

ภาคผนวกที่ 4

เอกสารสอบเทียบความถูกต้องของเครื่องมือ

**ตารางสรุปรายการเอกสารการสอบเทียบความถูกต้องของเครื่องมือเก็บตัวอย่าง
และเครื่องมือตรวจวิเคราะห์คุณภาพสิ่งแวดล้อม**

รายการตรวจวัด	เครื่องมือเก็บตัวอย่าง	เครื่องมือตรวจวิเคราะห์
	ชื่อเครื่องมือ	ชื่อเครื่องมือ
1. คุณภาพอากาศในบรรยากาศ Total Suspended Particulate	High Volume Air Sampler Blower & Recorder No. B09, R13, R14,	Digital Balance
PM ₁₀	PM ₁₀ Air Sampler No. R05, R08, R16	Digital Balance
Sulfur Dioxide	SO ₂ Analyzer No. R02, R06, R08	SO ₂ Analyzer No. R02, R06, R08
Nitrogen Dioxide	NO/NO _x /NO ₂ Analyzer No. R04, R06, R08	NO/NO _x /NO ₂ Analyzer No. R04, R06, R08
Carbon Monoxide	CO Analyzer No. B06, R02, R03	CO Analyzer No. B06, R02, R03
VOCs	Mass Flow Meter	GC/MS
2. คุณภาพอากาศจากปล่อง Total Suspended Particulate	Console No. R05 Pitot Tube No. B38, B58	Digital Balance
Oxides of Nitrogen	Vacuum Gauge	Spectrophotometer
Sulfur Dioxide	Personal Pump SKC No. B44, B55 Rotameter No. H-R03	-
Carbon Monoxide	Personal Pump SKC No. R05, R08 Rotameter No. H-R03	CO Analyzer No. B02, B03
Lead	Console No. R05 Pitot Tube No. B38, B58	ICP
Mercury	Console No. R05 Pitot Tube No. B38, B58	AAS
3. คุณภาพน้ำ pH	-	pH Meter
Temperature	-	Thermometer
Total Suspended Solids	-	Digital Balance
Total Dissolved Solids	-	Digital Balance
BOD ₅	-	BOD Analyzer
COD	-	COD Reactor
Grease & Oil	-	Digital Balance
TPH (C ₅ -C ₃₅)	-	GC/MS
4. ระดับเสียงในชุมชน L _{eq} 24 hr, L _{max} และ L ₉₀	Acoustic Calibrator Sound Level Meter No. ACO-R23, R-46	-
5. ระดับเสียงในสถานประกอบการ L _{eq} 8 hr	Acoustic Calibrator Sound Level Meter No. ACO-R40, R41	-
TWA	Acoustic Calibrator Sound Level Meter No. ACO-R40	-
6. คุณภาพอากาศในสถานประกอบการ		
7. ความร้อนในสถานประกอบการ		
8. แสงสว่างในสถานประกอบการ		



คุณภาพอากาศในบรรยากาศ



บริษัท เอส.พี.เอส. คอนซัลติ้ง เซอร์วิส จำกัด
S.P.S. CONSULTING SERVICE CO., LTD.
7 ซอยพหลโยธิน 24 ถนนพหลโยธิน แขวงจตุจักร กรุงเทพมหานคร 10900
7 Soi Phaholyothin 24, Phaholyothin Rd., Jompol, Chatuchak, Bangkok 10900
Tel : (662) 939-4370-72 Fax : (662) 513-4221 E-mail : sale@spsc.com www.spsc.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 (l ³ /min)	R ²
B01	B01	10/05/2024	y = 1.153x-1.686	1.000
B02	B02	06/05/2024	y = 1.118x+2.367	0.999
B03	B03	06/05/2024	y = 1.188x-5.422	1.000
B04	B04	07/05/2024	y = 1.263x-5.863	0.999
B05	B05	07/05/2024	y = 1.265x-7.057	0.999
B06	B06	09/05/2024	y = 1.213x-4.898	0.997
B07	B07	07/05/2024	y = 1.193x-4.616	0.999
B08	B08	07/05/2024	y = 1.207x-4.482	0.998
B09	B09	06/05/2024	y = 1.216x-4.533	1.000
B10	B10	07/05/2024	y = 1.170x-0.607	1.000
B11	B11	07/05/2024	y = 1.135x-1.256	0.999
B12	B12	07/05/2024	y = 1.211x-4.879	0.997
B13	B13	07/05/2024	y = 1.237x-4.608	1.000
B14	B14	06/05/2024	y = 1.252x-5.906	0.998
B15	B15	09/05/2024	y = 1.192x-2.587	0.999
B16	B16	06/05/2024	y = 1.133x-0.425	0.996
B17	B17	06/05/2024	y = 1.250x-4.910	0.997
B18	B18	06/05/2024	y = 1.181x-4.244	0.998
B19	B19	09/05/2024	y = 1.246x-8.218	0.999
B20	B20	08/05/2024	y = 1.218x-4.223	0.999
B21	B21	08/05/2024	y = 1.189x-4.448	0.998
B22	B22	09/05/2024	y = 1.195x-6.295	0.999
B23	B23	06/05/2024	y = 1.247x-5.137	0.999
B24	B24	09/05/2024	y = 1.157x-1.861	0.998
B25	B25	07/05/2024	y = 1.079x+1.324	1.000
B26	B26	07/05/2024	y = 1.204x-3.730	0.997
B27	B27	07/05/2024	y = 1.140x-2.924	0.999
B28	B28	07/05/2024	y = 1.220x-7.484	0.999
B29	B29	07/05/2024	y = 1.215x-3.763	1.000
B30	B30	10/05/2024	y = 1.198x-3.745	0.998
B31	B31	10/05/2024	y = 1.209x-4.851	1.000
B32	B32	10/05/2024	y = 1.186x-0.772	0.998
B33	B33	10/05/2024	y = 1.237x-4.394	0.997
B34	B34	10/05/2024	y = 1.191x-4.725	0.999

Calibrated by :  (Mr. Adul Dangklom)	Approved by :  (Mr. Peera Detudom)
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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 (l ³ /min)	R ²
B35	B35	06/05/2024	y = 1.193x-4.091	0.999
B36	B36	10/05/2024	y = 1.172x-3.010	0.998
B37	B37	06/05/2024	y = 1.212x-2.588	1.000
B38	B38	06/05/2024	y = 1.187x-3.844	0.997
B39	B39	06/05/2024	y = 1.178x-0.811	0.999
B40	B40	06/05/2024	y = 1.221x-5.480	0.998
B41	B41	06/05/2024	y = 1.219x-4.443	0.997
B42	B42	07/05/2024	y = 1.167x-2.748	0.997
B43	B43	07/05/2024	y = 1.161x-0.034	0.999
B44	B44	07/05/2024	y = 1.249x-4.278	0.999
R01	R01	07/05/2024	y = 1.183x-4.631	0.997
R02	R02	07/05/2024	y = 1.237x-5.919	0.998
R03	R03	07/05/2024	y = 1.234x-7.377	1.000
R04	R04	10/05/2024	y = 1.250x-6.680	0.996
R05	R05	10/05/2024	y = 1.176x-4.403	0.999
R06	R06	06/05/2024	y = 1.195x-4.419	0.999
R07	R07	06/05/2024	y = 1.061x+1.385	0.999
R08	R08	06/05/2024	y = 1.169x-1.426	0.999
R09	R09	06/05/2024	y = 1.150x-0.930	0.998
R10	R10	06/05/2024	y = 1.246x-6.734	0.999
R11	R11	06/05/2024	y = 1.171x-2.938	0.999
R12	R12	10/05/2024	y = 1.149x-3.415	0.998
R13	R13	10/05/2024	y = 1.158x-3.158	0.999
R14	R14	10/05/2024	y = 1.236x-4.390	1.000
R15	R15	06/05/2024	y = 1.229x-7.704	0.998
R16	R16	06/05/2024	y = 1.242x-7.570	0.998
R17	R17	07/05/2024	y = 1.211x-5.039	0.998
R18	R18	07/05/2024	y = 1.226x-5.530	0.999
R19	R19	07/05/2024	y = 1.185x-4.311	0.999
R20	R20	09/05/2024	y = 1.193x-4.417	1.000

Calibrated by :  (Mr. Adul Dangklom)	Approved by :  (Mr. Peera Detudom)
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High Volume PM-10 Air Sampler Calibration Report

Calibration Method : Multipoint Orifice Flow Transfer Standard Model : TE 5025A S/N : 3611

Calibration Data

High Volume PM-10 Data		Calibration Data		
Recorder No.	Blower No.	Date	Actual Flowrate (l/min)	R ²
R01	R01	06/05/2024	y = 1.174x-4.049	0.999
R02	R02	06/05/2024	y = 1.205x-3.581	0.998
R03	R03	07/05/2024	y = 1.235x-6.580	0.999
R04	R04	10/05/2024	y = 1.165x-5.072	0.998
R05	R05	10/05/2024	y = 1.211x-6.165	0.997
R06	R06	06/05/2024	y = 1.203x-3.045	0.998
R07	R07	06/05/2024	y = 1.195x-3.082	0.997
R08	R08	06/05/2024	y = 1.229x-5.593	0.999
R09	R09	06/05/2024	y = 1.223x-4.946	0.997
R10	R10	09/05/2024	y = 1.169x-3.241	0.999
R11	R11	07/05/2024	y = 1.228x-2.749	0.997
R12	R12	10/05/2024	y = 1.226x-6.607	0.996
R13	R13	09/05/2024	y = 1.154x-1.960	0.998
R14	R14	06/05/2024	y = 1.205x-4.415	0.998
R15	R15	06/05/2024	y = 1.199x-3.887	0.998
R16	R16	06/05/2024	y = 1.168x-3.045	0.998
R17	R17	06/05/2024	y = 1.140x-0.557	0.997
R18	R18	06/05/2024	y = 1.165x-3.692	0.998
R19	R19	06/05/2024	y = 1.157x-0.982	0.999
R20	R20	06/05/2024	y = 1.177x-5.526	1.000

Calibrated by :

(Mr.Adul Dangklom)

Approved by :

(Mr.Peera Detudom)

CALIBRATION REPORT

SO₂ FLUORESCENT ANALYZER

DATE : 12 May 2024 BRAND : API MODEL : 100E
 NO. SO₂-R02 SERIAL NO. 3431

Calibrator (Dilution System)

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

Reference Standard Gas

Standard Gas : Sulphur Dioxide (SO₂) Cylinder No. : A00814SK
 Certified Date : 21 June 2021 Expired Date : 21 June 2029 Cylinder Conc. : 49.8 ppm

CALIBRATING CONDITION

Pressure : 1011 mmbar Temp. : 24.5 24.5 % RH : 49

CALIBRATION SETTING

Span	Initial Reading (Before Adj.),PPB			Final Reading (After Adj.),PPB	
	Expected Concentration	Analyzer Response	%Dif	Analyzer Response	Slope
Zero	0	-0.10	-	0	-
SO ₂ Span	400.0	400.1	0.025	400.0	1.009

API Model 100E SO₂ 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	657	cc/min	650 ± 10%
PMT	103.2	mV	-20-150 with Zero Air
UV LAMP	3026.7	mV	1000-4900
STR. LGT	61.6	PPB	<100
DRK PMT	63.1	mV	-50 - 200
DRK LMP	57.9	mV	-50 - 200
HVPS	673	V	550-900 constant
DCPS	2521	mV	2500 ± 200
RCCELL TEMP	50.0	°C	50 ± 1
BOX TEMP	29.2	°C	5-40
PMT TEMP	7.3	°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	21.8	mV	<250
Stability at Zero	0.1	PPB	<0.2
Stability at Span	0.2	PPB	0.5% of reading (above 50 ppb)

Calibrated by :

(Mr.Adul Dangklom)

Approved by :

(Mr.Peera Detudom)

CALIBRATION REPORT					
SO ₂ FLUORESCENT ANALYZER					
DATE :	12 May 2024	BRAND :	API	MODEL :	100E
NO.	SO ₂ -R06	SERIAL NO.	066		
Calibrator (Dilution System)					
Brand :	API	Model :	700		
Last Cal. Date :	08 August 2023	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. :	49.8 ppm
CALIBRATING CONDITION					
Pressure	1011 mmbar	Temp.	24.5 °C	% RH	49
CALIBRATION SETTING					
Span	Initial Reading (Before Adj.),PPB			Final Reading (After Adj.),PPB	
Set Point	Expected Concentration	Analyzer Response	%Diff	Analyzer Response	Slope
Zero	0	0.10	-	0	-
SO ₂ Span	400.0	399.9	-0.025	400.0	1.007
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	655	cc/min	650 ± 10%		
PMT	103.4	mV	-20-150 with Zero Air		
UV LAMP	3039.8	mV	1000-4900		
STR. LGT	61.9	PPB	<100		
DRK PMT	63.4	mV	-50 - 200		
DRK LMP	58.2	mV	-50 - 200		
HVPS	675	V	550-900 constant		
DCPS	2519	mV	2500 ± 200		
RCELL TEMP	50.3	°C	50 ± 1		
BOX TEMP	29.4	°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	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 : 
(Mr.Adul Dangklom)

Approved by : 
(Mr.Peera Detudom)

CALIBRATION REPORT					
SO ₂ FLUORESCENT ANALYZER					
DATE :	12 May 2024	BRAND :	TELEDYNE	MODEL :	TML-60
NO.	SO ₂ -R08	SERIAL NO.	TRSL064		
Calibrator (Dilution System)					
Brand :	API	Model :	700		
Last Cal. Date :	08 August 2023	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. :	49.8 ppm
CALIBRATING CONDITION					
Pressure	1011 mmbar	Temp.	24.5 °C	% RH	49
CALIBRATION SETTING					
Span	Initial Reading (Before Adj.),PPB			Final Reading (After Adj.),PPB	
Set Point	Expected Concentration	Analyzer Response	%Diff	Analyzer Response	Slope
Zero	0	0.10	-	0	-
SO ₂ Span	400.0	399.8	-0.050	400.0	1.008
API Model TML-60 SO ₂ Analyzer Check list					
Test Values	Observed Value	Units	Nominal Range		
RANGE	500	PPB	0-500		
SAMPLE PRESS	28.5	in-Hg	25-35		
SAMPLE FLOW	660	cc/min	650 ± 10%		
PMT	103.5	mV	-20-150 with Zero Air		
UV LAMP	3044.3	mV	1000-4900		
STR. LGT	61.5	PPB	<100		
DRK PMT	63.0	mV	-50 - 200		
DRK LMP	58.1	mV	-50 - 200		
HVPS	674	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	7.3	°C	7 ± 2.0		
SO ₂ Span Conc	400	PPB	20-20,000		
SO ₂ Slope	1.008	-	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 : 
(Mr.Adul Dangklom)

Approved by : 
(Mr.Peera Detudom)



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CALIBRATION REPORT					
CHEMILUMINESCENT NO / NO ₂ / NO _x ANALYZER					
DATE :	12 May 2024	BRAND :	API	MODEL :	200E
NO.	NOX-R04	SERIAL NO.	4411		
Calibrator (Dilution System)					
Brand :	API	Model :	700		
Last Cal. Date :	08 August 2023	Serial No. :	911		
Reference Standard Gas					
Standard Gas :	Nitric Oxide (NO)	Cylinder No. :	A007265V		
Certified Date :	05 January 2023	Expired Date :	05 January 2026	Cylinder Conc. :	48.8 ppm
CALIBRATING CONDITION					
Pressure	1011 mmbar	Temp.	24.5 °C	% RH	49
CALIBRATION SETTING					
Span	Initial Reading (Before Adj.),PPB			Final Reading (After Adj.),PPB	
Set Point	Expected Concentration	Analyzer Response	%Dif	Analyzer Response	Slope
Zero	0	-0.10	-	0	-
NO Span	400	399.8	-0.050	400.0	1.006
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	509	cc/min	500 ± 50		
OZONE FLOW	79	cc/min	80 ± 15		
PMT	103.1	mV	-20 - 150		
AZERO	93.9	mV	-20 - 150		
HVPS	669	V	420 - 900 constant		
RCELL TEMP	50.0	°C	50 ± 1		
BOX TEMP	28.8	°C	8 - 48		
PMT TEMP	7.1	°C	7 ± 2		
MOLY TEMP	315.4	°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	1.006	-	1.0 ± 0.3		
NO _x Slope	1.010	-	1.0 ± 0.3		
NO Offset	1.3	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	< 2 ppb @ 400 ppb span gas		

Calibrated by :

(Mr.Adul Dangklom)

Approved by :

(Mr.Peera Detudom)



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CALIBRATION REPORT					
CHEMILUMINESCENT NO / NO ₂ / NO _x ANALYZER					
DATE :	12 May 2024	BRAND :	API	MODEL :	200E
NO.	NOX-R06	SERIAL NO.	4466		
Calibrator (Dilution System)					
Brand :	API	Model :	700		
Last Cal. Date :	08 August 2023	Serial No. :	911		
Reference Standard Gas					
Standard Gas :	Nitric Oxide (NO)	Cylinder No. :	A007265V		
Certified Date :	05 January 2023	Expired Date :	05 January 2026	Cylinder Conc. :	48.8 ppm
CALIBRATING CONDITION					
Pressure	1011 mmbar	Temp.	24.5 °C	% RH	49
CALIBRATION SETTING					
Span	Initial Reading (Before Adj.),PPB			Final Reading (After Adj.),PPB	
Set Point	Expected Concentration	Analyzer Response	%Dif	Analyzer Response	Slope
Zero	0	-0.10	-	0	-
NO Span	400	399.6	-0.100	400.0	1.004
NO _x Span	400	399.8	-0.050	400.0	1.007
API Model 200E NO _x Analyzer Check List					
Test Values	Observed Value	Units	Nominal Range		
RANGE	500	PPB	500 standard		
STABILITY (Zero Gas)	0.1	PPB	< 2 with zero air		
SAMPLE FLOW	507	cc/min	500 ± 50		
OZONE FLOW	78	cc/min	80 ± 15		
PMT	102.9	mV	-20 - 150		
AZERO	93.6	mV	-20 - 150		
HVPS	669	V	420 - 900 constant		
RCELL TEMP	50.4	°C	50 ± 1		
BOX TEMP	29.3	°C	8 - 48		
PMT TEMP	7.1	°C	7 ± 2		
MOLY TEMP	315.1	°C	315 ± 5		
RCELL PRESS	8.3	IN-Hg-A	2 - 10 constant		
SAMPLE PRESS	28.4	IN-Hg-A	25 - 30 constant		
NO Span Conc	400	PPB	20 - 20,000		
NO _x Span Conc	400	PPB	20 - 20,000		
NO Slope	1.004	-	1.0 ± 0.3		
NO _x Slope	1.007	-	1.0 ± 0.3		
NO Offset	1.2	mV	-20 to +150		
NO _x Offset	0.8	mV	-20 to 150		
Stability at Zero	0.1	PPB	< 0.2		
Stability at Span	0.2	PPB	< 2 ppb @ 400 ppb span gas		

Calibrated by :

(Mr.Adul Dangklom)

Approved by :

(Mr.Peera Detudom)



บริษัท เอส.พี.เอส. คอนซัลติ้ง เซอร์วิส จำกัด
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

