ภาคผนวกที่ 5

เอกสารสอบเทียบความถูกต้องของเครื่องมือ

เอกสาร 5-1 เอกสารสอบเทียบเครื่องมือการตรวจวัดคุณภาพอากาศ

เอกสาร 5-2 เอกสารการสอบเทียบเครื่องมือการตรวจวัดระดับเสียง

เอกสาร 5-3 เอกสารสอบเทียบเครื่องมือการตรวจวิเคราะห์คุณภาพน้ำ

เอกสาร 5-4 เอกสารสอบเทียบเครื่องมือการตรวจวิเคราะห์คุณภาพตะกอนดิน

เอกสาร 5-1

เอกสารสอบเทียบเครื่องมือการตรวจวัดคุณภาพอากาศ

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

High Volume Air Sampler Calibration Report

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

Calibration Data				
High Volume Air Sampler Data		Calibration Data		
Recorder No.	Blower No.	Date	Actual Flowrate (ft^3/min)	R^2
B01	B01	02/02/2026	y = 1.147x-3.983	0.998
B02	B02	02/02/2026	y = 1.158x-3.531	0.997
B03	B03	02/02/2026	y = 1.109x-2.595	0.999
B04	B04	02/02/2026	y = 1.123x-1.928	0.998
B05	B05	02/02/2026	y = 1.145x-3.659	0.999
B06	B06	02/02/2026	y = 1.100x-2.379	0.999
B07	B07	02/02/2026	y = 1.122x-2.377	0.999
B08	B08	02/02/2026	y = 1.102x-2.500	0.998
B09	B09	02/02/2026	y = 1.121x-3.479	0.999
B10	B10	02/02/2026	y = 1.143x-3.199	0.996
B11	B11	03/02/2026	y = 1.105x-1.251	0.999
B12	B12	03/02/2026	y = 1.136x-3.106	0.996
B13	B13	03/02/2026	y = 1.142x-2.536	0.998
B14	B14	03/02/2026	y = 1.135x-3.133	0.998
B15	B15	03/02/2026	y = 1.111x-2.932	0.998
B16	B16	04/02/2026	y = 1.104x-3.794	0.998
B17	B17	04/02/2026	y = 1.151x-2.773	0.998
B18	B18	04/02/2026	y = 1.140x-2.730	0.998
B19	B19	04/02/2026	y = 1.137x-2.624	0.998
B20	B20	04/02/2026	y = 1.139x-1.402	0.998
B21	B21	04/02/2026	y = 1.131x-1.657	0.999
B22	B22	04/02/2026	y = 1.166x-3.887	0.997
B23	B23	04/02/2026	y = 1.162x-4.278	0.998
B24	B24	04/02/2026	y = 1.128x-2.436	0.998
B25	B25	04/02/2026	Y = 1.159x-4.833	0.998
B26	B26	03/02/2026	y = 1.103x-1.969	0.997
B27	B27	04/02/2026	y = 1.149x-3.761	0.997
B28	B28	04/02/2026	y = 1.134x-3.377	0.999
B29	B29	04/02/2026	y = 1.118x-2.903	0.997
B30	B30	04/02/2026	y = 1.157x-2.504	0.999
B31	B31	04/02/2026	y = 1.165x-3.108	0.999
B32	B32	04/02/2026	y = 1.113x-2.480	0.999
B33	B33	04/02/2026	y = 1.155x-2.774	0.997
B34	B34	04/02/2026	y = 1.125x-1.905	0.997

Calibrated by :	Approved by :
Adul Dangklom (Mr.Adul Dangklom)	(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
B35	B35	04/02/2026	y = 1.154x-3.696	0.996
B36	B36	04/02/2026	y = 1.119x-2.463	0.997
B37	B37	04/02/2026	y = 1.129x-3.721	0.998
B38	B38	02/02/2026	y = 1.182x-2.931	0.997
B39	B39	02/02/2026	y = 1.062x-1.512	0.999
B40	B40	02/02/2026	y = 1.163x-3.556	0.997
B41	B41	02/02/2026	y = 1.116x-1.975	0.996
B42	B42	02/02/2026	y = 1.152x-4.140	0.997
B43	B43	02/02/2026	y = 1.167x-3.646	0.996
B44	B44	02/02/2026	y = 1.178x-4.362	0.999
R01	R01	02/02/2026	y = 1.097x-2.630	0.997
R02	R02	02/02/2026	y = 1.138x-3.218	0.996
R03	R03	02/02/2026	y = 1.133x-3.084	0.998
R04	R04	02/02/2026	y = 1.121x-2.102	0.998
R05	R05	02/02/2026	y = 1.041x+0.894	0.997
R06	R06	02/02/2026	y = 1.075x+0.254	0.997
R07	R07	03/02/2026	y = 1.126x-2.841	0.996
R08	R08	03/02/2026	y = 1.091x-2.104	0.996
R09	R09	03/02/2026	y = 1.065x+0.557	0.996
R10	R10	03/02/2026	y = 1.093x-1.217	0.999
R11	R11	03/02/2026	y = 1.130x-3.938	0.999
R12	R12	05/02/2026	y = 1.164x-2.698	0.997
R13	R13	05/02/2026	y = 1.120x-3.336	0.998
R14	R14	05/02/2026	y = 1.034x+0.445	0.997
R15	R15	05/02/2026	y = 1.076x+0.429	0.998
R16	R16	05/02/2026	y = 1.107x-1.468	0.996
R17	R17	05/02/2026	y = 1.078x-1.668	0.998
R18	R18	05/02/2026	y = 1.160x-5.001	0.997
R19	R19	05/02/2026	y = 1.077x-2.680	0.997
R20	R20	05/02/2026	y = 1.185x-4.839	0.998

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

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CALIBRATION REPORT

PM10 AIR SAMPLER

DATE : 30 March 2026 SERIAL NO. 00402425061100288754

NO. PM10-D17 ENVIR-0242

CALIBRATING CONDITION

Pressure 1011 mmbar Temp. 24.5 °C % RH 50

Calibration Method : Dry Cal Primary	Model : Defender 510 H	S/N : 136164

CALIBRATION SETTING

detaCal	PM10 AIR SAMPLER		
Flowrate Reading,L/min	Initial Flowrate Reading (Before Adj.),L/min	%Dif.	Final Flowrate Reading (After Adj.),L/min
16.70	16.66	0.240	16.70

Calibrated by : Adul Dangklom
(Mr. Adul Dangklom)

Approved by :
(Mr. Peera Detudom)

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CALIBRATION REPORT

PM10 AIR SAMPLER

DATE : 30 March 2026

SERIAL NO. 00402425061100137461

NO. PM10-D18

ENVIR-0242

CALIBRATING CONDITION

Pressure 1011 mmbar Temp. 24.5 °C % RH 50

Calibration Method : Dry Cal Primary	Model : Defender 510 H	S/N : 136164

CALIBRATION SETTING

detaCal	PM10 AIR SAMPLER		
Flowrate Reading,L/min	Initial Flowrate Reading (Before Adj.),L/min	%Dif.	Final Flowrate Reading (After Adj.),L/min
16.70	16.64	0.359	16.70

Calibrated by : Adul Dangklom
(Mr. Adul Dangklom)

Approved by :
(Mr. Peera Detudom)

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CALIBRATION REPORT

PM10 AIR SAMPLER

DATE : 30 March 2026 SERIAL NO. 00402425061100115414

NO. PM10-D19 ENVIR-0242

CALIBRATING CONDITION

Pressure 1011 mmbar Temp. 24.5 °C % RH 50

Calibration Method : Dry Cal Primary	Model : Defender 510 H	S/N : 136164

CALIBRATION SETTING

detaCal	PM10 AIR SAMPLER		
Flowrate Reading,L/min	Initial Flowrate Reading (Before Adj.),L/min	%Dif.	Final Flowrate Reading (After Adj.),L/min
16.70	16.68	0.120	16.70

Calibrated by : Adul Dangklom
(Mr. Adul Dangklom)

Approved by :
(Mr. Peera Detudom)

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CALIBRATION REPORT

PM10 AIR SAMPLER

DATE :	30 March 2026	SERIAL NO.	00402425061100142754
NO.	PM10-D20		ENVIR-0242

CALIBRATING CONDITION

Pressure	1011	mmbar	Temp.	24.5 °C	% RH	50

Calibration Method : Dry Cal Primary	Model : Defender 510 H	S/N : 136164

CALIBRATION SETTING

detaCal	PM10 AIR SAMPLER		
Flowrate Reading,L/min	Initial Flowrate Reading (Before Adj.),L/min	%Dif.	Final Flowrate Reading (After Adj.),L/min
16.70	16.65	0.299	16.70

Calibrated by : Adul Dangklom
(Mr. Adul Dangklom)

Approved by :
(Mr. Peera Detudom)

