DEPARTMENT

FR-SV-029 Rev. 04



VARIAN

2/2

SERVICE DEPARTMENT

FR-SV-029 Rev. 04



บริษัท ไทยยูนิค จำกัด

THAI UNIQUE CO., LTD.

80-82 ถนนประชาธิปไตย แขวงบางขุนพรหม เขตพระนคร กรุงเทพฯ 10200

80-82 Prachathipatai Rd., Bangkhunphrom, Pranakorn, Bangkok 10200

Tel. 0-2629-0191-6, 0-2280-1787, Fax. 0-2280-1788, E-mail : thawatt@thaiunique.com, Website : www.thaiunique.com

Results Integrated System Testing

Checkout Procedure	FID
Detector Position	Front
Inlet Type	1079 Injector
C15 Area 1	117,172
C15 Area 2	119,182
C15 Area 3	117,982
C15 Area 4	118,589
C15 Area 5	117,592
C15 Area Average	118,103
* % RSD (< 5 %)	1.68

* The precision specification should be less than 2.0 % RSD ** (Relative Standard Deviation) for an Auto sampler injection and less than 5 % for Manual injections. To calculate the %RSD, select the C15 peak area for each of the five (5) samples.

** (Relative Standard Deviation is determined by dividing the standard deviation by the average and multiplying by 100.)

$$\% \text{ RSD} = (\text{std.dev} / \text{avg}) * 100$$



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80-82 Prachathipatai Rd., Bangkhunphrom, Pranakorn, Bangkok 10200

Tel. 0-2629-0191-6, 0-2280-1787, Fax. 0-2280-1788, E-mail : thawatt@thaiunique.com, Website : www.thaiunique.com

Results Integrated System Testing

Checkout Procedure	FID
Detector Position	Front
Inlet Type	1079 Injector
C15 RT 1	4.048
C15 RT 2	4.048
C15 RT 3	4.048
C15 RT 4	4.048
C15 RT 5	4.048
C15 RT Average	4.000
* % RSD (< 0.5 %)	0.01

* The precision specification should be less than 0.5 % RSD ** (Relative Standard Deviation) for an Auto sampler injection and less than 0.5 % for Manual injections. To calculate the %RSD, select the RT C15 peak for each of the five (5) samples.

** (Relative Standard Deviation is determined by dividing the standard deviation by the average and multiplying by 100.)

$$\% \text{ RSD} = (\text{std.dev} / \text{avg}) * 100$$

GC Clarus 600/680 Preventive Maintenance (PM)

Company Name:	S.P.S. Consulting Service Co.,Ltd		
Address (Instrument Location):	7 Soi Phaholyothin24 Phaholyothin Road, Jompol, Chatuchak, Bangkok, 10900.		
Serial Number:	680S14042502	Service Tag:	N68APSSFEMP
Customer Name (if applicable):	Ms.Sujinda	PM number:	2 of 2
Service Engineer Name:	Pramote Chaisorn	Service Order Number:	WO-01841730
Date PM Performed: (DD-MMM-YYYY)	02-Sep-2022	Next PM Due Date: (DD-MMM-YYYY)	02-Mar-2023

Part Number	Release	Publication Date	
TH09370070	C	August 2016	

Scope

The purpose of this PM is to ensure the continued functionality of the Clarus 600 and Clarus 680 GC 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 or calibration, including a current back-up of system software and/or data files. The completed document should be signed by an authorized PerkinElmer and customer representative and left with the customer. Update the PM sticker and instrument logbook as required.

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Component List

Component / Specific Model	Serial #	Software Version	Configuration Notes
Clarus680	680S14042502	Totalchrom6.3.2	
Clarus SQ8T	648N4050804	Turbomass 6.4	
AtomX	US14113002	Tekma AtomX	

Parts Lists

Additional Tools Required for PM				
Part Number (if applicable)	Description	Quantity	Serial #	Calibration Due Date (MM/YY)
LF21-0503	Fluke179 multimeter	1	22460228	04-Nov-2022
Additional Reagents and Standards Required for PM				
Part Number (if applicable)	Description	Quantity	Batch/Lot #	Expiration Date (MM/YY)
N/A				

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.
- ☒ Check incoming AC line voltage for proper levels and grounding.

L-N	220	Volt
L-G	220	Volt
N-G	0.35	Volt

**Neutral to ground not more than 0.5 volts peak to peak*
- ☒ Inspect all gas line filters and traps; Replace if necessary with customer supplied spares.

Carrier gas	<input checked="" type="checkbox"/> Helium	<input type="checkbox"/> Nitrogen	<input type="checkbox"/> Hydrogen
Moisture level	<input checked="" type="checkbox"/> Good	<input type="checkbox"/> Need to replace	<input type="checkbox"/> Other _____

Detector gas	<input checked="" type="checkbox"/> Air Zero	<input checked="" type="checkbox"/> Hydrogen	<input type="checkbox"/> Nitrogen	<input type="checkbox"/> Helium
Moisture level	<input checked="" type="checkbox"/> Good	<input type="checkbox"/> Need to replace	<input type="checkbox"/> Other	_____
- ☒ Inspect the customer log book and make any appropriate PM entries.
- ☒ Leak check all fittings from the gas source to instrument.

Gas leakage	<input checked="" type="checkbox"/> Pass	<input type="checkbox"/> Fail	Comment _____
-------------	--	-------------------------------	---------------
- ☒ Perform general inspection of system for cleanliness.
- ☒ Inspect for functional and clean electronic cooling and oven vent fans

Electronic cooling fan	<input checked="" type="checkbox"/> Yes	<input type="checkbox"/> No
Oven cooling fan	<input checked="" type="checkbox"/> Yes	<input type="checkbox"/> No

2. Electronic :

- ☒ Check oven temperature. Calibrate if necessary.

Oven temperature	set point 150 °C	<input checked="" type="checkbox"/> Pass	<input type="checkbox"/> Fail
------------------	------------------	--	-------------------------------
- ☐ Check sub-ambient option. (If installed).

Oven temperature	set point 5 °C	<input type="checkbox"/> Pass	<input type="checkbox"/> Fail
------------------	----------------	-------------------------------	-------------------------------
- ☒ Perform routine maintenance on detector/injector. Replace parts as necessary with customer supplied spares.

- ☒ Check flows, including split flows if applicable. Calibrate if necessary.

Carrier flow	Pass
Split flow	Pass
- ☒ Check detector gas flows and adjust if necessary.

Detector flow	Pass
---------------	------
- ☒ Autosampler installed ☒ Yes ☐ No

Check autosampler	sensor for wear and replace if necessary.
Vial sensor	Pass
Door sensor	Pass
Tower sensor	Pass
Plunger sensor	Pass
Elevator sensor	Pass
- ☒ Remove syringe, manually flush. Replace with customer supplied spare if necessary.
- ☒ Check firmware version. Upgrade to current levels if necessary.

Firmware version	6.5
------------------	-----
- ☒ Measure all accessible power supply voltages.

5 Volt	Pass
+15 Volt	Pass
-15 Volt	Pass
24 Volt	Pass
- ☒ Record all detector voltage signal.

Detector Channel A	0.89	mV.
Detector Channel B	NA	mV.

3. Diagnostics Tests:

- ☒ Run instrument diagnostics.

BRAM	Pass
EPROM	Pass
- ☒ Run Autosampler diagnostics.

BRAM	Pass
EPROM	Pass

4. 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.
- ☒ Update Logbook.

Additional Comments

Additional Comments Regarding the PM

Review

<i>The preventive maintenance checks and if applicable performance tests for Clarus600/680 GC have been completed.</i>	
<i>This Clarus600/680 GC Pass the preventive maintenance.</i>	
Review of Preventive Maintenance:	
Authorized PerkinElmer Representative: Pramote Chaisorn	Date: 02-Sep-2022 (DD-MMM-YYYY)
Authorized Customer Representative:	Date: 02-Sep-2022 (DD-MMM-YYYY)

Turbomass/Clarus Mass/ SQ8 MS Preventive Maintenance (PM)			
Company Name:	S.P.S. Consulting Service Co.,Ltd		
Address (Instrument Location):	7 Soi Phaholyothin24 Phaholyothin Road, Jompol, Chatuchak, Bangkok, 10900.		
Serial Number:	648N4050804	PM Number:	1 of 2
Customer Name (if applicable):	Ms. Naruecha	Telephone Number:	NA
Service Engineer Name:	Monchai Kitcharoenkeat	Service Order Number:	WO-01852714
Date PM Performed: (DD-MMM-YYYY)	22-Feb-2023	Next PM Due Date: (DD-MMM-YYYY)	22-Aug-2023

Part Number	Release	Publication Date	
TH09370064	C	March 2013	

Scope

The purpose of this PM is to ensure the continued functionality of the Turbomass/Clarus MS SQ8 MS 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 or calibration, including a current back-up of system software and/or data files. The completed document should be signed by an authorized PerkinElmer and customer representative and left with the customer. Update the PM sticker and instrument logbook as required.

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Component List

Component / Specific Model	Serial #	Software Version	Configuration Notes
Clarus680	680S14042502	Totalchrom6.3	
Clarus SQ8	648N4050804	Turbomass 6.4	
Atom X	US14113002	Tekma AtomX	

Parts lists

Parts Included with the PM				
Part Number (if applicable)	Description	Quantity	Batch/Lot #	Expiration Date (MM/YY)
N/A				

Additional Tools Required for PM				
Part Number (if applicable)	Description	Quantity	Serial #	Calibration Due Date (MM/YY)
N/A				
Additional Reagents and Standards Required for PM				
Part Number (if applicable)	Description	Quantity	Batch/Lot #	Expiration Date (MM/YY)
N/A				



Procedure Checklist

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

General:

- ☒ Column type Elite 5ms
- ☒ Carrier gas flow rate 1 ml/min.
- ☒ Review the instrument performance with the customer and document any recent problems.
- ☒ Inspect the customer log book and make any appropriate PM entries.
- ☒ Check incoming AC line voltage for proper levels and grounding.

Mechanical:

- ☒ Inspect and clean all fans and filters.
- ☒ Check the level of FC-43 calibration compound in reference gas bulb and fill if necessary.
- ☒ Change the oil in the fore pump.
- ☒ Inspect cartridge in fore pump vacuum filter; replace adsorbent bead if necessary.
- ☒ Replace the exhaust vapor mist filter on the fore pump.
- ☒ Remove and clean the ion source assembly. Use the Insulator Replacement Kit and/or Optics Replacement Kit if necessary
- ☒ Replace the filament.
- ☒ Remove and clean the pre-quad rods.
- ☒ Observe Wide Range Gauge pressure; clean/adjust if required.
- ☒ Inspect and clean as needed all PC boards and bottom inside of MS chassis.

Electrical:

- ☒ Check head amp offset. Adjust if necessary for proper value (Service Manual).

Operational Tests:

- ☒ Vacuum pressure.
- ☒ Air/water leak check
- ☒ AutoTune and mass calibration.
- ☒ Make a Chromatographic injection to verify peak shape and integrity only (not meant for sensitivity test).



PC Maintenance:

- ☒ Delete all unnecessary temporary files.
- ☒ Empty deleted files from recycle bin.
- ☒ Perform hard drive defragmentation.

Review:

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

Additional Comments

Additional Comments Regarding the PM

Review

<i>The preventive maintenance checks and if applicable performance tests for Turbomass/ Clarus Mass/ SQ8 have been completed.</i>	
<i>This Turbomass/ClarusMS/SQ8 Pass the preventive maintenance.</i>	
Review of Preventive Maintenance:	
Authorized PerkinElmer Representative Monchai Kitcharoenkeat	Date: 22-Feb-2023 (DD-MMM-YYYY)
Authorized Customer Representative:	Date: 22-Feb-2023 (DD-MMM-YYYY)

เอกสารแนบ 5-5

เอกสารสอบเทียบเครื่องมือการตรวจวัดคุณภาพอากาศในสถานประกอบการ



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 ± 3 °C
Pressure : 1010 ± 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
B01	SKC	224-PCXR4	262101	03/01/2023	1,000	1,500	2,000	993	1,497	1,998	1.003x - 5.584	1.000
B02	SKC	224-PCXR4	626166	03/01/2023	1,000	1,500	2,000	1,003	1,505	2,001	1.009x - 19.667	0.999
B03	SKC	224-PCXR4	612968	03/01/2023	1,000	1,500	2,000	996	1,494	2,000	1.006x - 12.109	1.000
B04	SKC	224-PCXR4	602804	04/01/2023	1,000	1,500	2,000	1,000	1,502	1,995	1.000x - 0.893	1.000
B05	SKC	224-PCXR4	612693	04/01/2023	1,000	1,500	2,000	1,003	1,500	2,003	1.012x - 22.224	0.999
B06	SKC	224-PCXR4	262186	03/01/2023	1,000	1,500	2,000	995	1,508	2,005	1.011x - 20.273	1.000
B07	SKC	224-PCXR4	626262	03/01/2023	1,000	1,500	2,000	998	1,492	1,995	0.993x + 6.086	1.000
B08	SKC	224-PCXR4	626100	03/01/2023	1,000	1,500	2,000	1,003	1,500	2,003	1.012x - 23.308	0.999
B09	SKC	224-PCXR4	626477	03/01/2023	1,000	1,500	2,000	996	1,490	1,994	0.995x + 1.117	1.000
B10	SKC	224-PCXR4	091950	03/01/2023	1,000	1,500	2,000	992	1,503	2,001	1.018x - 36.582	0.999
B11	SKC	224-PCXR8	564315	05/01/2023	1,000	1,500	2,000	996	1,490	1,999	1.003x - 8.256	1.000
B12	SKC	224-PCXR4	034656	05/01/2023	1,000	1,500	2,000	1,003	1,503	2,003	1.010x - 19.324	0.999
B13	SKC	224-PCXR4	602073	05/01/2023	1,000	1,500	2,000	995	1,500	1,998	1.001x - 3.474	1.000
B14	SKC	224-PCXR4	626313	04/01/2023	1,000	1,500	2,000	999	1,491	1,988	0.992x + 6.844	1.000
B15	SKC	224-PCXR4	626474	04/01/2023	1,000	1,500	2,000	1,001	1,502	2,005	1.014x - 25.558	0.999
B16	SKC	224-PCXR4	626477	04/01/2023	1,000	1,500	2,000	994	1,504	2,001	1.015x - 31.345	0.999
B17	SKC	224-PCXR4	626860	04/01/2023	1,000	1,500	2,000	997	1,494	1,991	0.997x - 0.359	1.000
B18	SKC	224-PCXR4	691484	04/01/2023	1,000	1,500	2,000	1,003	1,500	2,001	1.008x - 17.589	0.999
B19	SKC	224-PCXR4	691599	03/01/2023	1,000	1,500	2,000	993	1,503	1,999	1.007x - 11.574	1.000
B20	SKC	224-PCXR4	691587	03/01/2023	1,000	1,500	2,000	992	1,504	1,999	1.015x - 32.235	0.999
B21	SKC	224-PCXR4	691531	03/01/2023	1,000	1,500	2,000	993	1,499	1,994	1.001x - 7.107	1.000
B22	SKC	224-PCXR4	691654	05/01/2023	1,000	1,500	2,000	1,003	1,501	2,003	1.011x - 21.107	0.999
B23	SKC	224-PCXR4	798393	05/01/2023	1,000	1,500	2,000	992	1,507	2,002	1.018x - 34.883	0.999
B24	SKC	224-PCXR4	626363	05/01/2023	1,000	1,500	2,000	1,000	1,502	2,000	1.011x - 22.387	0.999
B25	SKC	224-PCXR4	798489	05/01/2023	1,000	1,500	2,000	1,001	1,492	2,001	0.998x + 1.101	1.000
B26	SKC	224-PCXR4	798479	05/01/2023	1,000	1,500	2,000	999	1,500	1,993	0.996x + 4.008	1.000
B27	SKC	224-PCXR4	691673	04/01/2023	1,000	1,500	2,000	994	1,503	2,002	1.016x - 32.071	0.999
B28	SKC	224-PCXR4	691570	04/01/2023	1,000	1,500	2,000	1,002	1,500	2,002	1.012x - 22.515	0.999
B29	SKC	224-PCXR4	626472	04/01/2023	1,000	1,500	2,000	1,000	1,496	1,998	1.001x - 4.942	1.000
B30	SKC	224-PCXR4	691489	03/01/2023	1,000	1,500	2,000	1,004	1,510	2,004	1.008x - 12.460	0.999
B31	SKC	224-PCXR4	691509	03/01/2023	1,000	1,500	2,000	992	1,497	1,998	1.009x - 12.711	1.000
B32	SKC	224-PCXR4	091587	05/01/2023	1,000	1,500	2,000	991	1,504	2,001	1.016x - 32.322	0.999
B33	SKC	224-PCXR4	091756	05/01/2023	1,000	1,500	2,000	993	1,497	1,991	0.997x - 0.004	1.000
B34	SKC	224-PCXR4	612962	05/01/2023	1,000	1,500	2,000	1,002	1,501	2,002	1.007x - 14.195	1.000
B35	SKC	224-PCXR4	602682	05/01/2023	1,000	1,500	2,000	993	1,498	1,995	1.002x - 8.448	1.000
B36	SKC	224-PCXR4	626164	03/01/2023	1,000	1,500	2,000	999	1,496	1,999	1.001x - 5.424	1.000
B37	SKC	224-PCXR4	626256	03/01/2023	1,000	1,500	2,000	994	1,506	1,999	1.013x - 27.815	0.999
B38	SKC	224-PCXR4	626167	03/01/2023	1,000	1,500	2,000	997	1,496	1,996	0.999x - 0.997	1.000
B39	SKC	224-PCXR4	034637	03/01/2023	1,000	1,500	2,000	1,005	1,501	2,001	1.010x - 18.618	0.999
B40	SKC	224-PCXR4	798348	05/01/2023	1,000	1,500	2,000	994	1,506	1,999	1.014x - 29.602	0.999