CALIBRATION REPORT					
CHEMILUMINESCENT NO / NO ₂ / NO _x ANALYZER					
DATE :	12 May 2024	BRAND :	API	MODEL :	200E
NO.	NOX-R08	SERIAL NO.	243		
Calibrator (Dilution System)					
Brand :	API		Model :	700	
Last Cal. Date :	08 August 2023		Serial No. :	911	
Reference Standard Gas					
Standard Gas :	Nitric Oxide (NO)		Cylinder No. :	A00726SV	
Certified Date :	05 January 2023		Expired Date :	05 January 2026	
Cylinder Conc. :	48.8 ppm				
CALIBRATING CONDITION					
Pressure	1011	mmbar	Temp.	24.5	°C
% RH	49				
CALIBRATION SETTING					
Span	Initial Reading (Before Adj.),PPB			Final Reading (After Adj.),PPB	
Set Point	Expected Concentration	Analyzer Response	%Dif	Analyzer Response	Slope
Zero	0	0.10	-	0	-
NO Span	400	399.7	-0.075	400.0	1.007
NO _x Span	400	400.1	0.025	400.0	1.011
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	103.1	mV	-20 - 150		
AZERO	93.8	mV	-20 - 150		
HVPS	670	V	420 - 900 constant		
RCCELL TEMP	50.5	°C	50 ± 1		
BOX TEMP	29.0	°C	8 - 48		
PMT TEMP	7.2	°C	7 ± 2		
MOLY TEMP	314.7	°C	315 ± 5		
RCCELL 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	1.007	-	1.0 ± 0.3		
NO _x Slope	1.011	-	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	< 2 ppb @ 400 ppb span gas		

Calibrated by : 
(Mr. Adul Dangklorn)

Approved by : 
(Mr. Peera Detudorn)



บริษัท เอส.พี.เอส. คอนซัลติ้ง เซอร์วิส จำกัด
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Tel : (662) 939-4370-72 Fax : (662) 513-4221 E-mail : sale@spscon.com, www.spscon.com

CALIBRATION REPORT					
NON-DISPERSIVE INFRARED CO ANALYZER					
DATE :	12 May 2024	BRAND :	API	MODEL :	300E
NO.	CO-B06	SERIAL NO.	3117		
Calibrator (Dilution System)					
Brand :	TELEDYNE		Model :	700	
Last Cal. Date :	30 October 2023		Serial No. :	421	
Reference Standard Gas					
Standard Gas :	Carbon Monoxide (CO)		Cylinder No. :	D711839	
Certified Date :	14 March 2024		Expired Date :	14 March 2032	
Cylinder Conc. :	4,580 PPM				
CALIBRATING CONDITION					
Pressure	1011	mmbar	Temp.	24.5	°C
% RH	49				
CALIBRATION SETTING					
Span	Initial Reading (Before Adj.),PPM			Final Reading (After Adj.),PPM	
Set Point	Expected Concentration	Analyzer Response	%Dif	Analyzer Response	
Zero	0	-0.10	-	0	
CO Span	40.00	40.04	0.100	40.00	
API Model 300E CO Analyzer Check list					
Parameter	Observed Value	Units	Nominal Range		
RANGE	50	PPM	0-1000 ppm		
STABILITY	0.10	PPM	< 1 ppm with zero air		
CO MEASURE	4016.7	mV	2500-4800 mV		
CO REFERENCE	3948.6	mV	2500-4800 mV		
MEASURE/REFERENCE RATIO	1.180	-	1.1-1.3 w/zero air		
SAMPLE PRESSURE	28.5	IN-Hg-A	~2" < ambient absolute pressure		
SAMPLE FLOW	804	cc/min	800 ± 10%		
SAMPLE TEMPERATURE	48.5	°C	48 ± 4		
BENCH TEMPERATURE	48.2	°C	48 ± 2		
WHEEL TEMPERATURE	68.3	°C	68 ± 2		
BOX TEMPERATURE	30.8	°C	Ambient temp + 7 ± 10		
PHOTO-DRIVE	3024.7	mV	250 mV to 4750 mV		
SLOPE	1.017	-	1.0 ± 0.3		
OFFSET	0.2	-	0 ± 0.3		

Calibrated by : 
(Mr. Adul Dangklorn)

Approved by : 
(Mr. Peera Detudorn)

CALIBRATION REPORT				
NON-DISPERSIVE INFRARED CO ANALYZER				
DATE :	12 May 2024	BRAND :	API	MODEL :
NO.	CO-R02	SERIAL NO.	171-S	
Calibrator (Dilution System)				
Brand	TELEDYNE		Model	700
Last Cal. Date	30 October 2023		Serial No.	421
Reference Standard Gas				
Standard Gas	Carbon Monoxide (CO)		Cylinder No.	D711839
Certified Date	14 March 2024	Expired Date	14 March 2032	
CYLINDER CONC. : 4,580 PPM				
CALIBRATING CONDITION				
Pressure	1011	mmbar	Temp.	24.5 °C
% RH	49			
CALIBRATION SETTING				
Span	Initial Reading (Before Adj.),PPM			Final Reading (After Adj.),PPM
Set Point	Expected Concentration	Analyzer Response	%Dif	Analyzer Response
Zero	0	0.10	-	0
CO Span	40.00	40.03	0.075	40.00
API Model 300E CO Analyzer Check list				
Parameter	Observed Value	Units	Nominal Range	
RANGE	50	PPM	0-1000 ppm	
STABILITY	0.10	PPM	< 1 ppm with zero air	
CO MEASURE	4017.1	mV	2500-4800 mV	
CO REFERENCE	3949.3	mV	2500-4800 mV	
MEASURE/REFERENCE RATIO	1.180	-	1.1-1.3 w/zero air	
SAMPLE PRESSURE	28.4	In-Hg-A	~2" < ambient absolute pressure	
SAMPLE FLOW	809	cc/min	800 ± 10%	
SAMPLE TEMPERATURE	48.3	°C	48 ± 4	
BENCH TEMPERATURE	48.1	°C	48 ± 2	
WHEEL TEMPERATURE	68.5	°C	68 ± 2	
BOX TEMPERATURE	30.6	°C	Ambient temp + 7 ± 10	
PHOTO-DRIVE	3043.9	mV	250 mV to 4750 mV	
SLOPE	1.017	-	1.0 ± 0.3	
OFFSET	0.2	-	0 ± 0.3	

Calibrated by : 
(Mr.Adul Dangklom)

Approved by : 
(Mr.Peera Detudom)

CALIBRATION REPORT				
NON-DISPERSIVE INFRARED CO ANALYZER				
DATE :	12 May 2024	BRAND :	API	MODEL :
NO.	CO-R03	SERIAL NO.	1352	
Calibrator (Dilution System)				
Brand	TELEDYNE		Model	700
Last Cal. Date	30 October 2023		Serial No.	421
Reference Standard Gas				
Standard Gas	Carbon Monoxide (CO)		Cylinder No.	D711839
Certified Date	14 March 2024	Expired Date	14 March 2032	
CYLINDER CONC. : 4,580 PPM				
CALIBRATING CONDITION				
Pressure	1011	mmbar	Temp.	24.5 °C
% RH	49			
CALIBRATION SETTING				
Span	Initial Reading (Before Adj.),PPM			Final Reading (After Adj.),PPM
Set Point	Expected Concentration	Analyzer Response	%Dif	Analyzer Response
Zero	0	0.11	-	0
CO Span	40.00	40.09	0.225	40.00
API Model 300E CO Analyzer Check list				
Parameter	Observed Value	Units	Nominal Range	
RANGE	50	PPM	0-1000 ppm	
STABILITY	0.10	PPM	< 1 ppm with zero air	
CO MEASURE	4014.9	mV	2500-4800 mV	
CO REFERENCE	3948.1	mV	2500-4800 mV	
MEASURE/REFERENCE RATIO	1.180	-	1.1-1.3 w/zero air	
SAMPLE PRESSURE	28.7	In-Hg-A	~2" < ambient absolute pressure	
SAMPLE FLOW	805	cc/min	800 ± 10%	
SAMPLE TEMPERATURE	48.4	°C	48 ± 4	
BENCH TEMPERATURE	48.1	°C	48 ± 2	
WHEEL TEMPERATURE	68.2	°C	68 ± 2	
BOX TEMPERATURE	30.7	°C	Ambient temp + 7 ± 10	
PHOTO-DRIVE	3046.4	mV	250 mV to 4750 mV	
SLOPE	1.017	-	1.0 ± 0.3	
OFFSET	0.2	-	0 ± 0.3	

Calibrated by : 
(Mr.Adul Dangklom)

Approved by : 
(Mr.Peera Detudom)



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

Relative Humidity : 50 % ± 15 %

Location of Calibration : In-Lab

Calibration Procedure : SP-CPM-04-13

Received Date : 26 May 2023

Calibration Date : 29 May 2023

Recommend Due Date : 29 May 2024

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 : Mr.Jirasak Pumbut

Calibration Officer

Approved by :

(Mr.Prayoon Topart)

Authorized Signatory



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)



Result of Calibration

Certificate No. : SPR23050422-1

Page : 3 of 3

Function : Air Flow Measurement

Unit : mL/min

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	3.42	3.59	-0.17	1.04971	0.26
7.3	7.52	7.78	-0.26	1.03457	0.26
13.5	13.83	14.34	-0.51	1.03688	0.26
17.0	17.12	17.65	-0.53	1.03096	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 -



MIRACLE INTERNATIONAL TECHNOLOGY CO.,LTD

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



CALIBRATION CERTIFICATE

Certificate No. : L202312097-0001

Date Issued : 25-Dec-23

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

Equipment : Mass flow meter

Manufacturer : Dwyer

Model : GMF-2101

Serial No. : -

ID No./Tag No. : MF01/51

Date Received : 14-Dec-23

Date Calibrated : 25-Dec-23

Calibrated by : Mr. Jame Khaothong

Calibration Method or Calibration Procedure Used

In-house method : CP-34 by comparison against mass flow calibrator.

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

Result of Calibration

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

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

Approved by:



Page 1 of 3

Certificate No. : L202312097-0001

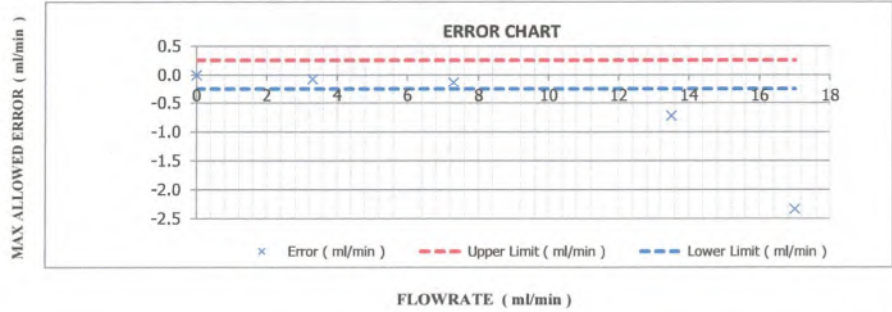
Environment : Ambient temperature : (23 ± 2) °C
Relative humidity : (50 ± 15) % RH
Capacity Range : 17 ml/min
Calibration Media : Air
Type : Mass Flowmeter

Unit Under Calibration Reference Condition : Pressure 101.325 kPa(abs) , 21 °C , Nitrogen							
Temperature (° C)	Pressure (kPa)	UUC Reading (ml/min)	STD Reading (ml/min)	Error (ml/min)	Uncertainty (± ml/min)	MPE ±(ml/min)	Pass / Fail Simple Acceptance
23.28	101.87	0.00	0.000 *	0.000	0.063	0.255	Pass
23.29	101.88	3.30	3.365	-0.065	0.14	0.255	Pass
23.25	101.90	7.30	7.428	-0.128	0.15	0.255	Pass
23.27	101.94	13.50	14.217	-0.717	0.16	0.255	Failed
23.26	101.97	17.00	19.331	-2.331	0.20	0.255	Failed

Error = Unit Under Calibration - Standard Pass = |error|<= |MPE|

MPE = Maximum Permissible Error Fail = |error|> |MPE|

Marked * are not included in the NSC-ONSC accreditation schedule for our laboratory.



Certificate No. : L202312097-0001

Note : The actual flow rate is determined by the equation :

$$Q_{Meas} = Q_{Ref} \times \frac{P_{Ref}}{P_{Meas}} \times \frac{T_{Meas}}{T_{Ref}}$$

; Q = Flow rate
; P = Absolute pressure
; T = Absolute temperature
; Subscript "Meas" = Measurement condition
; Subscript "Ref" = Reference condition

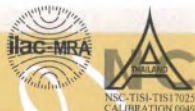
Condition As-Received : Used Item

The measurement results and statements of conformity with specification only relate to the item calibrated.

Traceability of Certificate :

The International System of Units (SI) through
NIMT Calibration Certificate No. MW-0013-22 for Mass Flow Calibrator (20 SCCM) Serial No. G500971G20, Due 22-Feb-24

End of Certificate



CERTIFICATE No : 24M2227
REFERENCE No : 72448-1

PAGE : 1 OF 2

Certificate of Calibration

EQUIPMENT : DIGITAL BALANCE
MANUFACTURER : METTLER TOLEDO
MODEL : XS105DU
SERIAL No : 1126422905
ID No : BA05/50
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 : 08-Mar-24

APPROVED BY : PONGSAK J.

ISSUED DATE : 14-Mar-24

RECEIVED DATE : 08-Mar-24

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

F-G010 REV 03



CERTIFICATE No : 24M2227

PAGE : 2 OF 2

Calibration Report

EQUIPMENT : DIGITAL BALANCE MODEL : XS105DU
MANUFACTURER : METTLER TOLEDO S/N : 1126422905
ID No : BA05/50 RECEIVED DATE : 08-Mar-24
AIR PRESSURE : 1010mbar \pm 1mbar CALIBRATION DATE : 08-Mar-24
AMBIENT TEMPERATURE : 25° C \pm 1° C RELATIVE HUMIDITY : 53 %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. THE CERTIFICATE IS VALID FOR THE ITEM CALIBRATED AS SHOWN ON THE 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:-

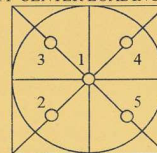
- NATIONAL INSTITUTE OF METROLOGY (THAILAND) THROUGH CENTRAL BUREAU OF WEIGHTS&MEASURES

RESULT OF CALIBRATION :- WITHOUT ADJUSTMENT

1. ZERO SETTING FUNCTION : NORMAL
2. TARE FUNCTION : NORMAL
3. REPEATABILITY OF READING AT 200 g WAS 0.000055 g
4. DEPARTURE FROM NOMINAL VALUE/ LINEARITY

NOMINAL VALUE (g)	BALANCE READING (g)	CORRECTION (g)	UNCERTAINTY (\pm g)
0.00	0.00000	0.00000	0.000065
0.02	0.02001	-0.00001	0.000065
0.10	0.10002	-0.00002	0.000066
0.20	0.20001	-0.00001	0.000066
0.50	0.50001	-0.00001	0.000065
1.00	1.00003	-0.00003	0.000066
2.00	2.00001	-0.00001	0.000067
5.00	5.00001	-0.00001	0.000068
10.00	9.99994	0.00006	0.000070
20.00	20.00008	-0.00008	0.000078
50.00	50.00000	0.00000	0.00013
100.00	100.0001	-0.0001	0.00019
120.00	120.0001	-0.0001	0.00022

5. OFF CENTER LOADING ERROR



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

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

END OF CALIBRATION REPORT

Certificate of System Qualification

GC-OQ + GCMS-OQ

System ID: GC_MS_03_52_CN10925102
Organization Name: S.P.S Consulting service
Organization Location: 7 Soi Phaholyothin Road, Ladyao, Khet Jatujak, Bangkok 10900

Date: March 31, 2023 1:21:52 PM
EQP Name: AgilentRecommended , AgilentRecommended
EQP Revision: GC.02.50, GCMS.02.50
Overall Qualification Status: Pass

System Inspection and Basic Safety and Operation

Name: 7890
Setpoint Status: Pass

Overall System Inspection and Basic Safety and Operation Test Status

Pass

Inlet Pressure Decay

Name: 7890
Front SSL

Setpoint Status: Pass
Pressure: 25.0 psi
Pressure Change: -0.1 psi /5 minutes
Agilent Recommended: ≥ -2.0 and ≤ 0.5

Overall Inlet Pressure Decay Test Status

Pass

Inlet Pressure Accuracy

Name: 7890
Front SSL

Date: March 31, 2023 1:21:52 PM
System ID: GC_MS_03_52_CN10925102

Setpoint Status:

Pass

Setpoint Actual
Inlet Pressure: 25.0 psi 25.0 psi
Accuracy: 0.0 psi
Agilent Recommended: ≤ 1.2

Overall Inlet Pressure Accuracy Test Status

Pass

Inlet Pressure Accuracy

Name: 7890
Back SSL

Setpoint Status:

Pass

Setpoint Actual
Inlet Pressure: 25.0 psi 25.2 psi
Accuracy: 0.2 psi
Agilent Recommended: ≤ 1.2

Overall Inlet Pressure Accuracy Test Status

Pass

Detector Flow Accuracy

Name: 7890
Front FID

Setpoint Status:

Pass

Flow Type: Fuel
Setpoint: 30.0 mL/min Measured Flow: 30.3 mL/min
Accuracy: 0.3 mL/min
Agilent Recommended: ≤ 10.0 % setpoint (3.0 mL/min)
Limit is percentage of setpoint or 0.5 mL/minute, whichever is largest.

Date: March 31, 2023 1:21:52 PM
System ID: GC_MS_03_52_CN10925102

Setpoint Status: Pass

Flow Type: Oxidizer

Setpoint: 400.0 mL/min **Measured Flow:** 396.2 mL/min

Accuracy: 3.8 mL/min

Agilent Recommended: ≤ 10.0 % setpoint (40.0 mL/min)

Limit is percentage of setpoint or 0.5 ml/minute, whichever is largest.

Setpoint Status: Pass

Flow Type: Makeup

Setpoint: 25.0 mL/min **Measured Flow:** 25.1 mL/min

Accuracy: 0.1 mL/min

Agilent Recommended: ≤ 10.0 % setpoint (2.5 mL/min)

Limit is percentage of setpoint or 0.5 ml/minute, whichever is largest.

