

ภาคผนวกที่ 5

เอกสารการสอบเทียบความถูกต้อง
ของเครื่องมือ

**ตารางสรุปรายการเอกสารการสอบเทียบความถูกต้องของเครื่องมือเก็บตัวอย่าง
และเครื่องมือตรวจวิเคราะห์ผลกระทบลิ่งแวดล้อม**

รายการตรวจวัด	เครื่องมือตรวจวัด		เครื่องมือตรวจวิเคราะห์	
	ชื่อเครื่องมือ	เลขหน้า	ชื่อเครื่องมือ	เลขหน้า
การตรวจวัดคุณภาพอากาศ - Total Suspended Particulates	- High Volume Air Sampler & Blower - No. 9, 9 - No. 11, 11 - No. 22, 22 - No. 25, 25	 ผ5 ผ5 ผ5 ผ5	- Electronic Balance	ผ5
การตรวจวัดระดับเสียง - Leq 24 hr	- Acoustic Calibrator - Sound Level Meter No. *ACO-B25 *ACO-B27 *ACO-B28 *ACO-B30	 ผ5 ผ5 ผ5 ผ5 ผ5	- -	- -
๑๘การตรวจวิเคราะห์คุณภาพน้ำ 1. pH 2. Turbidity 3. Total Solids 4. Total Hardness 5. Sulfate 6. Total Iron 7. Manganese 8. Copper 9. Lead 10. Silver 11. Arsenic	-	-	- pH Meter - Turbidity Meter - Electronic Balance - Electronic Balance - Spectrophotometer - Inductively Coupled Plasma (ICP) - Hydride Generation/Atomic Absorption Spectrophotometer	ผ5 ผ5 ผ5 ผ5 ผ5 ผ5 ผ5 ผ5 ผ5 ผ5 ผ5



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 (Automatic 5 Lines) Fax: (662) 513-4221 E-mail: sale@spscon.com

High Volume Air Sampler Calibration Report

Calibration Method : Multipoint Orifice Flow Transfer Standard

Model : TE 5025A

S/N : 3611

Calibration Data

High Volume Air Sampler Data		Calibration Data		
Recorder No.	Blower No.	Date	Actual Flowrate (ft ³ /min)	R ²
1	1	12/11/2019	$y = 1.266x - 1.567$	0.999
2	2	12/11/2019	$y = 1.146x + 2.945$	1.000
3	3	04/11/2019	$y = 1.293x - 1.689$	0.998
4	4	12/11/2019	$y = 1.127x + 4.904$	0.999
5	5	05/11/2019	$y = 1.099x + 2.376$	0.999
6	6	07/11/2019	$y = 1.096x + 2.928$	0.999
7	7	04/11/2019	$y = 1.264x - 2.030$	0.997
8	8	07/11/2019	$y = 1.265x - 1.247$	0.999
9	9	01/11/2019	$y = 1.490x - 10.201$	1.000
10	10	01/11/2019	$y = 1.286x - 1.755$	0.999
11	11	05/11/2019	$y = 1.431x - 4.089$	0.996
12	12	05/11/2019	$y = 1.205x + 7.282$	0.999
13	13	05/11/2019	$y = 1.423x - 8.916$	0.995
14	14	06/11/2019	$y = 1.197x + 3.977$	0.997
15	15	06/11/2019	$y = 1.197x + 1.351$	1.000
16	16	11/11/2019	$y = 1.374x - 7.016$	0.998
17	17	01/11/2019	$y = 1.366x - 6.185$	0.997
18	18	01/11/2019	$y = 1.269x - 0.401$	1.000
19	19	07/11/2019	$y = 1.155x + 6.711$	0.998
20	20	07/11/2019	$y = 1.339x - 3.079$	0.997
21	21	01/11/2019	$y = 1.472x - 2.564$	0.999
22	22	07/11/2019	$y = 1.816x - 2.347$	0.999
23	23	05/11/2019	$y = 1.029x + 6.148$	1.000
24	24	05/11/2019	$y = 1.297x + 3.806$	0.999
25	25	05/11/2019	$y = 1.115x + 4.394$	1.000
26	26	05/11/2019	$y = 1.463x - 7.257$	0.999
27	27	06/11/2019	$y = 1.299x - 4.427$	1.000
28	28	06/11/2019	$y = 1.398x - 1.712$	0.999
29	29	12/11/2019	$y = 1.516x - 8.571$	0.997
30	30	12/11/2019	$y = 1.141x + 4.430$	1.000