Calibrated by :

Approved by :



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Personal Pump Calibration Report

Calibration Method : Dry Cal Primary Flowmeter

Model : Defender 510-H

S/N : 136164

Environmental Conditions

Temperature : 25 ± 3 °C
Pressure : 1010 ± 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
B41	SKC	224-PCXR4	612669	05/01/2023	1,000	1,500	2,000	998	1,497	1,990	0.997x + 0.718	1.000
B42	SKC	224-PCXR4	626041	05/01/2023	1,000	1,500	2,000	1,004	1,498	1,991	0.986x + 18.291	1.000
B43	SKC	224-PCXR4	034636	05/01/2023	1,000	1,500	2,000	1,000	1,501	1,992	0.991x + 11.882	1.000
B44	SKC	224-PCXR8	529341	06/01/2023	1,000	1,500	2,000	1,002	1,502	2,002	1.005x - 9.213	1.000
B45	SKC	224-PCXR8	529594	06/01/2023	1,000	1,500	2,000	999	1,501	1,989	0.991x + 11.184	1.000
B46	SKC	224-PCXR8	566743	06/01/2023	1,000	1,500	2,000	995	1,504	2,002	1.014x - 30.571	0.999
B47	SKC	224-PCXR8	566747	06/01/2023	1,000	1,500	2,000	1,002	1,502	2,004	1.013x - 24.601	0.999
B48	SKC	224-PCXR8	566753	04/01/2023	1,000	1,500	2,000	1,000	1,494	1,998	0.998x + 0.319	1.000
B49	SKC	224-PCXR8	566780	04/01/2023	1,000	1,500	2,000	1,003	1,502	2,006	1.013x - 23.982	0.999
B50	SKC	224-PCXR8	500400	04/01/2023	1,000	1,500	2,000	1,001	1,496	2,002	1.001x - 3.538	1.000
B51	SKC	224-PCXR8	500363	04/01/2023	1,000	1,500	2,000	996	1,504	1,999	1.011x - 25.031	0.999
B52	SKC	224-PCXR8	093186	04/01/2023	1,000	1,500	2,000	995	1,496	1,994	0.997x - 0.602	1.000
B53	SKC	224-PCXR8	707670	03/01/2023	1,000	1,500	2,000	1,002	1,500	2,002	1.008x - 15.403	0.999
B54	SKC	224-PCXR3	509821	03/01/2023	1,000	1,500	2,000	993	1,502	2,001	1.017x - 34.237	0.999
B55	SKC	224-PCXR3	510710	03/01/2023	1,000	1,500	2,000	999	1,494	1,994	0.997x - 0.989	1.000
B56	SKC	224-PCXR3	511450	03/01/2023	1,000	1,500	2,000	1,002	1,500	2,001	1.004x - 8.081	1.000
B57	SKC	224-PCXR3	510798	06/01/2023	1,000	1,500	2,000	997	1,492	1,998	1.000x - 2.680	1.000
B58	SKC	224-PCXR3	509852	06/01/2023	1,000	1,500	2,000	1,000	1,498	1,999	1.007x - 18.953	0.999
B59	SKC	224-PCXR3	509862	06/01/2023	1,000	1,500	2,000	996	1,503	1,994	0.997x + 3.235	1.000
B60	SKC	224-PCXR3	512655	06/01/2023	1,000	1,500	2,000	1,002	1,500	2,003	1.006x - 11.407	1.000
B61	SKC	224-PCXR3	503915	06/01/2023	1,000	1,500	2,000	994	1,489	1,998	1.004x - 12.623	1.000
B62	SKC	224-PCXR3	505975	06/01/2023	1,000	1,500	2,000	999	1,494	1,996	0.997x + 0.343	1.000
B63	SKC	224-PCXR3	511432	03/01/2023	1,000	1,500	2,000	991	1,501	1,999	1.016x - 34.624	0.999
B64	SKC	224-PCXR3	508302	03/01/2023	1,000	1,500	2,000	997	1,492	1,989	0.992x + 6.226	1.000
B65	SKC	224-PCXR3	508310	03/01/2023	1,000	1,500	2,000	1,002	1,500	2,003	1.007x - 13.936	1.000
B66	SKC	224-PCXR3	509861	03/01/2023	1,000	1,500	2,000	1,002	1,491	1,991	0.987x + 14.183	1.000
B67	SKC	224-PCXR3	506295	04/01/2023	1,000	1,500	2,000	993	1,508	2,004	1.009x - 15.555	1.000
B68	SKC	224-PCXR3	505872	04/01/2023	1,000	1,500	2,000	1,002	1,490	1,997	0.995x + 3.841	1.000
B69	SKC	224-PCXR3	508375	04/01/2023	1,000	1,500	2,000	1,002	1,499	2,000	1.010x - 20.772	0.999
B70	SKC	224-PCXR3	510623	05/01/2023	1,000	1,500	2,000	992	1,503	1,997	1.002x - 5.855	1.000
B71	SKC	224-PCXR3	508367	05/01/2023	1,000	1,500	2,000	992	1,506	2,002	1.017x - 34.791	0.999
B72	SKC	224-PCXR3	505977	05/01/2023	1,000	1,500	2,000	1,001	1,498	1,993	0.991x + 8.962	1.000
B73	SKC	224-PCXR3	512606	05/01/2023	1,000	1,500	2,000	1,002	1,501	2,005	1.009x - 14.785	1.000
B74	SKC	224-PCXR3	505993	05/01/2023	1,000	1,500	2,000	998	1,495	1,994	1.000x - 6.916	1.000
B75	SKC	224-PCXR3	509820	04/01/2023	1,000	1,500	2,000	995	1,498	1,990	0.996x + 1.791	1.000
B76	SKC	224-PCXR3	509811	04/01/2023	1,000	1,500	2,000	993	1,498	1,998	1.006x - 14.322	1.000
B77	SKC	224-PCXR3	508301	04/01/2023	1,000	1,500	2,000	1,000	1,501	2,003	1.014x - 26.603	0.999
B78	SKC	224-PCXR3	510677	04/01/2023	1,000	1,500	2,000	995	1,503	1,999	1.013x - 28.158	0.999
B79	SKC	224-PCXR3	510920	03/01/2023	1,000	1,500	2,000	994	1,493	1,994	0.999x - 4.184	1.000



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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	R²
B80	SKC	224-PCXR3	504569	03/01/2023	1,000	1,500	2,000	1,002	1,499	2,002	1.012x - 24.026	0.999
B81	SKC	224-PCXR3	503480	03/01/2023	1,000	1,500	2,000	996	1,499	2,000	1.014x - 30.524	0.999
B82	SKC	224-PCXR3	505673	06/01/2023	1,000	1,500	2,000	994	1,498	1,996	1.001x - 5.943	1.000
B83	SKC	224-PCXR3	510785	06/01/2023	1,000	1,500	2,000	1,010	1,499	2,002	1.004x - 10.466	0.999
B84	SKC	224-PCXR3	508333	06/01/2023	1,000	1,500	2,000	997	1,495	1,991	0.996x + 1.260	1.000
B85	SKC	224-PCXR3	505757	06/01/2023	1,000	1,500	2,000	994	1,502	1,998	1.005x - 13.844	1.000
B86	SKC	224-PCXR3	512625	03/01/2023	1,000	1,500	2,000	1,013	1,503	2,004	1.001x - 0.726	0.999
B87	SKC	224-PCXR3	504324	03/01/2023	1,000	1,500	2,000	998	1,496	2,000	1.000x - 1.109	1.000
B88	SKC	224-PCXR3	508307	03/01/2023	1,000	1,500	2,000	996	1,498	1,994	0.996x + 1.532	1.000
B89	SKC	224-PCXR3	509860	04/01/2023	1,000	1,500	2,000	1,000	1,499	2,003	1.008x - 15.156	1.000
B90	SKC	224-PCXR3	508366	04/01/2023	1,000	1,500	2,000	993	1,508	1,999	1.006x - 12.512	1.000
B91	SKC	224-PCXR3	510919	04/01/2023	1,000	1,500	2,000	1,000	1,498	1,996	0.990x + 8.719	1.000
B92	SKC	224-PCXR3	510987	04/01/2023	1,000	1,500	2,000	1,002	1,501	1,999	1.000x + 0.299	1.000
B93	SKC	224-PCXR3	509845	04/01/2023	1,000	1,500	2,000	995	1,496	2,004	1.009x - 16.979	1.000
B94	SKC	224-PCXR8	A127871	03/01/2023	1,000	1,500	2,000	1,000	1,500	2,002	1.007x - 19.105	0.999
B95	SKC	224-PCXR8	A127921	03/01/2023	1,000	1,500	2,000	993	1,502	2,001	1.015x - 30.898	0.999
B96	SKC	224-PCXR8	A127942	03/01/2023	1,000	1,500	2,000	998	1,498	1,995	0.998x - 1.485	1.000
B97	SKC	224-PCXR8	A127955	03/01/2023	1,000	1,500	2,000	1,003	1,501	2,003	1.011x - 20.356	0.999
B98	SKC	224-PCXR8	A127956	03/01/2023	1,000	1,500	2,000	996	1,498	1,997	1.003x - 7.473	1.000

Calibrated by :

Approved by :