Overall Detector Flow Accuracy Test Status

Pass

GC Oven Temperature Accuracy

Name: 7890

Setpoint Status: Pass

Zone: Oven

Setpoint/Actual

Temperature: 230.0 230.6 °C

Accuracy: 0.6 °C

Agilent Recommended: ≥ -1.0 % setpoint in K (-5.0 °C)
≤ 1.0 % setpoint in K (5.0 °C)

Date: March 31, 2023 1:21:52 PM
System ID: GC_MS_03_52_CN10925102

Setpoint Status: Pass

Zone: Oven

Setpoint/Actual

Temperature: 100.0 100.4 °C

Accuracy: 0.4 °C

Agilent Recommended: ≥ -1.0 % setpoint in K (-3.7 °C)
≤ 1.0 % setpoint in K (3.7 °C)

Overall GC Oven Temperature Accuracy Test Status

Pass

GC Oven Temperature Stability

Name: 7890

Setpoint Status: Pass

Setpoint/Average

Temperature: 100.0 100.3833 °C

Stability: 0.1 °C

Agilent Recommended: ≤ 0.5 °C

Overall GC Oven Temperature Stability Test Status

Pass

Scouting Run

Tested Combination1 Front SSL / Front FID

Manual Injection

Name: Not applicable

Setpoint Status: Completed

Injection Volume on Column: 1.0 µL

Overall Scouting Run Status

Completed

Noise and Drift

Tested Combination1 Front SSL / Front FID

Date: March 31, 2023 1:21:52 PM
System ID: GC_MS_03_52_CN10925102

Name: 7890

Setpoint Status: Pass

Base Signal: 89800 Ab

ASTM Noise counts	Drift counts/Hr
285.31	96.04
<= 768.00	<= 19200.00

Agilent Recommended: Pass

Status: Pass

Overall Noise and Drift Test Status

Pass

Signal to Noise

Tested Combination1	Front	SSL	/ Front	FID
Name:	Manual Injection			
	7890			
Setpoint Status:	Pass			
Signal to Noise:	3814254			
Agilent Recommended:	>= 300000			

Overall Signal to Noise Test Status

Pass

Log Amp

Tested Combination2	Back	SSL	/ External	SQ
Name:	5975C			
Setpoint Status:	Pass			

Overall Log Amp Test Status

Pass

RFPA

Date: March 31, 2023 1:21:52 PM
System ID: GC_MS_03_52_CN10925102

Tested Combination2	Back	SSL	/ External	SQ
Name:	5975C			
Setpoint Status:	Pass			
Amu:	1050	m/z	Drift After Five Minutes:	1 mV
Agilent Recommended:	>= -100	and	<= 100	<= 479 mV

Overall RFPA Test Status

Pass

Tune EI

Tested Combination2	Back	SSL	/ External	SQ
Name:	5975C			
Setpoint Status:	Pass			
Filament:	1			
Setpoint Status:	Pass			
Filament:	2			

Overall Tune EI Test Status

Pass

Signal to Noise EI

Tested Combination2	Back	SSL	/ External	SQ
Name:	5975C			
Source:	EI - Inert		Filament: 1	
Setpoint Status:	Pass			
Signal to Noise:	425			
Agilent Recommended:	>= 160			

Date: March 31, 2023 1:21:52 PM
System ID: GC_MS_03_52_CN10925102

Source: EI - Inert

Filament: 2

Setpoint Status: Pass

Signal to Noise: 566

Agilent Recommended: >= 160

Overall Signal to Noise EI Test Status

Pass

Instrument Details

Purpose

This section describes the as found system configuration.

Details

System	
System ID	GC_MS_03_52_CN10925102
Manufacturer	Agilent Technologies
Name	7890
Tested Combination1	
Injection Technique	Manual Injection
Sampler Identifier	Sampler 1
Inlet	Front
Detector	Front
LTM Included?	No
Tested Combination2	
Injection Technique	Manual Injection
Sampler Identifier	Sampler 2
Inlet	Back
Detector	External
LTM Included?	No
Sampler 1	
Manufacturer	Agilent Technologies
Type	Manual Injection
Usage	Sample Injection
Syringe Volume (µL)	10
Sampler 2	
Manufacturer	Agilent Technologies
Type	Manual Injection
Usage	Sample Injection
Syringe Volume (µL)	10

Mainframe 1

Manufacturer	Agilent Technologies
Name	7890
Model Number	G3440A
Serial Number	CN10925120
Firmware Revision	A.01.10.3
Oven Type	Standard

Inlet 1

Manufacturer	Agilent Technologies
Name	7890
Type	SSL
Location	Front
Carrier Gas	Helium
Control Type	Electronic Pressure Control (EPC)
Purged Inlet	Yes

Inlet 2

Manufacturer	Agilent Technologies
Name	7890
Type	SSL
Location	Back
Carrier Gas	Helium
Control Type	Electronic Pressure Control (EPC)
Purged Inlet	Yes

Detector 1

Manufacturer	Agilent Technologies
Name	7890
Type	FID
Adapter	Capillary
Control Type	Electronic Pressure Control (EPC)
Location	Front
Makeup Gas	Nitrogen

Detector 2

Manufacturer	Agilent Technologies
Name	Mass Spectrometer
Type	Mass Spectrometer
Location	External

Mass Spectrometer 1

Manufacturer	Agilent Technologies
Type	SQ
Name	5975C
Serial Number	US91732743
Firmware Revision	5975 5.02.07
High Vacuum System	Turbo Pump
Scouting Run Standard	OFN Std

MS EI Source 1

Manufacturer	Agilent Technologies
Source Type	EI - Inert
Number of filaments	2

Electronic Signature

Purpose

This signature page was created and published because the ACE sign-off action was executed, which is valid for the entire document, including attachments. The ACE sign-off is an electronic signature that requires two distinct identification components: unique username and personal password. The Agilent representative who has delivered this service understands the meaning and legal status of an electronic signature. As a trained official operator, the Agilent representative has a unique password and logon to access ACE and electronically sign this document. (Other e-signatures can be applied to this document using a Document Content Management or other suitable method defined in your data access and control procedures.)

Details

Full Name of Signer:Saenguthai Tarak

Logged On User Name:saenguthai.tarak@non.agilent.com

Signature Creation Date:March 31, 2023

Reason for Signature:Executed protocol and published this original version of document

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GC_MS_03_52_CN10925120 Transaction log :

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
March 31, 2023 9:12:26 AM	Audit	SessionCreated	Session	None
March 31, 2023 9:12:28 AM	Start	Configuration	Session	None
March 31, 2023 9:12:26 AM	Audit	Entitlement	Licensing	User is Nonpaying and does not require an unlock code
March 31, 2023 9:20:14 AM	Audit	EqpLoaded	Session	EQP details for primary technique [Gc] - File path: [ProtocolPacks\Gc\Configurations\02.50\Gc.02.50.eqp], EQP File Name: [Gc.02.50.eqp], EQP Name: [AgilentRecommended] Protocol Revision: [Gc.02.50] EQP details for hyphenated technique [GcMs] - File path: [ProtocolPacks\GcMs\Configurations\02.50\GcMs.02.50.eqp], EQP File Name: [GcMs.02.50.eqp], EQP Name: [AgilentRecommended]
March 31, 2023 9:20:17 AM	End	Configuration	Session	None
March 31, 2023 9:20:27 AM	Start	Qualification	Session	OQ
March 31, 2023 9:20:27 AM	Start	Execution	System Inspection and Basic Safety and Operation - 7890: - Qualitative Test - No setpoints associated	None
March 31, 2023 9:21:33 AM	End	Execution	System Inspection and Basic Safety and Operation - 7890: - Qualitative Test - No setpoints associated	Run Count : 1

User Name: saenguthai.tarak
Hostname: LAPTOP-CQ3SKOMV

System Id: GC_MS_03_52_CN10925102
Print Date: March 31, 2023 1:21:53 PM

GC_MS_03_52_CN10925120 Transaction log :

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
March 31, 2023 9:21:35 AM	Start	Execution	Inlet Pressure Decay - Front SSL: - Pressure Controlled Inlet - S: 25.0 psi - L: >= -2.0 psi and <= 0.5 psi	None
March 31, 2023 9:21:51 AM	End	Execution	Inlet Pressure Decay - Front SSL: - Pressure Controlled Inlet - S: 25.0 psi - L: >= -2.0 psi and <= 0.5 psi	Run Count : 1
March 31, 2023 9:21:54 AM	Start	Execution	Inlet Pressure Accuracy - Front SSL: - Pressure Controlled Inlet - S: 25.0 psi - L: <= 1.2 psi	None
March 31, 2023 9:21:59 AM	End	Execution	Inlet Pressure Accuracy - Front SSL: - Pressure Controlled Inlet - S: 25.0 psi - L: <= 1.2 psi	Run Count : 1
March 31, 2023 9:22:02 AM	Start	Execution	Inlet Pressure Accuracy - Back SSL: - Pressure Controlled Inlet - S: 25.0 psi - L: <= 1.2 psi	None
March 31, 2023 9:22:07 AM	End	Execution	Inlet Pressure Accuracy - Back SSL: - Pressure Controlled Inlet - S: 25.0 psi - L: <= 1.2 psi	Run Count : 1
March 31, 2023 9:22:09 AM	Start	Execution	Detector Flow Accuracy - Front FID: - Type : Fuel - S: 30.0 mL/min - L: <= 10.0% setpoint	None
March 31, 2023 9:22:29 AM	End	Execution	Detector Flow Accuracy - Front FID: - Type : Fuel - S: 30.0 mL/min - L: <= 10.0% setpoint	Run Count : 1
March 31, 2023 9:22:30 AM	Start	Execution	Detector Flow Accuracy - Front FID: - Type : Oxidizer - S: 400.0 mL/min - L: <= 10.0% setpoint	None
March 31, 2023 9:22:41 AM	End	Execution	Detector Flow Accuracy - Front FID: - Type : Oxidizer - S: 400.0 mL/min - L: <= 10.0% setpoint	Run Count : 1

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Hostname: LAPTOP-CQ3SKOMV

System Id: GC_MS_03_52_CN10925102
Print Date: March 31, 2023 1:21:53 PM

GC_MS_03_52_CN10925120 Transaction log :

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
March 31, 2023 9:22:42 AM	Start	Execution	Detector Flow Accuracy - Front FID: - Type : Makeup - S: 25.0 mL/min - L: <= 10.0% setpoint	None
March 31, 2023 9:22:48 AM	End	Execution	Detector Flow Accuracy - Front FID: - Type : Makeup - S: 25.0 mL/min - L: <= 10.0% setpoint	Run Count : 1
March 31, 2023 9:22:49 AM	Start	Execution	GC Oven Temperature Accuracy - 7890: - Temperature : Oven - S: 230.0°C - L: >= -1.0 AND <= 1.0 % setpoint in K	None
March 31, 2023 9:23:31 AM	Audit	Data	GC Oven Temperature Accuracy - 7890: - Temperature : Oven - S: 230.0°C - L: >= -1.0 AND <= 1.0 % setpoint in K	Manual Data Entry
March 31, 2023 9:23:34 AM	End	Execution	GC Oven Temperature Accuracy - 7890: - Temperature : Oven - S: 230.0°C - L: >= -1.0 AND <= 1.0 % setpoint in K	Run Count : 1
March 31, 2023 9:23:37 AM	Start	Execution	GC Oven Temperature Accuracy - 7890: - Temperature : Oven - S: 100.0°C - L: >= -1.0 AND <= 1.0 % setpoint in K	None
March 31, 2023 9:26:00 AM	Audit	Data	GC Oven Temperature Accuracy - 7890: - Temperature : Oven - S: 100.0°C - L: >= -1.0 AND <= 1.0 % setpoint in K	Manual Data Entry
March 31, 2023 9:26:03 AM	End	Execution	GC Oven Temperature Accuracy - 7890: - Temperature : Oven - S: 100.0°C - L: >= -1.0 AND <= 1.0 % setpoint in K	Run Count : 1
March 31, 2023 9:26:05 AM	Start	Execution	GC Oven Temperature Stability - 7890: - Temperature : Oven - S: 100.0°C - L: <= 0.5°C	None

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Date: March 31, 2023 1:21:52 PM
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 Hostname: LAPTOP-CQ39KOMV

System Id: GC_MS_03_52_CN10925102
 Print Date: March 31, 2023 1:21:53 PM

GC_MS_03_52_CN10925120 Transaction log :

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
March 31, 2023 9:26:42 AM	Start	Execution	GC Oven Temperature Stability	None
			- 7890: - Temperature : Oven -	
			S: 100.0°C - L: <= 0.5°C	
March 31, 2023 9:27:39 AM	Audit	Data	GC Oven Temperature Stability	Manual Data Entry
			- 7890: - Temperature : Oven -	
			S: 100.0°C - L: <= 0.5°C	
March 31, 2023 9:27:46 AM	End	Execution	GC Oven Temperature Stability	Run Count : 1
			- 7890: - Temperature : Oven -	
			S: 100.0°C - L: <= 0.5°C	
March 31, 2023 9:27:51 AM	Start	Execution	GC Scouting Run - Manual Injection, Front SSL, Front FID:	None
			- Part of System Preparation -	
			No limits associated	
March 31, 2023 9:54:35 AM	Start	Execution	Log Amp - 5975C SQ: - Source: None	
			El - Inert	
March 31, 2023 9:55:59 AM	Start	Execution	RFPA - 5975C SQ: - Source: El	None
			- Inert	
March 31, 2023 10:23:19 AM	Start	Execution	Signal to Noise El - Liquid Injection, Back SSL, SQ: -	None
			Source: El - Inert using	
			Filament 1 - L: >= 160	
March 31, 2023 10:37:53 AM	Start	Execution	Tune El - 5975C SQ: - Source: -	None
			El - Inert Filament 1 (Qualitative	
			- No setpoints associated)	
March 31, 2023 10:38:04 AM	Start	Execution	Tune El - 5975C SQ: - Source: -	None
			El - Inert Filament 2 (Qualitative	
			- No setpoints associated)	
March 31, 2023 10:38:11 AM	Start	Execution	Tune El - 5975C SQ: - Source: -	None
			El - Inert Filament 1 (Qualitative	
			- No setpoints associated)	

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 Hostname: LAPTOP-CQ39KOMV

System Id: GC_MS_03_52_CN10925102
 Print Date: March 31, 2023 1:21:53 PM

GC_MS_03_52_CN10925120 Transaction log :

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
March 31, 2023 10:38:14 AM	Start	Execution	Noise and Drift - Front FID: -	None
			Detector FID - L (Noise): <=	
			0.10 pA - L (Drift): <= 2.50	
			pA/hour	
March 31, 2023 10:38:17 AM	Start	Execution	GC Scouting Run - Manual Injection, Front SSL, Front FID:	None
			- Part of System Preparation -	
			No limits associated	
March 31, 2023 10:46:28 AM	Audit	Data	GC Scouting Run - Manual Injection, Front SSL, Front FID:	Data files Path :
			- Part of System Preparation -	F:\Data\SC_FID,D\FID1A.ch
			No limits associated	
March 31, 2023 10:47:01 AM	End	Execution	GC Scouting Run - Manual Injection, Front SSL, Front FID:	Run Count : 1
			- Part of System Preparation -	
			No limits associated	
March 31, 2023 10:58:27 AM	Start	Execution	Noise and Drift - Front FID: -	None
			Detector FID - L (Noise): <=	
			0.10 pA - L (Drift): <= 2.50	
			pA/hour	
March 31, 2023 10:58:52 AM	Audit	Data	Noise and Drift - Front FID: -	Data files Path :
			Detector FID - L (Noise): <=	F:\Data\ND_FID,D\FID1A.ch
			0.10 pA - L (Drift): <= 2.50	
			pA/hour	
March 31, 2023 11:00:53 AM	End	Execution	Noise and Drift - Front FID: -	Run Count : 1
			Detector FID - L (Noise): <=	
			0.10 pA - L (Drift): <= 2.50	
			pA/hour	
March 31, 2023 11:02:02 AM	Start	Execution	Signal to Noise - Manual Injection, Front SSL, Front FID:	None
			- Detector FID - L: >= 300000	
March 31, 2023 11:14:32 AM	Audit	AccClosed	Session	None

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User Name: saunguthai.tarak
 Hostname: LAPTOP-CQ3SKOMV

System Id: GC_MS_03_52_CN10925102
 Print Date: March 31, 2023 1:21:53 PM

GC_MS_03_52_CN10925120 Transaction log :

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
March 31, 2023 11:15:13 AM	Audit	AceRestarted	Session	None
March 31, 2023 11:15:14 AM	Audit	SessionReloaded	Session	None
March 31, 2023 11:15:19 AM	Start	Qualification	Session	OQ
March 31, 2023 11:15:19 AM	Start	Execution	Signal to Noise - Manual Injection, Front SSL, Front FID: - Detector FID - L: >= 300000	None
March 31, 2023 11:16:23 AM	Audit	AceClosed	Session	None
March 31, 2023 11:21:04 AM	Audit	AceRestarted	Session	None
March 31, 2023 11:21:04 AM	Audit	SessionReloaded	Session	None
March 31, 2023 11:21:09 AM	Start	Qualification	Session	OQ
March 31, 2023 11:21:09 AM	Start	Execution	Signal to Noise - Manual Injection, Front SSL, Front FID: - Detector FID - L: >= 300000	None
March 31, 2023 11:22:16 AM	Audit	Data	Signal to Noise - Manual Injection, Front SSL, Front FID: - Detector FID - L: >= 300000	Data files Path : F:\SN_FID.D\FID1A.ch
March 31, 2023 11:24:02 AM	End	Execution	Signal to Noise - Manual Injection, Front SSL, Front FID: - Detector FID - L: >= 300000	Run Count : 1
March 31, 2023 11:24:17 AM	Start	Execution	Log Amp - 5975C SQ: - Source: None EI - Inert	
March 31, 2023 11:24:31 AM	End	Execution	Log Amp - 5975C SQ: - Source: Run Count : 1 EI - Inert	

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Date: March 31, 2023 1:21:52 PM
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 Hostname: LAPTOP-CQ3SKOMV

System Id: GC_MS_03_52_CN10925102
 Print Date: March 31, 2023 1:21:53 PM

GC_MS_03_52_CN10925120 Transaction log :

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
March 31, 2023 11:24:33 AM	Start	Execution	RFPA - 5975C SQ: - Source: EI None - Inert	
March 31, 2023 11:27:22 AM	End	Execution	RFPA - 5975C SQ: - Source: EI Run Count : 1 - Inert	
March 31, 2023 11:27:25 AM	Start	Execution	Tune EI - 5975C SQ: - Source: - None EI - Inert Filament 1 (Qualitative - No setpoints associated)	
March 31, 2023 11:28:04 AM	End	Execution	Tune EI - 5975C SQ: - Source: - Run Count : 1 EI - Inert Filament 1 (Qualitative - No setpoints associated)	
March 31, 2023 11:28:06 AM	Start	Execution	Tune EI - 5975C SQ: - Source: - None EI - Inert Filament 2 (Qualitative - No setpoints associated)	
March 31, 2023 11:28:26 AM	End	Execution	Tune EI - 5975C SQ: - Source: - Run Count : 1 EI - Inert Filament 2 (Qualitative - No setpoints associated)	
March 31, 2023 11:28:28 AM	Start	Execution	Signal to Noise EI - Liquid Injection, Back SSL, SQ: - Source: EI - Inert using Filament 1 - L: >= 160	None
March 31, 2023 12:59:45 PM	Start	Execution	Signal to Noise EI - Liquid Injection, Back SSL, SQ: - Source: EI - Inert using Filament 1 - L: >= 160	None
March 31, 2023 1:00:09 PM	Audit	Data	Signal to Noise EI - Liquid Injection, Back SSL, SQ: - Source: EI - Inert using Filament 1 - L: >= 160	Data files Path : F:\SN_F1_01.D\DATASIMMS
March 31, 2023 1:00:41 PM	End	Execution	Signal to Noise EI - Liquid Injection, Back SSL, SQ: - Source: EI - Inert using Filament 1 - L: >= 160	Run Count : 1

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Date: March 31, 2023 1:21:52 PM
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User Name: saenguthai.tarak
Hostname: LAPTOP-GQ3SKOMV
System Id: GC_MS_03_52_CN10925102
Print Date: March 31, 2023 1:21:53 PM

GC_MS_03_52_CN10925120 Transaction log :

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
March 31, 2023 1:00:43 PM	Start	Execution	Signal to Noise EI - Liquid Injection, Back SSL, SQ: - Source: EI - Inert using Filament 2 - L: >= 160	None
March 31, 2023 1:01:52 PM	Audit	Data	Signal to Noise EI - Liquid Injection, Back SSL, SQ: - Source: EI - Inert using Filament 2 - L: >= 160	Data files Path : F:\SN_F2_01.D\DATASIM.MS
March 31, 2023 1:02:09 PM	End	Execution	Signal to Noise EI - Liquid Injection, Back SSL, SQ: - Source: EI - Inert using Filament 2 - L: >= 160	Run Count : 1
March 31, 2023 1:02:13 PM	End	Qualification	Session	OQ
March 31, 2023 1:02:13 PM	Start	Reporting	Session	None
March 31, 2023 1:20:27 PM	Audit	Reporting	Session	Report Generated : Certificate