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CALIBRATION REPORT

PM2.5 AIR SAMPLER

DATE :	30 March 2026	SERIAL NO.	00402425061100288754
NO.	PM2.5-D17		ENVIR-0242

CALIBRATING CONDITION

Pressure	1011	mmbar	Temp.	24.5 °C	% RH	50

Calibration Method : Dry Cal Primary	Model : Defender 510 H	S/N : 136164

CALIBRATION SETTING

detaCal	PM2.5 AIR SAMPLER		
Flowrate Reading,L/min	Initial Flowrate Reading (Before Adj.),L/min	%Dif.	Final Flowrate Reading (After Adj.),L/min
16.70	16.66	0.240	16.70

Calibrated by : Adul Dangklom
(Mr. Adul Dangklom)

Approved by :
(Mr. Peera Detudom)

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CALIBRATION REPORT

PM2.5 AIR SAMPLER

DATE : 30 March 2026 SERIAL NO. 00402425061100137461

NO. PM2.5-D18 ENVIR-0242

CALIBRATING CONDITION

Pressure 1011 mmbar Temp. 24.5 °C % RH 50

Calibration Method : Dry Cal Primary	Model : Defender 510 H	S/N : 136164

CALIBRATION SETTING

detaCal	PM2.5 AIR SAMPLER		
Flowrate Reading,L/min	Initial Flowrate Reading (Before Adj.),L/min	%Dif.	Final Flowrate Reading (After Adj.),L/min
16.70	16.64	0.359	16.70

Calibrated by : Adul Dangklom
(Mr. Adul Dangklom)

Approved by :
(Mr. Peera Detudom)

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CALIBRATION REPORT

PM2.5 AIR SAMPLER

DATE : 30 March 2026 SERIAL NO. 00402425061100115414

NO. PM2.5-D19 ENVIR-0242

CALIBRATING CONDITION

Pressure 1011 mmbar Temp. 24.5 °C % RH 50

Calibration Method : Dry Cal Primary	Model : Defender 510 H	S/N : 136164

CALIBRATION SETTING

detaCal	PM2.5 AIR SAMPLER		
Flowrate Reading,L/min	Initial Flowrate Reading (Before Adj.),L/min	%Dif.	Final Flowrate Reading (After Adj.),L/min
16.70	16.68	0.120	16.70

Calibrated by : Adul Dangklom
(Mr. Adul Dangklom)

Approved by :
(Mr. Peera Detudom)

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CALIBRATION REPORT

PM2.5 AIR SAMPLER

DATE :	30 March 2026	SERIAL NO.	00402425061100142754
NO.	PM2.5-D20		ENVIR-0242

CALIBRATING CONDITION

Pressure	1011	mmbar	Temp.	24.5 °C	% RH	50

Calibration Method : Dry Cal Primary	Model : Defender 510 H	S/N : 136164

CALIBRATION SETTING

detaCal	PM2.5 AIR SAMPLER		
Flowrate Reading,L/min	Initial Flowrate Reading (Before Adj.),L/min	%Dif.	Final Flowrate Reading (After Adj.),L/min
16.70	16.65	0.299	16.70

Calibrated by : Adul Dangklom
(Mr. Adul Dangklom)

Approved by :
(Mr. Peera Detudom)

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CALIBRATION REPORT

NO_2 ANALYZER

DATE :	30 March 2026	SERIAL NO.	00402424101800438045-N
NO.	NO2-DG-B01		ENVIR-0242

Calibrator (Dilution System)

Brand	: Teledyne	Model	: 700
Last Cal. Date	: 24 October 2025	Serial No.	: 421

Reference Standard Gas

Standard Gas	: Nitric Oxide (NO)			Cylinder No.	: A00674SV
Certified Date	: 12 March 2025	Expired Date	: 12 March 2028	Cylinder Conc.	: 48.7 ppm

CALIBRATING CONDITION

Pressure	1011	mmbar	Temp.	24.6	°C	% RH	50

CALIBRATION SETTING

Span Set Point	Initial Reading (Before Adj.),PPB			Final Reading (After Adj.),PPB
	Expected Concentration	Analyzer Response	%Dif	Analyzer Response
Zero	0	-0.10	-	0
NO Span	400	399.7	-0.075	400.0
NO_x Span	400	399.9	-0.025	400.0

Calibrated by : Adul Dangklom
(Mr. Adul Dangklom)

Approved by :
(Mr. Peera Detudom)

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CALIBRATION REPORT

NO_2 ANALYZER

DATE :	30 March 2026	SERIAL NO.	00402424101800643114-N
NO.	NO2-DG-B02		ENVIR-0242

Calibrator (Dilution System)

Brand	: Teledyne	Model	: 700
Last Cal. Date	: 24 October 2025	Serial No.	: 421

Reference Standard Gas

Standard Gas	: Nitric Oxide (NO)			Cylinder No.	: A00674SV
Certified Date	: 12 March 2025	Expired Date	: 12 March 2028	Cylinder Conc.	: 48.7 ppm

CALIBRATING CONDITION

Pressure	1011	mmbar	Temp.	24.6	°C	% RH	50

CALIBRATION SETTING

Span Set Point	Initial Reading (Before Adj.),PPB			Final Reading (After Adj.),PPB
	Expected Concentration	Analyzer Response	%Dif	Analyzer Response
Zero	0	0.10	-	0
NO Span	400	400.1	0.025	400.0
NO_x Span	400	400.2	0.050	400.0

Calibrated by : Adul Dangklom
(Mr. Adul Dangklom)

Approved by :
(Mr. Peera Detudom)

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CALIBRATION REPORT

NO_2 ANALYZER

DATE :	30 March 2026	SERIAL NO.	00402424101800681924-N
NO.	NO2-DG-B03		ENVIR-0242

Calibrator (Dilution System)

Brand	: Teledyne	Model	: 700
Last Cal. Date	: 24 October 2025	Serial No.	: 421

Reference Standard Gas

Standard Gas	: Nitric Oxide (NO)			Cylinder No.	: A00674SV
Certified Date	: 12 March 2025	Expired Date	: 12 March 2028	Cylinder Conc.	: 48.7 ppm

CALIBRATING CONDITION

Pressure	1011	mmbar	Temp.	24.6	°C	% RH	50

CALIBRATION SETTING

Span	Initial Reading (Before Adj.),PPB			Final Reading (After Adj.),PPB
Set Point	Expected Concentration	Analyzer Response	%Dif	Analyzer Response
Zero	0	0.10	-	0
NO Span	400	399.8	-0.050	400.0
NO_X Span	400	400.1	0.025	400.0

Calibrated by : Adul Dangklom
(Mr. Adul Dangklom)

Approved by :
(Mr. Peera Detudom)

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

CALIBRATION REPORT

NO_2 ANALYZER

DATE : 30 March 2026 SERIAL NO. 00402425091300201920-N

NO. NO2-DG-B04 AQMS-06

Calibrator (Dilution System)

Brand	: Teledyne	Model	: 700
Last Cal. Date	: 24 October 2025	Serial No.	: 421

Reference Standard Gas

Standard Gas	: Nitric Oxide (NO)			Cylinder No.	: A00674SV
Certified Date	: 12 March 2025	Expired Date	: 12 March 2028	Cylinder Conc.	: 48.7 ppm

CALIBRATING CONDITION

Pressure 1011 mmbar Temp. 24.6 °C % RH 50

CALIBRATION SETTING

Span Set Point	Initial Reading (Before Adj.),PPB			Final Reading (After Adj.),PPB
	Expected Concentration	Analyzer Response	%Dif	Analyzer Response
Zero	0	-0.10	-	0
NO Span	400	399.6	-0.100	400.0
NO_x Span	400	399.8	-0.050	400.0

Calibrated by : Adul Dangklom
(Mr. Adul Dangklom)

Approved by :
(Mr. Peera Detudom)

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CALIBRATION REPORT

SO_2 ANALYZER

DATE :	30 March 2026	SERIAL NO.	00402424101800438045-S
NO.	SO_2-DG-B01		ENVIR-0242

Calibrator (Dilution System)

Brand	: Teledyne	Model	: 700
Last Cal. Date	: 24 October 2025	Serial No.	: 421

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.	24.6	°C	% RH	50

CALIBRATION SETTING

Span Set Point	Initial Reading (Before Adj.),PPB			Final Reading (After Adj.),PPB
	Expected Concentration	Analyzer Response	%Dif	Analyzer Response
Zero	0	-0.10	-	0
SO_2 Span	400.0	399.8	-0.050	400.0

Calibrated by : Adul Dangklom
(Mr. Adul Dangklom)

Approved by :
(Mr. Peera Detudom)

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CALIBRATION REPORT

SO_2 ANALYZER

DATE :	30 March 2026	SERIAL NO.	00402424101800643114-S
NO.	SO_2-DG-B02		ENVIR-0242

Calibrator (Dilution System)