Calibrated by :

Phakhdinal Khongkomnerd
(Mr. Phakhdinal Khongkomnerd)

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 (ft ³ /min)	R ²
31	31	08/11/2019	$y = 1.400x - 4.279$	0.999
32	32	08/11/2019	$y = 1.314x - 0.539$	0.999
33	33	01/11/2019	$y = 1.464x - 9.310$	0.996
34	34	01/11/2019	$y = 1.303x + 1.411$	0.999
35	35	08/11/2019	$y = 1.285x + 0.773$	0.998
36	36	11/11/2019	$y = 1.361x - 0.834$	0.998
37	37	08/11/2019	$y = 1.207x + 4.379$	1.000
38	38	12/11/2019	$y = 1.328x - 3.135$	0.997
39	39	08/11/2019	$y = 1.460x - 3.096$	1.000
40	40	08/11/2019	$y = 1.491x - 10.676$	0.998
41	41	08/11/2019	$y = 1.219x + 0.854$	0.999

Calibrated by :

Phakhinai Khongkornerd
(Mr. Phakhinai Khongkornerd)

Approved by :

Peera Detudom
(Mr. Peera Detudom)



THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-61/0559

MTC No. EEL. BP. 61/0561

CALIBRATION CERTIFICATE

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

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

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

Instrument Calibrated :

Description : Sound Calibrator

Manufacturer : ACO

Model : 2127

Serial No. : 130006

Ambient Environment

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

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

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

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

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

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

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

5. Pressure Transmitter Vaisala PTB202AD S/N T0650001.

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

7. Condenser Microphone B&K 4180 S/N 2633526.

Calibration Procedure : CP.SC.02 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

- 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 : 21 May 2018

Date of Calibration : 23 May 2018

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Touki

The results relate only to the items tested or calibrated.

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

FM.BL.MTC.002 Rev.3

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

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196 Phahonyothin Road, Chatuchak, Bangkok 10900,
Thailand
Tel. (66) 0 2579 1121-30 ext. 5219, 5225, 5217
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THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-61/0559

MTC No. EEL. BP. 61/0561

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

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

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

1. Sound Pressure Level

Standard Microphone Type	Sound Pressure Level			
	Measured Sound Pressure Level (dB)	Deviated value (dB)	Uncertainty (dB)	Tolerance limit IEC60942:2003 Class 1
1/2 inch B&K 4180	93.94	-0.06	± 0.15	± 0.40 dB

2. Frequency

Standard Microphone Type	Frequency			
	Measured Frequency (Hz)	Deviated value (Hz)	Uncertainty (Hz)	Tolerance limit IEC60942:2003 Class 1
1/2 inch B&K 4180	999.8	-0.2	± 1.5	$\pm 1.0\%$

3. Total distortion*

Standard Microphone Type	Total distortion*		
	Measured Total distortion (%)	Uncertainty (%)	Tolerance limit IEC60942:2003 Class 1
1/2 inch B&K 4180	1.03	± 0.50	$\pm 3.0\%$

Note : 1. No adjustment.

2. The calibration results exclude the calibrator pressure correction.

3. The calibration results exclude the microphone volume correction.

4. Results marked " * " in this Certificate are not accredited by NSC - ONSC

Calibrated by :

Tawikiat Iamsamran

(Mr. Tawikiat Iamsamran)

Approved by :



Electrical and Electronic Standards Laboratory

Industrial Metrology and Testing Service Center

Date of Calibration : 23 May 2018

Date of Issue : 24 May 2018

Ref : 2011261052101926001

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The results relate only to the items tested or calibrated.