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-02760693
Date PM Performed: (DD-MMM-YYYY)	22-Feb-2024	Next PM Due Date: (DD-MMM-YYYY)	22-Aug-2024

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	PSS,PSS,FID
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 624.
- ☒ 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 <i>monchai</i>	Date: 22-Feb-2024 (DD-MMM-YYYY)
Authorized Customer Representative: <i>naruecha</i>	Date: 22-Feb-2024 (DD-MMM-YYYY)

คุณภาพอากาศจากแหล่งกำเนิด



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

Console Calibration Report

Calibration Method

Critical Orifices

Calibration Data

Console Data		Calibration Data		
No.	Serial No.	Date	y	$\Delta H_{\frac{1}{2}}$ (mmH ₂ O)
B01	1563	01/03/2024	1.003	50.38
B02	8002514	04/03/2024	1.002	49.73
B03	1503016	02/03/2024	0.997	50.45
B04	00006659	01/03/2024	1.004	49.97
B05	00007428	02/03/2024	0.996	49.65
R01	1561	02/03/2024	0.999	50.18
R02	8002513	01/03/2024	1.005	50.04
R03	1570	03/03/2024	0.998	49.82
R04	8002519	02/03/2024	1.004	49.58
R05	1503015	03/03/2024	1.002	50.33

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

Accept Value of $\Delta H_{\frac{1}{2}}$ (test) is 46.7 ± 6.4 (mmH₂O)

Calibrated by :

Approved by :

(Mr. Peera Detudom)



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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

Pitot Tube Calibration Report

Calibration Method

Standard Pitot Tube

Calibration Data

Pitot Tube Data			Calibration Data		
No.	Type of Pitot	Coefficient of Standard Pitot	Date	Avg. of Cp (test)	
				Side A	Side B
B36	S	0.99	07/05/2024	0.84	0.84
B37	S	0.99	07/05/2024	0.84	0.83
B38	S	0.99	07/05/2024	0.85	0.84
B39	S	0.99	09/05/2024	0.84	0.84
B40	S	0.99	09/05/2024	0.84	0.83
B41	S	0.99	09/05/2024	0.84	0.84
B44	S	0.99	08/05/2024	0.83	0.84
B45	S	0.99	08/05/2024	0.84	0.84
B46	S	0.99	08/05/2024	0.84	0.84
B47	S	0.99	08/05/2024	0.85	0.84
B48	S	0.99	10/05/2024	0.84	0.84
B49	S	0.99	06/05/2024	0.84	0.84
B54	S	0.99	06/05/2024	0.85	0.84
B56	S	0.99	07/05/2024	0.83	0.84
B57	S	0.99	10/05/2024	0.84	0.84
B58	S	0.99	10/05/2024	0.85	0.84

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

Calibrated by :

(Mr. Adul Dangklom)

Approved by :

(Mr. Peera Detudom)



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[64-220088-1]
CLID. NO. : 212301419
JOB CONTROL NO. : 230725081570

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

DATE OF RECEIVED : 25 July 2023

DATE OF ISSUED : 31 July 2023

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

Calibrated By : Sittipong Pimdee

Approved By :

Authorized Signatory
31 July 2023



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

Certificate No. Q23081570

F3-011-04/01-12

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REPORT OF CALIBRATION

FOR

NOMENCLATURE : VACUUM GAUGE
MANUFACTURER : HI-LIGHT
MODEL / TYPE : N/A
SERIAL NO. : N/A[64-220088-1]
DATE OF CALIBRATION : 26 July 2023
DUE DATE OF CALIBRATION : 26 July 2024

ENVIRONMENT CONDITIONS :

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

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

PROCEDURE USED :

This instrument was calibrated under procedure No. CLC-CPPP-05 according to DKD-R 6-1 as calibration guidelines.
The calibration was performed by direct measurement with Document Process Calibrator and Pressure Module which maintained by the Calibration Laboratory Co., Ltd.

REFERENCE STANDARD USED :

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

TRACEABILITY :

The measurements are traceable to International System of Units (SI), through National Institute of Metrology (Thailand).
Certificate No. MP-0035-23, Due Date 02 February 2024.

UNCERTAINTY :

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

Certificate No. Q23081570

F3-011-04/01-12

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CONDITION OF CALIBRATION ITEM : GOOD

MEASUREMENT RESULTS : (X) without adjustment () adjustment

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

CALIBRATION DATA

CORRECTION OF PRESSURE

DUC Test point (inHg)	STD Reading (kPa)		Conversion to inHg		Correction (inHg)	
	Up	Down	Up	Down	Up	Down
0	0.00	0.00	0.0	0.0	0.0	0.0
-5	-15.07	-15.10	-4.5	-4.5	+0.5	+0.5
-10	-32.10	-32.13	-9.5	-9.5	+0.5	+0.5
-15	-49.20	-49.23	-14.5	-14.5	+0.5	+0.5
-20	-66.26	-66.26	-19.6	-19.6	+0.4	+0.4
-25	-83.30	-83.33	-24.6	-24.6	+0.4	+0.4
-30	-100.39	-100.39	-29.6	-29.6	+0.4	+0.4

Uncertainty of measurement ± 0.2 inHg

Transmitting fluid : Air.

Technical Note. Conversion factor 1 kPa ; 0.2953003 inHg

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

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

End of Certificate

Certificate No. Q23081570

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@clccalibration



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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@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 ± 3 $^{\circ}$ 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.)			y		R ²	
					1	2	3	1	2	3				
841	SKC	224-PCXR4	612669	05/04/2024	1,000	1,500	2,000	1,001	1,498	1,990	0.994x + 6.342		1.000	
842	SKC	224-PCXR4	626041	04/04/2024	1,000	1,500	2,000	1,006	1,496	1,990	0.984x + 20.844		1.000	
843	SKC	224-PCXR4	034636	04/04/2024	1,000	1,500	2,000	998	1,498	1,989	0.989x + 12.360		1.000	
844	SKC	224-PCXR8	529341	09/04/2024	1,000	1,500	2,000	1,000	1,501	2,002	1.005x - 9.213		1.000	
845	SKC	224-PCXR8	529594	04/04/2024	1,000	1,500	2,000	1,002	1,502	1,989	0.988x + 16.584		1.000	
846	SKC	224-PCXR8	566743	04/04/2024	1,000	1,500	2,000	996	1,507	2,001	1.012x - 24.724		0.999	
847	SKC	224-PCXR8	566747	08/04/2024	1,000	1,500	2,000	1,005	1,500	2,002	1.007x - 16.424		0.999	
848	SKC	224-PCXR8	566753	09/04/2024	1,000	1,500	2,000	998	1,492	1,997	0.998x - 1.157		1.000	
849	SKC	224-PCXR8	566780	08/04/2024	1,000	1,500	2,000	1,004	1,503	2,005	1.009x - 18.040		0.999	
850	SKC	224-PCXR8	500400	04/04/2024	1,000	1,500	2,000	1,003	1,495	2,003	1.000x - 1.783		1.000	
851	SKC	224-PCXR8	500363	04/04/2024	1,000	1,500	2,000	995	1,500	2,002	1.013x - 28.701		0.999	
852	SKC	224-PCXR8	093186	04/04/2024	1,000	1,500	2,000	992	1,494	1,991	0.996x + 0.116		1.000	
853	SKC	224-PCXR8	707670	08/04/2024	1,000	1,500	2,000	1,000	1,502	2,001	1.009x - 16.999		0.999	
854	SKC	224-PCXR3	509821	08/04/2024	1,000	1,500	2,000	996	1,503	2,002	1.015x - 30.009		0.999	
855	SKC	224-PCXR3	510710	05/04/2024	1,000	1,500	2,000	1,000	1,494	1,993	0.995x + 0.965		1.000	
856	SKC	224-PCXR3	511450	09/04/2024	1,000	1,500	2,000	1,004	1,499	2,000	1.002x - 4.651		1.000	
857	SKC	224-PCXR3	510798	08/04/2024	1,000	1,500	2,000	996	1,494	1,998	1.000x - 2.680		1.000	
858	SKC	224-PCXR3	509852	08/04/2024	1,000	1,500	2,000	1,002	1,501	2,000	1.006x - 16.480		0.999	
859	SKC	224-PCXR3	509862	08/04/2024	1,000	1,500	2,000	997	1,501	1,998	0.999x + 1.041		1.000	
860	SKC	224-PCXR3	512655	05/04/2024	1,000	1,500	2,000	1,005	1,507	2,003	1.003x - 4.627		1.000	
861	SKC	224-PCXR3	503915	05/04/2024	1,000	1,500	2,000	993	1,490	2,000	1.004x - 12.823		1.000	
862	SKC	224-PCXR3	505975	05/04/2024	1,000	1,500	2,000	1,001	1,495	1,997	0.995x + 2.616		1.000	
863	SKC	224-PCXR3	511432	05/04/2024	1,000	1,500	2,000	993	1,503	1,999	1.014x - 30.715		0.999	
864	SKC	224-PCXR3	508302	08/04/2024	1,000	1,500	2,000	1,000	1,493	1,987	0.988x + 13.991		1.000	
865	SKC	224-PCXR3	508310	09/04/2024	1,000	1,500	2,000	1,003	1,500	2,003	1.006x - 12.021		1.000	
866	SKC	224-PCXR3	509861	08/04/2024	1,000	1,500	2,000	1,004	1,489	1,990	0.986x + 16.775		1.000	
867	SKC	224-PCXR3	506295	04/04/2024	1,000	1,500	2,000	997	1,506	2,003	1.004x - 9.094		1.000	
868	SKC	224-PCXR3	505872	04/04/2024	1,000	1,500	2,000	1,004	1,490	1,997	0.992x + 7.829		1.000	
869	SKC	224-PCXR3	508375	04/04/2024	1,000	1,500	2,000	1,005	1,500	1,998	1.006x - 13.832		0.999	
870	SKC	224-PCXR3	510623	08/04/2024	1,000	1,500	2,000	995	1,491	1,996	1.000x - 4.938		1.000	
871	SKC	224-PCXR3	508367	09/04/2024	1,000	1,500	2,000	996	1,504	2,000	1.012x - 27.572		0.999	
872	SKC	224-PCXR3	505977	09/04/2024	1,000	1,500	2,000	1,001	1,500	1,995	0.994x + 5.791		1.000	
873	SKC	224-PCXR3	512606	04/04/2024	1,000	1,500	2,000	1,002	1,499	2,002	1.007x - 12.671		1.000	
874	SKC	224-PCXR3	505993	04/04/2024	1,000	1,500	2,000	995	1,495	1,996	1.003x - 9.967		1.000	
875	SKC	224-PCXR3	509820	05/04/2024	1,000	1,500	2,000	998	1,497	1,993	0.997x + 1.432		1.000	
876	SKC	224-PCXR3	509811	05/04/2024	1,000	1,500	2,000	992	1,497	2,000	1.008x - 17.753		1.000	
877	SKC	224-PCXR3	508301	05/04/2024	1,000	1,500	2,000	1,004	1,499	2,001	1.010x - 19.743		0.999	
878	SKC	224-PCXR3	510677	08/04/2024	1,000	1,500	2,000	997	1,505	2,001	1.013x - 27.321		0.999	
879	SKC	224-PCXR3	510920	09/04/2024	1,000	1,500	2,000	995	1,495	1,993	1.000x - 4.702		1.000	

Calibrated by :

(Mr. Adul Dangkiro)

Approved by :

(Mr. Peera Detudom)



บริษัท เอส.พี.เอส. คอนซัลติ้ง เซอร์วิส จำกัด

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



7 ซอยพหลโยธิน 24 ถนนพหลโยธิน แขวงจตุจักร กรุงเทพมหานคร 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	
R01	SKC	224-PCR4	602467	04/04/2024	1,000	1,500	2,000	994	1,506	2,006	1.009x - 15.012	1.000	
R02	SKC	224-PCR4	626450	04/04/2024	1,000	2,000	3,000	999	1,497	1,989	0.988x + 13.944	1.000	
R03	SKC	224-PCR4	691592	09/04/2024	1,000	1,500	2,000	1,006	1,498	2,005	1.011x - 20.963	0.999	
R04	SKC	224-PCR4	691672	02/04/2024	1,000	1,500	2,000	998	1,491	1,995	0.996x + 0.630	1.000	
R05	SKC	224-PCR4	798470	04/04/2024	1,000	1,500	2,000	995	1,508	1,998	1.010x - 23.496	0.999	
R06	SKC	224-PCR4	798456	05/04/2024	1,000	1,500	2,000	998	1,500	1,997	1.001x - 5.085	1.000	
R07	SKC	224-PCR4	798480	02/04/2024	1,000	1,500	2,000	996	1,491	2,002	1.009x - 17.230	1.000	
R08	SKC	224-PCR4	883215	04/04/2024	1,000	1,500	2,000	1,010	1,502	2,007	1.001x + 0.255	1.000	
R09	SKC	224-PCR4	034650	05/04/2024	1,000	1,500	2,000	994	1,503	2,003	1.017x - 34.105	0.999	
R10	SKC	224-PCR4	091765	05/04/2024	1,000	1,500	2,000	998	1,497	1,996	1.001x - 3.929	1.000	
R11	SKC	224-PCR4	091763	05/04/2024	1,000	1,500	2,000	1,001	1,501	2,001	1.010x - 21.251	0.999	
R12	SKC	224-PCR4	091568	04/04/2024	1,000	1,500	2,000	997	1,500	2,002	1.004x - 9.014	1.000	
R13	SKC	224-PCR4	091638	08/04/2024	1,000	1,500	2,000	1,003	1,503	1,993	0.990x + 13.944	1.000	
R14	SKC	224-PCR4	091764	09/04/2024	1,000	1,500	2,000	995	1,501	1,998	1.013x - 27.899	0.999	
R15	SKC	224-PCR8	529457	04/04/2024	1,000	1,500	2,000	1,002	1,501	2,003	1.005x - 8.870	1.000	
R16	SKC	224-PCR8	529643	08/04/2024	1,000	1,500	2,000	999	1,497	1,995	1.000x - 4.367	1.000	
R17	SKC	224-PCR8	529645	04/04/2024	1,000	1,500	2,000	997	1,507	2,003	1.012x - 23.233	0.999	
R18	SKC	224-PCR8	566756	08/04/2024	1,000	1,500	2,000	992	1,499	1,999	1.002x - 7.159	1.000	
R19	SKC	224-PCR8	566802	04/04/2024	1,000	1,500	2,000	1,002	1,497	2,002	1.011x - 21.211	0.999	
R20	SKC	224-PCR8	529089	08/04/2024	1,000	1,500	2,000	994	1,501	2,004	1.013x - 24.274	1.000	
R21	SKC	224-PCR8	665728	04/04/2024	1,000	1,500	2,000	1,000	1,496	1,998	0.999x - 1.264	1.000	
R22	SKC	224-PCR8	707444	04/04/2024	1,000	1,500	2,000	1,001	1,501	2,004	1.006x - 10.948	1.000	
R23	SKC	224-PCR8	761067	04/04/2024	1,000	1,500	2,000	997	1,493	1,992	0.994x + 2.840	1.000	
R24	SKC	224-PCR8	707893	02/04/2024	1,000	1,500	2,000	997	1,507	1,998	1.006x - 14.466	0.999	
R25	SKC	224-PCR8	761052	09/04/2024	1,000	1,500	2,000	1,009	1,494	1,996	0.987x + 17.592	1.000	
R26	SKC	224-PCR8	707956	08/04/2024	1,000	1,500	2,000	1,003	1,500	2,004	1.009x - 15.934	0.999	
R27	SKC	224-PCR8	707398	09/04/2024	1,000	1,500	2,000	995	1,502	2,003	1.008x - 17.956	1.000	
R28	SKC	224-PCR8	707481	09/04/2024	1,000	1,500	2,000	1,003	1,500	2,003	1.012x - 22.471	0.999	
R29	SKC	224-PCR8	707402	08/04/2024	1,000	1,500	2,000	1,005	1,495	1,992	0.987x + 16.057	1.000	
R30	SKC	224-PCR8	093811	09/04/2024	1,000	1,500	2,000	999	1,494	1,995	0.997x + 0.921	1.000	
R31	SKC	224-PCR8	093183	04/04/2024	1,000	1,500	2,000	1,002	1,504	2,001	1.001x - 1.723	1.000	
R32	SKC	224-PCR8	671950	09/04/2024	1,000	1,500	2,000	999	1,502	1,996	0.997x + 3.418	1.000	
R33	SKC	224-PCR4	626254	04/04/2024	1,000	1,500	2,000	996	1,499	2,001	1.010x - 22.367	0.999	
R34	SKC	224-PCR4	626131	04/04/2024	1,000	1,500	2,000	1,000	1,501	2,005	1.008x - 14.071	1.000	
R35	SKC	224-PCR8	707460	08/04/2024	1,000	1,500	2,000	996	1,496	1,996	0.997x + 1.671	1.000	
R36	SKC	224-PCR8	707446	02/04/2024	1,000	1,500	2,000	1,002	1,499	2,000	1.010x - 20.385	0.999	
R37	SKC	224-PCR8	707432	04/04/2024	1,000	1,500	2,000	998	1,497	1,999	0.997x + 1.683	1.000	
R38	SKC	224-PCR8	707349	04/04/2024	1,000	1,500	2,000	999	1,499	2,000	1.000x - 3.701	1.000	
R39	SKC	224-PCR8	761095	09/04/2024	1,000	1,500	2,000	1,002	1,496	1,993	0.996x + 2.987	1.000	

Calibrated by : 	Approved by : 
(Mr. Adul Dangklom)	(Mr. Peera Detadorn)



บริษัท เอส.พี.เอส. คอนซัลติ้ง เซอร์วิส จำกัด

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

7 ซอยพหลโยธิน 24 ถนนพหลโยธิน แขวงจตุจักร กรุงเทพมหานคร 10900

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

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

Rotameter Calibration Report (For Personal Pump High Flow Adjust)		
Calibration Method : Dry Cal Primary Flowmeter	Model : Defender 510-H	S/N : 136164

Calibration Data											
Rotameter Data			Calibration Data								
No.	Brand	Model	Date	Flow Rate (mL/min)						Value From Calibration Curve	
				Flow Rate (Reading)			Actual (Q std.)				
				1	2	3	1	2	3	y	R ²
H-R01	Dwyer	VFB-65	02/04/2024	500	1,000	2,000	502.7	995.4	1981.1	0.999x - 2.801	0.999
H-R02	Dwyer	VFB-65	04/04/2024	500	1,000	2,000	501.2	1000.7	1990.7	1.000x - 1.869	1.000
H-R03	Dwyer	VFB-65	09/04/2024	500	1,000	2,000	502.1	993.7	1998.1	0.992x + 5.811	1.000
H-R04	Dwyer	VFB-65	08/04/2024	500	1,000	2,000	497.2	993.8	2015.1	1.006x - 10.146	1.000
H-R05	Dwyer	VFB-65	05/04/2024	500	1,000	2,000	500.1	995.3	1991.1	1.001x - 3.418	1.000
H-R06	Dwyer	VFB-65	05/04/2024	500	1,000	2,000	503.6	996.6	1984.2	1.000x - 2.517	0.999

Calibrated by : 	Approved by : 
(Mr. Adul Dangklom)	(Mr. Peera Detadorn)



CERTIFICATE No : 24M2227
REFERENCE No : 72448-1

PAGE : 1 OF 2

Certificate of Calibration

EQUIPMENT : DIGITAL BALANCE
MANUFACTURER : METTLER TOLEDO
MODEL : XS105DU
SERIAL No : 1126422905
ID No : BA05/50
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 : 08-Mar-24

APPROVED BY : PONGSAK J.