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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	03/01/2023	1,000	1,500	2,000	993	1,508	2,004	1.008x - 13.936	0.999
R02	SKC	224-PCXR4	626450	06/01/2023	1,000	2,000	3,000	998	1,499	1,990	0.989x + 12.268	1.000
R03	SKC	224-PCXR4	691592	06/01/2023	1,000	1,500	2,000	1,003	1,500	2,004	1.011x - 21.761	0.999
R04	SKC	224-PCXR4	691672	06/01/2023	1,000	1,500	2,000	996	1,493	1,995	0.997x - 1.563	1.000
R05	SKC	224-PCXR4	798470	06/01/2023	1,000	1,500	2,000	993	1,505	1,999	1.014x - 31.752	0.999
R06	SKC	224-PCXR4	798456	06/01/2023	1,000	1,500	2,000	993	1,498	1,994	1.003x - 8.555	1.000
R07	SKC	224-PCXR4	798480	04/01/2023	1,000	1,500	2,000	994	1,490	1,999	1.007x - 16.073	1.000
R08	SKC	224-PCXR4	883215	04/01/2023	1,000	1,500	2,000	1,011	1,501	2,005	0.999x + 3.207	1.000
R09	SKC	224-PCXR4	034650	04/01/2023	1,000	1,500	2,000	991	1,504	2,002	1.018x - 35.900	0.999
R10	SKC	224-PCXR4	091765	04/01/2023	1,000	1,500	2,000	997	1,512	1,994	0.999x + 0.977	1.000
R11	SKC	224-PCXR4	091763	03/01/2023	1,000	1,500	2,000	1,000	1,499	2,002	1.013x - 25.119	0.999
R12	SKC	224-PCXR4	091568	03/01/2023	1,000	1,500	2,000	997	1,501	1,999	1.001x - 4.906	1.000
R13	SKC	224-PCXR4	091638	03/01/2023	1,000	1,500	2,000	1,002	1,499	1,994	0.992x + 9.636	1.000
R14	SKC	224-PCXR4	091764	03/01/2023	1,000	1,500	2,000	994	1,502	1,999	1.014x - 30.212	0.999
R15	SKC	224-PCXR8	529457	03/01/2023	1,000	1,500	2,000	1,001	1,500	2,004	1.006x - 11.941	1.000
R16	SKC	224-PCXR8	529643	05/01/2023	1,000	1,500	2,000	998	1,497	1,994	1.000x - 4.686	1.000
R17	SKC	224-PCXR8	529645	05/01/2023	1,000	1,500	2,000	994	1,509	2,000	1.015x - 30.731	0.999
R18	SKC	224-PCXR8	566756	05/01/2023	1,000	1,500	2,000	991	1,498	1,998	1.001x - 6.840	1.000
R19	SKC	224-PCXR8	566802	05/01/2023	1,000	1,500	2,000	1,002	1,499	2,000	1.010x - 21.027	0.999
R20	SKC	224-PCXR8	529069	03/01/2023	1,000	1,500	2,000	991	1,501	2,003	1.020x - 39.916	0.999
R21	SKC	224-PCXR8	665728	03/01/2023	1,000	1,500	2,000	998	1,493	1,999	1.000x - 5.404	1.000
R22	SKC	224-PCXR8	707444	03/01/2023	1,000	1,500	2,000	1,002	1,500	2,002	1.004x - 7.135	1.000
R23	SKC	224-PCXR8	761067	03/01/2023	1,000	1,500	2,000	998	1,494	1,991	0.993x + 4.132	1.000
R24	SKC	224-PCXR8	707893	04/01/2023	1,000	1,500	2,000	996	1,505	2,000	1.008x - 17.553	0.999
R25	SKC	224-PCXR8	761052	04/01/2023	1,000	1,500	2,000	1,010	1,499	1,993	0.984x + 23.464	1.000
R26	SKC	224-PCXR8	707956	04/01/2023	1,000	1,500	2,000	1,002	1,500	2,004	1.008x - 15.842	1.000
R27	SKC	224-PCXR8	707398	04/01/2023	1,000	1,500	2,000	996	1,503	2,001	1.005x - 13.449	1.000
R28	SKC	224-PCXR8	707481	04/01/2023	1,000	1,500	2,000	1,004	1,500	2,002	1.010x - 19.288	0.999
R29	SKC	224-PCXR8	707402	03/01/2023	1,000	1,500	2,000	1,004	1,493	1,991	0.986x + 14.167	1.000
R30	SKC	224-PCXR8	093811	03/01/2023	1,000	1,500	2,000	1,000	1,495	1,994	0.996x + 1.922	1.000
R31	SKC	224-PCXR8	093163	03/01/2023	1,000	1,500	2,000	1,001	1,501	2,001	1.002x - 3.618	1.000
R32	SKC	224-PCXR8	671950	03/01/2023	1,000	1,500	2,000	998	1,498	1,994	0.995x + 4.970	1.000
R33	SKC	224-PCXR4	626254	03/01/2023	1,000	1,500	2,000	995	1,502	1,999	1.014x - 31.070	0.999
R34	SKC	224-PCXR4	626131	03/01/2023	1,000	1,500	2,000	1,002	1,498	2,004	1.006x - 11.810	1.000
R35	SKC	224-PCXR8	707460	03/01/2023	1,000	1,500	2,000	999	1,498	1,995	0.994x + 6.669	1.000
R36	SKC	224-PCXR8	707446	03/01/2023	1,000	1,500	2,000	1,004	1,499	2,001	1.009x - 18.036	0.999
R37	SKC	224-PCXR8	707432	03/01/2023	1,000	1,500	2,000	996	1,499	1,998	1.000x - 2.070	1.000
R38	SKC	224-PCXR8	707349	03/01/2023	1,000	1,500	2,000	996	1,500	2,001	1.004x - 9.345	1.000
R39	SKC	224-PCXR8	761095	03/01/2023	1,000	1,500	2,000	1,001	1,496	1,994	0.997x + 2.373	1.000

Calibrated by :

Approved by :



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	R²
R40	SKC	224-PCXR4	612753	05/01/2023	1,000	1,500	2,000	1,001	1,502	2,003	1.012x - 23.564	0.999
R41	SKC	224-PCXR4	626140	05/01/2023	1,000	1,500	2,000	992	1,509	2,001	1.017x - 32.442	0.999
R42	SKC	224-PCXR4	626463	05/01/2023	1,000	1,500	2,000	998	1,493	1,999	1.001x - 2.963	1.000
R43	SKC	224-PCXR4	626129	05/01/2023	1,000	1,500	2,000	1,003	1,501	2,003	1.010x - 18.945	0.999
R44	SKC	224-PCXR4	602753	05/01/2023	1,000	1,500	2,000	1,002	1,496	1,993	0.995x + 2.529	1.000
R45	SKC	224-PCXR4	626137	05/01/2023	1,000	1,500	2,000	992	1,505	2,002	1.019x - 37.408	0.999

Calibrated by :

Approved by :



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

Personal Pump Calibration Report

Calibration Method : Dry Cal Primary Flowmeter

Model : Defender 510-H

S/N : 136164

Environmental Conditions

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

Personal Pump Data				Calibration Data								
No.	Brand	Model	Serial No.	Date	Flow Rate (ml/min)						Value From Calibration Curve	
					Setting			Actual (Q std.)				
					1	2	3	1	2	3	y	R ²
B01	SKC	224-PCXR4	262101	04/04/2023	1,000	1,500	2,000	994	1,498	2,003	1.005x - 7.897	1.000
B02	SKC	224-PCXR4	626166	04/04/2023	1,000	1,500	2,000	1,004	1,503	2,003	1.010x - 19.866	0.999
B03	SKC	224-PCXR4	612968	07/04/2023	1,000	1,500	2,000	995	1,496	2,001	1.007x - 13.664	1.000
B04	SKC	224-PCXR4	602804	05/04/2023	1,000	1,500	2,000	998	1,499	1,994	0.999x - 1.611	1.000
B05	SKC	224-PCXR4	612693	07/04/2023	1,000	1,500	2,000	1,002	1,501	2,004	1.014x - 24.856	0.999
B06	SKC	224-PCXR4	262168	07/04/2023	1,000	1,500	2,000	994	1,509	2,006	1.012x - 21.589	0.999
B07	SKC	224-PCXR4	626262	04/04/2023	1,000	1,500	2,000	997	1,490	1,996	0.994x + 3.454	1.000
B08	SKC	224-PCXR4	626100	04/04/2023	1,000	1,500	2,000	1,001	1,499	2,005	1.015x - 27.137	0.999
B09	SKC	224-PCXR4	626479	05/04/2023	1,000	1,500	2,000	997	1,492	1,994	0.994x + 2.385	1.000
B10	SKC	224-PCXR4	091950	03/04/2023	1,000	1,500	2,000	993	1,504	2,005	1.013x - 23.779	1.000
B11	SKC	224-PCXR8	564315	10/04/2023	1,000	1,500	2,000	995	1,492	1,998	1.002x - 7.259	1.000
B12	SKC	224-PCXR4	034656	04/04/2023	1,000	1,500	2,000	1,002	1,504	2,001	1.009x - 17.609	0.999
B13	SKC	224-PCXR4	602073	04/04/2023	1,000	1,500	2,000	997	1,501	2,000	1.004x - 7.622	1.000
B14	SKC	224-PCXR4	626313	03/04/2023	1,000	1,500	2,000	997	1,492	1,991	0.996x + 1.699	1.000
B15	SKC	224-PCXR4	626474	07/04/2023	1,000	1,500	2,000	1,003	1,503	2,006	1.013x - 23.245	0.999
B16	SKC	224-PCXR4	626477	03/04/2023	1,000	1,500	2,000	995	1,506	2,003	1.011x - 22.132	0.999
B17	SKC	224-PCXR4	626660	04/04/2023	1,000	1,500	2,000	996	1,493	1,993	1.000x + 4.627	1.000
B18	SKC	224-PCXR4	691484	04/04/2023	1,000	1,500	2,000	1,001	1,496	2,002	1.010x - 21.179	0.999
B19	SKC	224-PCXR4	691599	04/04/2023	1,000	1,500	2,000	994	1,504	2,000	1.006x - 10.498	1.000
B20	SKC	224-PCXR4	691587	03/04/2023	1,000	1,500	2,000	991	1,502	2,000	1.016x - 35.102	0.999
B21	SKC	224-PCXR4	691531	04/04/2023	1,000	1,500	2,000	994	1,501	1,995	1.001x - 5.153	1.000
B22	SKC	224-PCXR4	691654	07/04/2023	1,000	1,500	2,000	1,000	1,502	2,004	1.014x - 25.574	0.999
B23	SKC	224-PCXR4	798393	05/04/2023	1,000	1,500	2,000	990	1,508	2,004	1.013x - 23.994	1.000
B24	SKC	224-PCXR4	626363	03/04/2023	1,000	1,500	2,000	1,002	1,503	1,999	1.009x - 18.837	0.999
B25	SKC	224-PCXR4	798489	07/04/2023	1,000	1,500	2,000	1,002	1,494	2,000	0.997x + 3.494	1.000
B26	SKC	224-PCXR4	798479	07/04/2023	1,000	1,500	2,000	1,001	1,501	1,994	0.995x + 5.564	1.000
B27	SKC	224-PCXR4	691673	04/04/2023	1,000	1,500	2,000	995	1,505	2,004	1.013x - 25.091	0.999
B28	SKC	224-PCXR4	691570	04/04/2023	1,000	1,500	2,000	1,003	1,501	2,001	1.010x - 19.922	0.999
B29	SKC	224-PCXR4	626472	05/04/2023	1,000	1,500	2,000	1,001	1,498	2,000	0.999x - 1.831	1.000
B30	SKC	224-PCXR4	691489	04/04/2023	1,000	1,500	2,000	1,002	1,507	2,003	1.009x - 13.936	0.999
B31	SKC	224-PCXR4	691509	07/04/2023	1,000	1,500	2,000	994	1,496	1,997	1.004x - 9.680	1.000
B32	SKC	224-PCXR4	091587	10/04/2023	1,000	1,500	2,000	992	1,506	2,001	1.013x - 25.542	0.999
B33	SKC	224-PCXR4	091756	05/04/2023	1,000	1,500	2,000	993	1,498	1,992	0.998x - 1.121	1.000
B34	SKC	224-PCXR4	612962	07/04/2023	1,000	1,500	2,000	1,002	1,503	2,003	1.008x - 14.753	0.999
B35	SKC	224-PCXR4	602682	05/04/2023	1,000	1,500	2,000	991	1,497	1,996	1.003x - 11.598	1.000
B36	SKC	224-PCXR4	626164	05/04/2023	1,000	1,500	2,000	997	1,495	1,998	1.002x - 8.097	1.000
B37	SKC	224-PCXR4	626256	07/04/2023	1,000	1,500	2,000	993	1,505	1,996	1.012x - 27.161	0.999
B38	SKC	224-PCXR4	626187	07/04/2023	1,000	1,500	2,000	998	1,493	1,997	1.003x - 8.615	1.000
B39	SKC	224-PCXR4	034637	10/04/2023	1,000	1,500	2,000	1,003	1,500	2,003	1.013x - 23.125	0.999
B40	SKC	224-PCXR4	798349	07/04/2023	1,000	1,500	2,000	993	1,507	1,998	1.015x - 30.204	0.999

Calibrated by :

Approved by :



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 ± 3 °C
Pressure : 1010 ± 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
B41	SKC	224-PCXR4	612669	07/04/2023	1,000	1,500	2,000	997	1,496	1,991	0.998x - 1.396	1.000
B42	SKC	224-PCXR4	626041	10/04/2023	1,000	1,500	2,000	1,006	1,496	1,992	0.988x + 14.223	1.000
B43	SKC	224-PCXR4	034636	07/04/2023	1,000	1,500	2,000	1,001	1,503	1,993	0.992x + 8.810	1.000
B44	SKC	224-PCXR8	529341	10/04/2023	1,000	1,500	2,000	1,000	1,499	2,005	1.008x - 14.358	1.000
B45	SKC	224-PCXR8	529594	10/04/2023	1,000	1,500	2,000	998	1,506	1,987	0.990x + 12.580	1.000
B46	SKC	224-PCXR8	566743	05/04/2023	1,000	1,500	2,000	996	1,502	2,000	1.012x - 26.902	0.999
B47	SKC	224-PCXR8	566747	07/04/2023	1,000	1,500	2,000	998	1,501	2,002	1.014x - 27.552	0.999
B48	SKC	224-PCXR8	566753	10/04/2023	1,000	1,500	2,000	998	1,493	1,996	0.997x - 0.359	1.000
B49	SKC	224-PCXR8	566780	05/04/2023	1,000	1,500	2,000	1,007	1,501	2,007	1.011x - 19.156	0.999
B50	SKC	224-PCXR8	500400	07/04/2023	1,000	1,500	2,000	1,004	1,495	2,004	1.000x - 1.663	1.000
B51	SKC	224-PCXR8	500363	04/04/2023	1,000	1,500	2,000	997	1,502	1,998	1.008x - 21.322	0.999
B52	SKC	224-PCXR8	093186	05/04/2023	1,000	1,500	2,000	993	1,493	1,995	1.000x - 6.106	1.000
B53	SKC	224-PCXR8	707670	05/04/2023	1,000	1,500	2,000	1,000	1,498	2,002	1.009x - 18.883	0.999
B54	SKC	224-PCXR3	509821	05/04/2023	1,000	1,500	2,000	995	1,500	2,001	1.016x - 32.482	0.999
B55	SKC	224-PCXR3	510710	10/04/2023	1,000	1,500	2,000	998	1,497	1,992	0.996x - 0.191	1.000
B56	SKC	224-PCXR3	511450	05/04/2023	1,000	1,500	2,000	1,003	1,501	2,003	1.005x - 8.081	1.000
B57	SKC	224-PCXR3	510798	05/04/2023	1,000	1,500	2,000	999	1,490	2,000	1.001x - 9.920	1.000
B58	SKC	224-PCXR3	509852	10/04/2023	1,000	1,500	2,000	1,002	1,496	1,998	1.004x - 15.922	0.999
B59	SKC	224-PCXR3	509862	10/04/2023	1,000	1,500	2,000	998	1,501	1,996	0.996x + 4.471	1.000
B60	SKC	224-PCXR3	512655	07/04/2023	1,000	1,500	2,000	1,003	1,499	2,004	1.005x - 9.971	1.000
B61	SKC	224-PCXR3	503915	10/04/2023	1,000	1,500	2,000	993	1,488	1,999	1.007x - 15.934	1.000
B62	SKC	224-PCXR3	505975	10/04/2023	1,000	1,500	2,000	1,001	1,485	1,997	1.000x - 4.802	1.000
B63	SKC	224-PCXR3	511432	07/04/2023	1,000	1,500	2,000	993	1,500	2,000	1.015x - 32.709	0.999
B64	SKC	224-PCXR3	508302	05/04/2023	1,000	1,500	2,000	998	1,491	1,987	0.989x + 9.855	1.000
B65	SKC	224-PCXR3	508310	10/04/2023	1,000	1,500	2,000	998	1,502	2,005	1.012x - 20.596	1.000
B66	SKC	224-PCXR3	509861	10/04/2023	1,000	1,500	2,000	1,000	1,492	1,992	0.990x + 10.912	1.000
B67	SKC	224-PCXR3	506295	07/04/2023	1,000	1,500	2,000	993	1,506	2,002	1.007x - 13.999	1.000
B68	SKC	224-PCXR3	505872	05/04/2023	1,000	1,500	2,000	998	1,488	1,997	0.998x - 1.743	1.000
B69	SKC	224-PCXR3	508375	04/04/2023	1,000	1,500	2,000	1,004	1,502	2,002	1.009x - 18.897	0.999
B70	SKC	224-PCXR3	510623	05/04/2023	1,000	1,500	2,000	994	1,505	1,998	1.004x - 8.846	1.000
B71	SKC	224-PCXR3	508367	10/04/2023	1,000	1,500	2,000	994	1,503	2,003	1.011x - 23.544	0.999
B72	SKC	224-PCXR3	505977	10/04/2023	1,000	1,500	2,000	1,005	1,493	1,992	0.988x + 13.309	1.000
B73	SKC	224-PCXR3	512606	05/04/2023	1,000	1,500	2,000	1,000	1,504	2,004	1.008x - 14.506	1.000
B74	SKC	224-PCXR3	505993	05/04/2023	1,000	1,500	2,000	997	1,497	1,996	1.001x - 7.514	1.000
B75	SKC	224-PCXR3	509820	07/04/2023	1,000	1,500	2,000	997	1,496	1,992	0.997x + 0.195	1.000
B76	SKC	224-PCXR3	509811	05/04/2023	1,000	1,500	2,000	995	1,498	1,999	1.004x - 11.212	1.000
B77	SKC	224-PCXR3	508301	10/04/2023	1,000	1,500	2,000	1,003	1,502	2,004	1.013x - 23.811	0.999
B78	SKC	224-PCXR3	510677	04/04/2023	1,000	1,500	2,000	997	1,505	2,000	1.007x - 16.113	0.999
B79	SKC	224-PCXR3	510920	10/04/2023	1,000	1,500	2,000	996	1,495	1,993	0.998x - 1.232	1.000