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E-mail : sumalee@tistr.or.th

Certificate of Calibration

Certificate No. : 63-420104-1

Page : 1 of 2

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

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

Equipment : pH Meter with electrode

pH meter

Manufacturer : WTW

Model : inoLab PH Level 1

Range : N/A pH

Resolution : 0.001 pH

Serial No. : 01510033

ID No. : PH03/45

Electrode

Model : Sen Tix 81

Serial No. : C200337086

Environment : Ambient Temperature : (25 ± 2) °C

Relative Humidity : (50 ± 15) %

Date of Received : 20 July 2020

Date of Calibration : 22 July 2020

Date of Issue : 22 July 2020

Calibrated by : Bunjerd Masri

Calibration Method : In-house method CAL-M4201 direct measurement by using standard voltage calibrator and using certified reference material (CRM)

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

1. Multiproduct Calibrator

ID No.	Cert. No.	Due Date	Traceability
440001	19E779	13 Feb 2021	National Institute of Metrology Thailand (NIMT)

2. Certified Reference Material (CRM)

pH	Cert. No.	Lot No.	Exp. Date	Traceability
4.003	TRM-S2003	280319	29 Jul 2020	National Institute of Metrology Thailand (NIMT)
7.025	TRM-S2005	280119	29 Jul 2020	National Institute of Metrology Thailand (NIMT)
10.008	TRM-S2007	080719	29 Jul 2020	National Institute of Metrology Thailand (NIMT)

Approved by : 
(Bunjerd Masri)
Supervisor

Certificate of Calibration

Certificate No. : 63-420104-1

Page : 2 of 2

Result of Calibration :

UUC Condition As-Received : Good

Function : Electrical measurement
pH meter

Performing standard curve by Multiproduct Calibrator at pH (4,7) and (7,10)

Adjustment Curve at nominal pH	Applied Voltage (mV)	Nominal Value (pH)	UUC Reading		Correction (mV)	Uncertainty (± mV)
			(pH)	(mV)		
4, 7	177.4800	4	4.00	176.8	0.7	0.060
	0.0000	7	7.00	-0.5	0.5	0.058
7,10	0.0000	7	7.00	-0.5	0.5	0.058
	-177.4800	10	10.00	-177.6	0.1	0.060

Function : pH meter with electrode

Performing a three - buffer standard curve using buffer nominal pH (4,7) and (7,10)

Adjustment Curve at nominal pH	Standard Buffer (pH)	UUC Reading (pH)	Correction (pH)	Uncertainty (± pH)
4, 7	4.003	4.007	-0.003	0.025
	7.025	7.016	0.009	0.024
7, 10	7.025	7.017	0.008	0.024
	10.008	10.010	-0.002	0.070

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%

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

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

TEL. 0-2717-3000-24 FAX. 0-2719-9484

Cert.No.: 20CH747

Page.: 1 of 2

Certificate of Calibration

Equipment : Turbidity Meter
Manufacturer : Eutech
Model : Cyberscan WL TB1000
Serial No. : 201802206
ID. No. : TB 03/61
Condition As-Received: Used Item
Received Date : 26 May 2020
Calibration Date : 27 May 2020
Reference : 2005-0839WN-1
Submitted by : S.P.S. Consulting Service Co.,Ltd.
7 Soi Phaholyothin 24, Phaholyothin Rd.,
Jompol, Chatuchak, Bangkok 10900
Ambient Temperature : (25 ± 2.5) °C
Relative Humidity : (50 ± 20) %
Calibration Procedure : In - house method : CP-CH11
based on direct measurement by
using Formazin standard solution

Calibrated by : Walalak Sirithean

Approved by :

malee

Approved Signatory

() Pornthippa Tameyakul

() Malee Butkruea

() Saithip Meangmai

Issue Date : 2 June 2020

The Uncertainties are for a confidence probability of approximately 95%.