Brand	: Teledyne	Model	: 700
Last Cal. Date	: 24 October 2025	Serial No.	: 421

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.	24.6 °C	% RH 50

CALIBRATION SETTING

Span Set Point	Initial Reading (Before Adj.),PPB			Final Reading (After Adj.),PPB
	Expected Concentration	Analyzer Response	%Dif	Analyzer Response
Zero	0	0.10	-	0
SO_2 Span	400.0	400.2	0.050	400.0

Calibrated by : Adul Dangklom
(Mr. Adul Dangklom)

Approved by :
(Mr. Peera Detudom)

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CALIBRATION REPORT

SO_2 ANALYZER

DATE :	30 March 2026	SERIAL NO.	00402424101800681924-S
NO.	SO_2-DG-B03		ENVIR-0242

Calibrator (Dilution System)

Brand	: Teledyne	Model	: 700
Last Cal. Date	: 24 October 2025	Serial No.	: 421

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.	24.6 °C	% RH 50

CALIBRATION SETTING

Span Set Point	Initial Reading (Before Adj.),PPB			Final Reading (After Adj.),PPB
	Expected Concentration	Analyzer Response	%Dif	Analyzer Response
Zero	0	0.10	-	0
SO_2 Span	400.0	399.9	-0.025	400.0

Calibrated by : Adul Dangklom
(Mr. Adul Dangklom)

Approved by :
(Mr. Peera Detudom)

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CALIBRATION REPORT

SO_2 ANALYZER

DATE :	30 March 2026	SERIAL NO.	00402425091300201920-S
NO.	SO_2-DG-B04		AQMS-06

Calibrator (Dilution System)

Brand	: Teledyne	Model	: 700
Last Cal. Date	: 24 October 2025	Serial No.	: 421

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.	24.6	°C	% RH	50

CALIBRATION SETTING

Span Set Point	Initial Reading (Before Adj.),PPB			Final Reading (After Adj.),PPB
	Expected Concentration	Analyzer Response	%Dif	Analyzer Response
Zero	0	-0.10	-	0
SO_2 Span	400.0	400.1	0.025	400.0

Calibrated by : Adul Dangklom
(Mr. Adul Dangklom)

Approved by :
(Mr. Peera Detudom)

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Calibration Report
CO Analyzer

Date :	30 March 2026	SERIAL NO.	00402424101800438045-C
No.	CO-DG-B01		ENVIR-0242

Calibrator (Dilution System)

Brand	: Teledyne	Model	: 700
Last Cal. Date	: 24 October 2025	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. 24.6 °C % RH 50

Calibration Setting

Span Set Point	Initial Reading (Before Adj.), PPM			Final Reading (After Adj.), PPM
	Expected Concentration	Analyzer Response	%Dif	Analyzer Response
Zero	0	0.10	-	0
CO Span	40.00	40.03	0.075	40.00

Calibrated by : Adul Dangklom
(Mr. Adul Dangklom)

Approved by :
(Mr. Peera Detudom)

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Calibration Report
CO Analyzer

Date :	30 March 2026	SERIAL NO.	00402424101800643114-C
No.	CO-DG-B02		ENVIR-0242

Calibrator (Dilution System)

Brand	: Teledyne	Model	: 700
Last Cal. Date	: 24 October 2025	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.	24.6 °C	% RH	50

Calibration Setting

Span Set Point	Initial Reading (Before Adj.), PPM			Final Reading (After Adj.), PPM
	Expected Concentration	Analyzer Response	%Dif	Analyzer Response
Zero	0	-0.10	-	0
CO Span	40.00	39.98	-0.050	40.00

Calibrated by : Adul Dangklom
(Mr. Adul Dangklom)

Approved by :
(Mr. Peera Detudom)

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Calibration Report
CO Analyzer

Date :	30 March 2026	SERIAL NO.	00402424101800681924-C
No.	CO-DG-B03		ENVIR-0242

Calibrator (Dilution System)

Brand	: Teledyne	Model	: 700
Last Cal. Date	: 24 October 2025	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. 24.6	°C	% RH 50

Calibration Setting

Span Set Point	Initial Reading (Before Adj.), PPM			Final Reading (After Adj.), PPM
	Expected Concentration	Analyzer Response	%Dif	Analyzer Response
Zero	0	0.11	-	0
CO Span	40.00	40.04	0.100	40.00

Calibrated by : Adul Dangklom
(Mr. Adul Dangklom)

Approved by :
(Mr. Peera Detudom)

บริษัท เอส.พี.เอส. คอนซัลติ้ง เซอร์วิส จำกัด
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Calibration Report
CO Analyzer

Date :	30 March 2026	SERIAL NO.	00402425091300201920-C
No.	CO-DG-B04		AQMS-06

Calibrator (Dilution System)

Brand	: Teledyne	Model	: 700
Last Cal. Date	: 24 October 2025	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. 24.6	°C	% RH 50

Calibration Setting

Span Set Point	Initial Reading (Before Adj.), PPM			Final Reading (After Adj.), PPM
	Expected Concentration	Analyzer Response	%Dif	Analyzer Response
Zero	0	-0.10	-	0
CO Span	40.00	39.97	-0.075	40.00

Calibrated by : Adul Dangklom
(Mr. Adul Dangklom)

Approved by :
(Mr. Peera Detudom)

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

NSC-TISI-TIS17025
CALIBRATION 0049

CERTIFICATE No : 26M2266
REFERENCE No : 80204-1

Certificate of Calibration

EQUIPMENT	:	DIGITAL BALANCE
MANUFACTURER	:	METTLER TOLEDO
MODEL	:	XS105DU
SERIAL No	:	1126422905
ID No	:	BA 05/50
CONDITION AS RECEIVED	:	USED ITEM
SUBMITTED BY	:	S.P.S. CONSULTING SERVICE CO., LTD. 7 SOI PHAHOLYOTHIN 24, PHAHOLYOTHIN RD., JOMPOL, CHATUCHAK, BANGKOK 10900
CALIBRATED BY	:	SUCHAT S.
CALIBRATION DATE	:	05-Mar-26
APPROVED BY	:	PONGSAK J.
ISSUED DATE	:	06-Mar-26
RECEIVED DATE	:	05-Mar-26

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

QUALITY CALIBRATION CO.,LTD.
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www.qcalibration.com

CERTIFICATE No : 26M2266

Calibration Report

EQUIPMENT	:	DIGITAL BALANCE	**MODEL**	:	XS105DU
MANUFACTURER	:	METTLER TOLEDO	**S/N**	:	1126422905
ID No	:	BA 05/50	**RECEIVED DATE**	:	05-Mar-26
AIR PRESSURE	:	1004mbar ± 1mbar	**CALIBRATION DATE**	:	05-Mar-26
AMBIENT TEMPERATURE	:	25° C ± 1° C	**RELATIVE HUMIDITY**	:	50 %RH ± 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 LINEARLITY 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	C02250116	28-Jan-27
2) STANDARD WEIGHT	E2	15843	C02250117	29-Jan-27

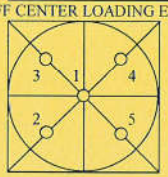
3. THE CERTIFICATE IS VALID FOR THE ITEM CALIBRATED AS SHOWN ON THE DATE AND PLACE OF CALIBRATION ONLY.
4. THIS RESULT EXCLUDE LONG TERM STABILITY OF THE UNIT UNDER CALIBRATION.
5. THIS CERTIFICATE IS TRACEABLE TO THE INTERNATIONAL SYSTEM OF UNIT MAINTAINED AT:-
   - NATIONAL INSTITUTE OF METROLOGY (THAILAND)

RESULT OF CALIBRATION :- WITHOUT ADJUSTMENT

1. ZERO SETTING FUNCTION : NORMAL
2. TARE FUNCTION : NORMAL
3. REPEATABILITY OF READING AT 120 g WAS 0.000055 g
4. DEPARTURE FROM NOMINAL VALUE/ LINEARITY

NOMINAL VALUE (g)	BALANCE READING (g)	CORRECTION (g)	UNCERTAINTY (± g)
0.00	0.00000	0.00000	0.000065
0.02	0.02000	0.00000	0.000065
0.10	0.10000	0.00000	0.000066
0.20	0.20000	0.00000	0.000066
0.50	0.50001	-0.00001	0.000065
1.00	1.00001	-0.00001	0.000066
2.00	2.00000	0.00000	0.000067
5.00	5.00001	-0.00001	0.000068
10.00	10.00004	-0.00004	0.000070
20.00	20.00006	-0.00006	0.000078
50.00	50.0000	0.0000	0.00012
100.00	100.0002	-0.0002	0.00019
120.00	120.0002	-0.0002	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

เอกสาร 5-2

เอกสารการสอบเทียบเครื่องมือการตรวจวัดระดับเสียง

THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-69/0204 **MTC No.** EEL. BP. 152/0169

CALIBRATION CERTIFICATE

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

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

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

Instrument Calibrated :

Description : Sound Calibrator

Manufacturer : ACO

Model : 2127

Serial No. : 130006

Ambient Environment

Temperature : (23 + 3) °C

Relative Humidity : (50 ± 15) %

Ambient Pressure : (101.325 ± 1.500) kPa

Standards used :

1. Digital Function Synthesizer NF Electronic DF-193A S/N 122037.
2. Measuring Amplifier Bruel&Kjaer 2636 S/N 1537484.
3. Programmable Attenuator Tamagawa TPA-303A S/N OF 2214.
4. Digital Multimeter Agilent 34401A S/N MY44005560.
5. Pressure Transmitter Vaisala PTB202AD S/N T0650001.
6. Audio Analyzer Keithley 2015-P S/N 4106495.
7. Condenser Microphone Bruel&Kjaer 4180 S/N 2889871.