Calibrated by :

Approved by :



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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 ± 3 °C
Pressure : 1010 ± 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
B80	SKC	224-PCXR3	504569	05/04/2023	1,000	1,500	2,000	1,003	1,498	2,003	1.011x - 22.431	0.999
B81	SKC	224-PCXR3	503480	05/04/2023	1,000	1,500	2,000	995	1,500	2,001	1.016x - 32.797	0.999
B82	SKC	224-PCXR3	505673	05/04/2023	1,000	1,500	2,000	995	1,496	1,997	1.003x - 7.259	1.000
B83	SKC	224-PCXR3	510785	05/04/2023	1,000	1,500	2,000	1,007	1,498	2,001	1.006x - 13.816	0.999
B84	SKC	224-PCXR3	508333	10/04/2023	1,000	1,500	2,000	995	1,498	1,993	0.998x - 1.970	1.000
B85	SKC	224-PCXR3	505757	10/04/2023	1,000	1,500	2,000	996	1,500	2,000	1.004x - 12.009	1.000
B86	SKC	224-PCXR3	512625	05/04/2023	1,000	1,500	2,000	1,011	1,501	2,005	1.002x - 3.877	0.999
B87	SKC	224-PCXR3	504324	05/04/2023	1,000	1,500	2,000	999	1,495	1,998	0.999x - 0.606	1.000
B88	SKC	224-PCXR3	508307	05/04/2023	1,000	1,500	2,000	997	1,497	1,992	0.994x + 4.682	1.000
B89	SKC	224-PCXR3	509860	05/04/2023	1,000	1,500	2,000	1,001	1,498	2,002	1.007x - 13.92	1.000
B90	SKC	224-PCXR3	508366	05/04/2023	1,000	1,500	2,000	995	1,507	1,998	1.004x - 9.640	1.000
B91	SKC	224-PCXR3	510919	04/04/2023	1,000	1,500	2,000	1,003	1,500	1,995	0.988x + 13.505	1.000
B92	SKC	224-PCXR3	510987	05/04/2023	1,000	1,500	2,000	1,003	1,503	1,998	0.997x + 5.125	1.000
B93	SKC	224-PCXR3	509845	10/04/2023	1,000	1,500	2,000	996	1,498	2,003	1.007x - 13.628	1.000
B94	SKC	224-PCXR8	A127871	04/04/2023	1,000	1,500	2,000	1,001	1,495	2,003	1.006x - 15.746	0.999
B95	SKC	224-PCXR8	A127921	03/04/2023	1,000	1,500	2,000	995	1,504	2,001	1.013x - 26.112	0.999
B96	SKC	224-PCXR8	A127942	07/04/2023	1,000	1,500	2,000	999	1,499	1,997	1.000x - 2.010	1.000
B97	SKC	224-PCXR8	A127955	07/04/2023	1,000	1,500	2,000	1,006	1,503	2,005	1.011x - 18.638	0.999
B98	SKC	224-PCXR8	A127956	07/04/2023	1,000	1,500	2,000	994	1,497	1,998	1.005x - 11.436	1.000

Calibrated by :

Approved by :



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-II

S/N : 136164

Environmental Conditions

Temperature : 25 ± 3 °C
Pressure : 1010 ± 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	R²
R01	SKC	224-PCXR4	602467	10/04/2023	1,000	1,500	2,000	992	1,507	2,005	1.009x - 15.491	1.000
R02	SKC	224-PCXR4	626450	10/04/2023	1,000	2,000	3,000	997	1,497	1,989	0.990x + 10.155	1.000
R03	SKC	224-PCXR4	691592	10/04/2023	1,000	1,500	2,000	1,005	1,496	2,003	1.010x - 19.567	0.999
R04	SKC	224-PCXR4	691672	04/04/2023	1,000	1,500	2,000	998	1,491	1,997	0.998x - 1.962	1.000
R05	SKC	224-PCXR4	798470	10/04/2023	1,000	1,500	2,000	994	1,506	1,998	1.012x - 28.038	0.999
R06	SKC	224-PCXR4	798456	05/04/2023	1,000	1,500	2,000	993	1,497	1,995	1.004x - 10.749	1.000
R07	SKC	224-PCXR4	798480	10/04/2023	1,000	1,500	2,000	996	1,492	1,998	1.005x - 11.766	1.000
R08	SKC	224-PCXR4	883215	10/04/2023	1,000	1,500	2,000	1,010	1,503	2,003	0.998x + 3.526	1.000
R09	SKC	224-PCXR4	034650	04/04/2023	1,000	1,500	2,000	994	1,505	2,003	1.017x - 33.985	0.999
R10	SKC	224-PCXR4	091765	07/04/2023	1,000	1,500	2,000	998	1,492	1,996	1.000x - 3.929	1.000
R11	SKC	224-PCXR4	091763	04/04/2023	1,000	1,500	2,000	1,002	1,497	2,003	1.012x - 23.883	0.999
R12	SKC	224-PCXR4	091568	10/04/2023	1,000	1,500	2,000	995	1,503	1,998	1.002x - 7.698	1.000
R13	SKC	224-PCXR4	091638	10/04/2023	1,000	1,500	2,000	1,005	1,497	1,993	0.989x + 13.679	1.000
R14	SKC	224-PCXR4	091764	10/04/2023	1,000	1,500	2,000	992	1,503	1,998	1.015x - 32.167	0.999
R15	SKC	224-PCXR8	529457	10/04/2023	1,000	1,500	2,000	1,003	1,501	2,005	1.005x - 9.429	1.000
R16	SKC	224-PCXR8	529643	04/04/2023	1,000	1,500	2,000	999	1,496	1,995	0.999x - 3.290	1.000
R17	SKC	224-PCXR8	529645	05/04/2023	1,000	1,500	2,000	995	1,511	2,001	1.012x - 23.233	0.999
R18	SKC	224-PCXR8	566756	07/04/2023	1,000	1,500	2,000	992	1,497	1,999	1.002x - 7.359	1.000
R19	SKC	224-PCXR8	566802	07/04/2023	1,000	1,500	2,000	1,002	1,498	1,999	1.009x - 19.671	0.999
R20	SKC	224-PCXR8	529089	07/04/2023	1,000	1,500	2,000	992	1,501	2,004	1.015x - 28.270	1.000
R21	SKC	224-PCXR8	665728	10/04/2023	1,000	1,500	2,000	997	1,494	1,997	1.001x - 7.797	1.000
R22	SKC	224-PCXR8	707444	05/04/2023	1,000	1,500	2,000	1,003	1,501	2,003	1.003x - 6.218	1.000
R23	SKC	224-PCXR8	761067	10/04/2023	1,000	1,500	2,000	996	1,495	1,993	0.995x + 0.263	1.000
R24	SKC	224-PCXR8	707893	10/04/2023	1,000	1,500	2,000	997	1,506	2,002	1.009x - 17.713	0.999
R25	SKC	224-PCXR8	761052	10/04/2023	1,000	1,500	2,000	1,009	1,497	1,992	0.983x + 22.945	1.000
R26	SKC	224-PCXR8	707956	10/04/2023	1,000	1,500	2,000	1,004	1,502	2,005	1.008x - 14.326	0.999
R27	SKC	224-PCXR8	707398	07/04/2023	1,000	1,500	2,000	995	1,502	2,002	1.007x - 16.361	1.000
R28	SKC	224-PCXR8	707481	10/04/2023	1,000	1,500	2,000	1,006	1,501	2,003	1.009x - 18.291	0.999
R29	SKC	224-PCXR8	707402	07/04/2023	1,000	1,500	2,000	1,002	1,494	1,989	0.987x + 14.566	1.000
R30	SKC	224-PCXR8	093811	04/04/2023	1,000	1,500	2,000	1,001	1,494	1,996	0.997x + 0.646	1.000
R31	SKC	224-PCXR8	093183	10/04/2023	1,000	1,500	2,000	1,001	1,502	2,004	1.004x - 5.652	1.000
R32	SKC	224-PCXR8	671950	05/04/2023	1,000	1,500	2,000	999	1,501	1,993	0.994x + 7.163	1.000
R33	SKC	224-PCXR4	626254	10/04/2023	1,000	1,500	2,000	996	1,504	2,001	1.015x - 30.192	0.999
R34	SKC	224-PCXR4	626131	04/04/2023	1,000	1,500	2,000	1,003	1,498	2,004	1.004x - 9.377	1.000
R35	SKC	224-PCXR8	707460	10/04/2023	1,000	1,500	2,000	998	1,496	1,996	0.996x + 3.677	1.000
R36	SKC	224-PCXR8	707446	10/04/2023	1,000	1,500	2,000	1,003	1,498	2,002	1.010x - 20.668	0.999
R37	SKC	224-PCXR8	707432	10/04/2023	1,000	1,500	2,000	998	1,496	2,000	0.999x - 0.873	1.000
R38	SKC	224-PCXR8	707349	07/04/2023	1,000	1,500	2,000	997	1,497	2,001	1.003x - 8.747	1.000
R39	SKC	224-PCXR8	761095	10/04/2023	1,000	1,500	2,000	1,001	1,497	1,997	0.998x + 0.140	1.000

Calibrated by :

Approved by :



บริษัท เอส.พี.เอส. คอนซัลติ้ง เซอร์วิส จำกัด
S.P.S. CONSULTING SERVICE CO., LTD.
7 ซอยพหลโยธิน 24 ถนนพหลโยธิน แขวงจอมพล เขตจตุจักร กรุงเทพฯ 10900
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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-II

S/N : 136164

Environmental Conditions

Temperature : 25 ± 3 °C
Pressure : 1010 ± 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	10/04/2023	1,000	1,500	2,000	1,001	1,503	2,004	1.014x - 25.279	0.999
R41	SKC	224-PCXR4	626140	07/04/2023	1,000	1,500	2,000	993	1,511	2,002	1.016x - 31.245	0.999
R42	SKC	224-PCXR4	626463	10/04/2023	1,000	1,500	2,000	999	1,495	2,001	1.003x - 5.636	1.000
R43	SKC	224-PCXR4	626129	10/04/2023	1,000	1,500	2,000	1,006	1,503	2,005	1.008x - 15.834	0.999
R44	SKC	224-PCXR4	602753	10/04/2023	1,000	1,500	2,000	1,000	1,496	1,994	0.997x - 0.383	1.000
R45	SKC	224-PCXR4	626137	10/04/2023	1,000	1,500	2,000	994	1,505	2,004	1.015x - 29.231	0.999

Calibrated by :

Approved by :

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-B01	Dwyer	VFB-65	05/01/2023	500	1,000	2,000	506.1	989.5	1973.5	0.990x + 8.311	1.000
H-B02	Dwyer	VFB-65	05/01/2023	500	1,000	2,000	494.9	998.2	1996.3	0.993x + 4.772	1.000
H-B03	Dwyer	VFB-65	05/01/2023	500	1,000	2,000	498.3	987.5	2010.6	1.005x - 15.690	0.999
H-B04	Dwyer	VFB-65	03/01/2023	500	1,000	2,000	500.4	999.5	2008.7	0.998x - 2.369	1.000
H-B05	Dwyer	VFB-65	03/01/2023	500	1,000	2,000	499.0	997.8	1972.3	0.981x + 20.957	0.999
H-B06	Dwyer	VFB-65	03/01/2023	500	1,000	2,000	503.6	995.0	1981.4	1.005x - 8.788	0.999
H-B07	Dwyer	VFB-65	04/01/2023	500	1,000	2,000	504.1	989.0	2018.7	1.002x - 2.144	1.000
H-B08	Dwyer	VFB-65	06/01/2023	500	1,000	2,000	499.8	999.2	1975.8	0.996x + 3.270	0.999
H-B09	Dwyer	VFB-65	06/01/2023	500	1,000	2,000	503.7	1006.6	2014.3	0.994x + 14.202	1.000
H-B10	Dwyer	VFB-65	06/01/2023	500	1,000	2,000	496.1	998.6	2012.4	0.997x + 2.443	1.000
Calibrated by :				Approved by :							

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-B01	Dwyer	VFA-21	04/01/2023	50	100	200	50.7	99.1	198.5	0.985x + 1.102	1.000
L-B02	Dwyer	VFA-21	04/01/2023	50	100	200	51.0	99.4	198.7	0.994x + 1.097	0.999
L-B03	Dwyer	VFA-21	06/01/2023	50	100	200	50.8	99.2	198.3	1.006x - 0.866	1.000
L-B04	Dwyer	VFA-21	06/01/2023	50	100	200	49.1	101.6	201.1	1.016x - 1.187	1.000
L-B05	Dwyer	VFA-21	06/01/2023	50	100	200	50.5	98.1	200.8	1.001x + 0.196	0.999
L-B06	Dwyer	VFA-21	03/01/2023	50	100	200	50.1	100.1	203.4	1.010x + 0.062	1.000
L-B07	Dwyer	VFA-21	03/01/2023	50	100	200	49.4	100.8	199.7	1.019x - 2.253	1.000
L-B08	Dwyer	VFA-21	03/01/2023	50	100	200	49.8	101.3	198.1	0.999x - 0.218	1.000
L-B09	Dwyer	VFA-21	03/01/2023	50	100	200	50.0	99.2	200.7	0.993x + 1.212	0.999
L-B10	Dwyer	VFA-21	05/01/2023	50	100	200	51.0	99.8	202.8	1.004x + 0.747	1.000
Calibrated by :				Approved by :							