This certificate may not be reproduced other than in full, except with the prior written approval of the head of Calibration and Testing Equipment Services.

A 0004697



Cert.No. : 20CH747

Page. : 2 of 2

Condition of this calibration result

1. Reference Standard Instruments :

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

<u>Instruments</u>	<u>Model</u>	<u>Serial No.</u>	<u>ID No.</u>	<u>Certificate No.</u>	<u>Due date</u>
1) Thermo-Hygrograph	NSII-Q	1103328	130EC010	19H1780	9 July 2020
2) Electronic Balance	AE200S	N03679	140RC001	19MM505	3 Oct 2020

2. Standard Material : The Formazin suspension has been prepared gravimetric from

<u>Material</u>	<u>Manufacturer</u>	<u>Lot No.</u>	<u>Assay</u>
1) Hexamethylenetetramine	HIMEDIA	0000343342	99.5%
2) Hydrazinium Sulfate	HIMEDIA	0000332928	99.2%

3. This certificate is valid only to the item calibrated on date and place of calibration.

Calibration result

Performing three - Formazin suspension standard curve by using 0,10,1000 NTU Turbidity Meter Serial Number : 201802206

Standard Formazine suspension (NTU)	UUC* Reading (NTU)	Uncertainty of Measurement (± NTU)	Coverage Factor <i>k</i>
20	19.1	0.39	2.00
40	39.5	0.40	2.00
100	99.1	0.71	2.00
400	392	1.5	2.00

Remark

- UUC* = Unit Under Calibration
- NTU = Nephelometric Turbidity Units

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

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maker



CERTIFICATE No : 20M2735
REFERENCE No : 56381-1

PAGE : 1 OF 2

Certificate of Calibration

EQUIPMENT : DIGITAL BALANCE

MANUFACTURER : METTLER TOLEDO

MODEL : XS105

SERIAL No : 1126422905

ID No : BA 05/50

CONDITION AS RECEIVED : USED ITEM

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

CALIBRATED BY : TETNITHI W.

CALIBRATION DATE : 20-Mar-20

APPROVED BY : 
PONGSAK J.

ISSUED DATE : 26-Mar-20

RECEIVED DATE : 20-Mar-20



CERTIFICATE No : 20M2735

PAGE : 2 OF 2

Calibration Report

EQUIPMENT	: DIGITAL BALANCE	MODEL	: XS105
MANUFACTURER	: METTLER TOLEDO	S/N	: 1126422905
ID No	: BA 05/50	RECEIVED DATE	: 20-Mar-20
AIR PRESSURE	: 1011mbar ± 1mbar	CALIBRATION DATE	: 20-Mar-20
AMBIENT TEMPERATURE	: 20° C ± 1° C	RELATIVE HUMIDITY	: 53 %RH ± 10 % RH

CONDITION OF THIS RESULTS OF CALIBRATION

1. THIS INSTRUMENT WAS CALIBRATED BY ACCORDING TO UKAS LAB 14 EDITION 4:2006 BY USING KNOWN WEIGHT STANDARD WEIGHT. THE BALANCE WAS ADJUSTED USING INTERNAL WEIGHT TO ADJUST. THE BALANCE HAS NO ZERO TRACKING FUNCTION. REPEATABILITY WAS MEASURED BY USING 10 REPEATED MEASUREMENTS. LINEARITY WAS MEASURED COVERING 10 POINTS, EVENLY SPREAD OVER THE RANGE. THE INSTRUMENT WAS SET ZERO BEFORE PERFORMING THE LINEARITY TEST. OFF-CENTER LOADING WAS MEASURED BY USING STANDARD WEIGHTS PLACED ON THE PAN AND MOVED TO VARIOUS POSITIONS ON THE PAN. THE INTERNAL WEIGHT WAS CHECKED BY USING