ISSUED DATE : 14-Mar-24

RECEIVED DATE : 08-Mar-24

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

F-G010 REV 03



CERTIFICATE No : 24M2227

PAGE : 2 OF 2

Calibration Report

EQUIPMENT : DIGITAL BALANCE MODEL : XS105DU
MANUFACTURER : METTLER TOLEDO S/N : 1126422905
ID No : BA05/50 RECEIVED DATE : 08-Mar-24
AIR PRESSURE : 1010mbar \pm 1mbar CALIBRATION DATE : 08-Mar-24
AMBIENT TEMPERATURE : 25° C \pm 1° C RELATIVE HUMIDITY : 53 %RH \pm 10 % RH

CONDITION OF THIS RESULTS OF CALIBRATION

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

INSTRUMENT	MODEL	SERIAL No	CERTIFICATE No	DUE DATE
1) STANDARD WEIGHT SET	E2	QK-I-151	M2302013S	02-Feb-25
2) STANDARD WEIGHT	E2	15843	M2302014S	02-Feb-25

3. THE CERTIFICATE IS VALID FOR THE ITEM CALIBRATED AS SHOWN ON THE 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:-

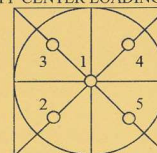
- NATIONAL INSTITUTE OF METROLOGY (THAILAND) THROUGH CENTRAL BUREAU OF WEIGHTS&MEASURES

RESULT OF CALIBRATION :- WITHOUT ADJUSTMENT

1. ZERO SETTING FUNCTION : NORMAL
2. TARE FUNCTION : NORMAL
3. REPEATABILITY OF READING AT 200 g WAS 0.000055 g
4. DEPARTURE FROM NOMINAL VALUE/ LINEARITY

NOMINAL VALUE (g)	BALANCE READING (g)	CORRECTION (g)	UNCERTAINTY (\pm g)
0.00	0.00000	0.00000	0.000065
0.02	0.02001	-0.00001	0.000065
0.10	0.10002	-0.00002	0.000066
0.20	0.20001	-0.00001	0.000066
0.50	0.50001	-0.00001	0.000065
1.00	1.00003	-0.00003	0.000066
2.00	2.00001	-0.00001	0.000067
5.00	5.00001	-0.00001	0.000068
10.00	9.99994	0.00006	0.000070
20.00	20.00008	-0.00008	0.000078
50.00	50.00000	0.00000	0.00013
100.00	100.0001	-0.0001	0.00019
120.00	120.0001	-0.0001	0.00022

5. OFF CENTER LOADING ERROR



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

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

END OF CALIBRATION REPORT

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. : SP23016

Pages : 1 of 3

Calibration Certificate

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

Condition As Found : GOOD

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

Location : ORGANIC LABORATORY IV

Ambient Temperature : (25.0 ± 5) °C
Relative Humidity : (48.4 ± 25) %

Received Date : 30 AUGUST 2023
Calibration Date : 30 AUGUST 2023
Date of Issue : 31 AUGUST 2023

Calibrated by : Nathakorn Pisutpaisan

Approved by : (Thanakul Petchurai)

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

SITHIPORN
associates

SITHIPORN ASSOCIATES CO.,LTD.
CALIBRATION LABORATORY

Continuation of Calibration Certificate

Cert. No. : SP23016

Job No. : VC66SP0014

Pages : 2 of 3

Calibration Method :

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

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

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

Condition of this result of calibration :

1. Certified reference materials

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

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

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

3.1 The UK National Physical Laboratory (NPL)

3.2 The National Institute of Standards and Technology,NIST.

Result of calibration : Wavelength Accuracy

(Without adjustment)

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	361.3	0.05	0.16	2.00
	467.82	468.0	0.18	0.16	2.00
	536.56	536.6	0.04	0.16	2.00
	640.50	640.4	-0.10	0.16	2.00
RM-DL	740.09	740.0	-0.09	0.16	2.00
	864.94	865.0	0.06	0.16	2.00

UUC* = Unit Under Calibration

Continuation of Calibration Certificate

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

Result of calibration : Photometric Accuracy

(Without adjustment)

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

UUC* = Unit Under Calibration

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

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

Measurement Mode Wavelength, Absorbance
Wavelength Scan 1100 nm-190 nm
Scanning Speed 7.5 nm/min
Data Pitch 0.1 nm
Band width(Wavelength) 1.0 nm
Band width(Vis) 1.0 nm
Band width(Uv) 1.0 nm

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

**Specific Acceptance :
Transmission ≤ 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



บริษัท เอส.พี.เอส. คอนซัลติ้ง เซอร์วิส จำกัด
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7 ซอยพหลโยธิน 24 แขวงจตุจักร เขตจตุจักร กรุงเทพฯ 10900
Tel : (662) 939-4370-72, Fax : (662) 513-4221, E-mail : sales@spsc.com, www.spsc.com

Calibration Report			
Non-Dispersive Infrared CO Analyzer			
Date :	09 May 2024	Brand :	API
No.	CO-R02	Model :	300E
		Serial No.	171-S
Calibrator (Dilution System)			
Brand :	API	Model :	700
Last Cal. Date :	08 August 2023	Serial No. :	911
Reference Standard Gas			
Standard Gas :	Carbon Monoxide (CO)	Cylinder No. :	D711839
Certified Date :	14 March 2024	Expired Date :	14 March 2032
		Cylinder Conc. :	4.580 ppm
Calibrating Condition			
Pressure :	1011 mmbar	Temp. :	24.5 °C
		% RH :	48
Calibration Setting			
Span	Initial Reading (Before Adj.), PPM		Final Reading (After Adj.), PPM
Set Point	Expected Concentration	Analyzer Response	%Diff
Zero	0	-0.10	-
CO Span	40.00	40.05	0.125
			40.00
API Model 300E CO Analyzer Check List			
Parameter	Observed Value	Units	Nominal Range
Range	50	PPM	0-1000 ppm
Stability	0.10	PPM	± 1 ppm With Zero Air
CO Measure	4016.2	mV	2500-4800 mV
CO Reference	3948.8	mV	2500-4800 mV
Measure/Reference Ratio	1.180	-	1.1-1.3 W/Zero Air
Sample Pressure	28.5	In-Hg-A	~2" ± Ambient Absolute Pressure
Sample Flow	808	CC/Min	800 ± 10%
Sample Temperature	48.4	°C	48 ± 4
Bench Temperature	48.2	°C	48 ± 2
Wheel Temperature	68.3	°C	68 ± 2
Box Temperature	30.8	°C	Ambient Temp + 7 ± 10
Photo-Drive	3045.7	mV	250 mV to 4750 mV
Slope	1.017	-	1.0 ± 0.3
Offset	0.2	-	0 ± 0.3

Calibrated by :

(Mr. Abdul Dangklom)

Approved by :

(Mr. Peera Detudom)



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7 Soi Phaholyothin Rd., Jompol, Chatuchak, Bangkok 10900
Tel : (062) 939-4370-72, Fax : (662) 513-4221, E-mail : sales@spscon.com, www.spscon.com

Calibration Report			
Non-Dispersive Infrared CO Analyzer			
Date :	09 May 2024	Brand :	API
No.	CO-R03	Model :	300E
		Serial No.	1352
Calibrator (Dilution System)			
Brand :	API	Model :	700
Last Cal. Date :	08 August 2023	Serial No. :	911
Reference Standard Gas			
Standard Gas :	Carbon Monoxide (CO)	Cylinder No. :	D711839
Certified Date :	14 March 2024	Expired Date :	14 March 2032
		Cylinder Conc. :	4,580 ppm
Calibrating Condition			
Pressure	1011 mmbar	Temp.	24.5 °C
		% RH	48
Calibration Setting			
Span	Initial Reading (Before Adj.), PPM		Final Reading (After Adj.), PPM
Set Point	Expected Concentration	Analyzer Response	% Dif
Zero	0	0.11	-
CO Span	40.00	40.07	0.175
			40.00
API Model 300E CO Analyzer Check List			
Parameter	Observed Value	Units	Nominal Range
Range	50	PPM	0-1000 ppm
Stability	0.10	PPM	± 1 ppm With Zero Air
CO Measure	4015.6	mV	2500-4800 mV
CO Reference	3947.3	mV	2500-4800 mV
Measure/Reference Ratio	1.180	-	1.1-1.3 W/Zero Air
Sample Pressure	28.6	In-Hg-A	~2"± Ambient Absolute Pressure
Sample Flow	807	CC/Min	800 ± 10%
Sample Temperature	48.5	°C	48 ± 4
Bench Temperature	48.2	°C	48 ± 2
Wheel Temperature	68.4	°C	68 ± 2
Box Temperature	30.9	°C	Ambient Temp + 7 ± 10
Photo-Drive	3048.5	mV	250 mV to 4750 mV
Slope	1.017	-	1.0 ± 0.3
Offset	0.2	-	0 ± 0.3

Calibrated by :

(Mr. Abdul Dangklom)

Approved by :

(Mr. Peera Detudom)



MAINTENANCE AND TEST CERTIFICATE MODEL OPTIMA 5300DV

Customer : S.P.S. Consulting Service Co., Ltd. Date Tested: January 4, 2024
Recommendation Recertification
Address : 7 Soi Phaholyothin 24 Period 6 Months
Paholyothin Road Recertification Due: July 4, 2024
Jompol Chatuchak, Bangkok 10900 Date Last Certified: July 6, 2023
User Name: K. Phenpha Vipphasthawit Visit Number: 2 of 2
Phone: 083-9269252 PerkinElmer Phone: 02-719-6420 ext 206
Fax: 02-513-4221 PerkinElmer Fax: 02-318-5597

CONFIGURATION TESTED

MODEL

OPTIMA 5300DV

SERIAL NUMBER

077C7042401

ACCESSORIES/COMPONENT NOT INCLUDED

TESTED EQUIPMENT

IPV Methods

CALIBRATION NUMBER

EXPIRATION

TEST STANDARD USED

Multielement Standard

Wavecal Solution

VIS Wavecal solution

Instrument Cal. STD4

CUSTOMER SUPPLIED

2 % HNO₃

10 % HNO₃

PART NUMBER

N069-1579

N058-2152

N930-2946

N930-0221

COMMENTS

EXPIRATION DATE

December 30, 2024

March 30, 2024

February 28, 2024

November 30, 2024

CUSTOMER INITIALS



MAINTENANCE AND TEST CERTIFICATE MODEL OPTIMA 5300DV

SERIAL NUMBER	<u>077C7042401</u>	DATE TESTED	<u>January 4, 2024</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"/>		



MAINTENANCE AND TEST CERTIFICATE MODEL OPTIMA 5300DV

SERIAL NUMBER :		<u>077C7042401</u>		DATE TESTED :		<u>January 4, 2024</u>	
PARAMETER	SPECIFICATION			FINAL VALUE			
Spectral Resolution : UV	As	193.696 nm	≤ 0.007	0.00529			
	Ni	231.604 nm	≤ 0.008	0.00672			
	Ni	341.476 nm	≤ 0.012	0.00793			
Spectral Resolution : VIS	La	408.672 nm	≤ 0.020	0.01588			
	Ba	455.403 nm	≤ 0.025	0.02280			
Precision	As	193.656 nm	% RSD < 1.0	0.92		%	
	Zn	213.856 nm	% RSD < 1.0	0.95		%	
	Mn	257.610 nm	% RSD < 1.0	0.75		%	
	La	379.478 nm	% RSD < 1.0	0.44		%	
	Ba	455.403 nm	% RSD < 1.0	0.46		%	
	Ba	493.408 nm	% RSD < 1.0	0.37		%	
Detection Limits : Axial	Tl	190.080 nm	3(sd)	19.99		ppb	
	As	193.696 nm	3(sd)	26.66		ppb	
	Pb	220.353 nm	3(sd)	1.81		ppb	
Detection Limits : Radial	As	193.696 nm	3(sd)	38.21		ppb	
	Zn	213.856 nm	3(sd)	2.48		ppb	
	Mn	257.610 nm	3(sd)	0.59		ppb	
	La	379.478 nm	3(sd)	5.52		ppb	
	Ba	455.403 nm	3(sd)	0.13		ppb	
	Ba	493.408 nm	3(sd)	1.08		ppb	
BEC : Axial (IB X 500)/(IS-IB)	Cd	226.502 nm	≤ 150 ppb	141.47			
BEC : Radial (IB X 1000)/(IS-IB)	Mn	257.610 nm	≤ 45 ppb	29.04			

SERIAL NUMBER 077C7042401	DATE TESTED January 4, 2024
Remarks : <div style="border: 1px solid black; height: 150px; margin-top: 10px;"></div>	
<p>This is to certify that the above tests have been performed and the configuration tested</p> <div style="display: flex; align-items: center; margin: 10px 0;"> <input checked="checked" style="width: 30px; height: 30px; margin-right: 10px;" type="checkbox"/> meets </div> <div style="display: flex; align-items: center; margin: 10px 0;"> <input style="width: 30px; height: 30px; margin-right: 10px;" type="checkbox"/> does not meet </div> <p>the PerkinElmer Specifications listed on this certificate.</p> <p>This certificate does not modify PerkinElmer's standard terms and condition of sale, including warranty terms.</p> <div style="text-align: center; margin-top: 20px;"> Service Department PerkinElmer Ltd. <div style="background-color: black; width: 200px; height: 60px; margin: 0 auto;"></div> </div>	
Authorized Representative: _____ <div style="background-color: black; width: 200px; height: 40px; margin: 0 auto;"></div>	
_____ Service Engineer	

Component List

Component / Specific Model	Serial #	Configuration Notes

Parts Lists

Parts Included with the PM		
Part Number (if applicable)	Description	Quantity
B0501696	Fan Filters	1
B3002013	THGA Contact Cylinders	1
B3141064	Glycerol for THGA Cooling	N/A
N3160156	O-Ring Kits for Sampling Introduction (Stainless Steels Nebulizer)	N/A
N3160157	O-Ring Kits for Sampling Introduction (Plastic Nebulizer)	1
N9301714	Replacement Acetylene Filter Cartridge	1
TH001022	Replacement Air Filter Cartridge	1

Additional Reagents and Standards Required for PM				
Part Number (if applicable)	Description	Quality	Batch/Lot #	Expired Date (MM/YY)
N9300183	1000 mg/L Copper Standard	AR	26-87CYUY1	30-Jan-2024
N9300244	GFAAS Mixed Standard	AR	58-142CRY1	30-Oct-2024

Additional Reagents and Standards Required for PM (Customer Support Solution)				
Part Number (if applicable)	Description	Quantity	Batch/Lot #	Expiration Date (MM/YY)
N/A	DI Water	250 ml.	AR	AR
N/A	0.5% HNO ₃	250 ml.	AR	AR

Additional Tools Required for PM			
Part Number (if applicable)	Description	Quantity	Serial #
N1013000	0.2A Neutral density filter	1	MG0-252
N1013002	1.0A Neutral density filter	1	MG2-358
B3100652 Or N9307029	Electronic Flow Meter	1	N/A
B0505495	Test Jig	1	N/A
03030997	System 2 EDL Driver	1	03030997
N3050605	As System 2 EDL	1	16148
N3050121	Cu Lumina HCL	1	092216-010130
N3050109	Ba Lumina HCL	1	1-2416--040160
N3050139	K Lumina HCL	1	110716-010060
N3050152	Ni Lumina HCL	1	100516-030190
N3050119	Cr Lumina HCL	1	091911-020150

Procedure Checklist

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

1. General:

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

2. PC Instrument Software:

- ☒ Instrument Software user files/databases archived, packed, and/or deleted as needed.

3. Mechanical:

- ☒ Inspect and clean all fans and filters. Replace filters if necessary
- ☐ Inspect all gas and water lines for leaks and/or wear. Replace if needed. Thoroughly inspect all quick connects. Replace the Y connector, P/N 09921079, if needed.
- ☒ Clean exterior of the instrument.

3.1 Flame Technique

- ☒ Inspect the burner head, burner chamber, and nebulizer. Clean if needed as stated in the Hardware Guide.
- ☒ Check burner head dimensions with the feeler gauge as stated in the Hardware Guide in the Maintenance chapter section on cleaning the burner head and checking slot width. Replace if out of specification
- ☒ Check the condition of the end cap, burner head, and nebulizer O-rings. Replace if necessary.
- ☒ Check the drain system for signs of wear. Replace worn or damaged parts.
- ☒ Visually check for proper flame conditions when igniting the Air-C₂H₂ and N₂O-C₂H₂ flames (if applicable).

3.2 THGA Technique

- ☒ Inspect the pole pieces and clean where the pole pieces contact the furnace. Replace the pole piece p-rings as needed, P/N's B0501018 & B0501250. Grease the O-rings as needed with Apiezon L grease, P/N 09905148
- ☒ Inspect the four insulation pads on the front contact housing of the THGA in furnace. If the pads are missing replace the THGA furnace or replace the insulator pads on the furnace.
- ☒ Inspect the graphite tube and clean the contact cylinders. Replace if necessary.
- ☒ Check internal and external gas flows with the Electronic Gas Flow Meter and the Gas Flow Test Probe as described in the Service Manual. Correct if necessary.
- ☒ Check furnace open/close function.
- ☒ Verify the operation of the GFTV Camera for proper operation and viewing alignment in the furnace camera Tube View window. Align if needed.
- ☒ Check the operation of the Halogen Light ASSY for the GFTV Camera. Replace if needed.
- ☒ Check the water level/quality in the recirculation (if applicable). Add distilled water if necessary.
- ☒ Check the cooling system fluid flow rate with the FCS In-Line Flow Meter for proper levels if needed. Refer to SDB# COSY008.STN

- ☒ Perform Cooling System maintenance if needed per SDB# COSY005.STN.
- ☒ Check auto sampler operation.
- ☒ Perform an auto sampler check valve test as described in the Service Manual.
- ☒ Lubricate the spindles of the auto sampler pumps and all moving parts of the tray mechanics as described in the Service Manual.
- ☒ Inspect the auto sampler sampling capillary as described in the Service Manual. Replace if necessary.

4. Electrical:

- ☒ Inspect PC boards. Clean if necessary.
- ☒ Carefully check all internal and external cable connections.
- ☒ Check instrument firmware revisions upgrade to current levels (if necessary)
- ☒ Run Diagnostics Test within the Advanced function of the Spectrometer page. Check the results in the service log folder in the Spectrometer BM Log Viewer.

5. Optics:

- ☒ Inspect and clean the sample compartment windows, if needed.
- ☒ Inspect and clean the furnace windows, if needed.
- ☒ Inspect and clean the GFTV camera lens, if needed.
- ☒ Inspect optics. Clean or replace if necessary,

6. Gasses:

- ☐ Verify that the Gasses supplied to the instrument are within the pressure and purity specifications found in the PinAAcle 900 Series Pre-installation Checklist SDB.
- ☐ Verify that the air filter element is dry. Replace if necessary.

7. Flame Interlock Check:

Description: Check to ensure that all safety interlocks are closed.

Parameter	Specification	Test Results	Pass/Fail
Flame Sensor	Air/C ₂ H ₂ Flame correctly shuts down	Active	Passed
Drain Sensor	Air/C ₂ H ₂ Flame correctly shuts down	Active	Passed
Nebulizer Sensor	Air/C ₂ H ₂ Flame correctly shuts down	Active	Passed
C ₂ H ₂ Pressure Sensor	Air/C ₂ H ₂ Flame correctly shuts down	Active	Passed
Air Pressure Sensor	Air/C ₂ H ₂ Flame correctly shuts down	Active	Passed
Burner Head Sensor	Choosing Nitrous Oxide as the oxidant should trigger an interlock shuts down	Active	Passed

8. After PM Performance tests [Flame]:

8.1 Detector Linearity with Barium

Description: Ensures that the detector is linear in the Visible Range.