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	05/01/2023	500	1,000	2,000	503.3	992.4	1978.7	0.999x - 3.199	0.999
H-R02	Dwyer	VFB-65	04/01/2023	500	1,000	2,000	501.2	995.3	1985.7	1.002x - 5.186	1.000
H-R03	Dwyer	VFB-65	04/01/2023	500	1,000	2,000	501.7	987.7	1996.9	0.994x + 1.679	1.000
H-R04	Dwyer	VFB-65	04/01/2023	500	1,000	2,000	496.4	989.6	2019.5	1.008x - 13.614	1.000
H-R05	Dwyer	VFB-65	06/01/2023	500	1,000	2,000	497.2	987.7	1988.1	1.004x - 9.360	1.000
H-R06	Dwyer	VFB-65	06/01/2023	500	1,000	2,000	505.2	992.4	1996.9	0.999x - 3.199	0.999
Calibrated by : _____				Approved by : _____							

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	04/01/2023	50	100	200	50.6	100.6	203.9	0.982x + 2.803	1.000
L-R02	Dwyer	VFA-21	04/01/2023	50	100	200	49.7	101.3	200.1	1.008x - 1.204	0.999
L-R03	Dwyer	VFA-21	04/01/2023	50	100	200	50.5	99.8	202.3	1.017x - 0.913	1.000
L-R04	Dwyer	VFA-21	03/01/2023	50	100	200	49.8	100.5	201.0	1.010x - 1.439	0.999
L-R05	Dwyer	VFA-21	03/01/2023	50	100	200	50.6	100.0	203.4	0.991x + 1.807	1.000
L-R06	Dwyer	VFA-21	03/01/2023	50	100	200	50.6	99.1	201.9	1.003x - 0.031	1.000
Calibrated by : _____				Approved by : _____							

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-B01	Dwyer	VFB-65	05/04/2023	500	1,000	2,000	506.9	990.3	1974.3	0.989x + 9.271	1.000
H-B02	Dwyer	VFB-65	04/04/2023	500	1,000	2,000	495.3	999.1	1996.1	0.994x + 4.127	1.000
H-B03	Dwyer	VFB-65	07/04/2023	500	1,000	2,000	497.5	988.1	2009.6	1.003x - 14.485	0.999
H-B04	Dwyer	VFB-65	07/04/2023	500	1,000	2,000	501.2	1000.3	2006.5	0.997x - 1.216	1.000
H-B05	Dwyer	VFB-65	07/04/2023	500	1,000	2,000	500.2	999.6	1974.3	0.980x + 21.307	0.999
H-B06	Dwyer	VFB-65	07/04/2023	500	1,000	2,000	504.3	996.2	1984.0	1.004x - 6.770	1.000
H-B07	Dwyer	VFB-65	04/04/2023	500	1,000	2,000	502.3	990.7	2016.7	1.001x - 1.154	1.000
H-B08	Dwyer	VFB-65	05/04/2023	500	1,000	2,000	500.2	1000.6	1979.5	0.995x + 5.040	0.999
H-B09	Dwyer	VFB-65	07/04/2023	500	1,000	2,000	504.4	1007.4	2010.7	0.993x + 15.376	1.000
H-B10	Dwyer	VFB-65	10/04/2023	500	1,000	2,000	495.7	1001.6	2009.2	0.996x + 3.966	1.000

Calibrated by :

Approved by :

Rotameter Calibration Report (For Personal Pump Low Flow Adjust)

Calibration Method : Dry Cal Primary Flowmeter

Model : Defender 510-H

S/N : 136164

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-B01	Dwyer	VFA-21	05/04/2023	50	100	200	50.3	98.7	198.9	0.986x + 0.859	1.000
L-B02	Dwyer	VFA-21	04/04/2023	50	100	200	50.6	99.8	198.3	0.995x + 0.956	0.999
L-B03	Dwyer	VFA-21	07/04/2023	50	100	200	50.4	99.6	197.9	1.009x - 1.350	1.000
L-B04	Dwyer	VFA-21	07/04/2023	50	100	200	49.5	102.0	200.7	1.012x - 0.487	1.000
L-B05	Dwyer	VFA-21	07/04/2023	50	100	200	50.9	98.9	201.2	0.998x + 1.040	0.999
L-B06	Dwyer	VFA-21	07/04/2023	50	100	200	50.8	99.7	202.8	1.009x + 0.150	1.000
L-B07	Dwyer	VFA-21	04/04/2023	50	100	200	49.0	101.2	200.5	1.014x - 1.381	1.000
L-B08	Dwyer	VFA-21	05/04/2023	50	100	200	50.2	102.1	197.7	0.997x + 0.307	1.000
L-B09	Dwyer	VFA-21	07/04/2023	50	100	200	50.8	99.6	201.1	0.990x + 2.095	0.999
L-B10	Dwyer	VFA-21	10/04/2023	50	100	200	51.0	99.0	203.2	1.005x + 0.453	1.000

Calibrated by :

Approved by :

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	05/04/2023	500	1,000	2,000	502.1	993.6	1981.1	1.000x - 3.647	0.999
H-R02	Dwyer	VFB-65	10/04/2023	500	1,000	2,000	500.4	996.7	1988.7	1.001x - 3.457	1.000
H-R03	Dwyer	VFB-65	07/04/2023	500	1,000	2,000	502.1	990.3	1997.7	0.993x + 4.022	1.000
H-R04	Dwyer	VFB-65	10/04/2023	500	1,000	2,000	497.2	992.2	2016.9	1.007x - 11.203	1.000
H-R05	Dwyer	VFB-65	05/04/2023	500	1,000	2,000	499.2	988.5	1990.7	1.003x - 7.136	1.000
H-R06	Dwyer	VFB-65	10/04/2023	500	1,000	2,000	504.8	994.6	1982.6	0.999x - 1.961	0.999

Calibrated by :

Approved by :

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	05/04/2023	50	100	200	50.2	101.0	204.3	0.981x + 2.956	0.999
L-R02	Dwyer	VFA-21	10/04/2023	50	100	200	50.1	102.0	201.0	1.007x - 0.506	0.999
L-R03	Dwyer	VFA-21	07/04/2023	50	100	200	50.1	100.2	202.7	1.015x - 0.825	1.000
L-R04	Dwyer	VFA-21	10/04/2023	50	100	200	50.2	100.9	200.6	1.005x - 0.751	0.999
L-R05	Dwyer	VFA-21	05/04/2023	50	100	200	50.2	101.0	202.6	0.994x + 1.409	1.000
L-R06	Dwyer	VFA-21	10/04/2023	50	100	200	50.8	100.2	202.3	1.001x + 0.717	1.000

Calibrated by :

Approved by :



GAS CHROMATOGRAPH TEST CERTIFICATION

Certificate No. : SV0822/20530

Instrument Type : GC

Model : CP-3800

Serial Number : 00734

Organization : S.P.S. Consulting Service Co., Ltd.

Address : 7 Phahonyothin Soi 24 Phahonyothin Rd. Ladyao Chatuchak Bangkok 10900

Date : 10/08/2022

ELECTRONIC TEST

CPU	<input checked="" type="checkbox"/> PASS	<input type="checkbox"/> FAIL
LCD TEST	<input checked="" type="checkbox"/> PASS	<input type="checkbox"/> FAIL
VENT TEST	<input checked="" type="checkbox"/> PASS	<input type="checkbox"/> FAIL
KEY ECHO TEST	<input checked="" type="checkbox"/> PASS	<input type="checkbox"/> FAIL
DESTRUCTION RAM TEST	<input checked="" type="checkbox"/> PASS	<input type="checkbox"/> FAIL

RUN CHROMATOGRAM TEST

DETECTOR : Flame Ionization Detector (FID Channel Front)

INJECTOR : Capillary Injector Model 1079

GC CONDITION:

Column	80 °C hold 1 min., rate 20 °C/min. to 200 °C hold 1min.
Injector	220 °C
Detector	300 °C
Column flow	5 mL/min
Makeup flow	25 mL/min
Air flow	300 mL/min
Hydrogen flow	30 mL/min

Column:Capillary Column CP sil 5 CB 0.25 ID x 15 M

Sample: 1 µL Injection FID Test Sample 0.218 g/L C14,C15,C16 in hexane

SENSITIVITY TEST: C15. (Area count) = 118,103 Counts.



Detector Sensitivity (FID)

Detector Response	Result	Specification
Baseline Noise (µV)	2.94	≤ 50
Baseline Drift (%)	0.18	≤ 1
Sensitivity (S/N for C15)	4,000	≥ 1,024

Temperature Specification

Temperature	Set	Result	Specification
Column Oven (° C)	80	80	± 5
Injector (° C)	220	220	± 5
Detector (° C)	300	300	± 5
Incubator (° C)	60	N/A	± 5

Relative Standard Deviation % (% RSD)

Checkout Procedure	Result	Specification
Area C15 (%)	1.68	≤ 5
Retention Time C15(%)	0.01	≤ 0.5



VARIAN

1/2

SERVICE DEPARTMENT

FR-SV-029 Rev. 04



VARIAN

2/2

SERVICE DEPARTMENT

FR-SV-029 Rev. 04



บริษัท ไทยยูนิค จำกัด

THAI UNIQUE CO., LTD.

80-82 ถนนประชาธิปไตย แขวงบางขุนพรหม เขตพระนคร กรุงเทพฯ 10200

80-82 Prachathipatai Rd., Bangkhunphrom, Pranakorn, Bangkok 10200

Tel. 0-2629-0191-6, 0-2280-1787, Fax. 0-2280-1788, E-mail : thawatt@thaiunique.com, Website : www.thaiunique.com

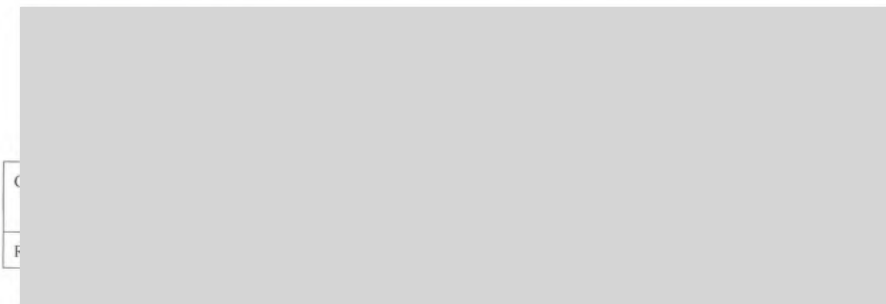
Results Integrated System Testing

Checkout Procedure	FID
Detector Position	Front
Inlet Type	1079 Injector
C15 Area 1	117,172
C15 Area 2	119,182
C15 Area 3	117,982
C15 Area 4	118,589
C15 Area 5	117,592
C15 Area Average	118,103
* % RSD (< 5 %)	1.68

* The precision specification should be less than 2.0 % RSD ** (Relative Standard Deviation) for an Auto sampler injection and less than 5 % for Manual injections. To calculate the %RSD, select the C15 peak area for each of the five (5) samples.

** (Relative Standard Deviation is determined by dividing the standard deviation by the average and multiplying by 100.)

$$\% \text{ RSD} = (\text{std.dev} / \text{avg}) * 100$$



บริษัท ไทยยูนิค จำกัด

THAI UNIQUE CO., LTD.

80-82 ถนนประชาธิปไตย แขวงบางขุนพรหม เขตพระนคร กรุงเทพฯ 10200

80-82 Prachathipatai Rd., Bangkhunphrom, Pranakorn, Bangkok 10200

Tel. 0-2629-0191-6, 0-2280-1787, Fax. 0-2280-1788, E-mail : thawatt@thaiunique.com, Website : www.thaiunique.com

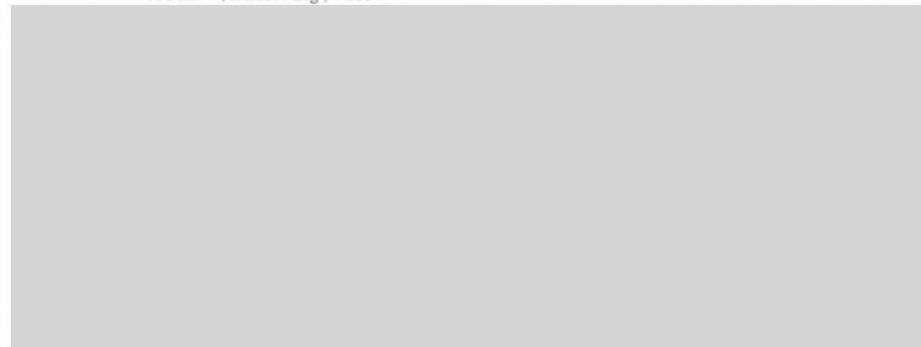
Results Integrated System Testing

Checkout Procedure	FID
Detector Position	Front
Inlet Type	1079 Injector
C15 RT 1	4.048
C15 RT 2	4.048
C15 RT 3	4.048
C15 RT 4	4.048
C15 RT 5	4.048
C15 RT Average	4.000
* % RSD (< 0.5 %)	0.01

* The precision specification should be less than 0.5 % RSD ** (Relative Standard Deviation) for an Auto sampler injection and less than 0.5 % for Manual injections. To calculate the %RSD, select the RT C15 peak for each of the five (5) samples.

** (Relative Standard Deviation is determined by dividing the standard deviation by the average and multiplying by 100.)

$$\% \text{ RSD} = (\text{std.dev} / \text{avg}) * 100$$



**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.comCERTIFICATE No : 22M2567
REFERENCE No : 64386-1

PAGE : 1 OF 2

Certificate of Calibration

EQUIPMENT : DIGITAL BALANCE

MANUFACTURER : METTLER TOLEDO

MODEL : XS 105DU

SERIAL No : 1126422905

ID No : BA 05/50

CONDITION AS RECEIVED : USED ITEM

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

CALIBRATED BY : TETNITHI W.

CALIBRATION DATE : 11-Mar-22

APPROVED BY :

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.