2. REFERENCE STANDARD INSTRUMENTS :-

<u>INSTRUMENT</u>	<u>MODEL</u>	<u>SERIAL No</u>	<u>CERTIFICATE No</u>	<u>DUE DATE</u>
1) STANDARD WEIGHT SET	E2	QK-I-151	SM9/2562	23-Jan-21
2) STANDARD WEIGHT	E2	15843	SM9/2562	23-Jan-21

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

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

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

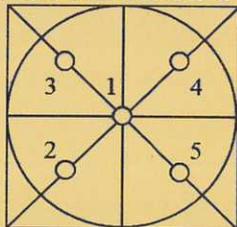
- NATIONAL INSTITUTE OF METROLOGY (THAILAND) THROUGH CENTRAL BUREAU OF WEIGHTS&MEASURES

RESULT OF CALIBRATION :- WITHOUT ADJUSTMENT

- ZERO SETTING FUNCTION : NORMAL
- TARE FUNCTION : NORMAL
- REPEATABILITY OF READIND AT 20 g WAS 0 g
- REPEATABILITY OF READIND AT 100 g WAS 0 g
- DEPARTURE FROM NOMINAL VALUE/ LINEARITY

NOMINAL VALUE (g)	BALANCE READING (g)	CORRECTION (g)	UNCERTAINTY (± g)
0.00	0.00000	0.00000	0.000030
0.02	0.02000	0.00000	0.000030
0.10	0.10000	0.00000	0.000030
0.20	0.20000	0.00000	0.000031
0.50	0.50001	-0.00001	0.000031
1.00	1.00000	0.00000	0.000060
2.00	2.00000	0.00000	0.000058
5.00	5.00000	0.00000	0.000063
10.00	10.00000	0.00000	0.000067
20.00	20.00000	0.00000	0.000073
50.00	50.0000	0.0000	0.00013
100.00	100.0000	0.0000	0.00019
120.00	120.0001	-0.0001	0.00022

6. OFF CENTER LOADING ERROR



POINT	READING (g)	
1	20.00000	50.0000
2	20.00000	50.0000
3	20.00000	50.0001
4	20.00000	50.0000
5	20.00000	50.0000
OFF-CENTER LOADING	0.00000	0.0001

7. INTERNAL WEIGHT ERROR :-0.00003333333320229 g

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

END OF CALIBRATION REPORT

Lambda UV Preventive Maintenance (PM)

Company Name:	S.P.S. CONSULTING SERVICE CO., LTD.		
Address:	7 Phaholyothin 24 Chompol Chatujak Bangkok		
User Name:	เบญจวรรณ	WO Number:	WO-00644804
Telephone Number:	086-141-2523	PM Number:	2 of 2
Customer Support Engineer:	Kerkkiat Kerdsil	Certificate Number:	UV5056-19
Date PM Performed: (DD-MMM-YYYY)	13-Feb-2020	Next PM Due Date: (DD-MMM-YYYY)	13-Aug-2020

Scope

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

General Instructions:

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

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Component List

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

Parts Lists

Part Number (if applicable)	Description	Quantity	Batch/Lot/SN#	Expiration Date (MM-YY)
B250 0999	Stray Light Standard			
	NaI	1	1740	Jun-20
	NaNO ₂	1	2708	
	KCl	1	31111	
	H ₂ O	1	71084	
RM-1N2N3N	Secondary Standard for calibration of wavelength and photometric accuracy or use NBS/NIST 930 standards			
	Gray Glass G1	1	3468	Jun-20
	Gray Glass G2	1	3382	
	Gray Glass G3	1	3309	
	Holmium Oxide	1	3831	
	NA	NA	NA	
	NA	NA	NA	

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

Procedure Checklist

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

1. General:

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

2. Optical checks:

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

3. Mechanical:

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

4. Performance Test:

- D2 Wavelength accuracy

	Actual Value	Specification
Accuracy at 656.1 nm	656.06	± 0.1

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

Filter ID #		3831	
Test	Calibration Value	Actual Value	Deviation
279.3 nm	279.4	279.31	-0.09
360.8 nm	360.9	360.9	0.00
459.9 nm	459.9	459.93	0.03
536.4 nm	536.2	536.33	0.13

- Stay Light.