Parameter	Specification	Certificate Value at 553.6 nm (Abs.)	Test Results	Pass/Fail
1.0 A ND Filter	± 5% from Cert.		0.1789	Passed
0.2 A ND Filter	± 5% from Cert.		1.0186	Passed

8.2 Baseline Noise at 1.0 Absorbance with Barium

Description: Ensures that a high absorbance will not produce excessive noise.

Parameter	Specification	Results	Pass/Fail
Standard Deviation	≤ 0.010	0.0017	Passed

8.3 AA Baseline Noise with Copper

Description: Check baseline noise.

Parameter	Specification	Results	Pass/Fail
Standard Deviation	≤ 0.001	0.0001	Passed

8.4 D₂ Background Compensation with Copper

Description: Verifies the instruments ability to compensate for Background absorption.

Parameter	Specification	Results	Pass/Fail
Standard Deviation	≤ 0.010	0.0084	Passed

8.5 AA-BG Baseline Noise with Copper

Description: Ensures that background correction does not produce excessive noise.

Parameter	Specification	Results	Pass/Fail
Standard Deviation	≤ 0.005	0.0004	Passed

8.6 AA-BG Baseline Noise with Arsenic

Description: Ensures that background correction does not produce excessive noise at a low wavelength.

Parameter	Specification	Results	Pass/Fail
Standard Deviation	≤ 0.005	0.0013	Passed

8.7 Flame Sensitivity

Description: Instrument Sensitivity checked against Copper standard.

Standard Copper Sensitivity	Specification	Results (Abs.)	Pass/Fail
5 mg/L Sensitivity SS Neb (if applicable)	> 0.250 Abs.	N/A	Not Applicable
2 mg/L Sensitivity HS Neb (if applicable)	> 0.250 Abs.	0.4241	Passed

9. After PM Performance tests [THGA]:

9.1 Furnace Gas Flows

Description: Ensures the flow rates are within specification.

Parameter	Specification	Test Results	Pass/Fail
Internal Flow Rate	250 mL/min ± 25 mL/min	251	Passed
External Flow Rate	100 mL/min ± 10 mL/min	102	Passed

9.2 Chromium Baseline Noise

Description: Signal to noise check.

Parameter	Specification	Results	Pass/Fail
Baseline Noise	≤ 0.005 Abs.	0.0008	Passed
Standard Deviation	≤ 0.005	0.0003	Passed

9.3 Chromium Characteristic Mass and Precision

Description: Calculate the characteristic mass using the characteristic mass tool and precision from the integrated absorbance values.

Parameter	Specification	Results	Pass/Fail
Cr m ₀ Results	≤ 7.0 pg/0.0044 A-s	6.2	Passed
Precision	≤ 2.0 %	0.61	Passed

9.4 Copper Characteristic Mass and Zeeman Ratio

Description: Calculate the characteristic mass using the characteristic mass tool and check the Zeeman Ratio.

Parameter	Specification	Results	Pass/Fail
Cu m ₀ Result	≤ 16.5 pg/0.0044 A-s	13.6	Passed
Zeeman Ratio	0.52 ± 0.04	0.544	Passed

10. Review:

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

Additional Comments

Additional Comments Regarding the PM

Zeeman Ratio

=

Atomic Signal (Peak area)

Atomic Signal (Peak area) + Background Signal (Peak area)

=

0.1602

0.2940

=

0.544



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.

ARCHEMICA LAB
บริษัท อาร์เคมีกา แล็บ จำกัด

Operator Signature

Date : Jul 3, 2023

(Mr.Nutdanai Laekhwan)

Applications Chemist

คุณภาพน้ำ

**QUALITY CALIBRATION CO.,LTD.**

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



CERTIFICATE No : 23E8494
REFERENCE No : 70413-1

PAGE : 1 OF 3

Certificate of Calibration

EQUIPMENT : pH METER
MANUFACTURER : HANNA
MODEL : HI 3512
SERIAL No : TH118035
ID No : pH04/56
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 : 06-Sep-23

APPROVED BY : PONGSAK J.

ISSUED DATE : 06-Sep-23

RECEIVED DATE : 31-Aug-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 03

**QUALITY CALIBRATION CO.,LTD.**

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

CERTIFICATE No : 23E8494

PAGE : 2 OF 3

Calibration Report

EQUIPMENT : pH METER
MANUFACTURER : HANNA
ID No : pH04/56
RECEIVED DATE : 31-Aug-23
AMBIENT TEMPERATURE : 23 ° C ± 3 ° C
MODEL : HI 3512
SERIAL NUMBER : TH118035
CALIBRATION DATE : 06-Sep-23
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 ELECTROD WAS CALIBRATED BY USING STANDARD pH BUFFER
- REFERENCE STANDARD INSTRUMENTS :-

<u>INSTRUMENT</u>	<u>MODEL</u>	<u>SERIAL No/ LOT No</u>	<u>CERTIFICATE No</u>	<u>DUE DATE</u>
1) pH STANDARD SOLUTION	00651-06	CC767907	4880-13836406	29-Dec-24
2) pH STANDARD SOLUTION	00651-08	CC765602	4881-13757019	18-Nov-24
3) pH STANDARD SOLUTION	00651-10	CC767180	4882-13813369	14-Dec-24
4) PROCESS CALIBRATOR	CA150	91S6079	23E1312	19-Apr-24
5) BATH	260014	1247 48074	22T9870	13-Sep-23
6) THERMOMETER WITH PROBE	421504	55000379	22T9904	13-Sep-23

- THE CERTIFICATE IS VALID FOR THE ITEM CALIBRATED AS SHOWN ON THE 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**1. DISPLAY UNIT ONLY**

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

mV APPLIED	UUC READING (mV)	CORRECTION (mV)	UUC READING (pH)	UNCERTAINTY OF MEASUREMENT (± mV)	COVERAGE FACTOR k
414.11	414.6	-0.49	-0.290	0.15	2.00
354.95	355.4	-0.45	0.741	0.15	2.00
295.80	296.3	-0.50	1.773	0.15	2.00
236.64	237.1	-0.46	2.804	0.15	2.00
177.48	177.9	-0.42	3.835	0.15	2.00
118.32	118.7	-0.38	4.867	0.15	2.00
59.16	59.6	-0.44	5.898	0.15	2.00
0.00	0.4	-0.40	6.930	0.15	2.00
-59.16	-58.8	-0.36	7.961	0.15	2.00
-118.32	-117.9	-0.42	8.992	0.15	2.00
-177.48	-177.1	-0.38	10.024	0.15	2.00
-236.64	-236.3	-0.34	11.055	0.15	2.00
-295.80	-295.5	-0.30	12.087	0.15	2.00
-354.95	-354.6	-0.35	13.118	0.15	2.00
-414.11	-413.8	-0.31	14.149	0.15	2.00

END OF CALIBRATION REPORT PAGE 2 OF 3



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CERTIFICATE No : 23E8494

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
4.006	4.006	0.000	4.015	0.012	2.00
7.000	7.000	0.000	6.914	0.012	2.00
10.008	10.010	-0.002	9.996	0.014	2.00

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
25.005	25.0	0.005	---	0.0085	2.00

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

CAL

Calibratech Co.,Ltd.

7/106-7 Moo 2, Sukhaprachasan 3 Rd., Bangpood, Pakkred, Nonthaburi 11120

Tel.(02) 964-6211 Fax.(02) 964-5155, e-mail : calibratech.cal@yahoo.com, calibratech.cal@hotmail.com



Certificate of Calibration

Certificate No. : 66-400065-2

Page : 1 of 2

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

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

Equipment : Liquid in Glass Thermometer

Manufacturer : SK

Model : N/A

Range : 0 $^{\circ}$ C to 100 $^{\circ}$ C

Resolution : 1 $^{\circ}$ C

Serial No. : N/A

Immersion : Total

ID No. : TM21/59

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

Relative Humidity : (50 \pm 15) %

Line Voltage : (220 \pm 22) VAC

Date of Received : 01 February 2023

Date of Calibration : 06 February 2023

Date of Issue : 06 February 2023

Calibrated by : Chortip Samchusri

Calibration Method : This instrument was calibrated by In-house method comparison technique CAL-M4001 based on ASTM E77-07 by compared with PRT in the liquid bath at the constant controlled temperature.

The temperature scale used was based on ITS-90

Reference Standard Instruments : This certification is traceable to the International System of Units

1. Platinum Resistance Thermometer (PRT)

ID No.	Cert. No.	Due Date	Traceability
400001	TT-0016-22	07 Feb 2024	National Institute of Metrology Thailand (NIMT)

2. Standard Digital Thermometer

ID No.	Cert. No.	Due Date	Traceability
400003	21E1850	14 Jun 2023	National Institute of Metrology Thailand (NIMT)
400004	21E1850	14 Jun 2023	National Institute of Metrology Thailand (NIMT)

Approved by :

(Bunjerd Masri)

Supervisor

The Uncertainties are for a confidence probability of approximately 95%

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CAL-F0031-03



Certificate of Calibration

Certificate No. : 66-400065-2

Page : 2 of 2

Result of Calibration : Without Adjustment

UUC Condition As-Received : Good

Function : Temperature measurement

Ice point check : UUC* reading 0 °C Standard reading 0.3606 °C

Standard Reading (°C)	UUC Reading (°C)	Correction (°C)	Uncertainty (± °C)
20.3607	20	0.4	0.31

Remark

UUC : Unit Under Calibration

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

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

-o0o-

Certificate of Calibration

Certificate No. : 67-400037-2

Page : 1 of 2

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

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

Equipment : Liquid in Glass Thermometer

Manufacturer : SK

Model : N/A

Range : 0 °C to 100 °C

Resolution : 1 °C

Serial No. : N/A

Immersion : Total

ID No. : TM21/59

Environment : Ambient Temperature : (23 ± 2) °CRelative Humidity : (50 ± 15) %Line Voltage : (220 ± 22) VAC

Date of Received : 23 January 2024

Date of Calibration : 03 February 2024

Date of Issue : 03 February 2024

Calibrated by : Chortip Samchusri

Calibration Method : This instrument was calibrated by In-house method comparison technique CAL-M4001 based on ASTM E77-07 by compared with PRT in the liquid bath at the constant controlled temperature.

The temperature scale used was based on ITS-90

Reference Standard Instruments : This certification is traceable to the International System of Units

1. Platinum Resistance Thermometer (PRT)

ID No.	Cert. No.	Due Date	Traceability
400001	TT-0016-22	07 Feb 2024	National Institute of Metrology Thailand (NIMT)

2. Standard Digital Thermometer

ID No.	Cert. No.	Due Date	Traceability
400003	23E1866	01 Jun 2025	National Institute of Metrology Thailand (NIMT)
400004	23E1866	01 Jun 2025	National Institute of Metrology Thailand (NIMT)

Approved by

(Surachai Promthong)

Laboratory Manager

The Uncertainties are for a confidence probability of approximately 95%

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CAL

Calibratech Co.,Ltd.

7/106-7 Moo 2, Sukhaphrachasan 3 Rd., Bangpood, Pakkred, Nonthaburi 11120

Tel.(02) 964-6211 Fax.(02) 964-5155, e-mail : calibratech.cal@yahoo.com, calibratech.cal@hotmail.com

Certificate of Calibration

Page : 2 of 2

Certificate No. : 67-400037-2

Result of Calibration : Without Adjustment

UUC Condition As-Received : Good

Function : Temperature measurement

Ice point check : UUC* reading 0 °C Standard reading 0.4336 °C

Standard Reading (°C)	UUC Reading (°C)	Correction (°C)	Uncertainty (± °C)
20.5609	20	0.6	0.31

Remark

UUC : Unit Under Calibration

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

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

- 000 -



CAL-F0031-03



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

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

www.qcalibration.com



PAGE : 1 OF 2

Certificate of Calibration

EQUIPMENT : DIGITAL BALANCE

MANUFACTURER : SARTORIUS

MODEL : BSA224S-CW

SERIAL No : 36591843

ID No : BA 09/61

CONDITION AS RECEIVED : USED ITEM

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

CALIBRATED BY : ATSAWIN Y.

CALIBRATION DATE : 10-Mar-23

APPROVED BY : PONGSAK J.

ISSUED DATE : 16-Mar-23

RECEIVED DATE : 10-Mar-23

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

F-G010 REV 02

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CERTIFICATE No : 23M2442

PAGE : 2 OF 2

Calibration Report

EQUIPMENT : DIGITAL BALANCE
MANUFACTURER : SARTORIUS
ID No : BA 09/61
AIR PRESSURE : 1010mbar \pm 1mbar
AMBIENT TEMPERATURE : 23° C \pm 1° C
MODEL : BSA224S-CW
S/N : 36591843
RECEIVED DATE : 10-Mar-23
CALIBRATION DATE : 10-Mar-23
RELATIVE HUMIDITY : 49 %RH \pm 10 % RH

CONDITION OF THIS RESULTS OF CALIBRATION

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

2. REFERENCE STANDARD INSTRUMENTS :-

	INSTRUMENT	MODEL	SERIAL No	CERTIFICATE No	DUE DATE
1)	STANDARD WEIGHT SET	E2	QK-I-151	M2302013S	02-Feb-25
2)	STANDARD WEIGHT	E2	15843	M2302014S	02-Feb-25

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

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

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

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

RESULT OF CALIBRATION :- WITHOUT ADJUSTMENT

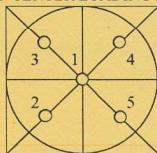
1. ZERO SETTING FUNCTION : NORMAL

2. TARE FUNCTION : NORMAL

3. REPEATABILITY OF READING AT 200 g WAS 0 g

4. DEPARTURE FROM NOMINAL VALUE/ LINEARITY

NOMINAL VALUE (g)	BALANCE READING (g)	CORRECTION (g)	UNCERTAINTY (\pm g)
0.0	0.0000	0.0000	0.000058
0.1	0.1000	0.0000	0.000059
0.2	0.2000	0.0000	0.000059
0.5	0.5000	0.0000	0.000060
1.0	1.0000	0.0000	0.000060
2.0	2.0000	0.0000	0.000061
5.0	5.0000	0.0000	0.000063
10.0	10.0000	0.0000	0.000067
20.0	20.0001	-0.0001	0.000073
50.0	50.0000	0.0000	0.00011
100.0	100.0001	-0.0001	0.00019
200.0	200.0000	0.0000	0.00032

5. OFF CENTER LOADING ERROR

POINT	READING (g)
1	100.0000
2	99.9999
3	99.9998
4	100.0001
5	100.0000
OFF-CENTER LOADING	0.0002

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

END OF CALIBRATION REPORT

**QUALITY CALIBRATION CO.,LTD.**235 Petchkasem 63/2 Road, Laksong, Bangkac, Bangkok 10160
Tel (662) 421-5402, (662) 444-0152-3, Fax (662) 809-4584www.qcalibration.com

CERTIFICATE No : 24M2229

REFERENCE No : 72448-3

PAGE : 1 OF 2

Certificate of Calibration

EQUIPMENT : DIGITAL BALANCE
MANUFACTURER : SARTORIUS
MODEL : BSA224S-CW
SERIAL No : 36591843
ID No : BA 09/61
CONDITION AS RECEIVED : USED ITEM
SUBMITTED BY : S.P.S. CONSULTING SERVICE CO., LTD.
7 SOI PHAHOLYOTHIN 24, PHAHOLYOTHIN RD.,
JOMPOL, CHATUCHAK, BANGKOK 10900

CALIBRATED BY : ATSAWIN Y.

CALIBRATION DATE : 08-Mar-24

APPROVED BY : PONGSAK J.

ISSUED DATE : 14-Mar-24

RECEIVED DATE : 08-Mar-24

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QUALITY CALIBRATION CO., LTD.



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

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CERTIFICATE No : 24M2229

PAGE : 2 OF 2

Calibration Report

EQUIPMENT : DIGITAL BALANCE MODEL : BSA224S-CW
MANUFACTURER : SARTORIUS S/N : 36591843
ID No : BA 09/61 RECEIVED DATE : 08-Mar-24
AIR PRESSURE : 1010mbar \pm 1mbar CALIBRATION DATE : 08-Mar-24
AMBIENT TEMPERATURE : 25° C \pm 1° C RELATIVE HUMIDITY : 55 %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. THE CERTIFICATE IS VALID FOR THE ITEM CALIBRATED AS SHOWN ON THE 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

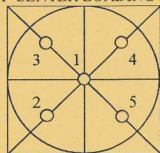
2. TARE FUNCTION : NORMAL

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)
0.0	0.0000	0.0000	0.000082
0.1	0.1000	0.0000	0.000083
0.2	0.2000	0.0000	0.000083
0.5	0.5000	0.0000	0.000083
1.0	1.0000	0.0000	0.000084
2.0	2.0000	0.0000	0.000084
5.0	5.0000	0.0000	0.000086
10.0	10.0000	0.0000	0.000089
20.0	20.0001	-0.0001	0.000094
50.0	50.0000	0.0000	0.00012
100.0	100.0001	-0.0001	0.00019
200.0	200.0000	0.0000	0.00032

5. OFF CENTER LOADING ERROR



POINT	READING (g)
1	100.0000
2	100.0000
3	100.0000
4	100.0000
5	100.0000
OFF-CENTER LOADING	0.0000

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

END OF CALIBRATION REPORT



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 = \pm 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.

Technician Signature

(Kittipong Maekwong)

Laboratory Manager

(Natenapha Pisatkunchon)

Harikul Science Co.,Ltd.

694 Soi Ratchadanivet 24, Pracharatbamphen,

Samsaennok, Huaikhwang, Bangkok 10310

Tel: 0-2274-2456 Fax: 0-2274-2443

Email: info@harikul.com www.harikul.com

Certificate of Calibration



CERT.No.: HS-V015C

Calibration Date : 20 Mar 24

Submitted by : ASIA LAB @ CONSULTANT CO.,LTD
184 Soi Phutthamonthon Sai 2 Soi 12,
Bangphai, Bangkae, Bangkok 10160

Avg Room Temp : 20 °C

Avg Water Temp : 20 °C

Air Pressure : 760.00 mmHg

Salinity : 0 ppt

Harikul Science Co.,Ltd.
694 Soi Ratchadaniwet 24, Pracharatbamphen,
Samsaennok, Huaikhwang, Bangkok 10310
Tel: 0-2274-2456 Fax: 0-2274-2443
Email: info@harikul.com www.harikul.com
Certificate of Calibration

Model : YSI 5000
S/N : 15B100751
Probe : YSI 5010
S/N : 22D100097
ID NO. : -
Air Temp ref : S/N. F8065C26
Barometric ref : S/N. F8065C26
Water Temp ref : S/N. 11430
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.

Technician Signature
(Kittipong Maekwong)

Laboratory Manager
(Supreecha Sumaritam)



QUALITY CALIBRATION CO.,LTD.

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

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

www.qcalibration.com

CERTIFICATE No : 23T0959
REFERENCE No : 68047-2

PAGE : 1 OF 3

Certificate of Calibration

EQUIPMENT : COD REACTOR
MANUFACTURER : HACH
MODEL : DRB200
SERIAL No : 15110C0235
ID No : CRB 05/59
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 : 07-Feb-23

APPROVED BY : PONGSAK J.

ISSUED DATE : 07-Feb-23

RECEIVED DATE : 31-Jan-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



QUALITY CALIBRATION CO.,LTD.