F-G010 REV 02

**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 : 22M2567

PAGE : 2 OF 2

Calibration Report

EQUIPMENT : DIGITAL BALANCE MODEL : XS 105DU

MANUFACTURER : METTLER TOLEDO S/N : 1126422905

ID No : BA 05/50 RECEIVED DATE : 11-Mar-22

AIR PRESSURE : 1008mbar \pm 1mbar CALIBRATION DATE : 11-Mar-22

AMBIENT TEMPERATURE : 22°C \pm 1°C RELATIVE HUMIDITY : 49%RH \pm 10% RH

CONDITION OF THIS RESULTS OF CALIBRATION

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

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

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

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

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

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

RESULT OF CALIBRATION :- WITHOUT ADJUSTMENT

1. ZERO SETTING FUNCTION : NORMAL

2. TARE FUNCTION : NORMAL

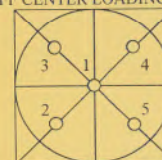
3. REPEATABILITY OF READING AT 20 g WAS 0.000004 g

4. REPEATABILITY OF READING AT 100 g WAS 0.000048 g

5. DEPARTURE FROM NOMINAL VALUE/ LINEARITY

NOMINAL VALUE (g)	BALANCE READING (g)	CORRECTION (g)	UNCERTAINTY (\pm g)
0.00	0.00000	0.00000	0.000058
0.02	0.01999	0.00001	0.000058
0.10	0.09999	0.00001	0.000059
0.20	0.19999	0.00001	0.000059
0.50	0.50001	-0.00001	0.000058
1.00	1.00001	-0.00001	0.000059
2.00	2.00000	0.00000	0.000059
5.00	5.00001	-0.00001	0.000061
10.00	10.00005	-0.00005	0.000063
20.00	20.00006	-0.00006	0.000069
50.00	50.00000	0.00000	0.00011
100.00	100.0001	-0.0001	0.00019
120.00	120.0001	-0.0001	0.00022

6. OFF CENTER LOADING ERROR



POINT	READING (g)	
1	10.00001	50.0000
2	10.00002	50.0000
3	10.00001	50.0000
4	10.00001	50.0000
5	10.00002	50.0001
OFF-CENTER LOADING	0.00001	0.0001

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

END OF CALIBRATION REPORT



CERTIFICATE No : 23M2441
REFERENCE No : 68471-1

PAGE : 1 OF 2

Certificate of Calibration

EQUIPMENT : DIGITAL BALANCE
MANUFACTURER : METTLER TOLEDO
MODEL : XS105DU
SERIAL No : 1126422905
ID No : BA 05/50
CONDITION AS RECEIVED : USED ITEM
SUBMITTED BY : S.P.S. CONSULTING SERVICE CO., LTD.
7 SOI PHAHOLYOTHIN 24, PHAHOLYOTHIN RD.,
JOMPOL, CHATUCHAK, BANGKOK 10900

CALIBRATED BY : ATSAWIN Y.
CALIBRATION DATE : 16-Mar-23
APPROVED BY :
ISSUED DATE : 16-Mar-23
RECEIVED DATE : 10-Mar-23

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



CERTIFICATE No : 23M2441

PAGE : 2 OF 2

Calibration Report

EQUIPMENT : DIGITAL BALANCE MODEL : XS105DU
MANUFACTURER : METTLER TOLEDO S/N : 1126422905
ID No : BA 05/50 RECEIVED DATE : 10-Mar-23
AIR PRESSURE : 1010mbar \pm 1mbar CALIBRATION DATE : 10-Mar-23
AMBIENT TEMPERATURE : 23°C \pm 1°C RELATIVE HUMIDITY : 49%RH \pm 10% RH

CONDITION OF THIS RESULTS OF CALIBRATION

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

INSTRUMENT	MODEL	SERIAL No	CERTIFICATE No	DUE DATE
1) STANDARD WEIGHT SET	E2	QK-1-151	M2302013S	02-Feb-25
2) STANDARD WEIGHT	E2	15843	M2302014S	02-Feb-25
3. THIS RESULT WAS FOUND ACCURATE AS SHOWN ON DATE AND PLACE OF CALIBRATION ONLY.
4. THIS RESULT EXCLUDE LONG TERM STABILITY OF THE UNIT UNDER CALIBRATION.
5. THIS CERTIFICATE IS TRACEABLE TO THE INTERNATIONAL SYSTEM OF UNIT MAINTAINED AT:-
- NATIONAL INSTITUTE OF METROLOGY (THAILAND) THROUGH CENTRAL BUREAU OF WEIGHTS&MEASURES

RESULT OF CALIBRATION :- WITHOUT ADJUSTMENT

1. ZERO SETTING FUNCTION : NORMAL
2. TARE FUNCTION : NORMAL
3. REPEATABILITY OF READING AT 200 g WAS 0 g
4. DEPARTURE FROM NOMINAL VALUE/ LINEARITY

NOMINAL VALUE (g)	BALANCE READING (g)	CORRECTION (g)	UNCERTAINTY (\pm g)
0.00	0.00000	0.00000	0.000039
0.02	0.02000	0.00000	0.000039
0.10	0.10000	0.00000	0.000039
0.20	0.20001	-0.00001	0.000040
0.50	0.50001	-0.00001	0.000040
1.00	1.00000	0.00000	0.000041
2.00	2.00003	-0.00003	0.000042
5.00	5.00001	-0.00001	0.000046
10.00	10.00003	-0.00003	0.000053
20.00	20.00005	-0.00005	0.000067
50.00	50.0001	-0.0001	0.00011
100.00	100.0001	-0.0001	0.00019
200.00	200.0001	-0.0001	0.00032

5. OFF CENTER LOADING ERROR



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

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

END OF CALIBRATION REPORT



Certificate of Calibration

Aquion : Anion (ID#894)

This certificate is to verify that instrument below are calibrated
by Archemica Lab Co.,Ltd.

AQUION S/N : 190840059

AS-DV S/N : 190915235

for

S.P.S. Consulting Service Co., Ltd.

Test Engineer



Certificate of Calibration

Aquion : Anion (ID#894)

This certificate is to verify that instrument below are calibrated
by Archemica Lab Co.,Ltd.

AQUION S/N : 190840059

AS-DV S/N : 190915235

for

S.P.S. Consulting Service Co., Ltd.

Test Engineer



WO-01981290/2023

MAINTENANCE AND TEST CERTIFICATE MODEL
OPTIMA 5300DV

Customer : <u>S.P.S.Consulting Service Co.,Ltd</u>	Date Tested: <u>January 11, 2023</u>
Address : <u>7 Soi Phaholyothin 24</u>	Recommendation Recertification
<u>Paholyothin Road</u>	Period <u>6</u> Months
Jompoi Chatuchak, Bangkok 1090	Recertification Due: <u>July 11, 2023</u>
User Name: <u>K.Phenpha Vipasthawatt</u>	Date Last Certified: <u>July 11, 2022</u>
Phone: <u>083-9269252</u>	Visit Number: <u>2 of 2</u>
Fax: <u>02-513-4221</u>	PerkinElmer Phone: <u>02-719-6420 ext 206</u>
	PerkinElmer Fax: <u>02-318-5597</u>

CONFIGURATION TESTED		ACCESSORIES/COMPONENT NOT INCLUDED
MODEL	SERIAL NUMBER	
<u>OPTIMA 5300DV</u>	<u>077C7042401</u>	
TESTED EQUIPMENT	CALIBRATION NUMBER	EXPIRATION
<u>IPV Methods</u>		
TEST STANDARD USED	PART NUMBER	EXPIRATION DATE
<u>Multielement Standard</u>	<u>N069-1579</u>	<u>May 30, 2023</u>
<u>Wavecal Solution</u>	<u>N058-2152</u>	<u>February 28, 2023</u>
<u>VIS Wavecal solution</u>	<u>N930-2946</u>	<u>August 30, 2023</u>
<u>Instrument Cal. STD4</u>	<u>N930-0221</u>	<u>November 30, 2023</u>
CUSTOMER SUPPLIED	COMMENTS	CUSTOMER INITIALS
<u>2 % HNO3</u>		
<u>10 % HNO3</u>		

Page 1 of 4



WO-01981290/2023

MAINTENANCE AND TEST CERTIFICATE MODEL
OPTIMA 5300DV

SERIAL NUMBER <u>077C7042401</u>	DATE TESTED <u>January 11, 2023</u>
1. MECHANICAL CHECKS	
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"/>
2. OPTICAL CHECKS	
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"/>
3. COOLING SYSTEM CHECKS	
A. Perform preventive maintenance on chiller.	<input type="checkbox"/>
B. Flush out the chiller every year.	<input type="checkbox"/>
4. PERFORMANCE CHECKS	
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 : <u>077C7042401</u>		DATE TESTED : <u>January 11, 2023</u>	
PARAMETER	SPECIFICATION		FINAL VALUE
Spectral Resolution : UV	As 193.696 nm	≤ 0.007	<u>0.00504</u>
	Ni 231.604 nm	≤ 0.008	<u>0.00646</u>
	Ni 341.476 nm	≤ 0.012	<u>0.00768</u>
Spectral Resolution : VIS	La 408.672 nm	≤ 0.020	<u>0.01597</u>
	Ba 455.403 nm	≤ 0.025	<u>0.02185</u>
Precision	As 193.656 nm	% RSD < 1.0	<u>0.89</u> %
	Zn 213.856 nm	% RSD < 1.0	<u>0.77</u> %
	Mn 257.610 nm	% RSD < 1.0	<u>0.51</u> %
	La 379.478 nm	% RSD < 1.0	<u>0.44</u> %
	Ba 455.403 nm	% RSD < 1.0	<u>0.44</u> %
	Ba 493.408 nm	% RSD < 1.0	<u>0.46</u> %
Detection Limits : Axial	Tl 190.080 nm	3(sd)	<u>4.04</u> ppb
	As 193.696 nm	3(sd)	<u>3.58</u> ppb
	Pb 220.353 nm	3(sd)	<u>1.90</u> ppb
Detection Limits : Radial	As 193.696 nm	3(sd)	<u>47.72</u> ppb
	Zn 213.856 nm	3(sd)	<u>1.02</u> ppb
	Mn 257.610 nm	3(sd)	<u>0.68</u> ppb
	La 379.478 nm	3(sd)	<u>1.43</u> ppb
	Ba 455.403 nm	3(sd)	<u>0.10</u> ppb
	Ba 493.408 nm	3(sd)	<u>0.36</u> ppb
BEC : Axial (IB X 500)/(IS-IB)	Cd 226.502 nm	≤ 150 ppb	<u>58.36</u>
BEC : Radial (IB X 1000)/(IS-IB)	Mn 257.610 nm	≤ 45 ppb	<u>104142.80</u>



MAINTENANCE AND TEST CERTIFICATE MODEL

OPTIMA 5300DV

SERIAL NUMBER 077C7042401 DATE TESTED January 11, 2023

Remarks :

Commissioning follow as commissioning performance sheets.

This is to certify that the above tests have been performed and the configuration tested



meets



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.

Authorized Representative

เอกสารแนบ 5-6

เอกสารสอบเทียบเครื่องมือการตรวจวัดระดับเสียงในสถานประกอบการ



THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-66/0413

MTC No. EEL. BP. 109/0366

CALIBRATION CERTIFICATE

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

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

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

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

Instrument Calibrated :

Description : Sound Calibrator

Manufacturer : ACO

Model : 2127

Serial No. : 130006

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.

Ambient Environment

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

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

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

Calibration Procedure: CP-102-04 based on IEC 60942-2003. The sound pressure level of instrument was measured by standard microphone using an insert voltage technique.

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

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

Date of Receipt : 27 Mar. 2023

Date of Calibration : 29 Mar. 2023

1/2

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

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

FM.BLMTC.002 Rev.4



THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-66/0413

MTC No. EEL. BP. 109/0366

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

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

Acoustic Output in dB re 20 μ Pa, Corrected to Reference Conditions : 101.325 kPa, 23.0 $^\circ\text{C}$ and 50 %RH

1. Sound Pressure Level

Standard Microphone Type	Measured Sound Pressure Level (dB)	Deviated value (dB)	Uncertainty (dB)	Tolerance limit IEC60942:2003 Class 1
1/2 inch Bruel&Kjaer 4180	93.94	-0.06	± 0.10	$\pm 0.40 \text{ dB}$

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	1.80	± 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 :

Approved by

Date of Calibration : 29 Mar. 2023

Date of Issue : 30 Mar. 2023

Electrical and Electronic Standards Laboratory

Industrial Metrology and Testing Service Centre

Ref : 2011266032701228001

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
Tel. (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
Tel. (66) 0 2579 8592
E-mail : sumalee@tistr.or.th

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

Noise R_158/23

Sound Level Meter Calibration Report

Acoustic Calibrator Data

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

Calibration Data

Sound Level Meter Data

Calibration Data

SLM No.	Brand	Model	Serial No.	Date	Actual Reading [dB]	
					Before Adjustment	After Adjustment
ACO-B18	ACO	6236	00172048	10 April 2023	94.0	94.0
ACO-B29	ACO	6236	00182011	10 April 2023	94.0	94.0
ACO-B33	ACO	6236	00182015	10 April 2023	94.0	94.0
ACO-B36	ACO	6236	00192027	10 April 2023	94.1	94.0
ACO-B41	ACO	6236	00192032	10 April 2023	94.0	94.0
ACO-B43	ACO	6236	00192034	10 April 2023	94.0	94.0
ACO-R51	ACO	6236	00192063	10 April 2023	94.1	94.0
ACO-R52	ACO	6236	00192064	10 April 2023	94.0	94.0
Acoustic Certified Value : Thailand Institute of Scientific and Technological Research (TISTR)					93.93 ± 0.10 dB	

Calibrated by :

Approved by :

Noise R_323/23

Sound Level Meter Calibration Report

Acoustic Calibrator Data

Brand	ACO	Number	AC 03/56
Model	2127	Serial No.	130006
Calibration Range	94 dB, 1000 Hz	Last Calibration	29 March 2023
		Due Date	29 March 2024

Calibration Data

Sound Level Meter Data

Calibration Data

SLM No.	Brand	Model	Serial No.	Date	Actual Reading [dB]	
					Before Adjustment	After Adjustment
ACO-R40	ACO	6236	00192052	23 June 2023	94.0	94.0
Acoustic Certified Value : Thailand Institute of Scientific and Technological Research (TISTR)						

Calibrated by :

Approved by :

เอกสารแนบ 5-7

เอกสารสอบเทียบเครื่องมือการตรวจวัดปริมาณเสียงสะสมติดตัวพนักงาน



THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-65/0760

MTC No. EEL. BP. 24/0965

CALIBRATION CERTIFICATE

Submitted by : S.P.S. CONSULTING SERVICE CO., LTD.

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

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

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

Instrument Calibrated :

Description : Acoustic Calibrator

Manufacturer : SVANTEK

Model : SV34

Serial No. : 33139

Ambient Environment

Temperature : (23 ± 3) °C

Relative Humidity : (50 ± 15) %

Ambient Pressure : (101.325 ± 1.500) kPa

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

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

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

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

5. Pressure Transmitter Vaisala PTB202AD S/N T0650001.

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

7. Condenser Microphone Brüel&Kjaer 4180 S/N 2633526.

Calibration Procedure: CP-102-04 based on IEC 60942-2003. The sound pressure level of instrument was measured by standard microphone using an insert voltage technique.