Test	Filter ID #	Result	Specification
NaI @ 220 nm	1740	0.0113	< 0.02 %T
NaNO ₂ @ 340 nm	2708	0.0080	< 0.02 %T
NaNO ₂ @ 370 nm	2708	0.0090	< 0.02 %T
KCl @ 200 nm	31111	2.7620	≥ 2 A

- Baseline Flatness.

Corrected Baseline	Specification
0.000144	± 0.001 A

- Noise Test @ 500 nm.

Actual Value	Specification
0.000011	± 0.00008 A

Photometric Accuracy. (Specification ± 0.006 A.)

Filter 1 ID #		3468	
Test	Calibrated Value	Actual Value	Deviation
440 nm	0.2993	0.3016	0.0023
546.1 nm	0.2861	0.2882	0.0021
635 nm	0.3550	0.3565	0.0015
Filter 2 ID #		3382	
Test	Calibrated Value	Actual Value	Deviation
440 nm	1.0525	1.0539	0.0014
546.1 nm	1.0257	1.0272	0.0015
635 nm	1.0759	1.0779	0.0020
Filter 3 ID #		3309	
Test	Calibrated Value	Actual Value	Deviation
440 nm	0.4893	0.4932	0.0039
546.1 nm	0.4730	0.4759	0.0029
635 nm	0.5301	0.5325	0.0024

5. Accessory (where applicable):

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

6. Review:

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

Additional Comments

Additional Comments Regarding the PM

Review

<p><i>The preventive maintenance checks and if applicable performance tests for Lambda UV have been completed.</i></p>	
<p>This Lambda UV Passes <input checked="" type="checkbox"/> Fails <input type="checkbox"/> the preventive maintenance.</p>	
Review of Preventive Maintenance:	
<p>Authorized PerkinElmer Representative:</p> <p style="text-align: center; font-family: cursive; font-size: 1.2em;">Kerkiat</p>	<p>Date:</p> <p style="text-align: center;">13-Feb-2020 (DD-MMM-YYYY)</p>
<p>Authorized Customer Representative:</p>	<p>Date:</p> <p style="text-align: center;">(DD-MMM-YYYY)</p>



MAINTENANCE AND IPV TEST CERTIFICATE MODEL

OPTIMA 5300DV

Customer : <u>S.P.S.Consulting Service Co.,Ltd</u>	Date Tested: <u>July 21, 2020</u>	
	Recommendation Recertification	
Address : <u>7 Soi Phaholyothin 24</u>	Period <u>6</u> Months	
<u>Paholyothin Road</u>	Recertification Due: <u>January 21, 2021</u>	
<u>Jompol Chatuchak, Bangkok 1090</u>	Date Last Certified: <u>January 22, 2020</u>	
User Name: <u>K.Phenpha Viphasthawat</u>	Visit Number: <u>1 of 2</u>	
Phone: <u>083-9269252</u>	PerkinElmer Phone: <u>02-719-6420 ext 206</u>	
Fax: <u>02-513-4221</u>	PerkinElmer Fax: <u>02-318-5597</u>	