Calibration Procedure: CP-102-04 based on IEC 60942-2003; The sound pressure level 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 : 29 Jan. 2026

Date of Calibration : 11 Feb. 2026

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.

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Bangkok 10900, Thailand
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(66) 08 1889 6827

NSC-TISI-TIS 17025
CALIBRATION 0037

THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-69/0204 **MTC No.** EEL. BP. 152/0169

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

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

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

1. Sound Pressure Level

Standard Microphone Type	Measured Sound Pressure Level (dB)	Deviated value (dB)	Uncertainty (dB)	Tolerance limit IEC60942:2003 Class 1
1/2 inch Bruel&Kjaer 4180	93.89	-0.11	± 0.10	±0.40 dB

2. Frequency

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

3. Total Distortion

Standard Microphone Type	Measured Total Distortion (%)	Uncertainty (%)	Tolerance limit IEC60942:2003 Class 1
1/2 inch Bruel&Kjaer 4180	1.90	± 0.50	±3.0%

Note : 1. No adjustment.

2. The calibrator pressure correction was not included.

3. The microphone volume correction was not included.

Calibrated by :

(Mr.Weerachai Deechaiyae)

Approved by :

(Mr.Prawale Kluaypa)

Director

Electrical and Electronic Standards Laboratory

Industrial Metrology and Testing Service Centre

Date of Calibration : 11 Feb. 2026

Date of Issue : 12 Feb. 2026

Ref : 2011269012900497001

End of Certificate

The results relate only to the items tested/calibrated or value assigned.
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FM.BL.MTC.002 Rev.5

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668 Mu 2 Tambon Bangpoomai, Amphoe Muang Samutprakan,
Changwat Samutprakan 10280, Thailand
Tel. (66) 0 2323 1672-80 ext. 115, 116
(66) 08 3219 9440
E-mail : mtc@tistr.or.th Website : www.tistr.or.th

Office
196 Phahonyothin Road, Ladyao, Chatuchak,
Bangkok 10900, Thailand
Tel. (66) 0 2579 1121-30 ext. 5219, 5225, 5217
(66) 08 1889 6827

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

Noise B_143/26

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	11 February 2026
		Due Date	11 February 2027

Calibration Data

Sound Level Meter Data				Calibration Data		
SLM No.	Brand	Model	Serial No.	Date	Actual Reading [dB]	
					Before Adjustment	After Adjustment
ACO-C1-B05	ACO	6238	00223042	31 March 2026	93.7	93.9
ST-C1-B18	SCARLET	ST-12D	10352316	31 March 2026	93.8	93.9
ST-C1-B20	SCARLET	ST-12D	10352322	31 March 2026	93.9	93.9
ST-C1-B21	SCARLET	ST-12D	10352325	31 March 2026	93.9	93.9
Acoustic Certified Value : Thailand Institute of Scientific and Technological Research (TISTR)					93.89 ± 0.10 dB	

Calibrated by : Adul Dangklom
(Mr. Adul Dangklom)

Approved by :
(Mr. Peera Detudom)

เอกสาร 5-3

เอกสารสอบเทียบเครื่องมือการตรวจวิเคราะห์คุณภาพน้ำ

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

NSC-TISI-TIS17025 CALIBRATION 0049

CERTIFICATE No : 26E3363
REFERENCE No : 80514-1

Certificate of Calibration

EQUIPMENT	:	pH METER
MANUFACTURER	:	HANNA
MODEL	:	HI3512
SERIAL No	:	TH118035
ID No	:	PH 04/56
CONDITION AS RECEIVED	:	USED ITEM
SUBMITTED BY	:	S.P.S. CONSULTING SERVICE CO., LTD. 7 SOI PHAHOLYOTHIN 24, PHAHOLYOTHIN RD., JOMPOL, CHATUCHAK, BANGKOK 10900
CALIBRATED BY	:	ATSAWIN Y.
CALIBRATION DATE	:	02-Apr-26
APPROVED BY	:	PONGSAK J.
ISSUED DATE	:	02-Apr-26
RECEIVED DATE	:	01-Apr-26

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

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

Calibration Report

EQUIPMENT	:	pH METER			
MANUFACTURER	:	HANNA	**MODEL**	:	HI3512
ID No	:	PH 04/56	**SERIAL NUMBER**	:	TH118035
RECEIVED DATE	:	01-Apr-26	**CALIBRATION DATE**	:	02-Apr-26
AMBIENT TEMPERATURE	:	23 ° C ± 3 ° C	**RELATIVE HUMIDITY**	:	50 % RH ± 10% RH

CONDITION OF THIS RESULTS OF CALIBRATION

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

INSTRUMENT	MODEL	SERIAL No/ LOT No	CERTIFICATE No	DUE DATE
1) pH STANDARD SOLUTION	00651-36	CC829914	4956-16178366	11-Sep-27
2) pH STANDARD SOLUTION	00651-38	CC831093	4957-16224157	01-Oct-27
3) pH STANDARD SOLUTION	00651-40	CC826321	4958-16046326	10-Jul-27
4) PROCESS CALIBRATOR	CA150	91S6079	26E936	17-Mar-27
5) BATH	260014	1247 48074	25T9431	12-Sep-26
6) THERMOMETER WITH PROBE	421504	55000379	25T9466	12-Sep-26

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 SI UNIT MAINTAINED AT :-
   - NATIONAL INSTITUTE OF STANDARD AND TECHNOLOGY, USA.
   - NATIONAL INSTUTITE 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	414.3	-0.19	-0.256	0.15	2.00
354.95	355.1	-0.15	0.759	0.15	2.00
295.80	296.0	-0.20	1.773	0.15	2.00
236.64	236.8	-0.16	2.787	0.15	2.00
177.48	177.7	-0.22	3.801	0.15	2.00
118.32	118.5	-0.18	4.816	0.15	2.00
59.16	59.4	-0.24	5.831	0.15	2.00
0.00	0.2	-0.20	6.845	0.15	2.00
-59.16	-58.9	-0.26	7.878	0.15	2.00
-118.32	-118.1	-0.22	8.915	0.15	2.00
-177.48	-177.2	-0.28	9.952	0.15	2.00
-236.64	-236.4	-0.24	10.990	0.15	2.00
-295.80	-295.5	-0.30	12.027	0.15	2.00
-354.95	-354.7	-0.25	13.064	0.15	2.00
-414.11	-413.8	-0.31	14.101	0.15	2.00

END OF CALIBRATION REPORT PAGE 2 OF 3

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 : 26E3363

Calibration Report

RESULT OF CALIBRATION (CONTINUE) :

2. DISPLAY UNIT WITH pH ELECTRODE S/N: 11340D0M

STANDARD pH BUFFER SOLUTION (pH)	UUC READING (pH)	CORRECTION (pH)	VALUE BEFORE ADJUSTMENT	UNCERTAINTY OF MEASUREMENT (± pH)	COVERAGE FACTOR k
4.008	4.008	0.000	4.142	0.012	2.00
6.998	7.000	-0.002	7.068	0.012	2.00
10.007	10.009	-0.002	10.226	0.014	2.00

3. DISPLAY UNIT WITH TEMPERATURE

STANDARD READING (°C)	UUC READING (°C)	CORRECTION (°C)	VALUE BEFORE ADJUSTMENT	UNCERTAINTY OF MEASUREMENT (± °C)	COVERAGE FACTOR k
25.004	25.0	0.004	---	0.0085	2.00

4. PERCENT SLOPE 91%

UUC : UNIT UNDER CALIBRATION

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

END OF CALIBRATION REPORT

Certificate

SITHIPORN ASSOCIATES CO., LTD.
CALIBRATION LABORATORY

451-451/1 Sirinthorn Road, Bangbumru, Bangplud, Bangkok, 10700 Thailand
Tel. +66 2433 8331 Email : calibration@sithiphorn.com

NSC-TISI-TIS 17025
CALIBRATION 0394

Cert. No. : SP25026
Pages : 1 of 4

Calibration Certificate

Equipment :	UV-VIS SPECTROPHOTOMETER
Manufacturer :	PERKINELMER
Model :	LAMBDA 25
Serial No.:	501S14123010
ID No.:	SP03/58
Calibration Mode :	WAVELENGTH ACCURACY PHOTOMETRIC ACCURACY STRAY LIGHT
Condition As Found :	GOOD
Customer :	S.P.S CONSULTING SERVICE CO., LTD. 7 SOI PHAHOLYOTHIN 24, PHAHOLYOTHIN ROAD, CHOMPHON SUB-DISTRICT, CHATUCHAK DISTRICT, BANGKOK PROVINCE 10900 THAILAND.
Location :	ORGANIC LABORATORY IV
Ambient Temperature :	(22.9 ± 5) °C
Relative Humidity :	(53.7 ± 25) %
Received Date :	22 AUGUST 2025
Calibration Date :	22 AUGUST 2025
Date of Issue :	25 AUGUST 2025

Calibrated by : Nitinun Srihawan

Approved by : Wichok B.
(Wichok Ekpongpradit)

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.