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

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

Date of Receipt : 13 Sep. 2022

Date of Calibration : 19 Sep. 2022

1 / 2

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

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

Head Office
35 Mu 3 Tambon Khlong Ha, Amphoe Khlong Luang,
Changwat Pathumthani 12120, Thailand
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
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Thailand
Tel. (66) 0 2579 1121-30 ext. 5219, 5225, 5217
Fax. (66) 0 2579 8592
E-mail : sumalee@tistr.or.th

FM.BLMTC.002 Rev.4



THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-65/0760

MTC No. EEL. BP. 24/0965

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 = 114 dB re 20µPa at 1000 Hz

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

1. Sound Pressure Level

Standard Microphone Type	Measured Sound Pressure Level (dB)	Deviated value (dB)	Uncertainty (dB)	Tolerance limit IEC60942:2003 Class 2
1/2 inch Brüel&Kjaer 4180	113.63	-0.37	± 0.10	± 0.75 dB

2. Frequency

Standard Microphone Type	Measured Frequency (Hz)	Deviated value (Hz)	Uncertainty (Hz)	Tolerance limit IEC60942:2003 Class 2
1/2 inch Brüel&Kjaer 4180	1000.0	0.0	± 1.5	± 2.0 %

3. Total Distortion

Standard Microphone Type	Measured Total Distortion (%)	Uncertainty (%)	Tolerance limit IEC60942:2003 Class 2
1/2 inch Brüel&Kjaer 4180	0.24	± 0.50	± 4.0 %

Note : 1. No adjustment.

2. The calibrator pressure correction was not included.

3. The microphone volume correction was not included.

Calibrated by :

Approved

Date of Calibration : 19 Sep. 2022

Date of Issue : 20 Sep. 2022

Electrical and Electronic Standards Laboratory

Industrial Metrology and Testing Service Centre

Ref : 2011265091304034002

2 / 2

End of Certificate

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

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

Head Office
35 Mu 3 Tambon Khlong Ha, Amphoe Khlong Luang,
Changwat Pathumthani 12120, Thailand
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
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Office
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Thailand
Tel. (66) 0 2579 1121-30 ext. 5219, 5225, 5217
Fax. (66) 0 2579 8592
E-mail : sumalee@tistr.or.th

FM.BLMTC.002 Rev.4



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

Noise Dose R_158/23

Noise Dose Meter Calibration Report

Acoustic Calibrator Data

Brand	SVANTEK	Number	SV 06/62
Model	SV34	Serial No.	33139
Calibration Range	114 dB, 1000 Hz	Last Calibration	19 September 2022
		Due Date	19 September 2023

Calibration Data

Sound Level Meter Data

Calibration Data

SLM No.	Brand	Model	Serial No.	Date	Actual Reading [dB]	
					Before Adjustment	After Adjustment
NMD-B01	SVANTEK	SV-104IS	80840	10 April 2023	113.5	113.6
NMD-B02	SVANTEK	SV-104IS	80842	10 April 2023	113.6	113.6
NMD-B03	SVANTEK	SV-104IS	80852	10 April 2023	113.5	113.6
NMD-B04	SVANTEK	SV-104IS	80854	10 April 2023	113.6	113.6
NMD-B05	SVANTEK	SV-104IS	80856	10 April 2023	113.5	113.6
NMD-B08	SVANTEK	SV-104IS	80818	10 April 2023	113.6	113.6
NMD-B09	SVANTEK	SV-104IS	80829	10 April 2023	113.6	113.6
NMD-B10	SVANTEK	SV-104IS	80830	10 April 2023	113.6	113.6

Acoustic Certified Value : Thailand Institute of Scientific and Technological Research (TISTR)

113.63 ± 0.10 dB

Calibrated by :

Approved by :



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

Noise Dose R_324/23

Noise Dose Meter Calibration Report

Acoustic Calibrator Data

Brand	SVANTEK	Number	SV 06/62
Model	SV34	Serial No.	33139
Calibration Range	114 dB, 1000 Hz	Last Calibration	19 September 2022
		Due Date	19 September 2023

Calibration Data

Sound Level Meter Data

Calibration Data

SLM No.	Brand	Model	Serial No.	Date	Actual Reading [dB]	
					Before Adjustment	After Adjustment
NMD-R03	SVANTEK	SV-104IS	60153	23 June 2023	113.6	113.6

Acoustic Certified Value : Thailand Institute of Scientific and Technological Research (TISTR)

113.63 ± 0.10 dB

Calibrated by :

Approved by :

เอกสารแนบ 5-8

เอกสารสอบเทียบเครื่องมือการตรวจวัดแสงสว่างในสถานประกอบการ



CALIBRATION LABORATORY Co., LTD.

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



CERTIFICATE OF CALIBRATION

FOR

NOMENCLATURE : LUX METER
MANUFACTURER : EXTECH INSTRUMENTS
MODEL / TYPE : 407026
SERIAL NO. : A.052323/A.052323 [LUX-R07]
CLID. NO. : 252201553
JOB CONTROL NO. : 220704067252

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

DATE OF RECEIVED : 04 July 2022

DATE OF ISSUED : 18 July 2022

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

Calibrated By :

Calibration Engineer

Approved By :

Authorized Signatory

18 July 2022

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. Q22067252

F3-011-04/01-12

page 1 of 3



CALIBRATION LABORATORY Co., LTD.

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



REPORT OF CALIBRATION

FOR

NOMENCLATURE : LUX METER
MANUFACTURER : EXTECH INSTRUMENTS
MODEL / TYPE : 407026
SERIAL NO. : A.052323/A.052323 [LUX-R07]
DATE OF CALIBRATION : 12 July 2022

ENVIRONMENT CONDITIONS :

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

Relative Humidity : $(55 \pm 15) \% \text{RH}$

PROCEDURE USED :

This instrument was calibrated under procedure No. CLC-CPEE-18 by comparison with Illuminance Sensor which maintained by the Calibration Laboratory Co., Ltd.

REFERENCE STANDARD USED :

Illuminance Sensor, Bentham Model ORM400/DH400VL S/N. 27710/1/27585/3.

TRACEABILITY :

The measurements are traceable to International System of Units (SI), through Optical Test and Calibration Ltd. Certificate No. 131916/ABU/1. Due Date 25 February 2023.

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:2021)"

Certificate No. Q22067252

F3-011-04/01-12

page 2 of 3





CALIBRATION LABORATORY Co., LTD.

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



CONDITION OF CALIBRATION ITEM : GOOD

MEASUREMENT RESULTS : (X) without adjustment () adjustment

CALIBRATION DATA

LUX METER RESULT

STD Applied (lux)	DUC Reading (lux)	Correction (lux)	Uncertainty \pm (% of rdg.)
100	103	-3	3.5
200	206	-6	3.8
300	309	-9	4.7
1000	1028	-28	4.7
2000	2020	-20	4.9
3000	3040	-40	5.6

Note. The Scope of Accredited ANAB Certificate No. ACDM-2814 Version 008 Page 46 of 54

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

End of Certificate

Certificate No. Q22067252

F3-011-04/01-12

page 3 of 3



@clccalibration

เอกสารแนบ 5-9

เอกสารสอบเทียบเครื่องมือการตรวจวัดระดับความร้อนในสถานประกอบการ



CALIBRATION LABORATORY Co., LTD.

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



CALIBRATION LABORATORY Co., LTD.

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



CERTIFICATE OF CALIBRATION

FOR

NOMENCLATURE : DIGITAL THERMOHYGRO METER
[THERMAL ENVIRONMENT MONITOR]
MANUFACTURER : 3M
MODEL / TYPE : QUESTemp®34
SERIAL NO. : TEN040005
CLID. NO. : 231802516
JOB CONTROL NO. : 220901088340

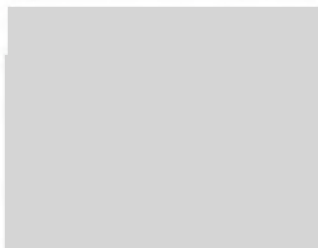
CUSTOMER : S.P.S. CONSULTING SERVICE CO., LTD.
7 SOI PHAHOLYOTHIN 24 ROAD., JOMPOL,
CHATUCHAK, BANGKOK 10900

DATE OF RECEIVED : 01 September 2022

DATE OF ISSUED : 07 September 2022

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

Calibrated By :



Approved By :

Authorized Signatory

07 September 2022

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. Q22088340

F3-011-04/01-12

page 1 of 3



@clccalibration

REPORT OF CALIBRATION

FOR

NOMENCLATURE : DIGITAL THERMOHYGRO METER
[THERMAL ENVIRONMENT MONITOR]
MANUFACTURER : 3M
MODEL / TYPE : QUESTemp®34
SERIAL NO. : TEN040005
DATE OF CALIBRATION : 02 September 2022

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. 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. 19944, Due Date 26 January 2023.

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:2021)"

Certificate No. Q22088340

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	30.01	30.0	+0.01	0.40
35.0	35.00	35.0	0.00	
40.0	40.02	40.0	+0.02	

2. CORRECTION OF TEMPERATURE : DRY

Test point (° C)	Actual Temperature (° C)	DUC Reading (° C)	Correction (° C)	Uncertainty ± (° C)
30.0	30.01	29.8	+0.21	0.40
35.0	35.00	34.8	+0.20	
40.0	40.02	39.8	+0.22	

3. CORRECTION OF TEMPERATURE : GLOBE BULB

Test point (° C)	Actual Temperature (° C)	DUC Reading (° C)	Correction (° C)	Uncertainty ± (° C)
30.0	30.01	30.0	+0.01	0.40
35.0	35.00	35.0	0.00	
40.0	40.02	40.0	+0.02	

Note. The Scope of Accredited TISI Certificate No. 19C087/0655 Issue 1 Page 36 of 111

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

End of Certificate





Certificate of Calibration

Certificate Number : SPR23030505-5 Page : 1 of 3
Customer : S.P.S. CONSULTING SERVICE CO., LTD.
7 Soi Phaholyothin 24 Phaholyothin Road., Jompol, Chatuchak,
Bangkok 10900

Equipment Name : Area Heat Stress Monitor
Manufacturer : Metrosonics
Model : hs-32
Serial Number : MCD070035
ID. Number : R05
Environmental Conditions
Ambient Temperature : 23 °C ± 2 °C Received Date : 30 Mar 2023
Relative Humidity : 50 % ± 15 % Calibration Date : 31 Mar 2023
Location of Calibration : In-Lab Recommend Due Date : 31 Mar 2024
Calibration Procedure : SP-CPT-04-13 Date of Issue : 01 Apr 2023

Method of Calibration

This certifies that the above instrument was calibrated in compliance with the calibration system requirement of ISO/IEC 17025:2017 in accordance with reference procedure. Standards used to perform this calibration are certified by to NIST or equivalent, National metrology institute, Natural physical constants, consensus standards. The result reported herein apply only to the calibration of the item described above as received. Our decision rule is to contact the customer if the item pass and fail calibration when the results include the uncertainties and the customer must determine if the results meets their needs.

All calibrations are performed within manufacture's specifications. The calibration certificate shall not be reproduced except in full, without written approval of SP Metrology System

Calibrated by

Calibration Officer

Approved by

Authorized Signatory



Calibration Report

Certificate Number : SPR23030505-5 Page : 2 of 3

Reference Standards

Equipment Name	Model	Serial No.	Certificate No.	Due. Date
Humidity Chamber	TH-80S	N/A	SPR23010480-5	22 Feb 2024
THERMO-HYGROMETER	5020A	A47046	QR23-0176	26 Jan 2024

Traceability

This certification is traceable to the International System of Unit maintained at :
SP Metrology - SP Metrology system (Thailand) Co.Ltd.

Quality Reborn Co., Ltd



Result of Calibration

Certificate No. : SPR23030505-5

Page : 3 of 3

Temperature Accuracy in the Measurement. (WET)

Unit : °C

Temperature Setting	Standard Reading	UUC Reading	Error	Uncertainty (±)
30.0	30.013	29.9	-0.113	0.50
35.0	35.010	34.9	-0.110	0.50
40.0	40.015	39.9	-0.115	0.50

Temperature Accuracy in the Measurement. (DRY)

Unit : °C

Temperature Setting	Standard Reading	UUC Reading	Error	Uncertainty (±)
30.0	30.013	29.9	-0.113	0.50
35.0	35.010	34.9	-0.110	0.50
40.0	40.015	39.9	-0.115	0.50

Temperature Accuracy in the Measurement. (GLOBE)

Unit : °C

Temperature Setting	Standard Reading	UUC Reading	Error	Uncertainty (±)
30.0	30.013	29.8	-0.213	0.50
35.0	35.010	34.8	-0.210	0.50
40.0	40.015	39.8	-0.215	0.50

Note:

The result of calibration was found accurate as show on date and place of calibration only.
This Certificate is not certified for any commercial transaction.

Measurement Uncertainty

The reported uncertainty of measurement is the expanded uncertainty obtained by multiplying the standard uncertainty with the coverage factor $k = 2$, providing a level of confidence approximately 95%.

- End of Certificate -



CALIBRATION LABORATORY Co.,LTD.

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



CALIBRATION LABORATORY Co.,LTD.

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



CERTIFICATE OF CALIBRATION

FOR

NOMENCLATURE : DIGITAL THERMOHYGRO METER
[THERMAL ENVIRONMENT MONITOR]
MANUFACTURER : METROSONICS
MODEL / TYPE : hs-32
SERIAL NO. : MCD070028
CLID. NO. : 231802275
JOB CONTROL NO. : 220901088338

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

DATE OF RECEIVED : 01 September 2022

DATE OF ISSUED : 07 September 2022

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

Calibrated By :



Approved By :

Authorized Signatory

07 September 2022

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. Q22088338

F3-011-04/01-12

page 1 of 3



@clccalibration

REPORT OF CALIBRATION

FOR

NOMENCLATURE : DIGITAL THERMOHYGRO METER
[THERMAL ENVIRONMENT MONITOR]
MANUFACTURER : METROSONICS
MODEL / TYPE : hs-32
SERIAL NO. : MCD070028
DATE OF CALIBRATION : 02 September 2022

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. 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. 19944, Due Date 26 January 2023.

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:2021)"

Certificate No. Q22088338

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	30.01	30.0	+0.01	0.40
35.0	35.00	35.0	0.00	
40.0	40.02	40.0	+0.02	

2. CORRECTION OF TEMPERATURE : DRY

Test point (° C)	Actual Temperature (° C)	DUC Reading (° C)	Correction (° C)	Uncertainty ± (° C)
30.0	30.01	29.8	+0.21	0.40
35.0	35.00	34.8	+0.20	
40.0	40.02	39.8	+0.22	

3. CORRECTION OF TEMPERATURE : GLOBE BULB

Test point (° C)	Actual Temperature (° C)	DUC Reading (° C)	Correction (° C)	Uncertainty ± (° C)
30.0	30.01	29.5	+0.51	0.40
35.0	35.00	34.5	+0.50	
40.0	40.02	39.5	+0.52	

Note. The Scope of Accredited TISI Certificate No. 19C087/0655 Issue 1 Page 36 of 111

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

End of Certificate





CALIBRATION LABORATORY Co.,LTD.