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

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

CERTIFICATE No : 23T0959

PAGE : 2 OF 2

Calibration Report

EQUIPMENT : COD REACTOR
MANUFACTURER : HACH
ID NUMBER : CRB 05/59
RECEIVED DATE : 31-Jan-23
AMBIENT TEMPERATURE : 23° C ± 1° C
MODEL : DRB200
SERIAL NUMBER : 15110C0235
CALIBRATION DATE : 07-Feb-23
RELATIVE HUMIDITY : 52 %RH ± 10 % RH

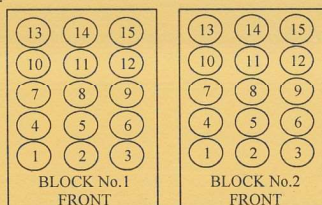
CONDITION OF THIS RESULTS OF CALIBRATION

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	2217511	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	149.4
	2	149.5
	3	149.4
	4	149.7
	5	149.4
	6	149.6
	7	149.6
	8	149.7
	9	149.7
	10	149.5
	11	149.7
	12	149.3
	13	149.5
	14	149.8
	15	149.6
Uncertainty of Measurement(± °C)	0.86	0.86

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

NOTE 2 : THIS CALIBRATION WAS CARRIED OUT AT THE CUSTOMER'S PLACE AT LABORATORY AREA.

THE REPORTED UNCERTAINTY OF MEASUREMENT WAS BASED ON A STANDARD UNCERTAINTY MULTIPLIED BY A COVERAGE FACTOR k =2, PROVIDING A LEVEL OF CONFIDENCE APPROXIMATELY 95%.

END OF CALIBRATION REPORT

F-C



QUALITY CALIBRATION CO.,LTD.

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

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

www.qcalibration.com

CERTIFICATE No : 24T0774

REFERENCE No : 71986-2

PAGE : 1 OF 2

Certificate of Calibration

EQUIPMENT : COD REACTOR
MANUFACTURER : HACH
MODEL : DRB 200
SERIAL No : 15110C0235
ID No : CRB 05/59
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 : 5-Feb-24

APPROVED BY : PONGSAK J.

ISSUED DATE : 5-Feb-24

RECEIVED DATE : 5-Feb-24

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, Bangkok, Bangkok 10160
Tel (662) 421-5402, (662) 444-0152-3, Fax (662) 809-4584

CERTIFICATE No : 24T0774

PAGE : 2 OF 2

Calibration Report

EQUIPMENT : COD REACTOR
MANUFACTURER : HACH
ID NUMBER : CRB 05/59
RECEIVED DATE : 5-Feb-24
AMBIENT TEMPERATURE : 23° C ± 1° C
MODEL : DRB 200
SERIAL NUMBER : 15110C0235
CALIBRATION DATE : 5-Feb-24
RELATIVE HUMIDITY : 52 %RH ± 10 % RH

CONDITION OF THIS RESULTS OF CALIBRATION

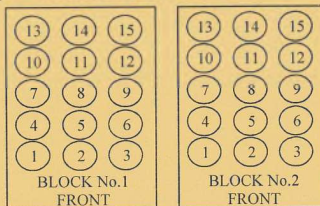
1. THIS INSTRUMENT WAS CALIBRATED BY DIRECT MEASUREMENT TEMPERATURE RECORDER WITH THERMOCOUPLE TYPE K UNDER NO LOAD CONDITION. THE THERMOCOUPLES WERE PLACED ON 15 POINTS AND LOCATED ONE THERMOCOUPLE IN EACH OF THE FOUR CORNERS OF THE REACTOR AND PLACED THE EIGHTH THERMOCOUPLE AT THE CENTER OF THE REACTOR.

2. REFERENCE STANDARD INSTRUMENTS :-

INSTRUMENT	MODEL	SERIAL No	CERTIFICATE No	DUE DATE
1) DATA LOGGER WITH TC TYPE K	HYDRA 2635A	8009008	23T6640	14-Jul-24

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	150.2
	2	150.2
	3	150.2
	4	149.9
	5	150.1
	6	150.7
	7	149.9
	8	149.9
	9	150.8
	10	149.5
	11	150.2
	12	150.0
	13	149.5
	14	149.5
	15	149.6
Uncertainty of Measurement(± °C)	0.86	0.86

NOTE 1 : THE UNCERTAINTY OF MEASUREMENT EXCLUDED TEMPERATURE UNIFORMITY OF THE CHAMBER.
NOTE 2 : THIS CALIBRATION WAS CARRIED OUT AT THE CUSTOMER'S PLACE AT LABORATORY AREA.

THE REPORTED UNCERTAINTY OF MEASUREMENT WAS BASED ON A STANDARD UNCERTAINTY MULTIPLIED BY A COVERAGE FACTOR k =2, PROVIDING A LEVEL OF CONFIDENCE APPROXIMATELY 95%.

END OF CALIBRATION REPORT

F-G010

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-02760693
Date PM Performed: (DD-MMM-YYYY)	22-Feb-2024	Next PM Due Date: (DD-MMM-YYYY)	22-Aug-2024

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	PSS,PSS,FID
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 624.
- ☒ 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	<i>monchai</i>	Date: 22-Feb-2024 (DD-MMM-YYYY)
Authorized Customer Representative:	<i>naruecha</i>	Date: 22-Feb-2024 (DD-MMM-YYYY)

ระดับเสียงในชุมชน



THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-67/0304

MTC No. EEL. BP. 109/0267

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/N4106495.

7. Condenser Microphone B&K 4180 S/N 2889871.

Ambient Environment

Temperature : (23 + 3) °C

Relative Humidity : (50 ± 15) %

Ambient Pressure : (101.325 ± 1.500) kPa

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

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

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

Date of Receipt : 22 Feb. 2024

Date of Calibration : 4 Mar. 2024

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 : rumpa@tistr.or.th Website:www.tistr.or.th

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

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



THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-67/0304

MTC No. EEL. BP. 109/0267

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 2
1/2 inch Bruel&Kjaer 4180	93.85	-0.15	± 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 Bruel&Kjaer 4180	999.9	-0.1	± 1.5	±2.0%

3. Total Distortion

Standard Microphone Type	Measured Total Distortion (%)	Uncertainty (%)	Tolerance limit IEC60942:2003 Class 2
1/2 inch Bruel&Kjaer 4180	1.65	± 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 :

(Mr.Weerachai Deechaiyae)

Approved by :

(Mr.Prawate Kluaypa)

Director

Electrical and Electronic Standards Laboratory

Industrial Metrology and Testing Service Centre

Date of Calibration : 4 Mar. 2024

Date of Issue : 5 Mar. 2024

Ref : 2011267022200795001

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 : rumpa@tistr.or.th Website:www.tistr.or.th

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

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



บริษัท เอส.พี.เอส. คอนซัลติ้ง เซอร์วิส จำกัด
S.P.S. CONSULTING SERVICE CO., LTD.
7 ซอย พหลโยธิน 24 แขวงพหลโยธิน เขตพญาไท กรุงเทพมหานคร 10900
Tel : (662) 939-4379-72 Fax : (662) 513-4221 E-mail : sales@spscon.com, www.spscon.com

Noise R_287/24

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	04 March 2024
		Due Date	04 March 2025

Calibration Data

Sound Level Meter Data				Calibration Data		
SLM No.	Brand	Model	Serial No.	Date	Actual Reading [dB]	
					Before Adjustment	After Adjustment
ACO-R23	ACO	6236	00192035	12 May 2024	93.9	93.9
ACO-R46	ACO	6236	00192058	12 May 2024	93.9	93.9
Acoustic Certified Value : Thailand Institute of Scientific and Technological Research (TISTR)					93.85 ± 0.10 dB	

Calibrated by :

(Mr.Adul Dangklom)

Approved by :

(Mr. Peera Detudom)

ระดับเสียงเฉลี่ยตลอดระยะเวลาการทำงาน (Leq)



THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-67/0304

MTC No. EEL. BP. 109/0267

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/N4106495.

7. Condenser Microphone B&K 4180 S/N 2889871.

Ambient Environment

Temperature : (23 + 3) °C

Relative Humidity : (50 ± 15) %

Ambient Pressure : (101.325 ± 1.500) kPa

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

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

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

Date of Receipt : 22 Feb. 2024

Date of Calibration : 4 Mar. 2024

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 : rumpa@tistr.or.th Website:www.tistr.or.th

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

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



THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-67/0304

MTC No. EEL. BP. 109/0267

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 2
1/2 inch Bruel&Kjaer 4180	93.85	-0.15	± 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 Bruel&Kjaer 4180	999.9	-0.1	± 1.5	±2.0%

3. Total Distortion

Standard Microphone Type	Measured Total Distortion (%)	Uncertainty (%)	Tolerance limit IEC60942:2003 Class 2
1/2 inch Bruel&Kjaer 4180	1.65	± 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 :

(Mr.Weerachai Deechaiyae)

Approved by :

(Mr.Prawate Kluaypa)

Director

Electrical and Electronic Standards Laboratory

Industrial Metrology and Testing Service Centre

Date of Calibration : 4 Mar. 2024

Date of Issue : 5 Mar. 2024

Ref : 2011267022200795001

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 : rumpa@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
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196 Phahonyothin Road, Chatuchak, Bangkok 10900,
Thailand
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Fax. (66) 0 2579 8592
E-mail : sumalee@tistr.or.th

Noise R_155/24

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	04 March 2024
		Due Date	04 March 2025

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	31 March 2024	94.0	93.9
ACO-R41	ACO	6236	00192053	31 March 2024	94.0	93.9
Acoustic Certified Value : Thailand Institute of Scientific and Technological Research (TISTR)					93.85 ± 0.10 dB	

Calibrated by :

(Mr.Adul Dangklom)

Approved by :

(Mr. Peera Detudom)

Noise R_279/24

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	04 March 2024
		Due Date	04 March 2025

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	12 May 2024	93.9	93.9
Acoustic Certified Value : Thailand Institute of Scientific and Technological Research (TISTR)					93.85 ± 0.10 dB	

Calibrated by :

(Mr.Adul Dangklom)

Approved by :

(Mr. Peera Detudom)

ระดับเสียงที่พนักงานได้รับตลอดระยะเวลาการทำงาน (TWA)



THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-67/0304

MTC No. EEL. BP. 109/0267

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/N4106495.

7. Condenser Microphone B&K 4180 S/N 2889871.

Ambient Environment

Temperature : (23 + 3) °C

Relative Humidity : (50 ± 15) %

Ambient Pressure : (101.325 ± 1.500) kPa

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

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

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

Date of Receipt : 22 Feb. 2024

Date of Calibration : 4 Mar. 2024

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

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 : rumpa@tistr.or.th Website:www.tistr.or.th

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Soi 1C, Bangpoo Industrial Estate, Sukhumvit Road,
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THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-67/0304

MTC No. EEL. BP. 109/0267

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 2
1/2 inch Bruel&Kjaer 4180	93.85	-0.15	± 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 Bruel&Kjaer 4180	999.9	-0.1	± 1.5	±2.0%

3. Total Distortion

Standard Microphone Type	Measured Total Distortion (%)	Uncertainty (%)	Tolerance limit IEC60942:2003 Class 2
1/2 inch Bruel&Kjaer 4180	1.65	± 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 :

(Mr.Weerachai Deechaiyae)

Approved by :

(Mr.Prawate Kluaypa)

Director

Electrical and Electronic Standards Laboratory

Industrial Metrology and Testing Service Centre

Date of Calibration : 4 Mar. 2024

Date of Issue : 5 Mar. 2024

Ref : 2011267022200795001

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



Certificate of Calibration

Certificate Number : SPR23090267-7 Page : 1 of 3

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

Equipment Name : Sound Level Meter

Manufacturer : ACO

Model : 6236

Serial Number : 192052

ID. Number : R-40

Environmental Conditions

Ambient Temperature : 23 °C ± 3 °C Received Date : 18 Sep 2023

Relative Humidity : 50 % ± 15 % Calibration Date : 18 Sep 2023

Location of Calibration : In-Lab Recommend Due Date : 18 Sep 2024

Calibration Procedure : SP-CPE-04-01 Date of Issue : 19 Sep 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 : Mr.Karoon Pengsalung

Calibration Officer

Approved by

(Mr.Nirut Loha)

Authorized Signatory



Calibration Report

Certificate Number : SPR23090267-7

Page : 2 of 3

Reference Standards

Equipment Name	Model	Serial No.	Certificate No.	Due. Date
Sound Level Calibrator	ST-120	211203773	EEL.BP. 114/0166	17 Jan 2024

Traceability

This certification is traceable to the International System of Unit maintained at :
TISTR - Thailand Institute of Scientific and Technological Research



Result of Calibration

Certificate No. : SPR23090267-7

Page : 3 of 3

Range : 94 to 114 dB

Function : @1kHz

Select A Unit : dB

Standard Setting	UUC Reading		Error		Uncertainty (±)
	Fast	Slow	Fast	Slow	
94	94.0	94.0	0.0	0.0	0.15
114	113.8	113.8	-0.2	-0.2	0.15

Select C Unit : dB

Standard Setting	UUC Reading		Error		Uncertainty (±)
	Fast	Slow	Fast	Slow	
94	93.9	93.9	-0.1	-0.1	0.15
114	113.7	113.7	-0.3	-0.3	0.15

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 $k = 2.00$, providing a level of confidence approximately 95%.

- End of Certificate -



บริษัท เอส.พี.เอส. คอนซัลติ้ง เซอร์วิส จำกัด
S.P.S. CONSULTING SERVICE CO., LTD.
7 ซอยพหลโยธิน 24 ซอยพหลโยธิน แขวงจตุจักร เขตจตุจักร กรุงเทพฯ 10900
Tel : (062) 939-4370-72, Fax : (062) 513-4521, E-mail : sales@spscon.com, www.spscon.com

Noise R_157/24

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	04 March 2024			
		Due Date	04 March 2025			
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	31 March 2024	94.0	93.9
Acoustic Certified Value : Thailand Institute of Scientific and Technological Research (TISTR)					93.85 ± 0.10 dB	

Calibrated by :

(Mr.Adul Dangklom)

Approved by :

(Mr. Peera Detudom)

ระดับความร้อน



ID LINE : IEC17025



Certificate of Calibration

Certificate Number : SPR24020220-11 Page : 1 of 3

Customer : Thai Environmental Technic Limited.
1/6 Soi Ramkhamhaeng 145, Khwaeng Saphan Sung, Khet Saphan
Sung, Bangkok 10240, Thailand.

Equipment Name : Liquid in Glass Thermometer

Manufacturer : AMA

Model : N/A

Serial Number : 1965940

ID. Number : N/A

Environmental Conditions

Ambient Temperature : $23^{\circ}\text{C} \pm 2^{\circ}\text{C}$ Received Date : 14 Feb 2024

Relative Humidity : $50\% \pm 15\%$ Calibration Date : 15 Feb 2024

Location of Calibration : In-Lab Recommend Due Date : 15 Feb 2025

Calibration Procedure : SP-CPT-04-08 Date of Issue : 16 Feb 2024

Method of Calibration

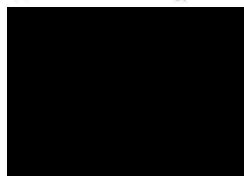
This certifies that the above instrument was calibrated in compliance with the calibration system requirement of ISO/IEC 17025:2017 in accordance with reference procedure. Standards used to perform this calibration are certified by to NIST or equivalent, National metrology institute, Natural physical 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 : Mr.Surasak Ritthikaew

Calibration Officer

Approved by :



Authorized Signatory



ID LINE : IEC17025



Calibration Report

Certificate Number : SPR24020220-11

Page : 2 of 3

Reference Standards

Equipment Name	Model	Serial No.	Certificate No.	Due. Date
Super Thermometer with PRT	1575/3850-40-392	58087/100288	PSL-T 0400/66	15 Feb 2024

Traceability

This certification is traceable to the International System of Unit maintained at :

TISTR - Thailand Institute of Scientific and Technological Research



ID LINE : IEC17025



Result of Calibration

Certificate No. : SPR24020220-11

Page : 3 of 3

Range : -5 to 110 °C

Resolution : 0.5 °C

Unit : °C

Setting Value	Standard Reading	UUC Reading	Error	Uncertainty (±)
25.0	25.007	25.0	-0.007	0.29
30.0	30.008	30.0	-0.008	0.29
35.0	35.009	35.0	-0.009	0.29
40.0	40.010	40.0	-0.010	0.29
45.0	45.010	45.0	-0.010	0.29
50.0	50.012	50.0	-0.012	0.29

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 $k = 2.00$, providing a level of confidence approximately 95%.

- End of Certificate -



ID LINE : IEC17025



Certificate of Calibration

Certificate Number : SPR24020220-10

Page : 1 of 3

Customer : Thai Environmental Technic Limited.

1/6 Soi Ramkhamhaeng 145, Khwaeng Saphan Sung, Khet Saphan Sung, Bangkok 10240, Thailand.

Equipment Name : Liquid in Glass Thermometer

Manufacturer : AMA

Model : N/A

Serial Number : 1965941

ID. Number : N/A

Environmental Conditions

Ambient Temperature : $23\text{ °C} \pm 2\text{ °C}$ Received Date : 14 Feb 2024

Relative Humidity : $50\% \pm 15\%$ Calibration Date : 15 Feb 2024

Location of Calibration : In-Lab Recommend Due Date : 15 Feb 2025

Calibration Procedure : SP-CPT-04-08 Date of Issue : 16 Feb 2024

Method of Calibration

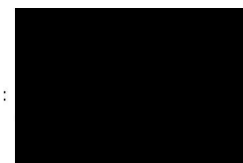
This certifies that the above instrument was calibrated in compliance with the calibration system requirement of ISO/IEC 17025:2017 in accordance with reference procedure. Standards used to perform this calibration are certified by to NIST or equivalent, National metrology institute, Natural physical 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 : Mr.Surasak Ritthikaew

Calibration Officer

Approved by :



Authorized Signatory



ID LINE : IEC17025



Calibration Report

Certificate Number : SPR24020220-10

Page : 2 of 3

Reference Standards

Equipment Name	Model	Serial No.	Certificate No.	Due. Date
Super Thermometer with PRT	1575/3850-40-392	58087/100288	PSL-T 0400/66	15 Feb 2024

Traceability

This certification is traceable to the International System of Unit maintained at :
TISTR - Thailand Institute of Scientific and Technological Research



ID LINE : IEC17025



Result of Calibration

Certificate No. : SPR24020220-10

Page : 3 of 3

Range : -5 to 110 °C

Resolution : 0.5 °C

Unit : °C

Setting Value	Standard Reading	UUC Reading	Error	Uncertainty (±)
25.0	25.008	25.0	-0.008	0.29
30.0	30.008	30.0	-0.008	0.29
35.0	35.007	35.0	-0.007	0.29
40.0	40.008	40.0	-0.008	0.29
45.0	45.010	45.0	-0.010	0.29
50.0	50.012	50.0	-0.012	0.29

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 $k = 2.00$, providing a level of confidence approximately 95%.
- End of Certificate -



ID LINE : IEC17025



Certificate of Calibration

Certificate Number : SPR24020220-9 Page : 1 of 3

Customer : Thai Environmental Technic Limited.
1/6 Soi Ramkhamhaeng 145, Khwaeng Saphan Sung, Khet Saphan
Sung, Bangkok 10240, Thailand.