Cert. No. : SP25026
Job No. : VC68SP0019
Pages : 2 of 4

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	126461	24/10/2026
Didymium liquid	RM-DL	28912	126462	24/10/2026
Neutral density filter	RM-1N2N3N	13877	126457	24/10/2026
Potassium dichromate solutions	RM-0204060810	14204	126497	25/10/2026
Potassium Iodide solution	-	KI-0701-001	CI-0185-24	14/05/2026

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)

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	278.21	0.08	0.16	2.00
	361.25	361.39	0.14	0.16	2.00
	467.82	467.71	-0.11	0.16	2.00
	536.56	536.50	-0.06	0.16	2.00
	640.50	640.36	-0.14	0.16	2.00
RM-DL	740.09	739.85	-0.24	0.16	2.00
	864.94	865.12	0.18	0.16	2.00

UUC* = Unit Under Calibration

Wichok B.

Cert. No. : SP25026
Job No. : VC68SP0019

Result of calibration : Photometric Accuracy

Material	Wavelength (nm)	Filter S/N	Nominal Absorbance (A)	Certified Absorbance (A)	UUC* Reading Absorbance (A)	Error (A)	Uncertainty ± (A)	*k* Factor
Neutral Density glass filter	440.0	29381	0.5	0.5443	0.5413	-0.0030	0.0043	2.00
		29914	0.7	0.7484	0.7455	-0.0029	0.0054	2.00
		29360	1.0	1.0527	1.0535	0.0008	0.0032	2.00
	465.0	29381	0.5	0.4948	0.4922	-0.0026	0.0041	2.00
		29914	0.7	0.6906	0.6877	-0.0029	0.0050	2.00
		29360	1.0	0.9695	0.9709	0.0014	0.0031	2.00
	546.1	29381	0.5	0.5090	0.5068	-0.0022	0.0036	2.00
		29914	0.7	0.6985	0.6960	-0.0025	0.0041	2.00
		29360	1.0	0.9814	0.9825	0.0011	0.0031	2.00
	590.0	29381	0.5	0.5375	0.5353	-0.0022	0.0034	2.00
		29914	0.7	0.7256	0.7231	-0.0025	0.0037	2.00
		29360	1.0	1.0213	1.0219	0.0006	0.0032	2.00
	635.0	29381	0.5	0.5223	0.5202	-0.0021	0.0033	2.00
		29914	0.7	0.6927	0.6901	-0.0026	0.0036	2.00
		29360	1.0	0.9744	0.9750	0.0006	0.0032	2.00

UUC* = Unit Under Calibration

Wichou B.

SITHIPORN associates
SITHIPORN ASSOCIATES
CALIBRATION LABORATORY

Cert. No. : SP25026
Job No. : VC68SP0019

Result of calibration : Photometric Accuracy

(Without adjustment)

Material	Wavelength (nm)	Solution (mg/l)	Certified Absorbance (A)	UUC* Reading Absorbance (A)	Error (A)	Uncertainty ± (A)	*k* Factor
Potassium dichromate solutions	235.0	20	0.2415	0.2443	0.0028	0.0101	2.00
		40	0.4866	0.4871	0.0005	0.0115	2.00
		60	0.7415	0.7295	-0.0120	0.0067	2.00
		80	0.9854	0.9844	-0.0010	0.0071	2.00
		100	1.2444	1.2425	-0.0019	0.0073	2.00

UUC* = Unit Under Calibration

Condition of this result of calibration : Spectrophotometer PERKINELMER Model LAMBDA 25 S/N 501S14123010

Resolution of Wavelength Mode	0.1 nm
Resolution of Photometric Mode	0.001 A
Parameter Setting	
Measurement Mode	Wavelength, Absorbance
Wavelength Scan	190 nm - 1100 nm
Scanning Speed	7.5 nm/min
Band width(Wavelength)	1.0
Band width(Vis)	1.0
Band width(Uv)	1.0

Stray Light** UUC* Reading at 220.0 nm	
Transimission T(%)	**Absorbance(A)**
0.020	3.7032

**Specific Acceptance :
Transmission ≤ 1.0 T(%), Absorbance ≥ 2.0 A
**Stray light not TISI Accredited

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

End of Calibration Certificate

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

NSC-TISI-TIS17025
CALIBRATION 0049

CERTIFICATE No : 26M2268
REFERENCE No : 80204-3

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	:	SUCHAT S.
CALIBRATION DATE	:	05-Mar-26
APPROVED BY	:	PONGSAK J.
ISSUED DATE	:	06-Mar-26
RECEIVED DATE	:	05-Mar-26

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

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

CERTIFICATE No : 26M2268

Calibration Report

EQUIPMENT	:	DIGITAL BALANCE	**MODEL**	:	BSA224S-CW
MANUFACTURER	:	SARTORIUS	**S/N**	:	36591843
ID No	:	BA 09/61	**RECEIVED DATE**	:	05-Mar-26
AIR PRESSURE	:	1004mbar ± 1mbar	**CALIBRATION DATE**	:	05-Mar-26
AMBIENT TEMPERATURE	:	25° C ± 1° C	**RELATIVE HUMIDITY**	:	50 %RH ± 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 LINEARLITY 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	C02250116	28-Jan-27
2) STANDARD WEIGHT	E2	15843	C02250117	29-Jan-27

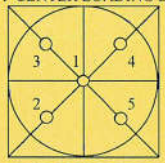
3. THE CERTIFICATE IS VALID FOR THE ITEM CALIBRATED AS SHOWN ON THE DATE AND PLACE OF CALIBRATION ONLY.
4. THIS RESULT EXCLUDE LONG TERM STABILITY OF THE UNIT UNDER CALIBRATION.
5. THIS CERTIFICATE IS TRACEABLE TO THE INTERNATIONAL SYSTEM OF UNIT MAINTAINED AT:-
   - NATIONAL INSTITUTE OF METROLOGY (THAILAND)

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 (± g)
0.0	0.0000	0.0000	0.00010
0.1	0.1000	0.0000	0.00011
0.2	0.2000	0.0000	0.00010
0.5	0.5000	0.0000	0.00011
1.0	1.0000	0.0000	0.00011
2.0	2.0000	0.0000	0.00011
5.0	5.0000	0.0000	0.00011
10.0	10.0000	0.0000	0.00011
20.0	20.0001	-0.0001	0.00011
50.0	50.0000	0.0000	0.00013
100.0	100.0001	-0.0001	0.00019
200.0	200.0001	-0.0001	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

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

CERT.No.: HS-X014C

Certificate of Calibration

Calibration Date :	16 March 2026	Model	: YSI 5000
Submitted by :	S.P.S CONSULTING SERVICE CO.,LTD	S/N	: 15B100751
	7 Soi Phaholyothin 24, Phaholyothin Rd., Jompol,	Probe	: YSI 5010
	Chatuchak, Bangkok, Thailand 10900	S/N	: 22D100097
		ID NO.	:
Avg Room Temp :	20 °C	Air Temp ref	: S/N. F8065C26
Avg Water Temp :	20 °C	Barometric ref	: S/N. F8065C26
Air Pressure :	760.00 mmHg	Water Temp ref	: -
Salinity :	0 ppt	ID NO.	HS001
		Technician	: Kittipong M.

Calibration Details

Calibration Point	100% air sat. (@20 °C, DO = 9.09 mg/l)	(status)		(status)
Measurement 1 (mg/l)	9.09	(PASS)	-	-
Measurement 2 (mg/l)	9.09	(PASS)	-	-
Measurement 3 (mg/l)	9.09	(PASS)	-	-
Measurement 4 (mg/l)	9.09	(PASS)	-	-
Measurement 5 (mg/l)	9.09	(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	9.09	mg/l	-	-
Inaccuracy	0.00	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
(Natenapha Pisatkunchon)

MIRACLE INTERNATIONAL TECHNOLOGY CO.,LTD
214 Bangwaek Rd. Bangpai Bangkae Bangkok 10160
Tel.: 0-2865-4647-8 Fax: 0-2865-4649 http://www.mit.in.th

CALIBRATION CERTIFICATE

Certificate No. : S2025070410-0004
Date Issued : 24-Jul-25

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

Equipment : Block Digestion (Gerhardt, TR)

Manufacturer : Gerhardt
Model : -
Serial No. : 4061832
ID No./Tag No. : KJ 01/43
Date Received : 22-Jul-25
Date Calibrated : 22-Jul-25

Calibrated by : Auttapol Kunaumpal

Calibration Method or Calibration Procedure Used

In-house method : CP-49 base on TLAS G-20 by comparing against Standard Thermometer.