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



CERTIFICATE OF CALIBRATION

FOR

NOMENCLATURE : DIGITAL THERMOHYGRO METER
(THERMAL ENVIRONMENT MONITOR)
MANUFACTURER : 3M
MODEL / TYPE : QUESTemp° 46
SERIAL NO. : TSI010011
CLID. NO. : 232000797
JOB CONTROL NO. : 220815082000

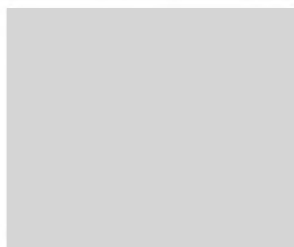
CUSTOMER : S.P.S. CONSULTING SERVICE CO.,LTD.
7 SOI PHAHOLYOTHIN 24 ROAD., JOMPOL,
CHATUCHAK, BANGKOK 10900

DATE OF RECEIVED : 15 August 2022

DATE OF ISSUED : 20 August 2022

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

Calibrated By :



Approved By :

Authorized Signatory

20 August 2022

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. Q22082000

F3-011-04/01-12

page 1 of 3



CALIBRATION LABORATORY Co.,LTD.

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



REPORT OF CALIBRATION

FOR

NOMENCLATURE : DIGITAL THERMOHYGRO METER
(THERMAL ENVIRONMENT MONITOR)
MANUFACTURER : 3M
MODEL / TYPE : QUESTemp° 46
SERIAL NO. : TSI010011
DATE OF CALIBRATION : 18 August 2022

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. 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. 19944, Due Date 26 January 2023.

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:2021)"

Certificate No. Q22082000

F3-011-04/01-12

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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	29.98	31.0	-1.02	0.40
35.0	34.98	36.2	-1.22	
40.0	40.00	41.3	-1.30	

Note. * means Calibrations marked " Not TISI Accredited " in this Certificate have been included for completeness.

2. CORRECTION OF TEMPERATURE [DRY]

Test point (° C)	Actual Temperature (° C)	DUC Reading (° C)	Correction (° C)	Uncertainty ± (° C)
30.0	29.98	30.0	-0.02	0.40
35.0	34.98	34.9	+0.08	
40.0	40.00	40.1	-0.10	

3. CORRECTION OF TEMPERATURE [GLOBE BULB]

Test point (° C)	Actual Temperature (° C)	DUC Reading (° C)	Correction (° C)	Uncertainty ± (° C)
30.0	29.98	30.0	-0.02	0.40
35.0	34.98	34.9	+0.08	
40.0	40.00	39.7	+0.30	

Note. The Scope of Accredited TISI Certificate No. 19C087/0655 Issue 1 Page 36 of 111

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

End of Certificate





CALIBRATION LABORATORY Co., LTD.

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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° 46
SERIAL NO. : TSH120011
CLID. NO. : 232000795
JOB CONTROL NO. : 220505044292

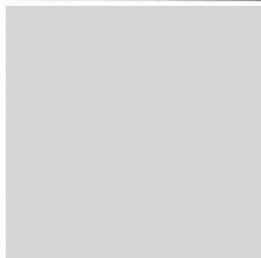
CUSTOMER : S.P.S. CONSULTING SERVICE CO.,LTD.
7 SOI PHAHOLYOTHIN 24 ROAD., JOMPOL,
CHATUCHAK, BANGKOK 10900

DATE OF RECEIVED : 05 May 2022

DATE OF ISSUED : 12 May 2022

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

Calibrated By :



Approved By :

Authorized Signatory
12 May 2022

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. Q22044292

F3-011-04/01-12

page 1 of 3



@clccalibration



CALIBRATION LABORATORY Co., LTD.

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



REPORT OF CALIBRATION

FOR

NOMENCLATURE : DIGITAL THERMOHYGRO METER
(THERMAL ENVIRONMENT MONITOR)
MANUFACTURER : 3M
MODEL / TYPE : QUESTemp° 46
SERIAL NO. : TSH120011
DATE OF CALIBRATION : 05 May 2022

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. 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. 19317, Due Date 09 July 2022.

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:2021)"

Certificate No. Q22044292

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	29.99	31.4	-1.41	0.40
35.0	35.01	36.4	-1.39	
40.0	39.99	41.4	-1.41	

Note. * means Calibrations marked " Not TISI Accredited " in this Certificate have been included for completeness.

2. CORRECTION OF TEMPERATURE [DRY]

Test point (° C)	Actual Temperature (° C)	DUC Reading (° C)	Correction (° C)	Uncertainty ± (° C)
30.0	29.99	30.0	-0.01	0.40
35.0	35.01	35.1	-0.09	
40.0	39.99	40.2	-0.21	

3. CORRECTION OF TEMPERATURE [GLOBE BULB]

Test point (° C)	Actual Temperature (° C)	DUC Reading (° C)	Correction (° C)	Uncertainty ± (° C)
30.0	29.99	29.9	+0.09	0.40
35.0	35.01	34.8	+0.21	
40.0	39.99	39.6	+0.39	

Note. The Scope of Accredited TISI Certificate No. 19C087/0655 Issue 1 Page 36 of 111

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

End of Certificate





CALIBRATION LABORATORY Co., LTD.

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



CERTIFICATE OF CALIBRATION

FOR

NOMENCLATURE : DIGITAL THERMOHYGRO METER
(THERMAL ENVIRONMENT MONITOR)
MANUFACTURER : 3M
MODEL / TYPE : QUESTemp° 46
SERIAL NO. : TSI010006
CLID. NO. : 232000793
JOB CONTROL NO. : 220505044316

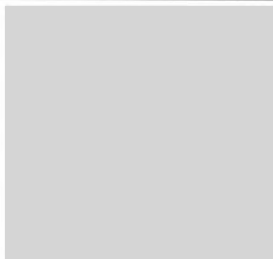
CUSTOMER : S.P.S. CONSULTING SERVICE CO., LTD.
7 SOI PHAHOLYOTHIN 24 ROAD., JOMPOL,
CHATUCHAK, BANGKOK 10900

DATE OF RECEIVED : 05 May 2022

DATE OF ISSUED : 12 May 2022

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

Calibrated By :



Approved By :

Authorized Signatory

12 May 2022

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. Q22044316

F3-011-04/01-12

page 1 of 3



@clccalibration



CALIBRATION LABORATORY Co., LTD.

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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° 46
SERIAL NO. : TSI010006
DATE OF CALIBRATION : 05 May 2022

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. 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. 19317, Due Date 09 July 2022.

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:2021)"

Certificate No. Q22044316

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	29.99	31.5	-1.51	0.40
35.0	35.01	36.5	-1.49	
40.0	39.99	41.5	-1.51	

Note. * means Calibrations marked " Not TISI Accredited " in this Certificate have been included for completeness.

2. CORRECTION OF TEMPERATURE [DRY]

Test point (° C)	Actual Temperature (° C)	DUC Reading (° C)	Correction (° C)	Uncertainty ± (° C)
30.0	29.99	30.1	-0.11	0.40
35.0	35.01	35.0	+0.01	
40.0	39.99	40.1	-0.11	

3. CORRECTION OF TEMPERATURE [GLOBE BULB]

Test point (° C)	Actual Temperature (° C)	DUC Reading (° C)	Correction (° C)	Uncertainty ± (° C)
30.0	29.99	30.1	-0.11	0.40
35.0	35.01	35.0	+0.01	
40.0	39.99	39.6	+0.39	

Note. The Scope of Accredited TISI Certificate No. 19C087/0655 Issue 1 Page 36 of 111

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

End of Certificate





CALIBRATION LABORATORY Co., LTD.

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



CERTIFICATE OF CALIBRATION

FOR

NOMENCLATURE : DIGITAL THERMOHYGRO METER
(THERMAL ENVIRONMENT MONITOR)
MANUFACTURER : 3M
MODEL / TYPE : QUESTemp° 46
SERIAL NO. : TSH120025
CLID. NO. : 232000794
JOB CONTROL NO. : 220815082001

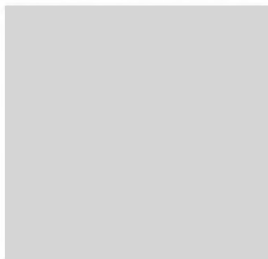
CUSTOMER : S.P.S. CONSULTING SERVICE CO., LTD.
7 SOI PHAHOLYOTHIN 24 ROAD., JOMPOL,
CHATUCHAK, BANGKOK 10900

DATE OF RECEIVED : 15 August 2022

DATE OF ISSUED : 20 August 2022

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

Calibrated By :



Approved By :

Authorized Signatory

20 August 2022

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. Q22082001

F3-011-04/01-12

page 1 of 3



CALIBRATION LABORATORY Co., LTD.

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



REPORT OF CALIBRATION

FOR

NOMENCLATURE : DIGITAL THERMOHYGRO METER
(THERMAL ENVIRONMENT MONITOR)
MANUFACTURER : 3M
MODEL / TYPE : QUESTemp° 46
SERIAL NO. : TSH120025
DATE OF CALIBRATION : 18 August 2022

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. 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. 19944, Due Date 26 January 2023.

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:2021)"

Certificate No. Q22082001

F3-011-04/01-12

page 2 of 3



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	29.98	31.1	-1.12	0.40
35.0	34.98	36.2	-1.22	
40.0	40.00	41.2	-1.20	

Note. * means Calibrations marked " Not TISI Accredited " in this Certificate have been included for completeness.

2. CORRECTION OF TEMPERATURE [DRY]

Test point (° C)	Actual Temperature (° C)	DUC Reading (° C)	Correction (° C)	Uncertainty ± (° C)
30.0	29.98	30.1	-0.12	0.40
35.0	34.98	34.9	+0.08	
40.0	40.00	39.9	+0.10	

3. CORRECTION OF TEMPERATURE [GLOBE BULB]

Test point (° C)	Actual Temperature (° C)	DUC Reading (° C)	Correction (° C)	Uncertainty ± (° C)
30.0	29.98	30.1	-0.12	0.40
35.0	34.98	34.8	+0.18	
40.0	40.00	39.9	+0.10	

Note. The Scope of Accredited TISI Certificate No. 19C087/0655 Issue 1 Page 36 of 111

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

End of Certificate





บริษัท เอส.พี.เอส. คอนซัลติ้ง เซอร์วิส จำกัด

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

7 ซอยพหลโยธิน 24 ถนนพหลโยธิน แขวงจอมพล เขตจตุจักร กรุงเทพฯ 10900
7 Soi Phaholyothin 24, Phaholyothin Rd., Jompol, Chatuchak, Bangkok 10900
Tel : (662) 939-4370-72, Fax : (662) 513-4221, E-mail : sale@spscn.com, www.spscn.com

Heat B042_1/23

Heat Stress WBGT Meter Verification Report			
Verification Data			
Heat Stress WBGT Meter No.	: R13	Verification Date	: 10 April 2023
Brand	: 3M	Ambient Temp.	: 24.5 °C
Model	: QUESTemp [®] 46	Barometric Pressure	: 1011 mmbar
Serial No.	: TSIO10011	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	69.5	-0.2	± 0.5
UUC* = UNIT UNDER CALIBRATION			

Verified by : _____

Approved by : _____



บริษัท เอส.พี.เอส. คอนซัลติ้ง เซอร์วิส จำกัด

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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

Heat B042_2/23

Heat Stress WBGT Meter Verification Report			
Verification Data			
Heat Stress WBGT Meter No.	: R14	Verification Date	: 10 April 2023
Brand	: 3M	Ambient Temp.	: 24.5 °C
Model	: QUESTemp [®] 46	Barometric Pressure	: 1011 mmbar
Serial No.	: TSH120011	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	47.2	-0.1	± 0.5
Globe Probe Temperature Measurement			
Verification Module Reading (°C)	UUC* Reading (°C)	Correction (°C)	Tolerance Limit (°C)
69.3	69.3	0.0	± 0.5
UUC* = UNIT UNDER CALIBRATION			

Verified by : _____

Approved by : _____



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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 B042_3/23

Heat Stress WBGT Meter Verification Report			
Verification Data			
Heat Stress WBGT Meter No.	: R15	Verification Date	: 10 April 2023
Brand	: 3M	Ambient Temp.	: 24.5 °C
Model	: QUESTemp ^o 46	Barometric Pressure	: 1011 mmbar
Serial No.	: TSIO10006	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	12.5	0.0	± 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 :

Approved by :



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7 Soi Phaholyothin 24, Phaholyothin Rd., Jompol, Chatuchak, Bangkok 10900
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Heat B042_4/23

Heat Stress WBGT Meter Verification Report			
Verification Data			
Heat Stress WBGT Meter No.	: R16	Verification Date	: 10 April 2023
Brand	: 3M	Ambient Temp.	: 24.5 °C
Model	: QUESTemp ^o 46	Barometric Pressure	: 1011 mmbar
Serial No.	: TSH120025	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	12.5	0.0	± 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			

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7 Soi Phaholyothin 24, Phaholyothin Rd., Jompol, Chulachak, Bangkok 10900
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Heat R065_1

Heat Stress WBGT Meter Verification Report			
Verification Data			
Heat Stress WBGT Meter No.	: R04	Verification Date	: 23 June 2023
Brand	: 3M	Ambient Temp.	: 24.5 °C
Model	: QUESTemp [®] 34	Barometric Pressure	: 1011 mmbar
Serial No.	: TEN040005	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	69.2	0.1	± 0.5
UUC* = UNIT UNDER CALIBRATION			

Verified by :



Approved by :

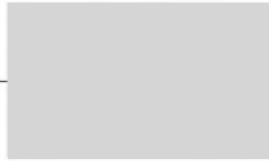


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7 Soi Phaholyothin 24, Phaholyothin Rd., Jompol, Chulachak, Bangkok 10900
Tel : (662) 939-4370-72, Fax : (662) 513-4221, E-mail : sale@spscn.com, www.spscn.com

Heat R065_2

Heat Stress WBGT Meter Verification Report			
Verification Data			
Heat Stress WBGT Meter No.	: R05	Verification Date	: 23 June 2023
Brand	: METROSONICS	Ambient Temp.	: 24.5 °C
Model	: hr-32	Barometric Pressure	: 1011 mmbar
Serial No.	: MCD070035	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	12.5	0.0	± 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	69.3	0.0	± 0.5
UUC* = UNIT UNDER CALIBRATION			

Verified by :



Approved by :



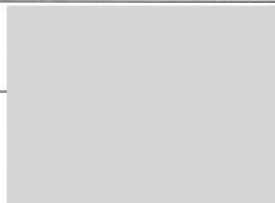


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7 ถนนพหลโยธิน 24 แขวงจตุจักร เขตจตุจักร 10900
7 Soi Phaholyothin 24, Phaholyothin Rd., Jompol, Chulachak, Bangkok 10900
Tel : (662) 939-4370-72, Fax : (662) 513-4221, E-mail : sale@spicon.com, www.spicon.com

Heat R065_3

Heat Stress WBGT Meter Verification Report			
Verification Data			
Heat Stress WBGT Meter No.	: R06	Verification Date	: 23 June 2023
Brand	: METROSONICS	Ambient Temp.	: 24.5 °C
Model	: hs-32	Barometric Pressure	: 1011 mmbar
Serial No.	: MCD070028	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	12.5	0.0	± 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 :



Approved by :