Equipment Name : Liquid in Glass Thermometer
Manufacturer : AMA
Model : N/A
Serial Number : 1965942
ID. Number : N/A

Environmental Conditions
Ambient Temperature : 23 °C ± 2 °C Received Date : 14 Feb 2024
Relative Humidity : 50 % ± 15 % Calibration Date : 15 Feb 2024
Location of Calibration : In-Lab Recommend Due Date : 15 Feb 2025
Calibration Procedure : SP-CPT-04-08 Date of Issue : 16 Feb 2024

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 : Mr.Surasak Ritthikaew

Calibration Officer

Approved by :

Authorized Signatory

SP-FM-04-15 rev.0



ID LINE : IEC17025



Calibration Report

Certificate Number : SPR24020220-9 Page : 2 of 3

Reference Standards

Equipment Name	Model	Serial No.	Certificate No.	Due. Date
Super Thermometer with PRT	1575/3850-40-392	58087/100288	PSL-T 0400/66	15 Feb 2024

Traceability

This certification is traceable to the International System of Unit maintained at :
TISTR - Thailand Institute of Scientific and Technological Research

SP-FM-04-15 rev.0



69/29 Moo 1 Klongsi Klongluang Pathumthani 12120 (Thailand) Tel: (662) 193-2220 5 คู่มือ www.สอวทียบเครื่องมือวัด.คอม



Result of Calibration

Certificate No. : SPR24020220-9

Page : 3 of 3

Range : -5 to 110 °C

Resolution : 0.5 °C

Unit : °C

Setting Value	Standard Reading	UUC Reading	Error	Uncertainty (±)
25.0	25.007	25.0	-0.007	0.29
30.0	30.007	30.0	-0.007	0.29
35.0	35.008	35.0	-0.008	0.29
40.0	40.009	40.0	-0.009	0.29
45.0	45.012	45.0	-0.012	0.29
50.0	50.014	50.0	-0.014	0.29

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 $k = 2.00$, providing a level of confidence approximately 95%.

- End of Certificate -



69/29 Moo 1 Klongsi Klongluang Pathumthani 12120 (Thailand) Tel: (662) 193-2220 5 คู่มือ www.สอวทียบเครื่องมือวัด.คอม



Certificate of Calibration

Certificate Number : SPR24020220-6

Page : 1 of 3

Customer

: Thai Environmental Technic Limited.

1/6 Soi Ramkhamhaeng 145, Khwaeng Saphan Sung, Khet Saphan Sung, Bangkok 10240, Thailand.

Equipment Name

: Liquid in Glass Thermometer

Manufacturer

: AMA

Model

: N/A

Serial Number

: 1965944

ID. Number

: N/A

Environmental Conditions

Ambient Temperature : 23 °C ± 2 °C

Received Date : 14 Feb 2024

Relative Humidity : 50 % ± 15 %

Calibration Date : 15 Feb 2024

Location of Calibration : In-Lab

Recommend Due Date : 15 Feb 2025

Calibration Procedure : SP-CPT-04-08

Date of Issue : 16 Feb 2024

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 : Mr.Surasak Ritthikaew

Approved by :

Calibration Officer

Authorized Signatory



Calibration Report

Certificate Number : SPR24020220-6

Page : 2 of 3

Reference Standards

Equipment Name	Model	Serial No.	Certificate No.	Due. Date
Super Thermometer with PRT	1575/3850-40-392	58087/100288	PSL-T 0400/66	15 Feb 2024

Traceability

This certification is traceable to the International System of Unit maintained at :
TISTR - Thailand Institute of Scientific and Technological Research



Result of Calibration

Certificate No. : SPR24020220-6

Page : 3 of 3

Range : -5 to 110 °C

Resolution : 0.5 °C

Unit : °C

Setting Value	Standard Reading	UUC Reading	Error	Uncertainty (±)
25.0	25.006	25.0	-0.006	0.29
30.0	30.006	30.0	-0.006	0.29
35.0	35.007	35.0	-0.007	0.29
40.0	40.008	40.0	-0.008	0.29
45.0	45.010	45.0	-0.010	0.29
50.0	50.011	50.0	-0.011	0.29

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 $k = 2.00$, providing a level of confidence approximately 95%.

- End of Certificate -



ID LINE: IEC17025



Certificate of Calibration

Certificate Number : SPR24020220-8 Page : 1 of 3

Customer : Thai Environmental Technic Limited.
1/6 Soi Ramkhamhaeng 145, Khwaeng Saphan Sung, Khet Saphan
Sung, Bangkok 10240, Thailand.

Equipment Name : Liquid in Glass Thermometer

Manufacturer : AMA

Model : N/A

Serial Number : 2197246

ID. Number : N/A

Environmental Conditions

Ambient Temperature	: 23 °C ± 2 °C	Received Date	: 14 Feb 2024
Relative Humidity	: 50 % ± 15 %	Calibration Date	: 15 Feb 2024
Location of Calibration	: In-Lab	Recommend Due Date	: 15 Feb 2025
Calibration Procedure	: SP-CPT-04-08	Date of Issue	: 16 Feb 2024

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 : Mr.Surasak Ritthikaew

Calibration Officer

Approved by :



Authorized Signatory



ID LINE: IEC17025



Calibration Report

Certificate Number : SPR24020220-8 Page : 2 of 3

Reference Standards

Equipment Name	Model	Serial No.	Certificate No.	Due. Date
Super Thermometer with PRT	1575/3850-40-392	58087/100288	PSL-T 0400/66	15 Feb 2024

Traceability

This certification is traceable to the International System of Unit maintained at :
TISTR - Thailand Institute of Scientific and Technological Research



Result of Calibration



Certificate No. : SPR24020220-8

Page : 3 of 3

Range : -5 to 110 °C

Resolution : 0.5 °C

Unit : °C

Setting Value	Standard Reading	UUC Reading	Error	Uncertainty (±)
25.0	25.008	25.0	-0.008	0.29
30.0	30.008	30.0	-0.008	0.29
35.0	35.009	35.0	-0.009	0.29
40.0	40.010	40.0	-0.010	0.29
45.0	45.010	45.0	-0.010	0.29
50.0	50.012	50.0	-0.012	0.29

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 $k = 2.00$, providing a level of confidence approximately 95%.

- End of Certificate -



Certificate of Calibration

Certificate Number : SPR24020220-7

Page : 1 of 3

Customer : Thai Environmental Technic Limited.

1/6 Soi Ramkhamhaeng 145, Khwaeng Saphan Sung, Khet Saphan Sung, Bangkok 10240, Thailand.

Equipment Name : Liquid in Glass Thermometer

Manufacturer : AMA

Model : N/A

Serial Number : 2197250

ID. Number : N/A

Environmental Conditions

Ambient Temperature : 23 °C ± 2 °C

Received Date : 14 Feb 2024

Relative Humidity : 50 % ± 15 %

Calibration Date : 15 Feb 2024

Location of Calibration : In-Lab

Recommend Due Date : 15 Feb 2025

Calibration Procedure : SP-CPT-04-08

Date of Issue : 16 Feb 2024

Method of Calibration

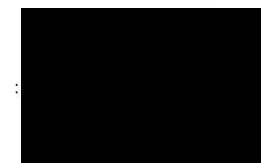
This certifies that the above instrument was calibrated in compliance with the calibration system requirement of ISO/IEC 17025:2017 in accordance with reference procedure. Standards used to perform this calibration are certified by to NIST or equivalent, National metrology institute, Natural physical 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 : Mr.Surasak Ritthikaew

Calibration Officer

Approved by :



Authorized Signatory



Calibration Report

Certificate Number : SPR24020220-7

Page : 2 of 3

Reference Standards

Equipment Name	Model	Serial No.	Certificate No.	Due. Date
Super Thermometer with PRT	1575/3850-40-392	58087/100288	PSL-T 0400/66	15 Feb 2024

Traceability

This certification is traceable to the International System of Unit maintained at :
TISTR - Thailand Institute of Scientific and Technological Research



Result of Calibration

Certificate No. : SPR24020220-7

Page : 3 of 3

Range : -5 to 110 °C

Resolution : 0.5 °C

Unit : °C

Setting Value	Standard Reading	UUC Reading	Error	Uncertainty (±)
25.0	25.007	25.0	-0.007	0.29
30.0	30.007	30.0	-0.007	0.29
35.0	35.008	35.0	-0.008	0.29
40.0	40.008	40.0	-0.008	0.29
45.0	45.009	45.0	-0.009	0.29
50.0	50.012	50.0	-0.012	0.29

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 $k = 2.00$, providing a level of confidence approximately 95%.

- End of Certificate -



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES
534/4 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG, BANGKOK 10250
TEL. 0-2717-3000-24 FAX. 0-2719-9484



Certificate of Calibration

Certificate No. : 24H850

Page : 1 of 2

Equipment : Heat Stress Monitor
Manufacturer: DELTA OHM
Model : HD 32.2
Serial No.: 22004315
ID No.: HD 17

Condition As-Received: Used Item

Received Date: 30 April 2024

Calibration Date: 03 May 2024
to 06 May 2024

Reference: 2404-0751DSC

Ambient Temperature: (25 ± 3) °C

Relative Humidity: (50 ± 20) %

Submitted by: Thai Environmental Technic Limited

1/6 Soi Ramkhamhaeng 145, Khwaeng/Khet Saphan Sung,
Bangkok 10240

Procedure used: Calibration were conducted using in-house calibration procedure CP-H03 according to comparison with standard temperature probe for temperature measurement function into humidity / temperature chamber.

Condition of this result of calibration

1.Reference standards instruments :

Instrument	Model	Serial No.	Certificate No.	Due Date
1) Handheld Thermometer With Sensor	1521	A5A339	23I1238	16 Oct 2024

2.The certificate is valid only to the item calibrated on date and place of calibration.

3.This Certification is traceable to the International System of Unit maintained through:-

-Technology Promotion Association (Thailand-Japan), NSC-ONSC Accredited No. Calibration 0008

Calibrated by : Somchai Dumwor
Issue Date : 08 May 2024

Approved Signatory

[] Chakrit Waewwanjua
[✓] Viporn Tantiyawutti
[] Unnopphol Harachai



Cert. No.: 24H850

Page.: 2 of 2

Result of Calibration:-

Function:

Without Adjustment

Temperature Measurement.

This instrument was connected with temperature probe.

Measurement Function	Model of Sensor	Serial of Sensor	Standard Temperature (°C)	UUC* Reading (°C)	Error (°C)	Uncertainty of Measurement (±°C)
Tn	HP3201.2	22010212	20.012	20.2	0.188	0.42
			25.000	25.1	0.100	0.42
			30.002	30.1	0.098	0.42
			34.953	35.1	0.147	0.42
			40.038	40.1	0.062	0.42
Tg	TP3276.2	22014933	20.012	20.1	0.088	0.42
			25.000	25.1	0.100	0.42
			30.002	30.0	-0.002	0.42
			34.953	35.0	0.047	0.42
			40.038	40.0	-0.038	0.42
T	TP3207.2	22015207	20.012	20.1	0.088	0.42
			25.000	25.1	0.100	0.42
			30.002	30.0	-0.002	0.42
			34.953	35.0	0.047	0.42
			40.038	39.9	-0.138	0.42

UUC* : Unit Under Calibration

The reported uncertainty of measurement was base on standard uncertainty multiplied by coverage factor k = 2.00, providing confidence level approximately 95%.

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แสงสว่างในสถานที่ทำงาน



Request No. : 22-66 / 0597

MTC No. : PSL-P 0153 / 66

CERTIFICATE OF CALIBRATION

Nomenclature : Digital Lux Meter
Maker : DIGICON

Serial No. : AA.23026
Model : LX-50

Customer : **THAI ENVIRONMENTAL TECHNIC LIMITED**

Address : 1/6 Soi Ramkhamhaeng 145, Khwaeng/Khet Saphan Sung, Bangkok 10240

Date of receipt : 7 June 2023

Date of calibration : 19 June 2023

Place of calibration : Photometry and Temperature Standards Laboratory, MTC. (Bangpoo)

Basis of calibration : calibration at 0 ~ 5000 lux.

Condition of calibration :- Ambient temperature : $(25 \pm 2) ^\circ\text{C}$
- Relative humidity : $(60 \pm 20) \%$

Reference Standard : Working Standard Luminous Intensity Lamp, Serial No.: FEL003 and 3501,
can be traceable to international system of units (SI), through calibration certificate
MTC No. PSL-P 131/66 and PSL-P 132/66, date of calibration 12 May 2023.

Traceability : This certificate is traceable to SI units through the National Institute of Metrology (Thailand),
calibration certificate No. TP-1010-23, TP-1011-23 and TP-1012-23

Support Equipment : 1. Photometric bench , 3.0 meter long
2. DC power supply, Serial No.: BC - 341006035007/2
3. Digital Multimeter , Model : R 6551 , S/N : 92041186 and 92041192

Calibration Procedure : The measurement was done in accordance with WLC.P.10.

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

R.P.

page 1 of 2

The results relate only to the items tested/calibrated or value assigned.
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FMIL.MTC.002 Rev.4

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

Office/Laboratory
Soi 12, Bangpoo Industrial Estate, Sukhumvit Road,
Amphoe Muang, Changwat Samutprakan 10280, Thailand
Tel. (66) 0 2323 1572-80 ext. 115, 116
Fax. (66) 0 2323 9165
E-mail : mtg@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



Request No. : 22-66 / 0597

MTC No. : PST-P 0153 / 66

Serial No. : AA.23026

Results :

UUC Range (lux)	Standard (lux)	*UUC Reading (lux)	Uncertainty of Measurement \pm (lux)
2000	100	101	2.3
	500	499	11
	1000	993	22
	1500	1480	33
20000 ($\times 10$)	2000	1973	44
	2000	199	50
	3000	298	70
	4000	397	90
	5000	493	110

Note : *UUC = Unit Under Calibration.

...end of certificate...

(Ms. Rattanawadee Pholprom)

Dr. (Mr. Kamchai Singhapivat)
Director

Photometry and Temperature Standards Laboratory

Ref. : 2012266060702194002

Issued date : 21 June 2023

page 2 of 2

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35 Ra. 3 Tambon Khlong Ha, Amphoe Khlong Luang,
Changwat Pathum Thani 12120, Thailand
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Fax. (66) 0 2577 9009
E-mail : rumpal@tistr.or.th Website: www.tistr.or.th

Office/Laboratory
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Amphoe Muang, Changwat Samutprakan 10280, Thailand
Tel. (66) 0 2323 1572-80 ext. 115, 116
Fax. (66) 0 2323 9165
E-mail : mtg@tistr.or.th

Office
196 Phahonyothin Road, Chatuchak, Bangkok 10900,
Thailand
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Fax. (66) 0 2579 8592
E-mail : sumalee@tistr.or.th



Request No. : 22-67 / 0063

MTC No. : PSL-P 0015 / 67

CERTIFICATE OF CALIBRATION

Nomenclature : Digital Lux Meter
Maker : DIGICON

Serial No. : AD.60206
Model : LX-50

Customer : **THAI ENVIRONMENTAL TECHNIC LIMITED**

Address : 1/6 Soi Ramkhamhaeng 145, Khwaeng/Khet Saphan Sung, Bangkok 10240

Date of receipt : 26 October 2023

Date of calibration : 9 November 2023

Place of calibration : Photometry and Temperature Standards Laboratory, MTC, (Bangpoo)

Basis of calibration : calibration at 0 ~ 2000 lux.

Condition of calibration : - Ambient temperature : $(25 \pm 2) ^\circ\text{C}$

- Relative humidity : $(60 \pm 20) \%$

Reference Standard : Working Standard Luminous Intensity Lamp, Serial No.: FEL003 and 3501, can be traceable to international system of units (SI), through calibration certificate MTC No. PSL-P 131/66 and PSL-P 132/66, date of calibration 12 May 2023.

Traceability : This certificate is traceable to SI units through the National Institute of Metrology (Thailand) calibration certificate No. TP-1010-23, TP-1011-23 and TP-1012-23

Support Equipment : 1. Photometric bench , 3.0 meter long
2. DC power supply, Serial No.: BC - 341006035007/2
3. Digital Multimeter , Model : R 6551 , S/N : 92041186 and 92041192

Calibration Procedure : The measurement was done in accordance with WI.CP.10.

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

R.P.

page 1 of 2

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Head Office

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Changwat Pathumthani 12120, Thailand
Tel. (66) 0 2577 9000
Fax. (66) 0 2577 9009
E-mail : numpai@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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Fax. (66) 0 2323 9165
E-mail : mtg@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



Request No. : 22-67 / 0063

MTC No. : PSL-P 0015 / 67

Serial No. : AD.60206

Results :

UUC Range (lux)	Standard (lux)	*UUC Reading (lux)	Uncertainty of Measurement \pm (lux)
2000	100	104	2.0
	500	503	10
	1000	1000	20
	1500	1494	30
	2000	1988	40

Note : *UUC = Unit Under Calibration.

...end of certificate...



(Ms. Rattanawadee Pholprom)



(Mr. Rattana Singhaewat)
Director

Photometry and Temperature Standards Laboratory

Ref. : 2012266102604262002

Issued date : 16 November 2023

page 2 of 2

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Changwat Pathumthani 12120, Thailand
Tel. (66) 0 2577 9000
Fax. (66) 0 2577 9009
E-mail : numpai@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

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



Request No. : 22-66 / 0597

MTC No. : PSL-P 0153 / 66

CERTIFICATE OF CALIBRATION

Nomenclature : Digital Lux Meter
Maker : DIGICON

Serial No. : AA.23026
Model : LX-50

Customer : **THAI ENVIRONMENTAL TECHNIC LIMITED**

Address : 1/6 Soi Ramkhamhaeng 145, Khwaeng/Khet Saphan Sung, Bangkok 10240

Date of receipt : 7 June 2023

Date of calibration : 19 June 2023

Place of calibration : Photometry and Temperature Standards Laboratory, MTC. (Bangpoo)

Basis of calibration : calibration at 0 ~ 5000 lux.

Condition of calibration : - Ambient temperature : $(25 \pm 2) ^\circ\text{C}$

- Relative humidity : $(60 \pm 20) \%$

Reference Standard : Working Standard Luminous Intensity Lamp, Serial No.: FEL003 and 3501,
can be traceable to international system of units (SI), through calibration certificate
MTC No. PSL-P 131/66 and PSL-P 132/66, date of calibration 12 May 2023.

Traceability : This certificate is traceable to SI units through the National Institute of Metrology (Thailand)
calibration certificate No. TP-1010-23, TP-1011-23 and TP-1012-23

Support Equipment : 1. Photometric bench , 3.0 meter long
2. DC power supply, Serial No.: BC - 341006035007/2
3. Digital Multimeter , Model : R 6551 , S/N : 92041186 and 92041192

Calibration Procedure : The measurement was done in accordance with WLC.P.10.
The reported uncertainty is based on a standard uncertainty multiplied by a coverage
factor $k = 2$, providing a level of confidence of approximately 95 %.

R.P.

page 1 of 2

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

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E-mail : sumalee@tistr.or.th



Request No. : 22-66 / 0597

MTC No. : PSL-P 0153 / 66

Serial No. : AA.23026

Results :

UUC Range (lux)	Standard (lux)	*UUC Reading (lux)	Uncertainty of Measurement \pm (lux)
2000	100	101	2.3
	500	499	11
	1000	993	22
	1500	1480	33
20000 ($\times 10$)	2000	1973	44
	2000	199	50
	3000	298	70
	4000	397	90
5000	5000	493	110

Note : *UUC = Unit Under Calibration.

...end of certificate...

Calibrated by :



Director
Photometry and Temperature Standards Laboratory
Ref. : 2012266060702194002
Issued date : 21 June 2023

page 2 of 2

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

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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
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Fax. (66) 0 2323 9165
E-mail : mtg@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