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

Result of Calibration

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

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

Approved by: K. Nathaong
(Nathapong Krudaum)

CERTIFIED MIT

Certificate No. : S2025070410-0004

Environment : Ambient Temperature : Start record 25.5 °C, Stop record 25.5 °C
Relative Humidity : Start record 50.4 %RH, Stop record 50.1 %RH

Calibration Temperature (°C)	Setting Temperature (°C)	Indicating Temperature (°C)	Measured Stability[1] (°C)	Measured Uniformity[2] (°C)	Overall Variation[3] (°C)
380	380	380	1.03	1.73	2.57

Calibration Temperature (°C)	Standard Reading (°C), Probe No. 10 is Reference Probe					Uncertainty[4] (±°C)
380	**No. 1**	**No. 2**	**No. 3**	**No. 4**	**No. 5**	1.9
	380.49	380.79	380.68	380.85	380.56	
	No. 6	**No. 7**	**No. 8**	**No. 9**	**No. 10**	
	380.60	379.85	380.28	379.65	380.55	
	No. 11	**No. 12**	**No. 13**	**No. 14**	**No. 15**	
	380.38	380.54	380.49	380.75	380.37	
	No. 16	**No. 17**	**No. 18**	**No. 19**	**No. 20**	
	380.25	379.64	379.73	380.52	380.79	

Without adjustment

No.1	No.2	No.3	No.4
No.5	No.6	No.7	No.8
No.9	No.10	No.11	No.12
No.13	No.14	No.15	No.16
No.17	No.18	No.19	No.20

Top view position

Condition As-Received : Used Item

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

Measurement Standards Used & Traceabilitly :

The International System of Units (SI) through

MIT Certificate No. L202502406-0002 for Digital Thermometer with Probe (Agilent) Module 2 (172) Type K Serial No. US37011 Due 10-Oct-25

Notes : 1. The temperature stability is the one-half of greatest maximum difference of measured temperatures at any one probe.
2. The temperature uniformity is the maximum difference of measured temperatures between of any probes and the measured temperature at the reference location which are observed at same time.
3. Overall variation is the difference of maximum and minimum measured temperatures throughout observation time.
4. The uncertainty of measurement is included temperature stability.

End of Certificate

PerkinElmer
For the Better

PinAAcle 900T
Preventive Maintenance Report

Company Name: S.P.S. Consulting Service Co.,Ltd.

Instrument Location: 7, 24 Soi Phaholyothin,

Ladyao, Khet, Bangkok 10900

Instrument Serial No.: PTCS14111103

Date: 18 Jun 2026

PinAAcle 900T Preventive Maintenance (PM)

Company Name:	S.P.S. Consulting Service Co.,Ltd.		
Address (Instrument Location):	7, 24 Soi Phaholyothin, Ladyao, Khet, Bangkok 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. Chayanan	**Service Order Number:**	WO-11540403
Date PM Performed: (DD-MMM-YYYY)	18 Jun 2026	**Next PM Due Date:** (DD-MMM-YYYY)	18 Jun 2027
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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PerkinElmer shall not be liable for incidental or consequential damages in connection with the furnishing or use of this document.

Component List

Component / Specific Model	Serial #	Configuration Notes
PinAAcle900T	PTCS14111103	Winlab32
Fias100	100S14090404	Winlab32

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	1
N3160156	O-Ring Kits for Sampling Introduction (Stainless Steels Nebulizer)	N/A
N3160157	O-Ring Kits for Sampling Introduction (Plastic Nebulizer)	2
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	28-83CUY1	Nov 26
N9300244	GFAAS Mixed Standard	AR	60-004CRY1	Jun 26

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	101N0089015
N1013002	1.0A Neutral density filter	1	101N0089015
B3100652 Or N9307029	Electronic Flow Meter	1	NA
B0505495	Test Jig	1	NA
03030997	System 2 EDL Driver	1	030309-97E
N3050605	As System 2 EDL	1	000003-26798A
N3050121	Cu Lumina HCL	1	060419-030180
N3050109	Ba Lumina HCL	1	061219-020041
N3050139	K Lumina HCL	1	030819-010130
N3050152	Ni Lumina HCL	1	052719-020020
N3050119	Cr Lumina HCL	1	060419-030180

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 N20-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_2H_2 Flame correctly shuts down	Active	Passed
Drain Sensor	Air/C_2H_2 Flame correctly shuts down	Active	Passed
Nebulizer Sensor	Air/C_2H_2 Flame correctly shuts down	Active	Passed
C_2H_2 Pressure Sensor	Air/C_2H_2 Flame correctly shuts down	Active	Passed
Air Pressure Sensor	Air/C_2H_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.	2.0405	1.9997	Passed
0.2 A ND Filter	± 5% from Cert.	0.1953	0.1855	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	0.001	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 D_2 Background Compensation with Copper

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

Parameter	Specification	Results	Pass/Fail
Standard Deviation	≤ 0.010	0.0001	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	0.0001	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.	NA	Not Applicable
2 mg/L Sensitivity HS Neb (if applicable)	> 0.250 Abs.	0.356	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	260	Passed
External Flow Rate	100 mL/min ± 10 mL/min	105	Passed

9.2 Chromium Baseline Noise

Description: Signal to noise check.

Parameter	Specification	Results	Pass/Fail
Baseline Noise	≤ 0.005 Abs.	0.0002	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	5.4	Passed
Precision	≤ 2.0 %	0.14	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	14.5	Passed
Zeeman Ratio	0.52 ± 0.04	0.54	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 $= \frac{Atomic\ Signal\ (Peak\ area\ )}{Atomic\ Signal\ (Peak\ area\ ) + Background\ Signal\ (Peak\ area\ )}$ $= \frac{0.1551}{0.1551+0.1315}$ $= 0.54$

Review

The preventive maintenance checks and if applicable performance tests for PinAAcle 900T have been completed.

This PinAAcle 900T Passes ☑ Fails ☐ the preventive maintenance.

Review of Preventive Maintenance:	
Authorized PerkinElmer Representative: Chayanan K.	Date: 18 Jun 2026 (DD-MMM-YYYY)
Authorized Customer Representative:	Date: 18 Jun 2026 (DD-MMM-YYYY)

PerkinElmer

MAINTENANCE AND IPV TEST CERTIFICATE MODEL

Optima 5300

Customer :	S.P.S. Consulting Service Co.,Ltd.	**Date Tested:**	June 18, 2026
		Recommendation Recertification	
Address :	7, 24 Soi Phaholyothin, Ladyao,	**Period**	6 **Months**
		Recertification Due:	June 18, 2027
	Khet, Bangkok 10900	**Date Last Certified:**	N/A
User Name:	K. Phenpha	**Visit Number:**	1 of 2
Phone:	083-926-9252	**PerkinElmer Phone:**	02-719-6420 ext 206
E - Mail :	phenpha@spscon.com	**PerkinElmer Fax:**	02-318-5597

CONFIGURATION TESTED

MODEL	SERIAL NUMBER	SOFTWARE
Optima5300	077C7042401	Winlab32

TESTED EQUIPMENT	CALIBRATION NUMBER	EXPIRATION
IPV Method	N/A	N/A

TEST STANDARD USED	PART NUMBER	EXPIRATION DATE
Multielement Standard	N069-1579	Dec-26
Instrument Cal. STD4	N930-0221	Dec-26

CUSTOMER SUPPLIED	COMMENTS	CUSTOMER INITIALS
2 % HNO3	N/A	N/A
10 % HNO3	N/A	N/A

WO-11962532

PerkinElmer

MAINTENANCE AND IPV TEST CERTIFICATE MODEL

Optima 5300

SERIAL NUMBER: 077C7042401 **DATE TESTED:** June 18, 2026

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 reqiured, check and replace all purgebfilters.	OK
C. Recheck optical alignment.	OK
3. COOLING SYSTEM CHECKS	
A. Perform preventive maintenance on chiller.	OK
B. Flush out the chiller every year.	OK
4. PERFORMANCE CHECKS	
A. Torch View Alignment.	OK
B. Wavelength Calibration.	OK

PerkinElmer Ltd. 290 Soi 17 Rama 9 Road, Khwang Bangkapi, Khet Huay Kwang, Bangkok 10310, Thailand