CONFIGURATION TESTED		ACCESSORIES/COMPONENT NOT INCLUDED
MODEL	SERIAL NUMBER	
<u>OPTIMA 5300DV</u>	<u>077C7042401</u>	
TESTED EQUIPMENT	CALIBRATION NUMBER	EXPIRATION
<u>IPV Methods</u>		
TEST STANDARD USED	PART NUMBER	EXPIRATION DATE
<u>Multielement Standard</u>	<u>N069-1579</u>	<u>November 30, 2020</u>
<u>Wavecal Solution</u>	<u>N058-2152</u>	<u>March 30, 2021</u>
<u>VIS Wavecal solution</u>	<u>N930-2946</u>	<u>December 30, 2020</u>
<u>Instrument Cal. STD4</u>	<u>N930-0221</u>	<u>April 30, 2021</u>
CUSTOMER SUPPLIED	COMMENTS	CUSTOMER INITIALS
<u>2 % HNO3</u>		
<u>10 % HNO3</u>		



MAINTENANCE AND IPV TEST CERTIFICATE MODEL

OPTIMA 5300DV

SERIAL NUMBER 077C8011701

DATE TESTED July 21, 2020

1. MECHANICAL CHECKS

A. Inspect and clean all fans and filters.

 OK

B. Inspect and replace as necessary, all torch components including the RF coil.

 OK

C. Inspect all tubing for sign of clacking or leaking.

 OK

D. Adjust water and gas pressure regulator settings.

 OK

E. Inspect and leak check pneumatics drawers.

 OK

F. Clean the exterior of the instrument.

 OK

2. OPTICAL CHECKS

A. Inspect and clean all optical components.

 OK

B. As required, check and replace all purgefilters.

 OK

C. Recheck optical alignment.

 OK

3. COOLING SYSTEM CHECKS

A. Perform preventive maintenance on chiller.

 OK

B. Flush out the chiller every year.

 N/A

4. PERFORMANCE CHECKS

A. Torch View Alignment.

 OK

B. Wavelength Calibration.

 OK



MAINTENANCE AND IPV TEST CERTIFICATE MODEL

OPTIMA 5300DV

SERIAL NUMBER : 077C8011701		DATE TESTED : July 21, 2020	
PARAMETER	SPECIFICATION	FINAL VALUE	
Spectral Resolution : UV	As 193.696 nm	≤ 0.007	0.00595
	Ni 231.604 nm	≤ 0.008	0.00791
	Ni 341.476 nm	≤ 0.012	0.00767
Spectral Resolution : VIS	La 408.672 nm	≤ 0.020	0.01602
	Ba 455.403 nm	≤ 0.025	0.02034
Precision			
	As 193.656 nm	% RSD < 1.0	0.94 %
	Zn 213.856 nm	% RSD < 1.0	0.86 %
	Mn 257.610 nm	% RSD < 1.0	0.53 %
	La 379.478 nm	% RSD < 1.0	0.41 %
	Ba 455.403 nm	% RSD < 1.0	0.39 %
	Ba 493.408 nm	% RSD < 1.0	0.38 %
Detection Limits : Axial	Tl 190.080 nm	3(sd)	1.91 ppb
	As 193.696 nm	3(sd)	2.79 ppb
	Pb 220.353 nm	3(sd)	1.14 ppb
Detection Limits : Radial	As 193.696 nm	3(sd)	40.70 ppb
	Zn 213.856 nm	3(sd)	1.13 ppb
	Mn 257.610 nm	3(sd)	0.18 ppb
	La 379.478 nm	3(sd)	2.89 ppb
	Ba 455.403 nm	3(sd)	0.25 ppb
	Ba 493.408 nm	3(sd)	1.00 ppb
BEC : Axial (IB X 500)/(IS-IB)	Cd 226.502 nm	≤ 150 ppb	80.49
BEC : Radial (IB X 1000)/(IS-IB)	Mn 257.610 nm	≤ 45 ppb	43.05



MAINTENANCE AND IPV TEST CERTIFICATE MODEL OPTIMA 5300DV

SERIAL NUMBER 077C8011701

DATE TESTED July 21, 2020

Remarks :

Commissioning follow as commissioning performance sheets.