PerkinElmer

MAINTENANCE AND IPV TEST CERTIFICATE MODEL

Optima 5300

SERIAL NUMBER: 077C7042401 **DATE TESTED:** June 18, 2026

PARAMETER		SPECIFICATION		FINAL VALUE	
Spectral Resolution : UV					
	As 193.696 nm	≤ 0.009	nm	0.006	nm
	Ni 231.604 nm	≤ 0.011	nm	0.008	nm
	Ni 341.476 nm	≤ 0.015	nm	0.011	nm
Spectral Resolution : VIS					
	Ba 455.403 nm	≤ 0.020	nm	0.015	nm
Precision					
	Zn 206.200 nm	% RSD	≤ 1.0 %	0.39	%
	Mg 280.271 nm	% RSD	≤ 1.0 %	0.41	%
	Mg 285.213 nm	% RSD	≤ 1.0 %	0.31	%
	Ba 455.403 nm	% RSD	≤ 1.0 %	0.68	%
Detection Limits : Axial					
	Tl 190.801 nm	3(sd)	<10	9.23	ppb
	As 193.696 nm	3(sd)	<10	6.78	ppb
	Se 196.026 nm	3(sd)	<5	4.12	
	Pb 220.353 nm	3(sd)	<3	2.34	ppb
Detection Limits : Radial				1.23	
	As 193.696 nm	3(sd)	<60	55.23	ppb
	Zn 213.857 nm	3(sd)	<2	1.03	ppb
	Mn 257.610 nm	3(sd)	<0.75	0.65	ppb
	La 379.478 nm	3(sd)	<3	3.15	ppb
	Ba 455.403 nm	3(sd)	<0.3	0.23	ppb
	Ba 493.408 nm	3(sd)	<0.6	1.11	ppb
BEC : Axial (IB X 1000)/(IS-IB)					
	Mn 257.610 nm	≤ 30 ppb		15.87	ppb
BEC : Radial (IB X 1000)/(IS-IB)					
	Mn 257.610 nm	≤ 30 ppb		10.35	ppb

PerkinElmer Ltd. 290 Soi 17 Rama 9 Road, Khwang Bangkapi, Khet Huay Kwang, Bangkok 10310, Thailand

WO-11962532

PerkinElmer

MAINTENANCE AND IPV TEST CERTIFICATE MODEL

Optima 5300

SERIAL NUMBER: 077C7042401 **DATE TESTED:** June 18, 2026

Remarks :

Test all pass

This is to certify that the above tests have been perfomed 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.

Customer Service Engineer: Chayanan K.

(Chayanan Kanan)

Sr. Customer Support Engineer

PerkinElmer Ltd. 290 Soi 17 Rama 9 Road, Khwang Bangkapi, Khet Huay Kwang, Bangkok 10310, Thailand

MIRACLE INTERNATIONAL TECHNOLOGY CO.,LTD
214 Bangwaek Rd. Bangpai Bangkae Bangkok 10160
Tel.: 0-2865-4647-8 Fax: 0-2865-4649 http://www.mit.in.th

NSC-TISI-TIS 17025 CALIBRATION 0052

CALIBRATION CERTIFICATE

Certificate No. : S2025070410-0003
Date Issued : 24-Jul-25

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

Equipment : Incubator

Manufacturer : BINDER
Model : BD 115
Serial No. : 12-16967
ID No./Tag No. : IN 05/56
Date Received : 22-Jul-25
Date Calibrated : 22-Jul-25

Calibrated by : Auttapol Kunaumpal

Calibration Method or Calibration Procedure Used

Standard method : CP-05 TLAS G-20.

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

Result of Calibration

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

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

Approved by: K. Nathapong (Nathapong Krudaum)

CERTIFIED MIT

Certificate No. : S2025070410-0003

Environment : Ambient Temperature : Start record 25.1 °C, Stop record 25.1 °C
Relative Humidity : Start record 48.9 %RH, Stop record 49.3 %RH

Calibration Temperature (°C)	Setting Temperature (°C)	Indicating Temperature (°C)	Measured Stability[1] (°C)	Measured Uniformity[2] (°C)	Overall Variation[3] (°C)
35	35.0	35.0	0.13	0.37	0.57
41.5	41.5	41.5	0.10	0.35	0.49

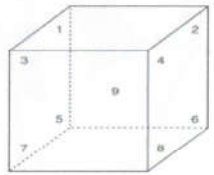
Without adjustment

Calibration Temperature (°C)	STD No. 1 (°C)	STD No. 2 (°C)	STD No. 3 (°C)	STD No. 4 (°C)	STD No. 5 (°C)	STD No. 6 (°C)	STD No. 7 (°C)	STD No. 8 (°C)	STD No. 9 (°C)	Uncertainty[4] (±°C)
35	34.97	34.91	34.96	34.82	34.81	34.86	34.83	35.11	34.95	0.23
41.5	41.51	41.37	41.40	41.26	41.27	41.42	41.43	41.53	41.50	0.23

STD = Standard

Note : Probe No. 9 is Reference Probe

Setting Air Fresh No. OFF



Condition As-Received : Used Item

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

Measurement Standards Used & Traceability :

The International System of Units (SI) through

MIT Certificate No. L202412300-0027 for Temperature Indicator with Sensor Serial No. US37020317, Due 09-Sep-25

Notes : 1. The temperature stability is the one-half of greatest maximum difference of measured temperatures at any one probe.
2. The temperature uniformity is the maximum difference of measured temperatures between of any probes and the measured temperature at the reference location which are observed at same time.
3. Overall variation is the difference of maximum and minimum measured temperatures throughout observation time.
4. The uncertainty of measurement is included temperature stability.
5. The temperature uniformity, stability, overall variation and indicating temperature is applicable to all air or gas filled temperature controlled enclosures at atmospheric pressure.

End of Certificate

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

NSC-TISI-TIS17025
CALIBRATION 0049

Certificate of Calibration

EQUIPMENT	:	WATER BATH
MANUFACTURER	:	MEMMERT
MODEL	:	WNB29
SERIAL No	:	L614.0123
ID No	:	WB 05/58
CONDITION AS RECEIVED	:	USED ITEM
SUBMITTED BY	:	S.P.S. CONSULTING SERVICE CO., LTD. 7 SOI PHAHOLYOTHIN 24, PHAHOLYOTHIN RD., JOMPOL, CHATUCHAK, BANGKOK 10900
CALIBRATED BY	:	CHARUKIT L.
CALIBRATION DATE	:	05-Mar-26
APPROVED BY	:	PONGSAK J.
ISSUED DATE	:	09-Mar-26
RECEIVED DATE	:	05-Mar-26

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

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

Calibration Report

EQUIPMENT	:	WATER BATH			
MANUFACTURER	:	MEMMERT	**MODEL**	:	WNB29
ID NUMBER	:	WB 05/58	**SERIAL NUMBER**	:	L614.0123
RECEIVED DATE	:	05-Mar-26	**CALIBRATION DATE**	:	05-Mar-26
AMBIENT TEMPERATURE	:	26 °C ± 1 °C	**RELATIVE HUMIDITY**	:	53 %RH ± 10 % RH

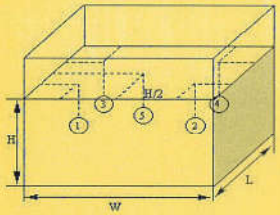
CONDITION OF THIS RESULTS OF CALIBRATION

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

INSTRUMENT	MODEL	SERIAL No	CERTIFICATE No	DUE DATE
1) DATA LOGGER WITH RTD	2625A	6603614	25T5341	04-Jun-26

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 QUALITY CALIBRATION CO., LTD.

RESULT OF CALIBRATION :- WITHOUT ADJUSTMENT



PROBE INSTALLATION
POSITION IN THE BATH

GENERAL INFORMATION

Overall Variation of Ambient Temperature around the Bath (°C) : 0.8
Overall Variation of Line Voltage (V) : 6
Instrument Condition : Normal
Bath Inner Size (W*L*H) : 60*40*10 cm

BATH PERFORMANCE

Calibration Point (°C)	Controller Temperature (°C)	Temperature Stability (±°C)	Radius Uniformity (°C)	Axial Uniformity (°C)	Overall Variation (°C)
50.0	50.3	0.03	0.05	0.04	0.08
60.0	60.3	0.03	0.07	0.05	0.13

TEMPERATURE MEASUREMENT ACCURACY TEST

Controller Temp (°C)	Indicating Temp (°C)	Measured Temperature (°C) at Spread Locations					Uncertainty (± ° C)
		#1	#2	#3	#4	Ref. 5	
50.3	50.3	49.88	49.89	49.94	49.93	49.92	0.14
60.3	60.3	59.94	59.93	60.01	60.00	59.99	0.15

NOTE 1 : THE UNCERTAINTY OF MEASUREMENT EXCLUDED TEMPERATURE UNIFORMITY OF THE BATH.
NOTE 2 : THIS CALIBRATION WAS CARRIED OUT AT THE CUSTOMER'S PLACE AT LABORATORY AREA.
THE REPORTED UNCERTAINTY OF MEASUREMENT WAS BASED ON A STANDARD UNCERTAINTY MULTIPLIED BY A COVERAGE FACTOR k =2, PROVIDING A LEVEL OF CONFIDENCE APPROXIMATELY 95%.

END OF CALIBRATION REPORT

เอกสาร 5-4

เอกสารสอบเทียบเครื่องมือการตรวจวิเคราะห์คุณภาพตะกอนดิน

PerkinElmer
For the Better

PinAAcle 900T
Preventive Maintenance Report

Company Name: S.P.S. Consulting Service Co.,Ltd.

Instrument Location: 7, 24 Soi Phaholyothin,

Ladyao, Khet, Bangkok 10900

Instrument Serial No.: PTCS14111103

Date: 18 Jun 2026

PinAAcle 900T Preventive Maintenance (PM)

Company Name:	S.P.S. Consulting Service Co.,Ltd.		
Address (Instrument Location):	7, 24 Soi Phaholyothin, Ladyao, Khet, Bangkok 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. Chayanan	**Service Order Number:**	WO-11540403
Date PM Performed: (DD-MMM-YYYY)	18 Jun 2026	**Next PM Due Date:** (DD-MMM-YYYY)	18 Jun 2027
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
PinAAcle900T	PTCS14111103	Winlab32
Fias100	100S14090404	Winlab32

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	1
N3160156	O-Ring Kits for Sampling Introduction (Stainless Steels Nebulizer)	N/A
N3160157	O-Ring Kits for Sampling Introduction (Plastic Nebulizer)	2
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	28-83CUY1	Nov 26
N9300244	GFAAS Mixed Standard	AR	60-004CRY1	Jun 26

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	101N0089015
N1013002	1.0A Neutral density filter	1	101N0089015
B3100652 Or N9307029	Electronic Flow Meter	1	NA
B0505495	Test Jig	1	NA
03030997	System 2 EDL Driver	1	030309-97E
N3050605	As System 2 EDL	1	000003-26798A
N3050121	Cu Lumina HCL	1	060419-030180
N3050109	Ba Lumina HCL	1	061219-020041
N3050139	K Lumina HCL	1	030819-010130
N3050152	Ni Lumina HCL	1	052719-020020
N3050119	Cr Lumina HCL	1	060419-030180

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 N20-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_2H_2 Flame correctly shuts down	Active	Passed
Drain Sensor	Air/C_2H_2 Flame correctly shuts down	Active	Passed
Nebulizer Sensor	Air/C_2H_2 Flame correctly shuts down	Active	Passed
C_2H_2 Pressure Sensor	Air/C_2H_2 Flame correctly shuts down	Active	Passed
Air Pressure Sensor	Air/C_2H_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.	2.0405	1.9997	Passed
0.2 A ND Filter	± 5% from Cert.	0.1953	0.1855	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	0.001	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 D_2 Background Compensation with Copper

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

Parameter	Specification	Results	Pass/Fail
Standard Deviation	≤ 0.010	0.0001	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	0.0001	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.	NA	Not Applicable
2 mg/L Sensitivity HS Neb (if applicable)	> 0.250 Abs.	0.356	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	260	Passed
External Flow Rate	100 mL/min ± 10 mL/min	105	Passed

9.2 Chromium Baseline Noise

Description: Signal to noise check.

Parameter	Specification	Results	Pass/Fail
Baseline Noise	≤ 0.005 Abs.	0.0002	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	5.4	Passed
Precision	≤ 2.0 %	0.14	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	14.5	Passed
Zeeman Ratio	0.52 ± 0.04	0.54	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 $= \frac{Atomic\ Signal\ (Peak\ area\ )}{Atomic\ Signal\ (Peak\ area\ ) + Background\ Signal\ (Peak\ area\ )}$ $= \frac{0.1551}{0.1551+0.1315}$ $= 0.54$

Review

The preventive maintenance checks and if applicable performance tests for PinAAcle 900T have been completed.

This PinAAcle 900T Passes ☑ Fails ☐ the preventive maintenance.

Review of Preventive Maintenance:	
Authorized PerkinElmer Representative: Chayanan K.	Date: 18 Jun 2026 (DD-MMM-YYYY)
Authorized Customer Representative:	Date: 18 Jun 2026 (DD-MMM-YYYY)

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MAINTENANCE AND IPV TEST CERTIFICATE MODEL

Optima 5300

Customer :	S.P.S. Consulting Service Co.,Ltd.	**Date Tested:**	June 18, 2026
		Recommendation Recertification	
Address :	7, 24 Soi Phaholyothin, Ladyao,	**Period**	6 **Months**
		Recertification Due:	June 18, 2027
	Khet, Bangkok 10900	**Date Last Certified:**	N/A
User Name:	K. Phenpha	**Visit Number:**	1 of 2
Phone:	083-926-9252	**PerkinElmer Phone:**	02-719-6420 ext 206
E - Mail :	phenpha@spscon.com	**PerkinElmer Fax:**	02-318-5597

CONFIGURATION TESTED

MODEL	SERIAL NUMBER	SOFTWARE
Optima5300	077C7042401	Winlab32

TESTED EQUIPMENT	CALIBRATION NUMBER	EXPIRATION
IPV Method	N/A	N/A

TEST STANDARD USED	PART NUMBER	EXPIRATION DATE
Multielement Standard	N069-1579	Dec-26
Instrument Cal. STD4	N930-0221	Dec-26

CUSTOMER SUPPLIED	COMMENTS	CUSTOMER INITIALS
2 % HNO3	N/A	N/A
10 % HNO3	N/A	N/A

WO-11962532

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MAINTENANCE AND IPV TEST CERTIFICATE MODEL

Optima 5300

SERIAL NUMBER: 077C7042401 **DATE TESTED:** June 18, 2026

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 reqiured, check and replace all purgebfilters.	OK
C. Recheck optical alignment.	OK
3. COOLING SYSTEM CHECKS	
A. Perform preventive maintenance on chiller.	OK
B. Flush out the chiller every year.	OK
4. PERFORMANCE CHECKS	
A. Torch View Alignment.	OK
B. Wavelength Calibration.	OK

PerkinElmer Ltd. 290 Soi 17 Rama 9 Road, Khwang Bangkapi, Khet Huay Kwang, Bangkok 10310, Thailand

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MAINTENANCE AND IPV TEST CERTIFICATE MODEL

Optima 5300

SERIAL NUMBER: 077C7042401 **DATE TESTED:** June 18, 2026

PARAMETER		SPECIFICATION		FINAL VALUE	
Spectral Resolution : UV					
	As 193.696 nm	≤ 0.009	nm	0.006	nm
	Ni 231.604 nm	≤ 0.011	nm	0.008	nm
	Ni 341.476 nm	≤ 0.015	nm	0.011	nm
Spectral Resolution : VIS					
	Ba 455.403 nm	≤ 0.020	nm	0.015	nm
Precision					
	Zn 206.200 nm	% RSD	≤ 1.0 %	0.39	%
	Mg 280.271 nm	% RSD	≤ 1.0 %	0.41	%
	Mg 285.213 nm	% RSD	≤ 1.0 %	0.31	%
	Ba 455.403 nm	% RSD	≤ 1.0 %	0.68	%
Detection Limits : Axial					
	Tl 190.801 nm	3(sd)	<10	9.23	ppb
	As 193.696 nm	3(sd)	<10	6.78	ppb
	Se 196.026 nm	3(sd)	<5	4.12	
	Pb 220.353 nm	3(sd)	<3	2.34	ppb
Detection Limits : Radial				1.23	
	As 193.696 nm	3(sd)	<60	55.23	ppb
	Zn 213.857 nm	3(sd)	<2	1.03	ppb
	Mn 257.610 nm	3(sd)	<0.75	0.65	ppb
	La 379.478 nm	3(sd)	<3	3.15	ppb
	Ba 455.403 nm	3(sd)	<0.3	0.23	ppb
	Ba 493.408 nm	3(sd)	<0.6	1.11	ppb
BEC : Axial (IB X 1000)/(IS-IB)					
	Mn 257.610 nm	≤ 30 ppb		15.87	ppb
BEC : Radial (IB X 1000)/(IS-IB)					
	Mn 257.610 nm	≤ 30 ppb		10.35	ppb

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MAINTENANCE AND IPV TEST CERTIFICATE MODEL

Optima 5300

SERIAL NUMBER: 077C7042401 **DATE TESTED:** June 18, 2026

Remarks :

Test all pass

This is to certify that the above tests have been perfomed 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.

Customer Service Engineer: Chayanan K.

(Chayanan Kanan)

Sr. Customer Support Engineer

PerkinElmer Ltd. 290 Soi 17 Rama 9 Road, Khwang Bangkapi, Khet Huay Kwang, Bangkok 10310, Thailand