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

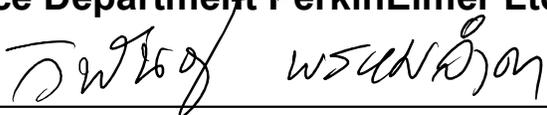
meets

does not meet

the PerkinElmer Specifications listed on this certificate.

This certificate does not modify PerkinElmer's standard terms and condition of sale, including warranty terms.

Service Department PerkinElmer Ltd.

Authorized Representative: 

(Mr. Wiphan Promlumda)

Service Engineer



PinAAcle 900T Preventive Maintenance Report

Company Name: S.P.S. CONSULTING SERVICE CO.,LTD

Instrument Location: PHAHOLYOTHIN RD, JOMPON, BANGKOK
51, TH, 10900

Instrument Serial No.: PTCS14111103

Date: 10-Jan-2020

PinAAcle 900T Preventive Maintenance (PM)

Company Name:	S.P.S. CONSULTING SERVICE CO.,LTD		
Address (Instrument Location):	PHAHOLYOTHIN RD, JOMPON, BANGKOK, 51, TH, 10900		
Serial Number:	PTCS14111103	PM Number:	1 OF 2
Customer Name (if applicable):	K.PHENPHA	Telephone Number:	083-926-9252
Customer Support Engineer Name:	K.DUANG	Service Order Number:	WO-00581839
Date PM Performed: (DD-MMM-YYYY)	10-Jan-2020	Next PM Due Date: (DD-MMM-YYYY)	10-Jul-2020
Standard Labor Hours to Complete PM :	5 hours		

Part Number	Release	Publication Date	
09370143 Rev.9	A	January 2018	

Scope

The purpose of this PM is to ensure the continued functionality of the PinAAcle 900T 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 #	Configuration Notes
AS900	AS9S14B1002	Winlab 32 V.7.2

Parts Lists

Parts Included with the PM		
Part Number (if applicable)	Description	Quantity
B0501696	Fan Filters	N/A
B3002013	THGA Contact Cylinders	N/A
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)	N/A
N9301714	Replacement Acetylene Filter Cartridge	N/A
TH001022	Replacement Air Filter Cartridge	N/A

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	24-91CUY1	28-Feb-2021
N9300244	GFAAS Mixed Standard	AR	6-80MKBY1	30-Apr-2020

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	PE200767
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	102416-040160
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 sloth 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.	0.9798	0.9786	Passed
0.2 A ND Filter	± 5% from Cert.	0.2042	0.2015	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	0.0013	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	0.0058	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	0.0003	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	0.0011	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.	0.3290	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	255	Passed
External Flow Rate	100 mL/min ± 10 mL/min	103	Passed

9.2 Chromium Baseline Noise

Description: Signal to noise check.

Parameter	Specification	Results	Pass/Fail
Baseline Noise	≤ 0.005 Abs.	0.0003	Passed
Standard Deviation	≤ 0.005	0.0001	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	5.2	Passed
Precision	≤ 2.0 %	1.8	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	13.2	Passed
Zeeman Ratio	0.52 ± 0.04	0.53	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	$= \frac{\text{Atomic Signal (Peak area)}}{\text{Atomic Signal (Peak area)} + \text{Background Signal (Peak area)}}$ $= \frac{0.1711}{0.1711+0.1468}$ $= 0.53$

Review

<i>The preventive maintenance checks and if applicable performance tests for PinAAcle 900T have been completed.</i>	
<i>This PinAAcle 900T Passes <input checked="" type="checkbox"/> Fails <input type="checkbox"/> the preventive maintenance.</i>	
Review of Preventive Maintenance:	
Authorized PerkinElmer Representative:	<div style="text-align: center; font-family: cursive;">Phang Hiransuk</div>
	Date: 10-Jan-2020 <small>(DD-MMM-YYYY)</small>
Authorized Customer Representative:	<div style="text-align: center; font-family: cursive;">674957</div>
	Date: 10-Jan-2020 <small>(DD-MMM-YYYY)</small>